RECONSTRUCTING CLASSIC MAYA ECONOMIC SYSTEMS: PRODUCTION AND EXCHANGE AT CANCUEN, GUATEMALA

By

Brigitte Kovacevich

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Approved:

Professor Arthur A. Demarest

Professor Tom D. Dillehay

Professor John W. Janusek

Professor William R. Fowler

Professor T. Patrick Culbert

Professor Barbara J. Mills

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If jade is not polished it cannot be made worth anything.
If man does not suffer trials he cannot be perfected.

Chinese Proverb (Chenault 1986)

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CHAPTER I

INTRODUCTION

There is little doubt that excavations at this place are likely to yield very interesting results.

-Teobert Maler 1908

Introduction and Purpose of this Study

Cancuen[1], a Classic-period (ca. A.D. 650-800/810) Maya site is located in the Department of the Petén, Guatemala on the Pasión/Usumacinta river system (Figure 1.1). This river system is a natural route of trade and communication, and Cancuen is located at the interface between two economically and ecologically distinct regions, the volcanic highlands and tropical lowlands of Guatemala. Transport along this route would have been by porter to Cancuen then downriver by canoe, and on to other overland and riverine routes. Cancuen's geographical location may have created opportunities for its residents to specialize in the production and distribution of highland goods, including high status goods, for exchange along the Pasión/Usumacinta route to the rest of the Maya lowlands.

The location of Cancuen between the highlands and the lowlands provides an important study for the investigation of the variation in Classic Maya elite power, as the control of production and exchange of exotic goods may have formed a basis for that power at this site, while at the same time providing a basis for prestige and the creation of

[1] The name of Cancuen means "nest of serpents" in the local Q'ekchi' Maya language (Maler 1908:36). This was not the ancient Maya name of the center, which remains unknown.

social identity for craft producers. The goal of this thesis is to investigate, through material remains, the economic strategies used by the residents at the Late Classic site of Cancuen, Guatemala. These economic strategies will be compared between different social groups within the site, highlighting differences in procurement, production, consumption, and distribution. The following questions are particularly pertinent to this study, considering the varied economic and political nature of Classic Maya polities: *What was the basis of power for Classic Maya rulers at Cancuen? Did political and social power allow rulers to control the production and distribution of crafted goods? Who was involved in production of prestige and utilitarian goods, and how were the relations of production structured? How were the social identity and status of elite and nonelite producers constructed in relation to the production system? How did household activities allow participants to negotiate social structures, while at the same time they were constrained by them?*

Thesis Statement and Summary

My work here will focus on Classic Maya economic systems, and more broadly preindustrial economic systems, using Cancuen as a case study. Lithic artifacts, the most durable in the archaeological record, provide information about procurement, production, distribution, and consumption within preindustrial economies. The analysis of the sequential manufacturing process indicates that production of prestige goods (such as jade artifacts) was completed in the early stages by domestic nonelite producers, transferred to elite producers in domestic contexts, who then transformed them into ritually charged objects for circulation in the political economy. Elites afforded direct control of craft production and distribution of final products through a monopoly on some forms of ritual and esoteric knowledge and sumptuary laws. The ideological power of Classic Maya elites at Cancuen was so great that nonelite producers could have thousands of pieces of raw jade, but not use them in ways that were not socially acceptable. At the same time, nonelite producers acquired some prestige and identified themselves socially through the early stages of production of these goods.

This dissertation focuses on lithic artifacts (stone tools and adornments) in order to investigate these issues. Lithics are especially important in inferring economic behavior, as lithic technologies are subtractive and leave clear evidence of all stages of production, which can then be mapped and compared throughout a site (e.g., Arnold and Munns 1994; Clark 1988; Collins 1993; Deetz 1976; Odell 1996, ed.; Rovner and Lewenstein 1997; Sheets 1978). Sourcing of lithic artifacts is also possible in many cases (most important for obsidian and jade in this study), which allows investigation of procurement strategies, changes in trade routes and consumption though time (e.g., Ford et al. 1997; Nelson and Clark 1990).

The types of lithic artifacts analyzed for this study include: 1) obsidian (volcanic glass) used to make blades for utilitarian cutting purposes and ritual tasks including scarification and bloodletting; 2) chert (a cryptocrystalline silicate stone) used to make blades, knives, weapons, tools, and ceremonial implements (Eccentrics), as metallurgy was not a technology possessed by the Classic Maya; 3) jade, the most precious stone of the Maya, used to make ornately carved adornments, dental incrustations, and other objects, which reinforced the high status and ritual power of the owner (see also Inomata 2001; Taube 2005; and Bourdieu 1977); and 4) pyrite (commonly called fool's gold), used to make ceremonial mirrors used by ritual specialists to emulate gods and create shamanic portals to the underworld (Taube 1992a; see also Chapter 6 for a more thorough discussion).

The following chapters are dedicated to discussing these findings. Chapter 2 will outline the sampling strategy and excavation methodology utilized to obtain a representative sample of elite and nonelite structures at Cancuen, how elite and nonelite structures were identified, and the general methodology for laboratory analysis of lithic materials. Chapter 3 will review research on preindustrial and Classic Maya economic systems, give definitions of relevant terms and concepts, and explain how lithic artifacts have been used to make inferences about ancient economic systems. Chapter 4 will explore the social and theoretical implications of production and exchange in complex societies, and how practice shaped the power relations of the Classic Maya. Chapters 5 through 8 will present the analysis of the jade, pyrite, chert, and obsidian for Cancuen. Each chapter is dedicated to a particular class of stone or mineral and will discuss the typology used for classification, sourcing results, contexts of discovery and distribution analysis, and a discussion of these results. Chapter 9 will take an in depth look at several intensively excavated structures in the sampling program. These structures will have wider variety of artifacts in their assemblage and will allow for a broader view of the activities and nature of these households, who was involved in the production, and what this meant for social roles of the Classic Maya. In addition to the lithic data discussed in the previous chapters, ceramic, geochemical, and groundstone data, information about interment type, form, and offerings, as well as other miscellaneous artifacts will be used. Finally, Chapter 10 will synthesize the findings and present conclusions regarding the nature of Classic Maya power structures, economic systems, and status and social identity at Cancuen.

Cancuen and Classic Maya Political Organization

The early twentieth century notion that the Maya lived in dispersed settlements with vacant ceremonial centers, and did not have the complexities of other archaic civilizations (i.e., Childe 1950; Thompson 1942) has now been abandoned. V. Gordon Childe (1950:9) once said, “Hence the minimum definition of a city, the greatest factor common to the Old World and the New will be substantially reduced and impoverished by the inclusion of the Maya.” It is now generally accepted that the Maya lived in true cities which housed a variety of part or full-time craft specialists (e.g., Chase et al. 1990; Inomata 2001; Inomata and Houston 2000; 2001; cf. Sanders and Webster 1998; Webster 2000). Still under debate are issues of the degree of political and economic complexity, the nature of hierarchical and heterarchical structuring of Maya power systems, the degree of centralization vs. segmentation of Maya polities, and the nature of Classic Maya social organization (see for example Adams 1995; Blanton and Feinman 1984; Braswell et al. 2005; Brumfiel 1994; Chase 1992; Chase and Chase 1987; Culbert 1988, 1991; Demarest 1992, 1996; Freidel 1981; Fox et al. 1996; Marcus 1983, 1992, 1993, 1998, 2004; Martin and Grube 1995, 2000; McAnany 1993, 1995; Rice 1987; Scarborough 1998; Scarborough et al. 2003; Sharer and Golden 2004; Sharer and Traxler 2006:711-716).

What is certain is that there was an extreme amount of political, economic, and social variation among Maya polities (e.g., Demarest 2003:213-215; Sharer and Traxler

704-705), and Cancuen adds to that variation, as a strategically located center between two diverse regions, which allowed it to benefit from shifting alliances with powerful lowland centers (see Demarest and Fahsen 2004; Fahsen and Demarest 2001; Fahsen and Jackson 2001, 2002; Fahsen et al. 2001, 2003), as well as a great degree of symbolic wealth demonstrated by its monumental royal palace.

Cancuen was primarily occupied during the Late Classic period (A.D. 650-800/810; see Bill et al. 2003; Bill and Callaghan 2001; Callaghan et al. 2003; Callaghan and Bill 2003). The fluorescence of Cancuen, the main period of construction of the royal palace, and the main occupation phase of most of the structures around the epicenter corresponds to the reign of *Tah Chan Akh* during the late Tepeu 2 phase (A.D. 770-795/800) (Fahsen et al. 2004; Callaghan et al. 2003), this was also the period of intensification of craft specialization in prestige goods. As was mentioned above, much crafting took place in dispersed domestic activity areas, but this did not preclude elite control of that production.

Craft Production for the Classic Maya and at Cancuen

While many have argued that utilitarian craft production took place in domestic households of the Classic Maya (e.g., Ball 1993; Becker 1973; Freidel 1981; Haviland 1970; McAnany 1993; see also Masson 2002), there has been little evidence of production of prestige goods outside of elite residences or the site core, although it has been postulated (Ball 1993; Potter and King 1995). Recent evidence for specialized production of prestige goods comes primarily from elite contexts (see Ball 1993; Ball and Taschek 1991; Inomata 2001; Emery and Aoyama 2006; Reents-Budet 1998). Some of this may be due in part to a focus on site centers and elite contexts for excavations, although there are many extensively excavated Classic-period sites that have not yet yielded evidence similar to that at Cancuen.

Elites at Cancuen and elsewhere in the Classic Maya world seem to have controlled the right of alienation and distribution of prestige goods and derived power from the ownership and gifting of those inalienable possessions (see also Helms 1993; Mauss 1990 [1925]; Weiner 1992), but nonelites may have also been able to contest the existing power structure and gain prestige and status through participation in the segmented production of those goods. This may have been an unintended consequence of the intensification of production because of increased elite tribute demands due to a growing elite class and immigration from other regions (e.g., Demarest and Escobedo 1998; Palka 1995). While nonelites were precluded from using and possessing some types of artifacts, the production of those goods helped to construct their social identity.

Description of the Location and Region around Cancuen

Cancuen is located in the Pasión Region, which is in the southeastern part of the Department of the Petén, Guatemala (Figure 1.2). The region is and was characterized by tropical forests and expansive savannahs with karst topography which formed escarpments particularly suited for ancient and modern settlements along rivers. The region is bounded by the Salinas-Chixoy River to the west and the Pasión River to the north, and the mountains of the highlands to the south, including the Sierra de Chinaja just south of Cancuen (Mathews and Willey 1991). The geographical borders of this region roughly correspond to the following geographic coordinates: 15°50' to 16°50' north latitude and 89°30' to 91°00' west longitude (Willey et al. 1975:10, Figure 4; see also Figure 1.1 for the general geographic borders of the region). The altitude of the region is between 500 meters above sea level on the eastern and western borders and 100 meters in the center (Wadell 1938).

The Pasión region is geologically located on the major tectonic unit of the Chayapal Basin, which extends on an east/west axis through Chiapas, the Petén of Guatemala, Belize, and east to the Caribbean (Vinson 1962). The geology of the Pasión region is composed of some soft rock formations, including soft shale Lower Eocene Cambio and Reforma strata, above a harder Lower Cretaceous limestone (Vinson 1962). The Lower Cretaceous limestone varies greatly in color, from white, to light yellow, to gray, and are difficult to distinguish from Tertiary deposits unless fossils are present (Wadell 1938). The softness of the shale deposits allows the extreme meandering of the Pasión River as well as the formation of numerous oxbow lakes, but outcrops of the tougher limestone and carbonate rock of the Lower Eocene Santa Amelia Formation occasionally appear. Such limestone outcrops, especially along the banks of the river, form perfect areas for settlement as in the case of Cancuen. These outcrops are also important sources of materials for monumental construction as well as local chert used for tool production (Tourtellot, Sabloff, and Sharick 1978). In much of the south and southeastern Petén region surrounding Cancuen, Lower Eocene Santa Amelia arenaceous dolomites or dolomitic limestone with siliceous replacements are exposed, often producing high quality chert for stone tool production. Hakon Wadell (1938:341), in his 1923 geologic survey of the Petén collected six samples of chert between Chisec and Sayaxche, the area surrounding Cancuen. The Santa Amelia Formation is also frequently interbedded with reddish evaporate clays and limestone breccias eroded from earlier deposits, especially the erosion of the Jurassic Todos Santos Formation (Vinson 1962). Some of these red clays are present near Cancuen, especially near the modern settlement of Raxruja, and these clays were often used in the construction of earth works at Cancuen. Quaternary sediments are also present to a large degree in the region, especially in the river valleys, and may include sands, gravels, clays, and silts (Vinson 1962).

The karstic topography and the foothills between the Guatemalan highlands and lowlands are a product of Tertiary folding of Cretaceous Period strata, which then subsided, and east/west fractures that caused the step-like descent and many of the karst towers from the Alta Verapaz to the Petén lowlands (Wadell 1938). These foothills eventually give way to the metamorphic deposits of the northern mountainous region of Guatemala. The highest mountains in these ranges exceed 3000 meters above sea level. The metamorphic deposits of these mountains are generally formed by the high temperature, low pressure movement of the fault zone. Most of these metamorphic deposits date from the Paleozoic to the Cenozoic (West 1964). This tectonic activity produces rich mineral deposits; especially important for the ancient Maya were jadeite and associated green minerals such as serpentine (Harlow 1993), used for sacred and ritual purposes.

The southern highlands of Guatemala are characterized by volcanic and tectonic activity due to the Quaternary volcanoes that line the Pacific coast. This line of volcanoes is in large part due to the NW-SE structural fractures on the eastern margin of the Pacific Basin, including the Middle American Trench (West 1964). The movement along these faults causes heavy tectonic activity, including frequent earthquakes and volcanic eruptions. The volcanoes that line this plate boundary produced and continue to produce important resources for ancient and modern peoples, including volcanic glass or obsidian (see also Chapter 8) for stone tool production, basalt for groundstone production (basalt manos and metates are still often used today), as well as other stone such as pumice and volcanic ash used as temper in the production of ceramics and figurines (Rice 1987). Volcanic soils are also very fertile and provide a good environment for agriculture, in the highland region and the lower alluvial region as a result of erosion (Maldanado-Koerdell 1964). Twelve volcanoes are present in Guatemala, of which, Santa Maria, Pacaya, and Fuego, are still active today (see West 1964: Table 1).

Cancuen is located in the intermediate zone between the highlands and the lowlands, but is still in the "Tropical Rain Forest" formation, as discussed by Wagner (1964), but has also been called a "quasi-rainforest" by Lundell (1937). It is certainly located in the *Tierra Caliente,* below 1000 m in Guatemala that receives between 2000-3000 mm of rainfall per year, has an average relative humidity of 70-80%, and daily temperatures between 20-25º C, with a variation of only about 10º all year (Vivó Escoto 1964). The topography immediately surrounding Cancuen is today composed mainly of pasture, but in ancient times was primarily composed of tropical forests and swampy *bajos*. As the highlands begin just south of Cancuen there are numerous karst towers and cave environments, including the Candelaria cave system. A small patch of tropical forest remains over Cancuen, which has been heavily logged for the most precious trees that form the upper levels of tall forest canopies, but some ceiba (*Ceiba pentandra*), mahogany (*Swietenia macrophylla*), and cedar (*Cedrela angustifolia*) still remain. The tropical canopy is still high enough in some places to support several troops of Howler Monkeys (*Cebidae alouatta*). Many classes of snakes inhabit the forest around Cancuen (too many to mention here), including several varieties of Pit Vipers, primarily the Fer-de-lance (*Bothrops asper*), as well as varieties of poisonous and false Coral snakes (*Micrurus spp.*), as well as the non-venomous Boa Constrictors and Tiger snakes. Other amphibians and reptiles include many varieties of frog, toads (*Bufo Marinus*), iguanas (*Iguana iguana*), and lizards (*Basiliscus basiliscus*). Numerous mammals also inhabit the region. Jaguars (*Felis Onca*) appear to be extinct in the area at this time, but they were certainly present during the Classic Period, as this region would form a perfect habitat. Some Classic-period interments at Cancuen were also found with jaguar claws or teeth (e.g., Berryman et al. 2003).

Cancuen is located in the southern region of the Petén at the foothills of the mountainous highland region. Streams draining from the highlands form the Pasión River, where there are numerous archaeological sites that have not yet been intensively investigated by archaeologists. Cancuen is the southernmost site in the region before the highlands, and the largest site south of Seibal (the largest site in the Pasión region). Cancuen has recently been intensively explored and excavated by the Vanderbilt University Cancuen Archaeological Project (see below), but many sites still remain uninvestigated in this *terra incognita*. Further to the north archaeological investigation has taken place at sites such as Seibal and Altar de Sacrificios (Adams 1971, 1973; J. Graham 1972, 1990; Pohl 1990; Sabloff 1975a; Sabloff et al. 1982; Saul 1972; A.L. Smith 1972, 1982; Tourtellot 1988, 1990; Willey 1972, 1973, 1978, 1990; Willey et al. 1975). Large-scale investigations were also carried out in the Petexbatun region directed by Arthur Demarest (Demarest and Houston 1989, 1990; Demarest et al. 1991, 1992, 1996, 1997; Valdes et al. 1993). At Seibal the Pasión River turns west and joins the larger Usumacinta River, which flows out to the Gulf Coast. This river system formed the largest route of trade and communication in the western Petén in ancient times, as well as today.

Previous Research

Until recently, Cancuen was the only site identified in the southernmost portion of the Upper Pasión region. Teobert Maler was the first to "rediscover" the site in 1905 (Maler 1908; Figure 1.3) and Sylvanus Morley then visited Cancuen in 1915 and published his findings in the important work *The Inscriptions of Petén* (Morely 1937). These early explorations by Maler and Morley did not uncover evidence of monumental architecture, primarily because their main objective was to uncover carved monuments with inscriptions. For this reason, Cancuen was thought of as a modest sized site. Morley mentioned Cancuen in *The Ancient Maya*, calling it a "small site" of "Class 4" size (Morley 1937; Figure 1.4). There was little further interest in the site until 1967 when a team from the Harvard Seibal Project made a short visit and created a map of the monumental palace and epicenter of Cancuen for the first time (Figure 1.5). Team members also excavated eight test units in the plazas of the palace and three in peripheral structures in order to establish a general chronology for the site. Surface collections from 15 areas also added to the ceramic sample. The ceramics recovered dated exclusively to the Late Classic period, but chronological change was apparent. This research was published as an appendix in the Seibal monographs (Tourtellot, Sabloff, and Sharick 1978).

Excavations and discoveries at Dos Pilas by the Petexbatun Regional Archaeological Project again sparked archaeological interest in Cancuen (see Demarest et al. 1997). These include the discovery at Dos Pilas of the palace, funerary throne, and tomb of the "Lady of Cancuen," wife of Dos Pilas Ruler 3, *Toh K´in K´awil* (Wolley and Wright 1990). The marriage and alliance between Cancuen and Dos Pilas are demonstrated in the iconography and inscriptions of Dos Pilas Panel 19, where the "Lady of Cancuen" and Ruler 3 are shown witnessing the first ritual of autosacrifice performed by their son and heir to the thrown, Ruler 4, or *K'inich Chan K'awil* (Houston and Stuart 1990; Martín and Grube 2000:60-1). This connection led members of the Petexbatun Regional Archaeological Project, headed by Arthur Demarest, to launch a new reconnaissance at Cancuen in 1996 and 1997 in order to determine suitability for large-scale excavations. Large-scale residential and palace excavations were initiated by Demarest and Tomás Barrientos in 1999 and are continuing at this point at the site and in the region.

Research Objectives

It is with questions of the nature of Classic Maya political, economic, and social systems in mind that excavations for this dissertation were implemented at Cancuen. Sampling strategy and artifact analysis was established in order to define the nature of Cancuen's political and economic power (see Chapter 2). This dissertation is, to date, the most comprehensive study of lithic artifacts from Cancuen, although much of the work has been published elsewhere (Kovacevich 2007, 2001, 2000; Kovacevich, Cossich, and

Duarte 2005; Kovacevich, Cossich, Duarte, and Nelson 2006; Kovacevich, Neff, and Bishop 2005; Kovacevich, Cook, and Beach 2004; Kovacevich, Bishop, Neff, and Pereira 2003, 2002, 2001).

An important part of the methodology was defining groups of structures as representative of different social groups, and whether these groups were meaningful in the past, possibly representing dominant and subdominant power strategies within the site. An architectural typology (discussed in Chapter 2) was established based on the initial assumption that larger more labor intensive structures would likely represent elite residences, while the intent of the archaeological sampling strategy and artifact analysis was to test this hypothesis including variables such as construction type, material culture, and grave treatment.

Elites were assumed to be those who had greater access to resources, exotic materials, communal labor, and symbols of power and status, who inherited their social position through bloodlines and kinship. These characteristics would manifest themselves as larger, more labor intensive residences or ritual structures, imported trade goods, restricted classes of artifacts (including symbols of office like royal diadems), hieroglyphic inscriptions detailing bloodlines and legitimating heritage, and larger and more elaborate grave treatment. Nonelites had relatively less access to all of these things, although where to draw the line between these two social groups is often more difficult archaeologically (see Chase and Chase 1992; Marcus 2004). Some have also argued that there were more than just two social classes during the Classic period (e.g., Adams 1981; Chase 1992; Chase and Chase 1992; Palka 1995; Sabloff 1975b; Willey et al. 1965), a hypothesis that will also be tested in this work.

The purpose of this study is to investigate whether different residential forms correspond to different artifact assemblages and different activities. While this difference may indicate differences in status, they may also relate to social identity, ethnicity, or other group affiliation. For this work, investigation of social status and identity are the significant goals, although future ceramic and osteological analyses will help to better define the types of group affiliation that these structures represent.

The scope of this dissertation is limited primarily to the study of lithic artifacts and interpretations of preindustrial economic systems, connected with factors of status, power, domestic activities, and how these are connected to the construction of social identities. Other data are used here in a limited way to understand these related factors, including settlement patterns, geochemical data, ceramic data, and interment data.

Groundstone data will also be presented for several structures, as a complete inventory of groundstone for Cancuen is not yet complete. Groundstone is an important indicator of feasting, political maneuvering, domestic subsistence activities, and especially for investigating the role of women's domestic and political work, but was also an important tool in the working of jade in some cases.

Ceramics, especially as grave goods, were also helpful in inferring differences for residents of different compounds. Ceramics were also used as chronological markers to identify change in economic, social, and political patterns and strategies through time. Continuing ceramic analysis will shed more light on this data set.

Interment data also provided support for the inference of status, and for the purposes of this study and taking into account the osteological analyses that have been completed to date, grave treatment and dental modification were the primary variables considered. This includes elaboration of grave type (Welsh 1988) and the grave goods included. Further osteological analysis will continue to inform this research and will be published in the future.

Summary

The aforementioned data will be used in a synthetic way to investigate the relationship of craft production to social status and identity, as well as the power derived from the consumption, production, and distribution of crafted goods during the Classic period at Cancuen. The primary goals and conclusions of this dissertation relate to the power derived from craft production, for elites and nonelites, and how that power reinforced and modified existing social structures. Crafting was an essential part of the identity and power of the *K'uhul Ajaw* (Holy Lord or ruler) of Classic-period Maya sites, but in the great variation within and between Classic Maya polities, sometimes prestige and status could also be gained by others in the society as a result of that production.

Due to the strategic location of Cancuen, much of the population, at all social levels, was involved in the manufacture of trade goods. Excavations have uncovered the largest jade workshop yet discovered in the Maya lowlands. Of equal importance are crafting of pyrite mirrors, obsidian and chert stone tools, as well as other utilitarian goods. The study of these artifacts and archaeological contexts can provide valuable insight into the nature of preindustrial economies as well as an understanding of the domestic life of the ancient Maya. Furthermore, since these crafting activities include household production controlled by the state, Cancuen evidence has the potential to add to existing scholarship, which examines the nature of household economies and their integration into the broader political economy.

Figure 1.1. Map showing the location of Cancuen (drawing by Luis Fernando Luin).

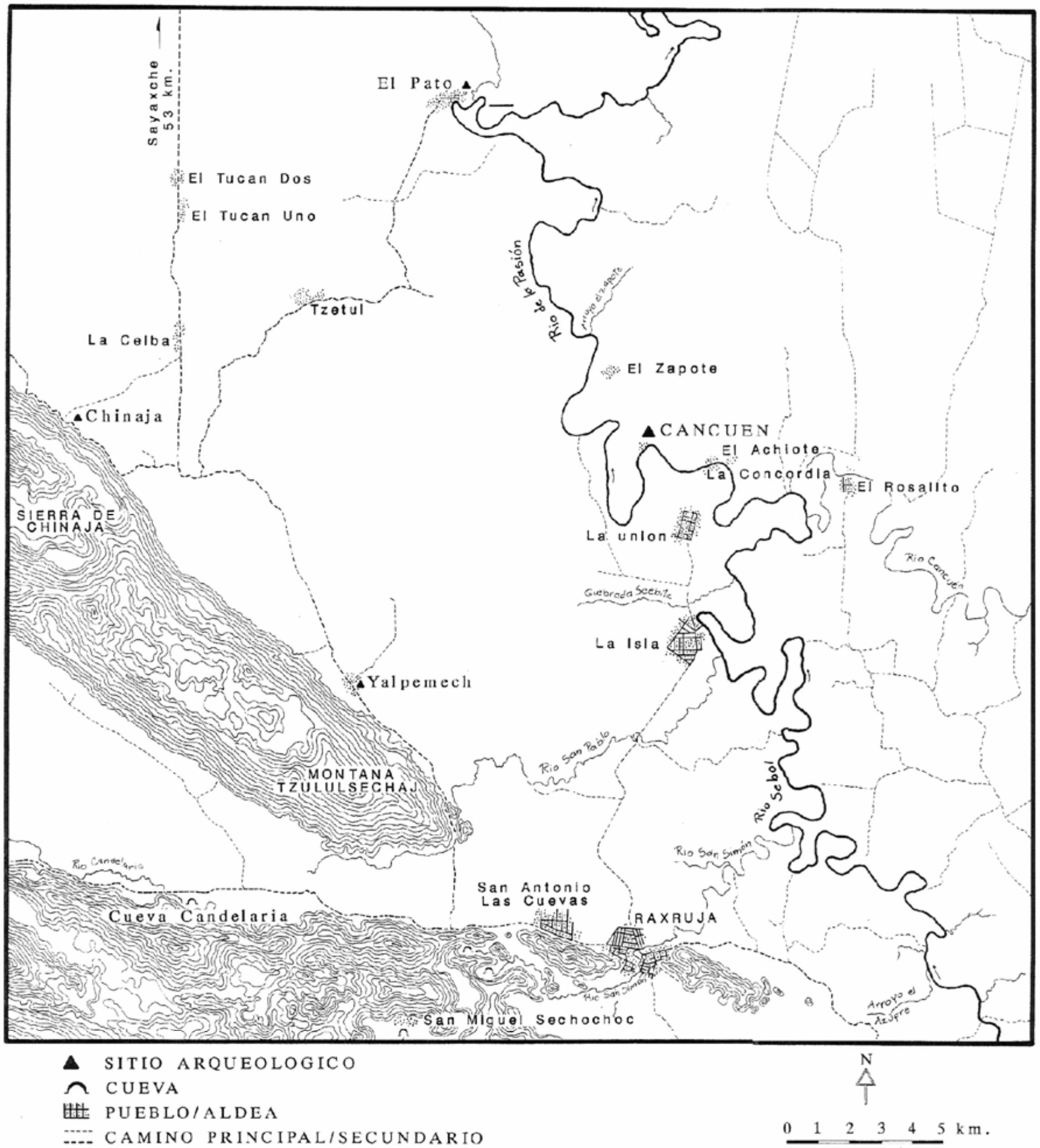


Figure 1.2. Map of Cancuen region showing its relation to the highlands and the lowlands (drawing by Luis Fernando Luin).

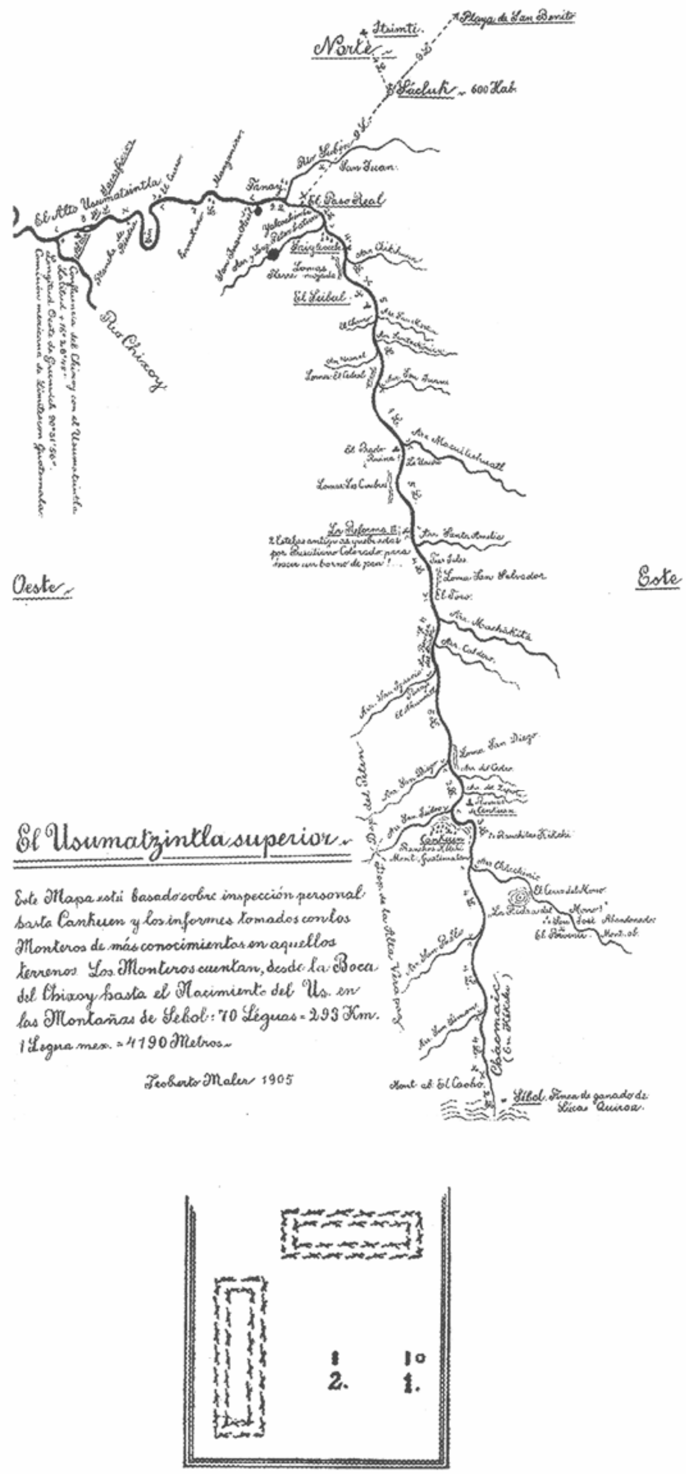


Figure 1.3. Maler’s map of Usumacinta region and Cancuen (from Maler 1907: Fig. 8, pp. 48 and 50).

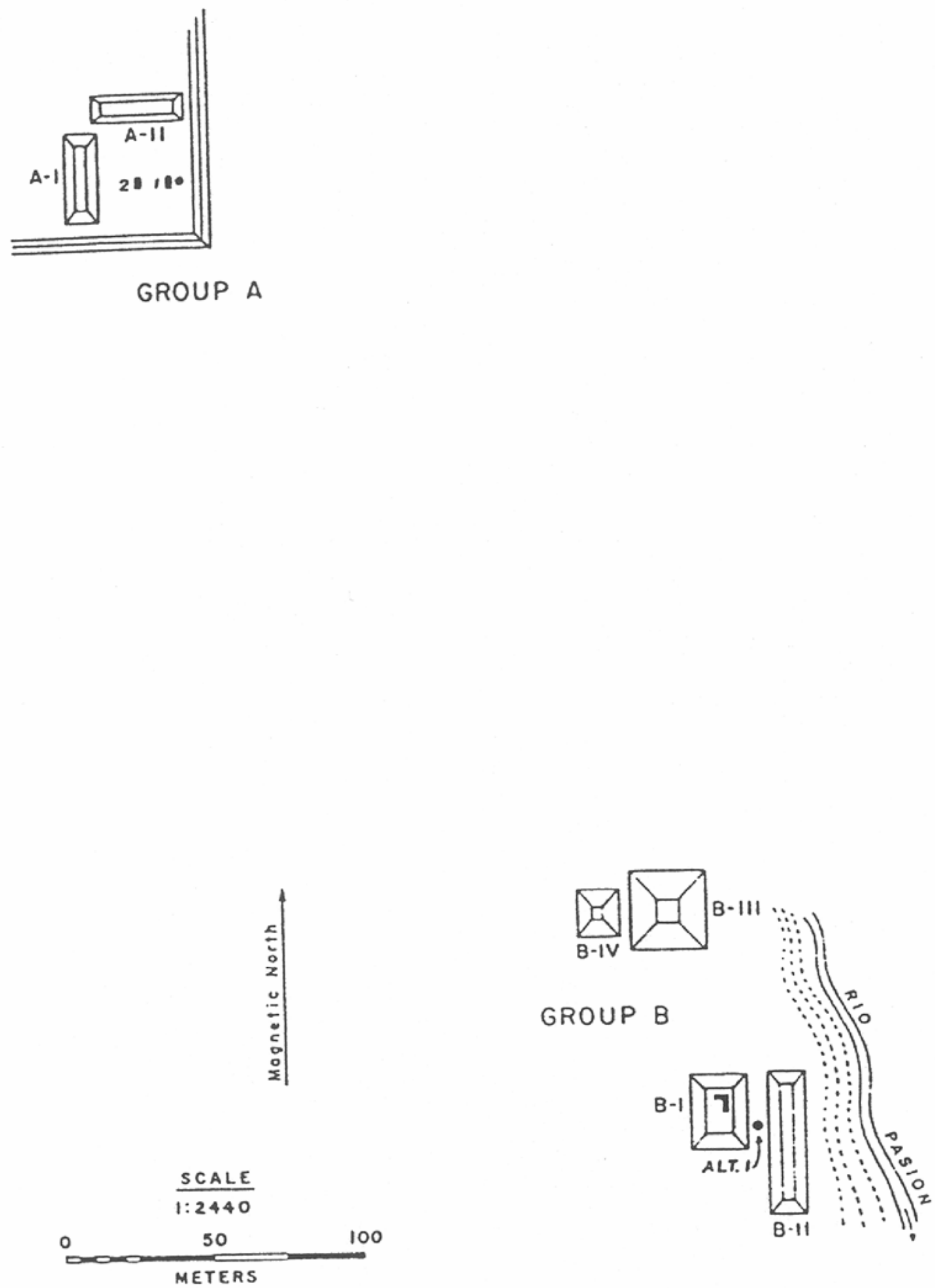


Figure 1.4. Morley's map of Cancuen (from Tourtellot et al. 1978: Fig. 4; after Morely 1937-1938).

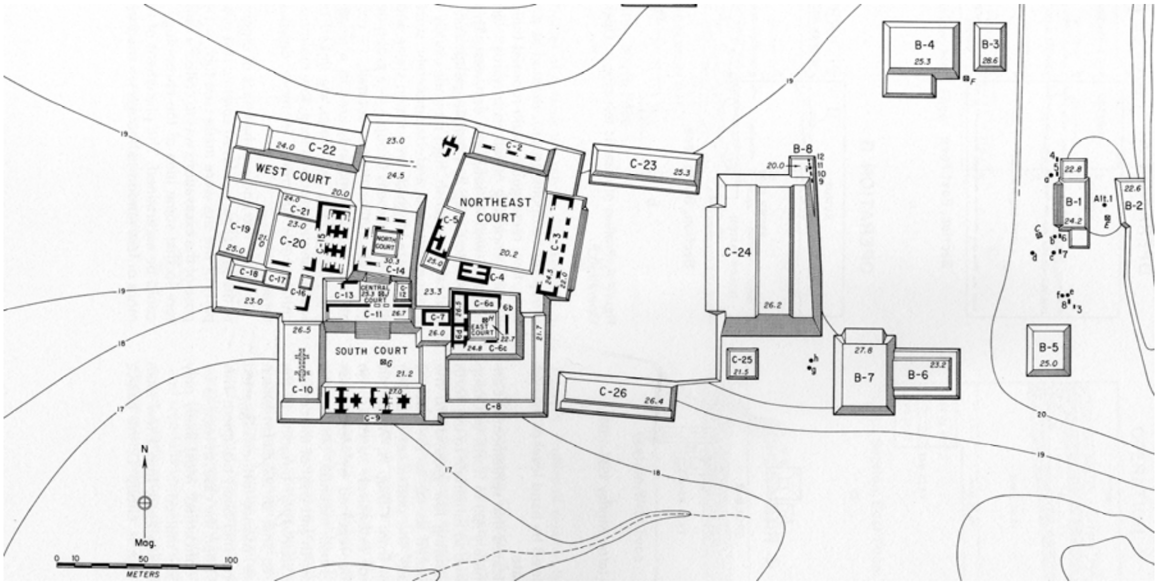


Figure 1.5. Harvard Seibal Project's map of the palace and associated structures at Cancuen, the A Group to the north, also mapped is not pictured (modified from Tourtellot et al. 1978: Fig.5).

CHAPTER II

METHODOLOGY AND RESEARCH DESIGN

Science is built up of facts, as a house is built of stones; but an accumulation of facts is no more science than a heap of stones is a house.

-Jules Henri Poincaré, *Science and Hypothesis*
(cited in Wilk 1996:1)

Introduction

The methodology and research design for this dissertation were formulated with respect to questions of the nature of the political, social, and economic systems at Cancuen. Probabilistic and non-probabilistic sampling of various architectural types exposed household activities to achieve a holistic view of how the Cancuen community engaged in social reproduction and negotiation. Horizontal excavations focused on defining architectural elements in order to help to infer construction type, as well as uncover household activity areas where domestic and specialized production may have taken place. These activities could give clues to social status and identity of the residents. Vertical excavations were carried out in middens and interior structure fill to sterile soil in order to establish a chronology for the structure, reach burials often beneath interior floors or in middens, and to uncover production refuse that may be located in trash deposits often found behind Classic-period (and modern; see Clark 1988; Deal and Hayden 1987) Maya structures. The importance of the identification of household activities relates to the greater questions regarding the construction of social identity, and how that may change through time. The analysis of the sequential manufacturing process of lithic artifacts can provide insight into differential patterns of production throughout the site, domestic and specialized (see Chapter 3 for definitions of specialized production). Tracking differences in activities and artifact patterning through time and space will hopefully help to highlight differences in social identity between households, as well as recognize some collective features of community identity. The investigation of differential household activities also relates to issues of power, such as how it is mobilized, legitimated, and contested.

Site Description and Settlement Patterns

The site of Cancuen is located on a peninsula created by the meandering Pasión River (Figure 2.1). As mentioned in Chapter 1, Cancuen was known as a modest sized site for many years in the archaeological community because of the work of Maler (1908) and Morley (1937 [1915]), who did not encounter the royal palace in their explorations of the site. Maler noted two structures that he called A-1 and A-2, primarily because they were large structures associated with two carved stelae and an altar (see Figure 1.3). During Morley's visit to Cancuen, he recorded a new group of structures, which he called the B Group after Maler's designation of the A Group to the north (see Figure 1.4). Two of the four structures recognized appeared to be parallel. Morley believed that they formed a ballcourt. This claim was supported by the ballcourt marker discovered during his visit, which is now on display at the National Museum of Archaeology and Ethnohistory of Guatemala.

In 1967, members of the Harvard Seibal Project were the first to recognize and map the extent of the monumental palace at Cancuen, which was designated Group C (see Figure 1.5). The Harvard team also recognized residential settlement approximately 400 meters north and 700 meters south of Group A. Settlement was also noted on the full east-west extent of the peninsula (Toutellot, Sabloff, and Sharick 1978: 202). Mapping these settlements was beyond the scope of the visit of the Harvard Seibal Project, but was continued by members of the Vanderbilt Cancuen Archaeological Project. Mapping by Matt O'Mansky in 1999 and 2000 revealed residential settlement south of the epicenter of Cancuen almost completely to the river's edge (see Figure 2.1; O'Mansky 1999, 2000). In 2000, O'Mansky established a grid-based map and replaced the alphabetic group system first implemented by Maler (O'Mansky 2000). The grid-based map facilitated the use of a stratified probabilistic sampling strategy to excavate housemounds within the residential area in order to achieve a representative sample of residences (Kovacevich 2003a). Subsequent mapping by Marc Wolf recorded settlement 500-600 meters north of the epicenter (see Figure 2.1; Wolf 2003), and it is believed that settlement continues from the border of the modern archaeological park nearly one kilometer to the north. More than 500 structures (per approximately 2.5 km^2) were mapped and recorded in the immediate sustaining area around the royal palace. Undoubtedly, numerous structures were not found, as recognition of 100% of ancient Maya structures is nearly impossible due to tropical vegetation and the low height of the smallest mounds (Culbert 1990; Rice 1988; Wilk and Wilhite 1991). Further, these numbers do not include structures located outside the peninsula of Cancuen, which were not as densely nucleated. Some of these settlements were mapped and excavated (see Seijas and Pereira 2001), but were not sampled as systematically as the peninsula settlement. The site of Cancuen is much larger than once believed, with monumental architecture and evidence of a large residential population.

The excavations in the residential area of Cancuen are the focus of this dissertation, as economic activities primarily took place in residences of the ancient Maya (Ball 1993; Freidel 1981; Hendon 1991; Inomata 2001; Inomata et al. 2002; Masson 2002; McAnany 1993, 1995). While production and specialization may have taken place in the core of Maya city centers (Aldenderfer et al. 1989; Aoyama 1996; Chase et al. 1990; Sheets 2000), it was often found in elite residences (Aoyama 2001; Chase and Chase 1998; Fash 1991; Hendon 1991, 1992, 1997, Inomata 2001; Inomata and Triadan 2000; Inomata et al. 2002; Webster 1989; Webster et al. 2000). For this reason, residences inside and outside the epicenter were sampled. Excavations ranged from residential areas within the royal palace to the humblest earthen mounds. This research attempts to address the disjunction that has often occurred between studies of elite vs. nonelite. Excavations have often focused nearly exclusively on the site core or monumental architecture, excluding smaller residences and outlying structures (see for example, Henderson and Sabloff 1993; Marcus 1983). My goal is to investigate production, distribution, and consumption of all social levels at Cancuen in order to expose similar and different patterns of economic, political, and social interaction between those in the site epicenter and those in outlying areas.

Household Archaeology

Household archaeology is a relatively new, yet productive approach to understanding social processes within ancient Mesomaerica (see Hendon 1996; Netting, Wilk, and Arnold 1984; Robin 2003; Santley and Hirth 1993; Sheets 2000; Wilk and Ashmore 1988; Wilk and Rathje 1982) and elsewhere in the Old and New Worlds (see for example, Ames et al. 1992; Bawden 1982; Dillehay 1998; Gijsehem 2001; Peregrine 1992; Pollock et al. 1996; Wattenmaker 1994; Wills 2001). Early household studies in Mesoamerica were initiated by Edward Herbert Thompson (1886, 1892) in order to test Lewis Henry Morgan's (1877) unilineal cultural evolutionary model. Morgan used the presence of certain material goods and technological advances to classify societies into a three-tiered unilineal scheme. He asserted that the Classic Maya did not have true cities due to the lack of urbanism and residence surrounding the ceremonial centers, and therefore did not reach the level of a 'civilization' (Morgan 1880, 1881). Thompson documented residences and housemounds, arguing that the Classic Maya truly did have cities. Residential and household studies eventually became popular among archaeologists, especially after the work of Gordon R. Willey's pioneering Belize Valley settlement survey (Willey 1953; Willey et al. 1965; as well as his Viru Valley survey in Peru; Willey 1946).

Definitions of the Household

The aim of excavations at Cancuen was to sample *households*, not just houses or structures. While a house may be a communal, family living area, a household can be made up of multiple structures and is primarily an activity group, not just a group bound by kinship (Ashmore and Wilk 1988). A household can be defined as a place of common residence, economic cooperation, and socialization (Gonzalez 1969). Ashmore and Wilk (1988:6) present a more complex definition of households:

> A social unit, specifically the group of people that shares in a maximum definable number of activities, including one or more of the following: production, consumption, pooling of resources, reproduction, co-residence, and shared ownership. The unit may or may not be recognized by the people themselves. It may live in one locale or it may be spatially dispersed. Individuals can be members of more than one household, and it is possible for a household to have inactive members. The household is an analytical unit that can be defined empirically in archaeological samples only after protracted study.

Hendon (1999, 2000, 2002a, 2002b) presents a practice-based definition of households,

> a setting in which many groups of men and women not only lived but engaged in activities that affirmed the importance of their household identity and contributed to the social reproduction of the group (Hendon 2002a:78).

Hendon sees households as playing an active part in shaping the communal identity of its diverse constituents, as well as shaping the society around them.

All of these studies and definitions are based on earlier work in anthropology and sociology, which recognized the family and the household as an important unit of study. Malinowski (1963 [1913]:303-304) described the individual family as,

> a unit playing an important part in the social life of the natives and well defined by a number of moral, customary and legal norms; it is further determined by the sexual division of labour, the aboriginal mode of living, and especially by the intimate relation between the parents and children.

Murdock (1949) and Parsons (1955) noted the universality of the institution of the 'elementary' or 'nuclear' family. Goody (1972:3) questioned whether the 'nuclear' family "constitutes an identifiable unit within society," as well as the size and composition of the 'family.' Goody (1972:3) found that "Indeed the analysis of domestic groups is closely linked to the study of contemporary social change and the balance of human population and resources." Goody (1958, 1972) focused on the larger units of social reproduction, and how they cycled developmentally, concentrating on the implications for social change. He saw nuclear families as a unit too small to truly represent the collective and domestic activities that make up the household in most societies.

> The small units that are such a widespread feature of human society never stand altogether without the support of the ramifying ties of kinship. That is to say, these groups are articulated into the wider society of linkages with neighboring units, the links being maintained by similar ties (but obviously more inclusive and hence more diffuse). Thus domestic groups are nested into wider kinship groups or networks, which, as clans, lineages, or kindreds, often provide the basis of social organization, as well as a means of support in times of need (Goody 1972:27).

While *dwellings* may represent one single nuclear or extended family, *households* can be made up of multiple dwellings with multiple related or non-related families involved in familial, social, and economic production and reproduction (i.e., Ashmore and Wilk 1988:6; also called *dwelling* or *domestic* groups by Goody 1972). This study focuses on *households* as groups of structures inhabited by related or non-related people (men and women of all ages), who are invested in cooperative, shared, or complementary economic and social activities, which link them to the society at large and define their social identity. Structures within a household need not be places of residence in terms of where people ate and slept. The household is much more inclusive, as it is where the domestic group preformed nearly all of their economic and social tasks (as opposed to modern society in which economic tasks, religious worship, and even socialization [education] often take place outside of the household). The study of households throughout the site also allows comparisons of economic strategies, wealth (symbolic and economic), status, and varying power relations.

Household Characteristics for the Classic Maya

Traditionally, Maya patio groups have been seen as extended family residences and/or the fundamental unit of the household during the Classic Period in the Maya Lowlands (Andrews 1975; Ashmore 1981; Ashmore and Wilk 1988; Flannery 1972a; Haviland 1988; Pollock 1965; Rice 1988; Thompson 1939; Willey et al. 1965). The goal of this sampling program was to sample multiple structures within these groups in order to get a more complete sense of the activities taking place. Often a single structure within a household was sampled due to time constraints. Sampling a large number of structures while intensively excavating 5-10% would provide more information than simply intensively excavating a few structures. Therefore, the collective data sometimes includes only single structures which are in many cases, *dwellings* (see definition above and Ashmore and Wilk 1988:6) or other special function structures, but still provide information about the household of which they were a part. Because these patio groups were the primary location for most economic, religious, and social activities, all structures within the patio groups were considered part of the household, as even associated shrines, burial structures, kitchens, storage facilities, activity areas, patios, and middens contained evidence of the household activities and identity. Structures that were excluded as part of the household sampling project included those that seemed to be communally used by numerous households or the Cancuen community as a whole, such as ballcourts, defensive structures, pathways, and temples.

The main focus of this research was not to identify a function for each structure, as much as to define the activities that took place there, and how these activities relate to social identity and power. It has been found that numerous activities often took place in single structures or dwellings in Classic Maya society (Aoyama 2001; Hendon 1991; Inomata 2001; Inomata et al. 2002; Leventhal and Baxter 1988). For this study it was not as important to define a single structure such as a kitchen, as it was to find what activities took place within that structure and how they compared with other households in the community. Household studies at Tikal and Seibal have found that ancillary structures (non-dwellings) comprise approximately 10-15% of total structures in the sustaining area of those sites (Haviland 1965; Tourtellot 1988:102). Although Ashmore (1988) cautions against applying this percentage to other sites, the findings do suggest that many structures were probably dwellings (Webster and Gonlin 1988) and/or served multiple functions.

Household Archaeology at Cancuen

Households at Cancuen are usually in the patio group form, representative of most Classic Maya settlement patterns. Multiple structures often face each other around a central patio with refuse thrown behind or to the sides. The number of structures within a patio group, or household, varies widely. Many scholars have found that the number of structures within a household or patio group has to do with the developmental cycle of the family or household itself. In other words, the number of structures increases through time as the family grows and becomes more complex (Cliff 1988; Goody 1958, 1972; Haviland 1988; Tourtellot 1988). The number of households at Cancuen experienced a great deal of growth during the later part of the Late Classic (late Tepeu 2, A.D. 770-800). This may have been due to natural family growth, but also may have been affected by immigration, possibly from warring polities downriver (Demarest and Escobedo 1998; Inomata 2003; Palka 1995).

At Cancuen the size and elaboration of household groups vary greatly (see below). Many of the structures within households at Cancuen had political and ritual functions, especially among the elite (Barrientos et al. 2002, 2003; Jackson 2001, 2002, 2003; Kovacevich, Quintanilla, and Arriaza 2003; Sears 2002), and Moran (2003, 2004) also identified a possible communal kitchen used for palace residents. Especially important to this study are residential structures with exterior stone patio floors that served as activity areas for domestic activities and craft production (described below as Type IV structures). The examination of exterior space was very important in this study of households. Many activities and material remains were discovered that would never have been discovered if it were not for widespread horizontal excavation outside of structure lines. The significance of exterior space in the study of household archaeology cannot be ignored (Becker 2001; Gonlin 1994; Johnston and Gonlin 1998; Robin 2002; Robin and Rothschild 2002; Winter 1976). All types of structures were sampled intensively in interior and exterior spaces in an attempt to expose activity areas for public and private activities. Exterior spaces include exterior patio floors and work areas, domestic midden deposits, as well as specialized dumps that may have been located farther from the residential structure due to the dangerous or hazardous nature of the waste such as lithic production debris (see Aoyama 1996 and Clark 1989a, 1991 for an ethnographic example).

As entire households could rarely if ever be completely excavated, these excavations relied on samples of households, certain structures within the household in general. While this does not provide a complete picture of all activities in the household and the function of each structure within the household, it does provide a sample of household activities throughout the site. For this reason and others, an architectural typology was formulated according to construction type in order to facilitate comparisons across the site. At time of the creation of this typology (see Kovacevich 2003a), it was not known if the different types represented status, function, ethnicity, temporal differences, or other markers of social identity.

Architectural Typologies and Inferring Status and Social Organization

Inferring status and social organization from the archaeological record for the Classic Maya has proven to be difficult. Recent studies have focused on the variability of Maya social structure and markers of such structure (cf. Becker 2004; Kintz 2004; Freter 2004; Hutson et al. 2004; Manahan 2004; Chase and Chase 2004). Studies using investment in architectural construction as a sole discriminator of social status are often not effective because architectural variability can be related to many factors (Becker 2004; Haviland 1982; Tourtellot 1988; Tourtellot et al. 1992; Turner et al. 1981). Nonetheless, when combined with data such as artifact assemblages (Smith 1987), burial form and burial goods (Bartel 1982; Chapman et al. 1981), osteological evidence (Haviland 1967; Huss-Ashmore et al. 1982; Lewis 1951), architectural form and investment of labor can be helpful in inferring social status (Chase and Chase 1992; Gonlin 1994; Palka 1995, 1997).

Some scholars have argued that household prestige decreases from the site core. This can be called the ‘concentric model’, as concentric rings are drawn radiating out from the site epicenter and samples taken from zones farther and farther away from the core representing lower status residences (Carmack 1981; Fash 1983; Folan 1979; Kurjack 1974; Moholy-Nagy 1997; Thompson 1966; Trigger 1990; Landa [Tozzer] 1941; Willey and Leventhal 1979). Recent studies have shown some Classic Maya settlement patterns to be more complex, with elite structure types often located outside of the site core in strategic locations (Arnold and Ford 1980; Ashmore 1988; Becker 2004; Chase and Chase 2004; Freter 2004; Palka 1995; Webster 1992). Inferring status for the Classic Maya at certain sites may be too varied to use concentric models, as seems to be the case for Cancuen.

Ancient Maya Social Status

Thompson (1942, 1966) created the basis for a two-class model of Mesoamerican society, royals/elites and peasants/commoners (Becker 1979; Flannery 1983; Haviland 1970; Marcus 1983, 1992, 2004; Sanders 1981, 1992; Sanders and Price 1968; Spores 1983; Webster 1985). Many of the arguments regarding social status were based on ethnohistoric Spanish accounts of Mesoamerican settlement, although the bias of ethnohistoric sources must be taken into account (Carmack 1981; D. Chase 1992). Other scholars argue that Classic Maya social organization may have been much more complex with at least three or more social strata (Adams 1970, 1981; Chase and Chase 1992; A. Chase 1992; Hammond 1982, 1991; Haviland 1965, 1967; Kintz 2004; Palka 1995, 1997; Sabloff 1975b; Willey et al. 1965). Evidence for a growing group of ‘secondary elite’ (Adams 1981) was present in many of these arguments.

What many have found during investigations of social status, no matter what indicators used, is that there was extreme variation in archaeological indicators of social status, and the distinction between the two or more social strata may not be clear cut (Kintz 2004; Marcus 2004; Palka 1995). It may be so complex in fact, that it may at times be difficult to distinguish between social strata, and a social continuum of statuses may have been in place (Haviland 1967). Social theory (see especially Palka 1995) suggests that social groups or classes are often not extremely well-defined (Marx 1969; Ossowski 1970) and are very fluid and change through time (Weber 1947; 1969). Evidence from Cancuen supports the existence of several social strata. Distinguishing distinct strata or classes has been argued to be virtually impossible, although broad comparisons can be made.

In addition to status distinctions, differential construction of social identity can also be an important tool in identifying social groups in the archaeological record (e.g., Gillespie 2000a, b, and c, 2001, 2002; Hendon 2000, 2001 2002b; Joyce 2000b; Mills 2006). The economic and domestic activities described above are left as patterns that can be recovered in the archaeological record. Whether lithic or ceramic production waste, grinding stones, utilitarian ceramics, geochemical residues in floors, or tools used in craft production. Socialization also leaves clues in the ground. How members of households learned to think about themselves and create identity is manifested in material culture (Gillespie 2000a), which can include material culture such as architectural elaboration of the household itself, possessions (prestige and utilitarian), interment patterns (Joyce 2000b), caching and storage behavior (Hendon 2000), and body modification (such as cranial and dental modification).

Architectural Typology at Cancuen

Cancuen's architectural typology relies not only on the size of plaza groups, but on construction material and architectural form. Through initial excavations in 1999 and 2000, five architectural types were defined (Kovacevich 2003a; Figure 2.2). Although these types were defined, they remained types to be tested with the excavation of material culture. The types were created in 2000, when large-scale household excavations at Cancuen were implemented. Type I is characterized by standing architecture, or stone-walled or corbel-vaulted residences with a large labor investment (Figures 2.2, 2.3, and 2.4). Type II structures are those with masonry platforms, staircases and/or wall-braces, and perishable superstructures (Figures 2.2, 2.5, and 2.6). Type III are earthen platforms with low wall braces or retaining walls and perishable superstructures (Figures 2.2, 2.7, and 2.8). Type IV are earthen platforms with a surrounding, exterior *laja* (flat limestone) stone patio and perishable superstructures (Figures 2.2, 2.9, 2.10, and 2.11), and Type V are simply earthen platforms with perishable superstructures (Figures 2.3 and 2.12). Type 0 was a classification later added for low mounds without visible surface architecture that could not be concretely identified. Type 0 mounds in short are unidentified, probably nonelite, low mounds (Kovacevich 2003a), and may have been Type V mounds that were not excavated sufficiently to be able to say with confidence that they had no stone architecture. Types III and IV can vary in labor investment according to amount of earthen fill, but generally do not require the large labor investment involved in the construction of masonry structures. These types were to be tested as distinct social groups through excavation and analysis of material culture. While these types are not necessarily hierarchical, differences in architectural investment between structure types I and II, and III and IV have been found in many cases to correlate with differences in grave type, grave goods, and material culture (Kovacevich and Callaghan 2005; Kovacevich, Cook, and Beach 2004). Many studies have shown that it is difficult to tell if those with variation in wealth and architectural investment were actually high-status commoners or low status nobles (Carmean 1991; Haviland 1982; Hirth 1993; Palka 1995, 1997; Robin 2003; Tourtellot et al. 1992). For this reason, I will test not only that these distinctions exist, but how these different groups were related to each other in social space using multiple lines of evidence. Cancuen provides a favorable archaeological environment to test these relationships, as many artifacts were left *in situ* from termination rituals and/or rapid abandonment. Using the Cancuen data, I will attempt to demonstrate differences between these structure types, and although differences in status are difficult to prove, definite differences in activities are apparent in architectural form, investment of labor, as well as material culture, which seems to correlate with differences in social identity and corresponding power and resource relationships.

It will initially be assumed and tested that Types I and II structures correspond to elite residences, Types III, IV, V, and 0 correspond to nonelite residences. Types III and IV may have represented a middle status or at least some variation in status or social identity. The possibility that differences in these structures also correspond to social identity will also be explored, as status is one form of social identity (see also Janusek 2005). The initial correlates of “elite” structures relied on investment of labor in construction, as elite members of the society would likely have more access to resources and labor to construct large or monumental structures. Through excavation, the size and elaboration of architecture would be tested against material culture correlates, such as elaborate grave treatment and goods, access to exotic materials, hieroglyphic writing, and badges or markers of status or office. Some of these material culture correlates do indeed seem to be restricted to Types I and II structures. Types III and IV structures appeared to be in the middle range of investment in construction, as well as structures where crafting activities took place, at times on a large-scale. As noted above, divisions between classes and/or social groups are not always clear cut, but with several material culture correlates, broad comparisons can often be made (see especially Palka 1995).

Household Excavations at Cancuen

Beginning in 1999, household excavations were initiated in order to test the hypothesis that the Classic Maya kingdom of Cancuen had a strategic location between the volcanic highlands and tropical lowlands on the Pasión/Usumacinta River that allowed its residents to specialize in the production and trade of volcanic highland goods for trade in the tropical Maya Lowlands (Demarest and Barrientos 1999). In 2001, a formal residential sampling program was initiated in order to obtain a representative sample of households within Canucen's sustaining area (Kovacevich 2003a). In 2002 and 2003 these excavations were funded by the National Science Foundation (Arthur Demarest, P.I.). Residential excavations at Cancuen were focused on: 1) defining the chronology of occupation at the site, 2) identifying patterns of access of imported raw materials through time, and 3) investigating the distribution of artifacts, focusing on domestic and specialized activities for mound groups at varying distances from the palace.

The archaeologists that took part in this sampling program included, Brigitte Kovacevich, Michael Callaghan, Tomas Barrientos, George Higginbotham, Erin Sears (ELS), Lucia Moran, Alejandro Seijas, Sarah Jackson, Karen Pereira, Jenny Guerra, Carlos Alvarado, Janet Castellanos, Molly Morgan, Arik Ohnstad, John Tomasic, Carrie Anne Berryman, Luis Rios, Anna Novotny, Edgar Suyuc (ES), Paola Torres, Claudia Arriaza, Maria Antonieta Cajas (MAC), Moises Ariazza (MAC2), Mirza Monterroso, Walter Burgos, and Claudia Quintanilla (see corresponding excavations in Table 2.1).

Excavation Methodology and Sampling Strategy

Excavation methodology relied on a stratified random sample of residential structures in grid squares within Cancuen's sustaining area (see Figure 2.1). Twenty to twenty-five percent of mounds within each grid square on the Cancuen peninsula were sampled with either a test unit in the rear of the structure to reach the middens often located behind structures, or a trench across the structure in order to expose middens and/or architectural features. Depending on the number of mounds within the grid square, 5-10% of those mounds were strategically chosen in each grid square, depending on architectural type and artifact assemblage, for horizontal exposure.

The initial sampling of structures had three goals: 1) the establishment of a chronology for each excavation unit and residential area in order to ensure a chronologically variable sample, 2) the identification of various forms of architecture possibly indicating different social groups, and 3) the identification of workshop dumps and possible activity areas that would give clues to household activities.

During the initial phase, two by two meter test units were placed behind mounds identified for sampling in order to expose middens that may contain secondary refuse from specialized production, as well as ceramic chronological data. These units were sometimes excavated in arbitrary levels, but if possible natural and cultural strata were followed to sterile soil in order to expose all phases of occupation and deposition. Arbitrary levels were used to break up homogeneous-looking midden deposits in the event there was chronological change that was not apparent to the investigator. From these initial units, horizontal excavations following a 2x2 meter trench exposed front and rear structure foundations, as well as possible activity areas. These test excavations helped to identify areas with evidence of production from different chronological phases and social strata within the site. The initial trenches often uncovered burials as well. Because we extended units across the mound (usually in the center) to expose construction phases, burials beneath structure floors were often encountered and excavated. The interment type and artifactual evidence recovered from these burials were also important for determining status and chronology of the structure. In some cases, multiple burials were uncovered within a single unit, trench, or structure, providing an unbalanced sample of burials from certain structures or grid squares.

Following the initial random sampling, residences were strategically chosen that initially appeared to vary chronologically, socially, and economically for horizontal exposure. These excavations were intended to give a representative sample of economic activities in residential areas of varying social and temporal categories. A grid of 2 x 2 m units extending from the original trench extended across the mound to cover as much as possible of the interior and exterior area of the structure, including interior floors, adjacent patios, middens, and lithic dumps that could represent workshop and domestic refuse.

Sampling Results

In total, 107 structures of more than 500 on the peninsula were sampled within the sampling program within 20 grid squares in Cancuen's residential area (roughly 20% of the total mounds), of which 35 were horizontally exposed (roughly 7% of the total mounds). These structures are listed on Table 2.1, including the structure type, operation number, number of units excavated, midden density (coded as 0=none, 1=low density, 2=medium density, and 3=high density), associated burial numbers, years excavated, and excavator (see above for complete list of excavators). Data from Type III and IV structures include pyrite working in structures K6-34 (Kovacevich et al. 2001; Kovacevich et al. 2002; Kovacevich 2002) and M6-12 (Cook et al. 2006; Kovacevich, Cook, and Beach 2004), large-scale jade working in structures K7-24, N10-1, M10-4, M10-7, and M10-3 (Kovacevich 2003b; Kovacevich, Cook, and Beach 2004), and obsidian and chert production throughout the site (Kovacevich et al. 2001). Type I and II structures yielded tools used in the final stages of production of prestige goods, such as earflare polishers in M9-1 and L7-9, and fine jade finished products such as those from Burial 50 in structure K7-1 (Barrientos et al. 2003; Jackson 2002; Kovacevich 2003a; Kovacevich, Cook, and Beach 2004; Sears 2002). Of the more than 500 structures on the peninsula, ten Type I Structures were excavated, nineteen Type II, twenty-three Type III, twenty-two Type IV, and two Type V. Although thirty-seven structures were classified as Type 0, unidentifiable due to insufficient excavation, and many may have represented Type V Structures without any kind of stone masonry.

Laboratory Methodology

The tools and artifacts investigated in this dissertation were analyzed in the spirit of studies that attempt to define how those artifacts were constituted by, and reconstituted the identities of, their makers and users (Appadurai 1986; Chilton 1999; Deitler and Herbich 1993; Dobres 2000; Dobres and Hoffman 1994; Schiffer and Skibo 1987; Shanks and Tilley 1987). The work of these scholars was influenced directly and indirectly by many pioneering scholars in the realm of technological analysis, including Mauss (1935), Leroi-Gourhan (1945), and Lemonnier (1986, 1992, 1993), (see also Chapter 4). The importance of these studies lies in their interest not only in the manufacturing sequence or *chaîne opératoire*, but in how these operational chains at the same time created and/or reinforced existing social structures, and how they reflected the identity of producers.

An essential part of the laboratory methodology for handling the lithic materials recovered in these household excavations was the creation of a standardized and comprehensible typology for each class of material. This was challenging in some cases as extensive typologies were not in standard use (especially in the case of jade and pyrite; see also Chapters 5 and 6) and in other cases, many typologies and grouping systems existed (in the case of chert; see also Chapter 8).

It is for this reason that the analysis of all lithic artifacts at Cancuen attempted to follow the studies of lithic industries of Crabtree (1968, 1972), Hester (1972), Sheets

(1975, 1978), and Clark (Clark and Bryant 1997). The basic typological scheme for this study will follow the Behavioral Typology of Sheets, and the Technological Typology of Clark and Bryant (closely related to the *chaîne opératoire* method). The important characteristic of these typologies is that they attempt to elucidate inherent traits in artifacts versus traits that are imposed by the investigator (Sheets 1975). This technique is concerned with identifying the behavior changes made during the production of an artifact. This is important because it allows us to use the tools *and* the byproducts in the manufacture of those tools to reconstruct production activities and compare the technologies behind those activities.

The Technological Typology of Clark and Bryant (1997) is an expansion of the Behavioral Typology of Sheets (1975, 1978), and will be applied to the study of obsidian and chert tools and debitage in this study. In the production of obsidian prismatic blades, there were several stages that could immediately be identified in an obsidian artifact. Sheets initially focused these stages or outcomes for obsidian core/blade technology. Clark and Bryant argue that many times it is possible and necessary to identify transitional forms between the stages identified by Sheets. They also argue that other behaviors can be identified, such as rejuvenation and error removal. They see the process as flexible and partially reversible. "A technological typology subsumes all the information on manufacturing techniques that formed the basis of behavioral analysis while, at the same time, allowing for greater analytical precision in the definition of more specific types" (Clark and Bryant 1997:113). This study lies somewhere in between the more general approach of Sheets and the highly detailed approach of Clark and Bryant. While a highly detailed approach is of course preferable, it is often not possible due to time constraints and the skill of the analyst. Clark and Bryant are highly experienced analysts with a small and restricted data set in the case of the Ojo de Agua "workshop dump." When possible, a great degree of specificity was used to categorize the technology used at Cancuen, and activities outside standard reduction sequences such as rejuvenation and error removal were identified and recorded. These identifications are also important for inferring levels of skill as well as loci of blade production (see Chapter 7).

While these typological schemes were initially applied to the obsidian industry in Mesoamerica (Sheets 1975; Clark and Bryant 1997), which is particularly suited to this type of analysis, they have been applied to chert artifacts as well (e.g., Moholy-Nagy 1994;Clark 1988; Fowler 1987). Here, I will extend the same concepts to the production of jade and pyrite artifacts.

The specific features recorded and utilized in this analysis will be discussed in the individual chapters as they pertain to each class of artifact and each technology. Other factors besides technology that were revealed by laboratory analysis include levels of skill, standardization, possible chronological markers, etc. Most important were artifact distributional studies, technologies utilized, levels of skill, standardization, and how these characteristics were distributed throughout the site and how they differed among the various social groups at Cancuen. The use of technological sequences for artifact analysis at Cancuen is significant because it will help to elucidate differential patterns of production, distribution, and consumption throughout the site, and therefore differential power structures and social identities.

Conclusions

Chapters 5-8 provide broad data about the distributions of obsidian, chert, jade, and pyrite in elite and nonelite households, and what this may have meant for larger economic patterns throughout the site. The artifact patterns and distributions discussed in these chapters include the entire sample excavated from the 107 structures. Chapter 9 will discuss in depth several of the most completely excavated households, comparing activities in detail also using other types of artifacts including groundstone, geochemical data, ceramics, interment data, and other miscellaneous artifacts. While these structures are only a portion of the sample, the artifact patterns found are confirmed by the other less fully excavated structures in the sample, and these specific structures were chosen for their representation of the structure group as a whole.

Variation between households at a site could be due to many factors, some of which could include economic, ethnic, ideological, kin, demographic, and status (Wilk and Ashmore 1988:11). It is also important to note that variation or uniformities between households can reveal the larger organizing principles of the society itself (Marcus 1983; Rice 1988). These are driving principles behind these investigations, sampling a wide variety of households in order to find what factors cause variation between them, and how that reflects the organization of Classic Maya society.

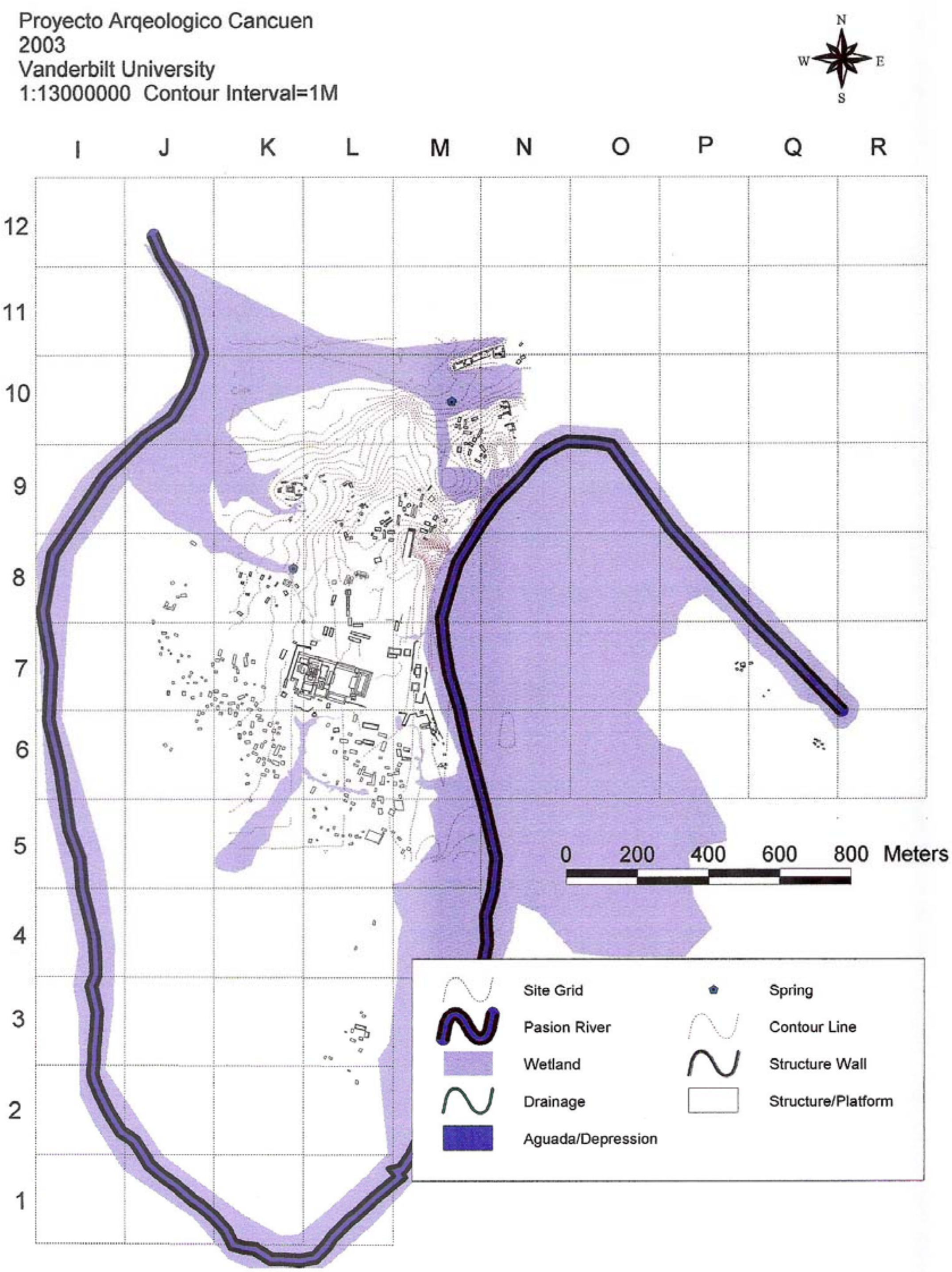


Figure 2.1. Map of Cancuen showing the grid squares (map by Marc Wolf).

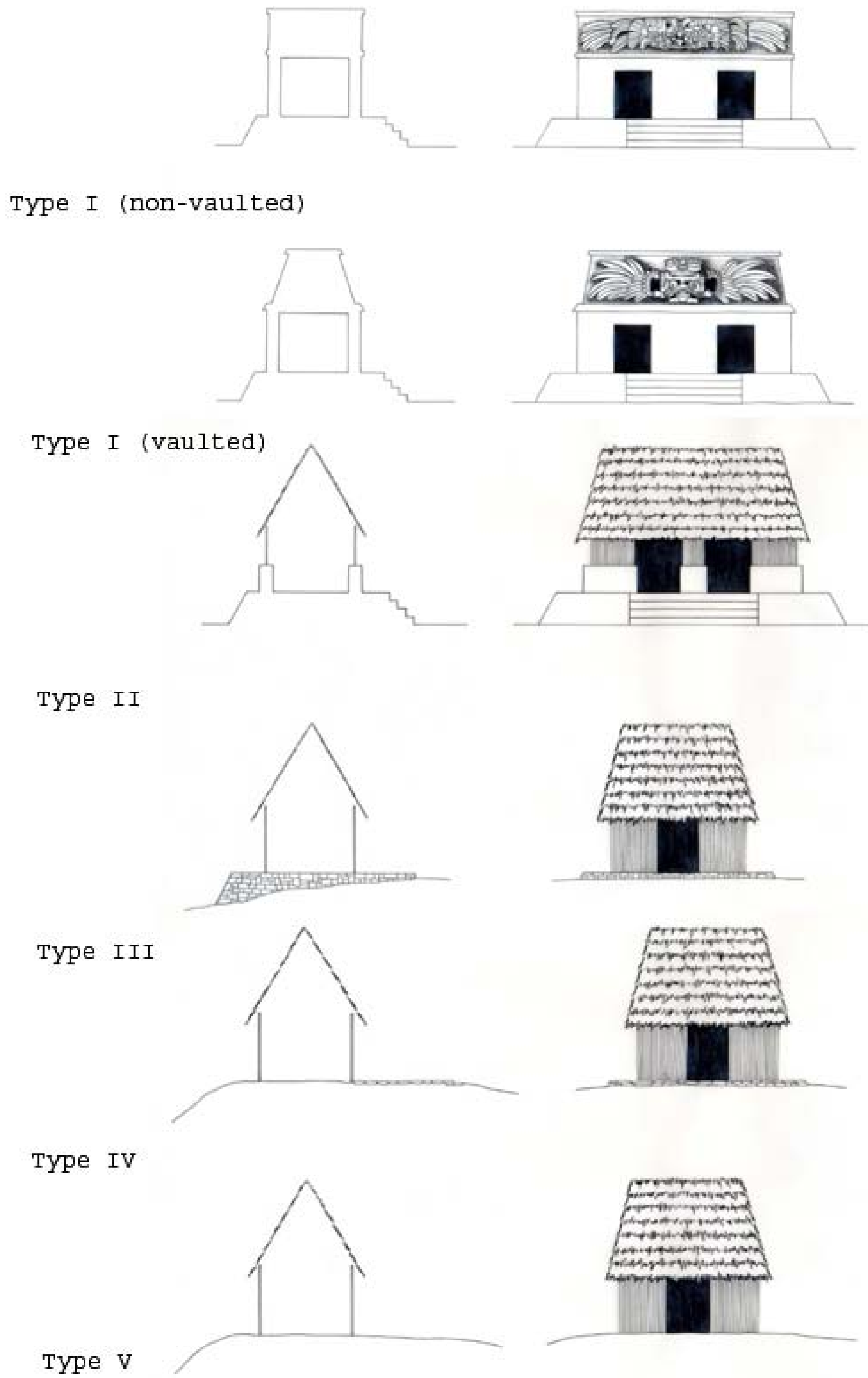
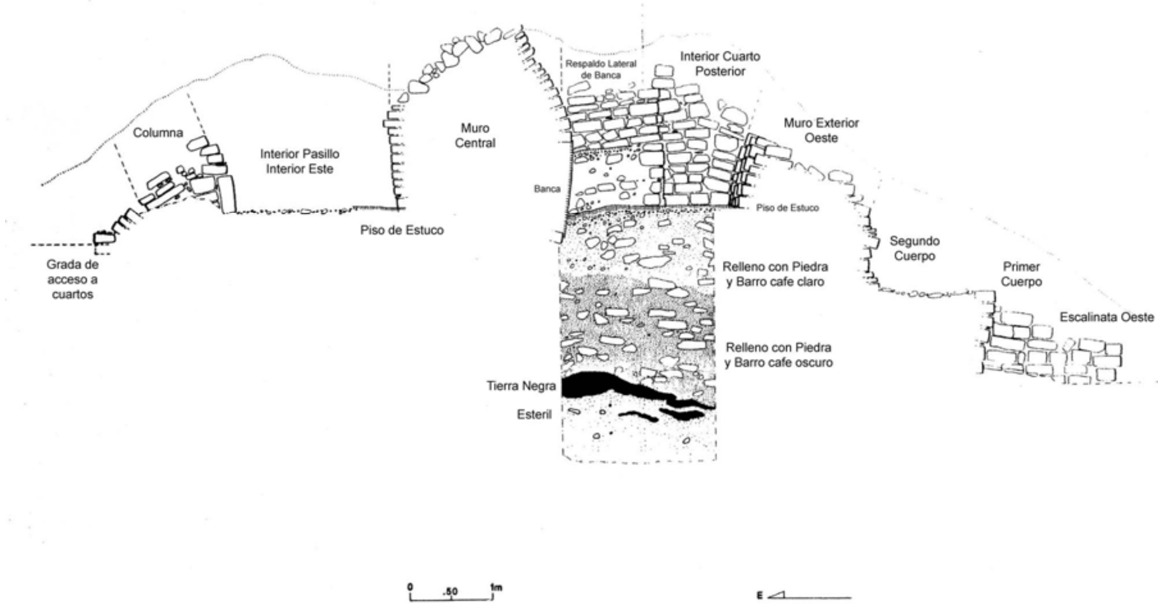


Figure 2.2. The architectural typology created for Cancuen (Kovacevich 2003a; drawing by Luis Fernando Luin).

a.



b.

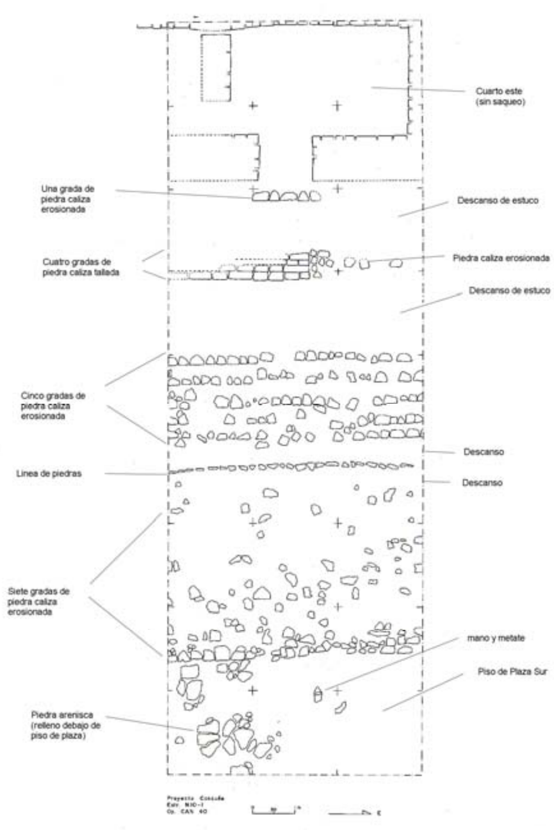
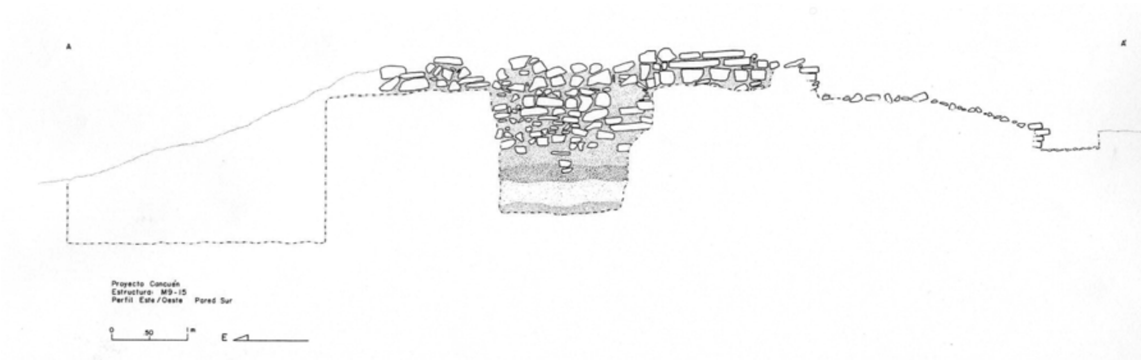


Figure 2.3 Type I Structures a) Profile of Structure M9-1, b) Plan view of Structure N10-1 (drawings by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

Figure 2.4. Photo of Type I structure M9-1 (photo by Sarah Jackson).

a.



b.

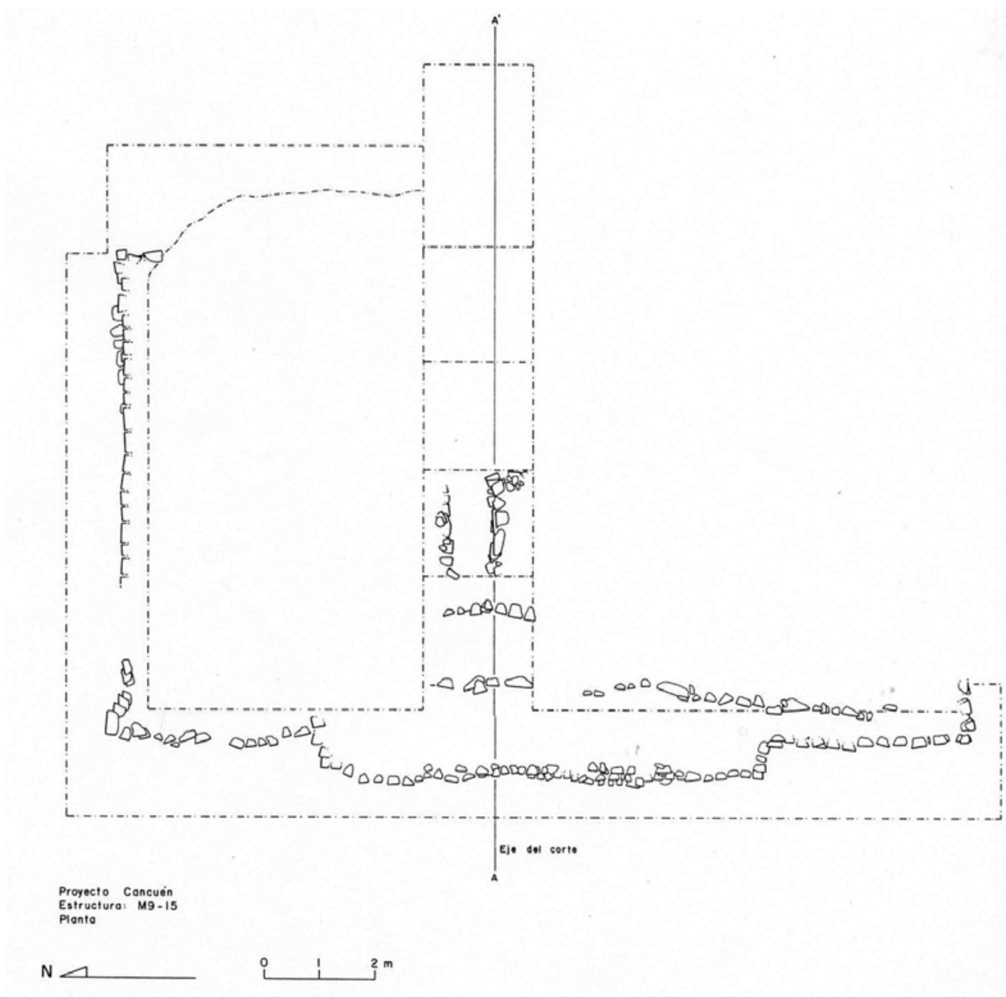


Figure 2.5. Type II Structures a) Profile of Structure M9-15, b) Plan view of Structure M9-15 (drawings by Luis Fernando Luin Used with permission of the Cancuen Archaeological Project).

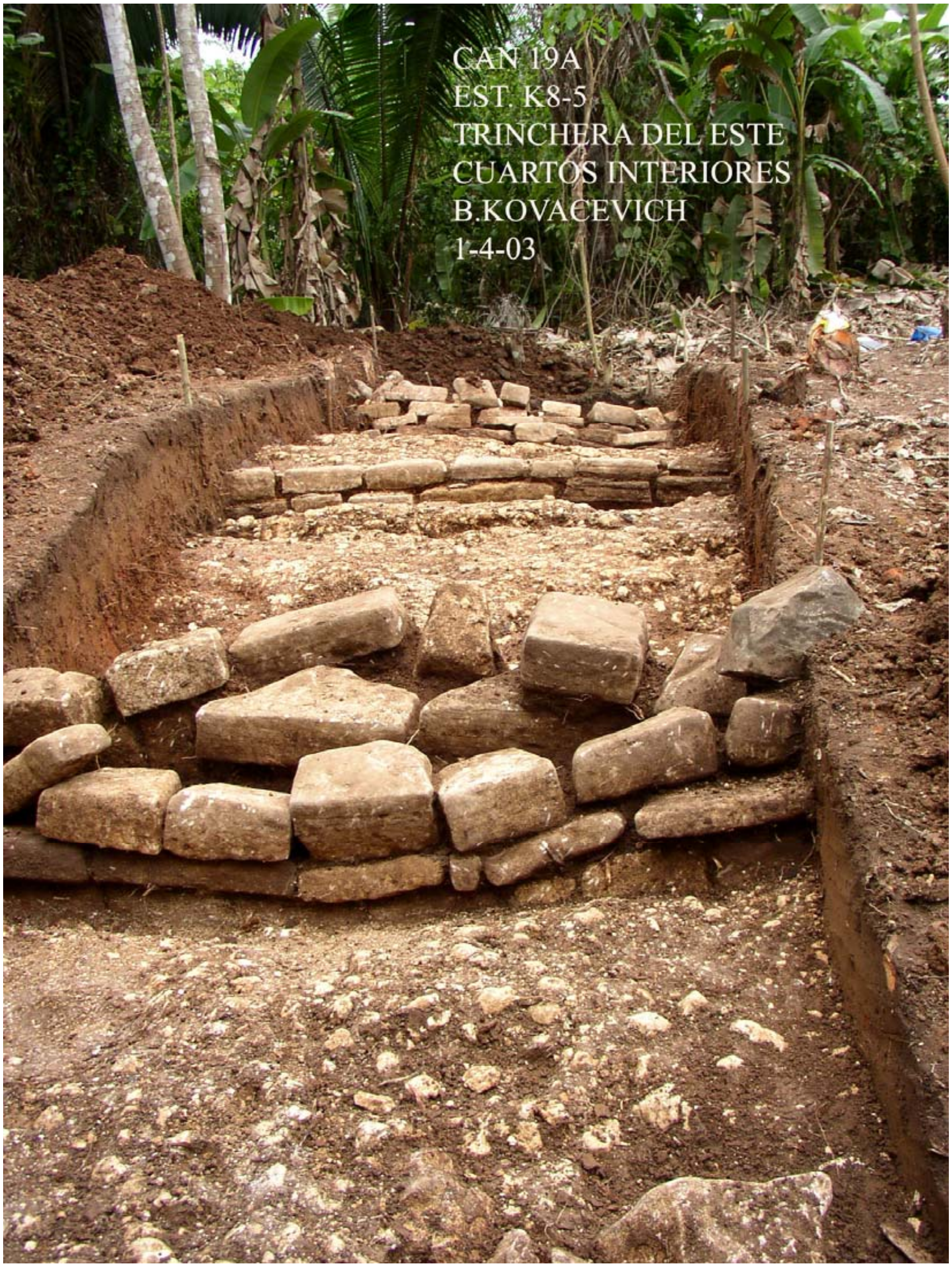
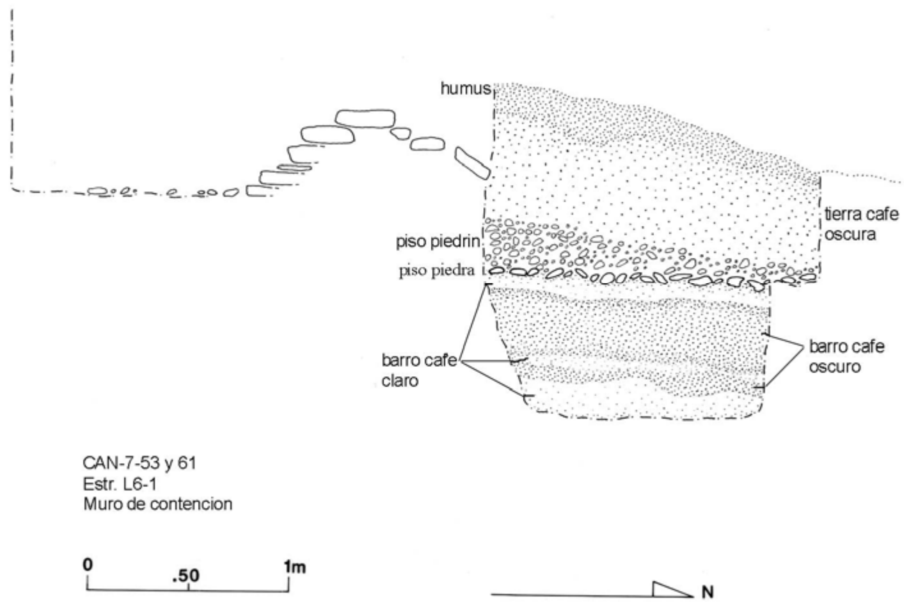


Figure 2.6. Photo of Type II structure, K8-5 (photo by author).

a.



b.

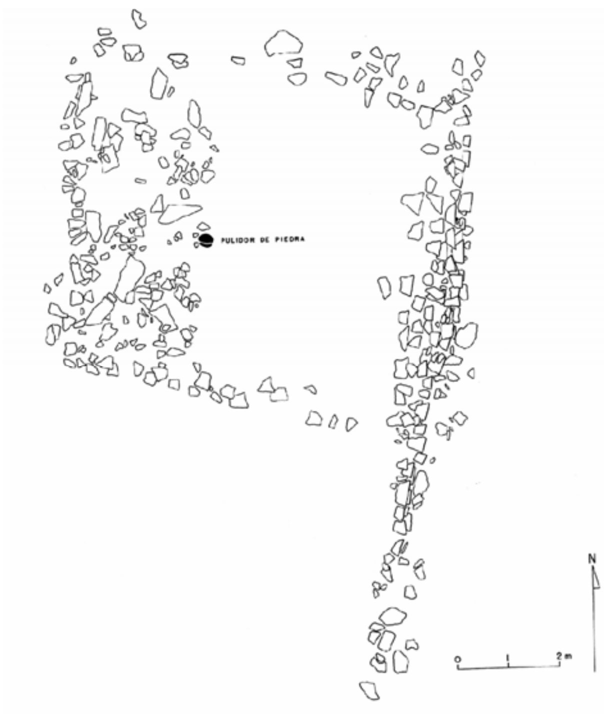
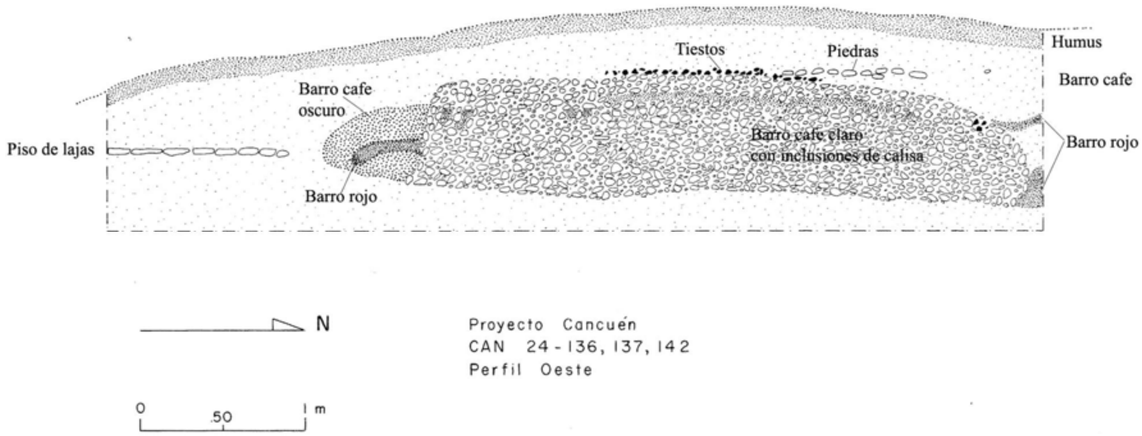


Figure 2.7. Type III Structures a) Profile of Structure L6-1, b) Plan view of Structure K6-34 (drawings by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

Figure 2.8. Photo of Type III structure, K6-34 (photo by Tomás Barrientos).

a.



b.

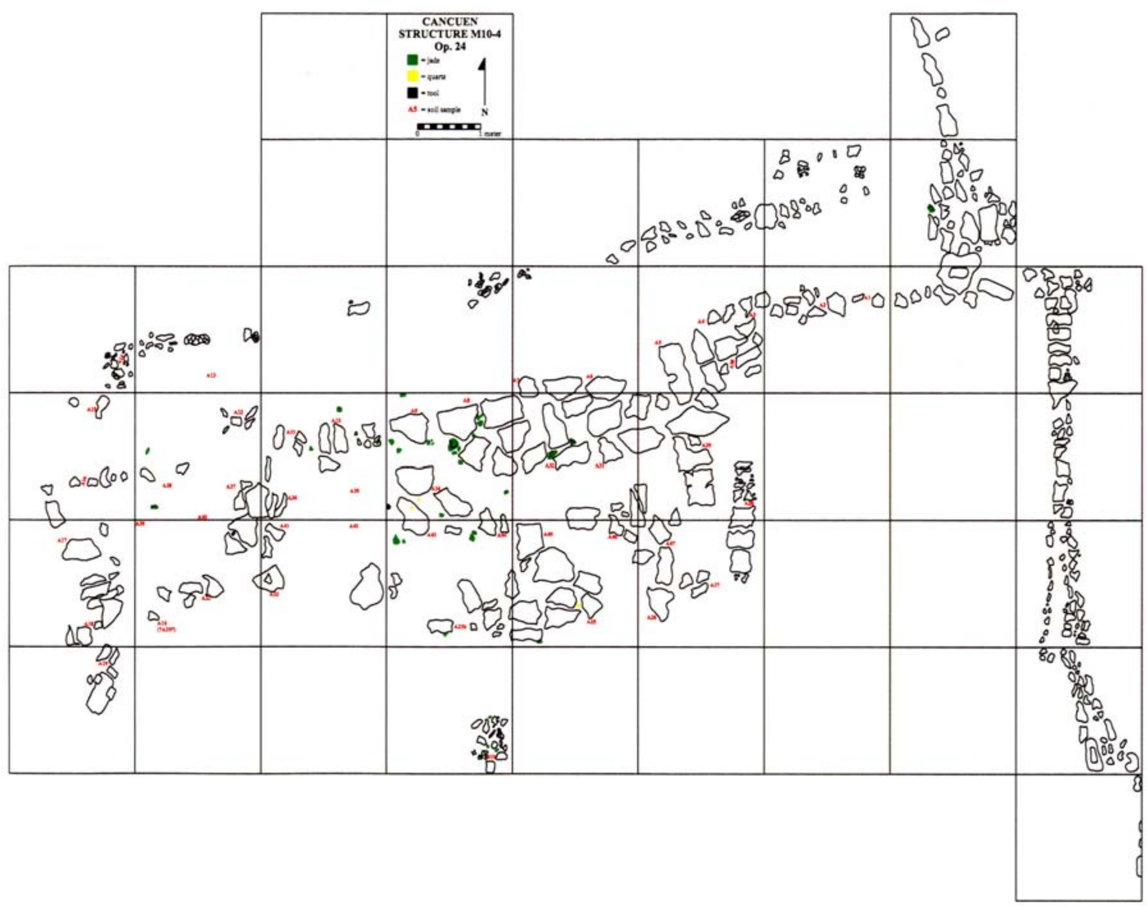


Figure 2.9. Type IV Structures a) Profile of Structure M10-3 (drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project), b) Plan view Structure M10-4 (map by Matt O'Mansky).

Figure 2.11. Photo of Type IV structure, M10-4 (pictured above in Figure 2.10b; photo by author).

Figure 2.12. Photo of Type IV structure, M6-12 (photo by author).

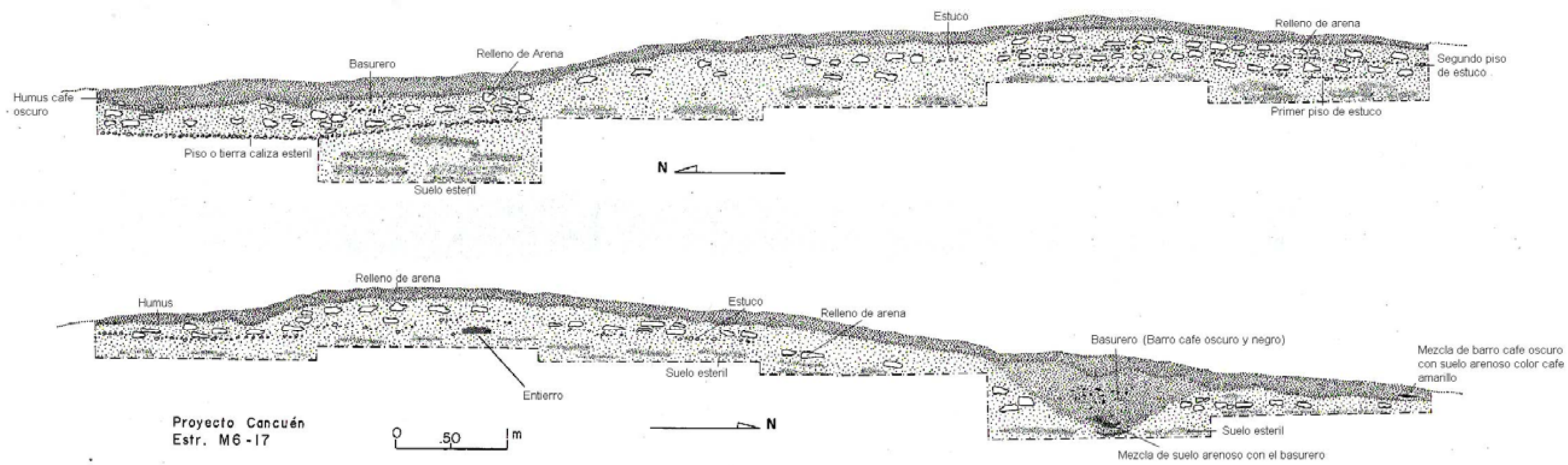


Figure 2.13. Type V Structure M6-17 (drawing by Luis Fernando Luin).

Table 2.1. Results of the residential sampling program, noting quadrant of excavation according to map in Figure 2.1, structure number, structure type, operation number, number of units excavated in the structure, midden presence and density, burial numbers, years excavated, and initials of excavator(s).

Quad.	*Structure*	*Struct. Type*	*Operation*	*Units*	*Midden*	*Burials*	*Year*	*Arch*
J6	J6-5	3	13	31	1	10	2000	GH
	J6-3	5	13	13	0	0	2000	GH
J7	J7-7	4	15	24	1	0	2000	GH
	J7-3	0	13	1	0	0	2000	MC
	J7-5	0	13	1	0	0	2000	GH
	J7-4	0	13	1	1	0	2000	GH
J8								
K6	K6-39	4	13	2	0	4	2000	GH
	K6-16	0	13	2	2	0	2000	BK
	K6-19	4	13	2	1	0	2000	BK
	K6-20	0	13	1	0	0	2000	BK
	K6-23	0	13	1	0	0	2000	BK
	K6-24	0	13	3	0	1a	2000	BK
	K6-28	3	13	7	3	2,6	2000	BK
	K6-34	3	13	23	3	11	2000	TB
	K6-33	0	13	1	1	0	2000	ES
	K6-10	0	13	1	1	0	2000	ES
	K6-12	0	13	1	1	0	2000	ES
	K6-40	0	13	2	1	0	2000	BK
K7	K7-1	2	17	30	0	31	2000	ELS
	K7-2	2	18	24	1	8	00&02	LM/JC
	K7-3	2	16	24	0	50	00&02	ELS
	K7-13	0	13	2	0	0	2000	MC
	K7-14	0	13	2	1	0	2000	MC
	K7-20	0	13	4	0	3	2000	MC
	K7-22	0	13	1	1	0	2000	MC
	K7-23	0	13	2	1	5	2000	MC
	K7-24	4	13	51	3	0	2000	MC
	K7-25	0	13	1	0	0	2000	MC
K8	K8-1	2	19	2	0	0	2000	AS
	K8-2	1	19	4	0	9	2000	AS
	K8-5	2	19 & 19A	32	0	0	00&03	AS/BK/PT
	K8-11	3	19 & 19A	18	3	65,72	00&03	AS/MAC
	K8-12	4	19A	16	3	0	2003	PT
K9	K9-1	2	39 & 39A	13	1	0	02&03	JT/AO
	K9-3	4	39	5	0	0	2002	JT
	K9-4	4	39A	14	1	70	2003	WB/AO
	K9-5	3	39A	5	0	0	2003	AO
	K9-6	4	39A	15	1	63,64	2003	CA
	K9-7	3	39A	13	2	73,74	2003	AO
	K9-8	4	39A	5	1	0	2003	AO
L2	L2-1	0	6	1	0	0	1999	GH

	L2-2	0	6	1	0	0	1999	GH
L3	L3-1	3	6	9	0	0	1999	MC
	L3-2	0	6	1	0	1	1999	MC
	L3-3	3	6	7	3	0	1999	BK
	L3-4	3	6	2	2	0	1999	BK
	L3-5	3	6	2	2	0	1999	BK
	L3-6	0	6	1	0	0	1999	GH
	L3-7	0	6	1	0	0	1999	GH
	L3-8	0	6	1	0	0	1999	GH
	L3-10	0	6	1	0	0	1999	GH
	L3-11	0	6	1	0	0	1999	GH
L5	L5-1	2	8	1	1	0	1999	GH
	L5-3	0	8	1	0	0	1999	GH
	L5-4	3	8	1	0	0	1999	GH
	L5-5	2	8	1	0	0	1999	GH
L6	L6-1	3	7	58	3	7,37	99&02	LM/JG
	L6-2	2	7	23	3	0	2002	LM
	L6-3	4	7	10	1	0	99&02	GH/LM/KP
	L6-4	3	7	1	0	0	1999	LM
	L6-12	4	7	1	0	0	1999	GH/LM
	L6-19	0	7	1	0	0	1999	LM
	L6-21	0	7	1	0	0	1999	LM
L7	L7-9	1	4	114			02,03,04	TB
	L7-8	1	4				2004	TB
	L7-12	1	23A			?	2002	MC
	L7-14	1	26A	11	0		2003	MC
	L7-1	1	26A	12	0	75	2003	MC
	L7-27	1					2004	MAC2/TB
L8	L8-5	3	37C	2	1	0	2002	AO
	L8-6	1	37C	5	3	51	2002	AO/JG
L9	L9-4	2	25C	25	1	0	2001	MC
	L9-5	2	25C	31	3	0	2001	MC
	L9-8	4	37A	20	3	44,45	2002	AO
	L9-9	2	37B	22	2	0	2002	MM
	L9-10	2	37B	1	0	52	2002	MM/AO/JG
	L9-12	0	37C	1	0	0	2002	AO
M10	M10-6	4	24	25	3	0	2001	BK
	M10-4	4	24	48	3	47,48	2002	BK
	M10-7	4	24	42	3	23,24,25,26	01,02	BK
	M10-3	4	24	20	3	49	2002	BK/KP
	M10-5	3	24	2	0	18,19	2001	KP
M6	M6-12	4	14B	34	3	0	2003	MC/MM
	M6-17	5	14A	10	2	61	2003	BK
	M6-18	3	14 & 14A	3	0	14,56,57,59,62	2003	LR/AN
	M6-19	3	14A	13	3	60,62	2003	AO

	M6-20	3	14 & 14A	2	0	15	02&03	LR/AO
M9	M9-1	1	25E	42	3	36,38	2002	SJ
	M9-15	2	25A	35	3	21,22,28, 27,29	01,02	SJ
	M9-16	2	25A	8	3	54		SJ
	M9-17	2	25A	18	3	41,42,39, 40	2002	SJ
	M9-18	2	25A	29	2	55	01,02	SJ
	M9-19	2	25A	7	3	0	2002	SJ
	M9-26	2	25A	8	2	0	2002	SJ
	M9-25	3	24	3	1	0	2001	BK
	M9-2	0	25B	1	0	0	2001	CA
	M9-6	4	25B	1	0	0	2001	CA
N10	N10-1	1	40	37	3	0	2003	BK
	N10-2	4	40A	9	3	0	2003	BK
N11	N11-1	3	40	8	1	66,67	2003	CQ
	N11-2	4	40	9	1	68,69,71	2003	MAC2
	N11-3	4	40	5	3	0	2003	BK
N9	N9-1	4	24	10	0	17	2001	BK
P7	P7-1	3	35	3	0	0	2001	AS
	P7-3	0	35	1	0	0	2001	AS
	P7-4	3	35	2	1	0	2001	AS
Q6	Q6-1	0	36	3	0	0	2001	KP
	Q6-2	0	36	1	0	0	2001	KP
	Q6-4	0	36	1	0	0	2001	KP
	Q6-5	0	36	1	1	0	2001	KP
Q7	Q7-1	3	35	1	0	0	2001	KP
	Q7-2	0	35	1	0	0	2001	AS
	Q7-3	0	35	1	0	0	2001	AS

CHAPTER III

PREINDUSTRIAL ECONOMIC SYSTEMS

> The word *economy* can be traced back to the Greek word *oikonomos*, "one who manages a household," derived from *oikos,* "house," and *nemein,* "to manage"
>
> (The American Heritage Dictionary of the English Language, Fourth Edition*;* see also Polanyi 1957a:81; Wilk 1996:15).

Introduction

In the study of preindustrial economic systems, household archaeology plays an integral role. Within preindustrial systems, the household is an important unit of analysis as the components that make up any economy; production, consumption, and distribution (e.g., Costin 1991), often took place in household contexts. For this reason, the household is the primary unit of analysis in this investigation.

The study of production, consumption, and distribution systems has evolved in the social sciences from more systemic, non-agent centered rational views of preindustrial economies, to more practice based interpretations that rely on the interaction of the individual with social structure within which he/she is imbedded. In this chapter I will first review previous debates and literature showing the evolution of thought on preindustrial economic systems, and then characterize the approach that will be used here, providing some background on Classic Maya economic systems, and issues that are particularly relevant to Cancuen. I will also define the terms and concepts previously and currently used, as the proliferation of these definitions in the literature has led to a great deal of variation, often lacking clarity (see also Costin 1991).

Moving Beyond the Substantivist/Formalist Debate

The substantivist/formalist debate polarized the study of preindustrial economic systems for decades. Karl Polanyi (1957b:241) explains the two viewpoints,

> The substantive meaning of economic derives from man's dependence for his living upon nature and his fellows. It refers to the interchange with his natural and social environment, in so far as this results in supplying him with the means of material want satisfaction.
>
> The formal meaning of economic derives from the logical character of the means-ends relationship, as apparent in such words as "economical" or "economizing." It refers to a definite situation of choice, namely that between the different uses of means induced by an insufficiency of those means. If we call the rules governing choice of means the logic of rational action, then we may denote this variant of logic, with an improvised term, as formal economics.

Polanyi goes on to say that the two definitions have nothing in common; the substantive meaning derives from fact, while the formal meaning derives from logic. Substantivists drew inspiration from social theorists such as Durkheim and Marx, seeing the economy as embedded in social and political structures. Substantivists tend to view economic actors as socially embedded, acting according to cultural norms and values (Dalton 1969; Herskovitz 1941, 1952; Polanyi 1944; 1957b; Sahlins 1972), while from the formalist perspective, economic actors tend to be self-interested individuals concerned with rational maximizing behavior (Burling 1962; Cancian 1966, 1979, 1989; Cook 1966; LeClair 1962; LeClair and Schneider 1968). At the basis of these arguments are fundamental differences in approaches to the study of human societies; inductive vs. deductive reasoning, social vs. individual, free will vs. determinism, altruism vs. selfishness (see Wilk 1996). In most cases these positions argued past one another, but these two arguments are not mutually exclusive. Many now argue that both the social relations of reproduction and individual choice are motivating factors in economic decisions and development (e.g., Giddens 1979; Wilk 1996). Practice based analyses (see Bourdieu 1977; Giddens 1984; Ortner 1984) have allowed a more holistic approach to understanding the economic (and social) behavior, in that both agency in the form of individual choice is considered, as well as how agency is shaped and constrained by social structure, and at the same time creates and contests that structure.

A different understanding of value has allowed the analysis of economic systems to move beyond dichotomies such as social vs. individual, irrational vs. rational economic action, which polarized the substantivist/formalist debate. The work of Bourdieu (1977) and others attributes value to spheres outside of economic wealth. 'Rational' choices can be influenced by the accumulation of either economic or symbolic capital, symbolic capital -- meaning social ties, possession and manipulation of 'high culture,' prestige, and honor. These concepts allow for calculation and rational economic decisions, while at the same time grounding these choices in social practice and competition for more ephemeral forms of wealth including prestige and status, which can then be further converted into material wealth or increasing prestige and influence (i.e., economic, social, and cultural capital).

This debate has also developed into Feminist critiques of economic studies. During eighteenth century industrialization the household began to be overlooked as a unit of economic study, marginalizing and conflating female and domestic activities (Brumfiel 1992; Foucault 1978; MacCormack and Strathern 1980; Rosaldo and Lamphere 1977; Tringham 1991; Wilk 1989; Wright 1996; Yanagisako 1979). In Classical Greek economic studies the household was the central unit of study and the economy was a partnership between men, women, and children (Aristotle 1998 [350 B.C.]: Book I, Chapter 3; see also Polanyi 1957a). While in capitalist societies it is true that the “money making” activities generally take place away from the household itself, this was not the case in many preindustrial societies. This attitude has permeated the study of preindustrial societies, especially in the area of household production (see Pearson 1957 on the *oikos* debate). This prejudice can be seen in the language and attitude towards household production. A certain level of complexity is often assigned to societies that have moved craft production from the household to a secondary location outside of the domestic realm (e.g., Costin 1991; Peacock 1982, Santley and Kneebone 1993; van der Leeuw 1976). Mills (1995) questioned this unilineal evolutionary scheme for economic complexity. She discovered that Zuni silversmiths moved from separate workshops to intensive domestic production as specialized production increased and became more complex, the entire household also became involved in production as output increased. Mills’ study also questions traditional assumptions that specialized production always moves from female to male work as it becomes more complex (although in some cases this type of social evolution holds true, cf. Peacock 1982). This finding demonstrates the importance of household archaeology in the study of preindustrial economic systems, as many economic activities take place in household contexts, including craft specialization, to be defined below.

Specialized Production: Definitions and Debates

Debates and discussions about the nature and definition of craft specialization and specialized production have long taken place in the social sciences. This debate began especially with Émile Durkheim’s (1933[1893]) discussion of ‘organic solidarity’ and the division of labor, and drew on scholars such as Rousseau (1984 [1755]), Smith (1776:

Book 1), Morgan (1877), Marx (1990 [1867]), Engels (1972 [1884]), and Boas (1940). Archaeologically, much scholarly interest in specialized production was sparked by V. Gordon Childe's discussion of craft specialization as a driving force in the 'Urban Revolution' (Childe 1936, 1946, 1950). Childe's studies focused to a great degree on the development of full-time specialization and how it related to food surpluses and the leisure time produced by agricultural intensification. Sahlins' (1968, 1972) efforts to debunk the 'myth of leisure time' have called into question these early ideas about the nature of specialization and the role that food surplus and leisure time played in the development of craft specialization and civilization, as leisure time and the ability to accumulate surplus did not begin with the shift to agriculture and the 'Neolithic Revolution.'

Following Childe, numerous studies explored the nature of specialization and its role in complex society (e.g., Brumfiel and Earle 1987; Clark 1995; Clark and Parry 1990; Costin 1991; Costin and Wright eds. 1998; Earle 1981; Evans 1978; Peacock 1982; Rice 1981; van der Leeuw 1976; Wailes ed. 1996). Much of the recent debate focuses on the definition of specialization and the question of whether specialized producers must be removed in part or in full from food production and supported by the consumers of their products, an idea grounded in Childe's early discussions of full-time specialists working for agricultural surplus provided by the state. This can be seen in Costin's (1991:4) definition of specialization as:

> A differentiated, regularized, permanent, and perhaps institutionalized production system in which producers depend on extra-household exchange relationships at least in part for their livelihood, and consumers depend on them for acquisition of goods they do not produce themselves.

This definition of specialized production was then dimensionalized into the four parameters discussed below, polarizing the difference between part-time vs. full-time and attached vs. independent specialization.

By contrast, other scholars argue that interdependence between producer and consumer is not necessary in a definition of specialization. Importantly, this type of dependence would preclude many kinds of specialized production in many small-scale or non-state societies. This argument is supported by the work of Cross (1993:65), who defines specialization as:

> A situation in which a relatively large portion of the total production of a given item or class of items is generated by a small segment of the population….One of the advantages of this definition is that craft specialization may be recognized at low levels of output and not only on a large economic scale. Thus, the definition applies to cases in which production activities fluctuate seasonally; it also applies to the comparatively infrequent production of items for elite and/or ceremonial use.

This definition does not assume a dependence of producers on consumers. Cross also acknowledges the importance of ritual and ceremony in the stimulation of economic specialization and activity (Ames 1995; Cross 1993; Spielmann 1998; Wells and Davis-Salazar 2007, eds.), a finding that is particularly pertinent to Cancuen, as ritual and ceremony were key to the intensification of craft production.

Clark and Parry (1990:297) provide an even broader definition of craft specialization; "specialized production is the production of alienable, durable goods for non-dependent consumption." This definition again does not assume that the producer must be dependent in some way on the consumer, but does assume that for specialized production to occur, the consumer cannot be a member of the producer's household.

The definition of specialized production used in this work is that which is above the direct household needs of the producer (Clark 1986, 1995; Clark and Parry 1990; Inomata 2001), and is unevenly distributed on the social landscape (i.e. some are producing, while others are consuming) (Clark and Houston 1998; Costin 2001; Evans 1978). This definition does not require that specialized producers be removed from food production, or that it occur only at the state level. This definition is used because in many cases it appears that craft specialists at Cancuen were not removed from food production and carried out domestic activities while still attached to elite consumers (see below).

Independent vs. Attached Specialization

The debate over dependence and support continues into the realm of attached vs. independent forms of specialization, which was first defined by Earle (1981). Specialized production has traditionally been defined according to these two categories: independent craft specialization refers to the production of goods for an unspecified demand crowd by persons working outside of elite control, while attached specialization involves production for a specific elite demand crowd who control part or all of production and derive power and prestige from the control of production and/or products (Earle 1981; Brumfiel and Earle 1987). Central to these arguments is the issue of dependence, the sponsorship of the production of goods by elites (Costin 1991:7), and the control by elites of some or all of the means of production (Costin 2001). Costin (1991: 12) also argued that by definition, attached specialization cannot exist in egalitarian societies, and it evolves with social complexity as a means for elites to control symbols of prestige. According to these definitions, independent specialists usually (but not always) produce subsistence or utilitarian goods. This type of production usually arises in response to unevenly distributed resources and/or economic and demographic stress. Attached specialists usually (but not always) produce prestige goods, wealth items, or weapons. This type of production is stimulated by developing political complexity and the emergence of elites (Brumfiel and Earle 1987; Costin 1991).

Clark and Parry (1990: 298) distinguish independent and attached specialization more broadly as those who do or do not retain rights of alienation over the final product. By this definition, attached specialization could take place in ranked or stratified societies (see Fried 1967), and elite patrons need not control the means of production (see also Inomata 2001), just the rights of alienation. In independent specialization, the patron would retain rights of allocation and authorization over the product (Giddens 1984; see Chapter 4 and also Clark and Parry 1990). Costin (1996:211-212) argued that direct elite control of the production system is nearly a necessity in attached specialization because it allows the elite the ability to restrict access to valuable raw materials, to ensure quality and homogeneity in the products, and to regulate output and limit the distribution of finished products. While these are effective means to control production, she typically does not address the abilities of elites to exert control through ideological or social means. These immaterial strategies could include, sumptuary laws (Anawalt 1980; Kovacevich 2007), ritual prescriptions or taboos (Reents-Budet 1998), legitimating ideologies (Inomata 2001) and creation myths (Drennan 1976), stylistic preferences (see Janusek 1999), and status or ritual rewards (see Sinopoli 1988).   While controlling the materiality of production may be extremely efficient in terms of output, it is not the only way to control production.

Clark (1995:278) argues that the definitions of specialization that require the dependence of producer on consumer preclude situations where, “no substantive compensation is received.” There are many other situations of social and economic relations that could take place beyond purely economic (financial) or subsistence dependence. Relationships between producers and consumers may involve some type of reward, but not necessarily complete dependence for survival, livelihood, or even subsistence. For example, in Sinopoli’s (1988) work with the Vijayanagara of India, she found that textile production fell into what she calls “centralized production,” which she considers to fall between Earle’s (1981) attached and independent forms. Centralized production of textiles took place in households and was organized by households, but much of the production was for the elites, who used textiles for international trade and to acquire horses for military ventures. While elites benefited from the distribution of these products, they were not involved in controlling the means of production. The compensation received by the producers took the form of social privileges, including the building of white washed, two-story homes; ritual recognition, including the right to blow the conch shell at important rituals, and occasional tax exemptions. This type of compensation could hardly be classified as dependence, and many of the benefits fell into the realm of non-consumable or transferable wealth. In other words, the producers did not use and did not need state compensation for their livelihood.

Clark (1995:290) points out the essentialism in the explanation for the impetus of independent or attached specialization, which Costin (1991:12) and others (Brumfiel and

Earle 1987:5) characterize as economic and ecological vs. social and political. This dichotomy could be questioned on many fronts. For example, ecological or economic conditions might affect elite and political institutions (see for example Costin 1996; McAnany 1993), and political and social conditions could easily affect independent production (Brumfiel 1998; Sinopoli 1998). Arnold and Munns (1994) also point out that these two features could occur together in any number of ways, producing highly variable situations in the organization of production (see below). The motivation for independent specialization as primarily economic (Costin 1991:12) could also be challenged by ritual and ceremonial stimulants in complex *and* less complex societies, specialists in these capacities do not have to be contracted by or dependent on elites (Spielmann 1998; Wells 2007; Wells and Davis-Salazar 2007). It is not a necessity to think of these categories as binary oppositions (see Cross 1993:63). These forms are not usually separable in complex societies, and the multiplicity of determinants involved in the development of specialized production must be investigated according to each specific case.

Recent research has argued that attached and independent specialization are not mutually exclusive and that each may take many forms (Ames 1995; Arnold and Munns 1994; Brumfiel 1998; Childs 1998; Clark and Parry 1990:299; Inomata 2001; Janusek 1999; Lass 1998; Sinopoli 1988; Spielmann 1998; Wright 1998). Ames' (1995) identification of 'embedded' specialization among early chiefdoms on the Northwest coast calls into question the dichotomy drawn by Earle in his definition of independent and attached specialization (Brumfiel and Earle 1987; Earle 1981). Ames (1995:158) finds that in these societies producers were not dependent on elites, but were usually elites themselves, and that specialized production was part of their role and identity as elites. For example, specialist painters may have lived with the chief, but as equals, rather than in a dependency relationship (Ames 1995:175). Ames (1995:176) also suggests that this type of embedded specialization may apply to Classic Maya elite production, citing Hammond (1991) and the work of elite Maya monument carving specialists.

Janusek argues for evidence of embedded specialization at the Andean site of Tiwanaku. He challenges the traditional assumptions that valued goods were always produced by full-time specialists in non-domestic workshops and that they were attached to ruling elites (Janusek 1999:108). Janusek (1999) finds that production of elaborate ceramic serving wares at Tiwanaku, at first glance, would appear to be homogenous and state controlled. However under closer scrutiny, differentiation in details of iconographic style are apparent. Certain households produced valued ceramic wares that were not commissioned or regulated by elites, but still did so in the corporate art style of the state. Although this type of production was not directly controlled by elites, it reinforced and solidified the power of the state, leading Janusek to idenitfy this type of production as a corporate political strategy as defined by Blanton et al. (1996). It is important to note from this example that even at the state level, multiple forms of production may have existed, and the state was not always characterized by full-time attached specialization working in elite controlled workshops.

Arnold and Munns (1994) found that climatic and political factors facilitated the indirect control of production of shell beads by elites in the Channel Islands region of the Northwest coast of North America. A small group of elites controlled canoe manufacture and transportation between the islands, allowing them to derive power from the production, and more importantly the distribution of shell beads. The producers themselves did not control the means of transportation, and therefore were alienated from some of the prestige derived from producing and exchanging their products. The authors also argue that strong social constraints prohibited the producers from acquiring power from production, and therefore direct elite intervention and control over production were not necessary. This type of organization of production does not fit easily into established categories of attached or independent specialization. They acknowledge that this might be a reflection of the limitations of their data, and the definitions of these categories may be overly restrictive (Arnold and Munns 1994:487). They conclude with a redefinition of the categories of attached and independent specialization very similar to Clark's (Clark 1995; Clark and Parry 1990),

> *attached specialists* produce items whose distribution is ultimately controlled by elites or exchange/transportation specialists; *independent specialists* produce items over which they maintain control of distribution, resulting in more direct contact with consumers and little or no economic dependence on elites (emphasis in original; Arnold and Munns 1994:487).

Arnold and Munns go on to add that these definitions avoid variable conditions such as those that precipitate each type of specialization, where they must work, what types of goods they produce, and who the demand crowd would be. This equals a broader definition of production that could be characterized as overly simplistic by some scholars, but it avoids the pitfalls of narrow definitions of complex human behavior.

These studies show that the nature of specialization is highly varied, and different types of specialization can take many forms. They also call into question the ability to define specialization by the nature of external demand or the degree of dependence of producer on consumer (Arnold and Munns 1994; Clark 1995; Janusek 1999:109). These studies and others also challenge the separation of attached specialization from household production (Ames 1995; Costin 1998; Feinman 1999; Inomata 2001; Janusek 1999).

The tendency of the investigator might be to assign too much value on demand and political and economic interest at the expense of more dynamic social factors (e.g., Appadurai 1986; Costin 1998, 2001; Helms 1993; Mintz 1985; Sahlins 1981). These later arguments demonstrate the evolution of thought on the nature of specialized production in preindustrial societies, from investigating similarities and forming typologies, to investigating variation and the complex elements that come together in the intensification of production.

Many of these studies have important bearing for the Cancuen data, as Cancuen does not seem to fit into some of the traditionally argued parameters for elite-controlled, attached craft specialization (see also Parameters below). Demand crowd and degree of dependence are not always effective indicators of specialized production, and the distinction between attached and independent specialization does not always hold up (see especially, Ames 1995; Clark and Parry 1990; Clark 1995; Cross 1993; Janusek 1999). The following discussion reiterates some of these issues, and focuses specifically on Costin's (1991, 1998, 2001) shift in definition and perspective on the analysis of specialized production, and how her more current discussions reflect a dynamic and agent-centered approach that will be used in this work.

Parameters of Specialized Production

Costin's (1991) parameters for the analysis of specialization reflect the above debates, and are founded in earlier explanations of craft specialization that relied primarily on scale as an indicator of complexity (Childe 1950; Peacock 1982; van der Leeuw 1976). Costin expands the analysis of craft specialization with the use of four parameters: *context*, *concentration*, *scale*, and *intensity*, which she explains can occur along a continuum. These parameters reflect her definitions of attached and independent specialization as a changing relationship of dependence of producers on consumers. Costin's main objective in the creation of these parameters was to simplify existing paradigms and make them easy to operationalize, but the result was merely a dimensionalization of existing rubrics for identifying and describing specialization.

Context refers to the locus and nature of production, specifically whether the specialist is attached versus independent. Attached contexts can be identified utilizing direct indicators, such as proximity to ruling elite, physical separation of activity areas, and administrative objects, while independent specialists will be more prone to work in domestic contexts with unrestricted access. The production of utilitarian items versus prestige goods can also be an indicator, or at least corroborative evidence for elite controlled or independent production.

Concentration refers to the spatial distribution of the producers, whether nucleated or dispersed across the landscape. Costin argues that attached specialists are often concentrated in certain areas because nucleation facilitates elite control, while independent production is often dispersed throughout the community.

Scale refers to the number of individuals participating in production, as well as their affiliation, kinship-based or otherwise. Costin suggests that the best way to infer scale is correlate size and nature of the facility. If it is domestic, the number of individuals is limited to the size of the structure, and probably based on kin relations.

Specialized production rendered by non-related individuals will take place in non-domestic contexts.

Identifying level of *intensity* is also tricky, whether the specialist worked full- or part-time. Costin argues that the most efficient method for understanding intensity is to identify the number of activities occurring at the manufacturing locus. If there are numerous economic activities taking place, especially subsistence activities coupled with specialized production, the intensity can be inferred as part-time, while if only one activity occurs, it can be assumed that it occurs on a full-time basis (Costin 1986).

Costin (1991) critiques preceding typologies (e.g., Clark and Parry 1990; Peacock 1982; van der Leeuw 1976) in that they reflect the authors' theoretical orientations and limitations of data. She presents her own classification for modes of specialized production, but it too suffers from the same problems as those used to critique other studies, her typology reflects her own definition of specialization and theoretical orientation. By another definition, production may be in a nonelite context, dispersed, part-time, and carried out by a few individuals in a household and still possibly be commissioned or in some part controlled by elites or others outside of the household (Cross 1993; Clark and Parry 1990).

Costin's (1991) parameters implicitly follow the theoretical and conceptual program of Flannery (1972b) in his study of the cultural evolution of civilizations through the development and integration of subsystems within a society. Costin's *context* corresponds to Flannery's notion of *stratification, intensity* to *intensification, concentration* to *centralization,* and *scale* to *segmentation* or *specialization* (Barbara Mills, personal communication 2005). Consequently these dimensions suffer from many of the same weaknesses of the Systems Theories of processual archaeology (see also Clark 2007). In archaeology of this period, there was a general focus on external stimulants for cultural change, as well as increasing political centralization being equated with increasing social and economic complexity. As the theoretical focus of archaeologists began to incorporate more internal and agent-centered explanations for change, so too did many studying craft specialization, including Costin herself (1998, 2001; see also below), providing a bridge between the substantivist/formalist perspectives.

New Directions for the Study of Craft Specialization

These studies, along with general theoretical trends in social and anthropological theory, have resulted in new perspectives on the study of craft specialization and cultural evolution. Many scholars (e.g., Costin 2001; Costin and Wright 1998, eds.; Janusek 1999) are beginning to move beyond the restrictive types and modes, which do not allow for variation within and between societies and even the variation within and between crafting activities themselves. The use of rigid types also can lead to a view of emerging craft specialization as evolving along a single unilineal trajectory. Agent centered explanations for social change have become the focus of many studies of specialization, allowing for more dynamic interpretations, which can also include external political and economic factors. Individual agents and groups become the focus for explaining social changes, like those related to the development of craft specialization.

This is reflected in Costin's (2001:276) broader definition of specialization:

> What we needed, of course, is a fairly simple definition of specialization that can be operationalized archaeologically. Central to most definitions is the conception

> that production is variable across time, space, and/or personnel, and that the "specialist" produces more of some good or service than she or he [personally] uses. The core idea is that "*fewer people make a class of objects than use it*"….Such a definition is broadly applicable to societies of all sizes and degrees of sociopolitical complexity. It does not presuppose units of analysis. It clearly avoids the trap of being overly rooted in concepts and concerns of Western economics (emphasis in original).

Recently, this type of broad definition appears to be more commonly accepted, and is widely used in the literature (Byrne 1994; Clark 1995: 290-291; Cross 1993: 65; Inomata 2001; Rice 1991:293).

While Costin's (2001:276) most recent definitions of specialization are much more dynamic and inclusive, she still retains notions of dependence and compensation as important indicators of types of specialized production. These are important factors in describing the organization of production, but they may not reflect hard and fast boundaries between types of production. Costin (ibid.) acknowledges that any set of typologies or strict characteristics may not fit the complexities of a given society, but can be used and applied flexibly to describe the organization of production. Costin's recent approach comes much closer to combining formalist and substantivist perspectives, while not overly prescribing strict guidelines or parameters for assigning formalized types.

This study will follow Costin's (1991, 1996, 1998, 2001) work in attempting to describe and explain the numerous components that may make up the *production system*, including *identity of the artisan, means of production, organization and social relationships of production, nature of objects created, relationships of distribution*, and *identity of the consumers* (Costin 2001: 277). These categories are descriptive and not typological. They pay special attention to the agency and identity of the producers and the consumers of crafted objects, while not overly restricting certain characteristics to all-inclusive, at times rigid types.

As just discussed, much variation existed in ancient economic systems, and the organization of production varied greatly as well. The most effective approach to understanding the organization of production is to describe in detail these differences using the above factors to elucidate that variation. While this information will be unique to the Classic Maya site of Cancuen, it can be used and compared to other Maya sites and preindustrial cultures. Cancuen had many producers of various social and possibly ethnic identities. A great deal of variation existed in the organization of production, and certain stages of production of certain classes of goods were restricted to certain groups, which also helped to shape and define their social identities.

Distribution and Consumption

In addition to production, distribution and consumption are important components of any economic system. Distribution, which could also be called transfer, or most often trade or exchange, is an essential component of production. How goods move from producer to consumer is indicative of the social and political structures of the society. Trade is a term widely used to denote many different types of activities. Exchange will be used here in the sense of "the spatial distribution of materials from hand to hand and from social group to social group" (Earle 1982:2). Much of the study of exchange by archaeologists has focused on the movement of raw materials and finished products from place to place, as opposed to the social relationships and mechanisms behind the transfer (cf. Costin 2001:305; Earle and Ericson 1977; Ericson and Earle 1982; Fry 1980; Hirth

1984; Hodder 1978, 1982; Renfrew 1975, 1977). Again, archaeological studies of distribution have moved from systemic and quantifiable to socially imbedded and agent centered, although the social aspect of exchange has deeper roots in social theory (i.e., Mauss 1990 [1925]).

Commodities vs. Gifts

A basic distinction in types of goods exchanged, originally made by Marx (1990 [1876]) and then elaborated by Mauss (1990 [1925]) and others, is the difference between commodities and non-commodities. Commodity exchange is characterized by the exchange of material, alienable objects between social actors who are in a state of reciprocal independence (see Marx 1990 [1876]). Gift exchange is the exchange of inalienable objects between social actors who are in a state of reciprocal dependence (Lévi-Strauss 1949; Mauss 1990 [1925]; Morgan 1877; see also Gregory 1982 and Wiener 1992). Mauss (1990 [1925]:63) emphasizes the inalienability of the gift, noting that "the alliance that has been contracted is no momentary phenomenon, and the contracting parties are deemed to be in a perpetual dependence towards one another."

The giver becomes socially bound in "perpetual dependence" with the receiver. The act of gifting creates an asymmetrical social debt relationship. As Mauss (1990 [1925]:65) states, "Charity is still wounding for him who has accepted it." Gift exchange can serve as a basis for domination and control, and the benefactor of that control is the one who maintains rights of alienation over the gift (although cf. Mills 2004 for how inalienable possessions can also defeat hierarchy). The gift had to travel between multiple producers and was extremely difficult to produce. It required esoteric, restricted knowledge to create, imbuing it with an even greater social meaning (Mauss 1990 [1925]; Helms 1993).

For Mauss, the gift is a 'total social phenomenon,' in that,

> all kinds of institutions are given expression at one and the same time – religious, juridical, and moral, which relate to both politics and the family, likewise economic ones, which suppose special forms of production and consumption, or rather, of performing total services and of distribution (Mauss 1990 [1925]:3).

While gifting may be calculated, it is not in terms of equivalencies or even terms that may seem 'rational,' as the process of gifting is embedded in all of the above social institutions. "Almost always such services have taken the form of the gift, the present generously given even when, in the gesture accompanying the transaction, there is only a polite fiction, formalism, and social deceit, and when really there is obligation and economic self-interest." (Mauss 1990 [1925]:3). Calculation is masked by ceremony and ritual.

Not all gifts are given to living, breathing individuals, many are given to gods and ancestors, and in the same spirit of "the gift," the deity is compelled to make a return (Hubert and Mauss 1964). In this sense, labor and tribute can also be seen as gifts that bind social entities, gods, and ancestors in perpetual indebtedness (e.g., Monahan 1995; Saitta 1999)

It is important to note that not all inalienable possessions are gifts and not all gifts are inalienable possessions (e.g., Godelier 1999; Mills 2004). Wiener returns to the distinction between alienable and inalienable possessions,

> What makes a possession inalienable is its exclusive and cumulative identity with a particular series of owners through time. Its history is authenticated by fictive or true genealogies, origin myths, sacred ancestors, and gods. In this way, inalienable possessions are transcendent treasures to be guarded against all the exigencies that might force their loss (1992:33).

Godelier (2004:6) makes the point that certain things are made to be sold, some given, and some kept. He goes on to say that the same object can make the transition from commodity, to gift, to clan treasure taken out of economic circulation, or the other way around.

Sahlins (1972) argues that in gifting societies, it is morally wrong to benefit from someone else's possession, or to gain at someone else's expense. Therefore the gift must be returned, but more in the spirit of the profit acquired from that gift. At the heart of this argument is the assumption that reciprocity promotes and reinforces equality. Wiener (1992) questions the assumption that reciprocity creates and stabilizes egalitarian social relationships. Wiener (1992:43) points out that Mauss himself said that if reciprocity were introduced to capitalist economic systems that a more egalitarian spirit would follow. Her point is that reciprocity can actually create and maintain social and economic difference (see also Mills 2004). The act of giving or even the keeping of inalienable possessions actually adds more to social status and economic gain than egalitarianism.

> When a Trobriander keeps a famous kula shell, other players seek him out, bestowing upon him other bounty in an attempt to make him into a partner, just as feudal lords through the authority vested in their estates attracted merchants, peasants, and monks. It is not accidental that inalienable possessions represent the oldest economic classification in the world (Wiener 1992:43).

Wiener (1992) builds on Mauss's original idea of the spirit of the gift, or the Maori concept of *hau*, which requires reciprocity. She argues that the gift is actually endowed with two principals, the inalienable right of ownership and the alienable right of use. It is the inalienable right of ownership that requires reciprocity (Wiener 1992; see also Godelier 2004). Wiener (1992:9) also argues that inalienable possessions can act as a stabilizing force, as opposed to cultural change, as they reinforce and authenticate “cosmological origins, kinship, and political histories.” However, inalienable possessions can also be manipulated to reconstruct or fabricate these things. Inalienable possessions are authenticated by the authority of ancestors, gods, sacred sites, divine rulers, and sacred ideologies. In this way they become different from the commodities used in everyday exchange (Wiener 1992:42).

Inalienable possessions often do not disguise difference, they proclaim it. This could take the form of an ancestral name, knowledge of a ritual or myth, or a material inalienable possession like a cloak. All enter into an exchange, and the ultimate goal is to establish difference without the need to defend it (Wiener 1992:64-65).

Hendon (2000:49) notes that Classic Maya caches of prestige/ritual items are not taken out of circulation as long as they are remembered; they become inalienable possessions. By implication, the individual or group associated with the cache may still be sought out as a valuable trade partner or alliance because of the existence of the cache. The requisitioning of materials from burials or caches would only increase their prestige or value.

Commodities on the other hand have exchangeable value. Calculating the value of commodities is usually less grounded in socially or ritually prescribed behavior as compared to the calculation of the value of gifts. Commodities can exist in non-market economies without money in the Western sense of the term. Trade of commodities in preindustrial societies most often takes the form of equivalencies (Appadurai 1986) and can take place in informal markets or in the form of individual barter relationships. When something becomes a commodity, it moves from use-value to exchange-value, which means that a surplus-value can be extracted and a “profit” can be made. While economic profit may not have always been the primary motive of economic actors in preindustrial economies, social profit was also a significant motivator (see also Bourdieu 1977).

The distinction between commodity and gift is an important one in the study of preindustrial economic systems, especially for Cancuen, as many of the artifacts crafted by specialized producers resulted as gifts and inalienable possessions that helped to establish social networks, and social capital that reinforced the power of the elite, but also were important in forming the social identities of various social groups involved in crafting.

Forms of Distribution

Polanyi (1957b) elaborated on the original Marxian distinction between commodities and non-commodities. He investigated three forms of distribution: reciprocity, redistribution, and exchange. Although Polanyi recognized that all three forms could exist in a single society, he saw one as always dominant, and generally argued that they were evolutionarily successive forms of economic development. Recent anthropological and archaeological investigation has shown that indeed the three forms can coexist within a single society, and their existence is much more complex than evolutionary replacement (see Goody 1982:45; Pryor 1977; Yoffee 1995). Sahlins (1972) expanded the discussion of reciprocity to include generalized, balanced, and negative reciprocity. Each type of reciprocity occurs more frequently with greater social distance, an explanatory tool widely used by archaeologists (Hodder 1978; Pires-Ferreira and Flannery 1976; Refrew 1975, 1977). Generalized reciprocity usually occurs in the closest of social situations, inside the family unit, in which gifts or commodities are given, but an equivalent return is not expected. Balanced reciprocity occurs at a greater social distance, and requires an equal return for the exchange or gift. Negative reciprocity occurs at the greatest social distance, often when the receiver believes that he/she will never again encounter the giver, and therefore has no social motivation to reciprocate.

Goody (1982:45-46) identifies 'types of transactions' based on the social relationships between producers and consumers. These include: a. allocation within the unit of production, b. gift, without expectation of return, c. 'reciprocal' exchange, d. the market, e. obligatory transfer, centric or non-centric, up or down, and f. destruction. For this study, certain types will be more important than others, especially that of gifts, but more in the Maussian sense of something given without immediate return, as gifts are never given without some expectation of return, whether it be social or material. 'Reciprocal' exchange is also important, as exchange or trade of commodities or equivalencies can occur with or without markets. Obligatory centric transfers refer to the state's ability to coercively collect tax or tribute, for either accumulation or redistribution. Goody (ibid.) cites Pryor (1977) in his definitions of centric transfers as those without balanced counterflow, relating here to production without substantial compensation.

Renfrew (1977) examines modes of trade in different spatial relationships and describes how that trade may take place. He also emphasizes the importance of how these modes differ operationally, or how differences in who was trading and where they were located on the social landscape affected patterns of artifacts discovered by the archaeologist. Renfrew (1977:41-43) includes ten modes of exchange, including direct access, home-based reciprocity, boundary reciprocity, down-the-line trade, central place redistribution, central-place market exchange, middleman trading, emissary trading, colonial enclave, and port of trade. He notes that these modes as listed are not necessarily evolutionary, but do grow in complexity through the list. This study is one example of the many endeavors to formally identify recognizable patterns of exchange in the archaeological record. These studies, especially Renfrew's identification of the different forms that exchange may take, are essential to our ability to identify and describe the organization of exchange systems. At the same time it is nearly impossible to generate rigid social laws for patterns of artifacts, as numerous social situations could produce any given pattern (see Hodder and Orton 1976; Hodder 1982).

Exchange has proven to be extremely difficult to identify directly in the archaeological record (Earle 1982:8). Initial attempts to identify different types of exchange mechanisms with falloff patterns did not prove to be as fruitful as was hoped (i.e. Renfrew 1975, 1977 vs. Hodder 1982). Other studies attempted to go beyond these initial attempts in order to more fully understand systems of exchange, exploring sources of exchanged material, spatial patterning of exchanged material, as well as examining the organization of ancient exchange systems, and the social implications of those systems. The intention of this study is to investigate all of these patterns in hopes to illuminate both the economic (i.e. output and performance, see Hodder 1982) and social aspects of exchange, combining the formal and substantive approaches to the study of exchange systems, as well as how exchange as a system articulates with production and consumption.

At Cancuen and other Maya centers, all three of Polanyi's forms of exchange may have been in operation to a certain degree (although probably not formal markets; cf. Bohannan and Dalton 1965, see below). Reciprocity (balanced reciprocity in the terms of Sahlins [1972]) played an important role in the creation of social networks for the Classic Maya, especially in the form of gifting of prestige or ritual goods. While economizing and rationalizing behaviors may have taken place in Classic Maya exchange systems, social factors cannot be ignored as reasons for trade and exchange. Tribute systems and 'obligatory centric transfers' were also important stimulators of craft production and the economy of the Classic Maya. This work will attempt to investigate the rational economic and social choices made by those involved in production and distribution.

Craft Production and the Ancient Maya

The primary evidence for specialized production of utilitarian or prestige goods on a large-scale has come from strategically located centers near valuable resources. Examples include obsidian for Copan (Aoyama 1996; although cf. Clark 2003) and Kaminaljuyu (Michels 1979), chert for Colha (Hester and Shafer 1994; Shafer and Hester 1983; Potter and King 1995), salt for Salinas de los Nueves Cerros (Andrews 1983; Dillon 1977), and jadeite for the Motagua Valley (Walters 1982). While entire communities were often involved in the specialized production of these resources, this did not preclude elite control of resources or distribution of the final product (Aoyama 1996; Hester and Shafer 1994; Walters 1982), which formed a basis for elite power in these regions.

In many other Classic Maya polities, specialized production of prestige goods seems to have taken the form of small-scale elite production. There is evidence at Copan of specialization in shell carving from a royal court (Aoyama 1995), elite controlled production of obsidian (Aoyama 1996), as well as scribal specialization (Fash 1991; Webster 1989). Epigraphic evidence suggests specialization by certain members of Maya royal families in certain types of polychrome vessel painting (such as the 'Codex Style' and 'Palace School' ceramics) and monument carving (Stuart 1989; Houston and Taube 1987; Reents-Budet 1994, 1998). Using microwear analysis, Aldenderfer, Kimball, and Sievert (1989) found that evidence for woodworking, shell working, and hide processing were distributed throughout the site of Yaxha, but fine woodworking and hard-stone processing (such as jade working) were confined only to the site center. Microwear analysis on the unique post-abandonment deposits of Aguateca have revealed evidence of probable specialization in monument carving, and shell, wood, and bone working (Aoyama 2001). Inomata and Triadan (2000) point out that these specialized activities occurred in a domestic setting, along with multiple activities including subsistence. At the same time, these activities were occurring in residences that were clearly those of the elite, and in one case, possibly a royal palace (Structure M7-22). Inomata (2001) argues that elite artisans had multiple social roles and identities and that their work was not highly specialized. He also argues that formation processes in the archaeological record may have obscured the type of low-volume craft production of prestige goods that was practiced by the Classic Maya.

Some also argue that elites at major centers had little to do with production or distribution of utilitarian goods, i.e. utilitarian ceramics, lithics, and domestic subsistence products (Ball 1993; Ball and Taschek 1991; Fry 1979; Potter and King 1995; Rands and Bishop 1980; Rice 1987). At the same time, Classic Maya political centers have been seen as consumers of utilitarian ceramic products made in the hinterland, yet with little control over their production (Ball 1993; Fry 1980; Masson 2002; Rands and Bishop 1980:42; Rice 1987). Rice (1987) argues that obsidian production and exchange patterns were altered from the Early Classic to Late Classic periods, as it moved from a 'wealth' item redistributed by elites, to a more 'utilitarian' good with more equal access in the Late Classic.

Evidence for nonelite participation in the production of prestige goods has been largely absent, but suggested by some (Ball 1993:264-5; Marcus 2004:262-3; Potter and King 1995:26). Due to the lack of this evidence, many have argued that the domestic/agrarian and prestige economies operated separately (Ball 1993:248,264; McAnany 1993:70-71; Potter and King 1995:28; see also Masson 2002:2), although recent work at Cerén, El Salvador seems to show that, at this site there may have been some integration of these separate economic spheres (Sheets 2000).

The variation of Classic Maya economic structures was great, and much debate has ensued on the degree of participation of nonelites, the degree of control of the elite class, much of it based on negative evidence. The following sentiment expressed by Joyce Marcus explains an important focus for current studies of Classic Maya economic systems and this dissertation:

> Some scholars regard the individual commoner household as the essential unit for understanding the Maya economy. Others regard elite control of household labor (and the products manufactured by that labor) as the essential ingredient for understanding the economy. A frequent assumption is that the elite not only directed the commoners but also led all aspects of the economy. We should not discount the likelihood that commoners had some degree of control over certain

> items, made active choices, created innovations, and displayed significant decision making in producing a product. Relationships between commoners and elite were no doubt dynamic, changing from period to period, differing by commodity and by site. What we need to determine is the degree of elite control and commoner autonomy rather than *assuming* absolute elite control. The elite may have controlled the distribution and access to some finished products, but commoners probably had opportunities to innovate during various steps in the chain of production. Commoner households should not simply be assumed to be passive recipients of elite directives (Marcus 2004:262-3).

The implication is that current studies of craft specialization in the Maya area must take a more holistic view to incorporate all of the variation in Classic Maya production systems, variation that existed between sites and between commodities or types of goods produced. The amount of elite involvement in the production and distribution of those goods must also have varied, and power over some aspects of production in nonelite realms should also be explored (see also Chapter 4).

Exchange and the Lowland Maya

Exchange of goods during the Classic period has been argued to have operated in two largely separate spheres, that of elite prestige goods and the other of utilitarian goods (e.g. Rice 1987:77; Potter and King 1995:26; Tourtellot and Sabloff 1972). Many argue that elite exchange took the form of gifting, often over long distances and vast interregional spheres, while utilitarian goods were traded locally and regionally based on kinship exchange systems. Some studies have questioned these two separate spheres of distribution, especially exchange of prestige and utilitarian ceramics (cf. Fry 1978:510; Rands and Bishop 1980:43).

Trade of prestige goods such as jade ornaments, pyrite mirrors, and ceramic fine wares most probably occurred as horizontal, long-distance exchange between elites of lowland polities (Marcus 1983). This type of trade probably took the form of *emissary trade*, as elite emissaries, or the nobles themselves would have been sent with prestige/ritual goods for exchange (Renfrew 1975). These exchanges most likely did not take the form of economic exchanges as commodities or equivalencies (Appadurai 1986; Dalton 1967; Halperin 1993; Marx 1990 [1876]; Polanyi 1957b; Wiener 1992:10). Exchanges of prestige goods probably took the form of gifting, and served to create social ties, reinforcing the ideological power of the elite. Gifts of prestige goods would not always have immediate returns, but gift giving is calculated (Mauss 1990 [1925]), especially regarding the symbolic and cultural value of the gift (Bourdieu 1977:171-183). Many of these goods were probably in the form of inalienable possessions made of exotic raw materials, and transported over long distances, passed through and/or owned by many important individuals, containing esoteric and ritual symbols, not able to be directly translated into an equivalent form.

The long-distance exchange of subsistence goods has been questioned by some on the basis that human transport of foodstuffs would require a significant consumption of those goods and would reduce the cost effectiveness of the transport (e.g. Drennan 1984; Sanders and Santley 1983). Culbert (1988) notes that cost effectiveness may not always be an issue, especially in times of crisis. Evidence for the trade of subsistence goods has not yet been conclusively demonstrated.

Other utilitarian or goods used in everyday life may have been distributed in market or barter-type relationships. Evidence for markets in the Maya world is sparse, but their presence has been suggested or inferred (Chase 1998; Coe 1967:73; Dahlin and Ardren 2002; Fry 1979; Freidel 1981; West 2002). Freidel (1981) has argued that market exchange corresponded to ritual and ceremonial events at major centers. Ethnohistoric and ethnographic sources suggest that markets were an important feature of the ancient Mesoamerican economy (Berdan 1982, 1983; Carrasco 1983; Sahagún 1950-1982, Book 9; C.A. Smith 1972, 1983), but their existence has been more convincingly demonstrated archaeologically outside the Maya realm (Feinman, Blanton, and Kowaleski 1984; Hirth 1998; Sheets 2000). This type of market would coincide with Bohannan and Dalton's (1965:5) description of peripheral marketplaces where the "institution of the market-place is present, but the market principle does not determine the acquisition of subsistence or the allocation of land and other resources."

Hirth (1998) has effectively argued for the identification of markets through homogenous distributions of artifacts, with the presence of some workshops creating goods for exchange in the market. Hirth's model has not yet been successfully applied to the Classic Maya, but it provides promise for a new technique to identify markets beyond the traditional structural and architectural features not found in many Mesoamerican sites. Some structural evidence for markets does exist in the Maya area, as the East Plaza at Tikal contains a possible stone market structure, and many other market areas may have been present at that large site (Jones 1996).

Even if exchange of utilitarian goods did not take place in informal markets in the Classic Maya world, barter relationships among regional kin relations periodically could have taken place. Mayer (2002:144) notes that,

> (b)arter systems exist when goods tend to be repeatedly exchanged with known people at particular times and places. Thus there is an in built tendency to act fairly, so that the opportunity to repeat the exchange is not spoiled. Barter is also a very direct and uncomplicated affair in contrast with the complexities involved in, say, gift giving, where the viscosity between object and person enriches the reciprocal relationships….the wire energizes the movement of goods between

> people from time to time, but it is insulated by a coating of sociability, such as hospitality, which, although it adds to the transaction costs, nevertheless permits the action to take place.

Rituals and ceremonies could have facilitated the gathering of regional groups for barter relationships (see also Freidel 1981). These barter relationships may have been very similar to exchange in an informal market, yet these exchange opportunities may have left little to no direct evidence in the archaeological record.

Masson (2002:6) also questions the identification of gifting of luxury items found in elite contexts, which may also be found in these contexts due to market exchange. She suggests careful attention to relative frequencies of artifact patterns in order to determine the distribution mechanism.

> Simply documenting presence/absence distributions of luxury items in nonelite contexts is insufficient for making such distinctions. The systematic documentation and comparison of relative frequencies of artifact classes is needed, with particular attention to raw material sourcing and the degree of specialized production [West 2002, Sheets 2000] (Masson 2002:6).

The present study will follow this sentiment. Relative frequencies, studies of significance, sourcing, and distribution and degree of specialized production will be used in conjunction to determine the mode of exchange. Again, the economic systems of the Classic Maya, typified by Cancuen seem to have been extremely complex (see also Freidel 1981), with many types of exchange and trade simultaneously taking place. Gifting was an important part of elite power, based on possessions (often inalienable) representing cultural capital which then created social bonds and social capital. Utilitarian commodities do appear to have circulated along a different path, whether it was in a market, or more informal barter relationships. The pursuit of power and the creation of social identity by different social groups through different mechanisms will be explored.

Conclusions

The goal of this study will be to bring together the analysis of production, distribution, and consumption at the Classic Maya site of Cancuen. These systems will be investigated from a humanistic perspective, exploring the agency and identity of the multiple social groups at Cancuen. Beyond the mutual structuring of the individual and society, agency theory incorporates the perspectives of both domination and resistance. Scholars have recently focused more on systems of production and the pursuit of power by numerous groups (e.g., Bourdieu 1977; Giddens 1979, 1984). The following chapter will discuss the ability of elites to assert power over nonelites, and how the nonelites were at the same time able to contest the dominant economic and symbolic systems.

CHAPTER IV

SOCIAL POWER AND CONTROL

> Men [sic] make their own history, but they do not make it just as they please, they do not make it under circumstances chosen by themselves, but under circumstances directly encountered, given and transmitted from the past.
>
> (Marx 1963:15[1869] cited in Dobres and Robb 2000:5)

Introduction

The previous chapter discussed the different forms of preindustrial economic systems, defining terms and giving the background and framework for the present study. This chapter will explore the abilities of elites to create and maintain power and control over political and economic functions, as well as how these structures can be challenged and changed over time. Defining the nature of power is important to understanding how these structures arise and how identities are created and changed within them. This chapter will also focus on political, economic, ritual, and ideological networks of power.

The concept of power and systems of control are important to the understanding of how Classic Maya elites were able to extract labor from commoners, and at the same time, how those commoners were able to contest that power and create a social identity associated with the prestige of craft production. This chapter begins by discussing the evolving definitions of power in the social sciences. Some definitions imply that power is a possession of only certain members of a society, while others rely on threats, sanctions, force, and sometimes violence. This work presents a definition of power that recognizes the existence of power everywhere, and that can be mobilized in the form of symbolic and real resources by all members of a society to a certain extent, and does not require coercive force. This definition is important to the basis of power for Classic Maya rulers, as they relied heavily on ritual and ideology as a basis for power and persuasion. This reliance on ritual and ideology allowed these rulers to mobilize power resources in the form of allocative and authoritative resources as discussed by Giddens (1984:258), which reinforced the elite power base.

The mobilization of power resources was done to varying degrees in different Maya polities depending on the resources present. At Cancuen, and other Maya centers the ideological power of rulers allowed them to extract labor from the masses. Specifically at Cancuen, its location between the volcanic highlands and tropical lowlands of Guatemala made it an important location for the production of stone goods from the highlands on their way to the lowlands. The elite used restriction of technology, ritual knowledge, and social prescriptions in order to legitimate and control production. The ritual nature of Classic Maya society precipitated craft production, as ritual paraphernalia and status reinforcing goods were integral to the success of the power strategies of the elite. At the same time, the participation of nonelites in this production served to create a separate social identity for the crafters, conferring at least some prestige and status, despite the fact that they were not socially able to own or possess some of the most powerful symbols of the elite.

The Nature of Power

The notion of power has been a point of debate on many fronts within social theory. As defined by Max Weber, “power is the probability that one actor within a social relationship will be in the position to carry out his own will despite resistance, regardless of the basis on which this probability rests" (Weber 1947:152). Thomas Hobbes suggested that "power represents the ability to produce desired effects—correspondent to cause and effect are power and act" (Hobbes 2005 [1642]: Part II, Chapter 10, Page 127). Morton Fried argued, "power is the ability to channel the behavior of others by threat or the use of sanction" (Fried 1967:13). Talcott Parsons provided this description of power,

> power here is conceived as a circulating medium, analogous to money, within what is called the political system, but notably over its boundaries into all three of the other neighboring functional subsystems of a society (as I conceive of them), the economic, integrative, and pattern-maintenance systems….Power then is generalized capacity to secure the collective organization when the obligations are legitimized with references to their bearing on collective goals and where in case of recalcitrance there is a presumption of enforcement by negative situational sanctions—whatever the actual agency of that enforcement (Parsons 1967:306).

Parsons made several advances in his definition of power, beyond what he deems 'traditional' definitions. He no longer conceives of power as a zero-sum game and also recognizes that the use of force is not required to assert or maintain power. These points are made by Giddens (1977) who also notes:

> frequent use of coercive sanctions indicates an insecure basis of power. This is particularly true, as Parsons indicates, of the sanction of force. The power position of an individual or group which has constant recourse to the use of force to secure compliance to its commands is usually weak and insecure. Far from being an index of the power held by a party, the amount of open force used rather is an indication of a shallow and unstable power base (Giddens 1977:338).

Parsons also recognizes that authority and force are not forms of power, but bases of power. Giddens (1977:347) goes on to critique Parsons and Durkheim for 'normative functionalism' that obscures the analysis of power in terms of different social groups, and not just in terms of the individual vs. society. Giddens also argues that Parson's definition of power is still exerted *over* others, a problem remedied by the more complex notions of *power over* vs. *power to* (Foucault 1978, 1980; Mann 1986; Miller and Tilley 1984), which sees power as created by and constitutive of social interactions. Mann (1986) also defines four sources of social power: ideological, economic, military, and political, and argues that these sources offer "alternative means of social control" (Mann 1986:3), meaning that there is no one route to power, no one way to effectively control social networks.

These points are reiterated by Earle (1991, ed.) and the participants of the School of American Research edited volume on *Chiefdoms: Power, Economy, and Ideology.* The conference generated a list of ten potential political strategies used by emerging elites in varying ways to consolidate power (including ideological, economic, military, and political strategies). These strategies include: 1) giving (inflicting debt), feasting, and presentations; 2) improving infrastructure or subsistence production; 3) encouraging circumscription; 4) outright force applied intentionally; 5) forging external ties; 6) expanding the size of the dependent population; 7) seizing control of existing principles of legitimacy (the past, supernatural, and natural); 8) creating or appropriating new principles of legitimacy; 9) seizing control of internal wealth production and distribution; 10) seizing control of external wealth procurement (Earle 1991:5). Strategies 1 and 2 involve economic power, as well as 9 and 10, but probably with more of an ideological base or backing. Strategies 3 through 6 depend on direct coercion or force, but also political sway. Ideology is the principal factor behind strategies 8 and 9, but again political maneuvering must accompany any bid for ideological power. In short, the complex avenues to power involve numerous strategies that are intertwined with the economic, ideological, and political realms. Many of these strategies can be seen in the case of the Classic Maya (see below).

Although power may seem as if it is a tangible quality in some of these definitions, many recent arguments assert that power is not a possession of the individual and is not restricted to the elite (see also O'Donovan 2002). Power is seen by many as residing in every aspect of social life, in mundane and everyday actions, enacted by all members of any given society (Bourdieu 1977; Foucault 1978, 1980). Foucault (1978:98) notes the ubiquitous nature of power "not because it embraces everything, but because it comes from everywhere." And importantly, any member of a society can exercise power, even those perceived to be least powerful in the form of 'weapons of the weak' and 'hidden transcripts' (Scott 1987, 1990); resistance is perceived to be an inherent component of power (Foucault 1980). All social actors are conscious agents able to mobilize resources of power to some extent, although, that may be limited or restricted by the social structure in some cases.

In this study, the definition of power will not have to be followed by the enforcement of sanction or force which limits the use of power to those with the capability to use force. Power will be defined here as the capability to either reproduce or transform the existing social structure (Giddens 1979:88-94, see also A. Joyce 2000). Power resides in numerous spheres, also discussed by Parsons (see above), and Bourdieu (1977) who identifies economic, social, and cultural spheres, and Giddens (1984) who identifies the control and manipulation of allocative and authoritative resources (further discussed below). Mann (1986:6) explains that power does not reside in a resource, but resources are the media through which power is exercised. The ability to exert power depends on the access to and ability to accumulate resources in these various spheres, which provides the basis for action. Capital and/or resources can be accumulated in these areas and exerted even in the face of competition or resistance from a dominant or elite group, equaling changing power relationships (Münch 1994: Volume 1, 151).

An important component of this debate is the question of how power is generated, where it comes from. The debate has often been polarized in material versus cultural or mental sources. Power is not simply confined to economic resources, but ideological and more ephemeral systems of social communication (Mann 1986). As the above scholars and others have argued, power exists in every social interaction within society, in material, cultural, ideological, and mental structures. Power permeates every aspect of the social experience and cannot be pinpointed to a single individual, institution, social class, class of artifact, or ideology. Which one of these realms or domains of power is dominant or primary depends on the specific society and historical development.

Many scholars have recently focused on the presence of diffuse power in social systems that were once thought of as strict and centralized hierarchies. There can be diffuse and competing nodes of power within societies manifesting themselves as 'heterarchy' rather than hierarchy (Becker 2004; Ehrenreich et al. 1995; O'Donovan 2002:7-8; Potter and King 1995; Scarborough et al. 2003).

> Heterarchy may be defined as the relation of elements to one another when they are unranked or when they posses the potential for being ranked in a number of ways. For example, power can be counterpoised rather than ranked (Crumley 1987:158; 1995:3).

Feinman (2000:211) argued that "traditional neo-evolutionary models have tended to conflate increasing hierarchical complexity with ever greater degrees of centralization" (cf. Flannery 1972; Fried 1967; Service 1971). Feinman (2000) further argues that heterarchical models or those that consider different modes of leadership or socioeconomic relationships (i.e., the dual-processual model; Blanton et al. 1996) can be considered in conjunction and as orthogonal to hierarchical analysis of societies. Crumley (1987, 1995) argues that hierarchy is often conflated with complexity. Confusing scalar and control hierarchies can be a vital mistake for social theorists and archaeologists, for the different components of a scalar hierarchy all affect one another, whereas the top levels in a control hierarchy affect all levels below (Crumley 1995). Crumley (1995) also notes that heterarchies can transform into hierarchies and vice-versa without an actual 'collapse' occurring. Situational hierarchies may form in response to internal or external factors.

In addition, the desire or motivation to accumulate power has been a source of debate. Many social theorists rely on 'interest theory' or Darwinian notions of cultural fitness and competition (e.g., Clark 2000 and Ortner 1984). More recent theories influenced by Marxian thought on structures of domination assert that the presence of inequality presupposes competition and motivation for power (Bourdieu 1977; Giddens 1979). Feminist scholars critique these theories as having their roots in capitalist, especially male dominated, Western economic and political structures (see especially Gero 2000). At the same time, Earle (1997) has pointed out that political relations are inherently competitive and promote the development of factions and competing social groups. Beyond this, many studies emphasize the importance of women's choices and agency in the reproduction and negotiation of social structures (e.g, Mills 1995; Shackel 2000). Clark (2000:99) points out that his (Clark and Blake 1994) aggrandizer model for the development of social hierarchy in southern Mesoamerica is an agency model, but agency models do not automatically assume or require the presence of aggrandizing behavior or "extreme self-interest." It is important to note that practice theory sees action as constituted by the historical structures present in the society. Aggrandizing behavior may be present in some, but not all societies. How actors react to certain choices is conditioned by the particular circumstances of the given social situation, as well as their perceived power and real power (in the form of symbolic resources). At the same time, historical situations of unequal distributions of resources and domination may often produce similar actions of self-interest and competition between social actors (see also Brumfiel 2000).

The exertion of power is often argued to be the result of intentional, calculated, and maximizing behavior. While social beings are certainly knowledgeable of the social structure and their place within it, unintended consequences of actions often form a significant part of changes in the structure of society (Giddens 1984). Assuming the extremes of either one of these scenarios would not reflect the dynamic nature of human behavior and the complexity of social situations. Social actors are at once knowledgeable agents who also make choices that may produce unintended changes to the structure.

> According to these theorists, and in contrast to previous paradigms, social agents are viewed not as omniscient, practical, and free-willed economizers, but rather as socially embedded, imperfect, and often impractical people. Agency theorists also talk of a much more interactive (or dialectic) relationship between the structures in which agents exist and, paradoxically, which they create (Dobres and Robb 2000:4).

This is not to say that individuals were not knowledgeable actors within the social structure. Social actors are often very aware of their environment and the constraints placed upon them, but there are social structures that can serve to obscure domination structures.

Ideologies often mask structures of domination (Althusser 1969; Kertzer 1988; Marx 1973 [1843]:13-14), but they also configure structures of domination and forms of resistance (Gramsci 1971). At the very least, ideologies serve to postpone conflict over unequal distributions of power and resources, although religion and ideology may also provide opportunities for dominated social actors to exert power and influence over others (A. Joyce 2000). Ideologies relate to the 'practical consciousness' of Marx (1990 [1867]; Marx and Engels 2002 [1848]; discussed further by Giddens 1984) and Durkhiem's 'collective consciousness', the ideas at least partially obscured and motivators to human action, also articulated in the 'habitus' concept of Bourdieu (1977). In archaeological research this concept often takes the form of the 'tradition' (see Barrett 1994, 2000; Pauketat 2000:115; Hodder 1991; Willey and Phillips 1958).

Dominant groups may create and control the material culture related to the dominant ideology; that is the meaning, uses, distribution, etc. of that material culture. Subdominant groups must express themselves through symbols of the dominant ideology (Little 1994; Shackel 2000). That is not to say other groups cannot make changes to the structure, but are often in a 'muted' position because of their inability to express other realities or worldviews through material culture (Little 1994, 1997). Variations in artifact patterns are often interpreted as "noise" or discounted as not fitting a proposed or normative model of how artifact patterns should reveal themselves. It is in just this forum that an investigation of social change can be relevant -- variation in technologies can be a key to unlocking those choices that break from traditional social structures (Sassaman 2000). In other words, the "noise" of variation in material culture can often be overlooked as subaltern ideologies and identities that don't fit with the dominant ideology.

This study does not attempt to focus exclusively on forms of resistance to the exclusion of the understanding and study of elites and structures of domination (see also Dirks et al. 1994:5). Elites at Cancuen increased power by exerting control over the production and distribution of prestige goods in the hands of nonelites. This control not only reinforced existing power structures in Classic Maya society, it allowed elites to create new and more plentiful economic and social ties with other powerful centers. Elites were able to establish ideological control over commoners, which was grounded in the dominant ideology and 'traditions' established in Classic Maya society through a type of sacred covenant (A. Joyce 2000; Pauketat 2000), which came from earlier deeply held beliefs and subsumed as the dominant ideology, such as the Preclassic period in the murals of San Bartolo (Saturno 2005) and in the Preclassic iconography of Holmul (Estrada-Belli 2006). These ideologies and creation myths provided a separate creation for the Maya rulers and nobility (cf. Drennan 1976), although still very much related to deep traditions easily recognizable and already shared by commoners before the development of social hierarchy (Lohse 2007). Maya commoners were indebted to nobles and elites for their service as intermediaries between humans and sacred ancestors and gods. In return for this service, elites could extract increased tribute and labor. An unintended consequence of this change in social structure may have added economic and social freedom for nonelite producers, who were able to co-opt some of the ritual power associated with production, even if they did not retain rights of alienation over their products.

Thus, both Classic Maya elites and nonelites were agents operating within the social structure, producing it and reproducing it, especially through the vehicles of craft production and exchange. Elites used ideology as ‘symbolic violence’ instead of direct coercive or violent power, to request labor and tribute, which is in many ways “cheaper” than actual violence (see Bourdieu 1977:191; Giddens 1984:257). This ideology also legitimated their positions of power as well as their monopoly on certain forms of cultural capital (see also discussion of sumptuary laws below). While nonelites still expressed themselves in context of dominant scheme (Little 1994; Shackel 2000), the *habitus*, or the everyday participation in production of prestige goods for elites became subsumed as part of their social identity and status in terms of prestige and cultural capital (Bourdieu 1977). This can be seen in the caching of raw jade nodules within jade working structures, although the use of finished products by these same producers was restricted by ideological prescriptions.

The Basis of Classic Maya Power

The previous chapter focused on Cancuen’s relationship to other preindustrial economic systems, I will now focus on Cancuen’s economic and political system and the basis of power for its rulers. Many discussions of Maya political organization emphasize the heavy reliance on ritual and ritual performance as a basis for power for Maya rulers (Demarest 1992; Fox and Cook 1996; Inomata 2001; Schele and Freidel 1990; Schele and Miller 1986; Stuart 1996, 1998; Taube 1992b, 1998; Marcus 1983; Sanders and Webster 1988; Sharer and Golden 2004). It is this emphasis that stimulated the development of a ritual economy at Cancuen, in which production of prestige/ritual goods benefited elites, but also other social groups. These ritual goods carried symbols of the dominant ideology and legitimated the unequal status and power relations of the elites.

Ritual/prestige goods are defined here as objects controlled and used by certain members of a society to reinforce status, which were - imbued and created with esoteric and cultural knowledge not always possessed by all members of the society, and often played a significant part in ritual or were ritual objects themselves. The use of the term ‘prestige goods’ is often problematic because it suggests a relationship of prestige with only elite segments of society, relegating much of the prestige and power to the economy (vs. ideology, ritual, ceremony, and politics), and the monopoly of elites over the control of production and distribution of the goods (see Friedman and Rowlands 1977; and also Cobb 1993; Mills 2000a, 2004; Pauketat 1992; Saitta 1999). These studies emphasize that power and prestige do not have to be relegated to the economic realm (see also above). Prestige in ritual and ideological realms of societies can be just as powerful, and the value of objects is much more than simply their economic or exchange value. Saitta’s (1999) discussion of prestige good models for ‘middle-range societies’ is also important for this work because he acknowledges the multiple means of material transfer of prestige goods, as not all relations are necessarily exploitative. For example, Saitta argues that the “extraction” of labor from nonelites:

> could be understood as distinctly nonexploitative *if* we see the labor that moves against valuables as a payment allocated by subordinates to elites as compensation for their work in procuring socially important valuables. In this view the status of the valuables is also different: they are *communal social entitlements* required for reproduction of the collective whole rather than instruments of elite power (Saitta 1999:137, emphasis in original).

While in state level societies, certain classes of goods certainly were restricted to elites and their ownership conferred prestige, they still ideologically and ritually reinforced the identity of the community and could be seen as simultaneous centripetal and centrifugal forces within the society. For the Classic Maya, monumental temples, which represented sacred mountains (see Schele and Freidel 1990), offer an effective example of the opposition of these forces. Community labor was conscripted for their construction, and the enactment of rituals as well as burials within them was restricted to the elite, but communal rituals practiced at the temples by elites served to reinforce the larger community identity and stability in the Durkheimian sense of 'collective consciousness'.

Items produced in the ritual economy served to reinforce the power of Maya rulers, therefore creating a basis for political power, but in this case and many others, nonelites also derived power and prestige from ritual production (e.g., Spielmann 1998). The notion of 'prestige goods' also does not address the social nuances of inalienable possessions which may be subsumed under the title 'prestige goods,' which are sometimes commissioned, sometimes given, or sometimes kept (Godelier 1999; Mauss 1990 [1925]; Weiner 1992) and can either serve to create or defeat hierarchy (Mills 2004).

Furthermore, many scholars have noted that the division between prestige and utilitarian goods does not hold up (cf. Costin 1998; Hayden 1998), a difficulty also noted here, and in other studies of the Classic Maya (Hruby 2003; Walker and Lucero 2000; Masson 2002; Morehart et al. 2005). A single artifact may go through numerous stages, from gift to commodity, utilitarian to prestige, circulated to non-circulated, actively utilized to cached, and many more. In this study, objects that have been used in ritual or ceremonial behaviors that are apparent in the archaeological record will be investigated, despite the recovery context, which may suggest a more mundane function. The possibility of multiple categories and stages of use will be considered.

Resources as the Media of Expressed Power in the Maya World

In the investigation of power and developing social complexity of the Classic Maya, much of the debate has revolved around two very different (at times diametrically opposed) categories of power strategies, such as "adaptationist" vs. "political" modes (i.e., Brumfiel and Earle 1987) or centralized vs. decentralized (i.e., Chase and Chase 1996; Fox and Cook 1996; Fox et al. 1996). These views in their extreme versions often characterize elites as either functional managers or exploiters (see also Ames 1995 and Gilman 1981). Much recent research has argued that these two forms of governance or political interaction are actually parts of the same whole (e.g., Blanton et al. 1996; Bourdieu 1977; Demarest 1996; Earle 1991; Giddens 1984; Marcus 1998; Saitta 1999). For Classic Maya polities, Giddens' (1984) work can provide a useful way to look at the formerly dichotomized perspectives of Classic Maya sociopolitical organization, which are now in many ways seen as complementary (Demarest 1996; Marcus 1998).

In the development and maintenance of power, many types of resources can be mobilized: including allocative and authoritative (Giddens 1984:258). *Allocative* resources are those that involve the control of material features of the environment, the means of material production, and the goods produced. Scholars have posited that the Classic Maya rulers controlled trade of subsistence goods (Rathje 1971, 1975), prestige goods (Blanton and Feinman 1984; Tourtellot and Sabloff 1972), subsistence systems

(Adams 1975, 1981; Chase and Chase 1987; Harrison 1990; Harrison and Turner 1978; Turner 1974) and hydraulic systems (Matheny 1976, 1987; Matheny et al. 1985; Scarborough 1998). *Authoritative* resources include the control of social spatial relations, esoteric knowledge, and dominant ideology. For the ancient Maya this took the form of public religious ritual, ritualized warfare, the creation of a body of esoteric knowledge in the form of hieroglyphic writing and astronomy, and the creation of sacred ritual space (e.g., Demarest 1989, 1992; Freidel 1982, 1986, 1992; Hammond 1991; Schele and Freidel 1990; Webster 1993). The use of both authoritative and allocative resources was present at Cancuen; the monopoly on esoteric knowledge and ritual allowed the elites of Cancuen to control production of prestige goods by nonelite residents, while the control of distribution and gift giving of these objects served to further reinforce the existing power structure. Both of these types of resources were employed as power venues to a certain extent in Classic Maya society, not only power for the elites, but subelites and/or nonelites as well. The mobilization of these resources for power by subelites or non-royal elite groups competing for power often expressed itself as heterarchy. Cancuen and the examples discussed below illustrate the highly varied paths to power used by Classic Maya elites and competing groups. Depending on location, environment, resources, social networks, different groups were able to mobilize different resources in the various Classic Maya polities, but some combination of authoritative and allocative resources was always present.

Arguments for the Control of Allocative Resources

These models often argue for intensive involvement by elites in the economy with beneficial results for all members of society (Brumfiel and Earle 1987). Systems of specialized production and exchange are “managed” by elites in order to provide economic security, prosperity, and integration for the general community.

Rathje (1971, 1975) posited that long-distance exchange developed to acquire ceremonial items, but also allowed elites to become managers of trade in necessary deficient resources such as salt, metates, and obsidian. In critique of Rathje’s theory, scholars have noted that some items such as obsidian were not necessary and others like salt and hard stone could be obtained within the lowlands (e.g., Nations and Nigh 1980; Puleston 1976; Sanders 1973), and his predictions for the timing of the movement of ‘ceremonial’ and ‘utilitarian’ goods were not supported by the archaeological record (Clark 2003; Freidel 1979; Marcus 1983)

Some Maya scholars argue for elite managerial control of subsistence systems at some centers (e.g., Adams 1975, 1981; Healey et al. 1983; Chase and Chase 1987), but it is generally argued that Maya agriculture was a ‘mosaic’ involving both intensive and extensive techniques in various different situations and sites (Culbert 1991; Culbert and Rice 1990, eds.; Dunning and Beach 2000; Fedick 1997; Houston and Stuart 2000; Marcus 1983; Rice 1993; Turner and Harrison 1983). Agricultural terracing has been documented in the Río Bec region, the Petexbatun, the Belize River Valley, and the Maya Mountains of Central Belize (Beach et al. 2002; Chase and Chase 1998; Dunning and Beach 1994; Dunning et al. 1997; Fedick 1994, 1995; Kunen 2001; Healey et al. 1983; Neff et al. 1995; Turner 1983), but as Turner (1983) pointed out, much of this terracing was of a small-scale and did not necessarily involve a centralized political authority. Kunen (2001) argues for agriculturally specialized communities that coordinated the labor involved in terracing in many cases. Some scholars argue that wetland agriculture and its management was central to ancient Maya subsistence and sociopolitical development (Culbert et al. 1995, 1996; Harrison 1977; Harrison and Turner 1978; Turner and Harrison 1983), but others have argued that wetland agriculture was not as much of a factor in large-scale subsistence and/or power strategies (e.g., Dahlin, Foss, and Chambers 1980; Demarest and Dunning 1990; Fedick and Ford 1990; Pope and Dahlin 1989; Pope et al. 1996). Other recent works have documented the extensive and enduring nature of *bajo* (seasonally inundated marshes) communities and how they allowed some lineages and groups to derive status from their exploitation and served as a basis for power not only for the agricultural resources, but also material resources such as chert and clay (Fialko 2000a; Kunen 2001, 2004; Kunen et al. 2000). Nevertheless, there was much variation in Classic Maya agricultural practices, but at least in some areas there was control, heterarchical or hierarchical, of agricultural resources and some power was derived from it.

There is substantial evidence of elite management of hydraulic systems in the Yucatan, where water is scarce (Harrison and Turner 1978; Matheny 1976, 1987; Matheny et al. 1985; Turner 1974). Scarborough (1993, 1998, 2003:115) also argues for elite water management at many lowland centers, especially Tikal, but also emphasizes the importance of the ritual and ideological control of water by elites, fundamental to the centralization of water control (combining the use of allocative and authoritative resources), although smaller communities had the resources and ability to manage their own reservoirs for domestic use (Scarborough 2003:113). He discusses the significance of Maya temples as 'water mountains' where excavated reservoirs collected water at their base for mundane and ritual uses, especially as 'mirrors' for the ritual actions of the rulers on temples and passageways to the underworld (Scarborough 1998; see discussion below on ritual significance of mirrors). Other research on Maya hydraulic systems suggests elite coordination of drainage systems at sites like Palenque (French 2002) and differential systems of water control based on status at Copan (Davis-Salazar 2003, 2006). In highland Guatemala, Barrientos (1997, 2000) found that irrigation and water diversion channels at Kaminaljuyu were not necessarily of the scale that required state control, but certain segments of the society (i.e., possibly powerful lineage groups) did derive power from their control and maintenance.

These examples demonstrate that elites may have, in some cases, performed an economic managerial function. The use of allocative resources as a source of power derives from the ability of elites or other groups to provide for their constituents in general or only in times of trouble or scarcity. While many of these studies are important in demonstrating elite involvement in the economy, evidence of elite management of large-scale craft production is notably weak in the literature. This avenue to power relates to the second on Earle's (1991) list of ten pathways to power: 2) improving infrastructure or subsistence production. A second way that these allocative resources could serve as a basis for power is restricting access to vital resources such as water and subsistence items. These examples also demonstrate the varying bases of economic and political power that existed among Classic Maya polities.

Controlling such resources as subsistence (maize agriculture) and water also have important ideological considerations as the value of these objects was very high in terms of ideology and world-view. Water and maize were essential to the creation of humans as detailed in the *Popol Vuh* creation myth (Tedlock 1985). The control of these life giving substances conferred power unto those who could restrict and/or provide them. Although they were available to all members of the society, they could be manipulated and restricted.

These studies show a widely varied strategy of managing allocative resources throughout the ancient Maya world and in many cases the combination of allocative and authoritative resources. At many sites there may have been heterarchical *and* hierarchical control of resources and power residing in diverse social groups within Classic Maya societies (e.g., Potter and King 1995; Scarborough 2003; Scarborough et al. 2003). The flux through space and time of hierarchical and heterarchical control also probably occurred as the availability of certain resources came and went, as well as being affected by political and social fluctuations of the unstable Classic Maya polities. Heterarchical relationships may have occurred with the proliferation of elites towards the end of the Classic period, non-royal elites, or even members of the royal lineage could compete for power through the manipulation of allocative resources.

Arguments for the Control of Authoritative Resources

These theories view political power as relying heavily on religious ideology, warfare, or both (e.g., Demarest 1992; Freidel 1982, 1986; Schele and Freidel 1990; Webster 1993). Most such views emphasize religious authority, ritual reinforcement, and political charisma. These types of pathways to power would include Earle's (1991:5), 3) encouraging circumscription; 4) outright force applied intentionally; 5) forging external ties; 6) expanding the size of the dependent population; 7) seizing control of existing principles of legitimacy (the past, supernatural, and natural); 8) creating or appropriating new principles of legitimacy. These theories also have components of the mobilization of allocative resources as exchange and specialization as a benefit for, and reinforcement of, elite power.

Although many of these arguments assert weak involvement of elites in economic infrastructure (allocative resources), some allow for state control of production and exchange of fine polychrome pottery, jade, shell ornaments, and other status-reinforcing goods in a parallel "palace" economy (Ball 1993; Ball and Taschek 1991). Exchanged sumptuary goods would have reinforced the tenuous power and prestige of the rulers. As a combination of both authoritative and allocative resources, these pathways to power include Earle's (1991:5): 9) seizing control of internal wealth production and distribution; 10) seizing control of external wealth procurement. The production of these ritual items also related to being able to give them as gifts in order to create social relationships and "inflict debt." The goods could also be kept and worn in presentations and rituals, or in the case of ceramics used in feasts, all reinforcing status and serving as a source of power according to Earle's (1991:5) first pathway to power: 1) giving (inflicting debt), feasting, and presentations.

These types of social currency, jade, shell, ceramics, as opposed to subsistence and water resources, were created as valued by elites, they did not have inherent life-giving properties that could be manipulated. These objects were imbued with these properties by the elites using the dominant ideology, especially the relation of jade to fertility, maize, water (vapor), and life's essence (see Chapter 5), and 'Palace School' ceramics created by and for elites often depicted scenes of creation, likening the owners and crafters to creator gods themselves (Reents-Budet 1998). The distribution of some of these items was likely restricted by social prescriptions (see section on below on *Sumptuary Laws*), which served to reinforce and legitimate the power of elites. While in state level societies, certain classes of goods certainly were restricted to elites and their ownership conferred prestige, they still ideologically and ritually reinforced the identity of the community (see also Barber and Joyce 2007) and could be seen as simultaneous centripetal and centrifugal forces within the society.

While scholars have suggested that nonelites may have been involved in craft production for Maya elites (Ball 1993; Potter and King 1995), this type of evidence has proven to be rare in the archaeological record of the Classic Maya, even after decades of research (cf. Marcus 2004). Rulers derived power and alliances through possession, trade, and gifting of these artifacts. High quality raw materials and various stages of production of sumptuary artifacts have been recovered from nonelite residences at Cancuen, and the involvement of nonelites in the production of prestige goods has been documented.

The importance of both of these allocative and authoritative resources is that each reinforces the other, and both types of resources are necessary for creating an operating power structure (Bourdieu 1977; Giddens 1984). Production and control of production (an allocative resource) were ritualized using authoritative resources. This control was facilitated by the dominant ideology of the Classic Maya, relating to the divine heritage of rulers, and their singular power to recreate the cosmos (Freidel et al. 1993; Schele and Freidel 1990; Schele and M.E. Miller 1986; see also Drennan 1976 for an Olmec example and Monahan 1990 for a Mixtec example). Monahan (1995) also argues that labor and tribute provided to nobles was seen as a form of sacrifice on the part of commoners (see also Saitta 1999).

The ritual focus of Maya rulers and the ideological basis of power may have allowed control of production without coercion or the threat of violence. The segmented production and elite monopoly of esoteric ritual knowledge and technology served to reinforce the existing power structure and constrain the nonelite producers within the ritual/political economy. Yet at the same time, production of prestige goods may have afforded commoners some degree of social latitude and economic freedom within the domestic economy, as well as accruing prestige and honor through participation in communal, segmented production.

Elites at Cancuen were able to mobilize and conscript ideological and economic resources (authoritative and allocative) in order to control production of goods for which they imbued with value, such as jade and pyrite. This control also reinforces the economic, and political variation of Maya polities, related to their ecological and environmental positions as well as situational differences such as political shifts in power and in this case a growing number of elites requiring status reinforcing goods.

Control Systems at Cancuen

Systems of control do not require violence or physical coercion. In order to exert power, 'symbolic violence' (Bourdieu 1977:191) often becomes the venue through which power resources are mobilized. It can also be argued that a *dialectic of control* (Giddens 1979) exists. As control becomes more restrictive, the more resources will be exercised to resist, although ideology can be a mediating factor. In order to mobilize the *authoritative* and *allocative* resources at Cancuen, elites needed forms of control that restricted access to those resources, including restriction of technology, ritual knowledge, and social prescriptions (such as sumptuary laws, see below). These systems of control were mediated by the dominant ideology, setting elites apart as ritual specialists and intermediaries with the gods and ancestors. At the same time, other social groups were able to appropriate some of the symbols and resources of power, negotiating their position within the social hierarchy.

Control of Technology

The perspective on technology taken in this research has deep roots in social and archaeological theory, beginning especially with Mauss (1979 [1935]), but also with Marx and Engels (2002 [1848]), as well as V. Gordon Childe (1936). Childe (1956:1) recognized that technologies were not only material, but also social transformations and were "concrete expressions and embodiments of human thought and ideas" (cited in Dobres and Hoffmann 1999:3). Mauss (1979 [1935]) saw technological production as a "total social fact" as it incorporates all aspects of the social and is not merely a sequence of action. Each step in the process of a technique is socially charged (no matter what it is), and each step used in creating it was socially informed. He called this process *enchaînement organique*. Mauss (1979 [1935]) and Heidegger (1977) were both interested in the sequential unfolding of actions and their social importance because that was the locus for the production of cultural meaning and practical action (see also Dobres 1999:127).

As a student of Mauss, Leroi-Gourhan introduced this concept into archaeology in the form of *chaîne opératoire*, and by doing so began to move the focus away from artifact typology and morphology on to "life-histories" of artifacts (see also Dobres 1999, 2000; Schiffer 1992 [although Schiffer included use of the object]). His interest was in the technological process of creation of artifacts, and how that process was socially informed.

Lemonnier was influenced by these works, which can be seen here: "(l)ike other social phenomena (myths, rules of marriage, religious concepts), being productions mediatized by social representations, techniques show an irreducible part of free creativity, and this despite the constraints of matter" (Lemonnier 1993:6). Another significant contribution of his work was his recognition that may not only have been the artifact or product that conferred status or identity, but the entire technical process of creation (1993:19). Following Leroi-Gourhan (1945), Lemonnier (1986, 1992, 1993) argues for the study of the operational sequence of actions that transform a raw material into a fabricated state (Lemonnier 1986:154), while emphasizing the social components and constraints on that transformation.

Lemonnier (1992:1-2) defines technology as any and all action upon matter. I will use this broad definition here, although, I would like to note the general bias behind the understanding of technology and many studies of technology which do not subscribe to such a broad definition. Dobres points out that we (Western culture) tend to equate technologies with "hard" and/or "male" technologies, such as ceramics, lithics, and architecture, while childbirth and food preparation are just as procedural and technical. Again, as with household production, we see female activities relegated to a lesser position in the importance of studies (Conkey and Spector 1984; Gero 1991; Lechtman 1993), that male and female spheres should be separated is a *construct* (Rosaldo 1980). Dobres (1999:131) cites Whitehead's (1927) "fallacy of misplaced concreteness" to explain our preoccupation with the "harder" aspects of technology. Mauss (1979 [1935]) himself considers techniques of the body, including swimming, walking, digging, throwing, as well as birthing, weaning, and rearing. He defines technique as anything that is *effective* and *traditional* (Mauss 1979 [1935]:104), all culturally informed, as the *habitus* of individuals (1979 [1935]:101). Mauss notes:

> I made, and went on making for several years, the fundamental mistake of thinking that there is technique only when there is an instrument. I had to go back to ancient notions, to the Platonic position on technique, for Plato spoke of a technique of music and in particular of a technique of the dance, and extend these notions (1979 [1935]:104).

While Lemonnier (1986, 1992, 1993) was among the few investigating the social context of production, the *chaîne opératoire* methodology lends itself to the study of both material and social processes of technology, although at the same time, studies that actually incorporate the social aspects of technological process are notably weak in the literature, while many times studies have been speaking about technological agency without even knowing it (Sinclair 2000). The *chaîne opératoire* concept investigates each action as a technological sequence, composed of raw materials, technical choices, as well as social choices. The technician is a knowledgeable and empowered actor with choices about the procedures and outcomes created by his/her actions, as opposed to the slave to mental templates of the ideal and standardized artifact that have sometimes been portrayed. This type of research methodology has also been called “operational chains” (Jennings et al. 2005), as well as “production sequences” or “manufacturing sequences” by Hayden (2005, and also Hayden 1998) in Americanist archaeology. The significant emphasis of all of these studies is the focus on the social aspect of production, moving beyond the mere material constraints of the raw material being processed. Concerns about sequences of production and their social components also developed in the American Behavioral Archaeology school of thought (e.g., Schiffer and Skibo 1987); although the focus in this approach was not only on the sequence of production, but the entire biography of the artifact, from procurement, to production, to use, to discard and possible reuse. Other Americanist archaeologists (especially in the realm of lithic analysis) also focused on the behavioral nature of production sequences including Sheets (1978) and Clark (Clark 1997; Clark and Bryant 1997). More recent work also addresses the disjunction between studies that focus just on production vs. those that include the entire life history of artifacts and/or human beings (e.g., Meskell 2002, 2004). The research presented here was influenced by and draws from both sides of this work.

It was with these studies that archaeologists began to realize that a deeper understanding of how the process of technology actually did affect changes in the social structure, how power and identities were negotiated and formed through techniques. The *chaîne opératoire* methodology has been widely used to accomplish these goals (Dietler and Herbich 1989, 1998; Dobres 1999, 2000; Dobres and Hoffman 1994, 1999; Jennings et al. 2005). Many of the more recent studies include applications of practice theory, implicitly or explicitly in order to more fully comprehend these processes.

Dobres (2000; Dobres and Hoffmann 1994, 1999) has also argued that we are again importing our own industrial age views on technology, as we ourselves are alienated from our own technologies, viewing them as rational products disembedded from social aspects or influence, but in truth, "technology and society are *inseparable*" (Dobres and Hoffman 1999:10). In our society this alienation is masked, our ideology makes it rational, commonsensical, understandable. If we desire a social connection with our technologies, only then would we realize that we are missing that connection.

Dobres expanded on the work of Lemonnier especially to focus on the inclusion of practice theory. The social aspect of production is focused on both aspects of action and tradition; "Technical acts can thus be treated as a medium for defining, negotiating, and expressing personhood" (Dobres 1999:129). Technical knowledge can be translated into social status and power (Childs 1999; Dobres 1999; Hoffman 1999; Pfaffenberger 1999). There is often not a need to control the material techniques and products as much as "techno-scientific knowledge" (Dobres 1999; Schiffer and Skibo 1987).

Dobres and Hoffman (1999:2) effectively argue that technological practice is inseparable from the spheres of politics and social structures; we cannot define technology solely on the basis of material, functional, rational, economizing behaviors. Technology (and not only in the "fallacy of misplaced concreteness" sense) at once concerns the material and the social. It produces and reproduces social structures. It can be used to recreate the status quo, or actively contest existing power relations.

> For example, many ethnographic studies have shown how the agency of gender is inscribed onto the material world of resources and power, thereby affording certain individuals control of the objects produced, control of the technologies and technicians involved, control of the value systems that regulate the status of gendered technicians, and control of both esoteric and practical knowledge (see outstanding examples in Herbert 1993; McGraw 1996; MacKenzie 1991; Schwarz

> Cowan 1979). Therefore technologies are, at one and the same time, arenas in which agents construct social identities and forge power relations while also producing and using utilitarian objects for practical ends (Dobres 1999:129).

As we have seen, production technologies actively reproduce the social relations that gave rise to them, and in this manner, technology can provide an important basis for analysis of social structure (see especially Dobres and Hoffman 1994; Wright 1993). Archaeological evidence at Cancuen suggests segmented production of prestige goods for the political economy in which nonelites or lesser elites were alienated from the final product by elites. Nonelite specialists may have been involved with only the early stages of production of jade artifacts, such as percussion, sawing, and drilling. The more intricate final stages of production, such as incising, may have been carried out by elites who were able to alienate the producer from the product through a monopoly on esoteric knowledge (i.e., the writing system, the calendar, ideology, and ritual) (Barber 1994; Childs 1998; Costin 1998; Inomata 2001; Reents-Budet 1998). The segmented production of jade artifacts emphasizes the importance of the operational chain approach. By looking at the different stages of jade production (see also Chapter 5) it becomes apparent that certain households had access to certain technologies, which were probably socially prescribed and reflective of social identities and relationships within the site.

The control of knowledge can be as powerful a method for social control as the direct control of raw material or labor (Dobres 2000). This type of segmented production of jade artifacts was also identified by Walters (1982) in the Motagua Valley workshop sites located directly adjacent to the Motagua jade source and has been recognized at other sites in Mesoamerica and beyond (Costin and Hagstrum 1995; Cross 1993; Urban and Schortman 1999). Segmented production was also noted by Sahagún in his descriptions of Aztec goldworkers:

> And the first mentioned are the goldworkers [and] the gold casters. And these goldworkers were each divided, separately classed, as to their workmanship, their artisanship. Some were called smiths. These had no office but to beat gold, to thin it out; to flatten it with a stone. Wherever it was required, it was polished, it was thinned. And some were called finishers. These were named to the real master craftsmen. And hence they were separate; for their tasks were of two kinds, so that they deliberated separately (Sahagun 1950-1982: Book 9, Chapter 15).

> The goldcaster [is] a possessor of knowledge, of information. [He is] the final processor, the processor of works of skill. (Sahagun 1950-1982: Book 10, Chapter 17).

This segmented production and control by certain groups of distinct technologies may reflect the social structure at Cancuen, in that certain groups were responsible for certain stages of production, which also helped to define their social identities. There may have even been two operational chains, one for nonelites and one for elites. The nonelite operational chain would include the initial shaping of the artifact, percussion, sawing, drilling, until it formed a blank or a template for elite crafters to begin incising and polishing. These technologies defined the crafters as social beings, although they were all involved in the divine act of creation.

Control of distribution of final products, ritual knowledge, and "high culture" (Baines and Yoffee 1998; Inomata 2001) reinforced power of elites, but nonelites also controlled some aspects of production technologies, allowing them to contest the existing power base and social structure. During the latter part of the Late Classic period, these nonelite individuals took up this production, probably due to increased tribute demands from elites and growing populations due to immigration (see Palka 1995; Demarest and Escobedo 1998). The identities and *habitus* of these artisans were changed; they became new individuals with new identities. While the early stages of production could be defined as "grunt work," and the conscious and/or subconscious desire of elites was to exploit a lower status workforce, these individuals were still involved in the divine act of creation (see also Reents-Budet 1998). Signs of their elevated status include imported grave goods, such as Chablekal Fine Gray wares from Palenque, figurines, some evidence of tooth filing and dental incrustations, but at the same time, jade finished products were not a part of the possessions of these individuals. When combined, architectural, mortuary, ceramic, and lithic data all support a division in social identity and possibly status between those with jade finished products, and those without (see following data chapters).

The segmentation of production and restriction of certain technologies may have served as a form of social control at Cancuen and a pathway to power. These technologies were not restricted by the types of tools used or restriction of materials, but by the knowledge and skill needed to produce them. Elites surely received special training in order to produce elaborately carved jade plaques, a form of cultural capital not available to all members of the society. Certain other objects created and possessed only by elites, such as earflares, may have been restricted by other means, discussed below.

Sumptuary Laws

Another form of social and ideological control probably practiced by the Classic Maya, also evidenced at Cancuen is that of sumptuary laws or social and ritual prescriptions. In this way, elites exerted control through the restriction of the use of symbols of power and authority. This type of control relates to Earle's penultimate pathway to power: 9) seizing control of internal wealth production and distribution.

Through the control of technology and ideology elites were able to control production of wealth, and through the implementation of sumptuary laws, they were also able to control its distribution.

Utilizing ethnohistoric and archaeological data, an inference can be made that some type of sumptuary laws existed during the Classic period, restricting the use and possession of the finest goods to only the rulers and nobles. Many of these laws referred to types of clothing, especially cotton, that was restricted to the elite, but jade, gold and other precious stones were also the exclusive property of the elite.

In the Aztec empire, the use of jade was controlled by sumptuary laws as described by Sahagún, "if it is known, if it is seen that someone took the privilege(s) of the rulers, they [the rulers] would speak, they [the commoners] would be punished, they would be hung, thus they would die" (cited in Walters 1982:1). This distinction is also seen in Sahagún's description of greenstone,

> Its name comes from nowhere. Its appearance is herb-green, like the amaranth herb. Also it is one which attracts moisture. It is precious, good looking, noble. It is really the property of the noblemen. During past times, when someone wore it, even though in an manner, if his necklace or his bracelet were of greenstone, this showed that he was a nobleman, a beloved prince; wherefore he was rendered honor, beloved by all. (Sahagún 1950-1982: Book 12, Chapter 8).

Duran (1994 [1588]:208-210) details the laws enacted by Montezuma three of which are relevant to sumptuary laws restricting the use of precious metals and stones:

> 2. Only the king may wear a golden diadem in the city, though in war all the great lords and brave captains may wear this (but on no other occasions). These lords and warriors represent the royal person when at war and thus could at that time wear the golden diadem and royal insignia.
>
> 9. Only the great lords are to wear labrets, ear plugs, and nose plugs of gold and precious stones, except for commoners who are strong men, brave captains, and soldiers, but their labrets, earplugs, and nose plugs must be of bone, wood, or other inferior material of little value.

> 10. Only the king of Tenochtitlan and sovereigns of the provinces and other great lords are to wear gold armbands, anklets, and golden rattles on the feet at the dances. They may wear garlands and hold headbands with feathers in them in the style they desire; and no one else may use them. These kings alone may adorn themselves with chains of gold around their necks, with jewelry of this metal and of precious stones, such as jade, all made by master jewelers; and no one else may. Other valiant soldiers who are not considered noblemen may wear common garlands and eagle, macaw, and certain other feathers on their heads. They may adorn themselves with necklaces of bone and of small snails, small scallop shells, bones of snakes, and common stones. (Some of the latter, though, were so well polished, carved, and painted that they were very handsome and looked fine).

The second law discusses a golden diadem, the royal insignia, which may have been similar to the "jester god" diadems frequently picture in portraits of rulers during the Classic Period (Schele and Miller 1986), and has been found in alabaster at Aguateca (Inomata and Triadan 2000) and in similar form in jade at Cancuen (Callaghan 2005; Sears 2002; see Chapter 5). It may only not have been the raw material that was the exclusive property of the ruler, but it also depended on the symbolism represented in that medium that made it the most restricted item. It should also be noted that "master jewelers" made the ornaments of precious metals and stone worn by nobles and rulers.

In Duran's description of a ritual of sacrifice performed by Montezuma and Tlacaelel, he describes their dress and mentions the use of dress and ritual paraphernalia to signify office and nobility:

> when the day of the festivities arrived, Motecuhzoma and Tlacaelel blackened their bodies with soot, with pitch, and they applied it in such a way that it seemed to be burnished and their faces seemed to shine with this; [the glow could be seen] from far away. [It was so dark that] they looked like black people pained black! They placed crowns of fine feathers, adorned with gold and precious stones upon their heads and on each arm was worn a sheath of gold reaching from the elbow to the shoulder. On their feet were richly worked jaguar skin sandals, adorned with gold and gems. They also were robed in splendid royal mantles and breechcloths done in the same manner as the capes. *From their back hung miniature bowls of finely worked jade. These last indicated that they were both kings and priests*.

> Jeweled nose plugs were placed in the pierced nose cartilage (Duran 1994 [1588]:190 [emphasis added]).

There is some evidence that sumptuary laws existed in Guatemala during the eighteenth century in the ethnohistoric work of Juarros, a Spanish descendant born in Guatemala. By this time, the use of jade had fallen out of favor in Guatemala. Foshag (1957:6) attributes this to the decline of civilization in the region, but surely the Conquest was also a contributing factor. Although jade is not directly discussed, the restriction of cotton and feathers to the elite is a sign that sumptuary laws existed, as well as gold and silver insignias of office, which would have replaced jade used during earlier periods, as the precious materials of the Conquistadors also became the valued materials of the indigenous peoples:

> The dresses of the noble Indians differed from those of the commoners; as did those of the civilized part of the population from those of the barbarians…The ears and lower lips were pierced, to receive star-shaped pendants of gold and silver; the insignia of office, or dignity, were carried in the hand…The habit of the mazaguales is simple, and very poor: they are not permitted the use of cotton, and substitute cloth made of *pita*…. Green feathers are the distinguishing marks of their chiefs and nobles (Juarros 1971 [1823]:193-5).

Forms of ideological and social control such as sumptuary laws were effective due to the nature of ancient Mesoamerican ideologies, which legitimized the distinctions between elites and commoners (e.g., Drennan 1976; Estrada-Belli 2006; Monahan 1995; Saturno 2005); Schele and Freidel 1990; Schele and Miller 1986), although this separation, as seen above, was not always hard and fast, as commoners could wear or use imitations of the more opulent artifacts, warriors (and possibly others) could gain status and be allowed the use of some status reinforcing goods, not to mention that the participation in the production of these valued products alone would have conferred status (e.g., Ames 1995; Reents-Budet 1998)

Conclusions

This chapter has discussed different notions of power, concluding that there are many pathways to power and that power exists in many forms, especially expressed and manifested in terms of capital (symbolic, cultural, social, economic) and resources (authoritative and allocative). These resources can be accumulated or manipulated by anyone in society, but they are often restricted through systems of control. In the case of the Classic Maya, allocative power resources often took the form of control of water or subsistence systems, craft production, and distribution of crafted goods. But to a great extent power was mobilized through more ideological and immaterial means; authoritative resources such as public religious ritual, ritualized warfare, the creation of a body of esoteric knowledge in the form of hieroglyphic writing and astronomy, and the creation of sacred ritual space. In order to control access to capital and resources within the society, the elite of Cancuen used the restriction of technology, ritual knowledge, and sumptuary laws.

The following chapters (5 and 6) will chronicle artifact distributions and contexts for Cancuen, exploring the possibility of segmented production of jade and the ritual nature of some of the products such as jade pendants and earflares, and pyrite mirrors. These chapters will explore the manufacturing sequences for the production and biographies of these artifacts, and its significance for pathways to power of various social groups at Cancuen. The restriction of some artifacts through social and ritual prescriptions will also be discussed, as well as the emulation of elite styles and different styles representative of subaltern identities.

Chapters 7 and 8 will describe the production and distribution of obsidian and chert, as well as their role in the ritual economy. The operational chain of these artifacts will also be investigated, as well as how their distribution reflects differential access to resources and power at Cancuen.

CHAPTER V

JADE

> I will also give you some very valuable stones, which you will send to him in my name; they are *chalchihuites* and are not to be given to any one else but only to him, your great Prince. Each is worth two loads of gold (Diaz 1632: vol. 2, pp. 136-7).
>
> --Montezuma to Cortés

Introduction

This chapter will begin by describing the properties of the mineral jadeite and the conditions under which it forms. The properties of jadeite are important because of its hardness, which makes it very difficult and time consuming to work, as well as its rarity, forming in only a few locations throughout the world. Both of these characteristics make jade a valuable gemstone in the past and today for jewelry and adornments. For the Classic Maya, jade was especially symbolic due to its green color which represented life's essence and fertility. The social and ritual significance of jade will also be discussed.

The manufacture of jade artifacts was a long and arduous process with numerous technological stages and different tools utilized. Ethnohistoric and ethnographic sources from Mesoamerica and the Far East can help to shed light on the nature of those technologies. The manufacturing sequence for Cancuen is described, as well as detailing which technologies were most prevalent in different households throughout the site. The total amount of jade artifacts at Cancuen recovered from residential excavations includes 3528 artifacts with a total of 91.6 kilograms or 201.5 pounds. The vast majority of these, 3380 artifacts, represent the early stages of production and were recovered from Type IV structures. Finished products, such as carved jade plaques, earflares, and large beads seem to have been the exclusive property of the residents of Type I and II structures. Despite the large amount of jade present in Type IV structures, the finishing stages of artifacts seem to have been carried out by residents of Types I and II structures.

The segmented manufacturing sequence of jade artifacts may represent the social structure at Cancuen and the authoritative and allocative power of the elite, who could alienate the final product from producers through a monopoly on certain types of technology and cultural knowledge, as well as sumptuary laws. Nevertheless, small beads, caches, and termination rituals suggest that residents of Types III, IV, and V structures had some access to jade and their involvement in the production was part of their social identity even if they were alienated from the final product.

What is Jade?

The term jade comes from early Spanish accounts, which referred to greenstones in Mesoamerica as *piedra de yjada* (Monardes 1569). This name was given to it as the Aztecs told the Spanish of its curative powers in the areas of the spleen, kidneys, and liver; therefore the Spanish named it piedra de yjada, or "loin-stone," and its modern name, jade, is a modern English take on the Spanish term (see Miller and Taube 1993:102). In ethnohistoric sources jade is often referred to as *chalchihuites*, a name derived from the Nahuatl word *xalxihuitl*, or *xalli,* sand or jewel and *xihuitl,* herb or herb-colored (see Foshag 1957:7). The Spanish often also called jade and similar greenstones emeralds, as they had no other point of reference for the stones. Sahagún notes that there were many different types of greenstone for the Aztecs, depending on color and quality. For example, *Quetzalitztli*, probably very similar to Chinese "Imperial Jade" with a bright emerald green color, *Quetzachalchihuitl*, described as high-quality, transparent, and without imperfections, *Chalchihuites,* which were green and of good quality, but not transparent, *Xiuhtomoltetl* is described as green and white mixed, but is also referred to as turquoise in other sources. Sahagún also describes poor quality "chalchihuites fingidos" which were used by the commoners who were not permitted to use jade (Sahagún 1950-1982: Book 11, Chapter 8; see also Foshag 1957:9). The different terms used at the time of conquest suggest that master crafters and general citizens knew of different types of qualities of greenstones, and were even able to attribute them to different statuses.

Geologically speaking, jade is a term for a gemstone used to encompass both jadeite and nephrite, nephrite is an amphibole mineral, which is restricted mainly to use in Asia and will not be discussed here as it does not occur in Mesoamerica. Jadeite is a pyroxene mineral composed of sodium, aluminum, and silicates ($NaAlSi_2O_6$). The colors of jadeite vary depending on its chemical composition from green, blue, lavender, white, and black. Green jade was highly prized by ancient Mesoamericans (see below) and derives its green color mainly from the presence of chromium and nickel (see also Kovacevich, Neff, and Bishop 2005).

Jadeite is a very hard mineral with a hardness of 6.5 to 7 on Moh's scale (talc is the softest at 1 and diamonds the hardest at 10). Guatemala has one of only six known jadeite sources in the world (Foshag and Leslie 1955). Jadeite is extremely rare because it only forms under high-temperature and low-pressure conditions associated with a major tectonic fault, such as the one along the Motagua River valley in Guatemala

(Figure 5.1). Around the world jade bearing faults are primarily associated with horizontal movement, and are of a relatively young age, i.e. Cretaceous or younger (Harlow 1993). Most jadeite has at least smaller amounts of related minerals that typically form under similar circumstances, including albite, diopside, acmite, and chloromelanite. Most of these minerals are characteristic of high-pressure, low-temperature metamorphism found in the Guatemalan Highlands. Pyroxene minerals such as jadeite, diopside, enstatite, clinoenstatite, augite, aegirine, omphacite, acmite, and calcium aluminum (Tschermak's molecule), as well as plagioclase feldspars like albite and anorthite (see Table 5.1) can all form together. Many of these minerals are closely related and varieties of one another. For example, if the sodium and aluminum in jadeite are replaced by calcium and magnesium, the result is omphacite, diopside, or enstatite (a magnesium rich diopside). Jadeite is also unstable, and as deposits of the mineral come closer to the surface and experience higher water saturation (especially below volcanic sediments) it can chemically break down into analcime or albite (Harlow 1993:16). Many of these minerals can occur with a green color, and have similar properties to jadeite, but certainly jadeite was favored for its superior color, luster, and workability (Foshag 1957). The other related minerals were also softer than jadeite, making jadeite much more difficult to work, requiring greater skill (see also Lange and Bishop 1988), but also resulted in a better and longer lasting polish. The term jade will be used in this study to refer to various combinations of all of the above minerals, as it is very difficult to identify the primary components of a very large number of samples, but the geological description of most of the jades at Cancuen would more accurately and verbosely be described as polymineralic jadeitite with jadeite as a major component (Ronald Bishop, personal communication, 2002).

There are also some other green stones that were worked by ancient crafters and are often confused for jade by modern peoples, but have very different properties of workability and luster, making them ultimately inferior as use for the creation of jewelry, these include soapstone (also known as steatite and a rock form of talc), serpentine (jadeite forms within bodies of serpentine, a much softer rock), agate (a cryptocrystlline silicate), amazonite (a type of quartz), muscovite (a type of mica), and jasper (also related to quartz). The majority of artifacts found in ancient Mesoamerican contexts were not pure jadeite, and while the most perfect material was desired, it was not always attainable.

The Social and Ritual Significance of Jade in Mesoamerica

Jade to the ancient Maya symbolized maize, centrality, rulership, and the *axis mundi* (Coe 1988; Schele and Freidel 1990; Taube 1996, 1998, 2005; Miller and Taube 1993). Taube (2005) also argues that jade symbolized breath and essence of life, making it a powerful symbol of the elite ability to conjure gods and ancestors in certain ritual contexts, as they were symbolically “exhaled” through jade ritual objects such as earspools and ceremonial bars. Taube’s (2005) argument is also supported by ethnohistoric accounts of the stone acquiring vapor, and being said to “breathe” by indigenous peoples:

> And those of experience, the advised, these look for it. In this manner [they see] they know where it is; they can see that it is breathing, [smoking], giving off vapor. Early, at dawn, when [the sun] comes up, they find where to place themselves, where to stand; they face the sun. And when the sun has already

> come up, they are truly very attentive in looking. They look with diligence; they no longer blink; they look well. Wherever they can see that something like a little smoke [column] stands, that one of them is giving off vapor, this one is the precious stone. Perhaps it is a coarse stone; perhaps it is a common stone, or something smooth, or something round. They take it up; they carry it away. And if they are not successful, if it is only barren where the little [column of] smoke stands, thus they know that the precious stone is there in the earth (Sahagún 1950-1982: Book 11, Chapter 8).

Taube (2005) concludes that jade was not only valued for its beauty and inherent qualities, not only as a symbol of maize and water, but individuals wearing crafted jade objects "probably were conceived as being in continuous sonic contact with numinous beings." He goes on to say:

> In part, the relation of jade to the ancient past concerns the tough and durable nature of this stone, which allows objects to be used and reused for hundreds of years. However, although an extremely hard stone, jade also symbolized the immaterial and fleeting breath essence of the soul, allowing for ritual contact with otherwise remote gods and ancestors. In Classic Maya thought, jade was a stone of beauty and ancient tradition, a living material that through heirlooms and rituals of conjuring linked the living to generations of the dead (Taube 2005:47).

This passage graphically illustrates that certain jade artifacts were themselves symbols of esoteric and ritual knowledge, not only were they adornments, jewels and inalienable possessions, but actually tools used in the conjuring of gods and ancestors, portals that opened the heavens to ritual specialists.

Jade was the most precious stone of the Maya and other Mesoamerican cultures. At the time of conquest, Montezuma said to Cortés that very valuable green stones or *chalchihuites* would be sent to his king, which were valued at more than two loads of gold each (Bernal Diaz de Castillo 1632, vol.2: 136-137; cited in Foshag 1957). While the beads have been known to be a form of currency for exchange during the contact period (e.g., Landa [Tozzer 1941]:19, 95-96, 130) the more elaborate pieces were possessed and worn only by the most elite. In the Aztec empire, the use of jade was controlled by sumptuary laws (Sahagún 1950-1982, Book 10, Chapter 24), which almost certainly existed during the Classic period (also see discussion in Chapter 4). Jade adornments formed an essential part of a ruler's burial goods as inalienable possessions and heirlooms, and were also essential to the ritual costume and paraphernalia used by Maya kings and nobles during ritual presentation, as attested to on monuments and stelae.

A Brief History of Jade Research in Guatemala

A comprehensive description of Mesoamerican jade was first published by Foshag in 1954. Kidder, Jennings, and Shook (1946) provide a study of the jade artifacts and techniques used to produce them at Kaminaljuyu. Smith and Kidder (1943) first reported on jade working activities in the Middle Motagua Valley area of Guatemala (see Figure 5.1). Walters (1982) carried out his dissertation research for the University of Missouri-Columbia in the Motagua Valley of East-Central Guatemala. Feldman and colleagues (1982) also briefly investigated jade working in the Motagua Valley. Current work is also being carried out in the Middle Motagua Valley by Rochette and Pellecer (Pellecer and Rochette 2006 and Rochette and Pellecer 2006) and in the Sierra de las Minas by Taube, Hruby, and Romero (2006).

Foshag and Leslie (1955) identified the first *in situ* jadeite source in Manzanal, Guatemala, and it was originally assumed that all Classic Maya jade artifacts had come from the same source. Then in 1971, artifacts from Lubaantun, Belize were compared with the Manzanal source using X-ray fluorescence. The results showed that the samples were not related, and opened the distinct possibility of multiple sources for Classic Maya jade artifacts. Hammond and coworkers (1977) utilized for the first time instrumental neutron activation analysis (INAA) in order to characterize samples of raw jade and compare them to artifacts from several regions in Guatemala, Belize, and Honduras. This analysis identified several compositional groups for jadeite from the Motagua Valley, but sufficient source sampling was not achieved to identify distinct source groups.

In 1978 the Brookhaven National Laboratory and the Boston Museum of Fine Arts launched the Maya Jade and Ceramic Research Project. This project allowed Ron Bishop and his colleagues to characterize source samples from Guatemala and Costa Rica and artifacts from Guatemala, Belize, Honduras, and Costa Rica with the use of X-ray diffraction and INAA (Lange, Bishop, and van Zelst 1981; Lange and Bishop 1988; Bishop, Sayre, and van Zelst 1984; Bishop, Sayre, and Mishara 1993). The source sampling in Guatemala focused primarily on the known source of jadeite in the Motagua Valley, but was extended to include sampling from northwestern Costa Rica—an area known for extensive use of greenstone artifacts. A conclusive source for jadeite in Costa Rica was not identified, reinforcing the possibility that there were unidentified sources of jadeite in Guatemala and Costa Rica (Lange et al. 1981; Lange and Bishop 1988). The primary findings of these studies demonstrated that there were almost certainly multiple jade sources utilized by Pre-Columbian peoples.

A major aim of the research of Bishop and colleagues was also to set limits of the chemical variability of the jadeites of the Motagua Valley. While the chemical signatures from the Motagua region clustered into distinct groups, there was shown to be a general compositional homogeneity, i.e. there was more heterogeneity between the Motagua samples and others than within the Motagua samples. The Motagua groups were composed of Motagua Light, Motagua Dark, Motagua Exceptional and Chichen Green groups (see Table 5.2). The Costa Rican samples also clustered into light and dark groups, but were compositionally distinct from the Motagua data. Only 10 artifacts from the Maya region matched the Costa Rican samples, and only 5 Costa Rican artifacts matched the Motagua data. One-third of sampled artifacts from Chichen Itza to Copan matched the Motagua data, while the others could not be assigned to any reasonably homogeneous compositional group (Bishop et al. 1993:40). The researchers reached the conclusion that Pre-Columbian populations must have utilized more than a single source for the procurement of jadeite.

Others (Harlow 1993) argue that variation within the Motagua source can account for all of the variation in Classic Maya artifacts, and inadequate sampling is to blame for the lack of match between Classic Maya jade artifacts and the known source. Harlow argues that only the Motagua Valley has the geologic preconditions necessary for jadeite formation in Mesoamerica. He also argues that jadeite samples cannot be looked at as homogenous material, such as obsidian, when there are numerous distinct mineralogical compositions for each sample. Bishop and Lange (1993) address these arguments and point out that chemical compositional analysis used in conjunction with archaeological data strongly suggests multiple sources. Recent use of LA-ICP-MS, for Cancuen and comparative materials, provides new data from which to address patterns of compositional variation of jade and their archaeological significance.

Lange and Bishop (1988) assume that long distance exchange functioned in the elite realm of ancient Mesoamerican society, and they apply Renfrew’s (1975) model for modes of exchange to their database in order to better understand how jade moved from Guatemala to Costa Rica. They found that down-the-line trade, using both land and sea routes would be feasible. Central Place Redistribution may have occurred, but exactly what was exchanged for the jade is not known. Middleman or "freelance" trading may also have occurred, but the authors argue that the limited contexts of jade in Costa Rica suggest that it was tightly controlled. Finally, the authors consider "prestige-chain-trade" also suggested by Renfrew (1975:50). This type of trade would occur over much longer distances and with much more gradual fall off curves than down-the-line or middle man trade. They note that while the paucity of jade in Costa Rica suggests that prestige-chain-trade did not exist, the analysis of other foreign materials may suggest otherwise. These conclusions demonstrate the difficulty in interpreting exchange patterns from the archaeological record, as many patterns may represent various modes of exchange. This study also highlights the importance of chemical sourcing as directionality can be determined.

LA-ICP-MS Chemical Sourcing of Jade at Cancuen

Twenty-seven pieces of the greenstone debitage recovered were submitted to chemical compositional analyses in 2001. These tests were initiated in order to identify the mineralogical composition of the Cancuen greenstones, to identify a source for the procurement of the raw materials, and to look for compositional matches with finished products from other centers. These tests could aid in the interpretation of jade procurement patterns, as well as distribution patterns. The primary research questions were: Did the residents of Cancuen procure jade from the known Motagua Valley source? And did any of the Cancuen jades match previously sampled jade artifacts from the highlands or the lowlands? Answers to these questions would allow the further interpretation of procurement patterns and exchange modes.

LA-ICP-MS elemental determinations on Cancuen jades were carried out by Hector Neff at the University of Missouri Research Reactor Center (MURR), utilizing the compositional data for jade collected by Ronald Bishop and his colleagues during the Maya Jade and Ceramic Research Project. LA-ICP-MS results support the earlier INAA results produced by Ron Bishop and coworkers (Bishop et al. 1993; Lange et al. 1981; Lange and Bishop 1988). Hector Neff is currently at the Archaeometry Laboratory of the Institute for Integrative Research in Materials, Environments, and Societies (IIRMES) at California State University, Long Beach and the most recent research was completed at this laboratory. The following describes the results of the reanalysis using LA-ICP-MS of source and artifact samples collected by Ronald Bishop, with the addition of the 27 samples of Cancuen jades (see Table 5.3). For a technical explanation of the methods used and a complete discussion of the data in these tests, please see Kovacevich, Neff, and Bishop (2005).

Data for the Cancuen samples were observed to form dark and light groups, as was previously found for the INAA analyses of the Motagua samples. The Cancuen samples, however, are compositionally distinct from the Motagua materials. Intriguingly, the Cancuen samples were found to be compositionally similar to some of the samples from the Salama Valley, located in the Alta Verapaz (Sharer and Sedat 1987). The earlier INAA work by Bishop et al. had left the Salama Valley artifacts unassigned to any compositional group. This finding of similarity among Salama Valley and Cancuen artifacts may indicate that the residents of these two regions were exploiting a jadeite source that has not yet been identified. The study also finds at least two other compositional profiles identifiable from the Alta Verapaz. Subsequent studies also found that the Cancuen jades compositionally match several mosaic pieces of the funerary mask of Lord Pakal of Palenque, a powerful lowland center (Neff et al. 2006).

The chemical data produced by LA-ICP-MS analysis of the jades were subjected to multivariate data analysis, as described by Neff (2002). In this case, a number of principal components plots and plots of the logged oxide concentrations of the data were examined in order to recognize potential chemical groups. Seven groups emerged from this analysis (Tables 5.2, 5.3 and Figures 5.2 – 5.10). The small size of these groups precluded statistical testing with Mahalanobis distance, although Mahalanobis distances were calculated on the first four principal components in order to check the subjective assessment of pattern (see Table 5.2). Probabilities of membership in Group 2 shown in Table 2 are somewhat inflated due to the small specimen-to-variate ratio. Thus, some specimens that appear from the probabilities in Table 5.2 to be linked to Group 2 (e.g., KOV12, 16, and 20) are left unassigned because they diverge from the group profile on plots of several oxides. For similar reasons, JA456, which would seem to fall well within the range of variation of Group 1 based on the probabilities shown in Table 5.2, is left unassigned.

A plot of the first two principal components of the data (Figure 5.3) illustrates some of the major patterning, including the discrimination of Group 3, the El Progreso Source Group, and the two Alta Verapaz groups from Groups 1, 2, and 4. Coordinates of the oxides on Figure 5 indicate how the various measurements contribute to the group separation: El Progreso and Alta Verapaz 1, for instance, are enriched in many of the measured oxides, while Group 3 is relatively diluted in most. Figure 6 shows the varying concentrations of ytterbium and thorium in several of the groups.

The two largest groups in the data, Group 1 and Group 2, are discriminated from one another on the third principal component (Figure 5.4). The largest contributor to this component is chromium oxide, followed by nickel oxide. The basic discrimination here is between dark jade (high chromium, high nickel, Group 1) and light jade (low chromium, low nickel, Group 2). The dark jade tends to have omphacite as its major mineralogical component (see the XRD column in Tables 5.1 and 5.3), whereas the light jade (Group 2) tends to have jadeite as its major component. This same concordance of mineralogy and chemistry was reported in the earlier INAA study of jade (Bishop et al. 1993). Moreover, the INAA results and the LA-ICP-MS results agree with one another for some of the analyses that were duplicated: Group 4 members JA300 and JS154, which were assigned to the Motagua Light INAA group, show low chromium consistent with Group 2, whereas Group 4 member JS70 along with unassigned specimens JA456 and JS76, which were assigned to the Motagua Dark INAA group, show the high-chromium composition of Group 1 (Figure 5.5; see Table 5.3 for INAA group assignments).

In light of the fact that a similar dark versus light distinction can be detected in both the sample analyzed by INAA and the Cancuen jade sample, it is important to reiterate that the Cancuen sample is otherwise somewhat distinct from Motagua Dark and Motagua Light groups identified in the earlier INAA study. Despite similar chromium concentrations, most of the Motagua source specimens and artifacts included in the INAA study fall into groups (Groups 3 and 4) that are otherwise distinct from the Cancuen dark (Group 1) and Cancuen light (Group 2) groups defined here (Figures 5.5 –

5.7). Group 3 specimen JS006 together with unassigned specimen JA301 are anomalous because, although both were previously placed in the Motagua Dark INAA group, both have chromium concentrations in line with the lighter Group 2 defined in the present study. The reason for this is probably that Neff tended to select darker green locations for laser sampling, whereas the earlier INAA characterizations were bulk analyses that presumably were dominated by lighter colored, low chromium parts of the rock. These observations serve to highlight the fact that the Cancuen dark and Cancuen light groups probably represent the same rocks, with dark/omphacitic/chromium+nickel-enriched sections being separable from light/jadeitic/chromium+nickel-depleted sections.

Data supporting the observed compositional difference of jadeite containing artifacts from Cancuen and the artifacts or source materials associated with the Motagua Valley come from qualitative X-ray diffraction performed at the Smithsonian Center for Materials Research and Education. While both groups of specimens are found to be polymineralic with jadeite occurring as a major mineral, the Motagua samples revealed a strong patterned co-occurrence of jadeite, albite, paragonite (a type of mica) and analcite. In comparison, the Cancuen samples lacked paragonite but contained aegerine and augite. Thus, the X-ray diffraction data seem to support the compositional differences between the Motagua and Cancuen samples that were identified by LA-ICP-MS (see Tables 5.1 and 5.3).

The two most anomalous compositions in the data set are source sample JS15, which shows an anomalously low silica concentration of around 16.5%, and Holmul artifact JA287, which shows an anomalously high silica concentration of >95% (Figure 5.7). In the case of JS15, the dominant component is magnesium oxide (~74%), which is consistent with serpentine but inconsistent with any variety of jade. The extremely high silica composition of JA287 is consistent with a greenish tinted quartzite; INAA data for this specimen were reported previously by Bishop et al. (1993:Appendix E.4), and it is interesting to note that the INAA data agree with the LA-ICP-MS data to the extent that major oxide concentrations Na_2O and Fe_2O_3 are very low, whereas Cr_2O_3, a presumed green colorant, approaches the level characteristic of the Motagua Dark/Group 1 dark green jade fingerprint.

Figures 5.8 through 5.10 show the unassigned specimens projected into the space of the first four principal components (Figures 5.8 through 5.10 are the same plots as Figures 5.2, 5.4, and 5.6, but without oxide concentration coordinates). It is evident from these plots that most of the unassigned specimens pertain to the same basic range of variation as Groups 1, 2, and 4. KOV41 is an exception: this grayish celt fragment, apparently from Quirigua, is highly enriched in light rare earth elements and other trace elements.

The Cancuen sample, as indicated already, falls into two basic groups, Group 1 (dark green) and Group 2 (light green). Motagua source samples in Group 4 (JS70, 71, and 154) and unassigned source sample JS76 fall within one or the other of these groups on many projections of the data, but are excluded from the group on key dimensions (Table 5.2; Figures 5.6 and 5.10). Similarly, the sample from the new Chiquimula source, KOV10, cannot be assigned to either of the Cancuen groups (Table 5.3), although it falls within one or the other of the groups on many projections of the data (Figures 5.5 and 5.7 – 5.10). Thus, although we cannot attribute the Cancuen workshop jade definitively to a specific source, a possibility may lie in the recently publicized source of the Sierra de las Minas (Seitz et al. 2001; Taube, Hruby, and Romero 2006).

The only previously sampled non-Cancuen specimens linked with the Cancuen samples are three specimens from a single site in the Salama Valley, Alta Verapaz, that are included in Group 1 (dark green). On its face, this linkage indicates that at least some of the jade from the Salama Valley was derived from the source favored by Classic period Cancuen jade workers. Besides the Cancuen-related composition, there are at least two other compositional profiles from Alta Verapaz, Alta Verapaz 1 and 2 (see also Sharer and Sedat 1987: Appendix 3).

Overall, this study parallels the earlier INAA study quite closely in a number of respects. The dark versus light dichotomy, which reflects varying chromium concentration and mineralogy, is just as clear in this study as it was in the earlier study. Also as in the earlier study, it is clear that rocks from the same location or even different parts of the same rock can exhibit both dark and light compositions. More generally, like the earlier study, this study did not yield secure, specific source attributions for most of the artifacts. This last observation indicates that source sampling is as yet incomplete; additional sampling, particularly of the “new” jade sources in the Sierra de las Minas (see Figure 5.1), might eventually yield a better basis for attributing the Cancuen and Salama jade as well as other jade from the Maya area.

The most recent work preformed by Neff (see Neff, Kovacevich, and Bishop 2006) compared the current source and artifact compositional profiles to jade mosaic pieces of the jade mask of Pakal, the eighth century ruler of the site of Palenque, located in present day Chiapas, Mexico. Three of the Pakal Mask specimens fall into Group 1, which corresponds to the “dark” group defined by Kovacevich, Neff and Bishop (2005) in the Cancuen study. This group is large enough to calculate multivariate probabilities of membership based on Mahalanobis distance from the group centroid; this calculation shows that the three Pakal Mask samples all exceed 5% probability of membership in the group. Although, given the compositional variability in jadeite discussed above, the evidence does not demonstrate conclusively that the Pakal Mask specimens passed through Cancuen, this is one possibility. More cautiously, the evidence establishes a clear and convincing connection between the Pakal Mask jades from Palenque and the dark green jades from the Motagua fault zone (possibly the Sierra de las Minas) that were exploited by the Maya, including the jade workers of Cancuen.

The fourth Pakal Mask specimen falls into Group 3, which, as noted above, shows a clear connection to jadeite artifacts from the Salama Valley of Alta Verapaz. The inference here is similar to that for the Group 1 members: inclusion of the Pakal Mask specimen in Group 3 does not establish a specific connection with the Salama Valley, but it does establish a connection with the Motagua fault zone resources that were also exploited by Maya jade workers of the Salama Valley.

As expected, the compositions of the greenstone samples from the Mask of Pakal are consistent with jadeite from the Motagua fault zone in Guatemala. Most saliently, three out of four of them fall within the range of variation of a subgroup defined based on analysis of debitage from a jade workshop at the Maya site of Cancuen (Kovacevich et al. 2005).

The location of Cancuen as the southernmost Classic Maya site on the Pasión River made it a favorable location for trade between the Guatemalan highlands and lowlands. Consistent with its favorable situation, archaeological evidence demonstrates that Cancuen's inhabitants pursued a variety of crafts, the best-documented of which was jade working (Kovacevich et al. 2005). Cancuen was ideally situated to control the flow of goods, such as jade into lowland areas controlled by Classic Maya dynasties. Archaeological evidence from the site documents the importance of craft production, including jade working, it is perhaps not surprising that a powerful Maya king like Pakal would have been buried with a jade mosaic mask with pieces that may have passed through Cancuen and/or been gifted to the ruler.

Influence and trade goods from Palenque occurred in numerous contexts at Cancuen, ranging from Types I through Type V structures, although the highest ceramic content of Chablekal Fine Gray pottery came from Type IV structures, especially those related to jade production. The presence of Chablekal ceramic material in Type IV structures may relate to redistribution and prestige redistribution by elite patrons, or possibly to direct trade in an informal market setting for the easily portable and tradable pots from this prestigious center (Figures 5.11 and 5.12). Elite connections and influence at the Palace and Type I structure level are more apparent and easily interpreted as elite alliance formation and interaction, although it seems that Chablekal was not as important a trade ware for the elite of Cancuen, as it appears in lower amounts in Types I and II structures (see also Chapter 9).

As of yet, these are the only trade connections that have been made using LA-ICP-MS, although there are certainly more connections that will be made with future research. Clearly more source sampling and artifact sampling are needed. The artifact samples utilized in the Maya Jade and Ceramic Research Project were biased towards

Belize, where access to artifacts was much more available. New samples from the Pasion/Usumacita and Central Peten sites could provide valuable data on these trade relationships. Since LA-ICP-MS has performed at least as well as INAA in the chemical characterization of jade we can continue to extrapolate information with the use of both data sets.

The patterns of jade exchange that emerge at this time suggest elite interaction and possibly “emissary trade” as discussed by Renfrew (1975), probably elite gifting in order to procure social capital and inflict debt relationships with other centers. The procurement of raw jade is still problematic, as a direct source has not yet been determined, although the raw materials utilized in jade production were exotic (procured at least 100 km from Cancuen), lending themselves to control of import by elites (Flannery 1968; Renfrew 1982). In the case of jade, the raw material is heavy and difficult to quarry and transport suggesting the need for coordination of import. The raw materials of jade also have little to no value when they are unworked (Chenault 1986), allowing for elite control of the ritual knowledge needed to incorporate them into the political economy. At the same time, the highest amounts of raw jade were recovered from Type IV structures (see below), with raw jade in smaller amounts found in Types I, II, and III structures, with almost none in Type V structures. The residents of Type IV structures may have been responsible for quarrying the raw materials for tribute themselves, they may have had some lineage connections to the highlands that would have facilitated this (possibly to be elucidated later by further ceramic analysis). On the other hand elites may have quarried the raw material and redistributed it in large quantities to Type IV residents for early stage production, either way, ideological control systems precluded them from using the jade in non-socially prescribed ways.

Jade Contexts in Other Lowland Maya Centers

As discussed above, jade was a precious material related to status and ritual. In Maya archaeology jade has often been used as a signifier of high status when recovered in the archaeological record. The use of jade as an exclusive marker of status has recently been challenged by many, and jade has been found, usually in small amounts and many times in the form of small beads, in nonelite households (see A. Chase 1992; Haviland and Moholy-Nagy 1992; Moholy-Nagy 1994, 1997; Palka 1997). At some sites, jade has also been recovered in larger amounts in "commoner" households (Garber 1993; Guderjan in press). In many cases, if there are large amounts of jade in nonelite contexts, this tends to occur during the Preclassic or Early Classic periods, and then decline or drop off during the Classic (see Moholy-Nagy 1994, 1997; Guderjan in press), and is part of a generally noted trend where the amount of jade decreases during the Late Classic and becomes much more restricted to elite use (e.g., Rathje 1970). One could argue that this pattern relates to consolidation of power and restriction of status reinforcing goods through mechanisms like sumptuary laws and/or control of elite exchange networks (see also Chapter 4). As discussed above, ethnohistoric sources suggest that there were many types of jade during the contact period, and common people were allowed the use of some of the more poor quality jades, and only in certain forms, especially beads. The high quality jade that incorporated certain types of iconography (i.e. large earflares [e.g. Pendergast 1998], ahau pendants [e.g. (Freidel 1993; Freidel, Reese-Taylor, and Mora-Martin 2002; Schele and Freidel 1990] and royal diadems [e.g. jester god (royal diadems) and other headdress ornaments, (Eberl and Inomata 2001; Schele and Miller 1986) were restricted to elite use. This debate may be fueled by the past bias in Maya archaeology to focus on "elite" or high status areas of sites, sometimes neglecting all together excavations in nonelite residential areas (see also Lohse and Valdez 2004; Robin 2003; Webster and Gonlin 1988). For this reason, our understanding of regional patterns of jade distribution between elites and nonelites is limited, but a new interest in household archaeology and the daily lives of nonelites is beginning to remedy this situation.

The Late Classic and Postclassic pattern of restricted access to finished products of jade is apparent at Cancuen (i.e., Rathje 1970), yet even among other sites with jade in nonelite contexts, Cancuen's nonelite jade contexts are still unique. Garber and coworkers (1993) point out that jade is a highly valued elite material almost always encountered in caches, burials, tombs, and sacrificial offerings in finished form. Digby (1964), Chenault (1986) and others discuss the value of jade, as each piece of debitage was shaped into something so as not to be wasted. When jade has been found in household refuse, it has been as part of a termination ritual, as discussed for Cerros, Belize by Garber (1993). Raw or partially worked pieces, such as the large wedge-sawed boulder recovered at Kaminaljuyu and the string-sawed pieces found at Seibal (Willey 1978) were cached in structures or under monuments as dedicatory offerings. The only comparable debitage deposits come from sites immediately adjacent to the source in the Middle Motagua Valley, first explored by Smith and Kidder (1943) and then later analyzed and described by Walters (1982) and currently under study by Rochette and

Pellecer (Pellecer and Rochette 2006 and Rochette and Pellecer 2006). The following is a limited comparison of jade contexts from several sites with extensive excavations in both elite and nonelite residences.

Piedras Negras

Piedras Negras is a lowland river site with relatively low amounts of jade artifacts, even in the most elite contexts. Much of the following discussion was presented in Kovacevich and Hruby (2005).

Elite burials from Piedras Negras reveal the small quantities of jade found at the site. Three burials, which are considered to be elite burials, a household patron, a *sajal*, and a prince, contained five to ten small jade beads per burial. The tombs of Ruler 3 and Ruler 4 each contain many jade beads, but they are all relatively small in size. For example, Burial 13, the probable resting place of Ruler 4, contained two small pectorals (the largest weighing 26.2 g) and 123 jadeite beads. The total weight of the jade in the tomb totals 299.7 grams, but the average weight per bead is 2.22 grams per bead. In contrast, the jade from Pakal's tomb from Palenque and Jasaw Chan K'awiil's tomb from Tikal can be counted in kilograms, and the average size of beads from these tombs is much greater.

The largest piece of jadeite associated with Piedras Negras was actually found in the Sacred Cenote at Chichen Itza, demonstrating that tomb jade may have been redistributed post-mortem (glyphically identified by Proskouriakoff 1960). Both Ruler 3 and Ruler 4's tombs contained a great quantity of clay reproductions of jade beads. These ceramic beads were painted blue in order to imitate the blue and green colors of jadeite. The large, finely carved jadeite from Chichen suggests that the Piedras Negras Maya may have had unique ways of treating jade heirlooms after a king's death. If the ceramic beads were real jadeite, then the size, number, and position of the beads would mirror those from other richer sites. It appears that the Piedras Negras elite simply did not have easy access to large quantities of jadeite. It should be noted that other tomb goods not made of jadeite, such as *Spondylus* shells and earspools were also imitated in clay. Compare the two *Spondylus* shells in Ruler 4's tomb with the more than 20 found in Jasaw Chan K'awiil's tomb from Tikal.

The only elite tomb from the Early Classic contained a sizeable number of jade beads, but 24 of the largest beads were not made out of jade, but rather a blue colored quartz crystal averaging 3.3 grams each, which is still smaller than the massive beads found elsewhere in the lowlands (Child and Child 1999). There was one polishing stone that may have been used to make small jade beads, but this is the only evidence of jade production at the site. Finally, a few jade beads were made out of heirlooms, jade pectorals with Early Classic carvings on them, which were then re-cut and polished into much smaller beads for the royal tombs.

It is unclear why there is so little jade at Piedras Negras compared to other areas of the lowlands, but distance from the source is not the only factor that determines the quantity or quality of jade imported into a site. It appears that the middle Usumacinta region was somehow "cut out" of the major jade trade, and that these items were being traded around this part of the river. Perhaps the ease of taxation and the high levels of warfare between Usumacinta sites made it a poor way to transport extremely valuable goods and materials, such as jadeite.

As noted above, the same jade source utilized at Cancuen was used in several mosaic pieces of Pakal's mask at Palenque (Neff et al. 2006). It is interesting to note that Piedras Negras may have been bypassed on the jade trade route from the highlands near Cancuen to Palenque. More chemical sourcing combined with epigraphic data could help us to shed light on the differential distribution of jade in the lowlands and the nature of trade relationships. This is part of research which will be continued after the completion of this dissertation, targeting especially centers and regions with which Cancuen had epigraphic ties.

Copan

The Maya site of Copan, Honduras had some stereotypical proveniences for jade in its elite epicenter. A Late Preclassic burial of an individual in a platform in Group 9N-8 contained over 300 drilled jade beads and jaguar claw effigies, indicating a great degree of social stratification and wealth for the period (Fash 1991:68-70).

Jade also figured prominently in the burial of what may be the founder of Copan, in the Early Classic Hunal Structure. The burial contained a single jade bar pectoral, which was also depicted on the founder's portrait on Altar Q (Fash 1991:84). An Early Classic burial in Group 9N-8 which contained numerous objects related to ritual and divination, dubbed 'el Brujo,' which also contained exotic goods such as 110 *Spondylus* beads, a caiman tooth, a deer mandible necklace, and a jade necklace (Fash 1991:91). Another Early Classic burial, probably a member of the royal family or of the ruler's court, buried near the Principal Group in Structure 10L-26 contained an imported Thin Orange vessel (Teotihuacan), numerous other ornate ceramic vessels, one in Kaminaljuyu style, hundreds of pieces of shell, a slate-backed pyrite mirror, finely polished pieces of jade, among other goods (Fash 1991:94). Burial XXXVII-$_{I}$, also an Early Classic Burial in the Principal Group had two large pieces of jade, one placed in the individual's mouth, and a vessel with the inscription K'uk' Mo', possibly relating the individual to the founder, Yax K'uk' Mo'. A second burial (XXXVII-$_{2}$) was placed on top of the first and the jade in this individual's mouth was carved into the shape of a vulture, or *ti* glyph, which can be read as *ahau* or lord, making the individual a possible lord of Copan (Fash 1991:95). The Late Classic tomb of Ruler 12 contained 113 ceramic vessels along with "an exquisite jade collar and jade earflares" (Fash 1991:112).

A cache beneath an altar at the base of the Hieroglyphic Stairway (the longest inscription in the New World) contained "a lidded ceramic censer containing two jadeite pieces, a lanceolate flint knife, a shell, some ash and carbon, and some sting-ray spines and sea urchin spines. Carefully placed next to the ceramic vessel were three elaborately chipped eccentric flints" (Fash 1991:147). Fash (1991:148) notes that the two jade pieces were heirlooms in the style of the fourth or fifth century A.D., and one was a pendant typical of those shown worn by rulers, and would have been worn and passed down for 300 years before it was placed there by Smoke Shell in the Late Classic.

Excavations in the Copan residential zone revealed 7 jadeite ear ornaments, 8 pendants, 8 "Adornos," 77 beads, 15 miscellaneous pebbles, and 7 raw pieces of jadeite (described as possible wastage from manufacturing) (Willey et al. 1994:252-257). These residences were principally elite residences located in the Las Sepulturas zone of the Copan Valley (see also Hendon 2002b; Webster et al. 2000; Willey and Leventhal 1979) and mostly date to the Late Classic Period.

Another cache was recovered in the Rio Amarillo area, a more humble residential area 21 kilometers from the Main Group at Copan. Structure 1 (Site 7D-3-1), where the cache was recovered, was not a large, vaulted mound, but with a stone cobble base and perishable superstructure. The cache contained "a fishhook-shaped obsidian eccentric on the surface; and from the base of the cist, two complete ceramic vessels, a 10 cm long chert spear point, and a small extremely thin piece of jade" (Gonlin 2007).   The modest sized site also yielded a cache with a "small, round mirror polished from some iron-bearing mineral - one of few such mirrors ever found at Copán" (Webster and Gonlin 1988:178).

The El Cajón region of central Honduras (roughly 20 km from Copan), also produced interesting contexts for jade artifacts. At the site of Salitrón Viejo 2,842 jade and marble artifacts were recovered. The contexts of these objects include "caches associated with the dedication, construction, or desanctification and termination of architectural monuments" (Hirth and Hirth 1993:176). Hirth and Hirth (ibid.) go on to say that the artifacts were deposited by scattering them in construction fill, placing the objects carefully in walls or caches as construction occurred, excavating caches in finished exterior walls, and breaking and/or burning objects prior to a structure's abandonment, these contexts date to A.D. 600-800. The authors argue that this was a separate "Ulua Lapidary Tradition," but they do note that the site probably had strong cultural and interaction networks with Copan, Quirigua, and the Guatemalan Highlands, which are demonstrated in the style of many of the objects (Hirth and Hirth 1993:188).

Tikal

Hattula Moholy-Nagy recorded 13,334 total pieces of jade at Tikal, 7,611 artifacts (over 2,500 of which were beads; see Moholy-Nagy 1994:84) and 5,732 pieces of debitage (most of which came from Classic Period special deposits; see Moholy-Nagy 1994:85 and 89, 1997). Unfortunately, weights and sizes of artifacts are not available from all years of excavation (especially the early years). Nevertheless, this is an impressive amount given the distance from the source.

The distributions of jade at Tikal include monument caches, structure caches, chamber burials, other burials, and problematic deposits. These distributions reiterate the variability of distributions of jade within Classic Maya sites, and attest to the ability of powerful lowland kingdoms to procure precious resources and restrict their distribution. Clearly, even though there was a good deal of jade at Tikal, it was still such a valued resource that it could not be left in ordinary refuse dumps. Moholy-Nagy (1997) suggests that caches of jade debitage not only served ritual functions, but also to restrict access of the precious material from nonelite use. Moholy-Nagy (1994) does note that jade debitage was found scattered in general excavations and sometimes in nonelite contexts (n=21), and that jade working was a possibility at Tikal, but the context of this jade working is unknown due to secondary deposition of 99% of the debitage in the Classic Period and the lack of microdebitage (Moholy-Nagy 1997).

Moholy-Nagy (1997:88) posits that the most likely areas for jade production may have been in the Intermediate and Small Structure Groups in the Central Area, such as 7F-1 and 4F-1. In Group 4F-1, a cache was found of two jade artifacts, one bead and one unfinished earplug. An Early Classic structure cache in Group 5D-2 (W.R. Coe 1990) also contained a waterworn unworked jade cobble, 24 cm long and weighing approximately 4.5 kg, attesting to the fact that some jade did reach Tikal in raw form (Moholy-Nagy 1997:87).

Jade finished artifacts, such as jade pendants, diadems, and earplugs became nearly exclusively restricted to chamber burials in the Late Classic (Moholy-Nagy 1994:89), following Rathje's (1970) argument for the restriction of jade artifacts to elites through time.

Blue Creek

This northern Belizean site yielded a wealth of jade artifacts (n=1350), especially when compared to other, smaller and larger lowland centers. Guderjan (in press) hypothesizes that this is due to its strategic location on a riverine trade route. The majority of jade artifacts from the site were recovered from Preclassic and Early Classic contexts, conforming to Rathje's (1970) findings. The majority of the artifacts were found associated with public architecture (1253) in ten separate caches and burials, associated with public ritual. The majority of these artifacts were of fine quality and workmanship.

Jade artifacts were also recovered from elite residential complexes, associated with caches and burials, although Guderjan (2006) notes that some may have been used in building ornamentation. By contrast, about one-third of the 148 artifacts found in nonelite contexts came from caches or burials. Some were found in general excavations, while 48 jade artifacts were found in a "ceramic concentration," which has still eluded interpretation because of its rarity.

In the Late Classic period at Blue Creek, jade in elite and nonelite contexts drops off, only one cache in a monumental structure was recovered, with only three small fragments and one celt from general excavations. Guderjan (2006) suggests that this may be due to the centralization of power at other larger sites during the Late Classic, controlling trade and use of jade.

Cerros

The site of Cerros, Belize provides another seemingly anomalous case for distribution of jade, as the majority of the (187 of the 236) jade artifacts that were recovered were broken and found in termination rituals covering Late Preclassic and Early Classic structures (Garber 1993). The remaining jades were recovered from caches, construction fill, humus, wall fall, and domestic middens, although only three beads came from a Late Preclassic floor (dedicatory cache) in a residential context (Garber 1993:167). A Late Preclassic cache from Structure 6B (public architecture) produced 28 jade artifacts inducing five head pendants (interpreted as royal symbols [see Schele and Freidel 1990]), two earflares, six beads, five mosaic fragments, nine ground fragments, one spangle, seven ceramic vessels, several *Spondylus* shells, white shell disks of unknown species, and 86 mirror fragments of specular hematite (Freidel 1979, 1986; Garber 1993:166). Garber (1993) found that 100 percent of jades from caches were whole, while 92 percent of jades from termination rituals were broken.

The most unique depositional pattern came from a residential zone associated with a wharf or docking facility (Freidel 1979; Cliff 1982), where 108 jade fragments were recovered from “midden deposits of transposed primary context, or domestic midden" (Garber 1993:168). The broken pieces were fragments of beads, earflares and celts, in similar numbers and relative percentages of public structures. Cliff (1982) has suggested that the fragments in this zone may not have been associated with its abandonment, but with the construction of new Structures 2A-Sub. 5-1st and 2A-Sub. 7-1st, or ritual activity conducted at nearby Structure 2A-Sub. 4-1st.

Dos Pilas

One significant find of jade at the lowland kingdom of Dos Pilas was in the Late Classic tomb of the "Lady of Cancuen," who had a marriage alliance with Ruler 3 of Dos Pilas and not only had a fine masonry palace built in Cancuen style and a carved hieroglyphic death throne, but also the only jade inlayed teeth recovered at the site (Wolley and Wright 1990:44-64). The investigations revealed 4 maxillary jade dental incrustations and 2 of hematite. There were also 4 mandibular hematite incrustations, and 2 were missing, presumably of jade. The burial also had two necklaces, one of 56 beads of greenstone (undetermined if they were jadeite), and another of 76 *Spondylus* beads. Two jade rings were recovered, as well as one jade disc beneath the cranium, and two jade buttons near the neck. Four jade beads were also found near the left ankle.

The tomb of Ruler 2 was also elaborately furnished with grave goods including jades (Demarest et al. 1991:60-66). These goods included six ceramic vessels (4 polychromes), a headdress of *Spondylus* and mother of pearl, jade necklace, jade earflares, and jade plaque bracelets, as well as shell, pearls, jaguar claws, and a sting ray spine located at the pelvis. In all, 73 pieces of jade were recovered from the Late Classic tomb, 66 circular and tubular beads, 2 earflares, and 5 bracelet plaques.

A residential sampling program was implemented at Dos Pilas in order to survey differences in material culture between social levels and test their significance. Small quantities of jade beads were found in burials of the smallest residential types (3 and 4), as well as in middle ranked (5 and 6) groups, but the largest jade, as well as the only carved (incised in this work) jades were recovered from the largest groups with masonry architecture (7 and 10) (Palka 1995, 1997). Palka does not report the presence of jade in midden or general excavations.

Cancuen has a large amount of jade comparatively in raw debitage and finished products, but often in different contexts than are seen at other lowland sites. Jade, often seen as a signifier of wealth in Classic Maya archaeology, was found at Cancuen in nonelite (mainly midden) contexts, indicating that it may be the form and representation of the final product that create value. In the case of Cancuen, it is certainly its strategic location that allowed this unique pattern of jade distribution within the site. While the amount of jade at sites like Tikal contrasts with Piedras Negras, it is the contexts that differ from Cancuen. None of the jade at Tikal was found in exterior midden deposits (especially nonelite midden contexts), as it was at Cancuen.

Jade Manufacturing Sequence

Ethnohistoric sources from Mesoamerica and the Far East can offer insight into the manufacturing sequence for jade in Pre-Columbian Mesoamerica. Although many of the tools and techniques may have differed, these descriptions can be used to extrapolate other preindustrial techniques onto those at Cancuen and possibly other Maya sites (although variation in technologies between Classic Maya sites certainly existed). These technological steps can then be inferred from the tools and debitage recovered, uncovering an operational chain for the production of jade at Cancuen.

Ethnohistoric sources discuss jade working techniques at the time of the Spanish conquest. Foshag (1957) translated Sahagún (1950-1982: Book 10, Chapter 7) to conclude the following:

1. The master lapidary cuts rock crystal, amethyst, *chalchihuitl* [common jade], and *quetzalitzli* [fine jade] which an abrasive and hard copper.
2. And he scrapes it with a trimmed flint.
3. And he perforates it and drills it with a small metal tube.
4. Then he carefully smooths [sic] it, polishes it, gives it luster and so prepares it.
5. He polishes it in [or with] wood so that it shines.
6. Or the lapidary polishes it with bamboo and so prepares it.
7. And in the same manner the amethyst is prepared.
8. First he breaks it into pieces and trims it with [a] copper [instrument] because he works only the good red material.
9. To prepare it in this manner it is not necessary to break it with [a] copper [instrument].
10. And then he grinds it and smooths it and makes it shine, and polishes it with wood, using the polisher with which they clean and prepare it.
11. And the stone called *eztacpatl* [bloodstone] is very hard and is not easily cut with the abrasive.
12. And it is broken by striking with a stone.
13. Also the flawed stone which is no good is thrown away and is not polished.
14. They select and seek only the good [stone], the good [stone] they polish, the blood-colored [stone] and the well-spotted [stone, i.e., bloodstone].
15. It is ground then upon a very hard stone that comes from the country of the Matlatzincatl.
16. It is good for this purpose for the bloodstone is as hard as the stone and they grind each other.
17. Then it is smoothed with abrasive and polished with emery.
18. And then it is prepared and polished with bamboo.
19. And in this manner they make it sparkle and give it the brilliance of the sun.
20. And that [stone] called *vitzitziltecpatl* [hummingbird stone, opal] resembles that bird.
21. When it is finished it is as if painted, white and green and like fire, similar to a star and like a rainbow.

Sahagún also describes the production of *chalchuites*:

> They are formed in this manner: they are round, reed-like, like a navel, like a tomato, triangular, cut in triangles, formed into triangles, thin formed into squares. They are polished, ground, worked with abrasive sand, glued with bat excrement, rubbed with a fine cane, made to shine. They glisten, they are transparent; there light appears (Sahagún 1950-1982: Book 12:223).

Although certain metals were in existence during the Postclassic period, others were an introduction of the Spanish at the time of the Conquest. The Classic Maya did not utilize metal, but this passage still provides important information about Classic period lapidary techniques. Some of the references are to stones other than jade, but again, one can imagine that similar techniques were used for similar stones. The known techniques for Mesoamerica are further discussed below, incorporating some ethnographic and ethnohistoric evidence from other world regions.

Percussion

This technique would have been the first used unless a nodule of desired size was readily encountered. Sahagún noted above "and it is broken by striking with a stone." The types of stones used in percussion are not much discussed in the literature, but again, stones of equal or greater hardness would be necessary. Walters (1982:19) defined percussion as "those techniques in which mass reduction was achieved by forcefully striking one body against another." He goes on to define two percussion techniques, shattering and pecking. He identifies the products of these two techniques by the size of the debitage, greater or less than 5 cm.

Percussion was by far the technique most used at Cancuen (Table 5.4). This probably results from the fact that so much material must be removed to acquire the perfect piece of jade to create an artifact, as Sahagún relates: "And it is broken by striking with a stone. Also the flawed stone which is no good is thrown away and is not polished." The tools used in this stage at Cancuen include stones with a hardness equal or greater than that of jade, chert (7), quartzite (7), and jade itself (6.5-7). Hammerstones in each of these materials were recovered (Figure 5.13), and the jadeworking residence with the most debitage found at the site (3259 pieces), had over 60 chert hammerstones.

Pecking

Pecking is a form of percussion, and there is some disagreement in the literature as to the tools, intent, and outcomes of this technique. Foshag (1957) suggested that it was used in shaping objects with short pecking motions, while Chenault (1986:52) argues that this technique would leave visible scars on an artifact that would be undesirable (Easby 1968). Foshag himself (1957:51) notes that this did occur and he had observed it, but mostly on lower quality jades when the beauty of the finished product was not as important. Walters considers pecking to be any percussion that results in debitage smaller than 5 cm. I believe that both techniques were used in the shaping of artifacts, but in the case of removing small undesirable pieces, it is difficult to say that the small sized debitage was not shatter as a result of larger scale percussion. In this study, all techniques that could be described as "one body forcefully striking against another" will be described as percussion because of the difficulty of determining the intent of the percussion, the intent to remove a large flake or a small flake. Pecking will be reserved for clear cases in which the intent is readable on the artifact.

The largest case for pecking of artifacts at Cancuen lies in very small hammerstones, especially of jade itself, these hammerstones are generally much smaller than those used in percussion removal of debitage (see Figure 5.13). Percussion scars were observed on Cancuen artifacts, but as Foshag (1957) suggested these scars were mainly visible only on lesser quality artifacts.

Sawing

In order to cut jade, Lothrop (1955) notes that there are two choices that can be made at this point, the saw can either be of a material of equal or greater hardness than the material being cut and would cut using direct abrasion, or the saw could be less hard than the jade (6.5-7), in this case, an abrasive would be needed that was of equal or greater hardness than the jade, which would act as the actual cutting agent. Harder saws could include other stone or hardwoods, but even with hardwoods, abrasives would probably be needed. Lothrop (1955) argues that these saws were flat, but evidence from Kaminaljuyu (Kidder, Jennings, and Shook 1946) suggests that wood saws were often wedge shaped and would leave a distinctive wedge shaped cut (Figure 5.14). The cut with the straight saw would most often be made from both directions until the piece could be broken off, leaving a visible septum in the middle. Modern lapidaries use a diamond saw, which easily and efficiently cuts jade, as diamonds have a hardness of 10 (even stainless steel is softer than jade and cannot cut it, with a hardness of about 5.5).

The second method would utilize a string as a saw, with abrasives as the actual cutting agent. The abrasive most easily used because it needed no preparation would be quartzitic sand (as quartz has a hardness of 7, equal to or greater than jade), used also by ancient Chinese lapidaries (see Chenault 1986:39; Treistman 1972:94). Other harder stones, such as crushed garnet or corundum (ruby dust) have also been documented in

Chinese lapidary techniques (Rawson and Ayers 1975; Treistman 1972:94), but the crushing of these stones is an added sequence in the technological process and certainly would have been time consuming. In Book 11, Chapter 10, Sahagún (1950-1982) describes abrasives such as pulverized pyrite, garnet, and what Foshag (1957:50) interprets as specular hematite, as well as ground flint and *piedra recia*, or quartz, which both have a hardness of 7. Foshag also notes that crushed jade itself may be used, which is corroborated by the presence of pulverized jadeite in a proposed jadeworker's tomb at Kaminaljuyu (Kidder, Jennings, and Shook 1946:85).

The string itself could have been made of plant fiber, or if there was none tough enough available, Lothrop (1955:49) suggests that leather cords may have been used based on ethnographic work in Peru and northern Chile. Chenault (1986) also suggests that animal sinew could be used in place of plant fibers as string, animal sinew would have been resilient and a bit tougher than some plant fibers. Another problem with this technique is the necessity of the sand or abrasive to stay in place. Ancient jadeworkers often used wet abrasive, but Chenault (1986:41) notes that the ancient Chinese used a substance called "toad grease" which was thought to have magical properties of softening the jade (see also Gump 1962:202), but it is suspected by most scholars to have been simple animal fat or lard, which helped to hold the abrasive in place, making it easier and faster to cut (Wills 1972).

The difficulties of cutting with a string saw are readily apparent, and one would wonder why such a technique would be used. Chenault's (1986) personal replication experiments found that a piece of string would only last about 20 strokes before having to be replaced. He found that cutting with a jade saw with abrasive is the easiest and most efficient, but a string saw with sand and grease made a cut of 1.2 mm in 7.5 hours, while the jade saw with sand and grease made a cut of 0.4 mm in 2 hours. He concludes that string sawing would have only been used when necessary when cutting interior cuts or curved cuts, drilling numerous holes then string sawing from hole to hole (Easby 1968). This does not appear to be consistent with Cancuen material, as discussed below.

Lothrop (1955) also points out that string sawing did have distinctive advantages:

1. With a flat saw, all initial cuts must start on an exterior surface. With a string saw, a small hole may be drilled and the cutting started anywhere.
2. By string sawing it is possible to cut curved interior lines which could not be made with a flat saw.
3. Conversely, as is the case with a narrow jigsaw, it is not easy to cut straight lines.
4. It is characteristic of sawing away from a drilled hole that the cut is narrower than the hole, because the string, when pulled tight, becomes narrower.
5. To obtain enough pressure, the string must be bent across the surface to be cut. The end of the cut, therefore, will not be flat but rounded.

Lothrop supports the use of the string sawing techniques in Mesoamerica with eyewitness accounts from Panama in the sixteenth century by Ferdinand Columbus (1744:590) and Las Casas (1951:Book 2, Chapter 26) who observed that indigenous peoples used string to cut iron.

String sawing was heavily used at Cancuen, it was actually more common than the use of hard saws. The evidence for this lies in string saw anchors recovered in jade contexts (Figure 5.15). Other evidence includes visible arc shaped striations on the cut surface of the artifact, due to the bowed motion of the string saw versus straight striations that would be present with the use of a straight, hard saw. These striations are visible with the naked eye, especially on darker jades, the striations on lighter jades are more difficult to see, but sometimes adding water can make them stand out more. If not, magnification may be needed.

Gump (1962:205; see also Figure 5.16) describes the process of sawing in the ancient Chinese tradition:

> Three men work in sawing the stone. Two work the saw (*la-suu-tzu*), which consists of a single strand of wire, generally notched, and drawn taut in a bamboo frame. With a ladle a third man supplies the wet abrasive mixture which does the actual cutting. After biting into the jade, the abrasive flows down into a bowl set to receive it, since it will be used again and again, until it contains too much jade dust to grip effectively.
>
> Weeks, even months, of constant, persistent, backbreaking sawing may be necessary before the stone is cut into desired pieces.

The Mesoamerican forms of this type of sawing may have used the string-saw, which could have been operated by a single individual, a second was probably needed to efficiently apply the abrasive, and the process was at the very least as time consuming, if not more so due to the more flimsy nature of the string.

Also associated with jade working structures were large amounts of microdebitage, flakes and chunks of greenstone and quartz measuring less than 3 mm in length and width. Not only were these flakes and chunks byproducts of production, much of it was probably used as the abrasive cutting agent for jade. From all excavations in a single jade working mound group, over 13 kilograms (30 lbs.) of broken or pulverized quartz were recovered, an amount significantly higher than any other excavations at Cancuen. The pulverized quartz was used in this case as an abrasive with the string saw or drill as the actual cutting agent, as quartz has a hardness of 7, comparable to or greater than that of jadeite, which has a hardness of 6.5 to 7 (Dietrich and Skinner 1979). These stones were probably crushed and pulverized with the same hammerstones used in percussion techniques. The pulverization of jade and quartzite river pebbles was probably the dominant technique used for cutting jade, as other ‘ready made’ abrasives, such as quartizitic sand were not available locally.

Incising

The technique that Sahagún described as “scraping with trimmed flint” could refer to incising, and was interpreted that way by Lothrop (1955). Incising would leave fine or thick lines in jade artifacts, and was probably accomplished with a stone harder, or at least as hard, as jade. This could include quartz or quartzite, chert, or jade itself. The most likely tool would be chert (or flint), as it could be more easily shaped (or “trimmed”) to create the desired thickness than either quartz or jade (although all three appear to have been used at Cancuen). This stage could have been accomplished after general polishing of the object, and sometimes the same tools used to create the incised lines could also be used with a fine abrasive to polish the depressions, although they were sometimes left rough. Lothrop (1955:49) also argues that cactus needles or tropical vines with a very fine abrasive could have been used for very delicate work, although this would be difficult to prove.

At Cancuen the primary tool for incising seems to have been the triangular chert blade (discussed more in Chapter 8; Figure 8.79). These blades were found in great numbers associated with jade production (although also used for drilling techniques). It was easier to distinguish chert incisors from chert drills because of wear patterns, incising tools were more rounded and worn, while drills often had some characteristic hinge fractures along the turning surface. Quartz and jade incising tools were also encountered, but the wear patterns made it difficult to determine the use of the artifacts.

Grinding/Abrading/Rasping

This technique in general requires the roughing of objects into the desired form, but as Foshag (1957:51) notes it would have been very labor intensive, and was probably only used when the artifact shape needed only slight modification. He describes two stones in the Robles Collection with wide grooves that were possibly used for grinding. It is noted in Sahagún's description of lapidary techniques, with the use of a very hard stone. Traces of this technique would include long, visible striations on the surface of the artifact, often only on a surface that was not later polished. Chenault (1986:61) defines grinding as abrading an artifact in order to shape it with a hard stone without any kind of abrasive. This process is sometimes also referred to as abrading in the literature. Foshag (1957:52) describes rasping as similar, yet with a file-like tool, often called a *texcalli* in ethnohistoric sources. He believes it to be the technique used to reduce smaller mosaic pieces. In Japan, grinding tools were made of granite and retained marks of the process with circular depressions and long grooves where the grinding took place (Chenault 1986:45-46; West 1963).

These techniques also appear to have been used by Cancuen jade workers. Some artifact surfaces retained marks of abrasion, scratches and rasped surfaces. Grinding tools were also recovered, large flat greenstone or schist appear to have been used. Possible rasping tools were also recovered, long rectangular slate artifacts with long scratches and striations on the surface. Slate is slightly too soft to have made a significant change in the jade, but the tools were found in association with jade working. Further replication studies are needed to determine if these tools were actually used for rasping.

Drilling

Drilling jade was accomplished by either a solid or hollow tubular drill, and is basically defined by Walters (1982:19) as the making of a hole with a rotating motion. But it is important to note that drilling did not have to make a hole. Drilling, especially with a tubular drill, could be used to create designs (Chenault 1986; see Figure 5.17). The tools used for drilling could be varied, including jade and chert, but even wood or bone could be used with an abrasive (the same as discussed above). These types of drills were often pointed, leaving a conical hole in the object drilled. Small objects were drilled from one side only, while larger objects were drilled from both sides to meet in the middle, leaving a biconical hole (Figure 5.18). Foshag (1957:55) also speaks of blunt drills. Chenault (1986:58) argues that no stone drills had been encountered in Mesoamerica, but chert blades were perfect tools for drilling and may not yet have been recognized. Ethnographic work among the Maori of New Zealand showed that they used chert or flint drills, rolling the tool back and forth between the hands or turning it with a cord. Their drilling was also primarily biconical, as it was during the Classic Maya period, and whale cartilage was used as a spindle to stabilize the drill (Chenault 1986:48; Wills 1964). The tubular drills were also probably of bone (probably bird bones; see Proskouriakoff 1947) or wood, and were also important instruments in the creation of earflares and long tubular beads (Digby 1964; see Figure 5.20). Mesoamerican drill bits could have been turned by hand or possibly pump drills (Chenault 1986:60; Digby 1964:16; Figure 5.19).

Solid and tubular drills were used at Cancuen. Solid drills were primarily made from chert, the same triangular chert blades used for incising. Again, some quartzite and jade drills were also possibly used. Some of these drills may have been turned by hand, but others may have been used in a pump drill as noted above. Five spindle whirls were discovered associated with a jade working area, which may have been for the production of textiles, but also may have served as flywheels on the pump drill. Tubular drills were not recovered, but the technique was apparent in artifacts like an earflare blank (Figure 5.20), abandoned because the tubular drilling did not line up properly to remove the drill blank (Kovacevich 2003b). Another bead from an elite (probably royal) burial (#50) had a very large and uniform hole, probably resulting from the use of a large tubular drill, which was drilled from either side, leaving small septa in the center of the artifact, very typical of jade drilling in Mesoamerica (see Sears 2003; see Figure 5.18).

The size of drill holes varies greatly at Cancuen, even on the same object. Many beads have different sized holes from each side (in the biconical drilling process). A plaque found in a palace cache beneath the royal throne room has drill holes (probably termination or “kill” holes) ranging from 0.25-0.15 cm (Figures 5.21 and 5.22). This all suggests that there was not a standardized tool kit, and even the same artisan used multiple tools and drills of different forms to complete work on a single artifact. Certainly the variety of natural resources (chert, bone, and wood) would also add to the variability. Obviously standardized drilling was not a valued technique of the Classic Maya at Cancuen.

Polishing

Polishing was probably the finishing step in the process of the creation of a jade artifact, and many techniques were possible. Sahagún described the use of wood, bamboo, and emery. Foshag (1957) argues that a hard polisher with fine abrasive was probably the polishing tool of choice in ancient Mesoamerica, based on microscopic investigation. This finding is supported at Cancuen, slate polishers were recovered in Type IV structures, these were small (roughly 10 cm x 5 cm) with a depression in the center where they had been worn, probably from polishing beads (Figure 5.23). Slate was also a tool used for polishing by the Japanese (West 1963). In elite contexts, we recovered limestone earflare polishers (Figures 5.24 and 5.25), which perfectly fit examples of earflares of all sizes. A fine abrasive may have been used in conjunction with this tool, although it is hard to differentiate between that abrasive and the surrounding sediments in this case. Indirect evidence for abrasives comes from geochemical evidence of gold in jade working floors, this gold could be present from the import of quartzitic sand sediments from other regions. The sediments near Cancuen are primarily of mud, and would not be very advantageous for cutting or polishing, therefore, the presence of gold may signify some import of these abrasives (see also Kovacevich, Cook and Beach 2004; Cook et al. 2006; Figure 5.26 and Chapter 9).

In the analysis of jade artifacts from Cancuen, I attempted to recognize and record the above techniques in combination with context in order to determine the operational chain for Cancuen and how it also reflected social structure.

Jade Typology at Cancuen

The characteristics recorded for Cancuen jades included: maximum length, width, thickness, weight, color, hardness, visible techniques used, and artifact type (see Appendix A for typology key). Hardness was determined by a series of tests, if the artifact could scratch a stainless steel knife, it was determined to have a hardness greater than 5.5, if it did not scratch the knife, it was then determined if it could scratch a penny, which has a hardness of 2.5. If the artifact did scratch the knife, it was then determined if it could scratch glass, which has a hardness of 6, if it did, it was then determined if the artifact could be scratched by a piece of quartz, which would determine if it was of equal or lesser hardness than 7. While hardness tests are not conclusive measures of the pureness of jadeite, it is an important test that could be outdone by the use of heavy liquids to measure the specific gravity of the artifact. In the case of jadeite, Methyline Iodide that is diluted with monobromonapthalene will have a specific gravity of 3.03 (or Boroform sg, 2.88), allowing pure jadeite to sink while those of lesser specific gravities, like diopside, serpentine, etc. to float. These liquids are extremely toxic and dangerous, transport and import into Guatemala made this method impossible for the current study, although it was performed on 3 pieces of debitage by Jay and Marylou Ridinger of Jades S.A., Guatemala, with a positive identification as jadeite. X-ray Diffraction was used to test the effectiveness of the hardness tests and it was found that it was a fairly efficient method (Table 5.1). The mean hardness of jade artifacts from Cancuen was 6.5, but the amount of artifacts with a high amount of jadeite probably near the average seen in other lowland areas, for example, Bishop and colleagues found that 50 percent of artifacts tested by heavy liquids or X-ray diffraction in the Maya Jade and Ceramic Project were quartz or another mineral. Hardness testing would not rule out the presence of quartz, as both jade and quartz have a hardness of 7, but the X-ray diffraction found nine samples out of nineteen had jadeite as a major component, and none of quartz see Table 5.1). This is a number similar to the findings of Bishop et al. (Lange and Bishop 1988; Bishop, Sayer, and Mishara 1993), but 5 of those samples chosen for XRD were selected because they were thought to not be jade, decreasing the presence of artifacts with jadeite. It should also be noted that the artifacts chosen were debitage, byproducts of the manufacture of artifacts, so the purest and best pieces may have been used for artifacts. The fact that nearly half of Maya artifacts were probably not primarily composed of jadeite should not be surprising, many minerals related to jade have very similar properties and are nearly as hard, especially in the case of diopside and related minerals. Again, pure jadeite was surely the desired raw material, but this may have not always been possible. The finest jades were surely reserved for the finest artifacts.

The total amount of jade artifacts at Cancuen recovered from residential excavations includes 3528 artifacts with a total of 91.6 kilograms or 201.5 pounds. The vast majority of this number, 3380 artifacts, represent debitage, worked by percussion or sawing (see Tables 5.4 and 5.5). The sizes of debitage and artifacts vary greatly, the mean length, width, and height being 2.61 x 2.24 x 1.93 cm with standard deviations of 22.35, 15.49, and 18.1 respectively, demonstrating the wide variation of size. The largest jade artifact recovered was a 15.9 kilogram (35 lb.) string sawn boulder from a Type IV structure, K7-24, measuring 27.5 x 25.5 x 18.5 cm and the smallest in powder form embedded in floors associated with jade production (Figures 5.27 and 5.28).

Artifact Types

The recorded artifact type by structure can be seen on Table 5.6. Types were based on the total assemblage found at Cancuen, and based on previous works such as Kidder, Jennings, and Shook (1946), Proskouriakoff (1947), and Walters (1982). Artifact types include macrodebitage (larger than 5 grams), microdebitage (less than 5 grams), raw/unworked nodules, axes, axe fragment, bead, bead fragment, partially drilled bead, earflare, undetermined worked fragment, dental inlay, earflare fragment, plaque, plaque fragment, hammerstone, earflare counterweight, and large worked nodule/boulder (above 2.5 kilograms).

Macrodebitage

Macrodebitage makes up the largest category of jade artifacts at Cancuen. This type can include any angular piece that has obviously been removed from a larger parent piece. This can include pieces worked by percussion (the great majority), sawing, drilling, abrading, but are the byproducts of the actual finished product. The sizes ranged greatly, but the cutoff was 5 grams on the lower end and 2.5 kilograms on the upper end (arbitrary divisions). It is easy to see from the above chart that the majority of macrodebitage was recovered from Type IV structures and that it is a significant difference from all other structure types at the site.

Microdebitage*

Microdebitage was any byproduct of production that was less than 5 grams, but is grossly underrepresented here because of the large quantity of tiny, miniscule fragments recovered from jade working floors (mostly in Type IV structures). Because most of the microdebitage was so tiny, some of it was almost in powder form, it was weighed instead of counted or measured, with a weight of nearly 1 kilogram. This category was also used to identify the actual loci of production as per Moholy-Nagy (1990).

Raw Nodule

This type refers to unworked, usually river rounded cobbles or pebbles of jade, which were not mined in any way at the source, but were just picked up and brought to the site and never worked. At other lowland sites (e.g., Holmul and Tikal), raw, unworked pebbles were often included in caches and ritual contexts, but at Cancuen, they were often found related to production areas, but were fairly evenly distributed between the structure types.

Axes and Axe Fragments

The greenstone or jade axe was common to all structure types at Cancuen and fairly evenly distributed throughout the site. Even fragments of axes appear to be fairly evenly distributed. One axe preform was discovered in a midden of Structure M6-12 (a Type IV structure), suggesting that at least some production of axes did take place at Cancuen.

Bead and Bead Fragment

This artifact type includes a wide variety of sizes and styles. These artifacts were also distributed throughout the site and across statuses. But the size and quality of the beads varied greatly, especially according to status (see statistics below).

Partially Drilled Beads

These were another category of artifact that was used to determine production areas and were found only in Types III and IV structures, usually in conjunction with other evidence of jade production.

Earflares, Earflare Fragments, and Earflare Counterwieghts

This artifact type could be considered a marker of status in this case study. The majority of the earflares were found associated with structure Types I and II, especially in burials and caches, but one example was recovered from the fill of a Type III structure (the smallest recovered at the site, 1.2 grams), and one fragment in an aguada (probably ritually broken and deposited) close to the structure, but the group itself appears to be of higher status than many others and does have an associated Type II structure nearby. Earflares varied greatly in size, and the largest one associated with a cache in the royal palace (245 grams; see Figure 5.29). Another line of evidence for earflares were two earflare polishers recovered from Type I structures (see Figures 5.24 and 5.25). These polishers had numerous sizes and shapes of earflares showing that there was no standardized size or shape used at Cancuen. One bead recovered from Type IV structure M10-7 midden may have been an earflare blank (see Figure 5.20), so there was certainly production of earflares taking place at the site.

Only 2 earflare counterweights were recovered from Burial 50 of a Type II structure (Figures 5.30 and 5.31). Other smaller earflares had bone counterweights, or counterweights were not recovered.

Undetermined Worked

This artifact type was used basically for a broken artifact that could not be placed into a category, such as a broken bead, plaque, earflare, etc, which could not be fully identified. In some cases, especially in Type I structures, these may have been artifacts that were broken during termination rituals (see Garber 1993), as many of them were found in humus and wall fall. In Type IV structures, these types were found primarily in middens, suggesting that they were artifact failures or possible debitage.

Dental Inlays

At many sites, these artifacts have been used as markers of status, although some have found that they may not always be a reliable a marker (e.g., Krejci and Culbert 1999). The data at Cancuen are ambiguous, one burial in a Type I structure had jade, in the form of four dental inlays, two burials in Type II (one with 6 inlays, the other with 4 jade and 4 pyrite; see Figure 6.10), one in Type III (10 inlays), in a Type IV structure, one burial had two spaces where inlays would have been, but the inlays were gone. This is also the case for one burial in a Type V structure, one space where an inlay would have been, was gone. This may indicate that inlays of some lower statuses were taken out to be reused, but in the case of Type IV structure M10-4, the burial with missing inlays was associated with thousands of pieces of jade debitage in middens, making it difficult to believe that the jade was hard to come by, although the association with a venerated ancestor may have made them valuable. The inlays may have also simply been lost. In any scenario, it is difficult to say in this case that dental inlays are an effective indicator of status.

Plaques and Plaque Fragments

Carved plaques in burials and caches were found exclusively in Type I and II structures (see Figures 5.21, 5.22, 5.30, and 5.31), this is a pattern mirrored at Dos Pilas (Palka 1995; see also Krejci and Culbert 1990). Plaque fragments were recovered in Type IV structures, but it is unclear if these were production failures, fragments of plaque blanks in production, or termination rituals. What is sure is that the contexts of these artifacts and their completeness are contrasted between Types I/II and Type IV structures.

Hammerstones

Only 4 jade hammerstones were recovered in the entire and site came from the Type IV mound group associated with mounds M10-7 and M10-4 (see Figure 5.13). All were heavily used, and two smaller ones were probably used for pecking (i.e., shaping) instead of direct percussion for removal of flakes. These artifacts were found in association with over three thousand pieces of jade debitage, nearly conclusively demonstrating their use in the jade production process.

Large Worked Nodules

These were pieces of jade debitage that stood out because of their large size (above 2.5 kilograms). The largest of these, 15.9 kilograms (35 lbs.), was recovered from a floor of a Type IV structure K7-24 (Barrientos et al. 2000: 106-110; see Figures 5.27 and 5.28), with obvious string sawn plaques removed. A second 16 pound nodule was found on a Type IV structure floor, M10-4, also string sawn (Figure 5.32); Kovacevich and Pereira 2002). Another string sawn nodule of 20 pounds was found cached in the earthen structure fill of Type IV structure M10-3 (Figure 5.33)(Kovacevich and Pereira 2002). The only caches associated with Type IV structures contained nodules worked by percussion or string-sawing, no types of finished artifacts or incised plaques were ever found. This could partially have been due to sumptuary laws, but the collective identity of these house groups was probably intricately tied to the production of jade artifacts in the early “raw” stages.

A 5.25 kilogram (11.5 lb.) nodule was recovered from a cache beneath the royal throne room in the palace (Callghan and Barrientos 2005; Figure 5.34). This nodule was also worked by string sawing, consecutively removing plaques from the nodule, with one string saw mark beginning to remove another, but not completed. The cache also contained a finely carved jade plaque/headdress ornament (see Figures 5.21 and 5.22), small face pendant (Figures 5.35 and 5.36), large earflare (Figure 5.29), two large beads, obsidian blade, two *Spondylus* shells (see Figure 9.8), and cinnabar, distinguishing it greatly from the caches of single nodules found in Type IV structures.

Face/Pendants

Only two face/pendants were recovered, from Types I and II structures. In this case, it seems that these pendants could be used as indicators of status. Especially the one recovered from the royal cache mentioned above probably represents a jewel of office (see also Schele and Friedel 1990), as this one was also a brilliant dark green color (see Figure 5.36). The septum left from string sawing is still present on the dorsal surface of this artifact (see Figure 5.35)

Technology

The identification of the techniques used in the production of jade artifacts followed and expanded on the work of Walters (1982) in the Motagua Valley, Chenault (1986) in Costa Rica and Guatemala and Foshag (1957) in Mesoamerica in general. The techniques are described in general above, and were recorded as they were visible on the artifact. The techniques included percussion (originally recorded as shattered and pecked according to Walters [1982]), sawing, drilling, abrading, polishing, and incising. Many times multiple techniques were visible on a single artifact, so they were recorded simultaneously, as a result there are more entries for techniques than there are total artifacts. See Table 5.4 for a list of techniques by structure type, with relative percentages of techniques used by structure in Table 5.5.   Descriptions of the various techniques are discussed above, but it can be seen here that Type IV structures primarily utilized earlier stages of production, and relatively, 91% of all artifacts found in Type IV structures were worked by percussion, the highest percentage of all structure types. While incising is not greatly represented in general at the site, the largest percentage of incised pieces by structure type come from Type I structures, 6.7% of the total artifacts. Polishing may be underrepresented in Type IV structures, as relatively it made up a small proportion of the techniques used in the creation of jade artifacts, while in other structures it was comparatively higher because each structure type (with the exception of Type V) contained beads, which were nearly all polished, at least somewhat. The tubular drill was another technique that showed differences between structure types, in many ways this technique is used to make more elite objects, either tubular beads, earflare blanks (see Figure 5.20), large beads (see Figure 5.18), or round, incised decorations on objects. This may explain why the highest percentage of tubular drilling was found in Type II structures.

Jade Contexts at Cancuen

The general contexts are discussed here by structure type, although Type V structures are not considered because no jade was found in excavations of these structure types (see Table 5.7).

Type 0 Structures

These structures were of undetermined architecture, but were generally small mounds, less than a meter, with no visible structure lines or stones from the surface (see also Chapter 2). Although the type of structure was undetermined, they are considered here to be "nonelite," humble households. A total of 19 jade artifacts were recovered from Type 0 Structures, 4 of which were complete axes, and 12 axe fragments, 1 bead, 1 bead fragment, and 1 undetermined worked piece were also found. Many of these artifacts were recovered from the humus or initial layers, in some cases this may be because these mounds were located in areas of high modern day traffic (like near corrals and grazing areas), so trampling and erosion may have brought the artifacts to the surface.

Type IV Structures

The great majority of the jade debitage was recovered from Type IV Structures, especially structures M10-7 and M10-4, located 500 meters north of the royal palace (Figure 5.37). This mound group produced a total of 3,259 pieces of greenstone debitage with a weight of over 170 pounds (Kovacevich, Cook and Beach 2004; Kovacevich 2003b). Thirty-two of these pieces, most of them with evidence of string sawing, including a twenty pound boulder (see Figure 5.32), were left on the patio floor of structure M10-4 (Figures 5.38 and 5.39). Also recovered embedded in the patio floors were large quantities of jade and quartzite microdebitage, which as primary refuse is an important indicator of lithic workshop production (Moholy-Nagy 1990). The pulverized quartzite was probably used in this case as an abrasive with the string saw or drill as the actual cutting agent (Chenault 1986). Tools directly associated with jade working on the floors and middens include slate and greenstone polishing tools (West 1963), chert, greenstone, and quartzite hammerstones, chert and chalcedony drills, and string-saw anchors (see Figure 5.15; Lothrop 1955). Also recovered were spindle whorls, possibly used as flywheels for pump drills (see Figure 5.19; Digby 1964).

Although excavations uncovered a high percentage of debitage that had been worked by percussion and string sawing, there was little evidence of the final stages of production of jade artifacts including incising. Eight beads including one large jade bead in the process of drilling, or possibly an ear flare blank (see Figure 5.20), were recovered from middens or embedded within floors, suggesting that at least some production of beads or early stages of production did occur in this area. The only jade artifacts recovered from the ten burials associated with the group were two jade inlayed teeth associated with one burial.

Caches in Type IV structures never included finished products, the two encountered contained either a nodule only worked by percussion or string sawn (these were the only structure fill caches recovered from Type IV structures). This was the case in M10-7, where a 10 cm raw nodule was found in the late Late Classic (A.D. 760-830) second phase construction fill. A 21 pound sawn nodule was found in the late Late Classic (A.D. 760-830) second phase construction fill of Structure M10-3 (see Figure 5.33). Both of these structures were associated with jade working patios and probably formed a part of the same ‘house’. These caches seem to demonstrate that jade working was a part of the identity of the residents of this house. The residents were not able to incorporate finished products in their caches or burials possibly due to ideological restrictions, but the raw materials were their domain, the working of the early stages of raw jade defined their position within the society. The incorporation of these caches into the final phase of construction of both structures supports other evidence that jade working by these type of houses either began or increased dramatically during this period and also may indicate that the continuity of this status was cut short by abandonment at the site, and we are unable to see the social and material changes that may have accompanied the production.

A possible termination ritual also was recovered on the edge of a patio floor of another Type IV structure, K7-24. The 15.9 kilogram string sawn boulder was found placed beneath two large metates (Barrientos et al. 2000:106-110; see Figures 5.27 and 5.28). The nodule was obviously part of the inventory of artifacts within this structure, and the careful placement of it intimates that it was part of the social identity of the residents, just too heavy to carry (along with metates) as they left the site. Other termination rituals in Type IV structures include ceramics and *incensarios* (Kovacevich Callaghan, Ohnstad, and Monterroso 2003; Kovacevich, Cook, and Beach 2004), not all termination rituals were accompanied by jade.

Type III Structures

The high numbers of jade artifacts listed in Table 5.6 recovered from Type III structures are due to one burial with 10 jade inlayed teeth and 6 non-polished extremely raw beads (Kovacevich 2000). The mound itself was less than 1 meter high, with a low, 3 course retaining wall and perishable superstructure. Also associated with the burial was a Chablekal Fine Gray vessel imported from the Palenque region, also often associated with jade working areas, and not correlated with burials in Types I and II structures. This could mark Burial 6 as a high status burial, but the other architectural and ceramic evidence suggest that this individual did not belong to the highest status group at the site, and was probably in the intermediate range.

Other than Burial 6, jade was not found in high amounts in any context in Type III structures. While there is evidence of some jade production in these structures, it did not occur on the large scale that it did in Type IV structures.

Type II Structures

Other burials at Cancuen did contain finished jade artifacts, but are primarily associated with Type II structures that required much more labor investment for construction than the Type III and IV earthen mounds. For example, a cyst burial from Structure K7-3 contained two large jade beads (17.1 and 21.6 grams), one of imperial green color, two light green jade ear flares with jade counterweights, and two intricately incised headdress ornaments carved out of light green jade with a vein of imperial green, 1.89 mm thick (see Figures 5.30 and 5.31; Sears 2002). These headdress ornaments have been interpreted by Karl Taube (personal communication 2002, 2005) as two ears of corn, represented by the two volutes projecting from the sides, with the central cross representing a cob. This structure was constructed with a large investment of labor with a masonry base, low level masonry walls, a staircase, and a bench. Also found within this structure placed above the tomb was hieroglyphic Panel 2 depicting a Cancuen Ruler handing over power to his son *Taj Chan Ahk*, certainly pointing to elite status for its residents (Fahsen and Jackson 2001, 2002; Sears 2002). Structure M9-16, a masonry platform with perishable superstructure, contained a burial with four jade inlayed teeth, a light green jade ear flare with a bone counterweight, and a light green bead (2.3 grams). In the same mound group, another dark green jade ear flare was associated with a midden context of structures M9-17 and M9-18 (Jackson 2002).

Type I Structures

A sandstone ear flare polisher was also recovered from the fill beneath the floor of Structure L7-9, the House of the Portraits, within the royal palace (Barrientos, Larios, and Luin 2003:53; Kovacevich, Quintanilla, and Arriaza 2003; see Figure 5.25). Another limestone ear flare polisher (see Figure 5.24) was associated with the largest structure of the group M9-1, a six room structure with standing masonry walls and corbelled-vaults (Jackson 2002; see Figures 2.2, 2.3, and 2.4). This evidence suggests not only that elite residents of Cancuen were consuming jade finished products, but that the final stages of production of jade artifacts may have been carried out by elite artisans in elite residences (cf. Inomata 2001).

Structure N10-1, located approximately 600 meters north of the royal palace, was identified as a Type I structure with masonry platform, standing walls, a post and lintel roof, and monumental stairway on the southern side (see Figure 2.3b). The structure was also decorated with a stucco façade with iconography very similar to that found in the royal palace. The south side of the structure appeared to be the presentation side of the structure, with monumental stairway, doorways, and elaborate stucco façade. The north side of the structure did not appear to have doorways leading to the enclosed courtyard that N10-1 shared with the other structures in the mound group, although there did appear to be a stuccoed frieze on the north side. This may suggest a more public and less domestic function for the structure. The structure may have had political, ritual and/or feasting functions. The presence of feasting is also supported by the presence of animal bone left on the floor within the excavated room and on the stairs, the presence of large amounts of groundstone, and the presence of large storage vessels within the artifacts found strewn on the southern stairway (see Chapter 9). Included in these artifacts were numerous pieces of jade debitage or fragments of jade artifacts found in humus, on stairs, or exterior floors (n=56). All of this evidence together suggests a final termination ritual for the structure.

It is probable that this structure was related to the jade working area in grid square M10 excavated in 2001 and 2002 as the presentation side of the structure faces the workshop areas across the *bajo*. This may have been an area for communal feasting, or food production and reciprocity for craft producers, as well as a probable point of control for production. The presence of raw and worked jade debitage within and outside the structure also supports this conclusion (Kovacevich, Quintanilla, and Arriaza 2003). High amounts of jade in humus in Type 1 structures (seen in Table 5.7) is probably due to termination rituals, numbers extremely high for N10-1 and also N9-1.

A cache in the Royal Palace, classified as an 'elite' Type 1 residence differed significantly. The cache was located beneath what has been interpreted as the Royal Throne Room (Barrientos et al. 2002; Callaghan and Barrientos 2005). This cache included a string sawn 11.5 pound jade nodule, similar to those in the early stage workshops (see Figure 5.34), but it also contained a 245 gram earflare, measuring 85.11 x 42.5 x 85.36 mm, with a large central bead (see Figure 5.29). Hirth and Hirth (1993:185) note the presence of some earflares that are too large to be worn in the ear and suggest that they may be headdress ornaments or belt plaques. The large size and weight of this single earflare may mean that it was a headdress or hair ornament. Taube (2005) notes that earflares are portrayed in Postclassic codices as a brow jewel element of the wind god (see also Taube 1992b:fig.25a, e), further supporting his thesis that jade was related to wind and essential life breath. Taube (2005) also points out that eastern and southern facades of the lower platform at Xochicalco bear seated figures with breathing earflares in their headdresses, demonstrating that they are conjured supernaturals. Another possibility that Taube suggests is that earflares were also often used as elements in ceremonial bars

Statistical Analyses

In order to test the differences in status between structures, t-Tests and Chi-Square analysis were used to see if differences were significant, or a result of sampling error.

Student's t-Tests

The t-Test assuming unequal variances (one and two-tailed) was used to test the mean bead size between structures. These data were used as beads were present in households of all architectural types (as is the case in many other lowland sites discussed above), but the size and quality of the beads appeared to differ greatly between these types. This difference is also supported by the ethnohistoric data discussed above and in Chapter 4, which suggests that the largest and finest quality beads and artifacts were reserved for strictly elite use. Beads were also an important artifact because they were the most plentiful, allowing for sample sizes to be sufficient to allow comparisons. Many other artifact types were not present in all structure types, or were present in such small numbers that comparisons of means would be impossible.

The first test had the null hypothesis that the mean bead weight in Type I structures (seemingly the most elite) would not be significantly larger than those found in Type II structures. The results of the one-tailed t-Test allow the rejection of the null hypothesis and demonstrates that beads in Type I structures are significantly greater in size than those in Type II structures at the .0238 level (Table 5.8). Thus, with 98% confidence we can say that the beads in Type I were greater in size. The two-tailed t-Test, showing the general difference between the two populations is significant at the .0477 level.

In the second t-Test, the null hypothesis again is that the mean bead size in Type II structures is greater than that of Type III structures. In this case, the p value for the one-tailed test is .08, greater than the .05 level of significance, so we cannot reject the null hypothesis, but we can still say with 92% confidence that the mean size is greater in Type II structures (Table 5.9). The two-tailed test allows us to say that the difference between the two groups is significant at the .161 level, giving us 84% confidence that the difference in the means is not due to random sampling error.

In the test between Type III and Type IV structures, the null hypothesis that the mean size of beads in Type III structures were greater than that in Type IV structures. With the p value of 1.72, we are not able to reject the null hypothesis and have a very low level of confidence that the differences are significant (Table 5.10). In general, this supports my observations that while different activities may be taking place in Type III and IV structures, their status differences were not as great.

As only one whole bead was found in a Type 0 structure, it was not compared, but it was considered in the t-Test below, which considered the null hypothesis that the mean size of beads in “elite” structures (Types I and II), was not significantly different than the mean size of beads found in “nonelite” (Types III, IV, and 0 [no jade was found in Type V, so it is not considered]). The p value of the one-tailed test, .012, allows us to *reject* the null hypothesis and say with 99.8% level of confidence that the mean size of beads is greater in “elite” structures versus “nonelite” structures (Table 5.11). The two-tailed test allows us to say that there is a 98% level of confidence that the general difference in the means is significant and not due to sampling error. Thus, we can say that there is a significant difference between structure Types I and II, less significant between II and III, and even less significant between III and IV, but when grouped together as “elite” and “nonelite,” the confidence level is strongest that differences are significant.

Chi-Square

Chi-square analysis was used here to measure the differences in proportions of burials with jade present or absent as part of the grave goods measured across structure types. Jade has been widely used as an indicator of social status in burials (see Palka 1995), and here and in Palka’s study seems to indicate a relationship between the presence and absence of jade in “elite” and “nonelite” burials.

Even given the small sample size, the differences are still significant at the .0582 level (Cramer’s V=.4218, Pearson R=.1239), giving us a 94% level of confidence that the proportions are not independent of structure type (Table 5.12). In other words, it is not very likely that we could select proportions of jade in burials as different as these if the presence or absence was not significant across structure type. While some would reject these findings because some of the expected values in the table are less than ten, in many archaeological examples a middle ground must be taken because of the nature of small archaeological samples. This middle ground approach is used here, no expected values are less than 1 and no more than 20% of expected values are greater than 5 (see Drennan 1996:197).

When the structure types are again divided into "elite" and "nonelite," we can see that the correlation becomes even more significant. Thus the proportion of burials with and without jade across "elite" and "nonelite" structure types is significant at the .0018 level (Table 5.13).

Discussion

Here, I would like to reiterate the similarities and differences between structure types. Incised jade (especially in the form of plaques), which seems to be an important marker of status, appears exclusively in burials and caches in Types I and II structures. Face pendants were also exclusive to "elite" structure types. Earflares appear to be another marker of status, nearly exclusively found in Types I and II structures, as well as earflare polishers, found in Type I structures. Jade dental inlays do not appear to have been as important a marker of status, and may have crossed some status boundaries. Beads, while found in all status levels, differed greatly in size, quality and workmanship, significantly so in most cases. Jade or greenstone axes were common to all structure types in relatively similar numbers. Jade debitage, jade hammerstones, raw nodules, and large boulders/nodules were found in great numbers in Type IV structures, so much so that statistical significance tests are not feasible. Jade working in the early stages is obviously correlated with Type IV structures, backed up by the high relative percentage of percussion used as a technology (n=2955, 91%) in Type IV structures. No jade in Type V and very little in Type 0 also differentiate and set them apart from all of the other structure types.

Conclusions

The data suggest segmented production, where the earlier stages of jade production were completed by residents in Type IV structures, while the finishing, use, and distribution of certain types of jade objects was monopolized by elites. This control may have been afforded by restriction of technology, esoteric knowledge, and sumptuary laws. The amount of jade debitage in Type IV contexts suggests that Type I and II residents may not have procured and redistributed the raw materials, although control over products was still possible due to the above restrictions.

While this relationship may seem exploitative, the ability of nonelites to make and possess beads, as well as their use of raw jade in caches suggests a higher status than other structure types at Cancuen (Type V), as well as in comparison with nonelites in other sites throughout the lowlands. Nonelite jade producers obviously tied this activity to their collective social identities through caching, also indicating the presence and importance of domestic ritual at the nonelite level (Lohse 2007).

Figure 5.1. Map showing the location of the Motagua River Valley and Sierra de las Minas mountain range, sources of jade in Guatemala (map by Viviana Gordillo; not to scale).

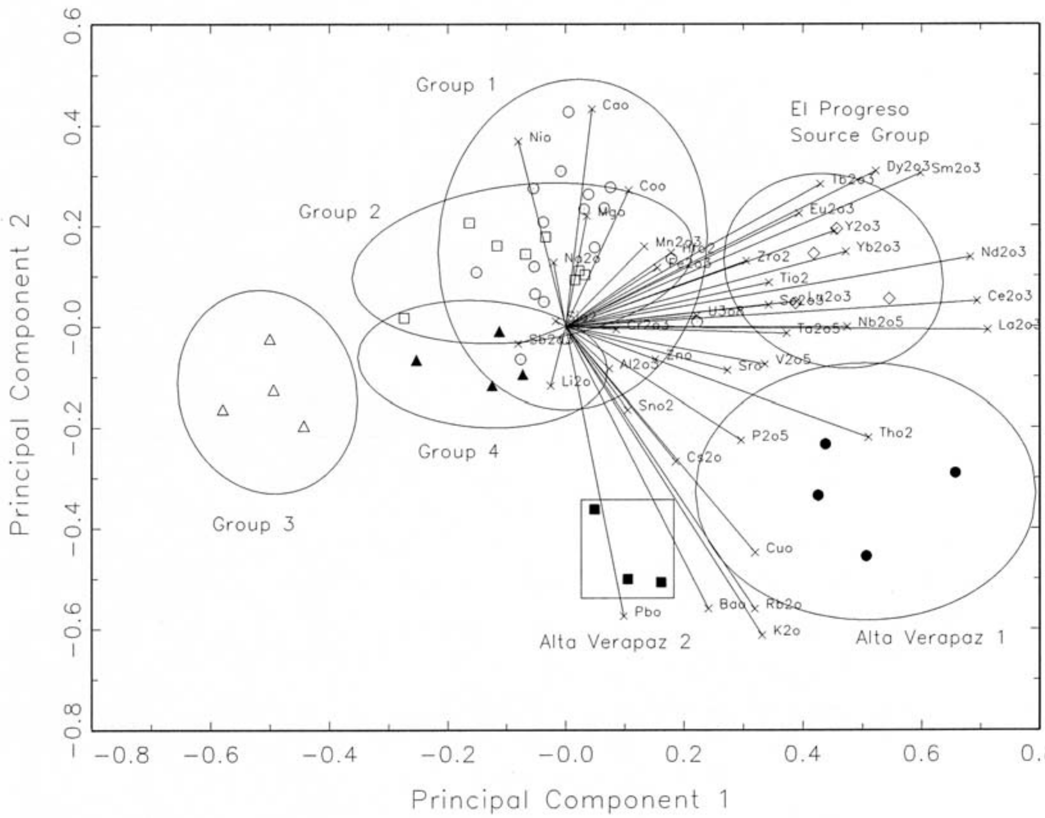


Figure 5.2. Plot of PC1 and PC2 derived from principal components analysis of the variance-covariance matrix of the jade data set. Ellipses represent 90% probability level for membership in the groups (from Kovacevich et al. 2005).

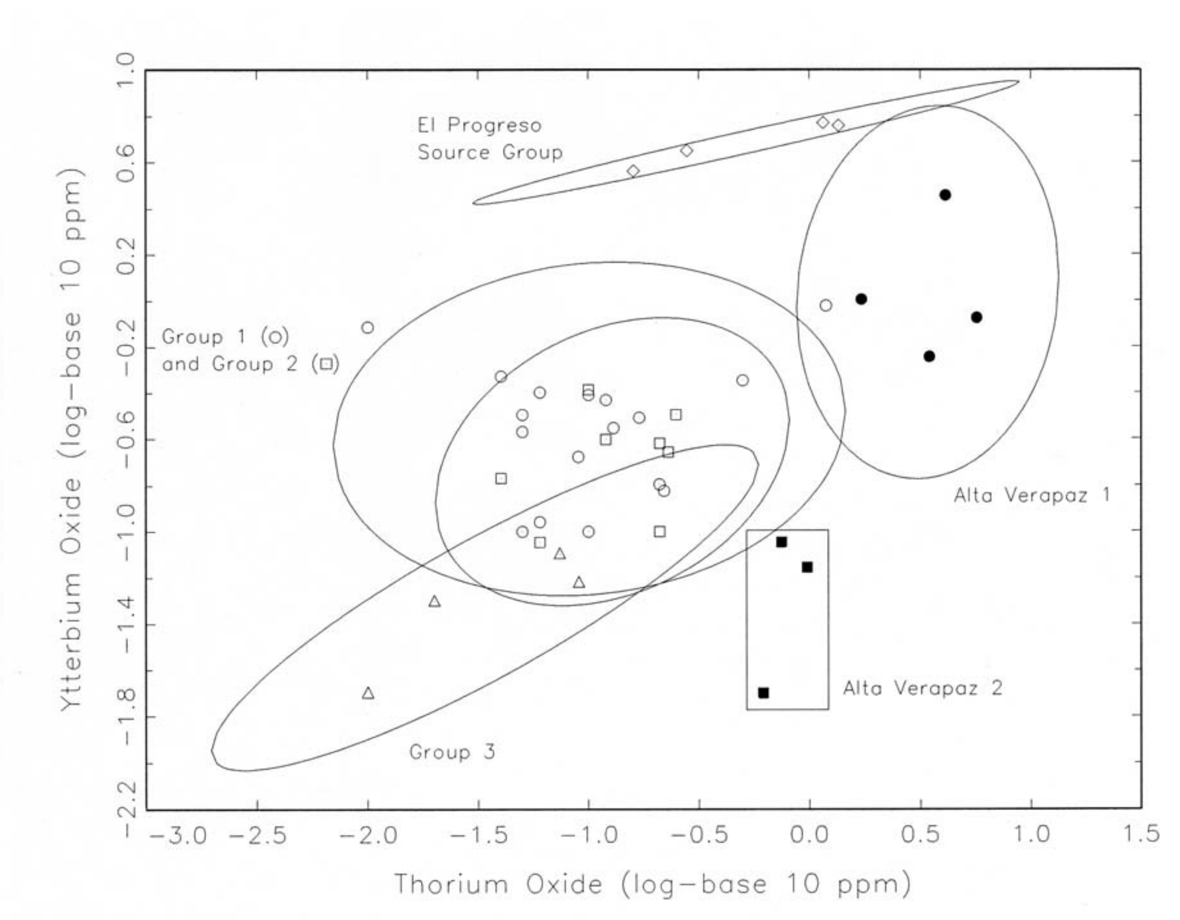


Figure 5.3. Bivariate plot of ytterbium and thorium oxide concentrations in compositional groups identified in the jade study. Ellipses represent 90% probability level for membership in the groups (from Kovacevich et al. 2005).

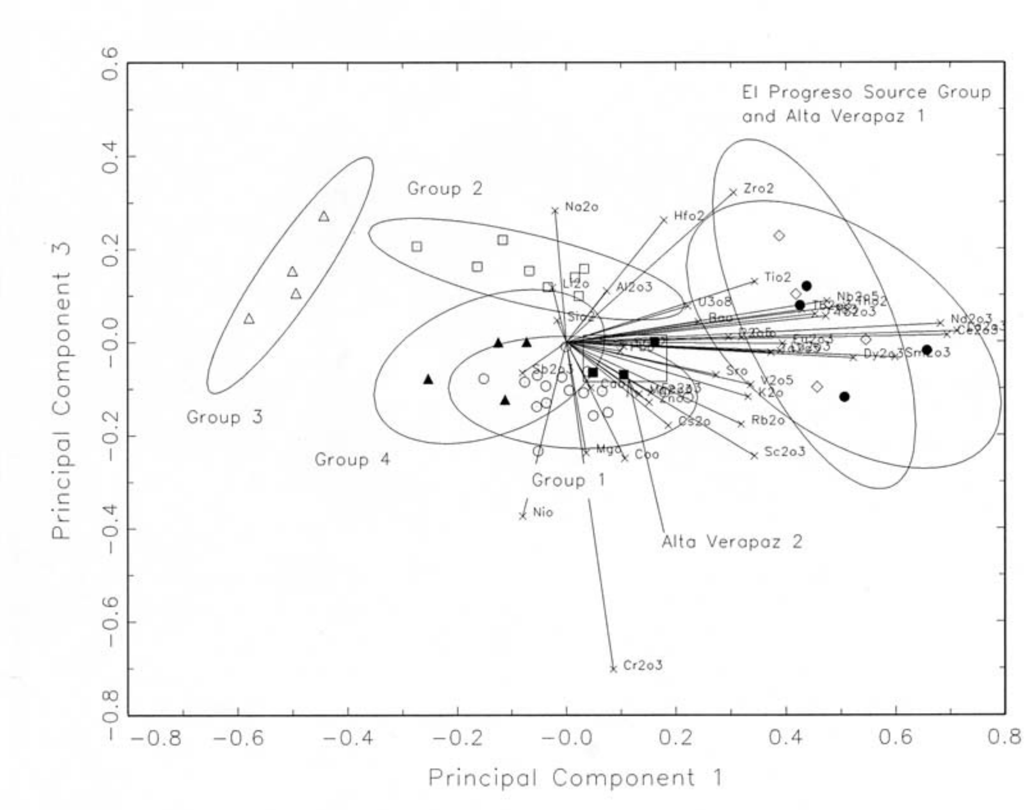


Figure 5.4. Plot of PC1 and PC3 derived from principal components analysis of the variance-covariance matrix of the jade data set. Ellipses represent 90% probability level for membership in the groups (from Kovacevich et al. 2005).

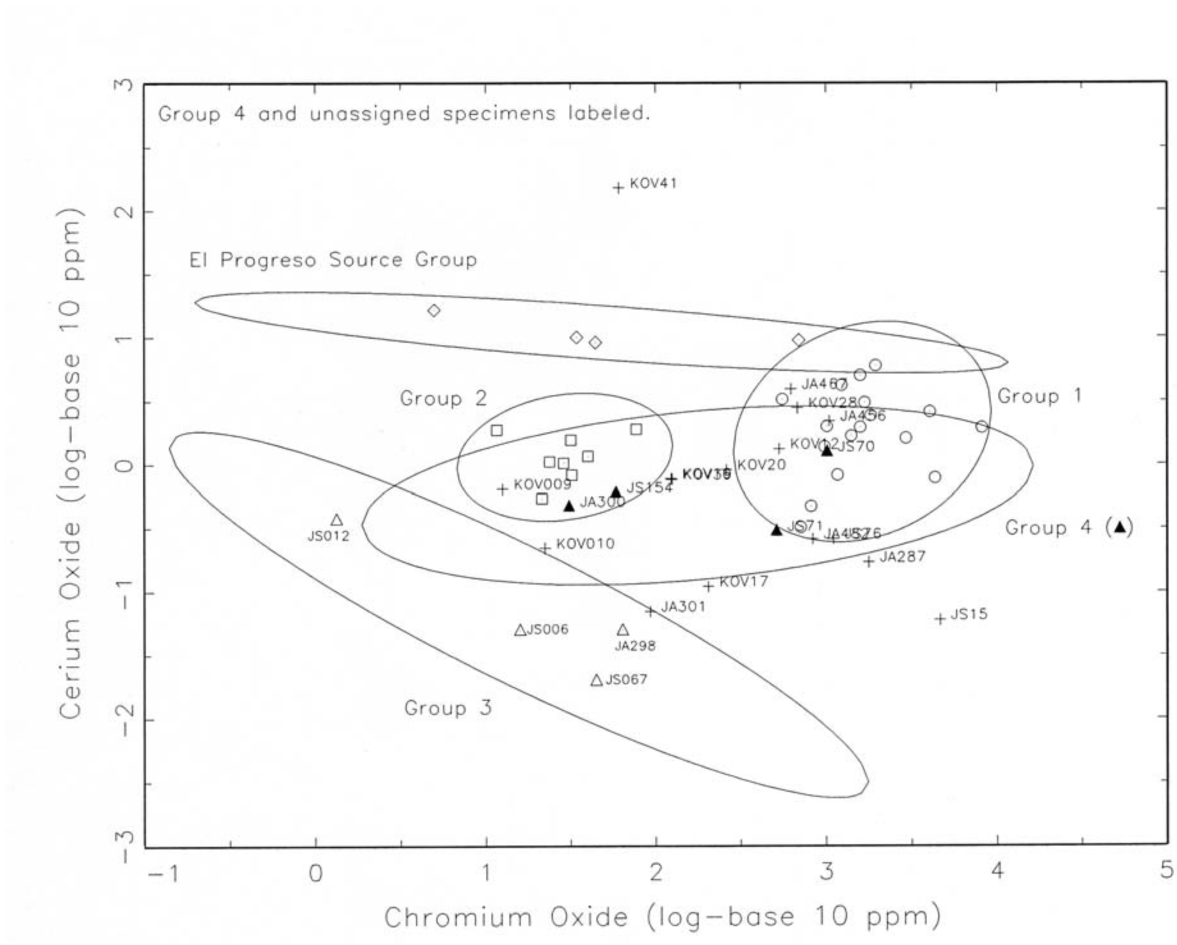


Figure 5.5. Bivariate plot of chromium and cerium oxide concentrations in compositional groups identified in the jade study. Ellipses represent 90% probability level for membership in the groups. Group 4 and unassigned specimens are labeled (from Kovacevich et al. 2005).

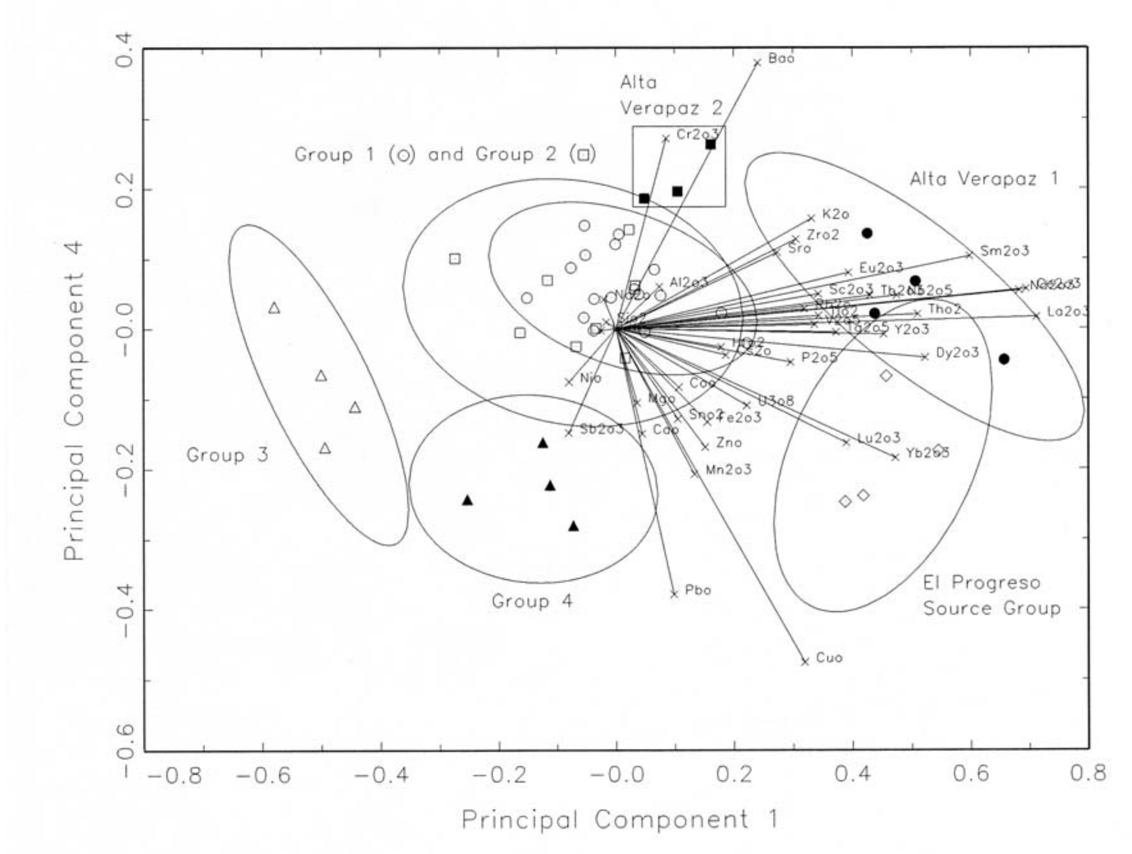


Figure 5.6. Plot of PC1 and PC4 derived from principal components analysis of the variance-covariance matrix of the jade data set. Ellipses represent 90% probability level for membership in the groups (from Kovacevich et al. 2005).

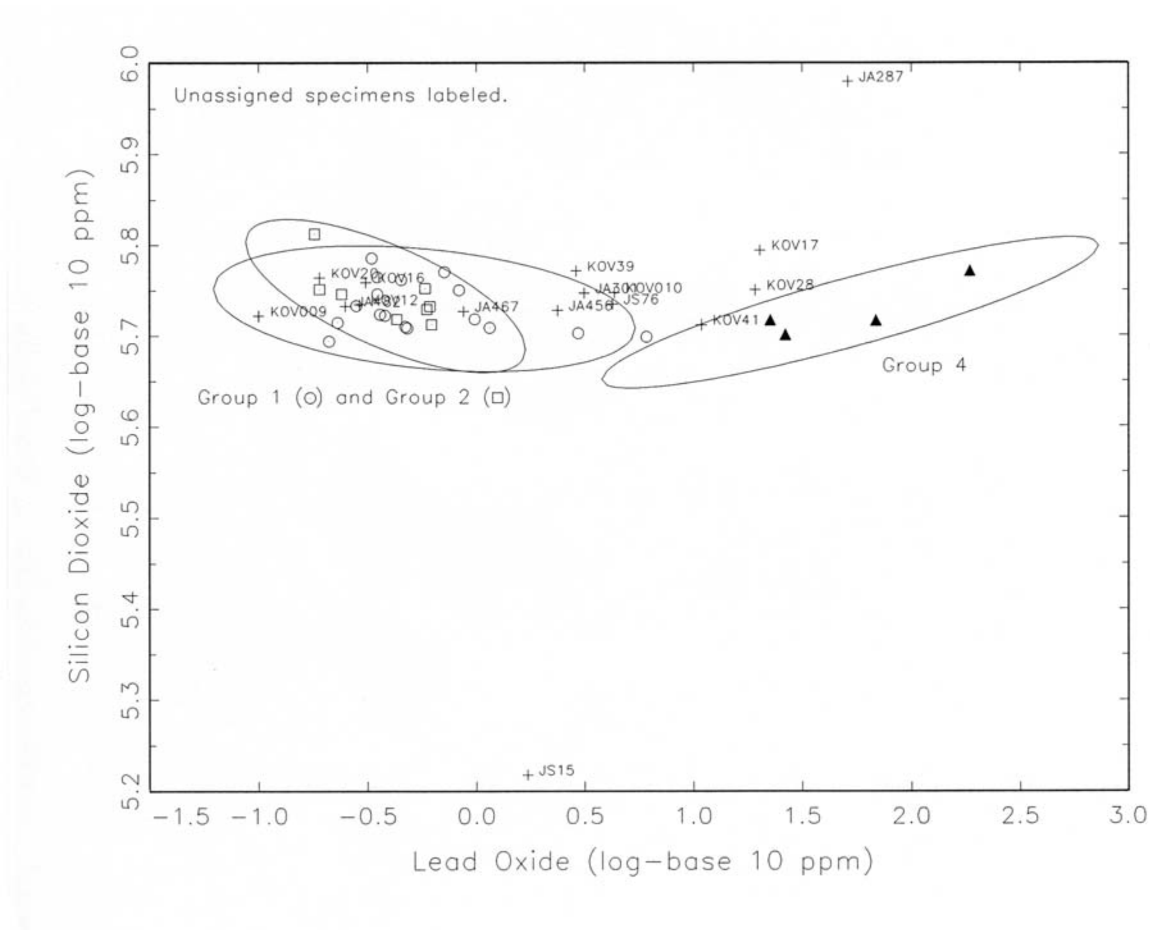


Figure 5.7. Bivariate plot of lead and silicon oxide concentrations in compositional groups identified in the jade study. Ellipses represent 90% probability level for membership in the groups. Unassigned specimens are labeled. Note the anomalous SiO_2 concentrations in JS15 and JA287 (from Kovacevich et al. 2005).

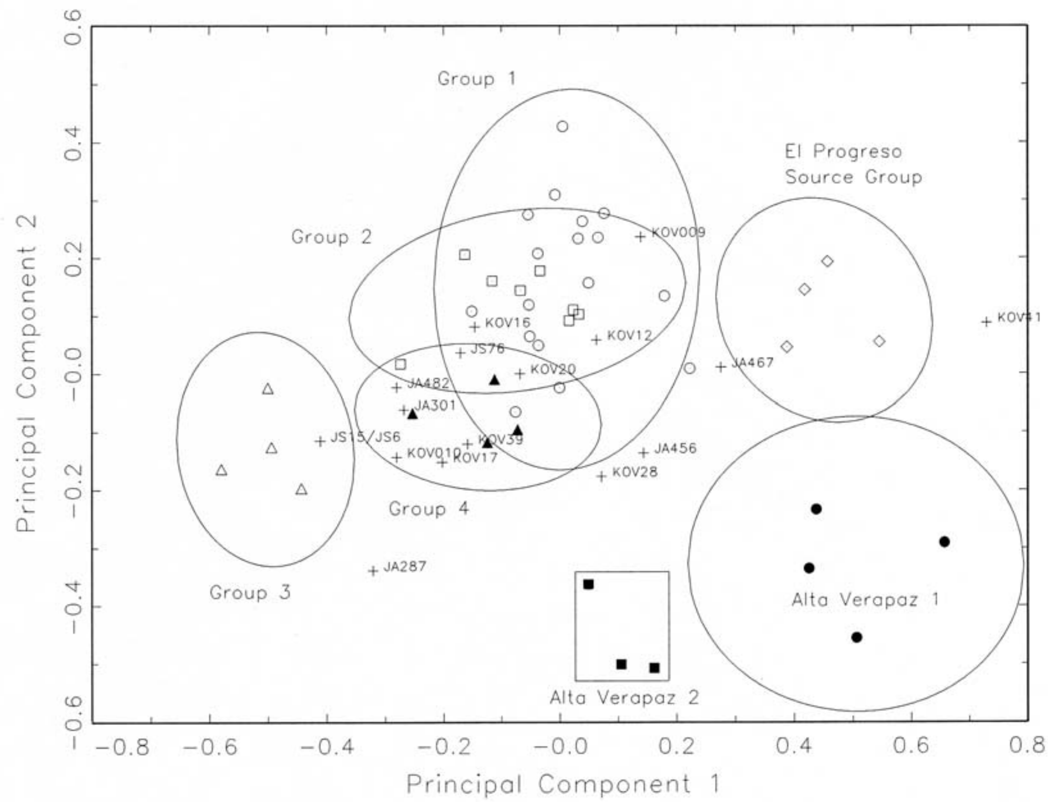


Figure 5.8. Same PCA space as Figure 5 but without variable coordinates. Unassigned specimens are labeled in this plot (from Kovacevich et al. 2005).

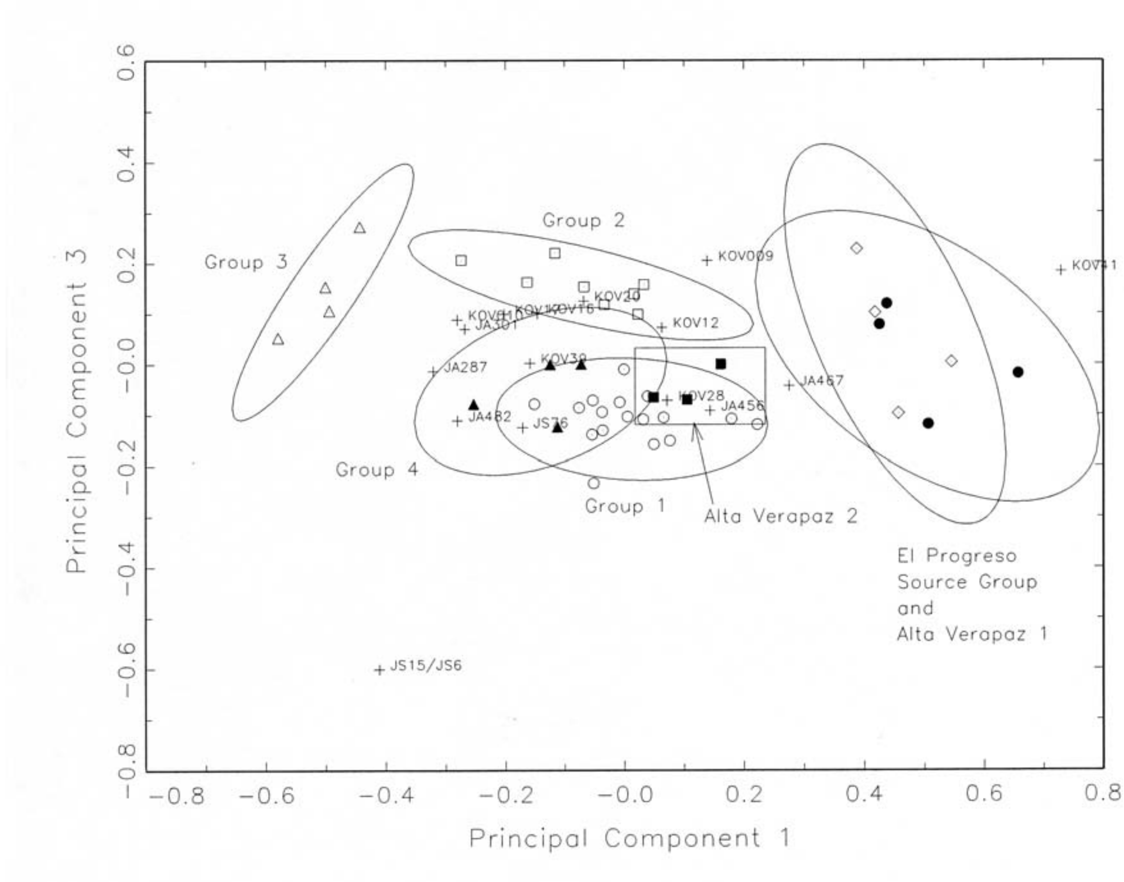


Figure 5.9. Same PCA space as Figure 7 but without variable coordinates. Unassigned specimens are labeled in this plot (from Kovacevich et al. 2005).

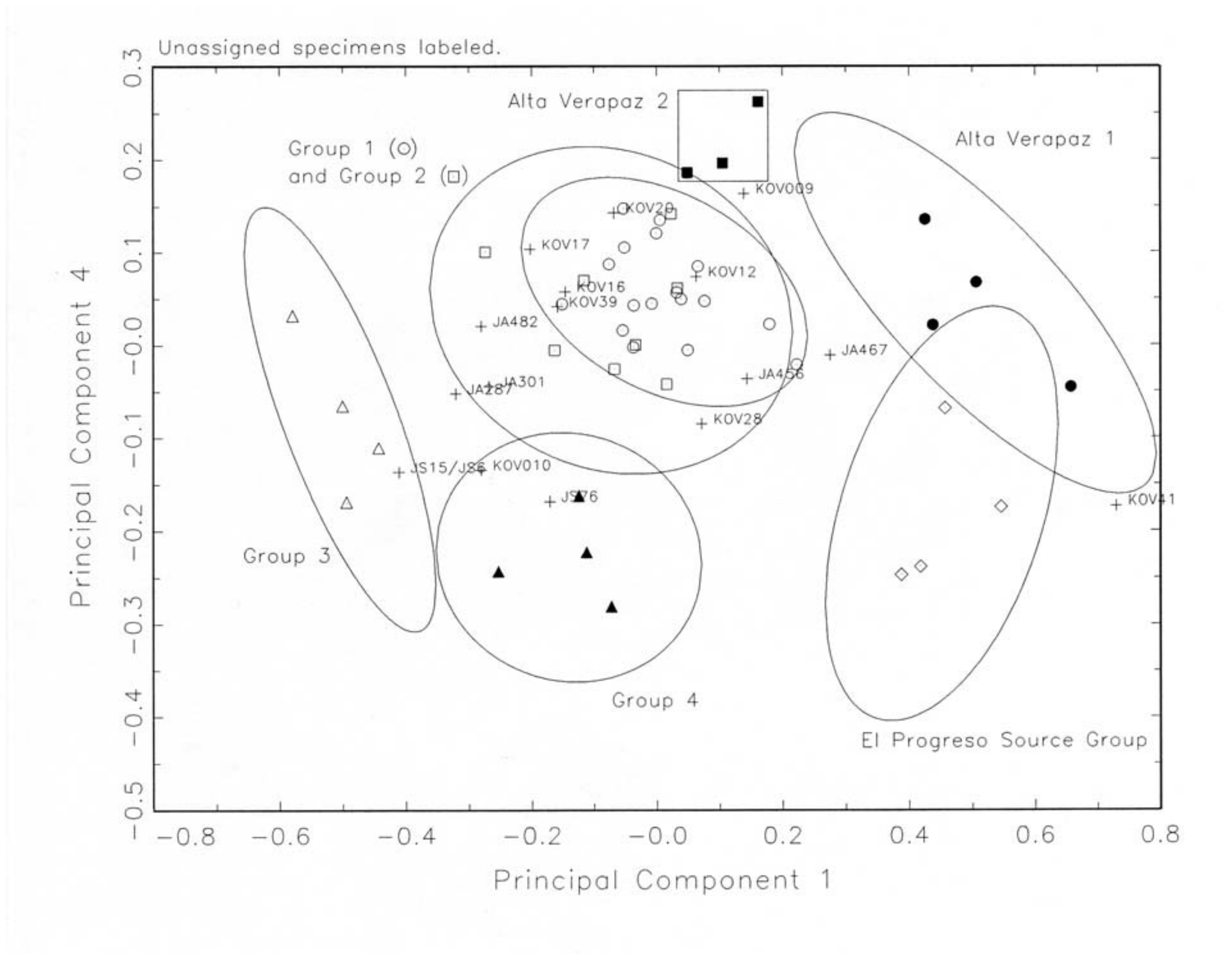


Figure 5.10. Same PCA space as Figure 9 but without variable coordinates. Unassigned specimens are labeled in this plot (from Kovacevich et al. 2005).

Figure 5.11. Chablekal Fine Gray ceramics showing portability (Photo by Michael Callaghan).

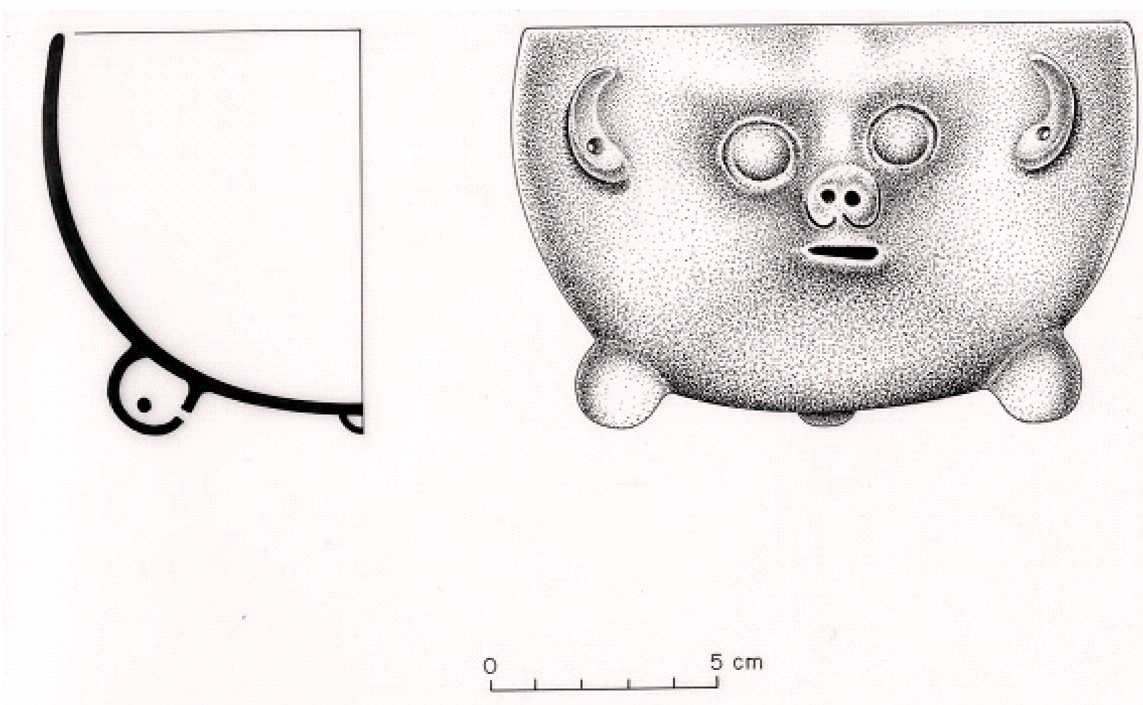


Figure 5.12. Chablekal Fine Gray pot from Burial 57 in midden of Structure M10-4 (Drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

Figure 5.13. Jade hammerstones and a pecking stone from middens in Structure M10-4 (Type IV structure; photo by author).

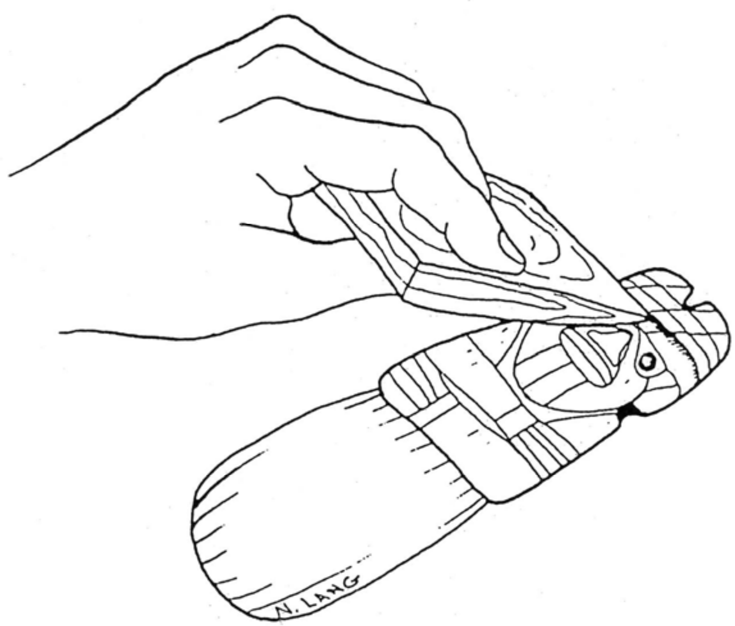


Figure 5.14. Depiction of a wedge shaped wood tool used here for insising, but also possibly used for sawing (from Chenault 1986:Fig. 6).

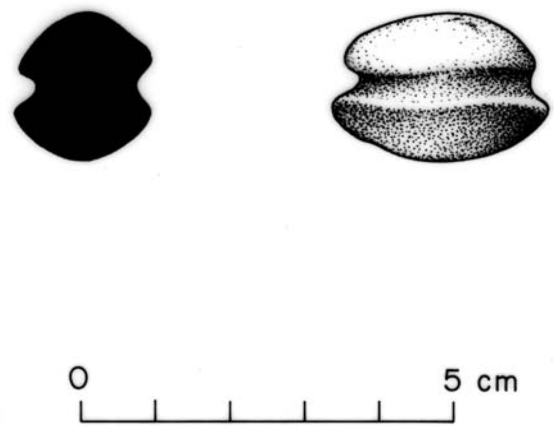


Figure 5.15. String saw anchor recovered from the exterior patio floor of Structure M10-6 (Type IV; drawing by Luis Fernando Luin).

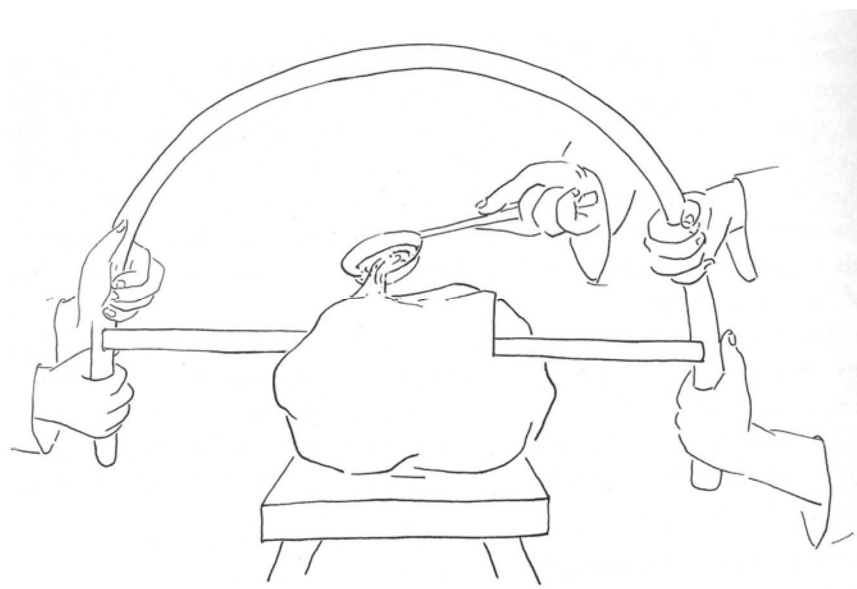


Figure 5.16. Depiction of ancient Chinese technique of sawing jade with abrasive (from Gump 1962:206).

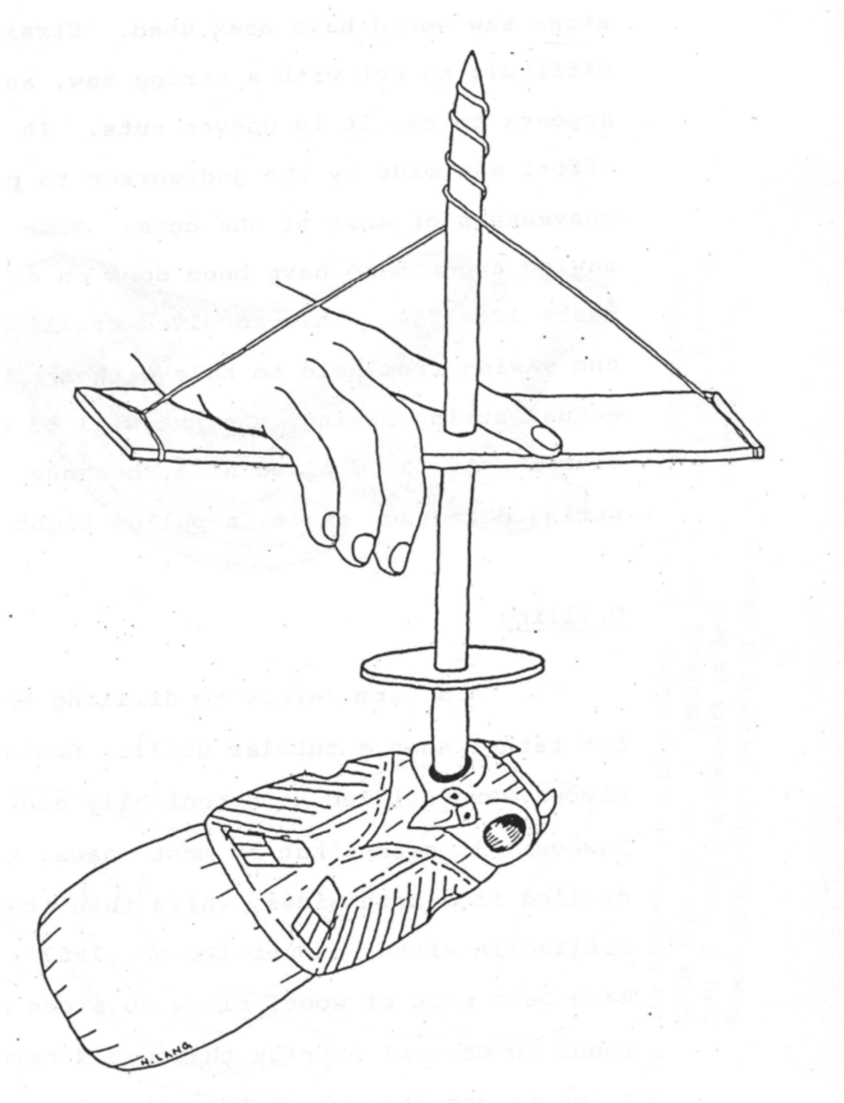


Figure 5.17. Depiction of pump drill used to make decoration vs. perforation (from Chenault 1986:Fig. 8).

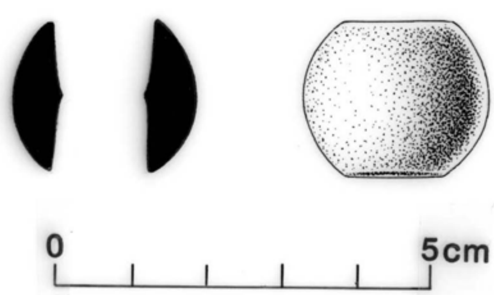


Figure 5.18. Biconically drilled bead from Burial 50, Structure K7-1 (Type II; drawing by Luis Fernando Luin).

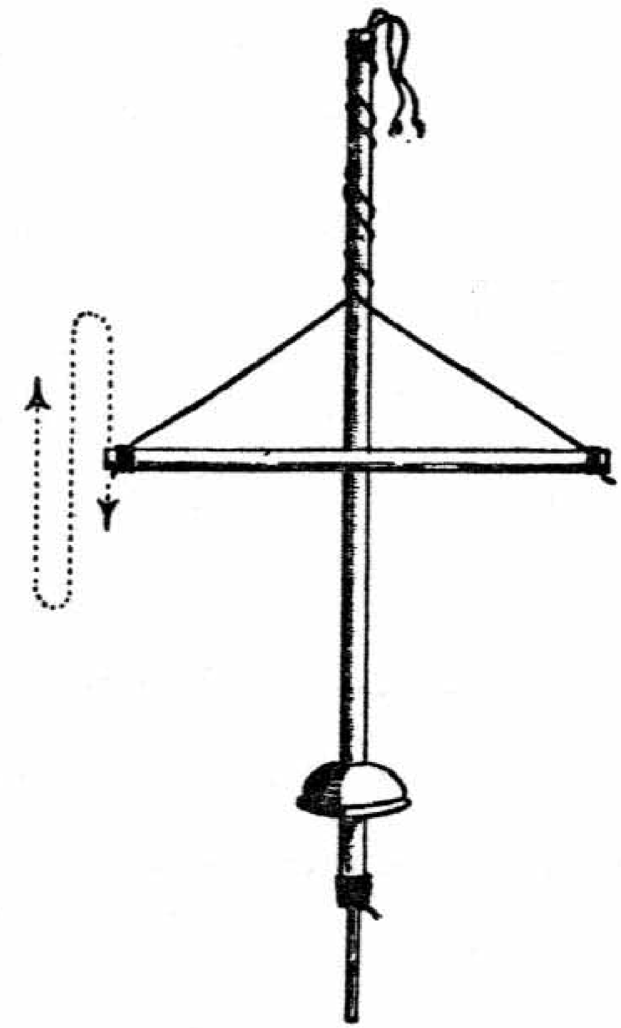


Figure 5.19. Depiction of a pump drill showing flywheel and hafted drilling element (after Digby 1979:16; redrawn by Luis Fernando Luin).

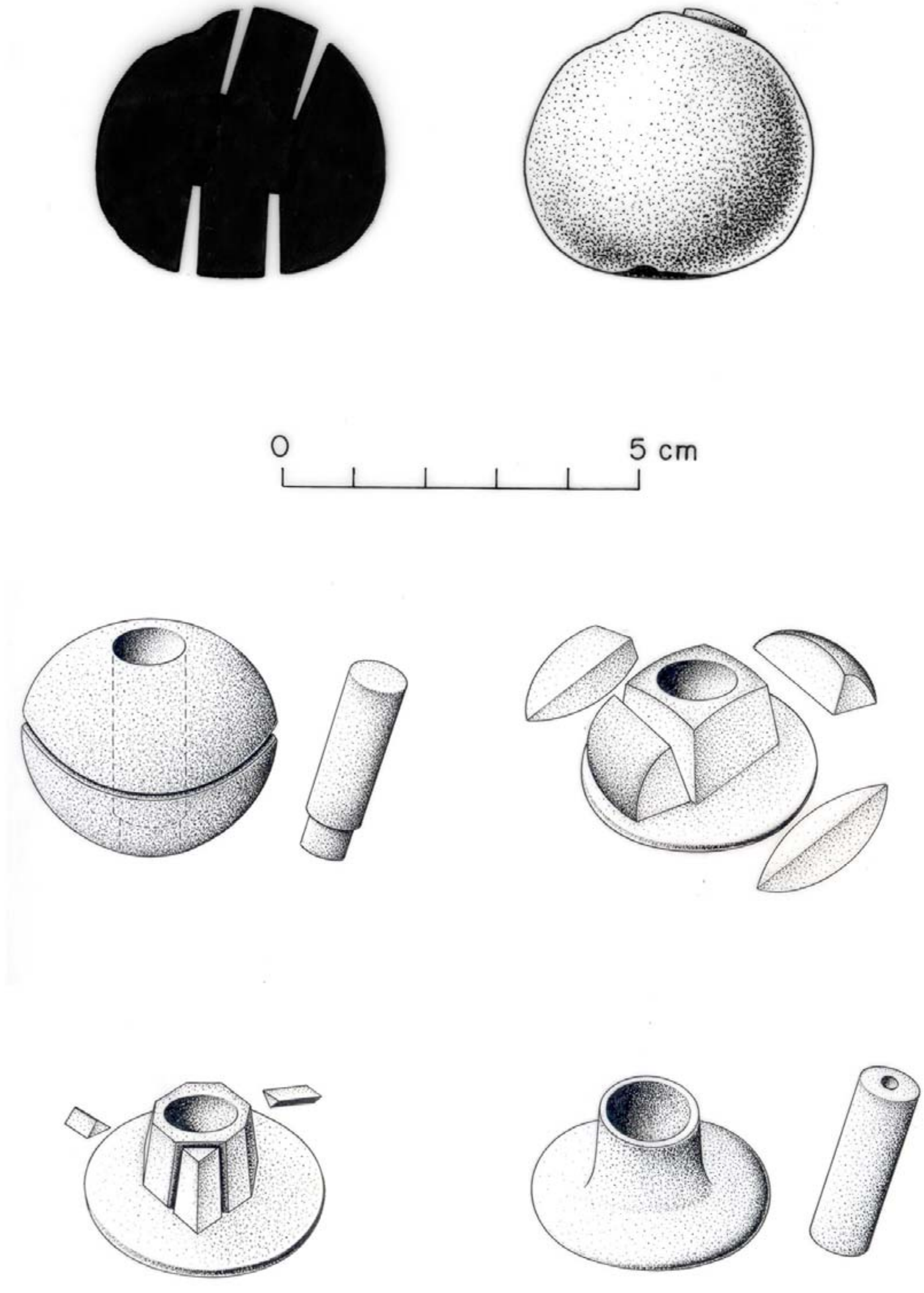


Figure 5.20. Above, possible earflare blank recovered from midden of Structure M10-7 (Type IV; drawn by Luis Fernando Luin); Below, sequence of earflare manufacture (after Digby 1979:20; redrawn by Luis Fernando Luin).

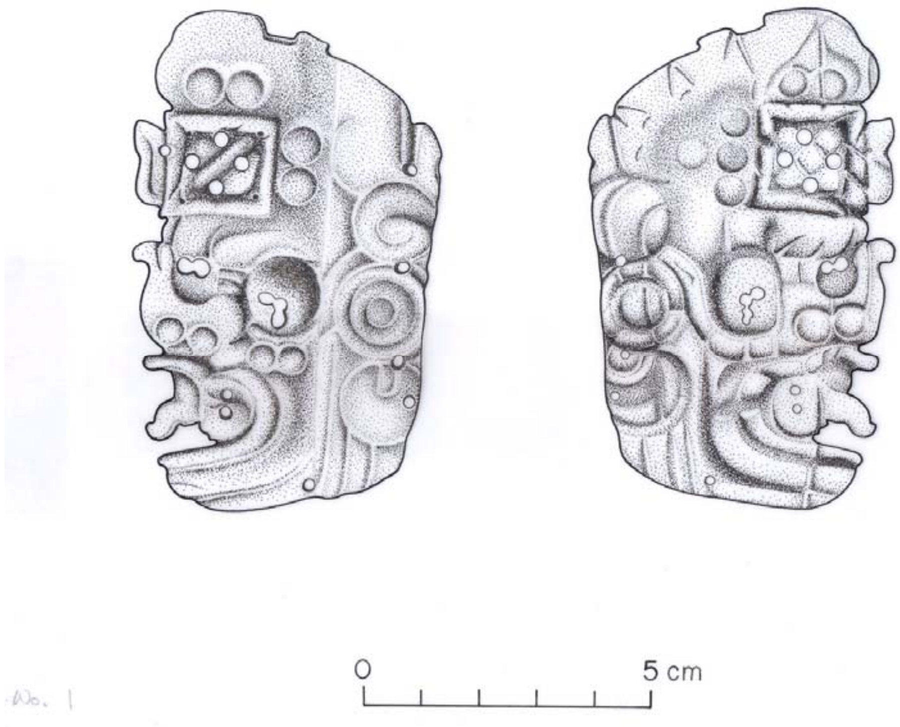


Figure 5.21. Headdress ornament recovered from cache beneath Royal Throne room (drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

Figure 5.22. Photo of headdress ornament from cache beneath Royal Throne room with cinnabar powder still visible (photo by author).

Figure 5.23. Possible slate polishing tools for jade recovered from exterior patio floor of Structure M10-7 (Type IV; photo by Andrew Demarest).

Figure 5.24. Limestone earflare polisher recovered from structure fill beneath the floor of Structure L7-9 (Type I; photo by author).

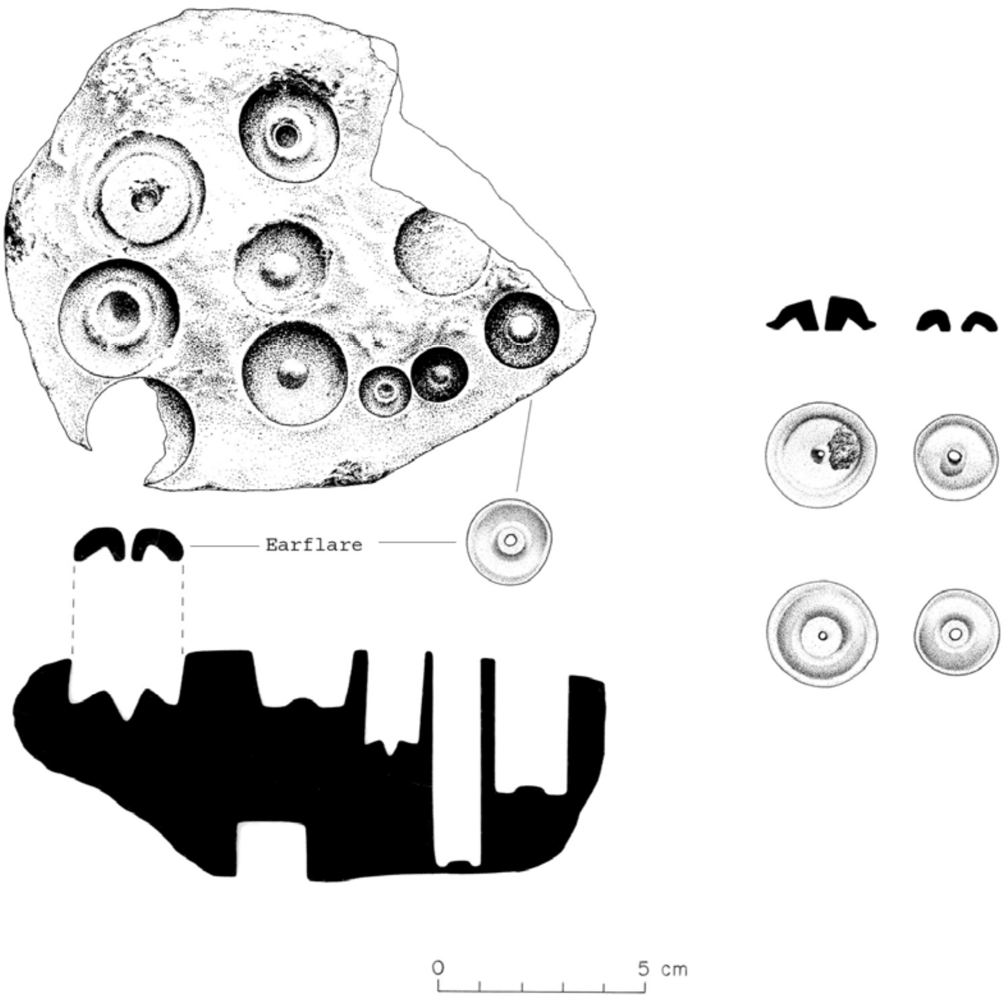


Figure 5.25. Limestone earflare polisher recovered from Structure M9-1 (Type I) shown with earflares recovered from the M9 Group (drawing by Luis Fernando Luin).

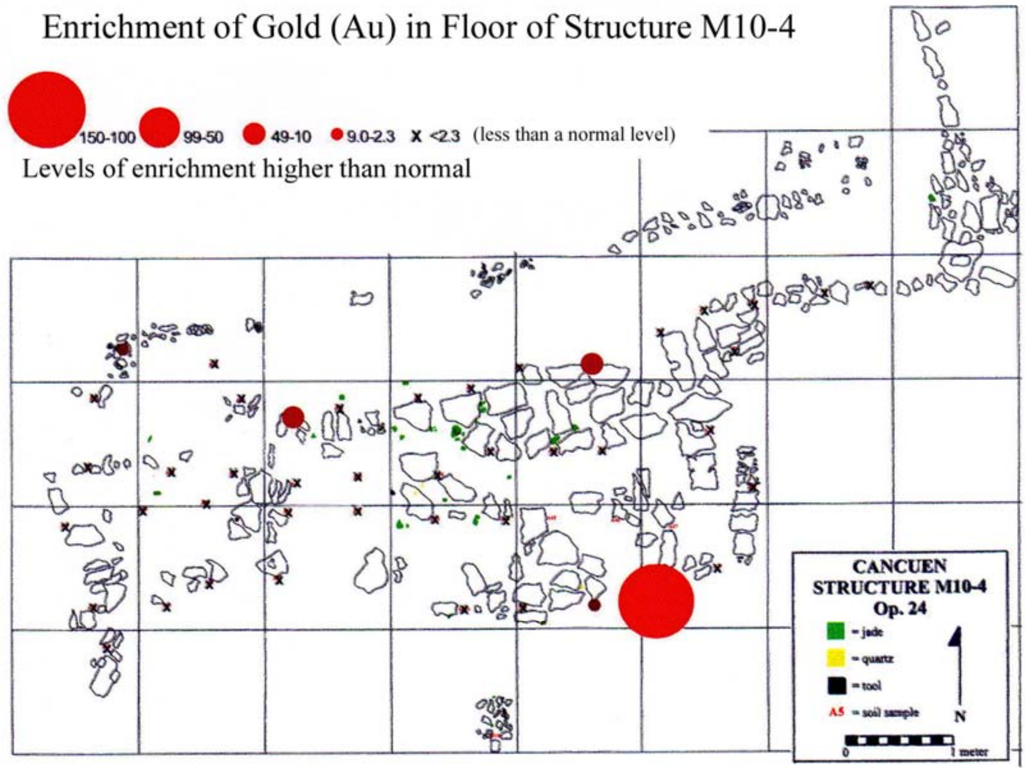


Figure 5.26. Enrichment of Gold (Au) across the exterior patio floor of Structure M10-4, enrichment measures are expressed as the measured concentration relative to the mean background concentration (+SD) for the site (from Kovacevich et al. 2003; see also Cook et al. 2006).

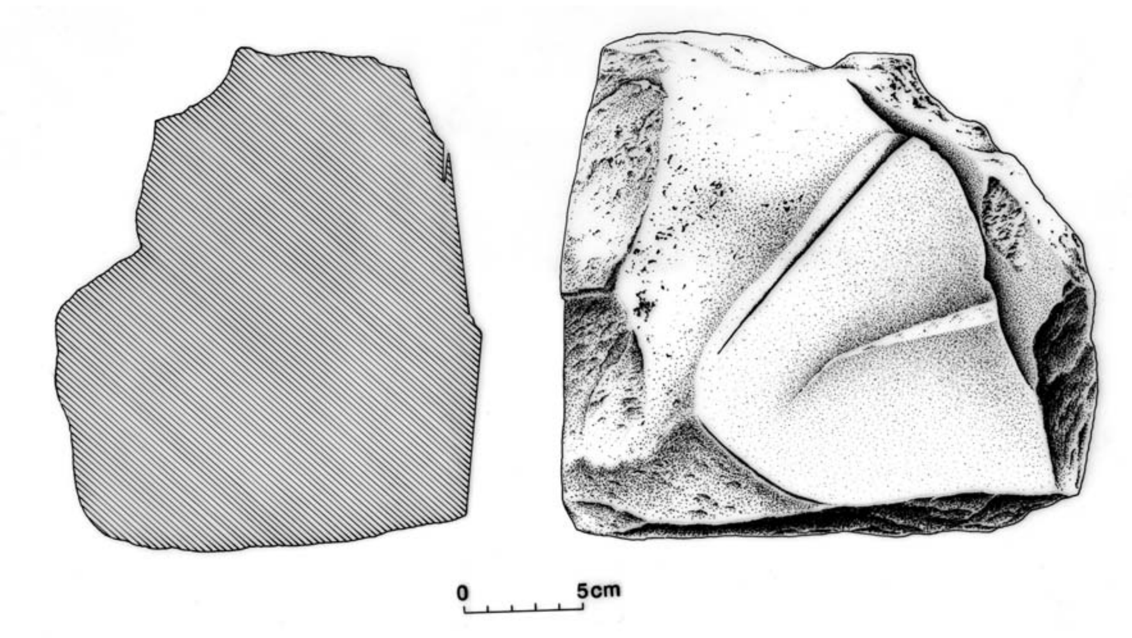


Figure 5.27. Jade Nodule (13.9 kilograms) found just off of the exterior patio floor of Structure K7-24 (Type IV; drawing by Luis Fernando Luin).

Figure 5.28. Photo of jade nodule from Structure K7-24 (photo by author).

Figure 5.29. Large earflare and bead recovered from the cache beneath the Royal Throne room (photo by author).

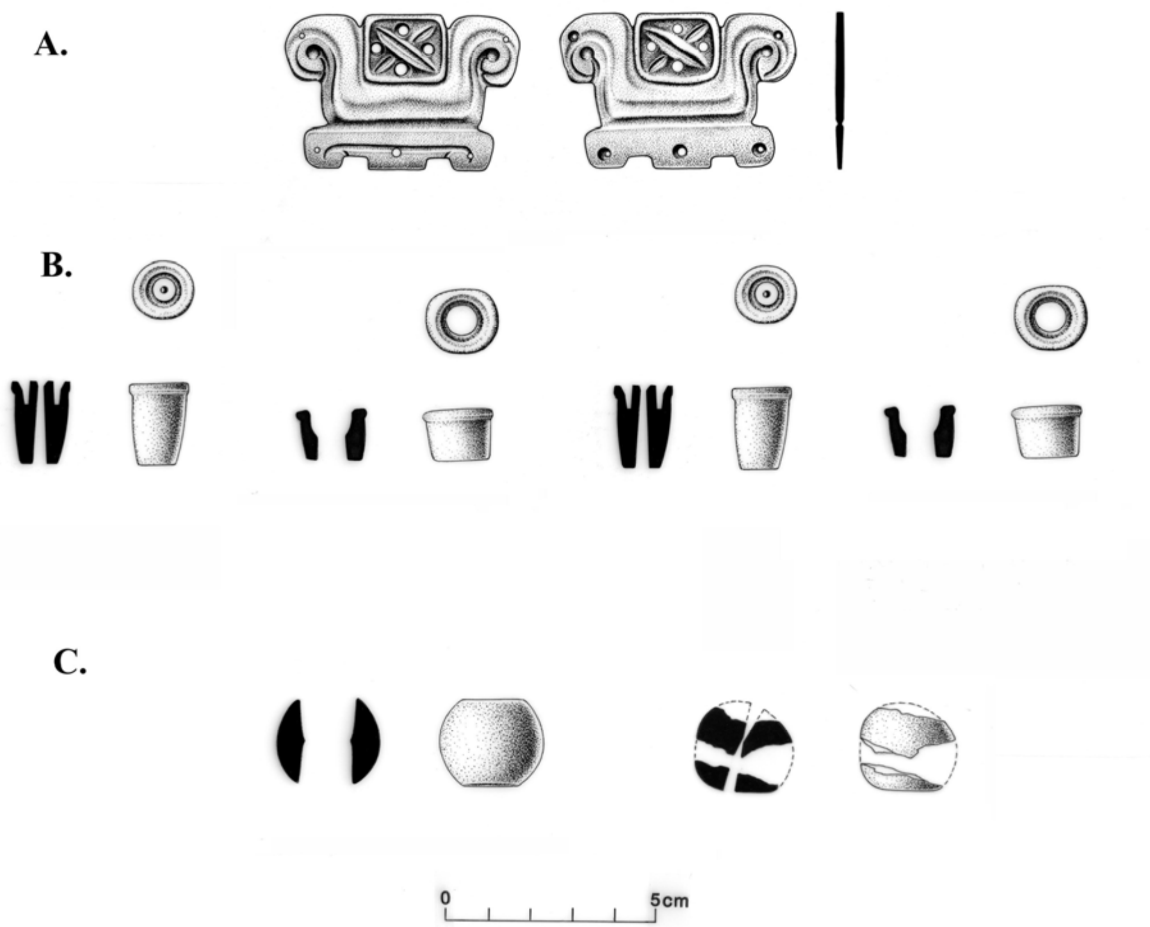


Figure 5.30. Jade from Burial 50 of Structure K7-1; A. Headdress ornaments, B. Earflares and jade counterweights, C. Jade beads (drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

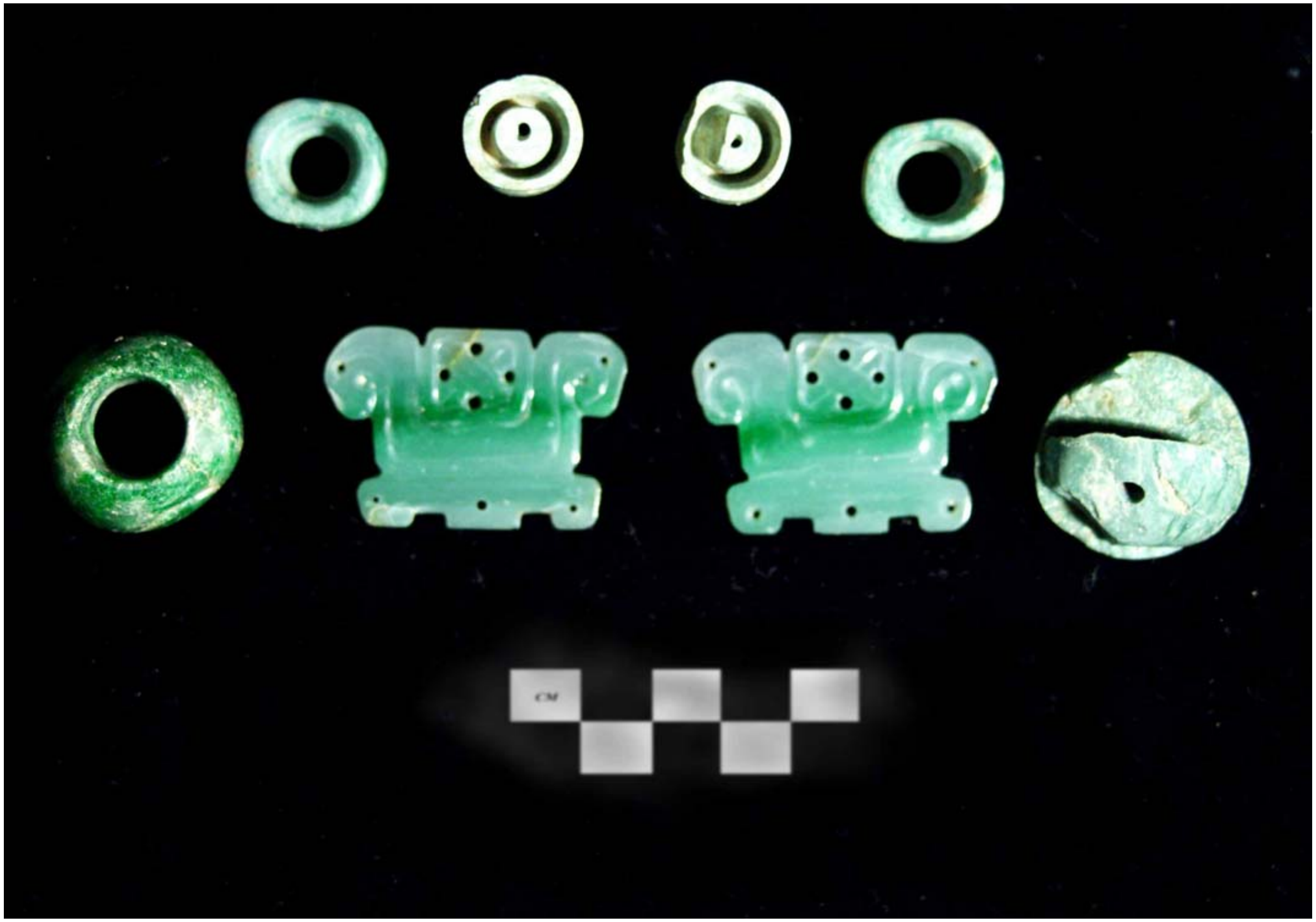


Figure 5.31. Photo of jade from Burial 50, Structure K7-1 (photo by Andrew Demarest; Used with permission of the Cancuen Archaeological Project).

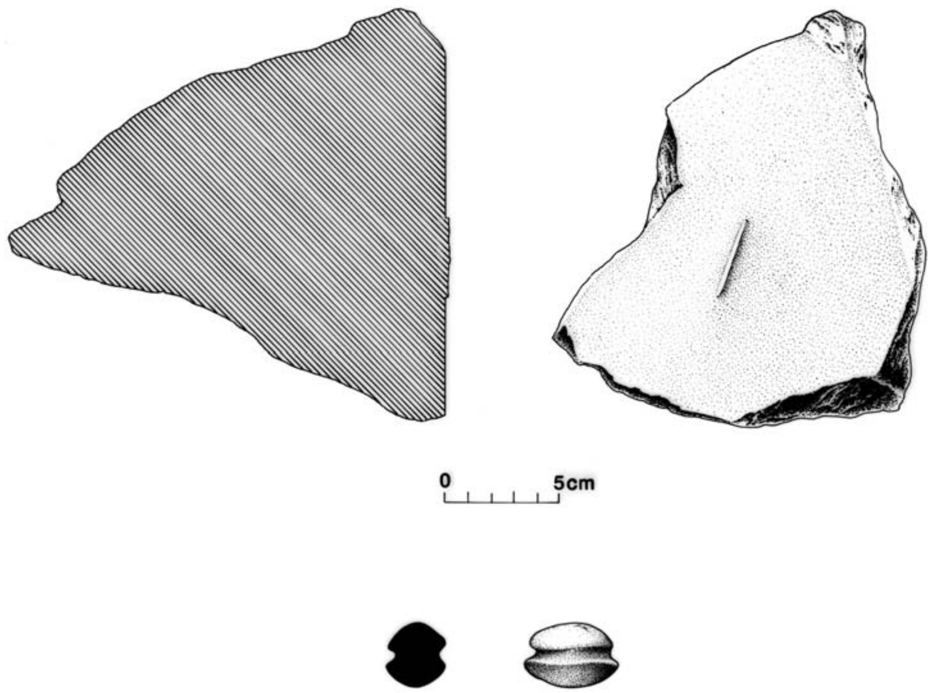


Figure 5.32. Jade nodule recovered from floor of Structure M10-4 (Type IV) with associated string saw anchor (drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

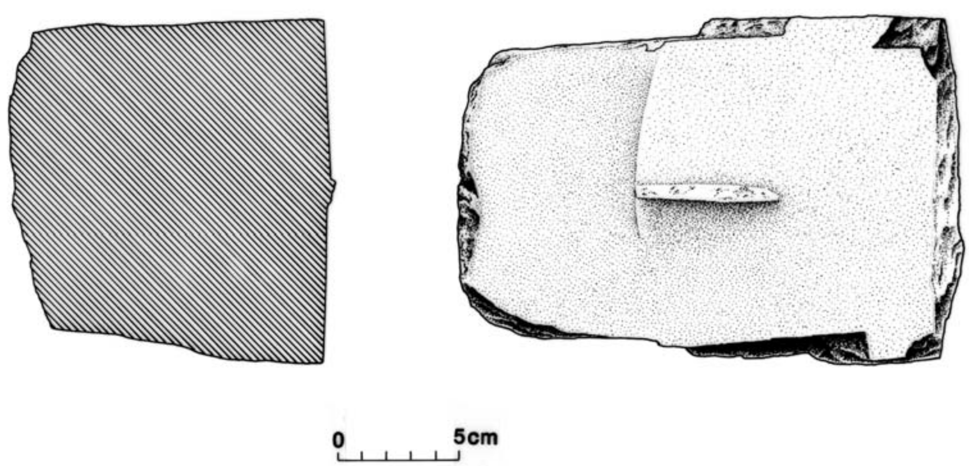


Figure 5.33. Jade nodule from structure cache of Structure M10-3 (Type IV; drawing by Luis Fernando Luin).

Figure 5.34. Photo of jade nodule from cache beneath the Royal Throne Room (photo by author).

Figure 5.35. Drawing of jade face pendant from cache beneath the Royal Throne Room, note the septum left from string sawing on the ventral side of the artifact (drawing by Walter Burgos).

Figure 5.36. Photo of jade face pendant from cache beneath the Royal Throne Room (photo by author)

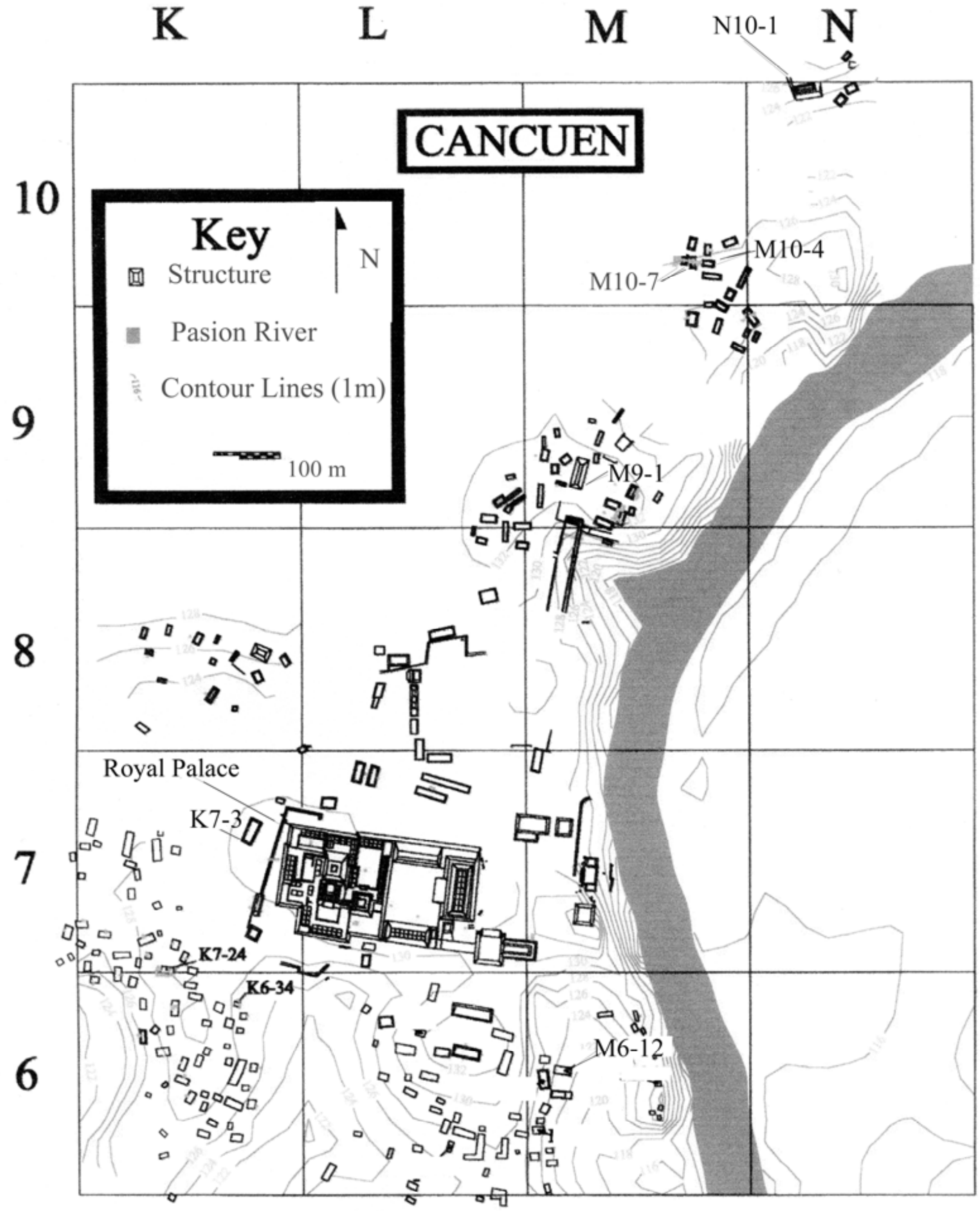


Figure 5.37. Map showing the location of structures mentioned in the text (map by Matt O'Mansky).

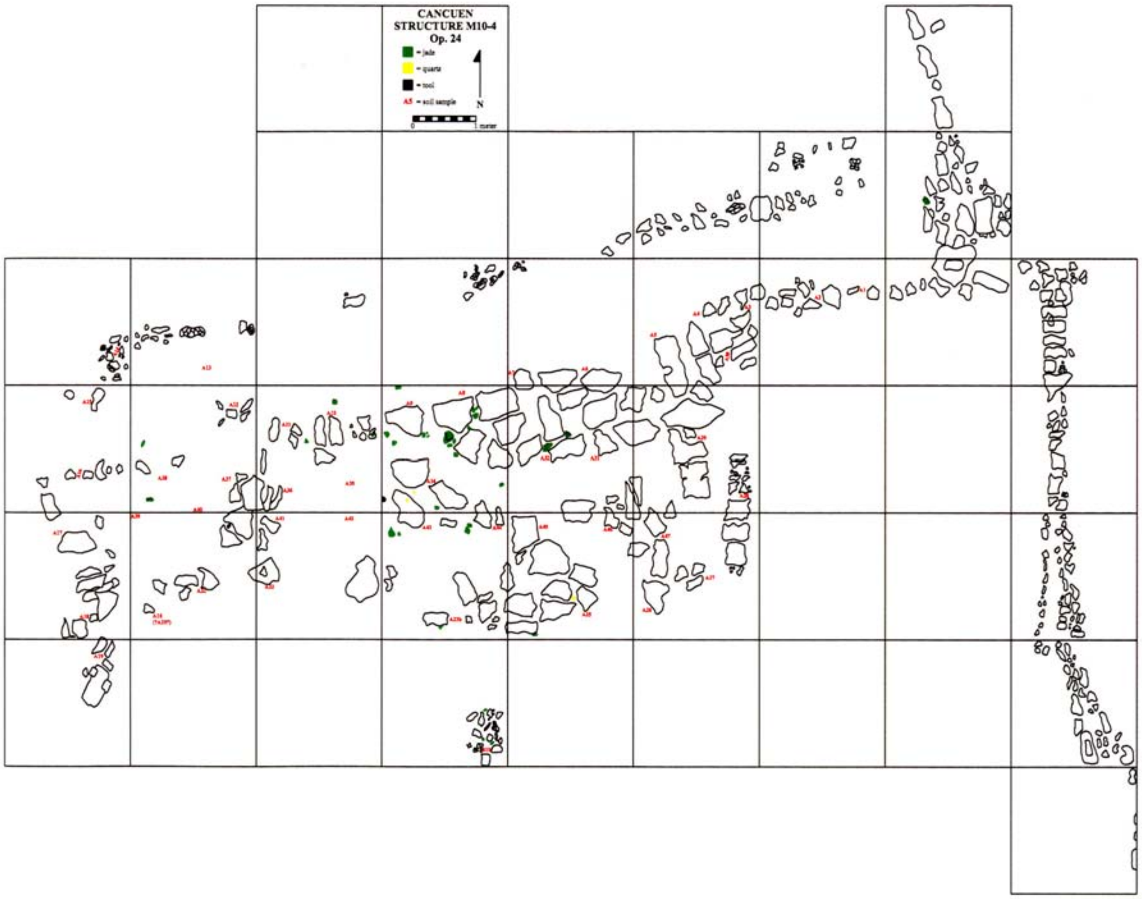


Figure 5.38. Map of artifacts and soil samples from exterior patio floor of Structure M10-4 (Type IV; drawing by author, map by Matt O'Mansky)

Figure 5.39. Photo of exterior patio floor of Structure M10-4 (photo by author).

Table 5.1. Results of X-Ray Diffraction analysis on 20 samples of jade debitage from Structure M10-7 (Type IV) performed at the Smithsonian Center for Materials Research and Education (SCMRE) showing the polymineralic composition of the samples.

Provenience	*Sample #*	**Weight (g)**	**Color**	*Composition determined through X-Ray Diffraction*
CAN 24-59-3	1	5.8	Dark green	Enstatite, Aegirine, Omphacite
CAN 24-59-3	2	10.7	Bluish Green	Omphacite, Clinoenstatite, Jadeite, Calcium Aluminum, Ankerite
CAN 24-59-3	3	13.7	Light Green	Jadeite, Enstatite, Muscovite
CAN 24-59-3	4	2.8	Aqua	Enstatite, Omphacite, Aegirine, Ankerite
CAN 24-59-3	5	5.5	Aqua	Albite, Jadeite, Ankerite, Anortita
CAN 24-58-4 1/2	1	5.4	Dark green	Enstatite, Omphacite, Diopside, Augite, Calcium Aluminum, Aegirine
CAN 24-58-4 1/2	2	8.3	Light Green	Undetermined
CAN 24-58-4 1/2	3	8.3	White	Undetermined
CAN 24-58-4 1/2	4	3.7	Aqua	Diopside, Omphacite, Augite, Aegirine, Calcium Aluminum
CAN 24-58-4 1/2	5	6.6	Dark green	Omphacite, Calcium Aluminum, Aegirine, Diopside, Augite
CAN 24-58-4 2/2	1	5.5	Dark green	Aegirine, Diopside, Enstatite, Augite, Calcium Aluminum
CAN 24-58-4 2/2	2	5.6	Aqua	Jadeite, Enstatite
CAN 24-58-4 2/2	3	31.2	Dark green	Muscovite, Enstatite, Omphacite, Aegirine, Jadeite, Diopside
CAN 24-58-4 2/2	4	11.3	Light Blue	Enstatite, Jadeite, Omphacite, Aegirine,
CAN 24-58-4 2/2	5	6.1	Light Green	Diopside, Omphacite, Anortita, Augite, Albite, Aegirine
CAN 24-62-2	1	7.4	Bluish Green	Omphacite, Calcium Aluminum, Enstatite. Diopside, Aegirine, Jadeite
CAN 24-62-2	2	4.8	Light Green	Jadeite, Enstatite, Omphacite, Diopside, Aegirine
CAN 24-62-2	3	6.5	White	Albite, Enstatite, Diopside, Aegirine Calcium Aluminum
CAN 24-62-2	4	4.6	Light Blue	Enstatite, Diopside, Calcium Aluminum, Augite, Aegirine, Jadeite
CAN 24-62-2	5	6.4	Dark green	Omphacite, Enstatite, Calcium Aluminum, Aegirine

Table 5.2. Mahalanobis-distance based probabilities of membership in Group 1 and Group 2 based on the first four principal components of the Jade data **(**Probabilities are jackknifed for specimens included in each group; after Kovacevich et al. 2005).

Probabilities for specimens in Group 1:

ID. NO.	Group 1	Group 2	From:	Into:
KOV001	10.767	1.408	1	1
KOV007	49.569	4.472	1	1
KOV11	0.505	0.483	1	1
KOV13	48.540	3.343	1	1
KOV15	58.514	1.368	1	1
KOV18	42.504	1.845	1	1
KOV19	99.108	2.732	1	1
KOV2	81.394	5.193	1	1
KOV21	72.793	1.553	1	1
KOV22	73.710	3.320	1	1
KOV26	29.544	2.187	1	1
KOV32	85.333	1.529	1	1
KOV33	10.415	8.106	1	1
KOV34	6.479	2.953	1	1
KOV4	55.517	2.733	1	1
KOV6	88.105	3.106	1	1
KOV6B	79.213	1.727	1	1

Probabilities for specimens in Group 2:

ID. NO.	Group 1	Group 2	From:	Into:
KOV008	0.077	22.308	2	2
KOV024	0.118	54.801	2	2
KOV14	0.545	76.120	2	2
KOV23	0.282	46.122	2	2
KOV25	0.191	95.644	2	2
KOV27	0.839	87.324	2	2
KOV3	2.993	14.814	2	2
KOV5	0.065	1.093	2	2

Probabilities for specimens in Alta Verapaz Group 1:

ID. NO.	Group 1	Group 2	BEST GP.
KOV29	0.029	1.400	2
KOV36	0.031	0.442	2
KOV37	0.016	0.844	2
KOV38	0.043	1.847	2

Probabilities for specimens in Alta Verapaz Group 2:

ID. NO.	Group 1	Group 2	BEST GP.
KOV30	0.038	0.690	2

KOV31	0.219	0.485	2
KOV35	1.241	0.899	1

Probabilities for specimens in El Progresso Group:

ID. NO.	Group 1	Group 2	BEST GP.
JS126	0.056	4.477	2
JS127	1.383	6.996	2
JS130	0.010	5.732	2
JS139	0.001	1.730	2

Probabilities for specimens in Group 3:

ID. NO.	Group 1	Group 2	BEST GP.
JA298	0.017	0.990	2
JS006	0.001	1.477	2
JS012	0.000	3.286	2
JS067	0.003	5.091	2

Probabilities for specimens in Group 4:

ID. NO.	Group 1	Group 2	BEST GP.
JA300	0.118	1.844	2
JS154	0.008	1.414	2
JS70	0.087	0.730	2
JS71	0.011	0.617	2

Probabilities for unassigned specimens:

ID. NO.	Group 1	Group 2	BEST GP.
JA287	0.110	0.543	2
JA301	0.189	5.397	2
JA456	16.986	1.823	1
JA467	9.983	8.553	1
JA482	5.316	0.765	1
JS15/JS6	0.000	0.020	2
JS76	0.261	0.790	2
KOV009	0.086	10.624	2
KOV010	0.016	2.677	2
KOV12	6.306	55.351	2
KOV16	1.750	47.919	2
KOV17	1.025	8.097	2
KOV20	1.406	54.880	2
KOV28	4.949	1.411	1
KOV39	7.720	3.226	1
KOV41	0.001	0.816	2

Table 5.3. Group assignments based on LA-ICP-MS analysis including sample site or source, provenience and X-Ray Diffraction results, when available (after Kovacevich et al. 2005).

Group assignments based on LA-ICP-MS data.

Chemical Group	**Site**	**Provenience**	**INAA Group**	**X-Ray Diffraction**
Verapaz 1	Alta Verapaz	EP1-1.8/9/2		
Verapaz 1	Alta Verapaz	EP1-1.8/10B/8		
Verapaz 1	Alta Verapaz	EP1-1.8/3/1		
Verapaz 1	Alta Verapaz	EP1-1.3/3/32		
Verapaz 2	Alta Verapaz	EP1-1.8/9/2		
Verapaz 2	Alta Verapaz	EP1-2.1/9/3		
Verapaz 2	Alta Verapaz	EP1-1.1/8/114		
El Progreso	El Rancho, El Progreso			
El Progreso	El Progreso			
El Progreso	Las Tapias (Motagua)			
El Progreso	El Progreso			
Group 1	Cancuen Jade			
Group 1	Cancuen Jade	Can 24-59-3		Aegerine/Omphacite/Ankerite
Group 1	Cancuen Jade	Can 24-58-4		Omphacite/Diopside/Enstatite
Group 1	Cancuen Jade	Can 24-58-4		Jadeite/Muscovite/Omphacite
Group 1	Cancuen Jade	Can 24-58-4		no reasonable match
Group 1	Cancuen Jade	Can 24-58-4		Omphacite/Aegirine
Group 1	Cancuen Jade			
Group 1	Cancuen Jade	Can 24-58-4		Omphacite/Aegirine
Group 1	Cancuen Jade	Can 24-58-4		Omphacite/Aegirine/Enstatite
Group 1	Cancuen Jade	Can 24-62-2		Jadeite/Aegirine/Omphacite
Group 1	Alta Verapaz	EP1-1.1/8/21		
Group 1	Alta Verapaz	EP1-1.3/3/9		
Group 1	Alta Verapaz	EP1-1.3/3/39		
Group 1	Cancuen Jade			
Group 1	Cancuen Jade			
Group 1	Cancuen Jade			
Group 1	Cancuen Jade	Can 24-59-3		Aegerine/Enstatite/Omphacite
Group 2	Cancuen Jade	Can 24-58-4		Jadeite/Enstatite
Group 2	Cancuen Jade	Can 24-62-2		Jadeite/Omphacite/Aegirine
Group 2	Cancuen Jade	Can 24-62-2		Jadeite/Omphacite/Enstatite
Group 2	Cancuen Jade	Can 24-62-2		Aegirine/Omphacite/Enstatite
Group 2	Cancuen Jade	Can 24-62-2		Aegirine/Omphacite/Enstatite
Group 2	Cancuen Jade			

Group 2	Cancuen Jade			
Group 2	Cancuen Jade	Can 24-59-3		Jadeite/Omphacite/Clinoenstatite
Group 3	Terzuola		Chich. Green	Jadeite/Albite
Group 3	Middle Motagua		Mot. Dark	Jadeite
Group 3	Middle Motagua		Mot. Exc.	
Group 3	Middle Motagua		Mot. Light	Jadeite/Analcite
Group 4	Terzuola		Mot. Light	Albite
Group 4	Middle Motagua		Mot. Light	
Group 4	Middle Motagua		Mot. Dark	Omphacite/Analcite
Group 4	Middle Motagua		Mot. Exc.	Jadeite/Albite
Unassigned	Holmul			
Unassigned	Terzuola		Mot. Light	Jadeite/Albite
Unassigned	El Cajon		Mot. Dark	
Unassigned	Salama Valley			
Unassigned	Salama Valley			
Unassigned	Middle Motagua			
Unassigned	Middle Motagua		Mot. Dark	
Unassigned	Chiquimula, El Salvador			
Unassigned	Cancuen Jade	Can 24-59-3		
Unassigned	Cancuen Jade	Can 24-58-4		Jadeite/Aegirine/Omphacite
Unassigned	Cancuen Jade	Can 24-58-4		Jadeite/Aegirine/Albite
Unassigned	Cancuen Jade	Can 24-58-4		
Unassigned	Alta Verapaz	EP1-1.3/4/3		
Unassigned	Alta Verapaz	MAN-1/3A/14		
Unassigned	Quirigua	25A/1-5, V2A/16		
Unassigned	Cancuen Jade	Can 24-59-3		Jadeite/Muscovite/Enstatite

Table 5.4. Breakdown of recordable techniques used to work jade by structure type.

TECHNOLOGY	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***Totals***
Percussion	34	8	9	2955	0	7	**3013**
Sawing	11	2	5	243	0	0	**261**
Drilling	4	12	9	9	0	1	**35**
Polishing	18	18	22	31	0	4	**93**
Abrading	1	6	10	6	0	0	**23**
Incising	5	2	1	1	0	0	**9**
Tubular Drill	1	6	0	1	0	0	**8**

Table 5.5. Relative percentages of techniques used to work jade by structure type.

TECHNOLOGY Relative %	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*
Percussion	45.95	14.81	16.07	91.04	0.00	58.33
Sawing	14.86	3.70	8.93	7.49	0.00	0.00
Drilling	5.41	22.22	16.07	0.28	0.00	8.33
Polishing	24.32	33.33	39.29	0.96	0.00	33.33
Abrading	1.35	11.11	17.86	0.18	0.00	0.00
Incising	6.76	3.70	1.79	0.03	0.00	0.00
Tubular Drill	1.35	11.11	0.00	0.03	0.00	0.00

Table 5.6. Jade artifact types separated by structure type including total numbers of artifacts.

ARTIFACT TYPE	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***TOTALS***
macrodebitage	54	6	2	3272	0	0	**3334**
microdebitage*	5	5	5	10	0	0	**25**
raw nodule	3	3	1	8	0	0	**15**
axe	4	4	4	3	0	4	**19**
axe fragment	12	12	7	9	0	12	**52**
bead	5	5	20	16	0	1	**47**
bead fragment	1	2	3	5	0	1	**12**
partially drilled bead	0	0	2	2	0	0	**4**
earflare	2	6	1	0	0	0	**9**
undetermined worked	6	0	3	5	0	1	**15**
dental inlay	2	10	10	0	0	0	**22**
earflare fragment	0	0	1	0	0	0	**1**
plaque	1	2	0	0	0	0	**3**
plaque fragment	0	0	0	3	0	0	**3**
hammerstone	0	0	0	4	0	0	**4**
earflare counterwieght	0	2	0	0	0	0	**2**
Large Worked Nodule	1	0	0	3	0	0	**4**
Pendant/Face	1	1	0	0	0	0	**2**

Table 5.7. Cultural contexts for jade artifacts by structure type including totals.

CONTEXTS	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***TOTALS***
humus	56	5	5	13	0	7	**86**
fill	1	2	2	4	0	0	**9**
wall fall	12	1	14	3	0	0	**30**
floor (int)	0	4	6	0	0	0	**10**
floor (ext)	5	0	0	46	0	0	**51**
midden	2	6	19	3299	0	3	**3329**
sediments	0	4	4	0	0	1	**9**
fire pit	0	0	0	0	0	0	**0**
bench platform	0	2	0	0	0	0	**2**
backdirt	3	0	5	1	0	1	**10**
burial	4	21	16	2	0	0	**43**
looter's trench	1	1	0	0	0	0	**2**
cache	8	0	0	2	0	0	**10**

Table 5.8. T-Test of mean bead weight between Types I and II structures. Null hypothesis: There is no significant difference in mean bead weight between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

	Type I	*Type 2*
Mean	55.74	8.42
Variance	1539.768	104.277
Observations	5	5
Hypothesized Mean Difference	0	
df	5	
t Stat	2.609594	
P(T<=t) one-tail	0.023847	
t Critical one-tail	2.015049	
P(T<=t) two-tail	0.047693	
t Critical two-tail	2.570578	

Table 5.9. T-Test of mean bead weight between Types II and III structures. Null hypothesis: There is no significant difference in mean bead weight between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

	TYPE 2	*TYPE 3*
Mean	8.42	0.584211
Variance	104.277	0.310292
Observations	5	19
Hypothesized Mean Difference	0	
df	4	
t Stat	1.715156	
P(T<=t) one-tail	0.080732	
t Critical one-tail	2.131846	
P(T<=t) two-tail	0.161463	
t Critical two-tail	2.776451	

Table 5.10. T-Test of mean bead weight between Types III and IV structures. Null hypothesis: There is no significant difference in mean bead weight between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

	TYPE 3	*TYPE 4*
Mean	0.584211	0.955556
Variance	0.310292	2.438791
Observations	19	18
Hypothesized Mean Difference	0	
df	21	
t Stat	-0.95305	
P(T<=t) one-tail	0.175704	
t Critical one-tail	1.720744	
P(T<=t) two-tail	0.351409	
t Critical two-tail	2.079614	

Table 5.11. T-Test of mean bead weight between “Elite” and “Nonelite” structure types (Types I and II vs. Types III, IV, V, and 0). Null hypothesis: There is no significant difference in mean bead weight between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

	"ELITE"	*"NONELITE"*
Mean	32.08	0.768421
Variance	1352.682	1.306408
Observations	10	38
Hypothesized Mean Difference	0	
df	9	
t Stat	2.691857	
P(T<=t) one-tail	0.012361	
t Critical one-tail	1.833114	
P(T<=t) two-tail	0.024721	
t Critical two-tail	2.262159	

Table 5.12. Chi-square analysis of proportions of jade in burials between all structure types. Null hypothesis: Proportions of jade in burials are independent of structure type.

Jade in Burials			
	Present	*Absent*	TOTAL
Type 0	0	2	2
Type 1	2	3	5
Type 2	4	11	15
Type 3	1	19	20
Type 4	0	15	15
Type 5	0	3	3
TOTAL	7	53	60
chi-squared Stat			10.6739
df			5
p-value			0.0582
chi-squared Critical			11.0705

Table 5.13. Chi-square analysis of proportions of jade in burials between "Elite" and "Nonelite" structure types. Null hypothesis: Proportions of jade in burials are independent of structure type.

Jade in Burials			
	Present	*Absent*	TOTAL
"Nonelite"	1	39	40
"Elite"	6	14	20
TOTAL	7	53	60
chi-squared Stat			9.7844
df			1
p-value			0.0018
chi-squared Critical			3.8415

CHAPTER VI

PYRITE

> Whatever their function, these brilliant shining discs seem to have formed part of the ceremonial costume and must greatly have added to its barbaric splendor.
>
> Kidder, Jennings, and Shook 1946:130-131

Introduction

This chapter will detail the evidence for pyrite production at Cancuen, which most often included reflective mirrors (ceremonial in nature), as well as beads and dental inlays. The properties of the mineral iron pyrite are discussed, as well as possible sources for the mineral in the Maya region. The social and ritual significance of pyrite and other magnetic mineral mirrors was great, and the contexts of these artifacts during the Classic period were primarily mortuary and ceremonial, although mirrors may have also been a part of domestic ritual.

The manufacturing sequence of pyrite was similar to that of jade in numerous respects. The use of pyrite mirrors may have been restricted, again by social prescriptions. It does appear that residents of Types III and IV structures were producing mirrors for Types I and II residents, as raw nodules and other production debris were only found in Types III and IV structures. Types III and IV residents may have used and possessed pyrite mirrors in domestic rituals, but production for elites almost certainly occurred and seems to have been the primary goal of household production.

As with jade, it seems that the use of pyrite mirrors may have been restricted to certain members of the society, while others were producing them, probably for tribute.

Again this would indicate a source of authoritative and allocative power for elites, as they were able to control production through ideological and esoteric means, while the products also reinforced their prestige and status through ritual communication with the gods and ancestors. At the same time, the producers of pyrite mirrors also had some prestigious items within the artifact assemblages of the household.

What is Pyrite?

Iron pyrite, also known as "fool's gold" can have a brilliant reflective surface like gold in a dry environment or when polished, but its iron content causes it to oxidize, turn red, and decompose into another mineral state with time in a wet environment (Figure 6.1). Chemically, pyrite is a mineral composed of iron sulfide, FeS_2. Pyrite has a hardness of 6 to 6.5, much harder than gold (2.5-3), resulting in the biting test of gold, stereotypical of gold prospectors. It has a specific gravity of 5.1, higher than that for many other metallic minerals, which makes it heavier and somewhat more easily identifiable in the field. The name pyrite is Greek in origin related to the word for fire, as pyrite will make sparks when struck with another rock (see also Zamora 2002:29). Another good field test for pyrite is that of streak on porcelain, which is greenish-black for this particular mineral. Raw pyrite is often recovered in crystals with cubic form in numerous geologic environments (see Figures 6.1 and 6.2), it can form as crystals in igneous, sedimentary, and metamorphic rock. Pyrite is often referred to in ethnohistoric sources as "mirror stone" (see Sahagún 1950-1982, especially Book 11), but is often not distinguished from other metallic minerals like magnetite (Fe_3O_4), ilmenite ($FeTiO_3$), hematite (Fe_2O_3), or even obsidian (see Chapter 7) that may have been used for mirror production. Pyrite itself in Nahuatl could be referred to as *temetztlalli* or *hapetztli* (Sahagún 1950-1982: Book 11, Chapter 10).

The most common use for pyrite in ancient Mesoamerica was for mosaic mirrors. Pyrite has received relatively little attention in the archaeological literature (although see below), and Marcelo Zamora (2002) has completed the most comprehensive study of pyrite use among the Maya, in which he presents evidence for the ritual significance of pyrite, contexts for its use, experimental replication studies, possible sources, and production sequences for the pyrite recovered at the site of Aguateca, Guatemala.

Sources of Pyrite

Pyrite is a mineral that forms as crystals within rock. This parent rock can be sedimentary, igneous, and metamorphic, making the formation of pyrite possible in almost any environment. It can occur in isolated crystals, but also in large outcrops that can be mined or quarried, but the existence of large mines is very rare, especially in Guatemala, but more possible in Mexico (Zamora 2002:30-31). Sahagún describes the Postclassic process of extracting pyrite or possibly other related mirror stones:

> Hay en esta tierra piedras de que se hacen espejos. Hay venas de estas piedras y minas de donde se sacan. Tienen muy bien metal. Hacen la cara muy al propio. Cuando están en piedra parecen pedazos de metal; cuando los labran y pulen son muy hermosos (Sahagún 1985:61).

The raw pyrite found at Cancuen is generally cubic in form (see Figures 6.1 and 6.2), and appears to have been collected in isolated crystals instead of cut or quarried from a mine or outcrop. During excavations crystals of pyrite have been noted embedded in limestone used in construction of residential structures. Pyrite could also have been found in the caves surrounding the Cancuen region. This was probably the most reliable source for exploitation of pyrite in the region, although the metamorphic environment where jade was quarried would also provide an area where pyrite would form and could have been collected while searching for other highland resources.

In his description of merchant traders, Sahagún lists pyrite mosaics (among other fine jades, shells, and feathers) as that among which rulers of outlying provinces would send to the Aztec emperors, as property of the state:

> And when the merchants reached Anauac Xicalanco [and] the rulers who governed the cities of Anauac, thereupon they gave to each of them all the items of trade-the precious capes, precious skirts, precious shifts, the property of Auitzotzin, with which they greeted them. And then the rulers of Anauac, Xicalanco, Cimatlan, [and] Coatzaqualco reciprocated with the large green stones, round green, like tomatoes; the cylindrical green stones; then the green stones cut on a bias; the well-colored precious green stone which today we call the finest emerald green jade; and fire bottle-green jadeite, and turquoise mosaic shields; and [stones] with green pyrites in their midst….All this which the merchants [and] vanguard merchants took there in Xicalanco [and] carried away belonged to Auitzotzin (Sahagún 1950-1982: Book 9, Chapter 4).

Zamora (2002:31) notes that large mines or sources of pyrite are not common in Guatemala, but the Archives of the Ministry of Energy and Mines of Guatemala do mention several sources for pyrite in Guatemala. In one report on geological excavations in Cerro Montecristo, Chiquimula, the presence of pyrite crystals is noted, but not the size or relative amount (MINORSA 1977). Another report (Kesler and Ascarrunz 1982) mentions pyrite outcrops in Huehuetenango, Chinuatla, San Sebastian and San Miguel Acatán, as well as Mataquesquintla in Jalapa. Certainly not all sources or outcrops of pyrite in Guatemala have been identified, as it does not have a specific commercial value in modern society, and it is usually noted in reports investigating other minerals or rocks.

The Social and Ritual Significance of Pyrite

The use of mirrors by the ancient Maya and other peoples of Mesoamerica has been well documented (Carlson 1981, 1993; Ekholm 1945, 1973; Flannery 1968; Gullberg 1959; Heizer and Gullberg 1981; Olson 1984; Pires-Ferreira 1976; Mata 2003; Nordenskiold 1926; Saville 1925; Taube 1992a; Merwin and Vaillant 1932:87; Zamora 2002). The highly polished surface of the mosaic mirrors not only reflected the sun, which was closely intertwined with the concept of rulership (Greene Robertson 1974; Schele 1976), but could also possibly be used to make smoke or fire during rituals (see Carlson 1981 and Ekholm 1973) and also important for divination (e.g., Taube 1992a; Miller and Taube 1993).

Mirrors could act as portals or divinatory devices, the king or shaman could conjure up gods and bring them into the human realm (Carlson 1981, 1993; Taube 1992a). The modern Huichol consider mirrors to be caves or passageways for gods and ancestors (see Taube 2001). This is often supported by the depiction of heads or individuals emerging from mirrors, for example at the Temple of Quetzalcoatl at Teotihuacan and Caracol Stela 5 (Taube 1992a:195-6, fig. 21 and 22). The use of mirrors as divinatory devices is well known around the world, especially in ancient China, for practices such as scrying (the act of seeing or telling the future with the use of a shiny object such as a crystal ball) and catoptromancy (a species of divination, which was performed by letting down a mirror into water, for a sick person to look at his face in it. If his countenance appeared distorted and ghastly, it was an ill omen; if fresh and healthy, it was favorable [Webster's 1998]) (e.g., Besterman 1997).

Taube (2001) also argues that the relation of mirrors to caves and portals can also be seen during the Late and Postclassic periods as their representation of the "middle place" or the symbolic opening between the earth and the heavens and underworld. He argues that mirrors were sometimes worn on the abdomens of figures to represent the earth navel or the middle of the cosmos.

In modern Maya languages the word *lem* (Eastern Maya languages) or *nen* (Western and Central Maya languages) is 'mirror' or the quality of reflecting or illuminating (see Schele and J. Miller 1983:10-12). Mirrors were also a direct representation of kingship. Schele and Miller (1983:12) report that there is an important description of the use of the word *nen* related to titles for priests and holders of office in the Motul Dictionary, "*u nen cab, u nen cah* el sacerdote, cacique, governador de la tierra o pueblo, que es el espejo en que todos se miran," or "the mirror in which all people see themselves reflected" or the people's or the earth's mirror (see also Carlson 1981, 1993; Martinez Hernandez 1929:669-70). The ruler as the people's mirror can also be seen in the following quote from Nezahualpilli as Montezuma takes the throne:

> O you most powerful of all the kings of earth! The clouds have been dispelled and the darkness in which we lived has fled. The Sun has appeared and the light of dawn shines upon as after the darkness which had been caused by the death of the king. The torch which is to illuminate Mexico has been lighted and today we have been given a mirror to look into (Duran 1994:220).

Some scholars also believe that there was a mirror ceremony, which marked heir designation or ascension to kingship, and in Maya iconography the grasping of a mirror is often indicative of the ascension of a new ruler (Schele and J. Miller 1983). Schele and J. Miller (1983:14) note that the term *nen* denotes rulers and persons of importance, "the reflection of the world (or people)" in Yucatec. In Quiche, *nem* can mean "succession in office." This reading for T617a (the *nen* mirror glyph) for the Classic Maya is supported by its use in iconographic contexts of accession and heir-designation, especially when it is followed by a prepositional phrase designating the person "as Enterer of the Succession." Schele and Miller argue for textual evidence of this at Palenque, Quirigua, and Yaxchilan.

Schele and Miller (1983:17) also argue that decorated belts of rulers during the Classic period often contain the elements of the human head, representing *ahau* combined with the *pop* or mat element, reading "Lord of the Mat" a title for the *K'uhul Ahau*, but is also sometimes pictured as *Ahau Nen* or "Lord of the Mirror" (see also Schele and M. E. Miller 1986:71).

The *Chilam Balam of Chumayel* (Roys 1933:109-110) also chronicles the use the mirror metaphor in birth and ascension:

> In the first katun was born the only son of God; in the second katun, the Father. In the third Katun was *Expleo-u-caan*, as he was called, who chastised him named *Chac Opilla* when he set up the heavens. *Enpileo-u-caan* was his name. *Expeo* was his name within the first noose of God. Hebones was the only son of God. [Like] a mirror he was born astride on the shoulder of his father, on the stone of his father (quoted in Schele and J. Miller 1983:19).

Thus as the god is born into divine status he becomes like a mirror, as a king becomes a mirror as he ascends to the throne.

Forehead mirrors and other body mirrors were often associated with the Sun God, the Jester God, God K, God D, and variants of God C (Miller and Taube 1993; Schele 1974, 1976; Schele and J. Miller 1983; Taube 1992b; see Schellhas 1904 for original designation of lettered gods, and Taube 1992b:148 for further explanation). God K is often represented with the dark (obsidian) mirror, while the Jester God is represented with the light mirror (probably pyrite or other magnetic minerals). Thus the ruler would become the personification of these gods as he wore the mirror.

> The "mirror" grapheme has been shown to appear as a major feature in the diagnostic traits of God K and the Jester God (both major gods of Classic rulership) as well as other deities. The prominence of both of these deities in the regalia and accoutrements of royal portraiture is relevant. If both gods participate in royal iconography and mythology, it is little wonder that the forehead motif of each becomes a symbol of accession to office in general and to the throne in particular (Schele and J. Miller 1983:14).

God K is often shown with the T617a grapheme associated with the forehead. This element is often shown penetrated by a smoking cigar, an *ocote* torch, a ceramic torch holder, a smoking celt or simply emitting smoke and/or sometimes flames (Schele and J. Miller 1983:11). Schele and Miller (1983:12) suggest that the use of the torch (*tah*) identifies it with an obsidian (*toh* or *tah*) mirror, as the two are homophones. The authors (ibid.) also note that the mirror is often marked by 'obsidian-dark' markings, as opposed to 'light' mirrors shown on the Jester God.

God K is associated with lightning, rain, maize, lineage, and rulership (Coggins 1975, 1979, 1988; Taube 1992b). Taube (1992b:79) also argues that the agricultural side of God K is intricately linked to elite power and dynastic descent. The god is often portrayed as the Manikin Scepter, often held by rulers in iconographic depictions, which Coggins (1988) has interpreted as a lightning axe. God K's association with mirrors is also supported by the four wooden figures recovered at Tikal depicting the god holding a mirror plaque in front (W. Coe 1967:57; Taube 1992b: Fig.36), which Taube notes is very similar to the back mirror of the effigy from Burial 10. Taube (1992b:76) also argues that the mirror representation of God K, as well as related elements, fire, burning axes, torches, and cigars, may all refer to lightning, and this may be a reason that God K is often counterpoised with Chac. The association of mirrors and God K with divination is also important. Zamora (2002) points out the connection between God K and the Postclassic god Tezcatlipoca (Taube 1992b) and points out that Sahagún (1985:195) mentions a divinatory role for that god.

The Jester God, so named for his tripartite headdress that looks like a jester's, has been tied by many scholars to the personification of kingship (e.g., Schele and M. E. Miller 1986:79), and is often worn as a headdress ornament in jade or other materials (i.e., alabaster at Aguateca [Triadan 2000]). The Jester God headdress recovered from Aguateca also had numerous pyrite incrustations that surrounded the headband, possibly recycled from pyrite mirrors. This headdress can be seen in many representations of Maya kings, including Stela 19 of Aguateca representing Ruler 5 (Zamora 2002:13). Another example of the Jester God headdress is pictured on Lintel 26 of Yaxchilan depicting Shield Jaguar (Schele and M. E. Miller 1986:66). The Jester God is also tied to mirror iconography, wearing a mirror symbol on his head, sometimes shown in opposition to the dark, obsidian mirror of God K, as in the ceremonial double headed serpent bar pictured on the sarcophagus lid of Lord Pakal of Palenque (Schele and M. E. Miller 1986:283-5).

Taube (1992b:30) notes that God C has been associated with maize offerings, growing trees, stone blades, mirrors, and blood, and suggests that these representations may indicate the more abstract relationship with ideas of sacredness, preciousness, life, godliness, and divinity. Houston (cited in Taube 1992b:30) has identified a representation of God C in the Dresden Codex holding a mirror. The face of God C appears in the mirror, perhaps marking it as a sacred ritual instrument of divination. The face of God C often appears in profile with inanimate objects (such as offerings, structures, or places) and other gods to mark them as sacred.

God D, considered by many scholars to represent Itzamna, has also been suggested to possibly be related to iconography associated with mirrors (Taube 1992b:32). The representation of God D with the *akbal* device on the forehead can be traced back to the Protoclassic Hauberg stela. Taube (ibid.) points out that in Classic epigraphy the T152 *akbal* device is often shown with personal names, such as that of Ruler 2 of Dos Pilas, and Shield Jaguar of Yaxchilan, and some have interpreted it as a representation of a shield. In contrast, Taube notes its similarity to T151 which contains the *nen* mirror sign and probably represents the Central Mexican *tezcauitlapilli* back mirror, and argues that the *akbal* symbol probably also represents a mirror. Schele and J. Miller (1983:14) suggest that the *nen* and *akbal* seem to be in complimentary opposition, the former representing a light, bright, shining mirror, the latter representing a dark, obsidian mirror. Taube (1992a:33) further argues that mirrors of all materials were widely used for divinatory scrying in ancient Mesoamerica, but the *itz* of Itzamna means obsidian in Nahuatl, but also divination – this is confusing. In Colonial Yucatec, Cakchiquel, and Pokomchi, *itz* means divination or witchcraft. Barrera Vásquez (1980:272, cited in Taube 1992a:33) translates *itzam* as “brujo o mago de agua,” while *na* in many Maya languages is translated as to contemplate, understand, or divine. Scrying could be performed with many reflective surfaces including water and mirrors (Taube 1992a), as indicated by the following quote from Covarrubias, “Shamanism is his medium; he can see “faraway” by going into a trance and looking into a mirror or a container with water” (Covarrubias 1937:349, cited in Scarborough 1998). Taube

(1992a:177) also suggests that pyrite and jade were often found together in ritual contexts and burials at least partially because of the high value of the pyrite mirrors themselves, but also because jade, as well as pyrite mirrors were both important for divinatory practices.

Schele and M. E. Miller (1986:43) note that the *nen* and *akbal* signs can be used to mark anthropomorphic figures, gods or ancestors, on the arm, leg, or torso. The former represents light and brightness, the latter represents darkness and perhaps malevolence or association with the underworld. Ethnohistoric sources also associate mirrors with rulers, gods, and rulers imitating gods as seen in the burial of the Aztec king, Tizoc;

> After them came the King and Lord of the Underworld, dressed like a diabolical creature. In the place of eyes he wore shining mirrors; his mouth was huge and fierce; his hair was curled; he had two hideous horns; and on each shoulder he wore a mask with mirror eyes. On each elbow there was one of these faces, on his abdomen another, and on his knees still other faces with eyes. With the shining of the mirrors that represented eyes on all these parts, it looked as if he could see in every direction. (Duran 1994:308 [Footnote says must be god Tlatecuhtli]).

There are also references by Landa to mirrors being the sole property of men, and also representing cuckholdery,

> All the men used mirrors while the women had none; and to call each other cuckholds, they said that the wife had put the mirrors in the hair at the back of their heads (Tozzer 1941:89).

As Zamora (2002:16) suggests (see also Schele and M. E. Miller 1983:12), this probably means that the usual position for mirrors would be to be worn on the forehead or on the front of the head. Mirrors appear in headdresses in murals of Teotihuacan (Miller 1973:fig.202, 210, 211; Langley 1986:fig. 32), as well as on a Teotihuacan style stela from Kaminaljuyu (Parsons 1986: fig. 190).

The use of mirrors as pectorals in Mesoamerica is also well documented in iconography and burial contexts, such as figurines at Teotihuacan (von Winning 1987), in tombs at Kaminaljuyu (Kidder, Jennings, and Shook 1946:126), as well as on Olmecoid figurines (Taube 1989:178).

Mirrors in Mesoamerica were also often worn on the small of the back, and in the Postclassic called a *tezcacuitlapilli*. Mirrors also had Early Classic counterparts, especially at Teotihuacan where they can be seen in the iconography, especially in warrior costumes (Taube 1992a:173), and also in dedicatory burials in the Temple of Quetzalcoatl (Sugiyama 1989:97) and the Pyramid of the Moon (Sugiyama and Lopez Lujan 2006). Back mirrors were also associated with two burials in Tomb B-I at Kaminaljuyu during the Esperanza phase (Kidder, Jennings, and Shook 1946). These can be seen on the Postclassic Atlantean figures at Tula and have been found in archaeological contexts in the Temple of the Chac Mool at Chichen Itza (Morris, Charlot, and Morris 1931). Taube (1992a:198) argues that back mirrors were more of an Early Classic innovation, where as Olmec mirrors were primarily worn on the chest or forehead, possibly because the use of pyrite in the Early Classic instead of magnetite or hematite allowed the elaboration of larger mirrors.

The association of mirrors with war, warriors, and warfare is present across Mesoamerica. Taube (1992a:192) notes that they could have in some cases served an actual protective function or possibly spiritual. He notes that Tezcatlipoca, the smoking mirror god, was seen as a warrior in the Postclassic, and mirrors represented aspects of fire and water, also represented in the Aztec concept of war *atl-tlachinolli,* or water-fire.

The mirror is also often seen as a representation of the sun. In Classic Maya art mirrors are represented with the *kin* sign, as well as Aztec representations of the smoking fifth sun (Taube 1992a:193-5). The modern Huichol of Mexico also see the sun as representing a mirror (Carlson 1981:125).

The representation of mirrors in Classic Maya ceramics also supports not only the connection of mirrors to the royalty and nobility, but also a divinatory rather than a banal function for the mirrors themselves (see Rivera Dorado 1999). Mirrors are often pictured in royal courts as evidenced in iconography depicted on pottery. These mirrors were often depicted as quite large, which may have meant that they were pyrite mirrors, as Taube (1992a:179) points out, mirrors of pyrite were the only ones with virtually no size limit, as they were made of mosaics, where as mirrors of obsidian or other metallic minerals would be limited to the size of the original nodule. One example, cylindrical vase MSO488, as discussed by Reents-Budet (1994:83, 92, 322), depicts three Maya elites involved in a divinatory ritual, the central figure, adorned with jade, stares into a large mirror held by an attendant. A bundle can be seen nearby, possibly holding ritual paraphernalia. Another attendant sips from a cup, possibly holding a ritual or hallucinogenic substance.

Miller and Taube (1993:79) note the importance of the connection between the acts of divination and creation, as the Divine Ancestral Couple and the creators themselves are characterized as diviners. In Central Mexico, Oxomoco and Cipactonal were considered the primordial couple as well as diviners, and the similar couple in the Quiché Maya *Popul Vuh,* Xpiyacoc and Xmucane performed a divinatory hand casting of sacred stones during the creation of humans. The Aztec goddess Toci was seen as a diviner as well as mother of the gods, similar to the Maya Goddess O, associated with creation and destruction, childbirth, and especially divination. Taube (1992a:103) finds that Goddess O was depicted in the Dresden Codex page 42a sitting upon a pyramidal structure holding a mirror bowl with the face of God C. Thus, the acts of creation and divination were inextricably linked throughout Mesoamerica, and the mirror was an important ritual tool in those acts:

> Among the Tarascans of Michoacan, the shamans of the king could see all past and future events through bowls of water or mirrors. The events witnessed by these seers could be used as evidence in court cases (Miller and Taube 1993:80).

Taube (1992b:181) finds that in different contexts mirrors at Teotihuacan can represent human eyes, faces, flowers, fiery hearths, pools, webs, shields, the world, the sun, and caves or passageways. It is not difficult to see how the relationship of mirrors and eyes can be conflated in the notion of divinatory practices, as "seeing" itself can take on both meanings. In the Florentine Codex, eye, pupil, and mirror, are all represented by the word *tezcatl* (Taube 1992b).

Paragraph 5 of Chapter 8 of Sahagún's chronicle of *Earthly Things* in Book 11 details the Colonial account of "mirror stones":

> Fifth Paragraph, which telleth of still another kind of stone. It is a stone [of which] mirrors are made, [a stone] which is converted [into a mirror].
>
> Mirror Stone (Tezcatl)
>
> Its name comes from nowhere. This can be excavated in mines; it can be broken off. Of these mirror stones, one is white, one black. The white one—this one is a good one to look into: the mirror, the clear, transparent one. They named it the mirror of the noblemen, the mirror of the ruler.
>
> The black one—this one is not good. It is not to look into; it does not make one appear good. It is one (so they say) which contends with one's face. When someone uses such a mirror, from it is to be seen a distorted mouth, swollen eyelids, thick lips, a large mouth. They say it is an ugly mirror, a mirror which contends with one's face.

> Of these mirrors, one is round; one is long; they call it *acaltezcatl*. [These mirror stones] can be excavated in mines, can be polished, can be worked.
>
> I make a mirror. I work it. I shatter it. I form it. I grind it. I polish it with sand. I work it with fine abrasive sand. I apply to it a glue of bat excrement. I prepare it. I polish it with fine cane. I make it shiny. I regard myself in the mirror. I appear from there in my looking mirror; from it I admire myself.

Again we see that as with jade, pyrite was a symbol of status and power, but also an actual ritual tool, used for conjuring, divination, production of smoke (and possibly fire) for ritual purposes. It is clearly stated in the passage above, "They named it the mirror of the noblemen, the mirror of the ruler."

Mirrors were a symbol of kingship, divinity, and ritual power. These symbols, in the context of Classic Maya ideology, were an authoritative resource, mobilized by the elite to reinforce and legitimate their power and special position within the social structure. The use of mirrors defined the ritual practitioner as a living god, with the divine power to communicate with the Otherworld and also to see the future. Acts of divination were also likened to acts of creation, again reinforcing the identity of the elite user as a creator of humanity, and one of the few individuals that had the power to recreate the cosmos on a daily basis and further the sacred covenant with the gods and ancestors.

Pyrite Contexts in the Classic Maya World

Much of the information on contexts for pyrite mirrors comes from the work of Marcelo Zamora (2002), I merely add some more recent information to his comprehensive list. I report here only those examples for which there is an explicit provenience, as context is the most important factor in this analysis. My main objective in this section is to identify an “elite” vs. “nonelite” context for other Maya sites in order to compare these to Cancuen.

From Zamora’s (2002:31-41) summaries we can determine that pyrite mirrors or mosaics were found in elite caches, tombs, or structures at Pusilha (Joyce et al. 1927:449), Piedras Negras (Barrientos, Escobedo, and Houston 1997; W. Coe 1959:42-43; Escobedo and Alvarado 1998; Escobedo and Zamora 1999; Houston and Arredondo 1999:253; Houston and Escobedo 1997, 1998, 1999), Aguateca (Inomata and Triadan 2000; Zamora 2002), Copan (Davis-Salazar and Bell 1999:1113-1128; Sanders 1990), Chichen Itza (Morris, Charlote, and Morris 1931; Ruppert 1935:36), Dzibilchaltun (Taschek 1994:97-99), Mayapan (Proskouriakoff 1962:354), San Jose (Thompson 1939:20, 47, 176, 184, 188-89), Holmul (Merwin and Valliant 1932:87), Uaxactun (Kidder 1947:52), Topoxte (Fialko 2000b:144-149), Altun Ha (Taschek 1994:97-99), Chama (Shook and Kidder 1952), Zacualpa (Wauchope 1975), Nebaj (Smith and Kidder 1951:87, 102), Zaculeu (Woodbury and Trick 1953:87, 102, 115), and Kaminaljuyu (Kidder, Jennings, and Shook 1946; Shook and Kidder 1952:126-134).

Some additional elite contexts that I found in the literature that contain pyrite (or other mosaic) mirrors include an Early Classic cache at Quirigua (Ashmore 1980, cited in Taube 1992b:177). Tomb 116 of Tikal in Temple 1 contained 3 mosaic mirrors (Harrison 1999). Mosaic mirror pieces were also recovered at Machaquila from Structure 4, an elite structure in the epicenter of the site (Ciudad Ruiz et al. 2003:250). A mosaic blue hematite crystal and mother of pearl mirror was discovered in a royal cache in Structure 6B at Cerros, along with the royal jade jewels of the first king (Schele and Freidel 1990:121). Excavations at Thompson’s Group, Belize revealed a cache in the principal group which contained numerous exotic items including pyrite (Kunen 2004:82,102; Robichaux 1995:390-395). Recent excavations at Pusilha, Belize by Braswell and colleagues (2005) have also uncovered a pyrite mirror and hematite sequins associated with Burial 6/1, a secondary elite burial located in a pyramidal structure in the epicenter of the site. Also recovered from the Pusilha tomb of a possible ruler (Burial 8/3) were a total of 81 jade artifacts including 24 beads and 3 carved jade ornaments, a large *Spondylus* shell, and a fragment of pyrite, among other goods (Braswell et al. 2005:79-80). A pyrite mirror was recovered from the Margarita tomb in the Copan Acropolis (Bell 2002:99). In the Sepulturas elite residential zone of Copan, four slate or mudstone mirror backs were recovered, one highly polished concave stone, and two (possibly three) pyrite mirror pieces (Willey et al. 1994:251). A rural sweatbath at the site of Piedras Negras also contained a pyrite mirror (Child and Child 1999), reaffirming the role of mirrors in shamanic ritual.

Importantly, some ‘mirror stones’ have been recovered from nonelite or lesser elite contexts (see Gonlin 2007); for example, the Rio Amarillo area, a more humble residential area 21 kilometers from the Main Group at Copan. Structure 1 (Site 7D-3-1), where the cache was recovered, was not a large, vaulted mound, but one with a stone cobble base and perishable superstructure. The cache contained “a fishhook-shaped obsidian eccentric on the surface; and from the base of the cist, two complete ceramic vessels, a 10 cm long chert spear point, and a small extremely thin piece of jade” (Gonlin 2007). The modest sized site also yielded a cache with a “small, round mirror polished from some iron-bearing mineral-one of few such mirrors ever found at Copán” (Webster and Gonlin 1988:178). Burial 2 in the B Group, a pair of small structures at the Bajo Hill site of Belize contained three small, polished hematite discs (the largest approximately 2 cm in diameter). This group is about 40 meters from the largest group at the site, and the structure itself had a limestone foundation brace wall, with a plaster interior floor (Kunen 2004:64). These findings suggest that pyrite or other mirror stones may have been the property of nonelites in some cases. As archaeological studies increasingly focus on household archaeology, we may find an increase of these types of contexts.

Pyrite Manufacturing Sequence

The study of the manufacturing sequence of pyrite can again be informed by ethnohistoric sources, as well as replication experiments preformed by Zamora (2002). Many of the technological steps and tools used are very similar to that for jade, suggesting that those who produced goods in one medium, could have produced them in the other. This seems to be the case in the archaeological record at Cancuen. The tools and manufacturing steps were recorded and compared for different contexts at Cancuen and are discussed below. Special attention was paid to the stages of production, distributions of raw materials, half-finished artifacts, and tools used in production.

The raw pyrite was probably shaped into mosaic mirror pieces by stone grinding tools used with an abrasive such as quartz. Then the mirror was polished with substances like red ochre, which is essentially jewelers' rouge used today. Pyrite could also be formed into beads and dental inlays, but it was not used for weapons or tools. In other words, while pyrite is a metallic mineral, its processing and production into artifacts in no way involved smelting or the technology of metallurgy, which fully developed as a technology during the Postclassic period (Bruhns 1989).

The first step in working pyrite after the procurement of the raw material would be either percussion, sawing, or shaping, depending on the size of the nodule and the desired end product. Zamora (2002:22) notes that the use of percussion (indirect in his reproduction studies) produces flakes with very irregular surfaces, which would have required an extensive amount of work in shaping and perfecting before they could be polished. Zamora (2002:23) also notes that cutting or sawing would produce perfect preforms for mosaic pieces and some samples of mosaics from Aguateca demonstrate evidence of sawing. This notion is supported by the presence of string-saw anchors in association with pyrite production areas at Cancuen, and the process was surely similar to that used for jade and other lapidary work (see Chapter 5).

Toscano (1970) discusses Aztec techniques for the creation of mosaics recounted by Sahagún, first the mosaic pattern would be drawn on paper, then the pieces would be cut and shaped by the lapidary to fit the pattern. Toscano (1970:175) explains:

> Las láminas de piedras finas eran raídas con cuchillos y después bruñidas con esmeril, y finalmente montadas y pegadas con goma tzauhtli, y las raen con un pedernal partido; y las ahuecan y hornadan con un tubito de cobre. Después les hacen facetas muy cuidadosamente, las bruñen y les dan lustre. Las pulen montadas en madera, de suerte que se ponen muy brillantes, radiosas, lucientes…

There is little mention of the direct process of sawing in the ethnohistoric literature, but the string-saw was the most probable option as that would produce the thin flat preforms, whereas wedge saws or stone saws would leave a more inverted surface which would not be as flat.

Shaping or abrading would be another option for creating mosaic or bead preforms. Some pyrite artifacts at Cancuen show signs of having been abraded, possibly with a grinding stone, although no definite tools with this quality were found directly associated with the objects. This would have been a laborious process, as pyrite is a very hard mineral itself, 6-6.5 on Moh's scale of hardness. This is probably also how pyrite beads were shaped. Abrasion and sawing could have been aided with fine sands or emery.

Sahagún (1950-1982: Book 11, Chapter 10) describes "flint sand," possibly referring to ground chert:

> It is crushed, pulverized, ground. It is flint. It is fragmented, broken up, fine, much ground, very fine, completely ground, all ground like *pinole*; powdery. It is a medium for cleaning, for polishing, for thinning, for scouring. It is a polisher of things, a smoother of things
>
> I polish something. I smooth something. I dress something.

The use of an abrasive such as this for shaping would be understandable as it would have a hardness of 7, greater than that of pyrite. In describing the activities of the lapidary, Sahagún (1950-1982: Book 11, Chapter 10) refers to abrasion with *teuxalli,* or emery (also called corundum, with a hardness of 8-9):

> It is now called *uei xullli*. [It is of] the mountains, the crags. It is white, yellow, ashen, ruddy, mixed black and green. It is a grinder; it is that which wears away, which thins things. Some are like volcanic rock, rough, fragmented; some are fine, quite minute. They grind, abrade, thin, wear things away.
>
> I treat things with *teoxalli*. I abrade things. I harden.

After cutting and shaping, the pieces must be polished to create the shine and brilliance associated with the finished product. All of the pyrite artifacts recovered from Cancuen are now oxidized and do not retain their original luster, but surely were polished as Sahagún recounts for Aztec lapidaries:

> The Mirror-Stone Seller, the mirror-stone maker [is] a lapidary, a polisher. He abrades (con el instrumento que se llama *teuxalli*); he uses abrasive sand; he cuts; he carves; he uses glue of bat excrement, polishes with a fine cane, makes it shiny. He sells mirror-stones—round, circular; pierced on both sides, [which] can be seen through; two faced, single faced, concave; good mirror-stones, white mirror stones, black mirror stones (Sahagún 1950-1982: Book 10, Chapter 24).

Polishing was most likely accomplished with cane (mentioned above), soft stone powder (like pumice, calcite, or finely ground emery; see Zamora 2002:25), or possibly leather (Aoyama cited in Zamora 2002:24).

If the end product was a pyrite mirror mosaic, the pieces would have been assembled on a mirror back, usually made of ceramic or slate, but possibly also made of wood, especially for the larger mirrors pictured in ceramic scenes of the royal court (although preservation in the Maya world has not permitted the recovery of a wooden mirror back). These backs nearly always have holes drilled in them so that they may be hung as an adornment (usually on the head, chest, belt, or back, as discussed above). Kidder, Jennings, and Shook (1946:126) argue that there is a chronological component to the type of holes drilled in the mirror backs, whether they were holes drilled straight through or with a channel allowing a string to set into the mirror back. It has not yet been determined exactly how the mosaics were affixed to the base. Sahagún's statement above mentions bat excrement, specimens at Aguateca (Zamora 2002:25) and Cancuen retain evidence of stucco. It is possible that other types of natural resin were used as adhesives, more tests must be done in order to determine this.

Pyrite Production at Cancuen

Evidence of pyrite mirror production in Type III and Type IV structures at Cancuen includes raw pyrite nodules, half-finished mosaic pieces, broken mosaic pieces, finished mosaic pieces, and stone and ceramic mirror backs. Nodules and mosaic pieces were identified as pyrite by Duncan Cook with a scanning electron microscope and X-ray diffraction at the Smithsonian Center for Materials Research and Education (SCMRE) (Figure 6.3). Geochemical evidence from structure M6-12 also revealed levels of iron five times higher than normal in a localized spot on the patio/production area. The high iron levels in the floor could possibly relate to pyrite production (Figure 6.4; Kovacevich, Cook, and Beach 2004; see Inomata et al. 2002 for a similar interpretation), supported by the presence of raw pyrite nodules and finished and broken mosaics in midden and floor contexts (Figures 6.5 and 6.6).

All pyrite artifacts at Cancuen were recorded for maximum length (mean 2.25 cm, sd 1.14), width (mean 1.75 cm, sd 9.33), and thickness (mean .55 cm, sd 4.74). The total weight of pyrite artifacts from Cancuen is 11.96 kg, with a mean weight of 12.46 grams with a standard deviation of 70.76. The mean thickness and weight of whole pyrite mosaic pieces (which were found in Types I, II, III, and IV structures) are strikingly similar (see Table 6.1), with the exception of one mosaic found in a Type II structure which was thicker, larger and heavier than any other found at Cancuen (30.61 x 18.37 x 5.33 mm, 9 grams), and was also found just below the surface. Only one mosaic fragment was found in the humus of a Type V structure, and no mosaics were found in Type 0 (undetermined nonelite) structures. What can be seen in the charts is that the most pyrite by far, in mosaic and nodule forms was found in Type III and IV structures.

Pyrite Contexts at Cancuen

One hundred and one pyrite or pyrite related objects were recovered from residential excavations at Cancuen from 1999-2003 (see Tables 6.2 and 6.3). The largest category of pyrite objects were pyrite mosaic pieces or fragments of those mosaics that would have formed mirrors, including 65 pieces in all. Five unfinished mosaics were recovered from a single Type III structure, K6-34 (see Figures 6.1, 6.2, 6.6, 6.9; Barrientos et al. 2000:124-128; Kovacevich 2002). This evidence seems to conclusively demonstrate that the residents of at least this structure were involved in the production of pyrite mosaics. The only two mirror backs, one complete and one fragmentary, were also recovered from this structure on the interior floor of the structure (Figures 6.7 and 6.8). Both of the mirror backs were perforated with two holes near one edge of the object, suggesting that they were made to be worn as adornments. Of the 15 nodules recovered from excavations at Cancuen, four were from Structure K6-34. All of the pyrite artifacts from K6-34 came from floor or wall fall contexts. Also located in the floor context was a string-saw anchor (see Figure 6.6), which was a tool certainly used in the production of jade, but may have also been used to saw off pyrite mosaic pieces before shaping and polishing. A pyrite bead weighing 5.5 grams was also recovered from the interior floor of the structure. The contexts of these artifacts, primarily on interior and exterior floors, suggests again, as with jade working that these artifacts were left in a rapid abandonment of the site as *de facto* refuse, and also possibly represent termination rituals.

The other raw nodules that were recovered were from Type IV structures, K7-24, M10-6, M10-7, M6-12, and two Type 0 structures (undetermined nonelite). One pyrite bead weighing 0.3 grams was recovered from the exterior floor of Type IV structure M10-4, also a floor related to jade production where 8 small jade beads were found embedded in the earth surrounding the patio floor stones. The only pyrite artifacts recovered from burial contexts were 4 dental incrustations in Burial 66 of Type II Structure N11-1 (Figure 6.10; Kovacevich, Quintanilla, and Arriaza 2003), which has also been found for elite burials at sites like Holmul (Merwin and Vaillant 1932:33). No pyrite artifacts were recovered from caches or ceremonial deposits.

Two Type I structures, K8-1 (1 mosaic) and N10-1 (3 mosaics) had finished, complete mosaic pieces recovered in the humus (Figure 6.11 and 6.12), approximately 5 cm below the surface, just above architecture and wall fall. These contexts again may be due to termination rituals of elites or priests ritually destroying objects that hold ceremonial power before abandoning the site (Hendon 2000; see also Mills 2006 for an example from the Southwest). This is a pattern also seen with broken jade artifacts (see Chapter 5). No evidence of raw nodules, or mosaics in the process of production was recovered from any context in Type I and II structures.

Statistical Analyses

In order to investigate the differences between structures, the average thickness of mosaic pieces was used in this case as it was the only pyrite artifact type which occurred across structure types, and it is the thickness that would vary from mirror to mirror as each mosaic piece would have to be the same thickness as each of its counterparts to form the mosaic, but the weight could vary depending on the size of the piece needed in the mosaic. In this case, the null hypotheses will be that there is not a significant difference between mean mosaic thickness between structures. In this case the probability is that the null hypothesis will *not* be rejected, as it seems that all mosaic pieces were actually very close to the same thickness, possibly because residents of structure Types III and IV were producing the mirrors (at least sometimes) for elite residences. Since only one mosaic was recovered from Type II structures, and one fragmentary piece from a Type V structure, they will be included in the general category of “elite” vs. “nonelite” structure types, but will not be compared as discrete entities against the other structure types.

Student’s t-Tests

The first t-Test compared the thickness of pyrite mosaics between “elite” (Types I and II) and “nonelite” (Types III, IV, V) structures. The test shows that we cannot reject the null hypothesis that there is not a significant difference between elite and nonelite structure types as the p-value (p>.05) of the one-tailed test is .26, and .52 for the two-tailed test (Table 6.4). Thus we can say with confidence that there is not a significant difference in pyrite mosaic thickness between elite and nonelite structures.

Again, when testing the difference in mosaic thickness between Types I and III, the null hypothesis cannot be rejected, as p is .33 for the one-tailed test and .65 for the two-tailed test (p>.05). The difference between the means is not significant (Table 6.5).

When testing the difference in means between Type III and IV structures, we find that the p-value (p>.05) for a one tailed test is .48 and .97 for a two-tailed test, so there would only be a 3% chance that there would actually be a difference between the means (Table 6.5).

Testing Type I structures against Type IV structures again does not allow the rejection of the null hypothesis, as the p value is again much greater than .05, .30 for the one-tailed test, and .58 for the two-tailed test (Table 6.7). Therefore we can say with confidence that there is *not* a difference between the mean thickness of pyrite mosaics between structures.

Chi-square Analysis

In this case, the chi-square test was used to look for differences between structures. I used the proportions of whole, finished mosaic pieces to raw nodules in the different structure types. Therefore, the null hypothesis is that proportions of finished products to raw nodules between structures are not significantly different.

In this test the p value ($p<.05$) is .01, allowing us to reject the null hypothesis with 99% confidence and say that there is a very strong difference between proportions of raw nodules to finished mosaics between structure types (Table 6.8).

Discussion

The mean thickness of pyrite mosaic pieces (which were found in Types I, II, III, IV, and V structures) do not differ significantly, with the exception of one mosaic found in a Type II structure, although one mosaic piece from a Type III structure did have a thickness of 10.2, suggesting that bigger mosaics were manufactured. This does not necessarily suggest that there were different industries creating larger or more elaborate mirrors for elites, as the thickness of mosaics in Type I structures were comparable to those from Types III and IV. No whole pyrite mosaics were recovered from the smallest mounds with the least amount of investment in labor, Types 0 or V (one fragment was found on the surface of a Type V structure). The most pyrite by far, in mosaic and nodule form, was found in Type III and IV structures. No raw nodules were recovered from Type I or II structures, although loose mosaics were recovered.

This evidence contrasts with that found at Aguateca where there was elite production of pyrite mosaics (Inomata and Triadan 2000; Zamora 2002). Although, if elites were producing mirrors, we would expect some production debris, abandoned mosaics in the process of production, and/or tools in middens or other contexts if elites were producing mirrors at Cancuen. No raw nodules, half-finished mosaics, or string-saw anchors were encountered in Type I or II structures. It should be noted that the only pyrite found in a burial or tomb at Cancuen to date was from the four dental incrustations of Burial 66 in a Type II structure, N11-1 (Kovacevich, Quintanilla, and Arriaza 2003).

The question that follows is whether the residents of Type III and IV structures were producing mirrors for elites, or the residents of Type I and II structures. I cannot deny the possibility that Type III and IV residents were producing mirrors for household use, domestic ritual, divination, etc. Recent research has emphasized the overlooked aspect of nonelite domestic ritual in Maya archaeology (Gonlin and Lohse 2007; Robin 2003). A domestic use of mirrors in these structures would support an enhanced status for the residents, for as was discussed above, the context and use of pyrite mirrors in the ancient Maya world was almost exclusively in the elite domain. This status may have resulted from the production for exchange or tribute of other important items, as in at least two cases, Type IV Structures M10-4 and M6-12, raw pyrite and possible production was associated with jade production.

It seems that nonelites produced mirrors (at least sometimes) for elites. First, the lack of production evidence in Type I and II structures, but the presence of mosaics, albeit single mosaics separated from a mirror back, suggests that they owned them, but did not produce them. Secondly, the size, thickness, and weight of the mosaics did not differ significantly between house types. The presence of pyrite in a Type II structure suggests that it was valued by elites (a similar finding of pyrite dental incrustations was recovered from Tomb 5 of *K'inich Yo'nal Ahk II* of Piedras Negras [see W. Coe 1959 and Sharer and Traxler 2006:426]). The fact that two mirror backs were recovered from one Type III structure, K6-34, one of fragmentary slate and one whole ceramic back suggests production for tribute or exchange. Two mirrors present in a single small structure would seem to represent something above that needed for household use (although no real precedent exists). The contexts of these mirror backs, as well as the raw nodules and mosaics in Type III and IV structures also suggests production, as they often were recovered from floors and middens, rather than caches or burials. They were also not carried away as treasured valuables or heirlooms as the site was abandoned.

The production of pyrite alongside that of jade would also make sense, as many of the lapidary techniques described in ethnohistoric sources for the production of mirrors were very similar to the early stages of jade production (discussed in Chapter 5). If elites were levying tribute in the form of unfinished jade plaque or earflare blanks from these residents, it would be easy to add pyrite production to these requests, as it would require nearly identical knowledge, skills, and tools.

I am not discounting the possibility that these mirrors could have been produced for domestic use and ritual, but the evidence from many other Maya sites (although cf. Gonlin 1997; Webster and Gonlin 1988), and the evidence at Cancuen suggests that this may not have been the case. Combined with evidence of jade production and use, data suggest that certain objects were restricted to elite use, and mirrors may have been one of them, especially because the ritual knowledge used to conjure, divine, and/or impersonate gods may have been the sole property of a certain elite group in the society, or even the ruler himself. This is not to say that prestige and status was not accorded to these producers, as they themselves were part of the creative process, which itself was divine (see Hruby 2006; Reents-Budet 1998).

Although they did not live in masonry structures with high investment in construction, or were not located in the epicenter of Cancuen, their burials did have signs of higher prestige and status when compared with other households, including a warrior figurine recovered with a burial from Type III Structure K6-34 (Figure 6.13) and Chablekal Fine Gray from Type IV Structures M10-7 and M10-4 (see Figures 5.11 and 5.12). The resident of K6-34 may have been a warrior and an artisan, he may have owned a pyrite mosaic mirror because of his warrior status (as noted above, pyrite mirrors are often associated with warfare [see Taube 1992b]), but he probably also produced pyrite mirrors for the elite residents of Types I and II structures.

Conclusions

Until recently, pyrite has received relatively little attention when compared to other "prestige" or ritual items and has been assumed by many to be an elite good. Contextual evidence across many ancient Maya sites largely supported this assumption, although recently some scholars have found that "mirror stones" or mirrors may have been used in nonelite domestic ritual (Gonlin 2007; Webster and Gonlin 1988). Evidence at Cancuen suggests that nonelites *could* have used mirrors in domestic ritual, but the possibility still exists that they produced the mirrors for elites who had the esoteric knowledge and social right to use them in divination rituals. At the very least, it does appear that residents of Type III and IV structures produced mirrors for residents of Type I and II structures, even if they did use them themselves.

Nevertheless, the status of mirror producers evidenced in artifact assemblage does appear to be relatively higher than some, but without many of the hallmarks of elite culture. None of the mirror producers in Types III and IV structures had masonry construction of their dwellings, tomb or cyst style burials, or certain jade artifacts such as carved plaques or earflares. Thus the material culture suggests different social identities for the producers and consumers of pyrite mirrors. Some prestigious artifacts, such as figurines and imported ceramics suggest that there was some honor and social reward in the form of cultural capital associated with production of these artifacts. Elites derived power from the possession, use, and probably distribution of pyrite mirrors, which represented divinity, royalty, ritual power, and creative power. Producers of these mirrors may have also been able to co-opt some of this power. They may have been able to use mirrors in their own domestic rituals, or at least identify themselves with the creation of a powerful object, linking themselves to the divine act of creation.

Figure 6.1. Raw pyrite nodules recovered from Structure K6-34 (Type III; photo by author).

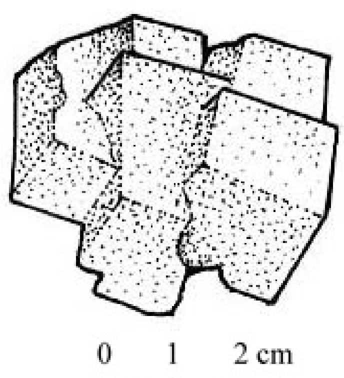
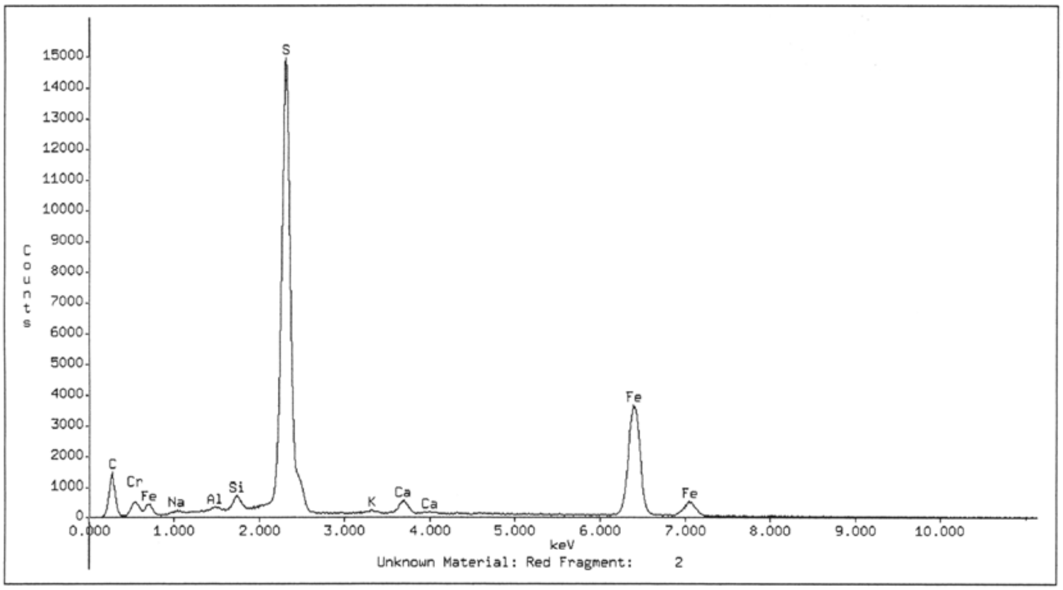


Figure 6.2. Drawing of pyrite nodule from Structure K6-34 showing the cubic form (drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).



Unknown Material: Red Fragment: 2

Accelerating Voltage: 20KeV   Take Off Angle: 58.3506°   Live Time: 120 seconds   Dead Time: 42.404 seconds

Figure 6.3. Results of Scanning Electron Microscope analysis of a mosaic fragment, identification as Iron Pyrite (FeS_2) (Chart by Duncan Cook).

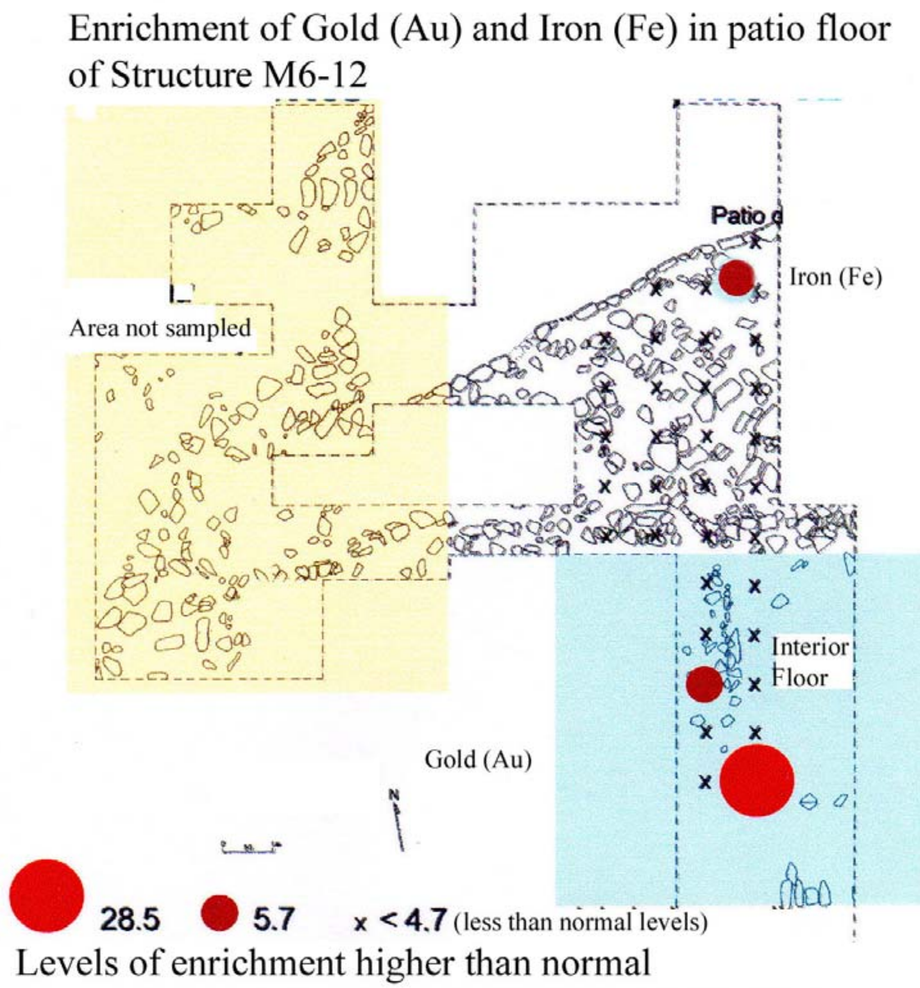


Figure 6.4. Enrichment of Gold (Au) and Iron (Fe) across the exterior patio floor of Structure M6-12, enrichment measures are expressed as the measured concentration relative to the mean background concentration (+SD) for the site (from Kovacevich et al. 2003; see also Cook et al. 2006).

Figure 6.5. Sample of raw pyrite nodules and mosaics from Structure M6-12 (photo by author).

Figure 6.6. Plan view of Structure K6-34 (Type III) showing the location of the string saw anchor (drawing by Luis Fernando Luin) and a photo of the string saw anchor recovered (not to scale; photo by Andrew Demarest; Used with permission of the Cancuen Archaeological Project).

Figure 6.7. Photo of mirror back recovered from interior floor of Structure K6-34 (not to scale; photo by Andrew Demarest; Used with permission of the Cancuen Archaeological Project).

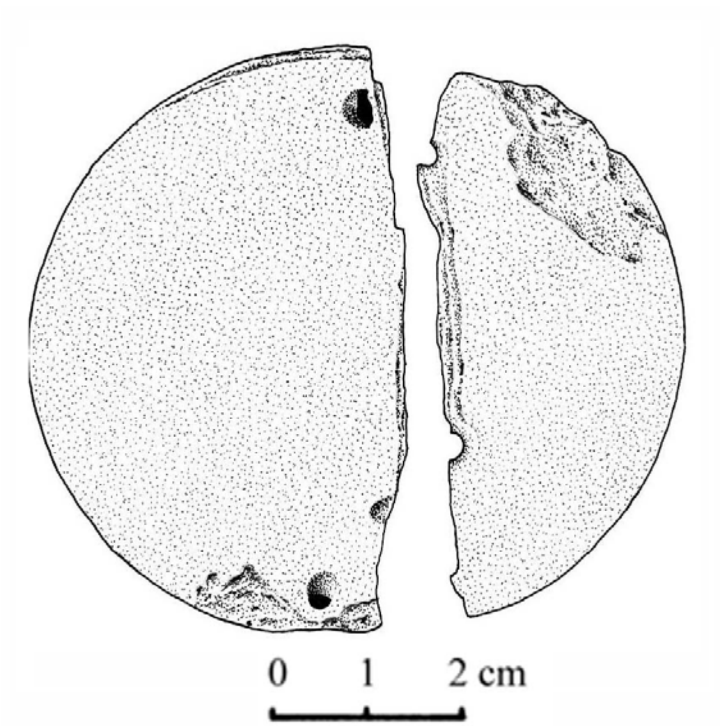


Figure 6.8. Drawing of mirror back recovered from Structure K6-34 (Type III; drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

Figure 6.9. Mosaics (finished, broken, and unfinished) recovered from Structure K6-34 (not to scale; photo by Andrew Demarest; Used with permission of the Cancuen Archaeological Project).

Figure 6.10. Jade and pyrite inlayed teeth, Burial 66, Structure N11-1 (Type II; photo by author).

Figure 6.11. Pyrite mosaics recovered from Structure N10-1 (Type I; photo by author).

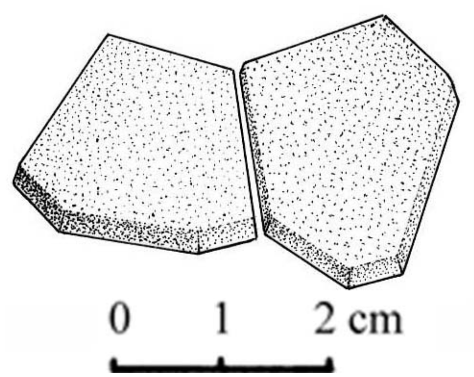


Figure 6.12. Drawing of finished pyrite mosaic from Structure N10-1 (drawing by Luis Fernando Luin).

Table 6.1. Mean length, width, thickness and weight for finished mosaics in each structure type.

Pyrite Mosaic Size	*Mean Length*	*Mean Width*	*Mean Thickness*	*Mean Weight*
Type 1 n=4	22.02	17.46	2.66	3.5
Type 2 n=1	30.61	18.37	5.33	9
Type 3 n=12	17.56	14.2	2.79	2.02
Type 4 n=11	20.72	16.61	2.78	3.56
Type 5	0	0	0	0
Type 0	0	0	0	0

Table 6.2. Distributions of pyrite artifacts per structure including totals.

Pyrite Artifacts	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***Totals***
Nodule	0	0	4	8	0	5	**17**
Mosaic (finished)	4	1	12	11	0	0	**28**
Mosaic (unfinished)	0	0	5	0	0	0	**5**
Mosaic (fragment)	0	0	16	15	1	0	**32**
Mirror back (fragment)	0	0	13	0	0	0	**13**
Bead	0	0	1	1	0	0	**2**
Dental Inlay	0	4	0	0	0	0	**4**
Totals	**4**	**5**	**51**	**35**	**1**	**5**	**101**

Table 6.3. Contexts of pyrite artifacts by structure type including totals.

Pyrite Contexts	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***Totals***
humus	4	0	1	7	1	5	**18**
fill	0	1	0	6	0	0	**7**
wall fall	0	0	23	0	0	0	**23**
floor (interior)	0	0	13	2	0	0	**15**
floor (exterior)	0	0	12	10	0	0	**22**
midden	0	0	2	10	0	0	**12**
burial	0	4	0	0	0	0	**4**
Totals	**4**	**5**	**51**	**35**	**1**	**5**	**101**

Table 6.4. T-Test of mean thickness of pyrite mosaics between "elite" and "nonelite" structures. Null hypothesis: There is no significant difference in mean pyrite mosaic thickness between elite (Types I and II) and nonelite (Types III, IV, V, and 0).

t-Test: Two-Sample Assuming Unequal Variances

Thickness of Pyrite Mosaics

	"Elite"	*"Nonelite"*
Mean	3.19	2.788333
Variance	1.54645	1.094994
Observations	5	60
Hypothesized Mean Difference	0	
df	4	
t Stat	0.701833	
P(T<=t) one-tail	0.260736	
t Critical one-tail	2.131846	
P(T<=t) two-tail	0.521471	
t Critical two-tail	2.776451	

Table 6.5. T-Test of mean thickness of pyrite mosaics between Type I and Type III structures. Null hypothesis: There is no significant difference in mean pyrite mosaic thickness between Type I and Type III structures.

t-Test: Two-Sample Assuming Unequal Variances

Pyrite Mosaic Thickness

	Type 1	*Type 3*
Mean	2.655	2.791714
Variance	0.153767	1.778556
Observations	4	35
Hypothesized Mean Difference	0	
df	14	
t Stat	-0.45761	
P(T<=t) one-tail	0.327128	
t Critical one-tail	1.761309	
P(T<=t) two-tail	0.654257	
t Critical two-tail	2.144789	

Table 6.6. T-Test of mean thickness of pyrite mosaics between Type III and Type IV structures. Null hypothesis: There is no significant difference in mean pyrite mosaic thickness between Type III and Type IV structures.

t-Test: Two-Sample Assuming Unequal Variances

Pyrite Mosaic Thickness

	Type 3	*Type 4*
Mean	2.7917143	2.7836
Variance	1.7785558	0.172199
Observations	35	25
Hypothesized Mean Difference	0	
df	43	
t Stat	0.0337791	
P(T<=t) one-tail	0.4866048	
t Critical one-tail	1.6810714	
P(T<=t) two-tail	0.9732096	
t Critical two-tail	2.0166908	

Table 6.7. T-Test of mean thickness of pyrite mosaics between Type I and Type IV structures. Null hypothesis: There is no significant difference in mean pyrite mosaic thickness between Type I and Type IV structures.

t-Test: Two-Sample Assuming Unequal Variances

Pyrite Mosaic Thickness

	Type 1	*Type 4*
Mean	2.655	2.7836
Variance	0.15376667	0.172199
Observations	4	25
Hypothesized Mean Difference	0	
df	4	
t Stat	-0.604018	
P(T<=t) one-tail	0.28920754	
t Critical one-tail	2.13184649	
P(T<=t) two-tail	0.57841507	
t Critical two-tail	2.77645086	

Table 6.8. Chi-square analysis of proportions of raw pyrite to finished mosaics between all structure types. Null hypothesis: Proportions of raw pyrite to finished mosaics are independent of structure type.

Contingency Table			
	Raw Nodules	*Finished Mosaics*	TOTAL
Type 1	0	4	4
Type 2	0	1	1
Type 3	4	12	16
Type 4	8	11	19
Type 5	5	0	5
TOTAL	17	28	45
chi-squared Stat			12.5337
df			4
p-value			0.0138
chi-squared Critical			9.4877

CHAPTER VII

OBSIDIAN

> [T]he small obsidian blades found throughout the region are called *u kach Lac Mam* in modern Chol. This phrase translates as “the fingernails of the Lightning Bolt.”
>
> Schele and Freidel 1990:463

Introduction

The study of obsidian at the site of Cancuen was not focused on defining it as a “utilitarian” or banal resource, as there were many ritual and status functions related to obsidian objects, even simple blades. The nature of obsidian made it the sharpest and most effective cutting instrument available to the Classic Maya. Obsidian was always an exotic resource when it was found outside of the highlands, although it may not have been restricted in distribution as were other items such as jade. Obsidian was used in ritual bloodletting and scarification from the most elite to the household level.

The initial goals of this obsidian analysis were to determine if elites controlled the import of obsidian to Cancuen, and if elites had more access to various exotic obsidian sources due to their social and symbolic capital. Obsidian again could have served as an allocative *and* authoritative resource for the elite of Cancuen. Controlling import and redistribution of the valued good could have been a solid basis for power, and the ideological foundations and uses for obsidian would have added to that “utilitarian” value. After final analysis, it seemed apparent that elites did not control the import or redistribution of obsidian, and did not have more trade connections than others at the site. Obsidian technology and sources were fairly evenly distributed throughout the site.

Nevertheless, elites did appear to have had more access to obsidian, attesting to and reinforcing their privileged role within the society.

What is Obsidian?

Obsidian is silicon dioxide (SiO_2), a glassy rock produced by a volcanic lava flow that cools so quickly that crystals do not have time to form in the rock. It is not classified as a mineral because it lacks the crystalline structure to be included in that category (sometimes called a mineraloid). Obsidian has the same composition as rhyolite, the volcanic equivalent of granite (which cools much more slowly under the earth to allow the formation of crystals). The lack of crystalline structure makes it perfect for the production of stone tools. The color of obsidian results from the oxidation of various tiny minerals present within the rock. The black color results largely from the presence of magnetite (Fe_3O_4), which when highly oxidized may contain hematite and have reddish streaks or a reddish, brownish hue. The presence of iron can cause somewhat of a greenish hue (Pachuca being the most well-known green obsidian source in Mesoamerica). The presence of iron and magnesium and can range from gray to black and includes greenish and brownish varieties. It can be opaque or translucent, dull or shiny. It can be banded because of folding of the flow as the lava moves and contain particulate inclusions and/or air bubbles. These characteristics are often particular to one source, often allowing visual attribution to a specific source, but one source can often have much variation causing confusion (see below). For this reason it is good to back up visual identification with chemical compositional sourcing, and trace elements specific to each lava flow make this sourcing possible. Obsidian can be confused with Smoky

Quartz, but obsidian has a hardness of 5-5.5, much less than that of quartz (7), and a specific gravity of 2.6. In comparison to quartz, it also has no crystal structure, or is amorphous. The fracture of obsidian is conchoidial (curved), which means that it creates a very predictable fracture plane depending on the type and force of strike and tool used, versus a break along a natural fracture plane of the rock with crystalline structure, which can be exploited by a skilled craftsmen to make tools or blades. The curved conchoidial fracture often produces undulations that resemble the seashell (Greek, *conchoid*), and hence the name. At the point of force there is a bulb of percussion and small fissures or cracks emanating from the blow. As it is essentially glass, the cutting edge is extremely sharp (sharper than that of steel) and could even be used in daily activities such as shaving. The glass-like nature of the obsidian also makes the fracture during the blow brittle, instead of plastic, which allows the retention of the form at the break, resulting in the predictability of the fracture. The conchoidial fracture is part of the *Hertzian cone* that forms at the point of force in an amorphous, brittle material, which can also be seen in our everyday lives when objects like a BB strike a window or a small rock hitting a windshield. The flake removed from a core forms half of a Hertzian cone (see also Whittaker 1994 for additional explanation).

Obsidian can be found as nodules, massive layers between other volcanic rocks, or exposed flows. Because it is a volcanic rock resulting from lava flow, the only sources of obsidian are in areas favorable to volcanic activity due to plate tectonics. The highlands of Guatemala and Mexico are two such areas. It typically forms near the end of the volcanic cycle and is often associated with volcanic domes. One of the most famous and easily identifiable sources in Mesoamerica is the green obsidian from the

Mexican source of Pachuca, used by the Maya mostly during the Early Classic and Postclassic. El Chayal is located on the upland flanks of the Motagua Valley, just outside of modern Guatemala City located 20 km to the northeast, Ixtepeque is 85 km to the southeast, and San Martin Jilotepeque located 32 km west of Guatemala City (Figures 7.1 and 7.2).

The Social and Ritual Significance of Obsidian

As seen in the opening quotation, obsidian in some modern Maya and certainly ancient Maya cultures was seen as associated with lightning strikes (Schele and Freidel 1990:463), and Chac and Tlaloc, as rain gods associated with lightning were associated with the creation of this material (as well as flint or chert; see Miller and Taube 1993:88).

As noted in the previous chapter, obsidian was an important stone used in the creation of mirrors, probably of the sacred, divinatory type, rather than the banal, utilitarian type. I have already discussed the association of obsidian mirrors and divination with ancient Mesoamerican gods such as Tezcatlipoca of the Aztecs and God K of the Maya (see Chapter 6). Miller and Taube (1993:125) also note that obsidian served as a divinatory device for the sixteenth century Cakchiquel Maya. The stone (the *Chay Abah*) had oracular properties and spoke to the Maya, the authors suggest its relation to Classic and Postclassic period mirror stones.

The relation of obsidian with mirrors probably also extends to its use as the eyes of figures, masks, and portraits. Taube (1992b) has already noted the association of eyes with mirrors at Teotihuacan, and it is certain that this metaphor of “seeing” and eyes as pathways to the soul and to the Otherworld were present for the Classic Maya as the use of obsidian as inlays for eyes was also frequent.

If there were errors or breakages during the production of obsidian blades, this would be ascribed to inadequate fasting or praying, as described by Montolinía:

> [Then] came the master craftsmen who detached the knives, they also had fasted and prayed, and they detached many knives with which the tongues had to be opened, and as they kept detaching them they kept placing them on a clean mantle. And if one should break while being detached, they said that they had not fasted properly (cited in Kidder, Jennings, and Shook 1946:135; see also Clark 1989a:305).

Clark (1989a, 1991) acknowledges that this type of prayer and fasting may not have been a part of every knapper's practice, especially the type of production that would occur on demand in a market type setting, but he does note that from his own research with the modern Lacondon Maya, they feel that knapping should be done on an empty stomach or the blades will break, they do chant to the flint before knapping, and before knapping became commercialized because of tourism, all knapping was done in the "god house" or the central temple of the village, away from women and children who could not watch the process.

Sahagún (1950-1982: Book 10, Chapter 24) describes obsidian merchants as selling several different varieties of obsidian, based on the color:

> The name of one is black obsidian. The name of one is white obsidian. It is not very black; it is somewhat white; its thin places are where it appears white; like rock crystal. A yellow one named *itzcuiniztli* is as if tawny-striped. The name of one is green obsidian; it is somewhat blue.

Clark (1989b:306-307) attributes these to possible or probable local sources such as Otumba or Parédon for the "white" which is probably translucent light gray, Pachuca for the "green" or "blue," "yellow" may refer to an outcrop of speckled, brownish-orange obsidian from the Otumba source. Clark suggests that the “black” obsidian, which probably refers to an opaque variety, may come from Pizarrín, the only source with opaque black obsidian that may have been close enough and not in hostile territory. Clark (1989b:308) further notes that other types of obsidian came in as tribute, the bulk of which was probably prefabricated weaponry or used for weaponry after it arrived and not generally used in market exchange.

Sahagún describes the profession of the *pochteca* merchant-traders of the Aztec Empire, they carried certain goods for the state, as well as certain goods which were not state controlled that they could trade on their own. Obsidian was among those items that were not state controlled:

> And the things used by the common folk were obsidian ear plugs, [or] tin, obsidian razors with leather handles, and pointed obsidian blades, and rabbit fur, and needles for sewing, and shells. All these were prepared as goods exclusively of the merchants, the vanguard merchants, the reconnoiterers, the outpost merchants (Sahagún 1950-1982: Book 9, Chapter 2).

As part of the rituals merchant traders undertook as part of their journeys, Sahagún recounts:

> And when it was done, when all their offerings were arranged together in the middle of the courtyard, thereupon they entered their home [and] stood before the fire. There they beheaded a quail [to honor the fire]. When they had beheaded it, thereupon, with pointed obsidian blades, they pierced their ears, or they pierced their tongues. When the blood already flowed, they took it with their hands [and] said, “Teonappa,” when they cast it into the fire. There upon they spattered the papers with it (Sahagún 1950-1982: Book 9, Chapter 3).

Here we can see that the Empire was not interested in direct control of obsidian, and also the juxtaposition of banal and ritual uses for obsidian blades. Therefore, the classification of blades, even in domestic contexts, as purely utilitarian artifacts is surely questionable at best. As Clark (1989a) mentions, the ethnohistoric sources focus more on the esoteric and ceremonial uses of blades vs. the banal and mundane everyday functions, whereas things such as shaving with obsidian blades may have received undue attention because of sheer fascination with the practice.

Karl Taube (1991) studied representations of obsidian blades and polyhedral cores in the art and writing of ancient Mexico. He found that the use of obsidian was depicted in both ritual and everyday life. The phonetic value of obsidian in Nahuatl was *itz*, and it was often depicted as attached to weapons, such as the blade studded club, the *macuahuitl*, but Taube concludes that there is not much evidence, in either art or archaeology, for the use of these weapons in earlier periods. He argues that the primary form of use for obsidian blades was as a hand held instrument, especially for use in everyday life, as in hair cutting, shaving, and cooking activities.

Thus, obsidian had somewhat of a different role in Classic Maya society than the two previously discussed mediums of jade and pyrite. Obsidian did have important ritual and ideological functions within the society, but it also served more banal purposes (in the modern sense of the term), although the Classic Maya probably did not make these distinctions. Connections that may be made from the Aztec Empire to the Classic Maya period seem to be that the state was not as interested in controlling the trade, production, and distribution of obsidian as it was in other prestige, status, and ritual objects. At the same time, obsidian could represent an allocative and authoritative resource in some cases. The use of obsidian in rituals (i.e., divination and bloodletting) and the gifting by elites of special obsidians, such as green obsidian (see Spence 1996; certainly also significant for its color; see also Chapter 5) was significant. It added to the resource and power base of elites, as well as other social groups, who could also participate in domestic ritual.

Obsidian Production

Production of obsidian tools in ancient Mesoamerica took three primary forms, prismatic blade production from polyhedral cores, expedient tool production, and biface production. Core/blade technology and biface production both had complex manufacturing sequences and required a much greater degree of skill than expedient tool production.

Core/Blade Technology

The production of prismatic blades is the most common and most discussed technique in the literature (e.g., Clark and Bryant 1997; Crabtee 1968; Gaxiola and Clark 1989, eds.; Hirth 2003, ed.; Hirth and Andrews 2000 eds.; Sheets 1975). Prismatic blade production involves several techniques (involving differences in tools used, force applied, direction of blow, and length of time involved in applied force) before the desired end product is achieved, each stage leaving distinctive features on the artifact or debitage, facilitating the use of a behavioral (Sheets 1975) or technological (Clark 1988, 1997; Clark and Bryant 1997) typologies. This technology is very complex and can be said to involve considerable skill (e.g., Clark 1986)

The first step in prismatic blade production (Figure 7.3) involves the preparation of the core. A large flake must initially be removed to prepare a platform for the removal of flakes and blades. Then initial large flakes are removed by hard hammer percussion to remove any cortex or imperfection from the raw nodule (decortication flakes and also macroflakes; Figure 7.5a). At that point, the core is ready for blade removal (a blade being a double-edged artifact that is twice as long as it is wide), but the blades at this point are often very large and still removed by hard hammer percussion (macroblades > 2.5 cm in width, and small percussion blades < 2.5 cm, as per Clark 1988; Figure 7.5 b and c). After the removal of percussion blades the core has become a polyhedral core and has ridges that allow for blades to follow as they are removed by pressure flaking. These initial pressure blades retain scars on the dorsal surface of the removal of percussion blades which have larger bulbs of percussion and are often larger and more irregular than later blades. These were identified in this study as initial series blades (as per Clark 1988; Clark and Bryant 1997; Figure 7.6a). The blades following these do not have percussion scars on the dorsal surface, are smaller and thinner in width and more regular in form, called here final series blades (Figure 7.6b and c). Clark (1988) distinguishes between first, second, and final series blades, but we found this to be difficult for our study and not particularly necessary for the obsidian from general excavations that did not need to be refitted to a specific core (i.e., Clark and Bryant 1997).

The technique for the pressure removal of blades has been debated (cf. Clark 1982; Crabtree 1968). Clark (see 1988) argues that ethnohistoric accounts suggest that the knapper secured the core with bare feet while sitting down and pressed off blades with the use of a wooden crutch, a technique which he successfully replicated. Sahagún also describes those who sold obsidian in the markets as the ones who also produced the blades on demand:

The Obsidian Seller (*Itznamacac)*

> The obsidian seller is one who, [with] a staff with a crosspiece, forces off [blades; he is] one who force of [blades] (*itzli*). He forces off obsidian blades, he breaks off flakes. He sells obsidian, obsidian razors, blades, single-edged knives, double-edged knives, unworked obsidian, scraping stones, V-shaped [pieces]. He sells white obsidian, clear blue obsidian, yellow obsidian, tawny obsidian, obsidian chips (Sahagún1950-1982: Book 10, Chapter 24).

The tools of the obsidian knapper are also depicted in ethnohistoric sources (Figure 7.8). It is certain that some type of implement was used to press off blades and this technique has been successfully replicated by many knappers. Montolinia (cited in Hester et al. 1971:69) also describes the process:

> It is in this manner: First they get out a knife stone (obsidian core) which is black like jet and 20 cm or slightly less in length, and they make it cylindrical and as thick as the calf of the leg, and they place the stone between the feet, and with a stick apply force to the edges of the stone, and at every push they give a little knife springs off with its edges like those of a razor.

There are also numerous other types of debitage that may result from the production of prismatic blades, especially different types of flakes that result from error recovery and also extending the life of the core. These types of debitage can also be used to calculate error rates and infer the skill of the knapper (see Clark 1997; Sheets 1978, 1991). Platform rejuvenation flakes were sometimes used to remove errors or also to renew the platform surface and allow for further removal of blades (Figure 7.9b and c). Distal rejuvenation flakes often remove errors such as hinges or step fractures and can also sometimes provide a new platform for the removal of blades (Figure 7.10a). Lateral rejuvenation flakes remove errors from the side of the core; the main indicator of this type of error recovery can result in a crested blade which retains the marks of the lateral flake removal on its dorsal surface (Figure 7.11). Once all possible blades have been removed, the polyhedral core is “exhausted,” but often times the knapper will continue to try to remove material with bipolar force (the use of an anvil and a heavy blow from above that leave distinct fracture patterns, see below and Figure 7.12), and sometimes compounded errors will prematurely end the life of a core.

Expedient Technology

This type of obsidian tool production produces expedient informal tools, such as flakes informally knocked off of a spall or small core. Sometimes bipolar technology can be used in these cases (Figure 7.13), where a core is place on an anvil and struck from above to remove a flake, leaving distinctive converging undulations on the ventral surface of the flake. Expedient technology is often used in places were access to obsidian is abundant and are sometimes close to a source, as at most lowland Maya sites, cores came in already reduced to the polyhedral stage, so there was not much opportunity for expedient production. Examples of this come from areas like the La Entrada region of Honduras, where finer Ixtepeque obsidian was used to produce prismatic blades, whereas lower quality nodules of closer regional sources were used for expedient tools (Aoyama 1996), and Paso de la Amada, Chiapas where expedient flake technology existed alongside core/blade technology (Clark and Lee 1979; see also Hay 1978; Sheets 1983). Expedient obsidian technology was not present to a great extent at Cancuen, and when bipolar cores or flakes were found, they were usually products of the reduction of exhausted polyhedral cores attempting to utilize all material possible, although some small nodules and pebbles of obsidian did reach Cancuen.

Bifacial Technology

Bifacial technology also usually makes up a small percentage of the obsidian artifact assemblage at many sites when compared to prismatic blade technology (although see Aoyama 2005). Obsidian bifaces are often manufactured from large flakes and macroblades resulting from polyhedral core production, but may also be reduced from a core or nodule. Many sites do not receive macrocores or polyhedral cores large enough to produce a blade or flake that would be suitable for biface production. Bifaces are mainly reserved for chert artifacts, but do often show up as obsidian knives, spearpoints, dartpoints, etc. It can be argued for some sites that these bifaces were imported as finished products, especially if there is no debitage associated with their production. The flakes produced by soft-hammer production, which is often used in bifacial reduction, are very distinctive (Figure 7.14) and their presence would signal on site production (or at least rejuvenation). This technology was also used to make obsidian eccentrics, elaborate ritual representations including ancestor silhouettes, scorpions, caterpillars, and many others (e.g., Hruby 2006), although obsidian eccentrics were not recovered at Cancuen.

Results of Sourcing Analysis at Cancuen

Analysis of obsidian artifacts from excavations in 1999-2003 at Cancuen was completed in 2003 with the aid of Margarita Cossich and Paola Duarte of Universidad San Carlos in Guatemala (as well as advice and help from Edgar Carpio). A large part of the analysis was identification of source, which provides information about trade routes, access to raw materials, and how these activities correlate to status and change through time related to political and economic changes. Our initial hypotheses were that we may find significant differences in source between elite and nonelite households, with possible increasing heterogeneity as the site reached abandonment. While visual analysis of Mesoamerican gray obsidian has been critiqued as highly inaccurate (Moholy-Nagy and Nelson 1990), Braswell and colleagues (2000) have noted that a skilled analyst can visually identify obsidian sources with high accuracy. We do not purport to have the skills and experience of the authors of those articles, but since chemical analysis of all samples is impossible, we were forced to visually identify most samples.

In order to aid us in this endeavor, Fred Nelson of Brigham Young University offered to help us create a type collection with sourced samples by X-Ray Fluorescence (XRF) (Table 7.1). Ten samples were submitted to this procedure, all of which confirmed our visual identification, except for one, Sample 4, which we believed to be from San Martin Jilotepeque. This sample actually ended up as unidentified, which Fred Nelson assured me is extremely unusual since the lab has source samples from all known sources in Guatemala and Mexico. Half of each blade was kept to serve as a visual reference for future comparison.

Our initial ten samples were chosen as typical and anomalous visual examples of the several sources present at Cancuen. The obsidian from Cancuen was initially divided into 11 groups based on visual similarities, some being completely made up of one source, while the variation within some sources caused us to separate it into multiple groups (especially to help familiarize ourselves with the appearance of different sources at Cancuen). One sample from each of these groups was submitted to XRF, with the exception of green obsidian from Pachuca, which is more easily visually identifiable (Moholy-Nagy and Nelson 1990). Four main groups emerged from the XRF: El Chayal, Ixtepeque, San Martin

Jilotepeque, and Zaragoza. Pachuca was the fifth and much smaller source represented, which was not tested. A very small number of samples from Cancuen were also visually identified as from the source San Bartolome Milpas Altas (based on the experience of Cossich and Duarte), located near modern day Antigua, Guatemala in the department of Sacatepequez. However, since none of the samples correlated with this source in the XRF testing, it is questionable whether artifacts from this source were present at Cancuen. The source groups from Cancuen will be discussed below (see Figure 7.1 for approximate source locations). Tables 7.2 and 7.3 record the artifacts attributed to a source listed by structure type, along with relative percentages of the total obsidian assemblage for each structure type. Of the total obsidian at the site 2.54% could not be securely attributed to a source and was not included in these numbers.

El Chayal

El Chayal makes up the largest represented source at Cancuen with 86.6% of the total obsidian at the site, and this is also the source with the most variety in appearance. The largest variety of this source appears to be grayish, with milky or cloudy inclusions and/or white or milky striations, with a general dull finish. Other varieties include a shiner look with wispy, feather like dark black inclusions, and a transparent gray shiny appearance with or without black particulate inclusions and possible gray or black striations. One variety resembles San Martin Jilotepeque, with numerous black particulate inclusions, but is generally distinguished from San Martin by the amount of particulate inclusions and the texture, which is smoother in the case of El Chayal, and very rough or even sticky looking in the case of San Martin. San Martin was also generally blacker than El Chayal and also sometimes had a brownish tinge.

Ixtepeque

This is the second largest source group at Cancuen with 6.23% of the total obsidian artifacts, but it is still greatly overshadowed by the presence of El Chayal. Visually, obsidian from Ixtepeque was identified by a very shiny, transparent and very smooth texture, with a brownish gray color. Samples could contain (but did not have to) striations of white milky color to grayish. Samples also often contained small white inclusions or imperfections that looked like bubbles. In all, this source was easily identifiable and probably not confused with other sources, with the possibility of San Bartolome Milpas Altas, but since it is inconclusive that the ancient residents of Cancuen used this source it is unlikely.

San Martin Jilotepeque

This source was not well represented at Cancuen, making up only 1.41% of the total obsidian at Cancuen. This source was argued by Nelson and Clark (2000) and others (Ford et al. 1997) to have been used primarily during the Preclassic periods and diminishing through the Early and Late Classic in the Maya Lowlands. Since the habitation of Cancuen was largely during the Late Classic (all of the epicenter and most of the housemounds), this could explain the low amount of obsidian from San Martin Jilotepeque. The obsidian from this source was characterized by a very rough surface, almost appearing grainy or sticky looking. It was usually transparent but had a very high percentage of very dark black particulate inclusions. It was often more black than El Chayal, which was more grayish, but could have been confused at times with El Chayal. If we did misidentify some El Chayal and San Martin Jiloteqeque, the percentage could not have been great enough to significantly change the amount of San Martin at the site as the amount is overall very low and the variety of El Chayal that resembles San Martin was not extremely large.

Zaragoza

Obsidian from this Mexican source made up .72% of the total obsidian at Cancuen. This source was easily visually identified due to its dark black opaque appearance. We found that the obsidian could have a shiny surface finish or could be a bit more dull. It also could be that transparent parts could be seen on the very edge of blades or it could be completely opaque. Some obsidian from this source can also have a dark gray opaque appearance, as did Sample # 3 of our study. Our visual identifications of source variation were confirmed by the XRF. While the overall percentage of Zaragoza obsidian at the site was low, the percentage of Zaragoza obsidian in each household was fairly homogenous, across all structure types, suggesting that each household had access to some obsidian imported from long-distances. Nearly every operation or household had a few blades of Zaragoza obsidian

Pachuca

Pachuca obsidian was extremely rare at Cancuen, making up only 0.1% of the entire assemblage. The contexts of the obsidian were strictly limited to very near to surface finds between 0-20 cm and in Type II structures (operations 19A and 25A, grid squares K8 and M9). It is highly probably that this obsidian is related to Postclassic squatting, as some Postclassic ceramics were also found in the same contexts in CAN 25A (Bill, Callaghan, and Castellanos 2003).

San Bartolome Milpas Altas

The presence of this source was not easily identified, it possibly made up 0.06% of the total obsidian at the site, but with the questionably attributed artifacts (0.14%) it may have formed 0.2% of the total. This source can be characterized as dark and particulate, but can sometimes be brownish with almost a champagne color. The source could be confused with San Martin Jilotepeque, but is often more smooth, whereas San Martin has a grainy or sticky texture. The source could also be confused with Ixtepeque, but Ixtepeque is more translucent than San Bartolome. Even if this source were confused for these other sources, their percentages of the total assemblage would not change greatly, and as said above, since this source was not confirmed by XRF, its presence at the site is still questionable.

Obsidian Source by Structure Type

The discussion above refers to artifacts by structure type, when grouped by the architectural typology reiterates the findings that a higher percentage of the more exotic obsidians (i.e. Ixtepeque, San Martin Jilotepeque, Pachuca, and Zaragoza) were not necessarily present in much higher percentages in Type I and II structures vs. Types III, IV, and V structures. Only securely sourced artifacts from residential contexts were included in this discussion.

Discussion

Evidence from Cancuen supports the general finding for the Maya lowlands, that El Chayal obsidian is dominant in the Late Classic period (Ford et al. 1997; Nelson and Clark 1990). Cancuen may also support the argument that Pachuca green obsidian becomes more prevalent in the Postclassic (for those sites that have a Postclassic component), as Classic Maya elite-controlled trade routes break down and long distance trade becomes more prevalent. The appearance of Pachuca is the only temporal change in obsidian sources that is apparent through time at Cancuen. It is surprising that Zaragoza obsidian was so homogenous in elite and nonelite contexts even during the Late Classic Period. If obsidian was controlled and redistributed by elites, I would expect to see more Zaragoza obsidian in elite contexts, or at least larger blades or macroblades, which is not the case. This ubiquitous distribution of obsidian may suggest that it was available to all residents in a market setting (Hirth 1998), or at least through informal barter or exchange relationships such as direct procurement from independent knappers or peddling (Santley and Kneebone 1993; see also Moholy-Nagy 1997:78 for similar Tikal comparison). The initial hypothesis that elite compounds would have more access to imported obsidian appears to be unsupported. Relative frequencies of obsidian across household groups appears to be fairly equal. The diversity of Mexican obsidian from various sources is also lower than other large Lowland Maya centers, such as Tikal (Moholy-Nagy 1999; Moholy-Nagy and Nelson 1990).

Obsidian Typology at Cancuen

The characteristics of obsidian artifacts recorded for the Cancuen material can be seen in the Typology Key included in Appendix A. All attributes were given numbers and recorded in spreadsheets to facilitate ease in recording and manipulating the data. The first characteristic recorded was source (as discussed above), the five known sources for Cancuen being El Chayal, Ixtepeque, San Martin Jilotepeque (also sometimes called Río Pixcaya), Pachuca, and Zaragoza. The typological categorization followed the behavioral typology of Sheets (Sheets 1975; Clark and Lee 1979 [based on Crabtree 1964]) and technological typology of Clark (Clark 1988, 1997; Clark and Bryant 1997), which also closely related and lends itself to the analysis of operational chains as discussed by Dobres (Dobres 2000; Dobres and Hoffman 1994, 1999) and Lemonnier (1986) among others. Artifacts are put into types depending on the technology used or behavioral changes that occur during the production process. The main changes in technology in the production of polyhedral cores and prismatic blades is one from percussion to pressure flaking, marking earlier to later stages (see Figure7.3). Rejuvenation is also an important technological characteristic that can be used to remove errors and extend the life of the core, which can speak to levels of skill as well as demonstrate locales of prismatic blade production (Clark 1986).

Other characteristics that were recorded include the type of termination (when possible to determine). This can tell us if the blade came off in the desired form (feather termination), or if inappropriate force was applied and the termination ended as a premature feather, hinge termination, step termination, or overshoot termination (Figure 7.4). All of these are errors and can often cause problems for the later removal of blades and in most cases must be remedied with different types of rejuvenation. These types of terminations can also be counted to help determine levels of skill. Table 7.4 represents percentages of errors in terminations found in blades at Cancuen. The best indicators of error are hinge and overshoot terminations, because step fractures can often be confused with a purposeful or accidental break of a whole blade. The percentages of hinge and overshoot terminations are not exceedingly high, and do not differ to a great degree between structures. Sheets (1978) suggests that below a 10% level of error, such as hinge termination, suggests a high level of skill.

The amount of use was recorded in order to see if there were any differences in amount of use across status types or through time. Heavily used blades may indicate a paucity of the resource. The same could also be true for retouch, where high frequencies and amount of retouch may indicate that a certain group may not have had as much access to obsidian as others. Table 7.5 shows that medium and heavy use may have been more prevalent in nonelite structures (Types III, IV, V, and 0), suggesting that nonelites had less access to obsidian than elites (see also below).

Retouch also presents some interesting comparisons, as there was actually less retouch in nonelite structures (Table 7.6), but more bifacial retouch in elite structure types, possibly for a special function. Distal retouch was highest in Type IV structures (n=8), possibly relating to craft activities.

The amount of cortex was recorded in an attempt to determine if the early stages of core reduction occurred at Cancuen, or if cores were imported as already finished and ready for blade reduction (Clark and Lee 1979; Sheets 1975). If cores reached the site already reduced to polyhedral cores, it suggests that the residents of Cancuen did not have direct access to the obsidian raw materials. The cores were probably traded through a middleman. Total amount of cortex for artifacts at the site was .05%, and the results for the different structure types are presented in Table 7.7.

The last attribute recorded was platform preparation, which can be a chronological indicator. Platform preparation is argued to change chronologically beginning with no preparation on the reduced or pointed platform, then scratched platforms with overhang removal and characteristic hinge fractures near the platform and some grinding, and then completely ground platforms (nearly resembling cortex). These heavily ground platforms were a feature almost exclusively of the Postclassic period (see Rovner and Lewenstein 1997). During the Late Classic a combination of techniques were often used, also seen at Cancuen. None of the observed platforms had the extensive grinding characteristic of the Postclassic period, but did utilize some grinding, as well as scratching and overhang removal, fairly typical of Late Classic technologies. No observable patterns between structure types or time periods were apparent. Each artifact was also measured for maximum length, width, and thickness (measured in mm, but presented in cm in this work) and also weighed in grams.

Obsidian Contexts at Cancuen

Although a total of 7074 obsidian artifacts were analyzed from all excavations from 1999-2003, only 7012 of those are included below because the remaining artifacts did not come from residential contexts (i.e., the port area) where status and context information may have been mixed and ambiguous (Tables 7.8, 7.9, and 7.18; see Figures 2.1 and 5.37 for location of grid squares and structures).

Type I Structures

Type I structures show some production of both prismatic blades and obsidian bifaces. Two exhausted polyhedral cores were recovered from the fill of palace patios, both of El Chayal obsidian. Both cores were short, one battered in an attempt to remove a last platform rejuvenation flake leaving only 1.934 cm of the exhausted core, the other was 4.716 cm. Only one small percussion blade was recovered, 7 percussion macroflakes and no macroblades. This supports the finding across the site that cores were imported as finished polyhedral cores ready for the pressure removal of prismatic blades. If percussion was used in core reduction it was usually to remove imperfections or to further ready the core for pressure reduction. Other evidence for the import of prepared cores is the low amount of cortex present on obsidian objects in Type I structures, one with 0-25% and 2 with 25-50%.

Further evidence of the production of prismatic blades in elite (Type I) structures includes rejuvenation flakes, intended to remove errors or extend the life of the core. These included one proximal, one distal, two medial and two lateral rejuvenation flakes intended to remove hinge or step fracture errors from the core to continue to allow regular removal of blades. Two platform rejuvenation flakes were also recovered, creating a new and more stable surface for the removal of blades. Seven distal fragments of blades had hinge fractures and four had overshoot (or *outrepassé*) terminations.

Thirteen exhausted polyhedral cores from El Chayal were also found within the burial in the Royal Palace of the probable last ruler of Cancuen, *Kan Maax*. The number of cores is significant representing the 13 levels of the underworld, a common number used in caches throughout the lowlands (see also Hruby 2006). The caching of these exhausted cores also may represent a different disposal pattern than that of Type III, IV, and V at Cancuen, as cores were usually discarded in general refuse in these structures, versus being used in elite fill and/or special deposits, also very much like patterns at other lowland centers like Tikal (Moholy-Nagy 1997) and Piedras Negras (Hruby 2006). An exhausted core, numerous prismatic blade fragments, and a deer antler were also discovered in a cache below a stela depicting the penultimate ruler *Tah Chan Ahk*. This core was certainly part of a bloodletting ritual associated with the dedication of the stela and represents a unique context for the ritual use of obsidian at Cancuen, but was common elsewhere (Hruby 2006). A whole prismatic blade of El Chayal obsidian was also recovered from the cache discovered beneath the Royal Throne Room (Barrientos et al. 2002 and Callaghan and Barrientos 2005), certainly used in ritual bloodletting and closely associated with the other ritual and royal objects of jade included in the cache (see Chapter 5). The blade was an initial series prismatic blade removed early in the reduction sequence, 7.84 cm long x .53 cm wide x .37 cm thick.

Three fragmentary obsidian bifaces were recovered from Type I structures, two from Structure M9-1, a vaulted structure with stucco sculpture near the northern port of the site. One of the biface fragments was from El Chayal, the other from Ixtepeque. Two bifacial reduction flakes were discovered in garbage nearby (both from El Chayal), suggesting that there may have been bifacial production at the site, but the lack of Ixtepeque bifacial flakes in these and other structures suggests that these may have been imported as finished artifacts. Another bifacial fragment and two bifacial reduction flakes were recovered near each other in the wall fall and termination garbage at the large, three-room masonry Structure N10-1, also with stucco sculpture about 1 km north of the royal palace.

Type II Structures

Ten exhausted polyhedral cores were also recovered from Type II structures, two from the humus and wall fall of structure K7-3 (CAN 16-9-1), and the other from the initial earthen fill of the structure K7-1 (CAN 17-25-2). The remaining 8 exhausted cores came mainly from midden contexts of the structures in the grid square M9, these Type II structures were associated with the vaulted Type I structure M9-1. All of the cores recovered appeared to be of El Chayal obsidian, but one from CAN 25A-29-1 was from Ixtepeque.

Two macroblades were recovered, one from the humus of K7-2, and one from CAN 25A-14-1 (Structure M9-15), both of El Chayal obsidian. Two small percussion blades also came from midden contexts of the structures of M9, also of El Chayal obsidian.

Three bifacial thinning flakes came from structure K7-2, but all of the bifaces recovered from Type II structures came from the M9 group (N=6), all of El Chayal obsidian, with only one bifacial reduction flake in lot number 25A-40-1.

Most of the rejuvenation flakes came from the M9 group, which also had the most other evidence for prismatic blade production, including 4 proximal rejuvenation flakes, one lateral rejuvenation flake, one distal rejuvenation flake and two platform rejuvenation flakes (Figure 7.16; one of San Martin Jilotepeque obsidian). One platform rejuvenation flake was recovered from the structure fill of N11-1, a Type II structure associated with the large N10-1 Type I structure north of the epicenter. A platform rejuvenation flake was also recovered from the humus/wall fall of structure K7-2.

One obsidian sequin was recovered from the humus of structure K7-2 (Figures 7.15 and 7.17). These round obsidian objects may have served as adornments, small mirrors (possibly for divination), or inlays for eyes in masks or stucco sculpture (Figure 7.18).

Again, very little cortex was present on the artifacts from Type II structures, 6 artifacts presented 0-25%, and four with 25-50% (N=925), two of which were macroflakes (one of El Chayal and the other of Ixtepeque), and most of those with cortex came from the M9 group.

Type III Structures

Exhausted polyhedral cores were present in Type III structures fairly evenly distributed throughout the site (see Figure 2.1), in map grid square K9 (Operation 39A), and L8 in the north (Operation 37C), K8 in the west (Operation 19A), J6 and K6 in the southwest (Operation 13), and L6 in the southeast (Operation 7). The number of cores was also consistent with those found in Types I and II structures, but none of them were found in special deposits or burials within these structures; the primary contexts were middens. Many of them were very fragmentary and showed signs of extensive battering, often bipolar reduction, to remove as much material as possible. Some were reused for grinding activities, especially one from Structure J6-5 (CAN 13-86-1). One complete exhausted core was recovered from 39A-71-6 (Structure K9-7), the only non-fragmentary core from Type III structures, with dimensions of 5.63 cm x 2.51 cm x 1.52 cm and 26.9

grams. None of the cores from Cancuen were of a particularly large size. Also from this structure (39A-56-1), a fragment of a core from the Ixtepeque source was also recovered, suggesting that obsidian from sources other than El Chayal (the primary source for Cancuen) was at least sometimes imported in core form, and not only in finished blades. One core fragment from CAN 37C-11-3 may have been from San Martin Jilotepeque, but it was difficult to tell with the thickness of the artifact, it may have been from El Chayal. The other cores found in Type III structures were from El Chayal.

Rejuvenation flakes were largely recovered from structure middens that also contained exhausted cores, but also came from Grid Squares M7 (Operation 14A), and L3 (Operation 6) suggesting that some production of prismatic blades did take place in these areas even though no cores were recovered. All rejuvenation flakes were of El Chayal obsidian.

Macroblades were also recovered from Grid Squares L7, K6, J6, and K8 (Operations 7, 13, and 19A). Two (CAN 7-74-1 and CAN 13-22-1) were from Ixtepeque and one (7-97-1) from San Martin Jilotepeque with bifacial retouch on the distal end. The other 10 macroblades came from El Chayal. The three small percussion blades from Type III structures all came from the fill of Structure J6-5 (Operation 13), all from El Chayal. A complete prismatic blade was recovered from structure fill of Structure L6-1 (Figure 7.20).

All bifacial reduction flakes (N=5) from Type III structures came from a single structure, K6-34 (Operation 13; locus of pyrite mirror production). While the flakes were recovered (all from El Chayal), bifaces were not. In contrast, obsidian biface fragments (N=5) were recovered from Grid Square M7 (Operation 14 A), K8 (Operation 19A), L8

(Operation 37C) and K9 (Operation 39A). Three sequins, or round obsidian artifacts of unknown use, were also found in Operations 7, 13, and 39A. Sometimes the edges of a blade or flake are bifacially flaked, or sometimes ground to obtain the round shape. In the Palace these round objects were sometimes used as inlays for eyes of stucco sculptures (Barrientos et al. 2002; see Figure 7.18), but their function is not known in these contexts. They are not found in special deposits, but may be 'mirror stones' used for domestic ritual. On the other hand, they are also often found made of chert (see Chapter 8), which could not have served this mirror function and are also found primarily in midden and floor contexts. These 'sequin' artifacts remain an enigma, but were found at many other Maya sites (e.g., Kidder, Jennings sand Shook 1946:138; Moholy-Nagy 1997:69; Rovner and Lewenstien 1997:42).

Again, cortex was not present on a large amount of artifacts, there were only 7 with 0-25%, 2 with 25-50%, and 1 with 50-75% (out of 1602 artifacts), indicating that as with Types I and II structures, finished polyhedral cores were the primary imports to the site.

Some bipolar technology was used (bipolar flakes N=2, bipolar cores N=2), usually to remove flakes from already exhausted polyhedral cores in an attempt to use all of the material possible.

Type IV Structures

Again, all of the exhausted cores recovered from Type IV structures where highly battered, often reduced in their final stages by bipolar percussion, and most were recovered from midden contexts (Figure 7.19). One small fragment of a polyhedral core was recovered embedded in the floor of Structure M10-4 (the jade working floor; lot CAN 24-94). The largest core was recovered from a midden between M10-4 and M10-7, which was 7.15 cm x 3.51 cm x 2.17 cm and 61.2 grams, but still had a bipolar flake removed from the distal area. One half of an exhausted polyhedral core of the Zaragoza source was found in the midden of Structure M6-12 (CAN 14B-24-1), again showing that even Mexican obsidian was imported in finished core form as opposed to blade form, and does not seem to have been controlled by residents of Types I and II structures. Also recovered from this structure were four small pebbles of El Chayal obsidian that were unworked, possibly suggesting direct access to the source or with those trading materials from the source. Most of the other cores were from El Chayal obsidian, while one from Structure K7-24 (also a jade working area) was possibly from San Martin Jilotepeque. These cores were again distributed throughout the site in grid squares K7, M6, M10, N10, L9, and K9.

Of the nine macroblades recovered from Type IV structures, three were form the Ixtepeque source, one from K7-24, and two from M10-7, and all small percussion blades came from the midden of M10-7 (jade working area). One macroblade from Structure L8-5 was of Zaragoza obsidian, with roughly 20% cortex present on the dorsal surface, again possibly indicating that obsidian from this source was imported as finished cores (Figure 7.21). Rejuvenation flakes were recovered from middens of Structures K7-24, M10-7, M10-4, M6-12, L9-9, all structures with polyhedral cores, but also J7-7, where no exhausted cores were found. One crested blade, suggesting the lateral removal of flakes to remove an error (see Clark and Bryant 1997), was recovered from Structure K7-24.

A relatively small percentage of cortex was found on obsidian artifacts in Type IV structures, 16 with 0-25%, 2 with 25-50 % and 4 with 50-75% (out of 3259 artifacts). This coupled with the shorter length of macroblades, the longest being 7.5 cm, suggesting the import of prepared cores and their reduction across the site in houses of varying social groups.

Sequins (the rounded objects made from blades or flakes) were found in domestic contexts as they were in Type III structures, 2 from a midden between structures M10-7 and M10-4 (along with 12 similar objects made of chert; see Chapter 8). If they were used for domestic ritual, they were not kept in any special or sacred place and were discarded with other domestic refuse.

Bifaces were also present in the middens of structures K7-24 (n=2; one of Ixtepeque) and M10-7 (n=2; one complete, from El Chayal KM 24 of the Caretera Altantico). Two were also recovered from the initial humus near J7-7 and K9-7. All bifacial reduction flakes were recovered from middens in the M10 mound group and were of El Chayal obsidian.

Type V Structures

The number of obsidian artifacts from Type V structures is dramatically lower than that of other structure types mostly because of the small sample size. Only two mounds were concretely identified as Type V structures through horizontal excavation (i.e., those having no stone architecture, simple earthen mounds; see Chapter 2). Many Type V structures were probably subsumed under Type 0, as those that were not excavated sufficiently to determine type, but with no visible stone or structure lines on the surface. Often Type III or IV structures would have some visible stones near the surface or they would be easily encountered with one or two test units.

No exhausted cores, bifaces, or bifacial reduction flakes were found in these structures, but three small percussion blades and three platform rejuvenation flakes were found in Structure J6-5, and two from Structure M6-17, suggesting that there was still some blade production activity going on in Type V structures. Only one artifact had 0-25% cortex (out of n=222).

Type 0 Structures

There were 4 exhausted polyhedral cores recovered from Type 0 Structures, three, including the two longest cores came from the superficial areas of the construction of the camp (8.65 cm and 8.4 cm), this would be grid square M6 on the map (see Figure 2.1). Another core came from a midden behind structure K6-10, a small mound with a high amount of lithic production refuse (obsidian and chert). Two macroblades were found in Structure J7-5. Platform rejuvenation flakes were found in P7-1 and P7-3 (Operation 35), also K6-10 (Operation 13), and recovered in surface collections around the camp area (Operation 14). One crested blade (the product of lateral rejuvenation), was recovered from P7-3 (CAN 35-3-2). Cortex was only present on 2 artifacts of the total (n=646).

One biface from Ixtepeque was recovered from P7-1, as well as in camp construction in the initial levels (Figure 7.22). One nearly complete laurel-leaf biface, probably from El Chayal (length 7.9 cm) was found on the surface near the camp area. Bifacial reduction flakes (n=12) were found in structures in grid square K7 and K6 (including six from Structure K6-10).

Statistical Analyses and Indices

Various calculations have been used by archaeologists to determine intensity of obsidian trade, often looking for falloff curves as distance increases from the source (see for example Renfrew 1975) and to evaluate a site's access to obsidian. Some of these techniques have included weights of obsidian per unit of excavated fill (Sidrys 1976), which can be tricky because collection methods may not be consistent between sites. Obsidian to chert ratios (Rice 1984) and obsidian to sherd ratios (Thompson 1948) have also been used, but the relative amount of sherds or chert may vary for many reasons (including local availability of chert), and is not a steady, controllable factor between sites. Cutting edge to mass (CE/M) ratios for pressure blades (see Sheets and Muto 1972) have also been used to infer the amount of obsidian present, assuming that a paucity of obsidian will cause blade makers to be more efficient and create smaller blades (usually assumed to happen at greater distances from the source; i.e., Sidrys 1978, 1979). This ratio has also been used to investigate intrasite patterns of access to obsidian (e.g., Braswell et al. 1994; Fowler, in Kelley 1988; Sheets 1978). A high CE/M ratio indicates less available obsidian. Sidrys (1979:595) cites a high cutting edge to mass ratio for the lowlands in general, 5.73 cm/g (n=983), and 3.52 for the highlands (n=417) (see also Table 7.10 for specific comparisons). The CE/M ratio for all Cancuen blades is 2.87 cm/g (only for pressure blades, n=5333). This number seems to indicate that Cancuen had a good supply of obsidian, certainly due to its strategic location.

While the CE/M ratios can be very effective in some cases, Rovner (1989) has argued that many of the blades are broken, making measurements of length and weights rather random and not a controllable variable. Rovner (1975) found that mean blade width, including the range of variation, could be a highly effective and standardized measure of access to obsidian (a sentiment echoed by Clark 2003 and Rovner and Lewenstein 1997).

In this study, mean blade width will be used in comparison to some sites at varying distances from obsidian sources. This comparison is also often problematic as the closest source may not always be the source of primary use, as is the case at Cancuen, San Martin Jilotepeque would actually be the closest source to the site, but the vast majority of obsidian comes from El Chayal (86.6%; see also Figure 7.2). The mean blade width for all blades from all sources in all residential excavations at Cancuen is 1.2 cm (n=5369, s.d. 3.37, range .17 cm to 4.61 cm), which includes macroblades, small percussion blades, initial series blades and final series blades, but does not include undetermined blade fragments as the width of these artifacts was often fragmentary. Blades with a width larger than 2 cm make up 1.38% of the total amount of blades (n=39), as opposed to Dzibilchaltun which did not have a single blade above 2 cm and Río Bec which had only one blade above 2 cm (Rovner and Lewenstein 1997:46). Rovner and Lewenstein (1997:46) report an average of 1.1 cm for the Yucatan region, which they cite as low compared to the >1.5 cm average for Zacualpa (range 1.0 to 4.5 cm), quite near an obsidian source, with imported green obsidian ranging between 1.0 to 1.4 cm. The mean blade width at Preclassic El Mirador increased through time, from 1.05 cm in the Late Middle/Late Preclassic, to 1.24 cm in the Early Late Preclassic, to 1.26 cm in the Late Preclassic, to 1.35 cm in the Late to Terminal Preclassic. This shift could be indicative of the rise of El Mirador as a sociopolitical and economic power in the Late Preclassic, (Fowler 1987:23) as social connections and alliances are formed access to obsidian would rise. Moholy-Nagy (2003:33) reports a mean blade width of 1.18 cm for a sample (n=318, range 0.7 to 1.9) of obsidian blades from Tikal, with blades from the Mexican source of Pachuca being slightly thinner, at 1.03 cm (n=56, range 0.5-1.03 cm). In comparison, the mean blade width for Palenque was 1.09 cm (Johnson 1976:36-38, cited in Rovner and Lewenstein 1997:46). At the site of Kaminaljuyu, blades from the local source of El Chayal ranged from 1.0 to 4.0 cm, while imported green obsidian ranged from 0.9 to 1.8 cm (Kidder, Jennings, and Shook 1946:136), while Sidrys (1979:Table 1) reports a mean blade width of 1.57 cm (n=15).

When separated by source, the mean blade width of Cancuen does not seem to follow the distance decay hypothesis in all cases, the mean for El Chayal is 1.22 cm (n=4620, range .17 to 4.24), for Ixtepeque, it is 1.28 cm (n=292, range .68 to 4.57), San Martin Jilotepeque 1.26 cm (n=69, range 0.68 to 1.87), Pachuca 1.06 cm (n=6, range .84 to 1.25), and Zaragoza 1.44 cm (n=57, range .9 to 2.12) (Table 7.11). Of the Guatemalan obsidians, San Martin is the closest source, but the lowest quality, probably accounting for its paucity at the site. El Chayal is the second closest, followed by Ixtepeque, which has the highest mean blade width of all three. The Pachuca obsidian conforms to patterns noted above for other sites (e.g., Nelson and Clark 1990), and it was only recovered from the humus layers near Type II structures, probably indicating Postclassic squatting and import of finished blades. Zaragoza obsidian of Mexico actually has the highest mean width and is located at the farthest distance. The most abundant obsidians appear to have the lowest mean widths, possibly because more whole cores were imported instead of ready made blades, allowing for the removal of every last possible blade, drawing down the mean.

While mean blade width does not appear to necessarily have been an effective indicator of distance decay ratios of imported obsidian, mean blade width will also be tested here to investigate intrasite differences in access to obsidian. One would assume that those with greater status would have more access to imported goods like obsidian, versus those of lower status. This comparison of means also remedies the problems posed by differential disposal patterns used by ‘elites’ versus ‘nonelites,’ as certain households may have had “more” obsidian, but it may not reflect actual consumption, merely recovery.

Student’s t-Tests

In this case, the null hypothesis is that the mean width of obsidian blades between structure types will be equal. The first t-Test compared means between Type I and II structures. In this test, the null hypothesis can be rejected, as there is a significant difference between blade widths from Type I to Type II structures. We can say with 99% level of confidence that blades are wider in Type I structures (Table 7.12).

The second test between Type II and III structures also reveals a significant difference ($p<.05$). With a 97% level of confidence we can reject the null hypothesis and accept the alternate hypothesis that blades are wider in Type II structures vs. Type III structures (Table 7.13). The test of mean blade width between Type III and IV structures also supports a significant difference at the .05 level (Table 7.14).

The test between the mean blade width of Type IV and V structures does *not* allow us to reject the null hypothesis ($p>.05$). In other words, there is not a significant difference of the width of blades in these two structure types (Table 7.15). Again, in the test between Type V and 0 structures, the null hypothesis cannot be rejected, and mean blade width is not significantly different ($p>.05$) (Table 7.16).

In the final test, the blade widths were lumped together into general elite and nonelite categories (Types I and II vs. Types III, IV, IV and 0). In this case the level of confidence with which we can reject the null hypothesis is very high, as the p value is 2.47×10^{-7} or .000000247 (Table 7.17).

While some would argue that this pattern could support elite "control" of the import and/or distribution of obsidian, it could also signify increased "purchasing power" because of status (see Clark 2003), or even tribute of prepared cores and/or blades. It does represent the possibility that elites were not as concerned with maximizing the highest possible amount of obsidian from each core. This could possibly have been because of a greater degree of 'wealth' of elite inhabitants of the site, not only economic capital, but symbolic and social capital (i.e., Bourdieu 1977), as elites would have the social connections and prestige to always acquire obsidian through tribute or gifting, while nonelites may have had to barter or trade for obsidian.

These results are reported here, but it is important to realize the underlying assumptions that support them, as Fowler (1991:10) points out, all of these models assume a maximizing and economizing behavior that may not have been a social reality. It does seem that the differences between house types at Cancuen do represent a significant difference, and it may be because the finest (i.e. widest, strongest) blades were given as tribute to elites, not necessarily that the producers maximized blade production in a way to produce wider blades. It could also be that nonelites utilized *all* possible blades, as the cores were exhausted and battered and used in nearly every possible way, so smaller blades were more widely represented in those contexts.

Discussion

The evidence for prismatic blade production, like obsidian sources, was well distributed throughout the site, and also between residences of different status. This evidence, including exhausted cores and/or rejuvenation flakes occurred in map grid squares J6, J7, K6, K7, K8, K9, L3, L6, L7, L8, L9, M6, M7, M9, M10, N10, N11, and P7, representing virtually every sector of the site across all statuses (see Figure 2.1 for map of site).

The differences in amounts of blades and other debitage associated with the production of prismatic blades is primarily a function of differential refuse and discard patterns. Refuse from Type I and II structures may have been hauled away or incorporated into construction fill or special deposits, burials, or even special workshop dumps that were not easy to encounter as they may have been in some out of the way place so as to not pose a threat to the heavy traffic areas of the palace and more public areas (see Aoyama 1996; Clark 1989; Moholy Nagy 1990). Some Type I and II structures may also have been under construction at the time of abandonment of Cancuen and cleared of refuse. Types III and IV structures were characterized by a more predictable secondary refuse pattern. Most garbage was disposed of in middens behind structures, and especially in the case of Type IV structures, sheet midden deposits surrounded patio areas and were very easy to identify and follow. Since a similar amount of cores were found in each structure type (with the exception of Type V), it seems reasonable to assume that similar production scales were being carried out, although the depositional patterns were different.

If there were production for exchange, we would expect to see a disproportionately large number of the early stages of production of prismatic blades (i.e. macroblades, small percussion blades, and initial series blades) versus the final series more regular blades (see Clark 1986:37). From Tables 7.8 and 7.9 it is obvious that this is not the case. Production of obsidian blades at Cancuen appears to be primarily for domestic consumption and not for trade, especially when the numbers of artifacts recovered are considered (e.g., Clark 1986; 2003). It does appear that the residents at Cancuen in general had more access to obsidian than some other lowland sites farther from the highland Guatemalan sources. This was certainly due to its strategic location between the two regions on a major trade route.

In comparison, a study at the Andean state of Tiwanaku contrasts with the patterns found at Cancuen, in that elites did control certain exotic obsidians and basalts. Obsidian from the Cotallalli source was the only transparent obsidian of all 9 sources present at the site. Its translucence represented water, sacredness, and ancestors, possibly the reason it was valued and controlled by elites demonstrated by its higher percentage in elite contexts (Giesso 2003). Giesso also suggests that elites had access to a greater number of raw materials and types of blanks than nonelites. This situation is actually the direct opposite of the data at Cancuen, where obsidian sources were equally distributed throughout the site, and exotic raw materials and types of blanks (such as jade and pyrite) were more prevalent in nonelite residential areas (although finished products appeared more in elite residences). But through time, as the Tiwanaku state expanded, the elites seem to have begun to levy tribute on commoners, requiring them to make projectile points and stone weapons for the state, from raw materials that were previously used for domestic products and from raw materials that were readily available (i.e., chert). This may be a similar pattern to the increased production of ritual items for elites during the later part of the Late Classic period at Cancuen.

Another example from Mesoamerica is presented by Aoyama (1996) for Copan, where he found that the primary stages of reduction of obsidian polyhedral cores of the finest local Ixtepeque obsidian (i.e. macroblades and small percussion blades) were almost exclusively present in central elite areas (although cf. Clark 2003 for critique), while the surrounding areas did not present evidence of prismatic blade production and also used expedient technologies of inferior quality obsidian from even closer sources. Again, this situation contrasts with that at Cancuen, where production debris and different sources were basically evenly distributed throughout the site and across various status groups.

It seems that the state had little involvement in the production and distribution of obsidian at Cancuen. This is similar to ethnohistoric records for the Aztec state, which controlled the trade and production of certain exotic objects, but not obsidian. It does appear that elites had more access to obsidian, probably due to wealth and prestige that brought gifts and tribute.

Conclusions

While the import of finished polyhedral cores, and battered exhausted cores does not suggest direct access to the source and access to large amounts of obsidian like that of a site very near the source such as Kaminaljuyu (Kidder, Jennings, and Shook 1946; Hruby 2003; Michels 1979), the even distribution of blades and blade technology suggest a similar situation to that of sites like Tikal (Moholy-Nagy 1997), where obsidian was fairly widespread, versus lowland sites like Piedras Negras (Hruby 2006) and Calakmul (Geoff Braswell, personal communication, 2000; e.g., Braswell et al. 2004), where obsidian was more scarce. This suggests that Cancuen may have served as a central place for trade in the immediate surrounding region, especially because of its location near the highlands, and brought in trade of various types of obsidian accessible to all residents of the city. While elites probably extracted polyhedral cores and possibly finished blades as a type of tribute, there is not sufficient evidence to suggest that elites controlled the import or distribution of Guatemalan or Mexican obsidians because of the even distribution of sources and technologies throughout the site. The even distribution of sources and technologies also suggests exchange in a market type setting (see Hirth 1998) as opposed to redistribution or direct procurement.

In the case of obsidian, these patterns represent power more evenly distributed throughout the site. The manufacturing sequence or operational chain of production of obsidian artifacts at Cancuen was not restricted on any levels according to structure type as it was with jade. Elite power may be expressed in the higher mean blade width for obsidian blades in Types I and II contexts, although residents of Types III, IV, V, and 0 structures had access to exotic obsidian from Mexico, core/blade technology, and also produced sequins, which in elite contexts were sometimes used as inlays and may have functioned as sacred mirrors or tools of divination. Again this may represent the superordinate power of elites, but at the same time nonelites and subordinates also exercised some power in the form of mobilization of technologies and resources.

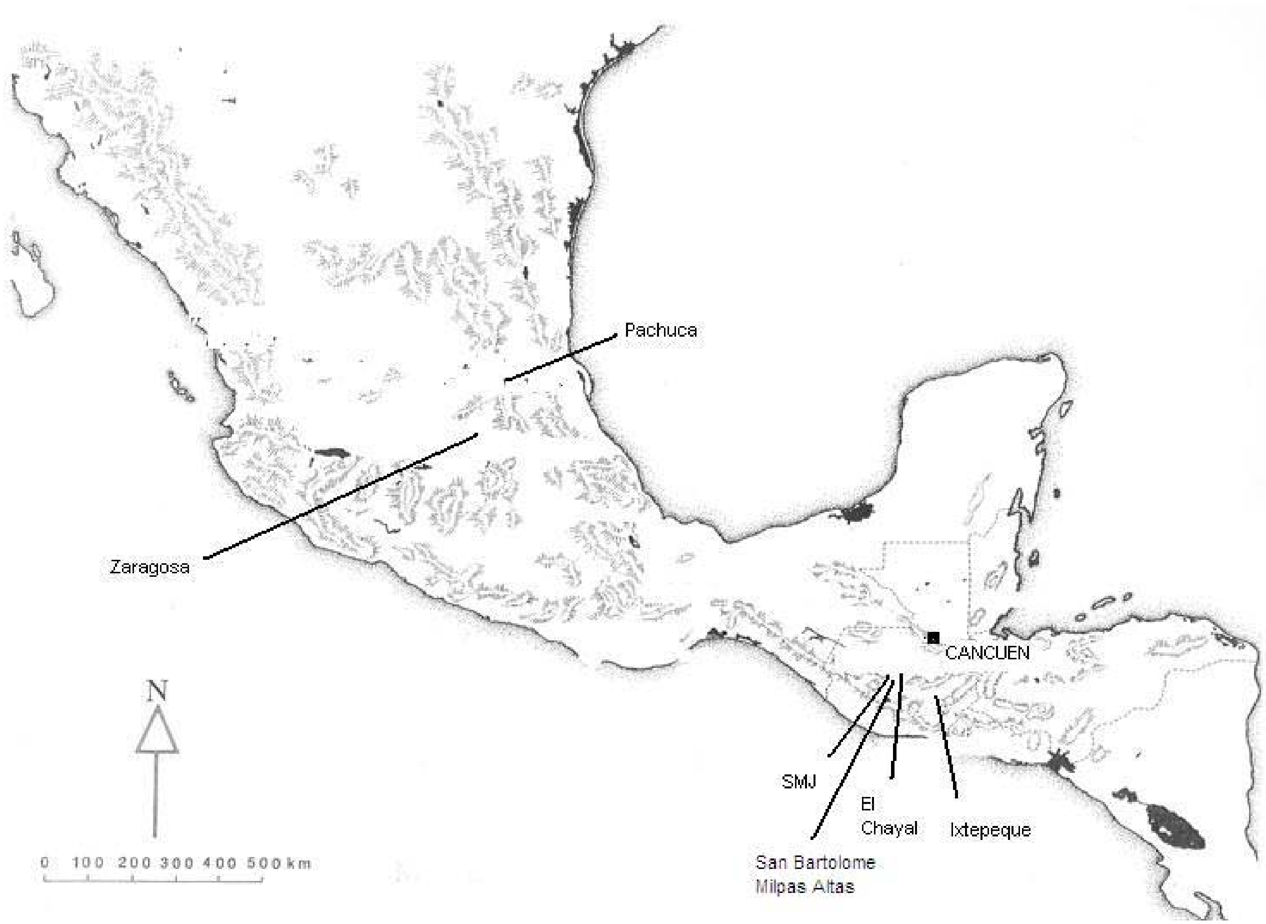


Figure 7.1. Map showing the location of the obsidian sources utilized at Cancuen (map drawn by Luis Fernando Luin).

Figure 7.2. Map showing location of obsidian sources and possible trade routes (modified from Hammond 1973; map drawn by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

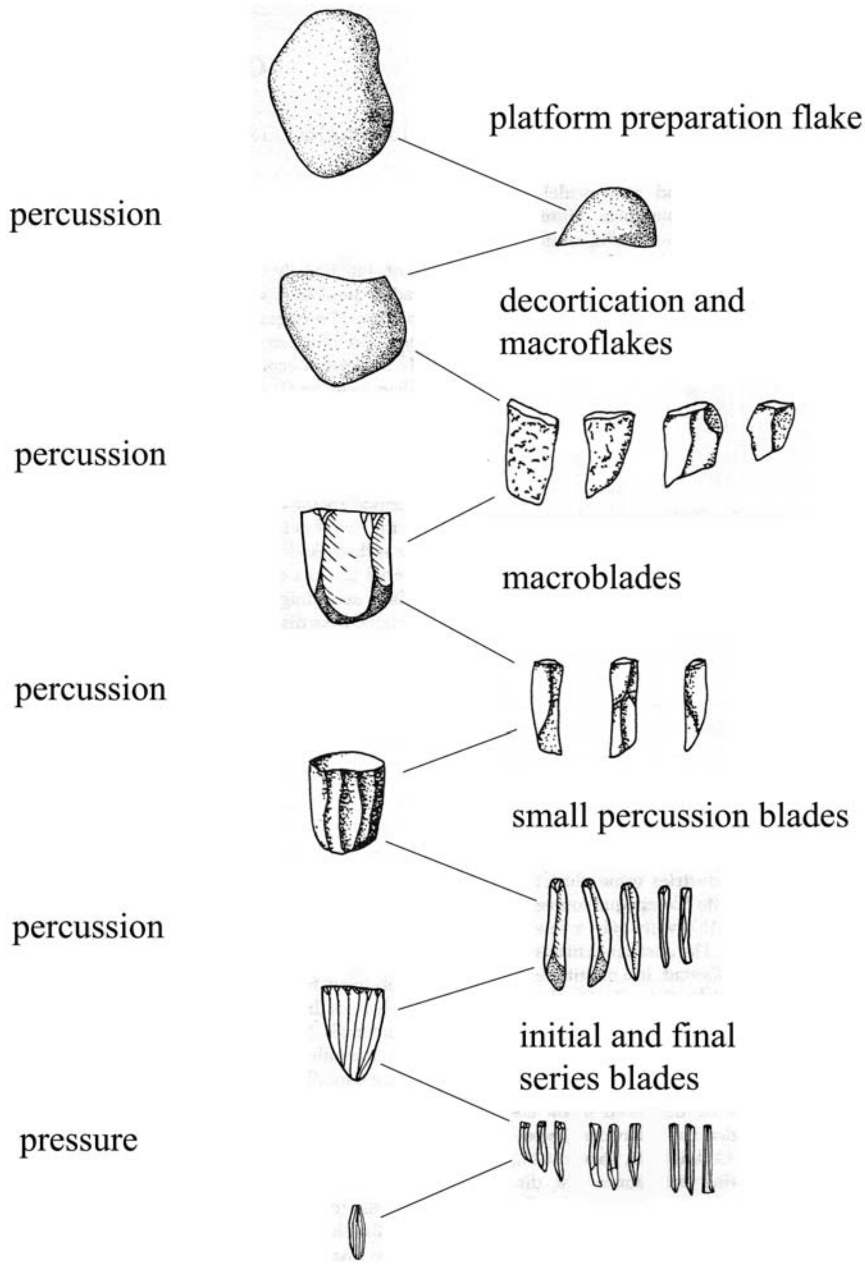


Figure 7.3. Manufacturing sequence of obsidian prismatic blades showing types and technology used to produce them (modified from Clark 1988:Fig. 5 And Hirth and Andrews 2002:Fig. 1.2).

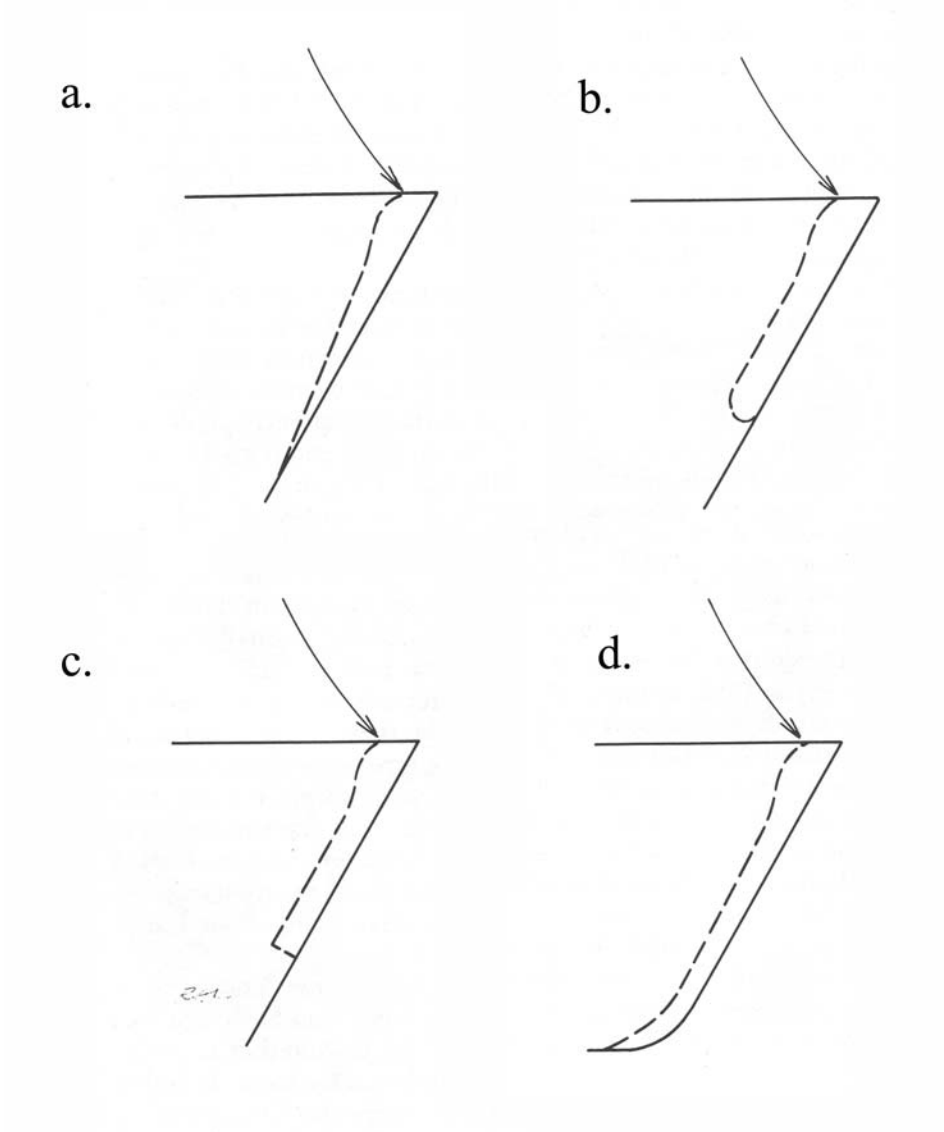


Figure 7.4. Possible terminations for flakes and blades, a. feather, b. hinge, c. step, d. overshoot (modified from Whittaker 1994:Fig. 2.4).

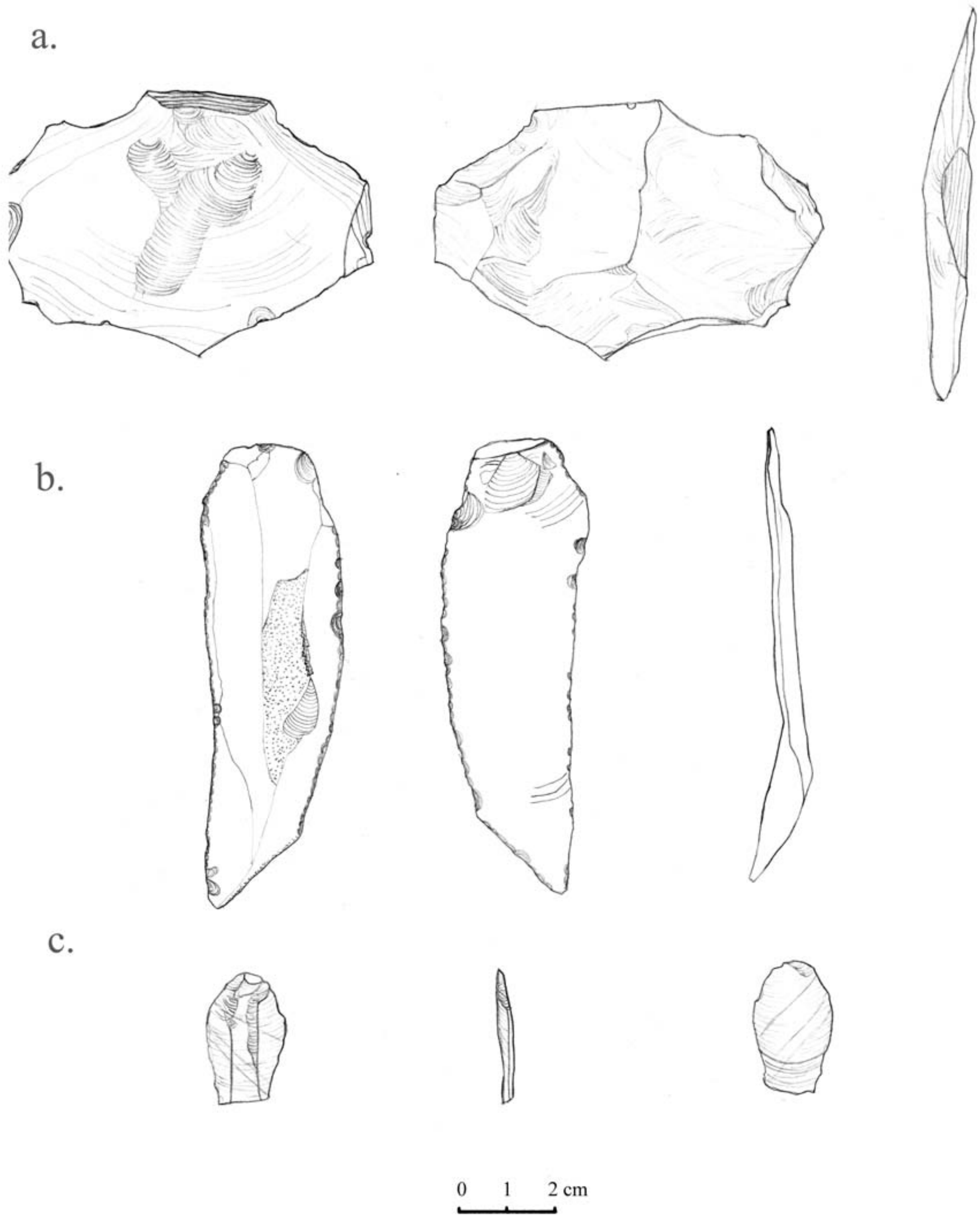


Figure 7.5. Early stage core/blade technology, a. Macroflake, lot CAN 3-4-4 (drawing by Margarita Cossich), b. Macroblade, lot CAN 37C-11-3 (drawing by Margarita Cossich), c. Small percussion blade, lot CAN 25A-7-3 (drawing by Margarita Cossich).

a.

b.

c.

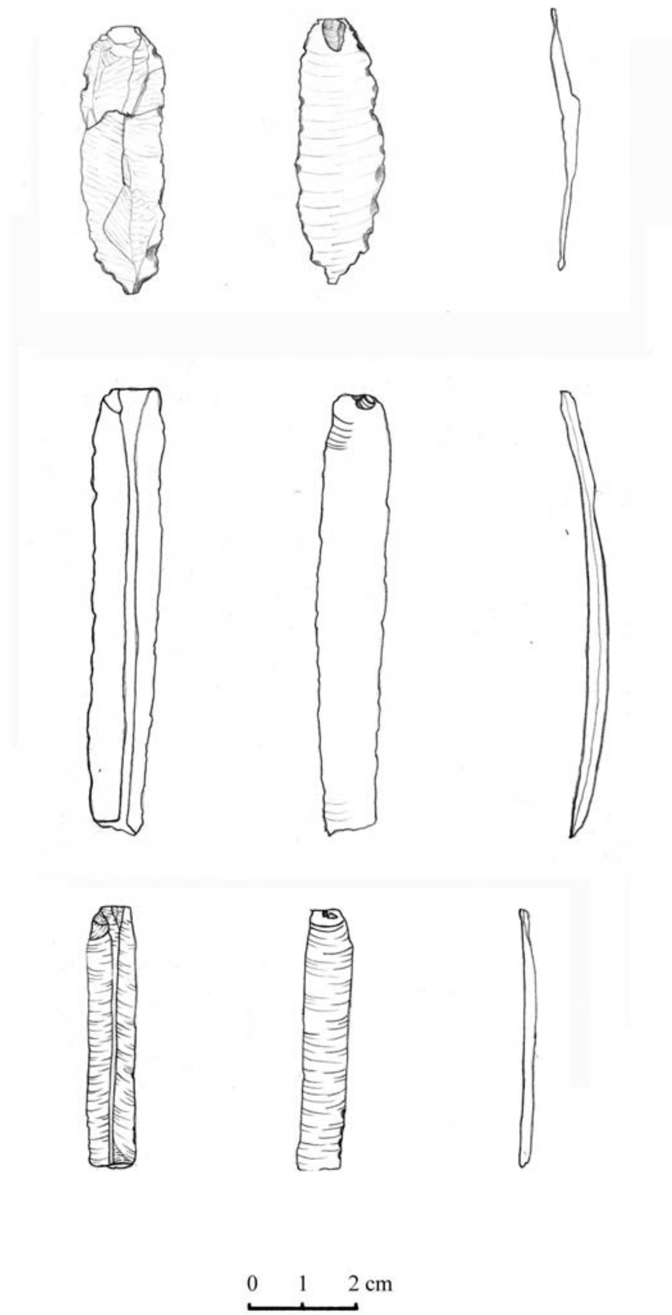


Figure 7.6. Obsidian blades from Cancuen; a. Initial series blade, lot 25A-4-4 (drawing by Margarita Cossich) b. Final series blade, lot CAN 40A-10-1 (drawing by Margarita Cossich) c. Final series blade, lot CAN 38-15-2 (drawing by Margarita Cossich).

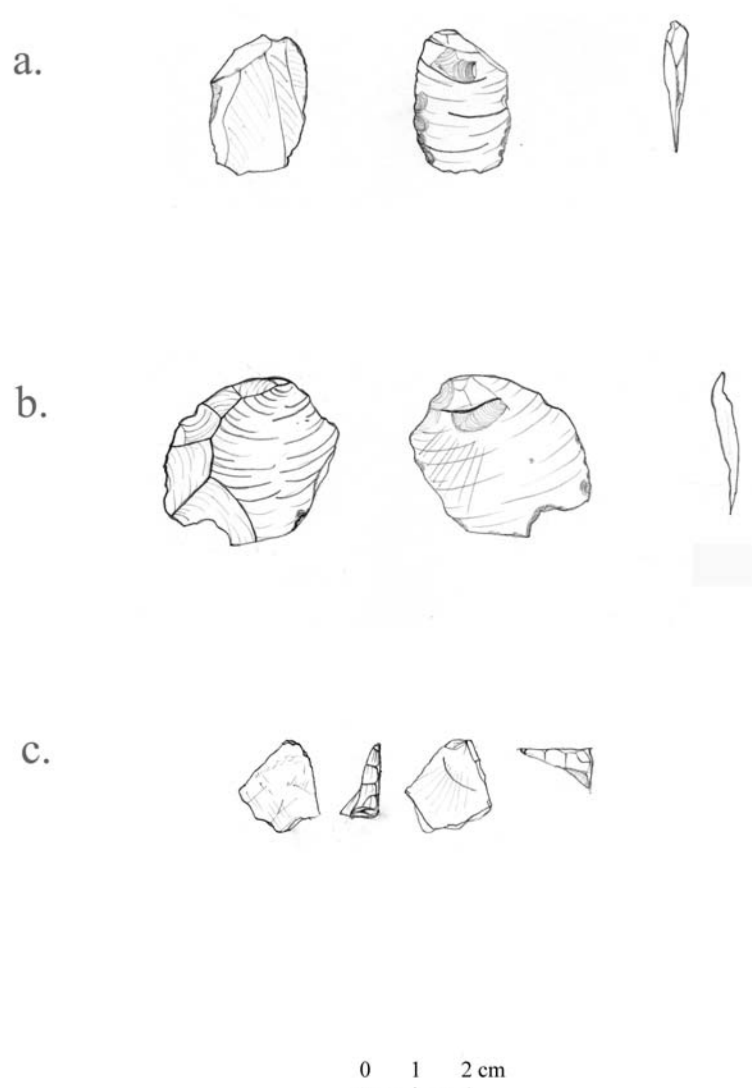


Figure 7.7. Rejuvenation flakes from Cancuen; a. Proximal rejuvenation flake, lot 25A-14-2 (drawing by Margarita Cossich) b. Platform rejuvenation flake, lot 25A-33-1 (drawing by Margarita Cossich) c. Platform rejuvenation flake, lot CAN 15-13-1 (drawing by Edgar Arévalo).

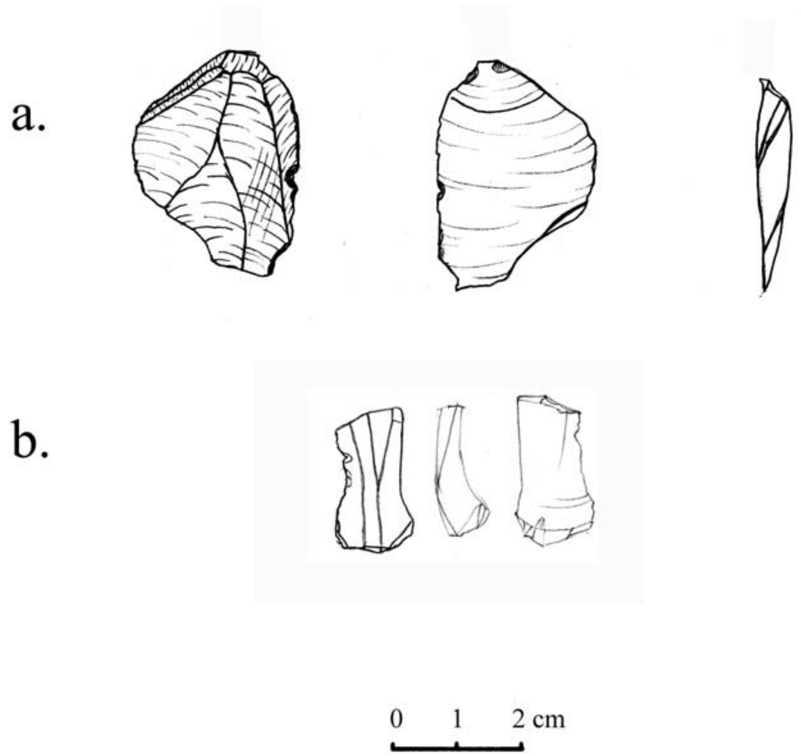


Figure 7.8. Obsidian rejuvenation and errors, a. Distal rejuvenation flake, lot 38-32-2 (drawing by Margarita Cossich) b. Overshoot (plunging) termination, lot CAN 25D-5-1 (drawing by Edgar Arévalo).

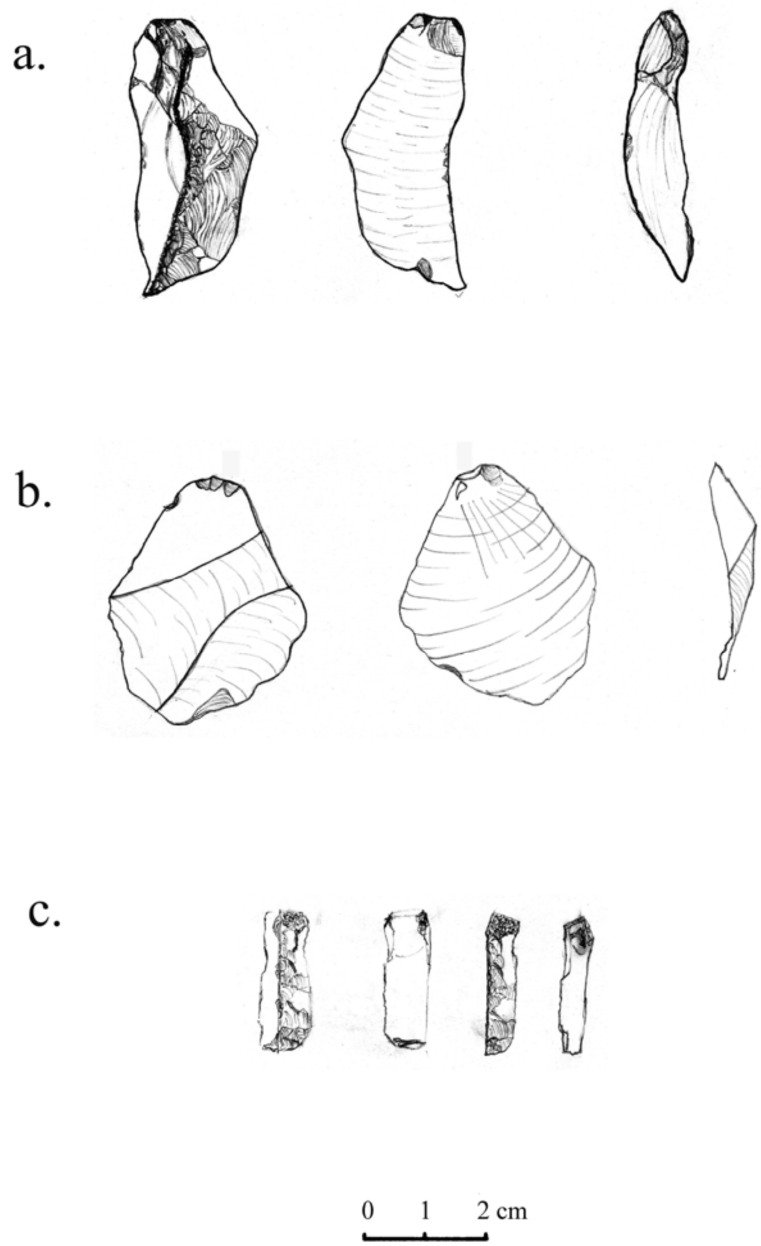


Figure 7.9. Lateral rejuvenation a. Crested blade, lot CAN 24-127-2 (drawing by Paola Duarte) b. Lateral rejuvenation flake, lot CAN 25E-39-1 (drawing by Margarita Cossich) c. Blade with lateral rejuvenation, lot CAN 7-39-8 (drawing by Edgar Arévalo).

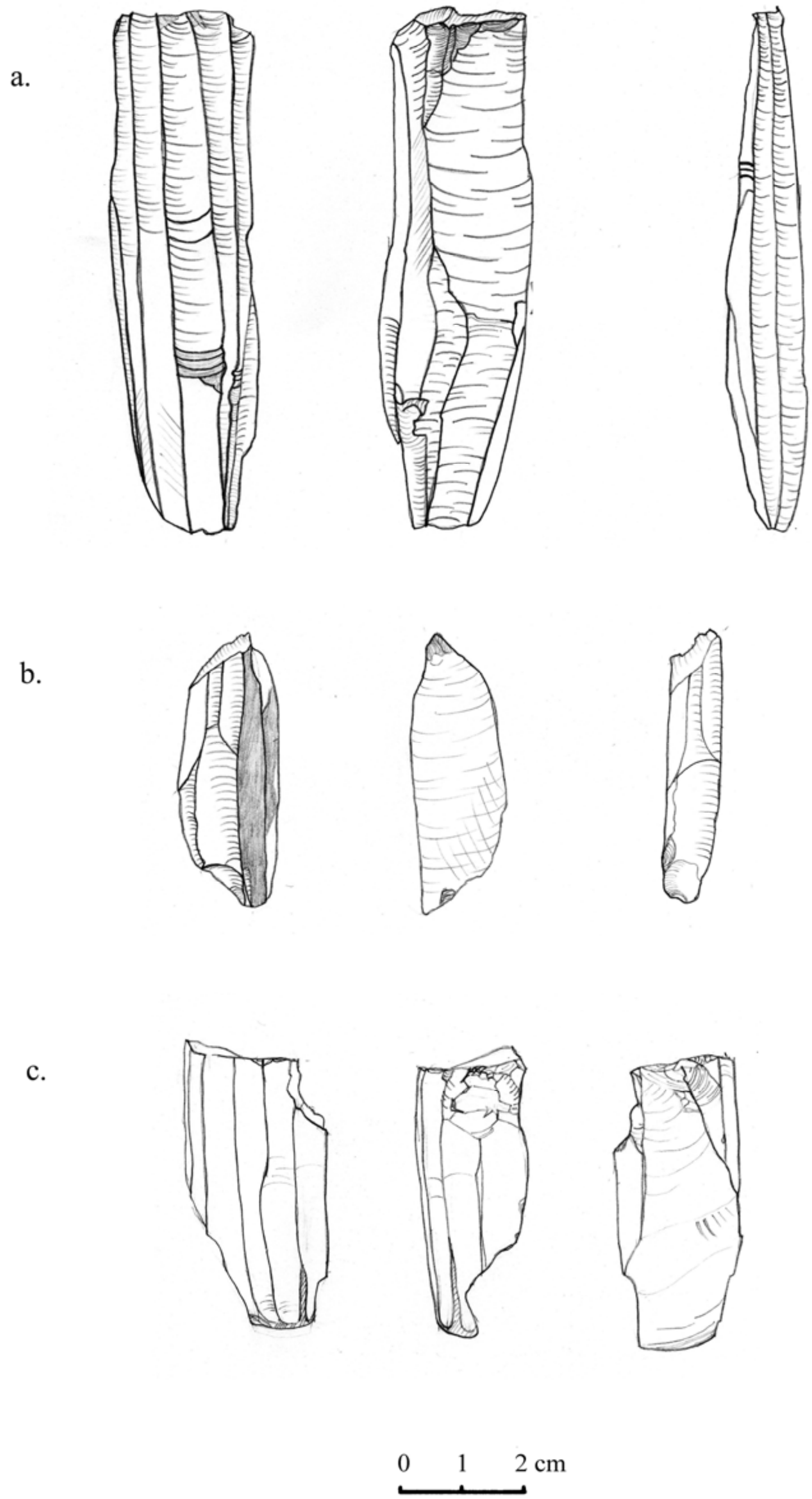


Figure 7.10. Exhausted polyhedral cores from Cancuen a. Flat core with some bipolar reduction, lot CAN 14-1-1 (drawing by Margarita Cossich) b. Core fragment with reuse and grinding visible, lot CAN 14B-3-1 (drawing by Margarita Cossich) c. Core fragment with bipolar reduction, lot CAN 13-86-1 (drawing by Margarita Cossich).

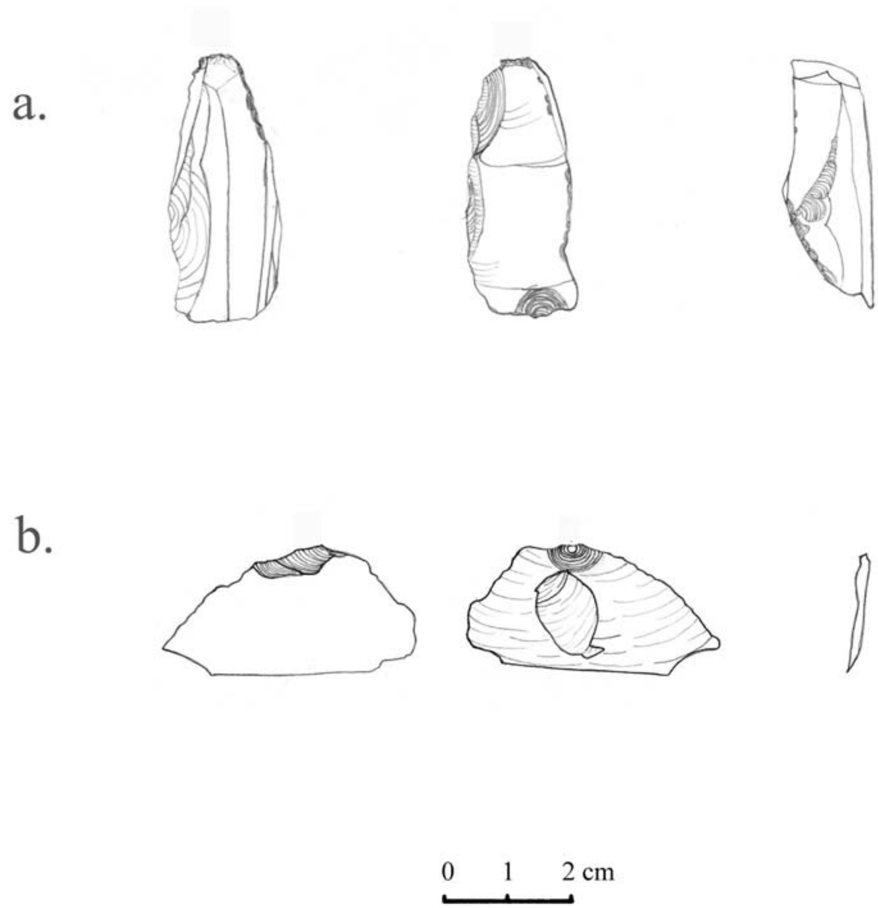


Figure 7.11. Bipolar reduction at Cancuen a. Core fragment reduced with bipolar technology, lot CAN 37C-11-3 (drawing by Margarita Cossich) b. Bipolar flake, lot CAN 14B-12-3 (drawing by Margarita Cossich).

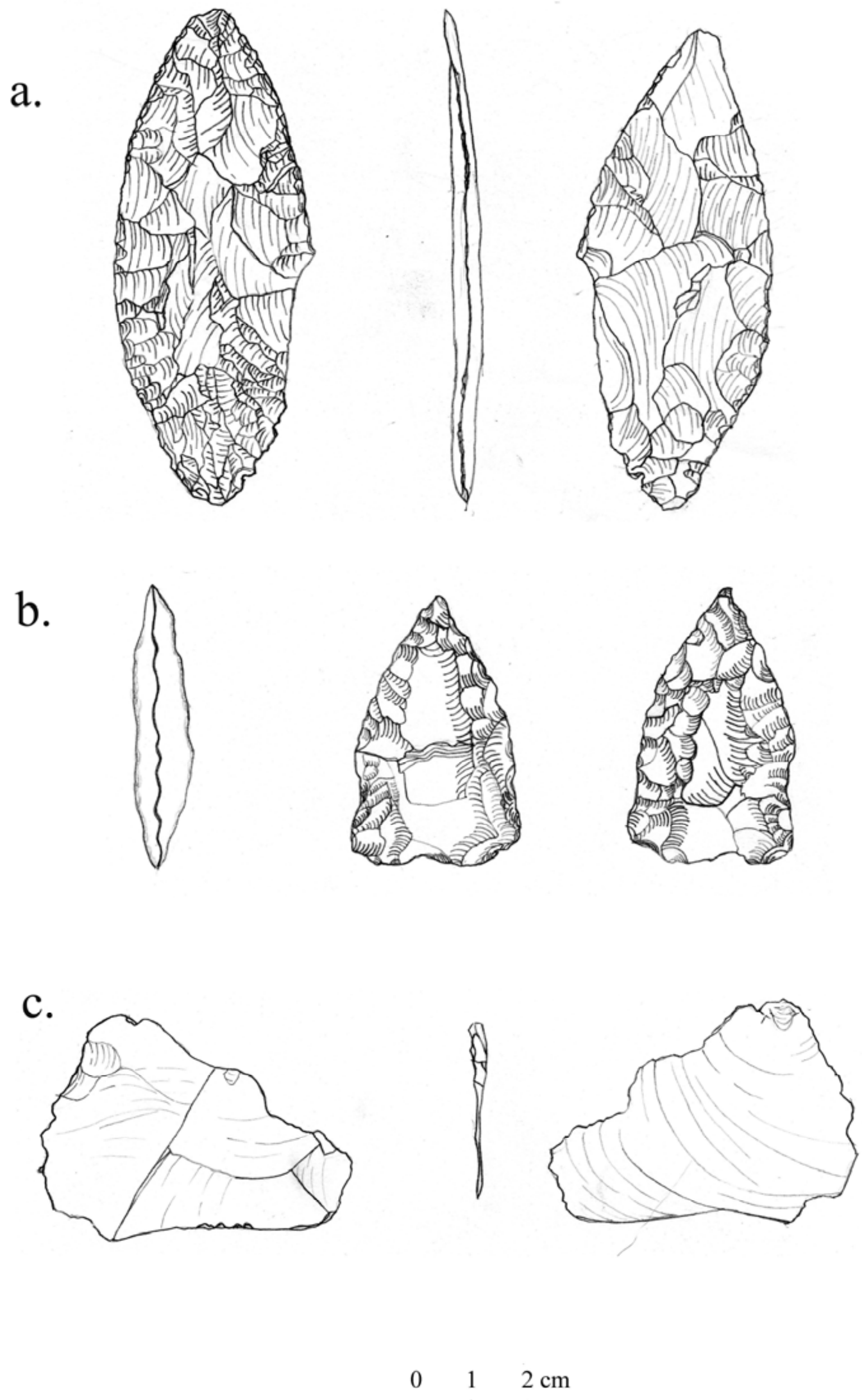


Figure 7.12. Obsidian bifacial technology at Cancuen; a. Biface (laurel leaf or small ovate type), lot CAN 15 (drawing by Edgar Arévalo) b. Projectile point, lot CAN 13-82-1 (drawing by Margarita Cossich) c. Bifacial reduction flake, lot CAN 24-153-3 (drawing by Margarita Cossich).

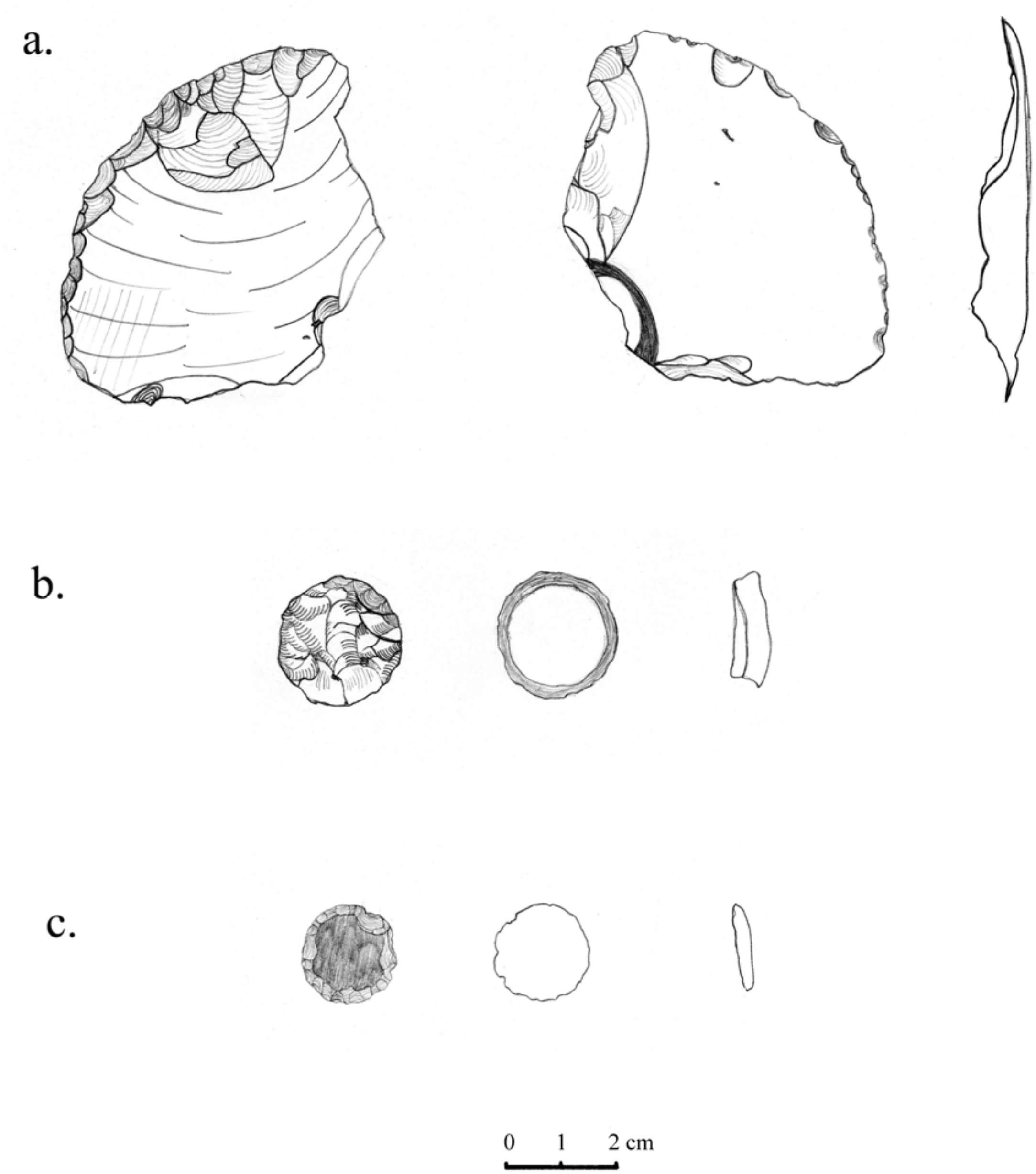


Figure 7.13. Obsidian sequins (round objects); a. Obsidian scraper on a macroflake with a ground portion on the ventral surface that seems to match the sequin pictured below, lot CAN 25A-7-0 (drawing by Margarita Cossich) b. Obsidian sequin flaked on one side and ground on lateral edges, lot CAN 14A (drawing by Margarita Cossich) c. Obsidian sequin fully ground on one site and flaked on lateral edges, lot CAN 14B-12-3 (drawing by Margarita Cossich).

Figure 7.14. Obsidian platform rejuvenation flake, lot CAN 25A-93-2 (photo by author).

Figure 7.15. Obsidian sequin, lot CAN 16-9-1 (photo by author).

Figure 7.16. Stucco sculpture of Cancuen king with obsidian sequin inlays for eyes, Structure L7-9, lot CAN 4 (not to scale; photo by Tomas Barrientos).

Figure 7.17. Exhausted polyhedral cores, lots CAN 24-57-2 (above) and CAN 14-1-1 (below) (photo by author).

Figure 7.18. Polyhedral core and complete prismatic blade, lots CAN 14-1-1 (above) and CAN 7-76-3 (below) (photo by author).

Figure 7.19. Obsidian macroblade (from Zaragoza source), lot CAN 37C-11-3 (photo by author).

Figure 7.20. Obsidian biface (laurel leaf or small ovate type), lot CAN 14-1-1 (photo by author).

Table 7.1. Results of X-Ray Fluorescence performed on obsidian by Fred Nelson of Brigham Young University.

Results of X-Ray Flourescence performed by Fred Nelson of Brigham Young University

Sample	Operation	TiO2 %	Fe2O3 %	MnO %	CaO %	Na2O %	K2O %	Zn ppm	Rb ppm	Sr ppm	Y ppm	Zr ppm	Nb ppm	Ba ppm	Ce ppm	**Source**
1	CAN 24-62-2	0.15	0.83	0.09	0.94	3.77	3.87	37	148	147	18	113	0	918	55	**4**
2	CAN 24-12-3	0.15	1.37	0.03	0.41	3.47	4.63	38	140	29	33	213	18	459	83	**17**
3	CAN 24-23-1	0.15	1.37	0.03	0.41	3.39	4.59	38	139	29	33	211	17	459	78	**17**
4	CAN 7-77-1	0.13	0.69	0.08	0.86	3.56	3.97	35	154	138	19	94	10	880	52	**?**
5	CAN 25A-95-2	0.15	0.81	0.09	0.93	3.72	3.8	37	148	147	19	114	10	912	52	**4**
6	CAN 25A-107-1	0.16	0.9	0.07	1.14	3.41	3.77	34	115	190	14	114	0	1065	57	**2**
7	CAN 24-62-2	0.15	0.82	0.09	0.94	3.94	3.83	38	148	146	18	112	11	932	52	**4**
8	CAN 25A-96-3	0.16	0.83	0.09	0.96	3.83	3.9	37	148	146	18	112	10	931	57	**4**
9	CAN 37C-6-4	0.23	1.35	0.06	1.15	3.65	4.12	29	98	149	16	165	9	1037	55	**3**
10	CAN 25A-33-1	0.15	1.38	0.03	0.42	3.44	4.66	37	133	25	30	205	16	468	88	**17**

4= **El Chayal**
3= **Ixtepeque**
2= **San Martin Jilotepeque**
17= **Zaragoza, Puebla**
?= **Unknown Source**

Table 7.2. Numbers of obsidian artifacts attributed to a source by structure type including totals.

Obsidian Source	Type 1	Type 2	Type 3	Type 4	Type 5	Type 0	**Totals**
El Chayal	285	796	1419	2799	183	573	**6055**
Ixtepeque	15	52	87	180	2	34	**370**
San Martin Jilotepeque	4	14	15	19	11	21	**84**
Pachuca	0	6	1	0	0	0	**7**
Zaragoza	2	8	12	23	0	1	**46**
San Bart. Milpas Altas	1	0	1	1	0	0	**3**
Unknown	14	22	20	63	3	8	**130**
Totals	**321**	**898**	**1555**	**3085**	**199**	**637**	**6695**

Table 7.3. Relative percentages of obsidian sources by structure type.

Obsidian Source	% Type 1	% Type 2	% Type 3	% Type 4	% Type 5	% Type 0
El Chayal	88.79	88.64	91.25	90.73	91.96	89.95
Ixtepeque	4.67	5.79	5.59	5.83	1.01	5.34
San Martin Jilotepeque	1.25	1.56	0.96	0.62	5.53	3.30
Pachuca	0.00	0.67	0.06	0.00	0.00	0.00
Zaragoza	0.62	0.89	0.77	0.75	0.00	0.16
San Bart. Milpas Altas	0.31	0.00	0.06	0.03	0.00	0.00
Unknown	4.36	2.45	1.29	2.04	1.51	1.26

Table 7.4. Types of terminations for blades in numbers and relative percentages by structure type.

Termination	Type 1	Type 1%	Type 2	Type 2 %	Type 3	Type 3 %	Type 4	Type 4 %	Type 5	Type 5 %	Type 0	Type 0 %
Feather	11	3.89	38	4.99	62	4.98	145	5.52	4	2.47	9	1.79
Premature Feather	0	0.00	1	0.13	12	0.96	15	0.57	5	3.09	2	0.40
Hinge	7	2.47	38	4.99	20	1.61	48	1.83	2	1.23	19	3.77
Step	12	4.24	58	7.61	25	2.01	70	2.67	7	4.32	19	3.77
Overshoot	4	1.41	8	1.05	10	0.80	15	0.57	5	3.09	15	2.98
Totals	283		762		1244		2626		162		504	

Table 7.5. Visible use on obsidian artifacts in numbers and relative percentages.

Visible Use	Type 1	Type 1 %	Type 2	Type 2 %	Type 3	Type 3 %	Type 4	Type 4 %	Type 5	Type 5 %	Type 0	Type 0 %
none	82	28.98	199	26.12	476	38.26	866	32.98	42	25.93	83	16.47
light	137	48.41	428	56.17	388	31.19	930	35.42	57	35.19	163	32.34
medium	26	9.19	74	9.71	194	15.59	313	11.92	53	32.72	59	11.71
heavy	7	2.47	26	3.41	105	8.44	258	9.82	19	11.73	20	3.97
Totals	283		762		1244		2626		162		504	

Table 7.6. Amount and location of retouch on obsidian blades in numbers and relative percentages.

Blade retouch	Type 1	Type 1 %	Type 2	Type 2%	Type 3	Type 3%	Type 4	Type 4%	Type 5	Type 5%	Type 0	Type 0%
none	111	39.22	204	26.77	702	56.43	1288	49.05	22	13.58	136	26.98
vental	7	2.47	51	6.69	62	4.98	156	5.94	16	9.88	17	3.37
dorsal	56	19.79	211	27.69	194	15.59	383	14.58	15	9.26	74	14.68
bifacial	79	27.92	260	34.12	152	12.22	524	19.95	12	7.41	59	11.71
distal	0	0.00	5	0.66	1	0.08	8	0.30	0	0.00	0	0.00
Totals	283		762		1244		2626		162		504	

Table 7.7. Amount of cortex present on dorsal surface of obsidian artifacts in numbers and relative percentages by structure type.

Cortex	*Type 1*	*Type 1%*	*Type 2*	*Type 2%*	*Type 3*	*Type 3%*	*Type 4*	*Type 4%*	*Type 5*	*Type 5%*	*Type 0*	*Type 0%*
0%	357	99.17	915	98.92	1592	99.38	3233	99.20	221	99.55	644	99.69
0-25%	1	0.28	6	0.65	7	0.44	16	0.49	1	0.45	2	0.31
25-50%	2	0.56	4	0.43	2	0.12	6	0.18	0	0	0	0
50-75%	0	0	0	0	1	0.06	4	0.12	0	0	0	0
75-100%	0	0	0	0	0	0	0	0	0	0	0	0
Totals	360		925		1602		3259		222		646	

Table 7.8. Obsidian artifact types by structure type including totals.

Obsidian Artifact Type	Type 1	Type 2	Type 3	Type 4	Type 5	Type 0	**Totals**
Exhausted polyhedral cores	15	10	15	13	0	4	**57**
Bipolar cores	0	0	2	2	0	1	**5**
Nodules	0	1	0	6	0	0	**7**
Macroblades	0	2	13	9	0	2	**26**
Small percussion blades	1	2	3	4	3	0	**13**
Initial Series blades	43	61	62	152	31	88	**437**
Final Series blades	237	676	1127	2326	123	406	**4895**
Undetermined blade frag	2	21	39	135	5	8	**210**
Crested blades	0	0	1	1	0	1	**3**
Macroflakes	7	11	18	25	0	6	**67**
Bifaces	3	6	5	7	0	3	**24**
Scrapers	0	1	0	0	0	0	**1**
Sequins (round flat object)	2	3	3	4	0	0	**12**
Flakes	17	76	99	219	23	32	**466**
Chunks	1	17	18	59	2	5	**102**
Bifacial reduction flakes	5	5	5	10	0	12	**37**
Bipolar flakes	2	1	2	2	4	1	**12**
Pressure flakes	17	23	163	262	25	70	**560**
Proximal rejuv. flakes	1	4	5	1	1	0	**12**
Medial rejuvenation flakes	2	0	0	5	1	0	**8**
Distal rejuvenation flakes	1	1	5	2	0	1	**10**
Lateral rejuvenation flakes	2	1	8	7	0	0	**18**
Platform rejuv. flakes	2	3	9	8	4	6	**32**
Totals	**360**	**925**	**1602**	**3259**	**222**	**646**	**7014**

Table 7.9. Relative percentages of obsidian artifact types by structure type.

Obsidian Artifact Type	% Type 1	% Type 2	% Type 3	% Type 4	% Type 5	% Type 0
Exhausted polyhedral cores	4.17	1.08	0.94	0.40	0.00	0.62
Bipolar cores	0.00	0.00	0.12	0.06	0.00	0.15
Nodules	0.00	0.11	0.00	0.18	0.00	0.00
Macroblades	0.00	0.22	0.81	0.28	0.00	0.31
Small percussion blades	0.28	0.22	0.19	0.12	1.35	0.00
Initial Series blades	11.94	6.59	3.87	4.66	13.96	13.62
Final Series blades	65.83	73.08	70.35	71.37	55.41	62.85
Undetermined blade frag	0.56	2.27	2.43	4.14	2.25	1.24
Crested blades	0.00	0.00	0.06	0.03	0.00	0.15
Macroflakes	1.94	1.19	1.12	0.77	0.00	0.93
Bifaces	0.83	0.65	0.31	0.21	0.00	0.46
Scrapers	0.00	0.11	0.00	0.00	0.00	0.00
Sequins	0.56	0.32	0.19	0.12	0.00	0.00
Flakes	4.72	8.22	6.18	6.72	10.36	4.95
Chunks	0.28	1.84	1.12	1.81	0.90	0.77
Bifacial reduction flakes	1.39	0.54	0.31	0.31	0.00	1.86
Bipolar flakes	0.56	0.11	0.12	0.06	1.80	16.67
Pressure flakes	4.72	2.49	10.17	8.04	11.26	10.84
Proximal rejuv. flakes	0.28	0.43	0.31	0.03	0.45	0.00
Medial rejuvenation flakes	0.56	0.00	0.00	0.15	0.45	0.00
Distal rejuvenation flakes	0.28	0.11	0.31	0.06	0.00	0.15
Lateral rejuv. flakes	0.56	0.11	0.50	0.21	0.00	0.00
Platform rejuv. flakes	0.56	0.32	0.56	0.25	1.80	0.93

Table 7.10. Cutting edge to mass ratios for various Highland and Lowland sites (after Sidrys 1979:Table 1 [note that the figures from Sidrys were from small sample sizes]).

Site	**CE/M Ratio**	**Citation**
El Mirador	4.25 cm/g	Fowler 1987:24
Seibal	3.74 cm/g	Sidrys 1978:150-152
Altun Ha	7.44 cm/g	Sidrys 1978:150-152
Chalchuapa, El Salvador (close to Ixtepeque source)	2.69 cm/g	Sheets 1978:11
Cihuatan, El Salvador	4.07 cm/g	Fowler 1981:323
Kaminaljuyu (close to El Chayal source)	3.27 cm/g	Sidrys 1978:150-152
Copan (close to Ixtepeque source)	4.75 cm/g	Sidrys 1978:150-152
Tikal	4.08 cm/g	Sidrys 1978:150-152
Palenque	6.96 cm/g	Sidrys 1978:150-152
Piedras Negras	5.15 cm/g	Sidrys 1978:150-152
Dzibilchaltun	5.96 cm/g	Sidrys 1978:150-152
Cancuen	2.87 cm/g	Kovacevich 2006

Table 7.11. Obsidian blade widths at Cancuen including mean, standard deviation, maximum and minimum shown by source and structure type.

Blade Width	Type I	Type 2	Type 3	Type 4	Type 5	Type 0	
El Chayal (n)	231	620	1049	2140	220	360	4620
Mean	1.29	1.24	1.21	1.18	1.28	1.15	1.23
Standard Dev.	3.33	3.38	3.01	3.24	4.23	2.59	
Max	0.62	0.17	0.5	0.12	0.53	0.26	
Min	2.24	3.93	3.68	3.9	4.24	2.27	
Ixtepeque (n)	13	47	72	119	19	22	292
Mean	1.33	1.36	1.26	1.35	1.2	1.19	1.28
Standard Dev.	3.4	2.41	5.09	4.36	2.29	2.97	
Max	0.79	0.77	0.78	0.68	0.75	0.68	
Min	1.9	1.9	4.57	3.86	1.63	1.69	
San Martin (n)	4	13	9	18	11	14	69
Mean	1.47	1.33	1.18	1.2	1.12	1.27	1.26
Standard Dev.	4.13	2.84	2.49	2.7	2.4	2.48	
Max	0.93	0.68	0.9	0.85	0.77	0.9	
Min	1.87	1.68	1.63	1.82	1.39	1.67	
Pachuca (n)	0	6	0	0	0	0	6
Mean		1.02					1.02
Standard Dev.		1.81					
Max		0.84					
Min		1.25					
Zaragoza (n)	2	7	29	18	0	1	57
Mean	1.23	1.28	1.27	1.29		2.12	1.44
Standard Dev.	1.73	3.27	2.61	3.71			
Max	1.11	1.03	0.9	0.86			
Min	1.35	1.84	1.81	2.03			

Table 7.12. T-Test of mean blade width between Types I and II structures. Null hypothesis: There is no significant difference in mean blade width between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Obsidian Blade Width	*Type 1*	*Type 2*
Mean	13.04866	12.53701
Variance	11.28576	10.38518
Observations	276	743
Hypothesized Mean Difference	0	
df	475	
t Stat	2.184298	
P(T<=t) one-tail	0.014714	
t Critical one-tail	1.648068	
P(T<=t) two-tail	0.029429	
t Critical two-tail	1.964972	

Table 7.13. T-Test of mean blade width between Types II and III structures. Null hypothesis: There is no significant difference in mean blade width between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Obsidian Blade Width	*Type 2*	*Type 3*
Mean	12.53701	12.24366
Variance	10.38518	11.82566
Observations	743	1204
Hypothesized Mean Difference	0	
df	1649	
t Stat	1.901528	
P(T<=t) one-tail	0.028704	
t Critical one-tail	1.645778	
P(T<=t) two-tail	0.057407	
t Critical two-tail	1.961403	

Table 7.14. T-Test of mean blade width between Types III and IV structures. Null hypothesis: There is no significant difference in mean blade width between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Obsidian Blade Width	*Type 3*	*Type 4*
Mean	12.24366	12.04446
Variance	11.82566	11.3868
Observations	1204	2488
Hypothesized Mean Difference	0	
df	2340	
t Stat	1.660122	
P(T<=t) one-tail	0.048512	
t Critical one-tail	1.645506	
P(T<=t) two-tail	0.097024	
t Critical two-tail	1.96098	

Table 7.15. T-Test of mean blade width between Types IV and V structures. Null hypothesis: There is no significant difference in mean blade width between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Obsidian Blade Width	*Type 4*	*Type 5*
Mean	12.04446	12.0679
Variance	11.3868	8.513656
Observations	2488	162
Hypothesized Mean Difference	0	
df	190	
t Stat	-0.09808	
P(T<=t) one-tail	0.460985	
t Critical one-tail	1.652913	
P(T<=t) two-tail	0.921969	
t Critical two-tail	1.97253	

Table 7.16. T-Test of mean blade width between Types V and 0 structures. Null hypothesis: There is no significant difference in mean blade width between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Obsidian Blade Width	*Type V*	*Type 0*
Mean	12.0679	12.02006
Variance	8.513656	11.61295
Observations	162	496
Hypothesized Mean Difference	0	
df	316	
t Stat	0.173575	
P(T<=t) one-tail	0.431155	
t Critical one-tail	1.649689	
P(T<=t) two-tail	0.862311	
t Critical two-tail	1.967501	

Table 7.17. T-Test of mean blade width between "Elite" and "Nonelite" structures. Null hypothesis: There is no significant difference in mean blade width between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Obsidian Blade Width	*Elite*	*Nonelite*
Mean	12.67559	12.09769
Variance	10.67001	11.42795
Observations	1019	4350
Hypothesized Mean Difference	0	
df	1570	
t Stat	5.049563	
P(T<=t) one-tail	2.47E-07	
t Critical one-tail	1.645826	
P(T<=t) two-tail	4.94E-07	
t Critical two-tail	1.961475	

Table 7.18. Obsidian artifact measurements showing mean length, width, thickness, weight, and standard deviation for each type separated by structure type.

Obsidian Artifact Measurements		**Type 1**	St. Dev.	**Type 2**	St. Dev.	**Type 3**	St. Dev.	**Type 4**	St. Dev.	**Type 5**	St. Dev.	**Type 0**	St. Dev.
Exhausted polyhedral cores	mean length	**3.33**	19.66	**3.37**	14.26	**3.8**	10.81	**3.91**	17.45			**5.92**	30.68
	mean width	**2**	1.61	**2.04**	7.75	**2.03**	5.22	**1.9**	6.28			**2.18**	3.08
	mean thickness	**1.01**	3.25	**1.45**	8.3	**1.27**	4.45	**1.05**	4.78			**1.18**	4.14
	mean weight	**4.95**	0.78	**9.27**	7.64	**10.9**	8	**11.01**	16.46			**2.25**	19.27
Bipolar cores	mean length					**4.45**	13.39	**4.03**	14.39			**4.01**	
	mean width					**1.55**	5.78	**2.32**	15.52			**1.94**	
	mean thickness					**1.38**	7.83	**1.25**	9.02			**0.95**	
	mean weight					**13.15**	13.22	**13.2**	15.85			**9.5**	
Macroblades	mean length			**4.35**	15.42	**4.46**	23.93	**4.5**	19.23			**4.19**	5.02
	mean width			**3.55**	5.36	**3.02**	8.84	**3.2**	6.36			**4.09**	2.21
	mean thickness			**0.92**	3.67	**0.79**	2.98	**1.01**	4.53			**1.07**	1.03
	mean weight			**12.35**	4.31	**10.78**	7.2	**15.58**	11.87			**19.65**	1.8
Small percussion blades	mean length	**2.37**		**3.47**	6.61	**2.28**	1.55	**3.03**	13.86	**2.23**	3.49		
	mean width	**2.16**		**1.64**	2.38	**1.18**	1.71	**1.33**	3.28	**1.12**	2.32		
	mean thickness	**0.59**		**0.36**	0.28	**0.28**	1.47	**0.44**	2.54	**0.26**	0.88		
	mean weight	**2.1**		**2.1**	0.71	**0.93**	0.71	**2.1**	2.55	**0.6**	0.1		
First Series blades	mean length	**3.08**	12.85	**2.7**	10.31	**2.78**	10.77	**2.79**	13.49	**2.44**	11.04	**2.64**	11.47
	mean width	**1.41**	3.72	**1.34**	2.93	**1.53**	3.82	**1.54**	4.01	**1.39**	3.63	**1.32**	3.53
	mean thickness	**3.42**	0.99	**0.33**	1.17	**0.38**	1.66	**0.39**	1.6	**0.29**	0.94	**0.32**	0.88
	mean weight	**1.68**	0.97	**1.44**	0.76	**1.84**	1.57	**1.94**	1.73	**1.2**	0.81	**1.39**	1.06
Final Series blades	mean length	**2.64**	10.68	**2.61**	10.31	**2.45**	9.76	**2.39**	10.13	**2.38**	8.75	**2.33**	9.71
	mean width	**1.29**	3.28	**1.23**	2.93	**1.19**	2.58	**1.13**	3.41	**1.16**	2.56	**1.16**	2.64

	mean thickness	**3.21**	1.14	**3.13**	1.17	**0.3**	0.72	**0.29**	0.31	**0.28**	0.65	**2.91**	0.72
	mean weight	**1.41**	1.41	**1.22**	0.76	**1.08**	0.71	**1.03**	0.78	**1.05**	0.71	**1.03**	0.77
Crested blades	mean length					**23.52**		**1.55**				**2.46**	
	mean width					**7.92**		**0.77**				**1.29**	
	mean thickness					**4.34**		**0.3**				**0.56**	
	mean weight					**1.1**		**0.3**				**1.2**	
Macroflakes (percussion)	mean length	**4.92**	9.39	**4.13**	10.29	**4.34**	11.56	**3.9**	12.29			**4.05**	11.14
	mean width	**3.74**	20.13	**2.88**	7.06	**2.93**	8.13	**3.51**	11.23			**3.26**	7
	mean thickness	**0.97**	1.65	**2.3**	2.26	**0.79**	4.24	**1.11**	4.92			**0.72**	3.11
	mean weight	**1.79**	14.03	**8.84**	4.29	**9.75**	9.82	**15.57**	18.14			**10.53**	6.3
Bifaces	mean length	**3.22**	16.35	**3.09**	9.55	**5.03**	37.19	**4.99**	16.58			**6.18**	16.21
	mean width	**3.22**	11.88	**2.86**	6.97	**3.25**	8.99	**2.86**	9			**2.92**	6.97
	mean thickness	**0.76**	3.11	**0.7**	2.26	**0.91**	3.64	**0.92**	4.62			**1.02**	3.74
	mean weight	**10.47**	8.39	**7.35**	4.65	**20.06**	21.34	**14.44**	11.12			**18.97**	11.17
Flakes (percusssion)	mean length	**3.03**	11.29	**2.25**	8.49	**2.51**	12.14	**2.46**	9.5	**1.77**	7.47	**2.23**	7.91
	mean width	**2.3**	6.36	**1.62**	5.41	**1.88**	6.5	**1.86**	7.14	**1.43**	3.34	**1.62**	5.61
	mean thickness	**0.6**	2.53	**4.17**	1.72	**0.56**	2.77	**0.49**	2.32	**0.27**	1.07	**0.48**	1.99
	mean weight	**0.39**	2.77	**1.66**	1.38	**2.57**	3.01	**2.11**	1.83	**0.78**	1.39	**1.62**	1.35
Chunks	mean length	**3.92**		**2.28**	8.24	**2.14**	7.1	**2.37**	10.24	**1.7**	1.36	**1.92**	6.81
	mean width	**2.56**		**1.58**	7.02	**1.54**	7.01	**1.86**	9.63	**0.98**	0.67	**1.65**	5.95
	mean thickness	**1.1**		**0.98**	4.65	**0.85**	4.45	**1.05**	6.06	**0.74**	2.83	**0.78**	3.03
	mean weight	**8.9**		**4.13**	4.65	**3.25**	3.2	**6.9**	16.33	**0.9**	0	**2.68**	2.31
Bifacial reduction flakes	mean length	**4.05**	9.17	**2.32**	8	**2.85**	7.54	**2.21**	11.38			**3.06**	11.09

	mean width	**3.01**	10.99	**1.45**	5.52	**2.59**	9.24	**2.13**	12.43			**2.65**	10.75
	mean thickness	**0.53**	1.55	**0.35**	0.6	**0.43**	1.97	**0.3**	0.99			**0.41**	1.93
	mean weight	**5.1**	1.3	**0.94**	0.59	**2.54**	1.96	**1.74**	2.22			**2.93**	2.66
Retouch flakes	mean length												
	mean width												
	mean thickness												
	mean weight												
Bipolar flakes	mean length	**30.92**	11.44	**2.52**		**3.26**	2.96	**2.6**	7.33	**2.43**	10.06	**2.35**	
	mean width	**17.05**	3.25	**1.49**		**2.31**	0.11	**1.04**	0.38	**1.53**	11.32	**0.93**	
	mean thickness	**9.91**	6.35	**0.38**		**0.78**	3.54	**0.44**	0.63	**0.38**	1.42	**0.52**	
	mean weight	**4.6**	4.24	**1.6**		**5**	1.7	**1.7**	1.13	**1.65**	2.23	**1.1**	
Pressure flakes	mean length	**2.43**	12.25	**1.89**	5.58	**1.9**	8.01	**1.84**	8.76	**1.54**	2.79	**1.65**	7.73
	mean width	**1.69**	5.98	**1.41**	4.49	**1.43**	5.58	**1.44**	5.95	**1.19**	2.13	**1.23**	5.3
	mean thickness	**0.37**	1.26	**0.33**	1.35	**0.32**	2.04	**0.38**	2.42	**2.12**	0.81	**0.3**	1.59
	mean weight	**1.99**	1.72	**0.98**	1.01	**0.9**	1.17	**1.2**	1.78	**0.35**	0.12	**0.74**	1.06
Sequins	mean length			**3.17**	10.31	**1.62**	8.22	**1.87**	9.99				
	mean width			**2.75**	4.33	**1.43**	5.31	**1.39**	3.28				
	mean thickness			**0.64**	2.14	**0.41**	1.67	**0.28**	0.73				
	mean weight			**7.17**	3.25	**1.2**	0.95	**1.15**	0.85				

CHAPTER VIII

CHERT

> In this land there has not been found up to today any kind of metal, which is indigenous, and it astonishes that without it, so many buildings have been built, since the Indians do not give any account of the tools with which they were built. But seeing that they were without metals, God provided them with a ridge of flint near the range of hills….from which they got stones from which they made the heads of their lances for war and the knives for the sacrifices (of which the priests kept a good supply).
>
> (Landa 1864 [Tozzer 1941:186])

Introduction

Chert was another medium for the production of chipped stone tools and ritual objects in the Classic Maya world. There has been little evidence of elite control of chert production and distribution (although cf. Hester and Shafer 1994), and the use of chert as an allocative resource in the Maya world has been difficult to prove. Some chert implements could be defined as authoritative resources, such as chert eccentric flints (described below) used in ritual, often found in elite contexts in many Lowland Maya sites. Distributions of chert tools and debitage were analyzed at Cancuen in order to investigate patterns of technologies and finished products according to differing contexts. Identifying the manufacturing sequence for chert artifacts would help to determine if technologies were restricted to certain statuses or contexts. The quality and abundance of chert in differing contexts was also explored in order to elucidate differential patterns of restricted access to certain high quality raw materials or tools. The findings here support the notion that chert was both an allocative and authoritative resource to some extent, but was also well distributed throughout the site and not necessarily restricted to or controlled by elites.

What is Chert?

A local abundant resource available to Cancuen was chert, a hard, compact, fine-grained, sedimentary rock formed almost entirely of silica (SiO_2). The sedimentary limestone present in the banks of the Pasión River provides not only a wealth of construction material, but also a source of chert for stone tool production. Chert forms as irregular, lumpy nodules or beds within limestone as silica in water (most of it present from the weathering of silicate minerals like feldspars, clays, and volcanic rocks) replaces the original rock with silica (chemical precipitation).

Chert, as opposed to jadeite and pyrite, is a rock instead of a mineral, as rocks are aggregates of minerals and chert is primarily made up of grains of the mineral quartz. Obsidian was technically not a rock because it lacks a crystalline structure (Chapter 7), but chert does have microcrystalline or cryptocrystalline structure, although it is microscopic, and can be classified as a rock. In the case of cryptocrystalline rocks, the aggregate crystals are less than 3*u*m in diameter (Andrefsky 1998:xxii).

Chert (as a rock composed mainly of quartz) has a hardness of 7 on Mohs scale. This is as hard as jade or harder, making it a suitable tool for jade production (see Chapter 5), but it also is harder and more durable than obsidian (which has a hardness of 5-5.5; Chapter 7).

Chert is used as a general term here which subsumes related sedimentary rocks including microcrystalline quartz, flint, and chalcedony as there are many varieties of fine-grained siliceous rocks whose properties grade into one another (as per Luedtke 1992:5), but when possible the rocks were differentiated in the analysis. Flint was the first word used to refer to all cherts and siliceous rocks, but a dichotomy in usage began between American and British uses of the terms. American archaeologists generally consider flint to be a variety of chert, while British archaeologists consider them to be distinct materials, flint referring to the dark, fine-grained material that formed in Cretaceous period chalk beds in Britain, chert being lighter and of lesser quality forming in limestones or shale beds (see Luedtke 1992:6). Outside of Great Britain, this distinction does not hold up, and for example in Mesoamerica, chert that forms in limestone can be of very high quality, and can also be darker in color. Here I will refer to chert as material that formed in limestone and flint as material that formed in chalk beds, if the distinction can be made.

Chalcedony is a term used by most archaeologists to refer to translucent chert, but geologically it refers to the fibrous nature of chalcedony vs. the granular nature of quartz and chert, but they have the same chemical composition, thus, not all translucent cherts are chalcedonies. This distinction is made microscopically by petrography, a technique that was not used here, so translucence was recorded along with visual properties of the grain of the artifact.

The presence of clay and metal minerals tend to produce the darker colored and opaque cherts, the presence of iron can produce red or green colors. The grain texture of chert can vary from extremely fine to coarse, a result of a combination of factors including the density of silica nucleation sites, rate of crystal growth, and temperature (Luedtke 1992:25), and grain size can vary even within a single nodule.

Chert was used to make chipped stone tools, ceremonial knives, and weapons. Because of its cryptocrystalline structure, as it forms crystals develop, but they are so minute that they would not impede a clear fracture plane. Other rocks with large crystalline structure would be unflakeable or fracture along irregular planes. These types of rocks fracture very predictably and a desired outcome for a blow can be easily controlled by a skilled worker.

Chert was the most widely used stone for chipped stone tools around the world until its replacement by metals. Chert varies widely in color and quality. Unfortunately, chert is far less homogeneous than obsidian, making it difficult to subject to chemical sourcing (although some studies have had some success; see Luedtke 1992; Lyons et al. 2003; Roll et al. 2005) as some cherts have less variability than others. Chemical sourcing was not utilized for chert in this work, it was apparent that the majority of chert was available locally in abundance, and consideration of imports or exports was not necessarily an important research question for the time being, but may be considered in the future. The main questions addressed here had to do with artifact distribution, looking for patterns of intrasite differences in types of tools, ceremonial/ritual objects ("eccentric flints"), and types of debitage between statuses, especially looking for the production of specific tools for specialized tasks associated with craft production.

Chert Sources

The most well-known and well-described chert source in the ancient Maya world is Colha, Belize (e.g., Hester and Shafer 1994; Shafer and Hester 1983). The site itself is located 53 km northwest of Belize City and is about 6 km^2, with literally hundreds of workshops in chert (Roemer 1991), and in one example, one cubic meter of excavation yielded over 603,000 chert artifacts (Op. 2024, Drollinger 1989; Shafer 1991). The chert occurs as cobbles or boulders in the limestone deposits around the site. The appearance of the chert itself is very distinctive, described as crypto-crystalline (very fine grained), opaque, primarily of a honey brown color, but sometimes tan, gray, grayish brown, or banded tan and gray (see Mitchum 1991; Shafer and Hester 1983). This distinctive appearance and high quality have allowed it to be identified as an import at many sites that have no local chert sources or chert sources of poorer quality (e.g., Aldenderfer 1991; Moholy-Nagy 1991, 1997, 2003; Willey et al. 1965).

The quality and appearance of cherts at Cancuen vary greatly. Very fine grained chert was present to such a great degree that it must have been available locally (see below). Although no distinct source for all Cancuen chert has been identified, the limestone beds in the Pasión River certainly provide an important source, especially during the dry season when even more sedimentary deposits are exposed as the water level drops. Many of the nodules recovered from Cancuen are also very river rounded and were probably discovered as "floats" along the Pasión (see also Aldenderfer 1991). Wadell (1938) noted the presence of chert outcrops along the upper Pasión near Cancuen in his reconnaissance of the area during the 1930s (see also Chapter 1). The high quantities of flakes with cortex and the early stages of reduction (i.e. decortication flakes) also suggest that whole nodules were found locally, as one would expect some initial reduction or testing if the source were distant to reduce the material carried back to the house. One small outcrop of medium quality grayish chert was identified north of the royal palace, but was not mapped or published (Tomás Barrientos, personal communication, 2001). The colors of chert at Cancuen range from black, gray, white, tan, honey, brown, gold, red, pink, purple, and banded (gray and white or tan and white; see Appendix A for corresponding Munsell colors). Each of these colors have fine grained examples, some more medium grained, and the most coarse grained and poor quality cherts (with many inclusions) being white and light gray and primarily used for larger bifaces and hammerstones. The honey colored specimens are extremely fined grained and may have been imported from the Colha source, but the large amount of this variety recovered suggests that it may have been available locally.

The Social and Ritual Significance of Chert

The Classic Maya reading of the word for chert or flint appears to be confirmed by a phonetic reading of *to-k'(a)* or *tok'* (Houston 1983). Like obsidian, chert had both banal and ritual/ceremonial functions. The ability of chert to produce sparks and fire certainly would have made it an important resource for everyday functions, as well as a signifier of ritual power. The connection with fire and sparks probably also related this materials to the Maya and Central Mexican rain gods, Chac and Tlaloc. Both chert and obsidian were thought to have been created by lightning strikes caused by the gods (Freidel et al. 1993:200; Schele and Freidel 1990:463; Miller and Taube 1993:88). In one Aztec creation myth, Citlalique (She of the Star Skirt) gave birth to flint or chert and then hurdled it to earth, where it was implanted in Chicomostoc (the primordial cave with seven chambers thought to have given birth to all of the ethnic groups of Mesoamerica), where the flint created 1600 terrestrial gods (Miller and Taube 1993:88).

Chac can be depicted carrying a flint, representing lightning, or himself as a personified flint (see Taube 1992b:17). Chac (or God B) is closely identified with warfare, and his lightning axe can be shown as a battle weapon, also shown with a shield

(Taube 1992b:24). Aztec art sometimes depicts personified flints with teeth, probably demonstrating their ability to tear human flesh and the Aztec god of castigation, Itzlacoliuhqui-ixquimilli, was also shown as a personified flint (Miller and Taube 1993:88).

Chert and obsidian were the primary means of human and blood sacrifice, making them representations of sacrifice themselves, symbolic of the sacred covenant between humans and gods. Chac was also closely associated with human sacrifice in the Postclassic, and the assistants in sacrifice were actually called "Chacs" (Landa [Tozzer] 1941:119, cited in Taube 1992b:24). Sahagún (1950-1983: Book 9, Chapter 14) describes the process of human sacrifice for the Aztec, "To slay one they cut open his breast with a broad, leather-hafted knife; this was a well-sharpened, flint knife."

Chert was often fashioned into meaningful ritual and iconographic images called "eccentric flints." Freidel et al. (1993:200-201) argue that eccentric flints that depict human silhouettes represent the god *K'awil* and are the materialization of lightning itself, and grasping the eccentric would be likened to grasping the power of lightning, which is still believed by the highland Maya today to awaken blood and cause it to speak the intentions of ancestors by shamans (B. Tedlock 1982, 1986). These were also instruments of blood sacrifice themselves (Freidel et al. 1993:202-205), often being fashioned into representations of scorpions, Chacs, *K'awils*, Jester gods, Maize gods, Moon goddesses, Sun gods, and other images.

Chert is depicted in Classic Maya art as eccentric flints, personified gods, and weaponry (i.e. spear or dart points), and the spear/shield (*tok'-pakal)* imagery was a symbol of warfare that was passed down through generations (Freidel et al. 1993:305).

Sahagún (1950-1982: Book 11, Chapter 18) describes flint (chert) or *Tecpatl:*

> This name comes from nowhere. It is round, flat, triangular, irregular. It is slick, slick in all parts; it is asperous; it is rough, scabrous, concave, dented, billowed out, bored. It has holes through it; it is pierced in places. Nowhere does it appear [big], even though long. [One] is white; one yellow, not really yellow, just blended, just a little light yellow blended. One is shaded tawny. One is green, one is transparent, one dense, one shaded. This [flint] has fire. When struck, sparks come out from it, [which] burn, burn things, set things afire, cause things to ignite; [which] make ablaze, set flaming.

This passage reiterates the variable appearance of chert, in texture and color, also its ability to produce fire.

The separation of "utilitarian" and "ceremonial" categories of chert artifacts is again very difficult, if not completely in vain, as the distinctions do not truly exist (cf. Kidder 1947). Even the debitage and remains of production were treated ritually in many cases, as seen at special deposits in caches and burials at Tikal (Moholy-Nagy 1997), Colha (Shafer and Ogelsby<<check spelling here and in bib 1980), Rio Azul (Adams 1986:451), Piedras Negras (Hruby 2006), and also in the burial of the last ruler, *Kan Maax,* at Cancuen (Barrientos et al. 2005). As Sheets (1991:177) found, debitage, partially completed artifacts, and finished products were discovered ritually deposited in the sacred cenote at Chichen Itza, which may at first seem odd to our Western sensibilities, but "[t]he apparent problem is resolved if the <u>process</u> of lithic manufacture was, at least in part, a religious act" (emphasis in original). As noted in Chapter 7, ethnographic evidence shows that there was ritualization of any lithic production, despite the final use of the artifact (Clark 1991).

Chert Analysis in Mesoamerica

Lithic studies and analysis got off to a slow start in Mesoamerica, until Kidder's (1947) pioneering lithic analysis at Uaxactun, stone tools were largely ignored, often not collected and rarely described or pictured in monographs (see also Rovner and Lewenstein 1997). Although Kidder made great strides in the area of lithic analysis, his study suffered from several presumptions and limitations. The primary problem was his distinction between 'ceremonial' and 'utilitarian' artifacts, which he created because certain artifacts, especially eccentric flints, appeared not to be utilitarian in nature. The problems with the ceremonial/utilitarian dichotomy have already been discussed (see Chapters 4 and 7), and Kidder (1947:4) himself admitted that it was often difficult to make this distinction. This distinction also implies classification based on presumed function, which has been found to be inconsistent at best (Sheets 1978), especially when checked with microwear analysis (e.g., Aldenderfer 1991; Aoyama 1996). Many studies followed Kidders lead (e.g., W. Coe 1959; Lee 1969; Proskouriakoff 1962; Willey 1972; Willey et al. 1965), and also made improvements on his approach, but remained largely descriptive instead of interpretive (Rovner and Lewenstein 1997:7).

A significant shift in the field of lithic analysis in Mesoamerica came with Rovner's (1975) unpublished Ph.D. dissertation (which has now been updated and published as Rovner and Lewenstein 1997). In his study of lithic collections from Río Bec and Dzibilchaltun, he attempted the first regional comparison considering chronological sequences, trade spheres, production sequences, and economic interpretations. He largely attempted to avoid the functional attribution of type names to tools, although some of his types still allude to the function of the tool, including types like “axe” and “pick.”

Rovner’s (1975) study combined with Sheets’s (1978) behavioral typology for obsidian paved the way for more thorough and interpretive analyses of chert manufacturing sequences and artifacts (e.g., Clark 1988; Hester and Shafer 1983; Moholy-Nagy 1997), although there is still no agreement on terms for the classification of Mesoamerican lithic artifacts (Hester 1976; Hruby n.d.). The ‘functional’ description of types has been largely abandoned (i.e. Aldenderfer 1991), but the proliferation of type names can become cumbersome and mind boggling. For example (see also Hruby n.d.), a large, thick, biface (Figure) has been called a pick-axe (Ricketson 1937:184), General utility tool, standard form (Kidder 1947:5); Chopper, one end rounded, other pointed (W. Coe 1959:11); core, bifaced percussion flaked implement (W. Coe 1965); Standard chopper, biface (Willey 1965:423); Chopper or celt, general utility form (Willey 1972:157); Convex-sided a (Hammond 1975:36); Chopper, general utility tool (Hester 1976:13); Chopper (Anderson (1976:162); Chopper, general utility tool (Wilk 1977:58), Standard Maya biface (Stoltman 1978:24); Standard Maya biface (McAnany 1986:202); Large oval biface (Fowler 1987:7); Standard Biface, large oval/biface celt (Mitchum 1991); Celt (Thompson 1991:121); Contracting base biface (Aldenderfer 1991:129); Oval biface celt (Mitchum 1991:46); and Cordiform (Rovner and Lewenstein 1997:5), all refer to a single artifact type.

A major distinction in chert tools within Mesoamerica is between “ad hoc” or expedient tools, casually made of flakes or nodules with no clear pattern or much modification from their original shapes (many are flake scrapers or nodule hammerstones). The other category is comprised of "formal tools" (see also Clark 1988; Potter 1991) which have a regular form and pattern of manufacture that can be distinguished. Both categories are present at Cancuen, supporting the abundance of chert available to residents as they were able to produce both expedient and formal tools as needed from local materials.

Expedient tools require less skill than formal tools. Removing a flake from an objective nodule is very easy in comparison to the creation of thin, symmetrical biface or elaborate eccentric flint. Chert artifacts requiring a high level of skill in limited contexts across the site would signal a restricted manufacturing sequence with a monopoly of certain social groups on skilled technologies. This does not appear to be the case at Cancuen. A high level of skill was found for all structure types, including the manufacture and possession of ritually significant eccentric flints, found in structure types I through 0, probably indicating domestic ritual in many cases. Chert knapping was part of the social identity of all residents of Cancuen, and most seem to have been very proficient in its manufacture.

Chert Typology at Cancuen

A total of 10,051 chert artifacts from domestic contexts were analyzed for this study, for a total of 133.32 kg (293.92 lbs.). The analysis here follows the technological and sequential typology used for the other lithic artifacts described in earlier chapters. The reduction sequence and technology used (i.e. hard hammer percussion, soft hammer percussion, pressure flaking, etc.; see also Whittaker 1994) were recorded for debitage and finished tools when possible. The largest categories of formal tools at Cancuen were bifaces (chipped on both sides), unifaces (chipped on one side), blades (twice as long as wide and not bifacially flaked), and informal tools made from flakes and nodules/cores, which were then placed in types based on morphological finished form and technology used to produce them (Figure 8.1). The names given to the types of artifacts are less important than the reduction strategies and finished form of the artifact (see also Aldenderfer 1991:119), but I attempted to use a widely recognized and understandable type name that did not attempt to infer any function for the artifacts.

Debitage Analysis-Flakes

Debitage in this work includes all byproducts of the production of chert tools and implements, including flakes, cores, chunks (see also Clark 1988:16), and shatter. Flakes were categorized according to the stage of production and technology used to produce them (Figure 8.2). All debitage was weighed in grams, and measured for maximum length, width, and thickness (measured originally in mm, presented here in cm). Certain physical properties of each artifact were also recorded (see also Appendix A for Chert Typology Key). These included grain (fine, medium, or coarse; i.e. correlated to quality of material), which was then compared between structures to see if different social groups had more or less access to better cherts. The percent of cortex present on the dorsal surface was also recorded in order to determine if certain residents had more access to raw materials than others, or if they had access to larger nodules or spalls than others. The amount of use macroscopically present (ranging from 0=none to 3=heavy), also helped to determine if there may have been a paucity of chert in some residences requiring them to heavily use all available cutting edges, even flakes. The completeness of the artifact was also noted in order to remove fragments from measurements and means that would be skewed by fragmentary samples, but total weights of all chert in each structure type were calculated. The type of termination and the presence of hinge fractures are important to error rates and levels of skill that can be compared between structure types, as well as the notation of "edge bite" flakes (Figure 8.26; Whittaker 1994:189-190), which accidentally remove a large portion of the edge of a biface in the process of production, another form of error. Color was also recorded to determine if there were differences between structures, and to also possibly identify imported cherts (as discussed above), and may also give clues to heat treatment, which is generally believed to improve the flaking quality of the chert (Crabtree 1964).

The following are descriptions of the types used to categorize debitage for Cancuen. These distinctions were recorded to compare technologies and production stages between structure types and statuses in order to determine if there were any differences. Total numbers of each type (fragmentary and whole) are listed by each type, as well as the numbers within each structure type (Tables 8.1 and 8.2).

Decortication Flakes (Figure 8.2a)

These flakes represent the first stage used in chert tool production. Hard hammer percussion is nearly always used in the removal of these flakes, as they are mostly tough outer cortex and require a good blow with a strong hammerstone to remove them. The dorsal surface, or sometimes even the entire flake, is composed of cortex. These flakes can be important in determining access to raw materials and sometimes source of procurement.

Hard Hammer Percussion Flakes (Figure 8.2b)

While these flakes are produced with the same technology described above, they represent the second stage of reduction, but the technique of hard hammer percussion can be used throughout the reduction process until the finishing of the artifact. Therefore, the amount of cortex present on the dorsal surface, number of flake scars on the dorsal surface, and platform size can all be helpful in inferring whether the flake came from early or late stages in the production process (Fowler 1987). These flakes are generally characterized by a large platform and a large bulb of percussion.

Soft Hammer Percussion Flakes (Figure 8.2c and 8.3a)

These flakes represent a shift in technology in terms of the tool used to produce the flake, as well as the type of force applied. Tools used could include softer bone, wood, or antler implements as opposed to the stone implements used in hard hammer percussion. Harder limestone pebbles can also be used and have been noted archaeologically at Colha (Shafer 1991), and were certainly one of the tools of choice at Cancuen as they were available everywhere. Only one antler billet was recovered from a Stela cache, but the technology of soft hammer percussion was well represented in each structure type despite the lack of tools. The flakes produced from this type of technology are distinctive, they are generally thinner and flatter than hard hammer flakes and the bulb of percussion is much more flat (or “diffuse”). The platform is also generally smaller, and a very distinctive “lip” usually forms as the softer tool gives a little and the force of the blow is spread out (Crabtree 1972; Figure 8.3a). The flake is often curved, with multiple flake scars on the dorsal and little cortex as this technique is used later in the stage of biface production. It is well-suited to shaping and thinning bifaces with thin, relatively controllable flakes (see also Whittaker 1994:185-186).

Pressure Flakes

Pressure flakes also represent a change in technology, and usually are associated with the final stages of chert tool shaping and reduction. They are generally small, thin, and have a small bulb of percussion, as the flakes themselves would be "pressed" off rather than removed with a direct blow. The platform in this case is an edge rather than a flat surface, so this can change the morphology of the flake. These flakes are often much harder to distinguish as compared to hard and soft hammer percussion flakes (Andrefsky 1998:115). These flakes are often small and can be missed without screening or careful collection. The tools used in the pressure technique also include antler with a finer point and usually an abrader or harder rock that would remove sharp edges that would cause the platform to be crushed.

Bipolar Flakes

Bipolar flakes represent another technology in which a hard hammer and an anvil are used to remove the flake (see Figure 7.11), causing pronounced compression rings from both directions because of the load application at both ends. There is often crushing at one or both ends of applied force, and no pronounced bulb of percussion on either end. This technology is often used to create large blanks for further reduction (often erasing evidence of bipolar reduction) or in the last stages in an effort to remove every usable portion of material from a core or spent tool. Another reason for bipolar reduction may be when there is a paucity of raw materials, and the objective piece is too small to be held in the hand during reduction (Andrefsky 1998:38). This technology can also be used to quickly knock off a flake from a core to check for internal quality before further reduction.

Chunks (Figure 8.3c)

A chunk can be defined as an angular piece of core or flake that has no platform, bulb of percussion or dorsal or ventral surface (Clark 1988). Sometimes they could be abandoned cores or the result of breakage of a tool or flake

Shatter

Shatter are the small (here less than 2 cm) angular pieces with no platform, bulb, or dorsal or ventral surface, that can result from breakage and shatter during tool production. Sometimes these pieces can be an indicator of the location of production if embedded in floors, but also could result from the crushing or breaking of tools or flakes.

Flakes with Crushed Platforms (Figure 8.3b)

These flakes are typically soft hammer flakes that have crushed platforms, which is a frequent occurrence with this technique (Whittaker 1994:187). This type of flake is not necessarily an error, because most times the flake is removed whole despite the crushed platform. I did not include these with the other soft hammer flakes because the length and weight would be altered by the loss of the platform, and the technique used could not be definitively identified without the platform.

Flake Fragments

This category consists of broken flakes that do not have a platform, and therefore could not be ascribed to one of the categories above. If the flake was broken and did have a platform, it was still ascribed to a specific technology, but not included in the mean measurements. If the flake fragment retained the distal section, the type of termination was noted (i.e., hinge, overshoot, etc.)

Potlid Flakes (Figure 8.27)

These flakes were not produced by human technique, but were recorded and measured as they formed a large part of the debitage category. These flakes seem to have been produced by fire damage, where potlids popped off of tools or flakes as they were exposed to fire.

Each of these types of debitage represent a distinct technology or stage in the manufacturing sequence. These categories were compared between structure types in order to determine if certain stages or technologies were restricted to varying social groups at Cancuen.

Debitage Analysis-Cores

The core, as opposed to the flake, is the objective piece from which flakes or blades are removed. The technology used to reduce the core often leaves distinct marks on the core, allowing it to be classified. In some instances the core itself becomes a tool, making the finished product a core-tool instead of a flake-tool (also discussed below).

Multidirectional Core (Figures 8.28-8.31)

This category included angular nodules that presented flake removal from multiple directions. These artifacts were generally larger than “chunks” described above, but some chunks may have been very exhausted multidirectional cores. These cores may have started very large, in order to remove flakes to make flake tools, or may have been smaller and used to knock off flakes for the production of ad hoc tools or simply a sharp flake edge for informal cutting. The technology used in reduction of these cores was nearly always hard hammer percussion.

Unidirectional Core (Figure 8.32)

These cores had flakes removed from only one direction by hard hammer percussion. Generally these were flakes removed to test the nodule for quality, then the nodule was abandoned after one or two flakes. The presence of these cores often could signal access to raw materials that were collected and brought back to the residence for testing of quality.

Bipolar Cores

The technology used in the production of these cores is also described above (and in Chapter 7) for bipolar flakes, which consists of an anvil and a hard blow from above, causing compressive force to break the objective piece. It seems that these cores were also used for testing material and then abandoned, although at times the most suitable piece may have been used for the production of a tool.

Bipolar/Multidirectional Cores

These cores were initially broken with bipolar technology, but then further reduced with hard hammer percussion from multiple directions probably because the material was determined to be of sufficient quality.

Flake/Blade Cores (Figure 8.4 and 8.33)

These cores were usually large flakes or angular, flat cores that were then used to remove triangular chert blades (see Aldenderfer 1991; Arnold 1985:Fig. 4C, 5C). The lateral edge of the flake was often prepared, giving the finished blade a crested appearance, then the platform of the original flake could serve as a platform for the removal of the blade by hard hammer percussion or indirect percussion (see Moholy-Nagy 1997:55; John E. Clark, personal communication 2002). These cores are very often difficult to identify because they may appear as simple broken flakes (see Moholy-Nagy 1997), although the removal of a blade will leave a percussion scar on the platform and a negative area from a bulb of percussion, and often the blades were removed from both sides of the flake.

Pressure Blade Cores (Figure 8.85)

These cores are similar to those described for obsidian prismatic blade production, and often produce more trapezoidal blades than the triangular blades discussed above (see also Arnold 1985). The difference in cores often lies in the fact that they were created on flakes, and were not completely rounded like obsidian polyhedral cores, but it does seem that the pressure technique was used in the production of these blades. Moholy-Nagy (1997:55) notes that these types of cores are present at Tikal in the Early Classic, but then the triangular blade technology becomes more prevalent in the Late Classic. At Cancuen both technologies seem to be present during the Late Classic, but one mound group (M9) tended to use this technology more than the other groups.

Fire Damaged Cores

These are nodules or cores that show extensive fire damage. In some cases they could represent heat treatment gone wrong, in others possibly unusable pebbles may have been thrown into the fire. Some of the burnt nodules are found in middens and may represent the burning of garbage. Some may have been exhausted cores that were thrown into the fire as garbage, or ritually terminated. A possible ritual function for these pieces could not be overlooked, as they would have cracked and exploded in the fire, possibly producing a ritual effect. The fire damage of these nodules precludes there inclusion into any of the above categories.

Chert Tools-Formal-Bifaces

All tools were reconstructed and glued if fragmentary and possible. All measurements noted are for whole artifacts, and if only fragments were present, it is noted. Formal chert tools were divided into three types, bifaces, unifaces, and blades. Informal tools are divided by flake tools and core tools (Tables 8.3, 8.4, and 8.12).

Ovate Bifaces-Thin (Figures 8.5-8.7 and 8.34-8.40)

This variety refers to thin bifaces that are pointed at both ends (in the shape of a laurel leaf) or sometimes rounded at one end.

Ovate Bifaces-Thick (Figures 8.8, 8.9, and 8.38-8.40)

These tools have been called "General Utility Tools" (Willey 1965) and also Celts. They are thick and often constricted at one end, but sometimes rounded at both ends. Many times these tools are made of coarse grained chert, which is more durable, and not as suitable for the production of smaller tools. These tools can be made on large flakes or reduced directly from nodules or cores.

Rounded Bifaces-Thick (Figures 8.10a and 8.41-8.43)

These tools probably represent thick Ovate bifaces that were broken in half and then recycled and reworked into round tools used for chopping and pounding.

Biface Preforms-Thick (Figures 8.9 and 8.44)

This variety refers to bifaces that were never completely finished, and were usually only reduced by hard-hammer percussion. Many of them are coarse grained, suggesting that they may have been Large Ovate Bifaces in the process of production that were discarded due to breakage or imperfections in the chert.

Elongate Bifaces-Thick (Figures 8.10b, 8.45, and 8.47)

These bifaces are long, have a rounded cross section, and very informally flaked. They are very similar to those reported by Moholy-Nagy (2003: Figure 13), and called a "spud" by Rovner (Rovner and Lewenstein 1997:23). They, too, are often made of coarser, poor quality chert.

Elongate Bifaces-Thin (Figures 8.47 and 8.48)

These specimens are often referred to as "chisels" in the literature (Rovner and Lewenstein 1997:20, Figure 6h). They are long and more ovate in cross section, but are often made of finer grained, better quality chert than the thick variety, and almost certainly served a separate function because they were much more delicate.

Eccentrics (Figures 8.11, 8.12, and 8.49-8.54)

Chert "eccentric flints" are found at many Maya sites, and can take the form of gods, weapons, animals, or other symbolic matter. All Eccentrics recovered from Cancuen are fragmentary and most show signs of fire damage, possibly ritual termination. They were also found in all structure types at Cancuen, and were not restricted to elite, ceremonial contexts, but are not of the elaborate style, size, and form as seen at other Maya sites like Copan (Fash 1991), Tikal (Moholy-Nagy 2003), Altar de Sacrificios (Willey 1972), and Piedras Negras (Hruby 2006). At the same time, these forms require a high degree of skill for manufacture and signal a skilled crafter.

Shouldered Stemmed Bifaces (Figures 8.13, 8.14a and b, and 8.55-8.58)

These are generally long, thin bifaces with a square or rectangular stem on the distal end, probably for hafting as a spear.

Side-Notched Shouldered Stemmed Bifaces (8.14c and 8.59)

This variety is the same as above, but with a small notch present as the stem meets the medial section of the biface.

Tapered Stemmed Bifaces (Figures 8.15, 8.60-8.62)

In this case, the stem tapers gently from the “laurel leaf” shape to form a stem.

Tapered Rounded Stemmed Bifaces (Figures 8.16a and 8.63-8.64)

These tapered stems form a round projection at the distal end of the thin ovate biface, see also Moholy-Nagy (2003: Figure 29, k-m).

Triangular Tapered Stemmed Bifaces (Figures 8.16b, 8.65, and 8.66)

This variety can be characterized as much smaller than the other possible projectile points described above and may possibly represent a dart point as opposed to a spear point (cf. Aoyama 2005; Rovner and Lewenstein 1997). Its shape is triangular and it has a very thin and fragile tapered stem.

Corner Notched Bifaces (Figure 8.16c, 8.67, and 8.68)

It is not certain that these tools were present at Cancuen, as this identification was made only through fragmentary artifacts. These projectile points would be triangular, with notches projecting up into the medial portion of the biface (see also Bryant et al. 1988: Figure 39g; Clark and Bryant 1991: Figure 13).

Chert Tools-Formal-Unifaces

Unifaces were usually made on flakes, and flaked only on the dorsal side of the flake.

Uniface on Flake-Thin (Figures 8.17a and 8.69-8.72)

These specimens are often curved, possibly because they were made on large, thin, soft-hammer flakes, apparent from the diffuse bulb of percussion that is sometimes still present.

Uniface on Flake-Thick (Figures 8.19, 8.73, and 8.74)

These tools are often very large, often made of coarse grained chert, like the large ovate bifaces. They are mostly triangular in form, or rounded at one end and pointed at the other. Many times the proximal end is slightly incurved. Gibson (1991) found through microwear analysis, that these tools, sometimes called “adzes” were often used for chopping of wood rather than hoeing as suggested by some. These tools are made from very large flakes, and hard hammer percussion scars are often present on the ventral surface, while the dorsal surface is completely flaked, but cortex is sometimes still present.

Domed Uniface (Figures 8.17b and 8.75)

Rovner (Rovner and Lewenstein 1997) calls this a “Domed Smoother” as they often have visible striations on the ventral side, while the dorsal is flaked in a thick, “dome” shape. These tools were often made from an abandoned core, but could also be made on flakes, using the ventral surface as a platform. These tools have also been called “pyramidal cores” (Stoltman 1978:11). If there were no apparent signs of use, I classified them as unidirectional flake cores.

Edge Flaked Round Uniface (Figure 8.21 and 8.76)

These tools appear to be formal tools, as they appear in several contexts in the exact same form, although there would not be much time invested in their production. They are usually thicker hard-hammer flakes, flaked only around the edges using the ventral surface of the platform. The central portion of the tool on the dorsal surface retains the original characteristics of the flake.

Complete Flaked Round Uniface (Figure 8.77)

These unifaces are very similar in form and thickness to those above, but are completely flaked on the dorsal surface.

Round Uniface-Small (Figure 8.78)

The function of these artifacts is unknown, they are sometimes called “sequins,” and in the same form as obsidian are often used as mosaics or inlays (see Chapter 7). They are often flaked unifacially around the edges, but sometimes ground along the edges. The primary context for these artifacts was middens, adding to the mystery of their use as I was not able to determine a use-life for the objects.

Elongate Uniface (Figures 8.20 and 8.79-8.81)

These tools are similar in form to the thin, elongate bifaces (“chisels”), but are flaked only on one side. The other side is highly polished and is often colored red with residue. This suggests that they may have served similar functions as those reported by Inomata (2001) for Aguateca, that were used as pigment grinders. The tools of this form that were recovered always had sustained fire damage, suggesting that they may have been ritually terminated because of their ceremonial importance in the production of pigments.

Uniface Preform-Thick (Figures 8.18 and 8.82)

This category is represented usually by large, amorphous unifacially flaked artifacts not yet in any discernable form.

Chert tools-Formal-Blades

Blades were twice as long as wide and not bifacially flaked. If the length measurements were less, these tools would be classified as flake tools. Some flakes are fortuitously twice as long as wide, but they were only classified as blades if they were utilized. Most of the blades described here were intentionally created for specific uses, which could have been graving, drilling, cutting, and other similar activities.

Macroblades (Figures 8.83 and 8.85)

Macroblades encompass flakes that are twice as long as they are wide, and are wider than 2.5 cm. These blades could have been produced fortuitously, but in some cases were intentionally created, and often served as a core for the removal of subsequent smaller blades.

Crested Blades (Figures 8.22a and b, 8.84, and 8.85)

These blades are again identified as at least twice as long as they are wide. The distinctive feature about these blades is their triangular shape (see Aldenderfer 1991; Arnold 1985), and that they often are flaked on one or both sides of the dorsal surface. Their production is also discussed above under Flake/Blade Cores. They are often produced by hard hammer percussion from the lateral edges of flakes, macroblades, or thin nodules.

Blade with Modified Distal (less than 1 cm; Figure 8.22a)

These blades have distals modified or resharpened to a point, but the extent of the modification does not extend very far up the blade. Rovner (Rovner and Lewenstein 1997:22) calls this a "graver-on-blade."

Bipointed Blade

In this case, both the proximal and distal ends of the blades are modified into a point. This is probably a case of attempting to use all possible ends for working surfaces after one has dulled

Blade with Modified Distal (more than 1 cm)

Rovner (Rovner and Lewenstien 1997:18) refers to this tool as a "beak-on-blade." Clark (1988: Figure 25e) also calls it a "long-beaked graver." These blades have a flaked or modified distal portion more than 1 cm.

Blade with Rounded Distal

This type of blade was separated from the others because of the special use wear patterns macroscopically observable. The distal portion of these blades is extremely smooth and rounded, showing signs of rotational use, probably from use as a drill of a very hard material such as jade, and also with some type of abrasive. They may have been exhausted drills or used to expand drill holes after more pointed drills were used.

Blades with Multifaceted Dorsal Surface (Figure 8.22 c and 8.86)

These blades are often trapezoidal in shape, and show signs of having other blades removed from the dorsal surface, sometimes resulting in hinge or step fractures. The blades were largely removed by pressure, separating these artifacts from Flake/Blade Cores, but use on the distal and lateral portions caused me to include them with tools instead of cores.

Fortuitous blades

These are blades (twice as long as wide) that were produced fortuitously in the process of flaking another tool (see also Clark 1988).

Chert tools-Informal-Flake Tools

While informal tools required less skill to produce, it does not mean that they were not then used for skilled crafting in another medium, such as jade or shell. Since informal tools were found in all contexts alongside formal tools, it seems that their production was not due to lack of skill. The production of these tools was probably a matter of expediency and also a virtue of the intended use of the tool

Flake Modified to Point (Figure 8.87)

This informal tool is also called a “Beak-on-flake” by Rovner (Rovner and Lewenstein 1997:18). The flake largely retains its original form, but is flaked to a sharp point somewhere along the margins.

Triangular Broken Flake (Figures 8.23, 8.87, and 8.88)

This variety of tool could be called a formal tool, because it is nearly sure that the knapper had a specific form in mind while producing it. The process was demonstrated to me by John Clark (personal communication 2002). A flake (usually a soft-hammer flake) is taken and crushed by a large hammerstone. Many of the pieces already take a triangular shape, then they are informally flaked along the edges in order to sharpen and define the point. It can also be called a Triangular Beak (see Rovner and Lewenstein 1997:18). While these tools may have been used for graving and drilling, they would not require the skill used to manufacture blades, which could be used for the same purpose.

Edge Modified Flake (Figures 8.24 and 8.89)

These are flakes that were quickly, informally flaked along the distal and/or lateral edges in order to sharpen them, often called a "scraper" in colloquial archaeological usage, but was called a "Flake-Retouched" by Rovner (Rovner and Lewenstein 1997:22).

Chert Tools-Informal-Core Tools

These tools were created on nodules or cores, again the production of a core tool would be very expedient, but they may have been used to work jade or other materials.

Nodule Tool (Figure 8.90)

These tools were basically found as nodules then used without modification as hammers or pounders.

Flaked Core Tool (Figures 8.25, 8.91, and 8.92)

Some exhausted or abandoned flake cores were then extensively used as hammers or pounders.

Edge Flaked Nodule Tool (Figures 8.93 and 8.94)

These tools resemble "scrapers" and may have been used as such, but are nodules that were flaked unifacially or bifacially only along one edge, also called "choppers" (Willey 1965).

Chert Contexts at Cancuen

I will now discuss the distributions of types of artifacts and debitage across the various residential types at Cancuen in hopes of elucidating patterns of technology and craft production for different social groups at the site. While technologies do not appear to be restricted to specific groups, certain classes of tools are more prevalent in some structure types.

Type I Structures

Chert assemblages for the largest and most elaborate residences at Cancuen included all stages of bifacial reduction, although no pressure flakes were recovered. It could be the result of lack of field collection, or possibly that I was not able to identify them, but some bifacially flaked tools show that this technology was used. Most cores recovered were multidirectional flake cores, although blade cores were present, and crested blades made up 4.93% of the total assemblage. The only Eccentric recovered was found on the interior floor of Structure M9-1, an elite vaulted structure, located near the primary port of Cancuen (Jackson 2002). The Eccentric was heavily damaged by fire, probably in a termination ritual, but possibly formerly portrayed a *K'awil* (i.e. God K; Hruby, personal communication 2003). A second burned and broken Eccentric fragment was recovered from a construction fill mixed with midden layer of Structure N10-1, a three roomed masonry structure with an exterior stucco façade similar to that of the royal palace, but located 600 meters north of the palace (Kovacevich, Quintanilla, and Arriaza 2003). There were not any strong indications of chert tools used for special or craft production purposes, although nine informal flakes modified to a point, possibly used as drills or gravers on a soft material due to the delicate nature of the point were recovered from one construction fill layer in a unit excavated into the patio floor of the Northwest Court of the royal palace (CAN 23A-8-11; 13.08% of the total chert tool assemblage for

Type I structures). This does not however preclude craft production activities in Type I structures, as two jade earflare polishers were recovered from these Type I structures (see Chapters 7 and 9; Kovacevich et al. 2004; Kovacevich 2007). This disparity could also be due to differences in refuse disposal patterns between elites and nonelites, as previously discussed, we may not have encountered the larger portions of chert refuse as it may have been more thoroughly distributed in construction fill (as seen in M9-1, N10-1, and the Royal Palace), chert production refuse was also deposited in ceremonial caches. Many Type I structures may have also been under construction at the time of abandonment, another possible reason for the paucity of refuse and production debris.

Type II Structures

Again, all stages of biface reduction were represented in the debitage, and in this case pressure flakes and debitage shatter were recovered, suggesting that we did encounter some possible primary reduction sites. One interesting deposit was a large pile of soft hammer reduction flakes (n=70) and Triangular Broken Flake tools (n=147; making up 50.95% of the total assemblage) along a low wall near Structures K7-1, K7-2, and K7-3 (CAN 33). These flakes appear to have been used in the production of these small tools probably used as drills during craft production of some sort and then deposited in a place that would be out of the way where no one would be walking or playing (see also Clark 1991 for an ethnographic example). This reinforces the idea that residents of Type I and II structures disposed of garbage differently, as residents of Types III, IV, V and 0 structures generally seem to have disposed of their lithic refuse behind the structures in middens, or off the sides of patio work areas.

In the M9 group of Type II mounds associated with the Type I structure M9-1, blades make up 9.81% of the total chert assemblage (n=31). Twelve pressure blade cores were present (usually thick flakes, with blades removed from the dorsal side, producing blades with a trapezoidal cross-section), as well as 3 flake/blade cores, with triangular (in cross-section) blades removed from the lateral sides. The large quantities of blades in this particular mound group could signify craft production, especially related to drilling and incising of jade, shell, or bone, as a jade earflare polisher was recovered from M9-1, and jade, shell, and bone artifacts were recovered from burials in the group (Jackson 2003).

One small Triangular Tapered Stemmed projectile point was found in the humus below the main stairway of Structure K8-5 (CAN 19A-21-1; Kovacevich, Torres, and Cajas 2003), possibly a sign of violence.

Type III Structures

The relative percentages of debitage types did not differ significantly in these structures versus Types I and II. Chert blades again made up a large percentage of the total assemblage (19.38%; n=66). The blades in this case were more equally distributed among Type III structures in grid squares K6, L9, K9, M6, L6, K8, and L3 (see Map Figure). Informal Flake Tools (n=48), possibly also used for drilling were also evenly distributed throughout these groups (with the exception of M6). One reconstructable Elongate Uniface and another fragmentary example were recovered from Structure K6-34 (also associated with pyrite production; Chapter 6). The possible pigment grinders were significantly red on the unflaked surface and broken into three pieces by fire damage.

This tool could represent other craft activity for this structure, as well as domestic ritual. Fire damaged eccentrics were recovered from the floor beneath the wall fall of Structure K6-34 (adding to the interpretation of domestic ritual). An eccentric fragment was also recovered from the humus layer of Structure M6-18, which had been severely disturbed by modern settlement, precluding the interpretation of exact context. One fragmentary small projectile point was recovered from the bottom layers of an *aguada* associated with the Type III structure K9-7 (CAN 39A-37-8; Ohnstad, Arriaza, and Burgos 2003).

Type IV Structures

The most significant difference in Type IV structures is the presence of certain tools probably associated with craft production, such as chert blades (13.94%; n=104), 60 of these came from the M10 mound group (Operation CAN 24), directly associated with jade production, and 24 from Structure M6-12 (Operation 14B) associated with jade and pyrite production (see also Chapter 9). The informal Triangular Flake Tools also made up 22.73% (n=178) of the chert assemblage for Type IV structures, mainly present in Structure K7-24 (n=165), also associated with jade production. It is still not completely clear if these tools were used to drill jade, but many have tips that have bending rotational fractures, indicating that they may have been used in a rotating motion. Even if they were not used in the production of jade, the high amount of these tools in this structure suggests a specialized activity. Core tools (n=103) 13.15% of the total assemblage were also represented in greater numbers than other structures, n=78 from the M10 group. These were probably present in such high percentages as the percussion reduction of jade was a primary activity in these groups (also noted in the debitage itself and the presence of jade and quartz cobble hammerstones). Many of these tools showed heavy battering and/or were broken. This was the highest percentage of core tools in the entire site.

Four Eccentric fragments were recovered, 2 from Structure J7-7, one a stylized weapon Eccentric, the other a possible part of a 'U' shape. Two other weapon style Eccentrics were also found in the humus of structures M10-4 and K7-24, both associated with jade production. Stemmed bifaces were present in larger numbers in Type IV Structures, but they were not higher in relative percentages when compared with other structures. One small triangular projectile point was recovered from the humus of Structure J7-7 (Operation 15), and one possible corner notched biface fragment was recovered from a midden associated with Structure M10-4, suggesting more of a hunting function for the projectile.

Type V Structures

Excavations were not as prolific in these structures, but some comparisons can still be made, and when combined with the assemblage from Type 0 Structures, which were probably Type V, the numbers make more sense. Debitage of all stages was still present and similar in relative percentage (although hard-hammer percussion was more represented than soft-hammer) in comparison to the other structure types. The smallest examples of pressure flakes and shatter were not present, as we may not have encountered a primary reduction area in these structures. One triangular biface projectile point fragment was recovered from the fill of structure J6-3, although it was somewhat larger than the other examples of this particular tool. There were no high amounts of specialized tools in these structures.

Cortex on debitage, usage of flakes, coarse grained flakes, and error rates were slightly higher for these structure types, but this could be a function of the small sample size. It could also mean that these residents were not as proficient at bifacial flaking as those in other structures, or that the coarse grained materials caused more errors because of inclusions and generally coarse grained cherts are more difficult to work. The high amount of cortex could be from coarse grained cherts, which often have thicker cortex or cortex-like inclusions that could be interpreted as cortex. The ratio of "thick" ovate bifaces to "thin" ovate bifaces (4:8) is higher than that for other structure types, possibly due to more activities related to farming and chopping for the larger bifaces. The higher amount of usage fell mostly into the "light" category, making it less significant as a marker of paucity of chert.

Type 0 Structures

Debitage was represented in all stages in these structures, including small pieces of chert shatter. One eccentric fragment with fire damage was recovered from a midden associated with Structure K6-12. Test excavations in middens from the mound group of K6-10, K6-11, K6-12 produced the majority of soft-hammer reduction flakes for Type 0 structures (n=77), along with 27 informal Triangular Flake tools, 34.14% of the total chert assemblage for Type 0 structures. A biface preform and fragments of thick and thin ovate bifaces were also present in the refuse. General tools used in everyday domestic production were present in relatively equal numbers in these structures.

Statistical Analyses

As seen above, the production sequences for chert bifaces and other tools are fairly equally represented in all structure types. Differences primarily exist in the amount of specialized tools in certain households (elite and nonelite) used for crafting, in addition to the expected assemblage for domestic use. There was one area in which there may have been some difference between elite and nonelite households. Decortication flakes appear to have been larger and thicker in elite contexts than nonelite contexts, suggesting that elites may have had access to larger nodules of chert than nonelites. In the following t-tests, I will compare the difference between the mean weights of decortication flakes between structures (only complete flakes were used in these tests). While t-tests did not show the means to be significantly different between individual structures, when grouped into "elite" and "nonelite" structures (i.e., Types I and II vs. Types III, IV, V, and 0), the null hypothesis can be rejected that there is no significant difference between the mean weights of Decortication flakes ($p=.009$; $p<.05$).

The tests were repeated for Hard-Hammer ($p=.035$; $p<.05$) and Soft-Hammer percussion flakes ($p=.0008$; $p<.05$) with the same findings, the rejection of the hypothesis that mean weights of the flakes were equal between "elite" and "nonelite" structures.

While these tests are not able to demonstrate a corresponding rise in flake weight or size from Type I through Type 0 Structures, differences between elite and nonelite structures were present, possibly representing elite access to larger nodules, either through tribute, or command over labor used to procure the larger raw materials.

Discussion

The relative percentages of debitage, quality of chert, or amount of cortex between structure types are fairly evenly distributed (see Tables). It seems that all households, whether elite or nonelite, had access to chert raw materials, and high quality raw materials at that. The types of tools between structures did vary, especially related to tools that were probably used in specialized production including blades, triangular flake fragment tools, and core tools (for percussion). Certain types of tools were more evenly distributed, those related to domestic activities (such as Large Ovate Bifaces or "General Utility Tools", and Large Unifaces on Flakes or "Azdes"). Uniface and Biface preforms were found in small quantities (1-3) in all structure types, supporting the distribution of debitage that all residents of all structures were producing tools. But some artifacts related to ritual activities were also more evenly distributed, lending support to the growing attention paid to domestic ritual (Gonlin and Lohse 2007). Eccentrics were found in Types I, III, IV, and 0, not restricted to elite contexts. Elongate unifaces, possible pigment grinders were found in Types III, IV, and 0 Structures, probably related to grinding pigments and craft production, but also household ritual (found in elite residences at Aguateca; see Inomata 2001). All structure types had at least a few Shouldered Stemmed, Tapered Stemmed, or Tapered Rounded Stemmed chert artifacts, probably hafted projectile points (cf. Aoyama 2005). Structure Types II, III, IV, and V had smaller examples of Triangular Tapered Stemmed or Corner Notched Bifaces that may have served as dart points or spear points.

Nothing that could be classified as an arrow point was recovered at Cancuen, largely based on the size of the artifact, which is to be expected as the bow and arrow was primarily a Postclassic technology in the Maya world (cf. Aoyama 2005:297; Patterson 1985; Rovner and Lewenstein 1997:27-28; Thomas 1978:470). Four small bifaces *could* be classified as dart points under Rovner and Lewenstein (1997:27) and Patterson's (1985) classification of dart points as those with widths between 2.1 cm and 3.4 cm, but Aoyama's (2005) recent study of bifaces at Aguateca finds that while it is fairly easy to distinguish arrow points from dart and spear points, it is much more difficult to distinguish between dart and spear points, and he determined through microwear analysis that many (65.4%) of points that would be classified as darts using size were actually used as spear points or knives. Nevertheless, 26 of 56 probable hafted projectiles were found in the initial humus layer throughout the site, *possibly* suggesting conflict (this is not including "laurel-leaf" style bifaces which were not able to be determined as hafted without microwear analysis).

The relative percentage of coarse grained chert goes up from Type I structures to the highest percentage in Types V and 0 (Table). The relative percentages of fine grained cherts remains fairly constant, suggesting access to finer, easier to work materials in all structure types. This could represent the need for tougher tools for chopping and agriculture in the smaller mounds outside of the site epicenter. Statistical tests suggest that residents of Types I and II structures *may* have had greater access to larger nodules. Error rates measured in hinge terminations or edge bite flakes were not exceedingly high for any of the structure types or the site as a whole (cf. Sheets 1991:178).

The social and economic implications are that chert raw materials or technologies were not restricted in any way to certain structure types. Types I and II structures may have had access to larger nodules than other residents, but all had access to high quality chert and possessed high levels of knapping skill. The even distribution of high quality materials may be a function of the location of Cancuen and the ease of access to these materials, which would be difficult for elites to control. Other sites in the Maya world (cf. Piedras Negras, Hruby 2006 and Tikal, Moholy-Nagy 1994) did not have such direct access to high quality materials and therefore they were probably more restricted.

The presence of eccentrics and pigment grinders in all structures points to the performance of domestic ritual in all structure types. Public communal rituals performed by nobles were paramount in promoting community identity and serving to integrate all social groups, while private domestic ritual served to reinforce household group identity.

Conclusions

Chert artifacts may not have been as significant of a marker of status as other materials such as jade because it was not restricted in technology or finished products. Chert debitage and artifacts were treated ritually, as in the burial of *Kan Maax* (Barrientos et al. 2005) and in what seems to be the ritual burning of certain types of artifacts, like Eccentrics and Elongate unifaces (probably pigment grinders). Chert Eccentrics were evenly distributed throughout the site in small numbers, and were a significant part of domestic ritual of all social groups. Eccentrics were not found in elaborate forms in elite caches as at many other lowland sites. Elites may have had access to larger chert nodules through tribute or elevated access to labor and/or wealth (including symbolic wealth). The most significant difference in chert artifacts were the differences in specialized tool forms used for craft production (such as blade and flake drills and hammerstones), especially in the Type II mounds of the M9 Group and the K7 group, as well as the Type IV residences of the M10 group and also in the K6/K7 area.

Overall, chert was more abundant than obsidian for producing and using stone tools. As a local resource it was much more readily available. Technologies for both obsidian and chert were not restricted to certain social groups, as were technologies for pyrite and jade. Pyrite production was restricted to Types III and IV structures. Jade production occurred in the early stages primarily in Type IV structures, but to a lesser degree in Type III structures, while the finishing stages seem to have taken place in Types I and II structures. The significance of chert to this study lies in its relatively equal distribution. While elites may have controlled exotic items important for status reinforcement and communal ritual, other types of stone artifacts were available to all, and part of their social power and identity in their production and use for domestic ritual.

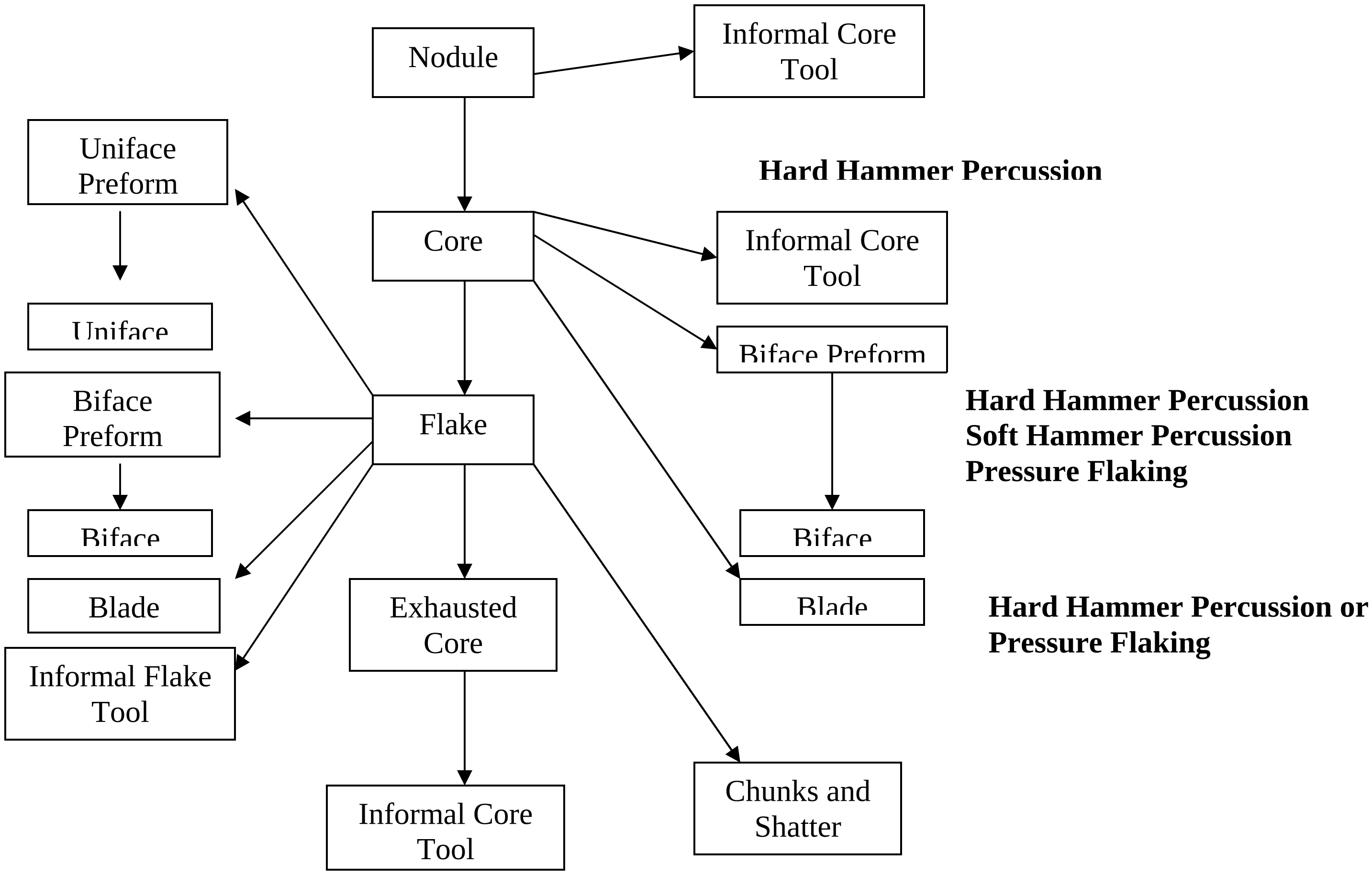


Figure 8.1. Chert manufacturing sequence for Cancuen.

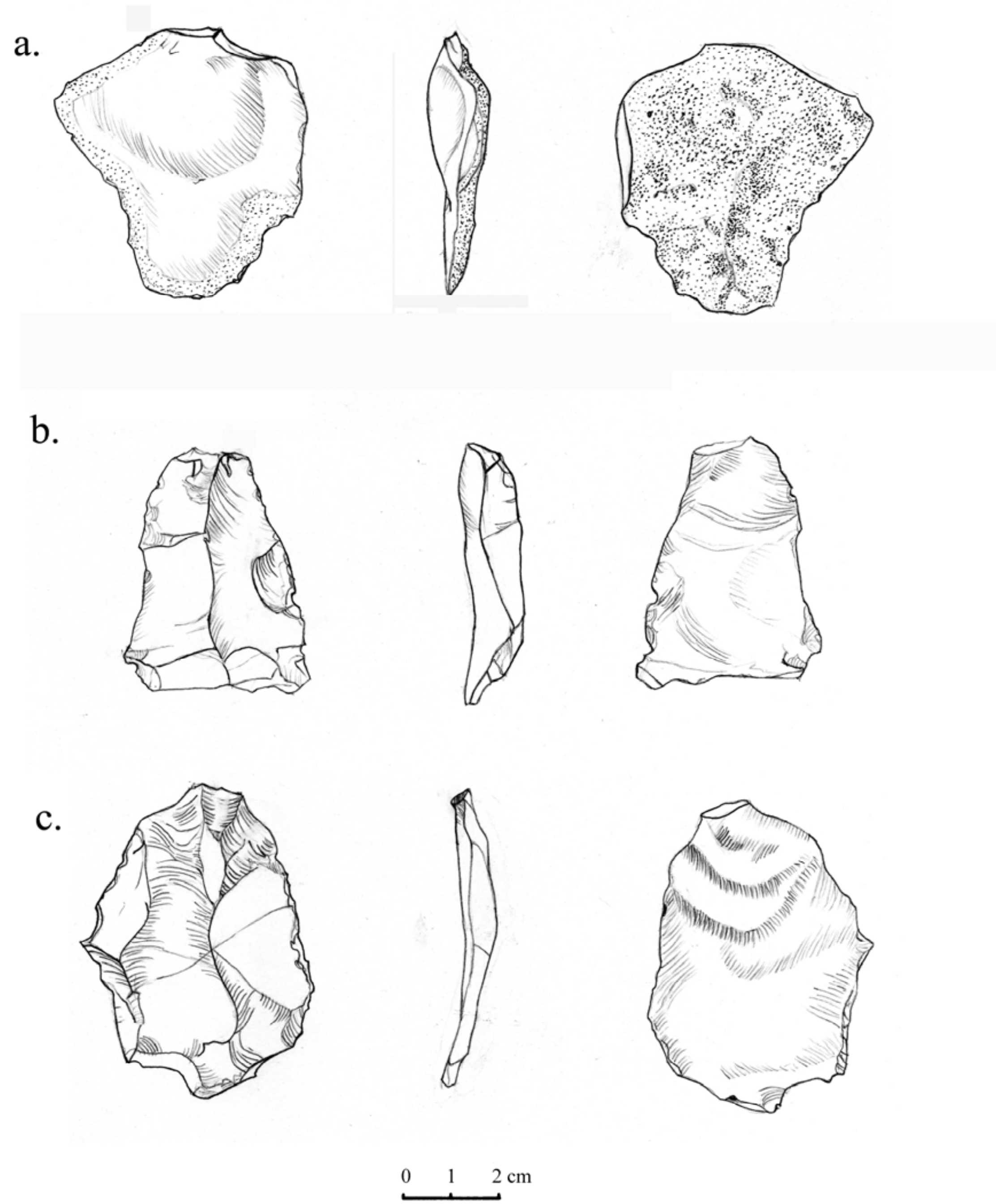


Figure 8.2. Chert Flakes, a. Decortication Flake, lot CAN 25A-109-1, b. Hard hammer percussion flake, lot CAN 25A-111-1, c. Soft hammer percussion flake, lot CAN 25A-46-1 (drawings by Walter Burgos).

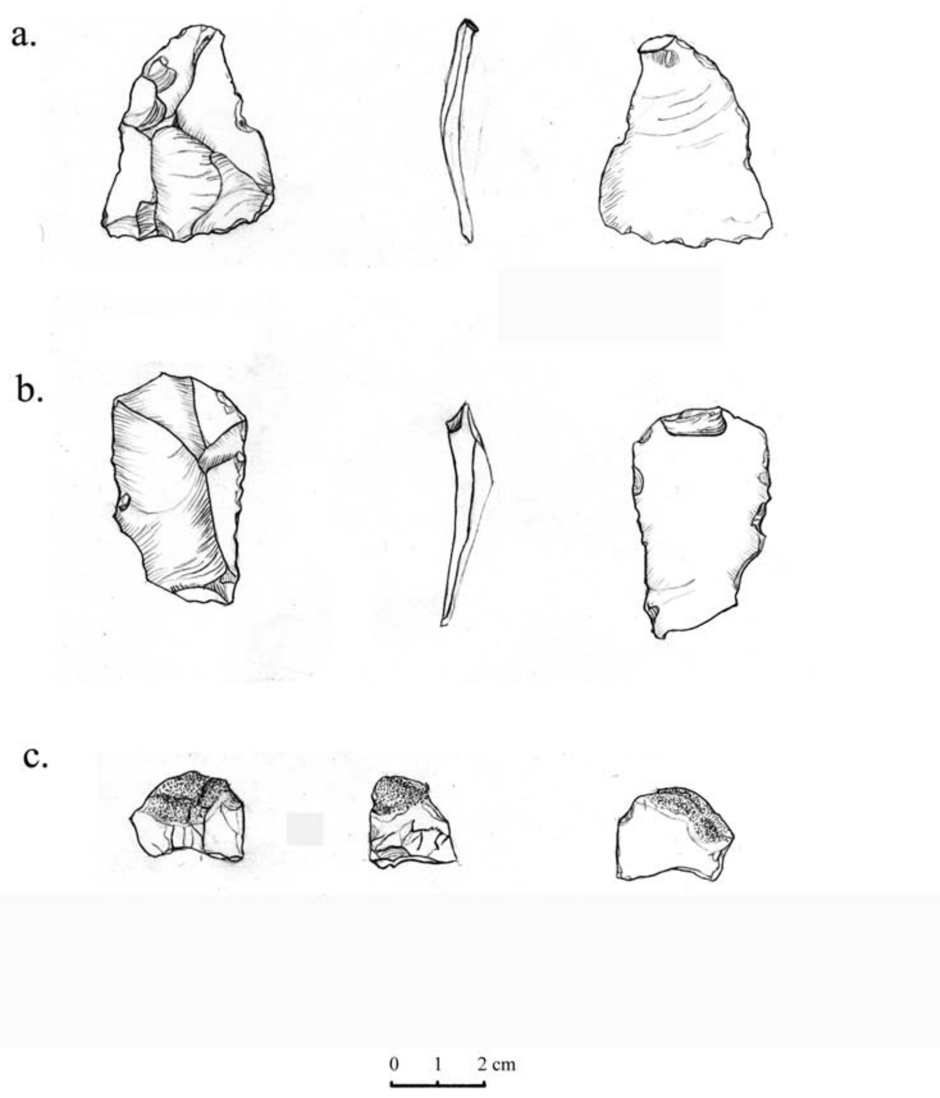


Figure 8.3. Chert Debitage, a. Soft hammer percussion flake, lot CAN 13-75-1 b. Soft hammer percussion flake with crushed platform, lot CAN 13-72-1 c. chunk (drawings by Walter Burgos).

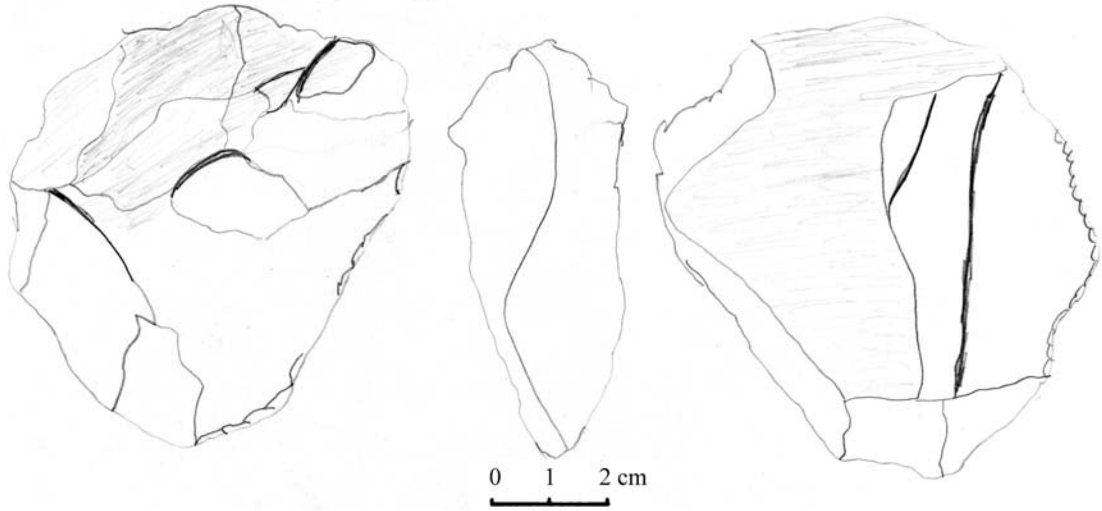


Figure 8.4. Flake/Blade core with flakes removed as well as blades on the right side of the drawing, lot CAN 25E-34-1 (drawing by author).

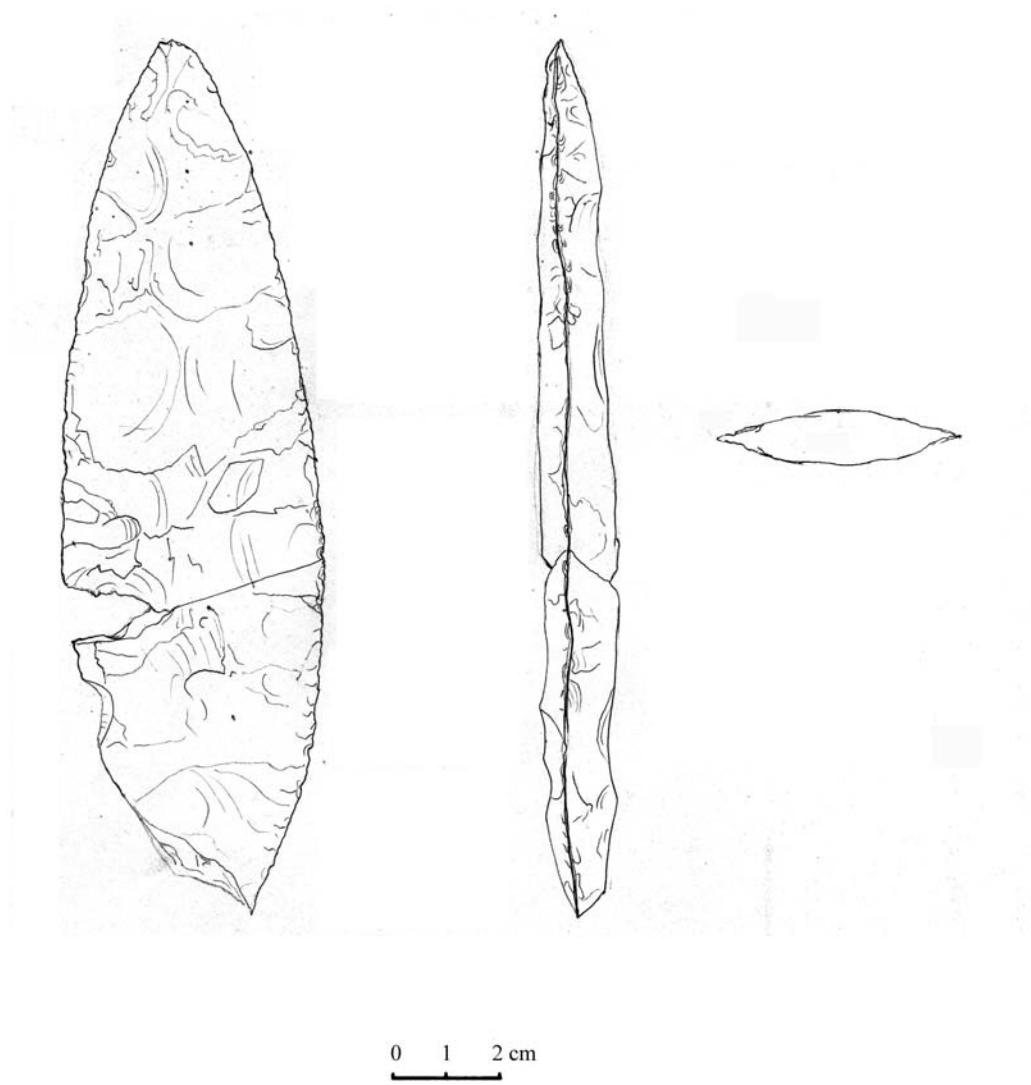


Figure 8.5. Large, Thin Ovate Biface, lot CAN 7-10-4 (drawing by Federico Paredes).

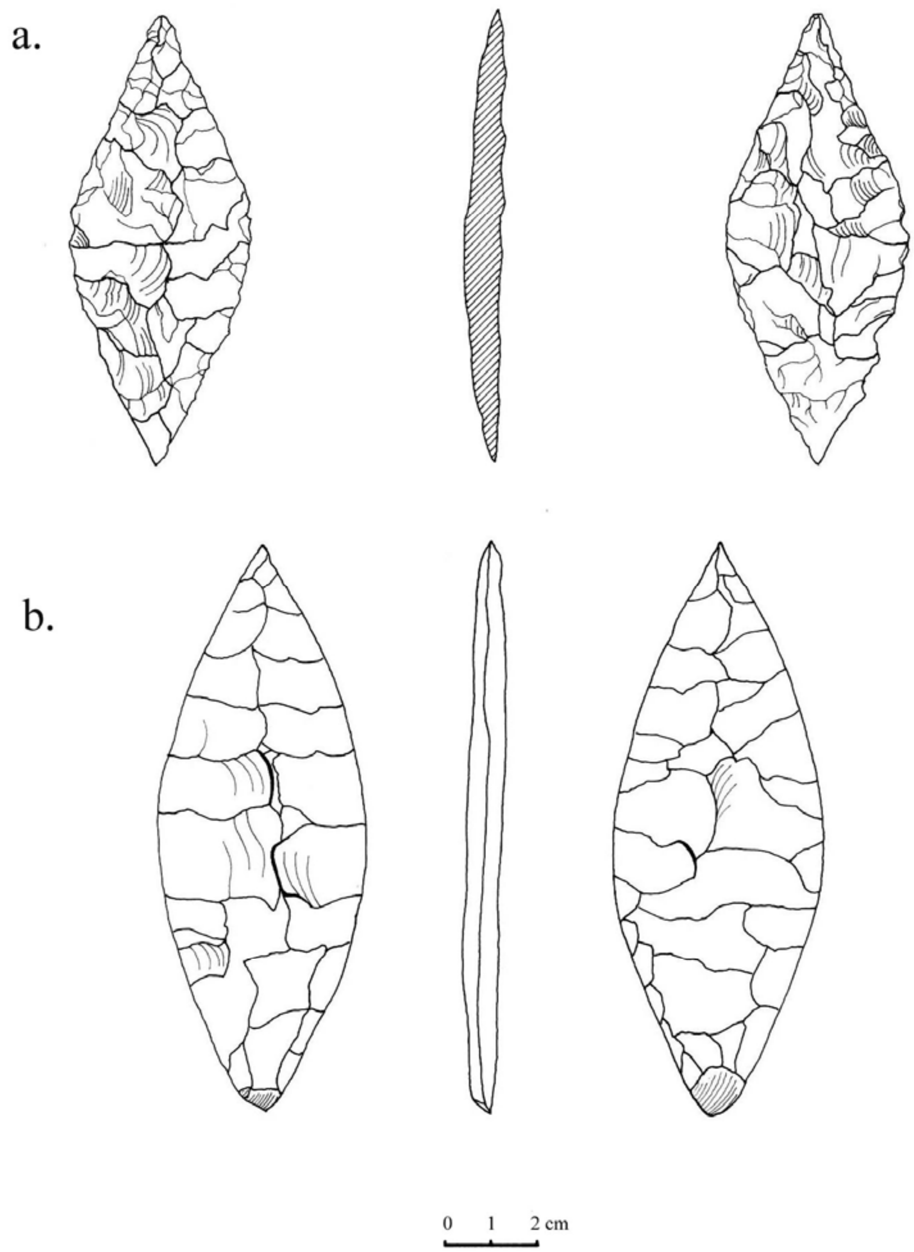


Figure 8.6. Thin Ovate Bifaces, a. CAN 39A-71-1 (drawing by Walter Burgos, inked by Luis Fernando Luin), b. CAN 25A-7-2 (drawing by author, inked by Luis Fernando Luin).

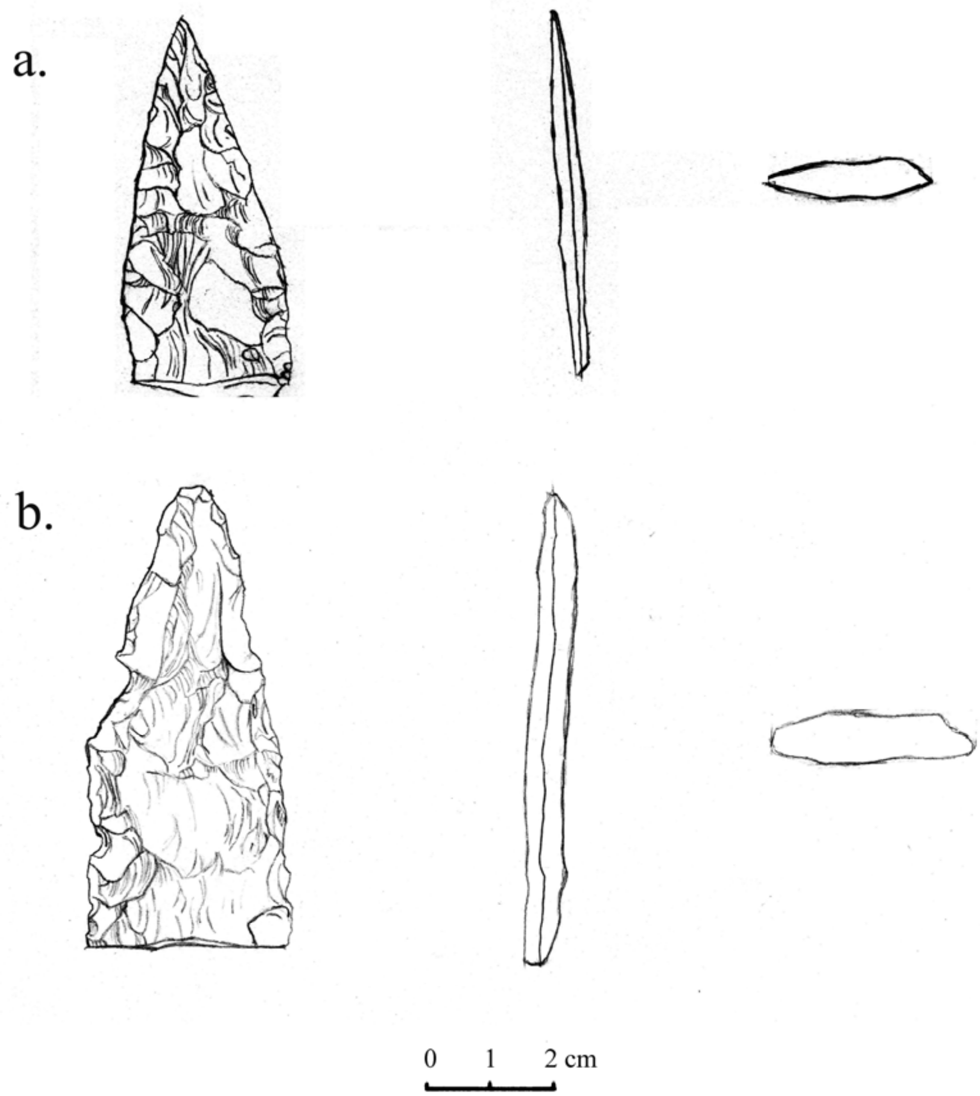


Figure 8.7. Probable Thin Ovate Biface fragments a. lot CAN 13-133-2 b. lot CAN 13-74-1 (drawings by Walter Burgos).

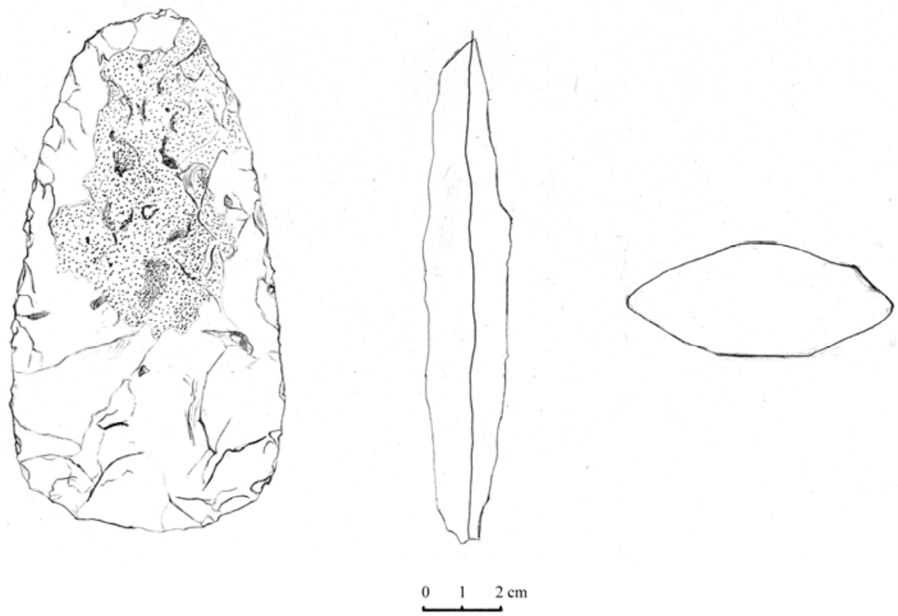


Figure 8.8. Large, Thick Ovate Biface, lot CAN 15-15-1 (drawing by Walter Burgos).

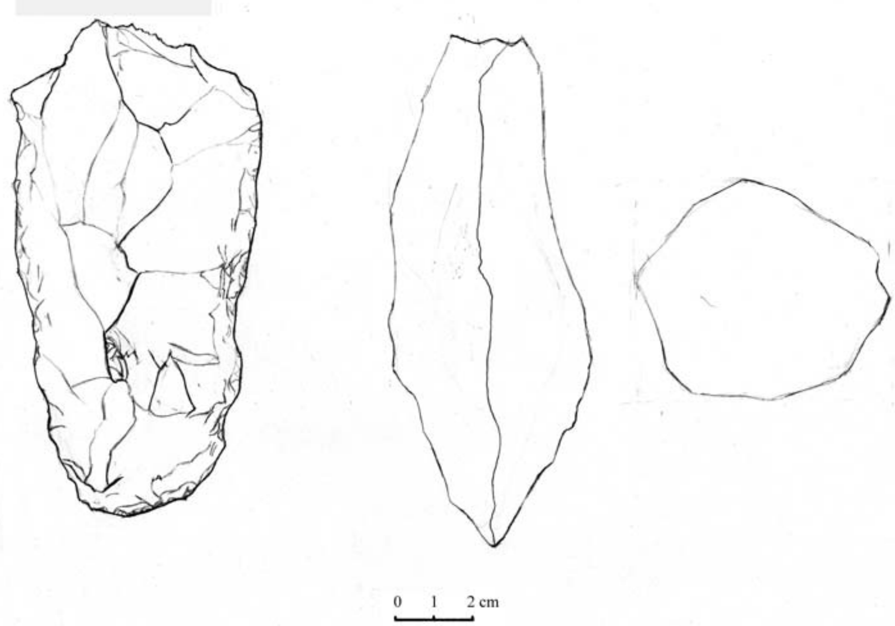


Figure 8.9. Thick Ovate Biface Preform, lot CAN 13-115-1 (drawing by Walter Burgos).

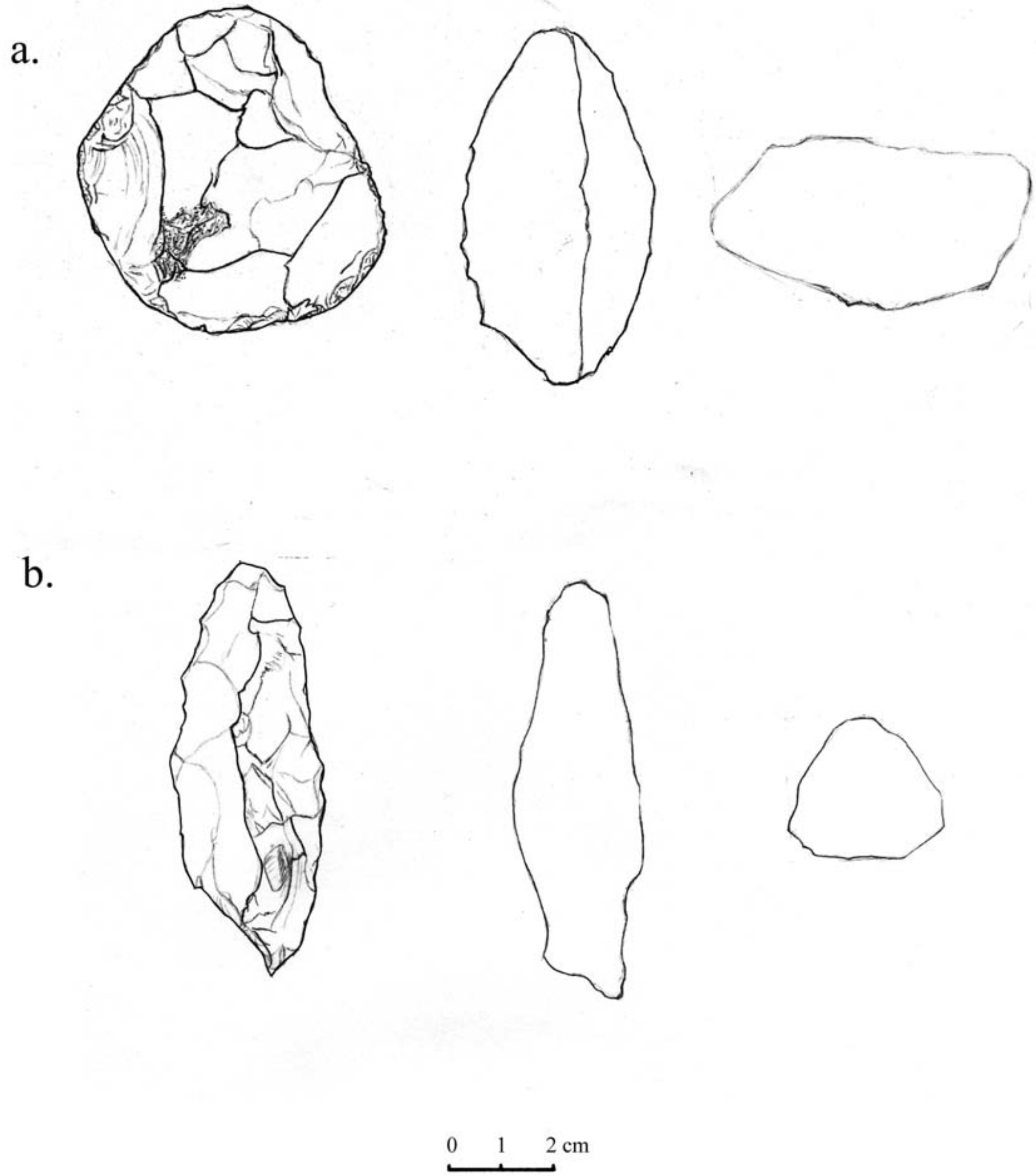


Figure 8.10. Thick Bifaces a. Round Thick Biface, lot CAN 14-0-0, b. Thick Elongate Biface fragment, lot Can 14B-19-2 (drawings by Walter Burgos).

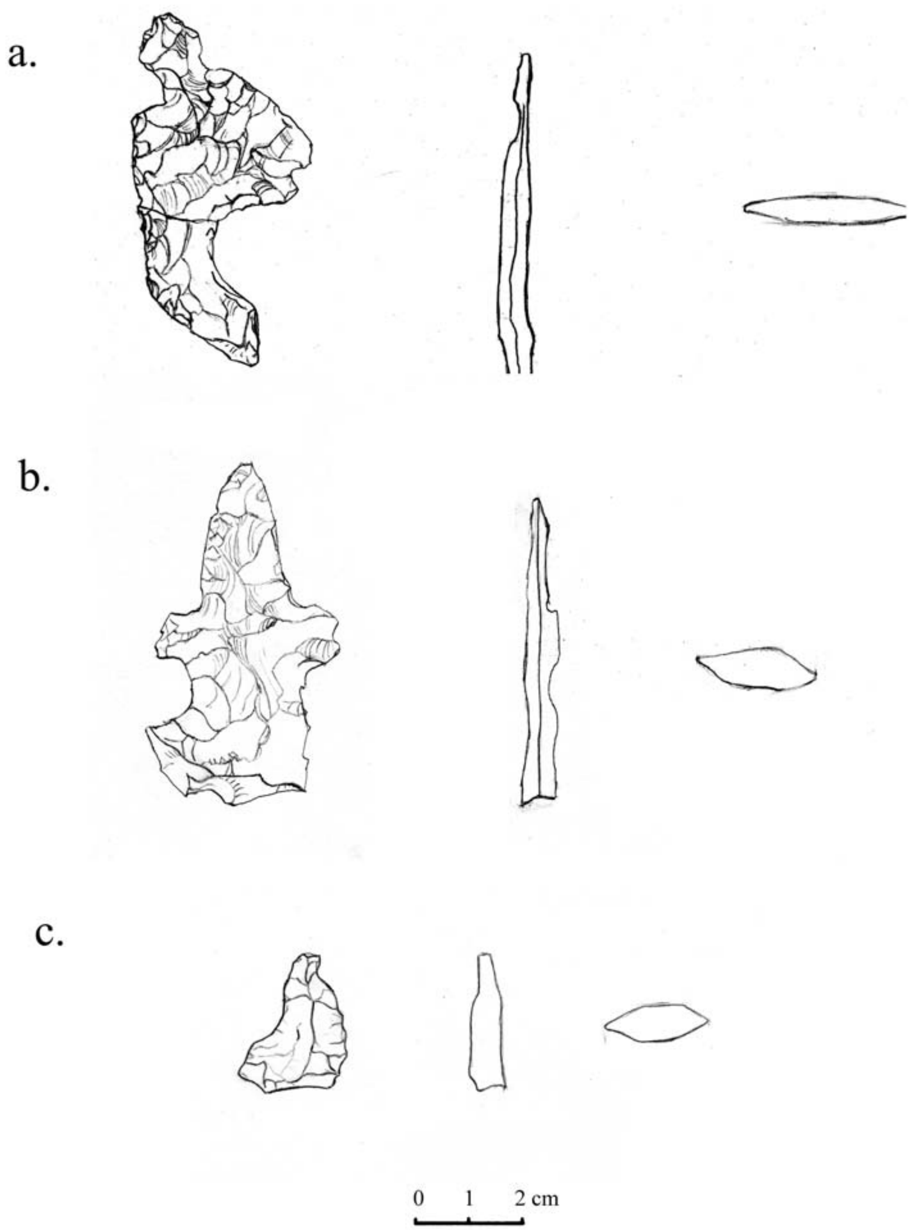


Figure 8.11. Chert Eccentrics, a. lot CAN 15-19-1, b. lot CAN 13-17-1, c. lot CAN 14-1-1 (drawings by Walter Burgos).

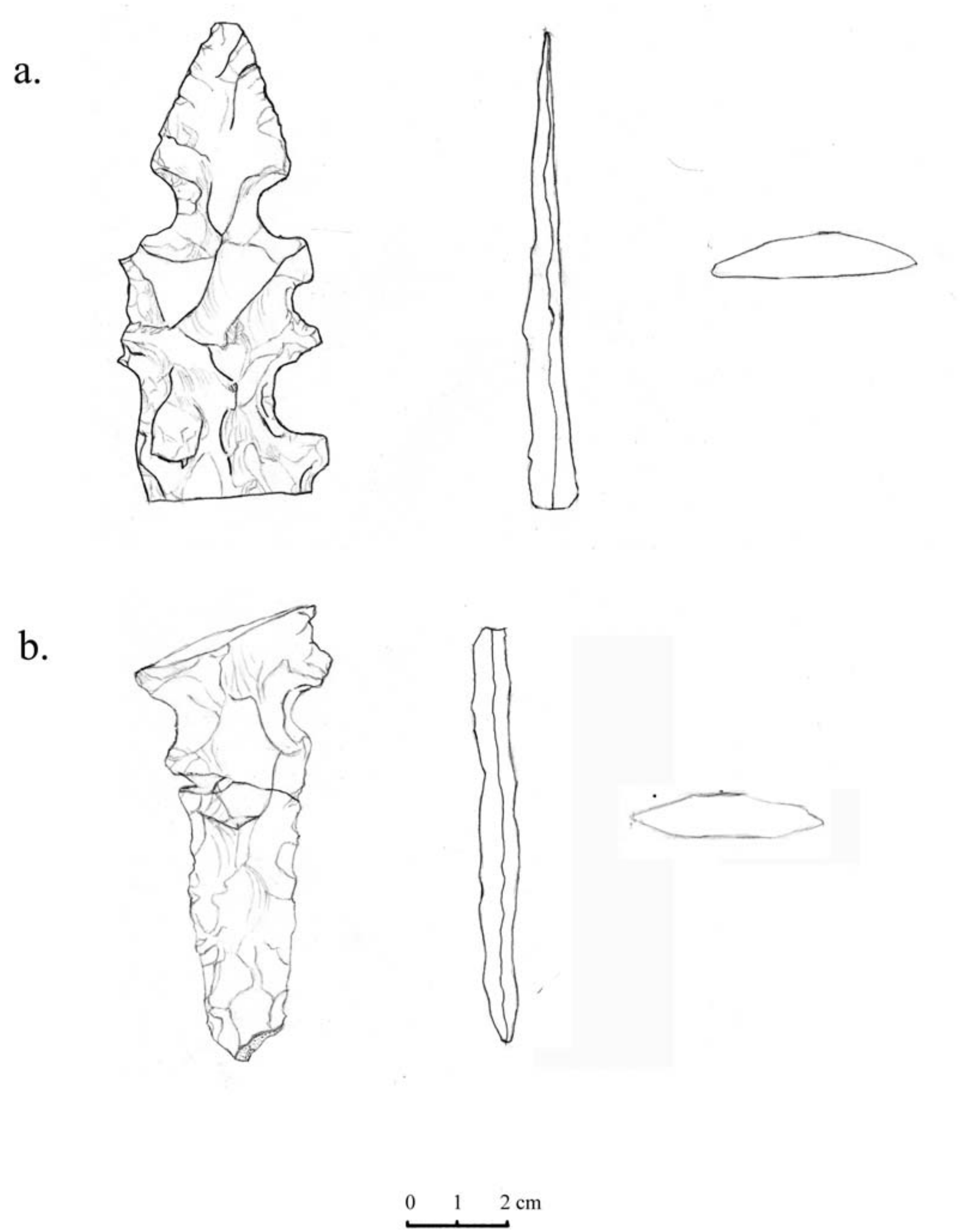


Figure 8.12. Chert Eccentrics, a. lot CAN 15-16-1, b. lot CAN 13-92-1 (drawings by Walter Burgos).

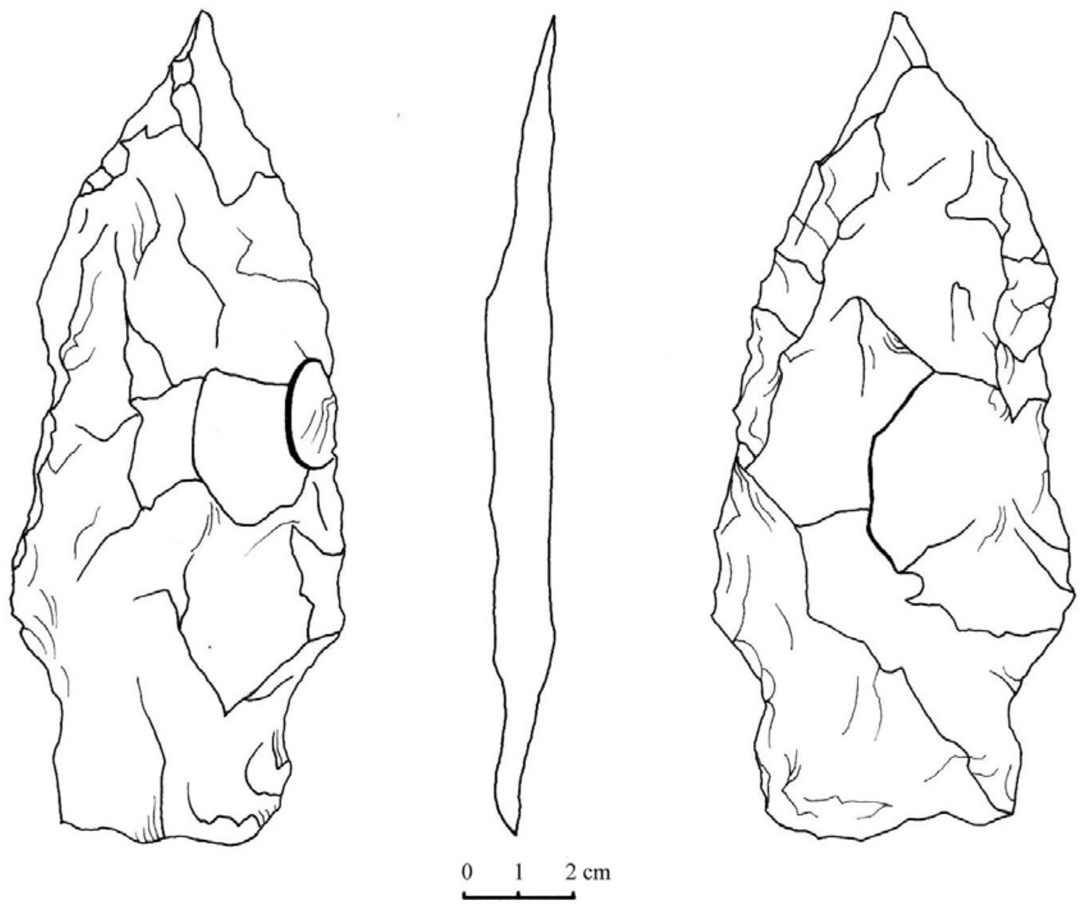


Figure 8.13. Shouldered Stemmed Biface, lot CAN 39A-12-3 (drawing by Walter Burgos, inked by Luis Fernando Luin).

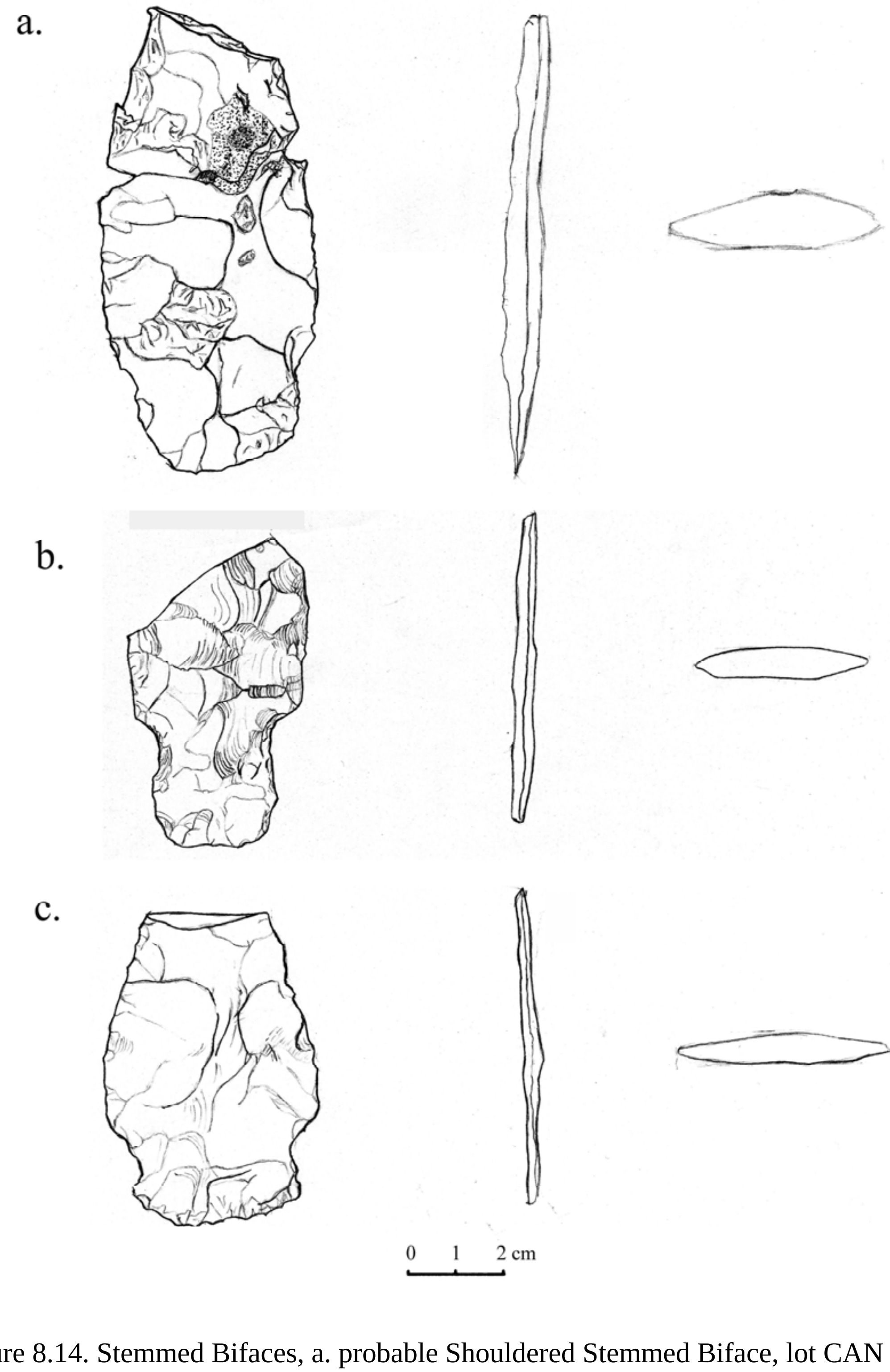


Figure 8.14. Stemmed Bifaces, a. probable Shouldered Stemmed Biface, lot CAN 13-72-1, b. Shouldered Stemmed Biface, lot CAN 19A-0-0, c. Side Notched Shouldered Stemmed Biface, lot CAN 15-11-1 (drawings by Walter Burgos).

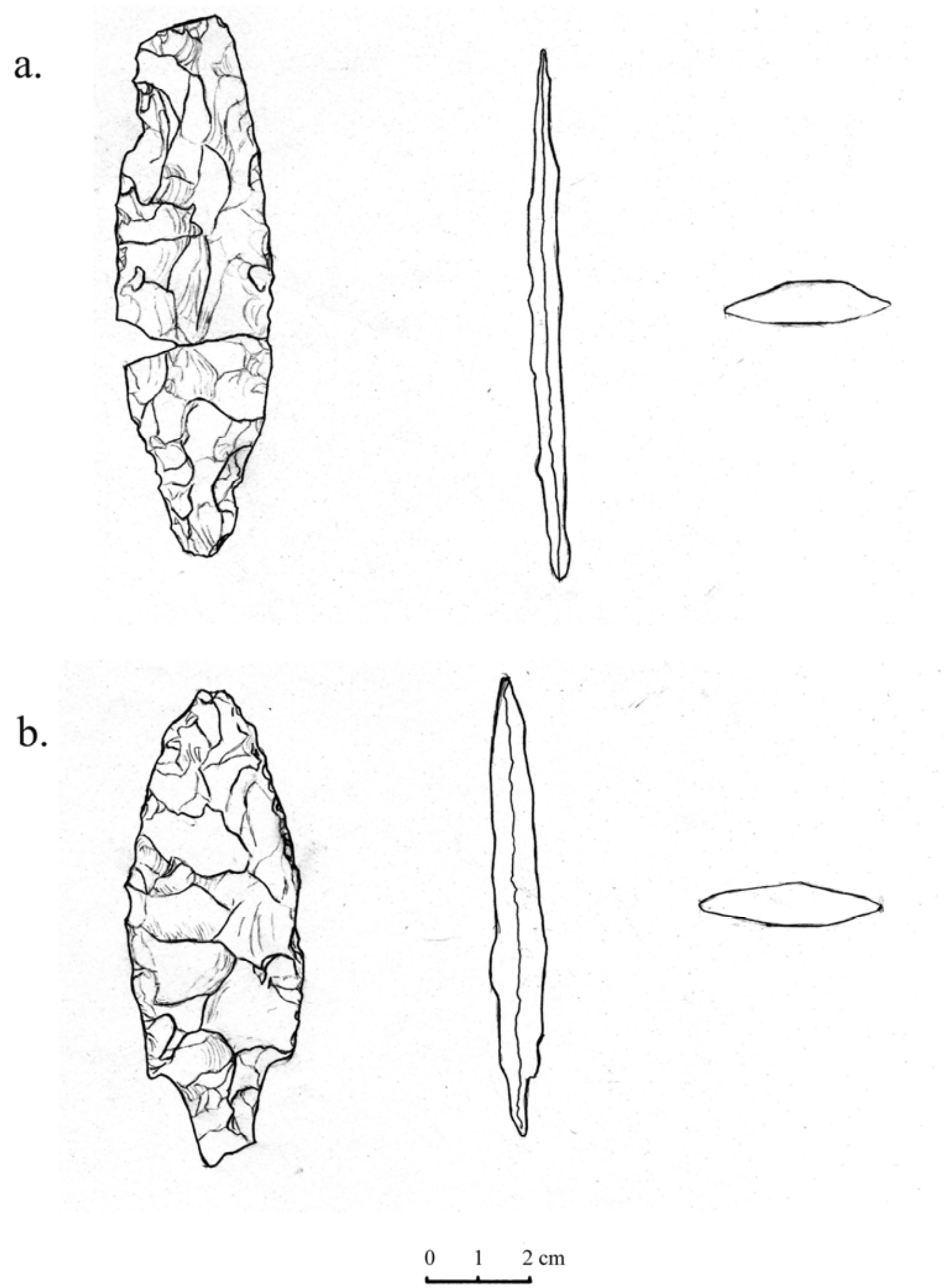


Figure 8.15. Tapered Stemmed Bifaces, a. lot CAN 14B-3-1, b. lot CAN 14-0-0 (drawings by Walter Burgos).

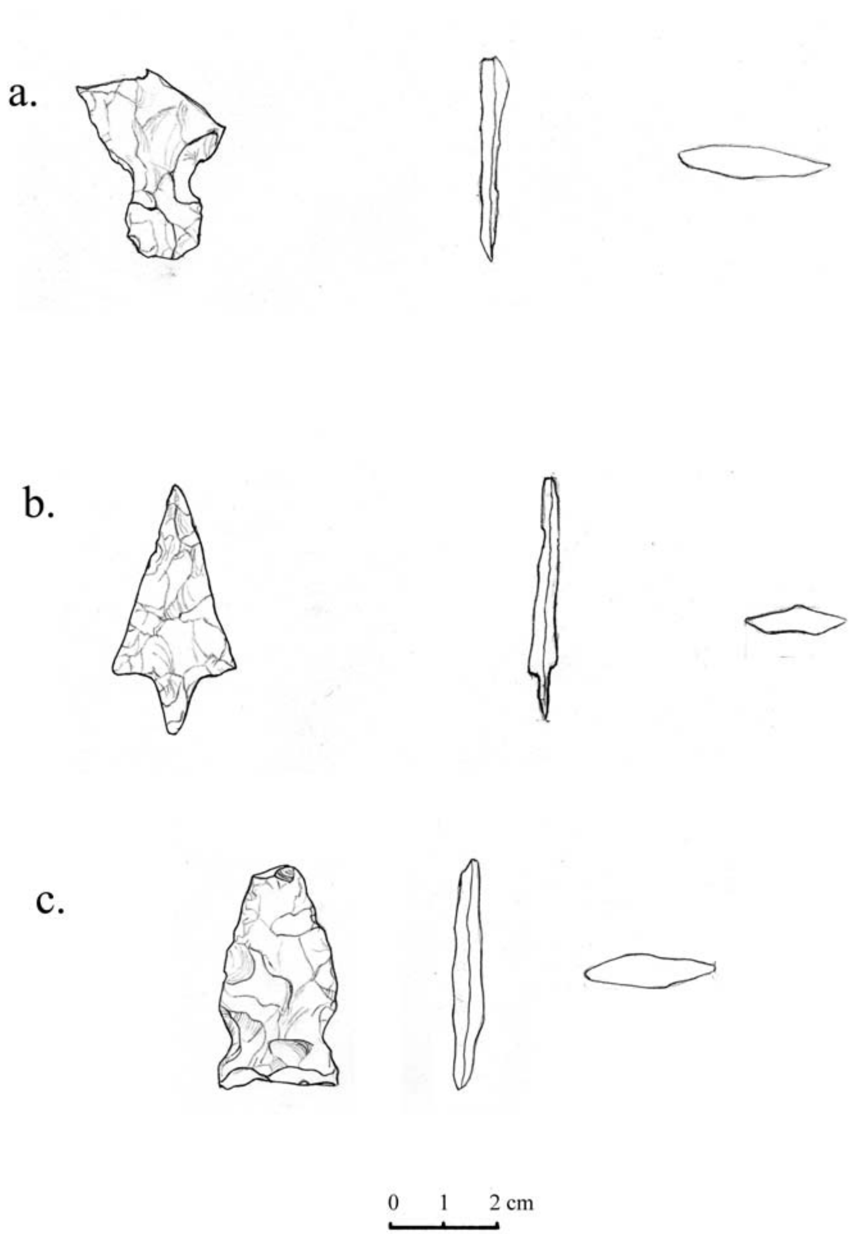


Figure 8.16. Stemmed Bifaces, a. Tapered Rounded Stemmed, lot CAN 14B-12-1, b. Trianglar Tapered Stemmed, lot CAN 15-15-1, c. Corner Notched, lot CAN 19A-41-1 (drawings by Walter Burgos).

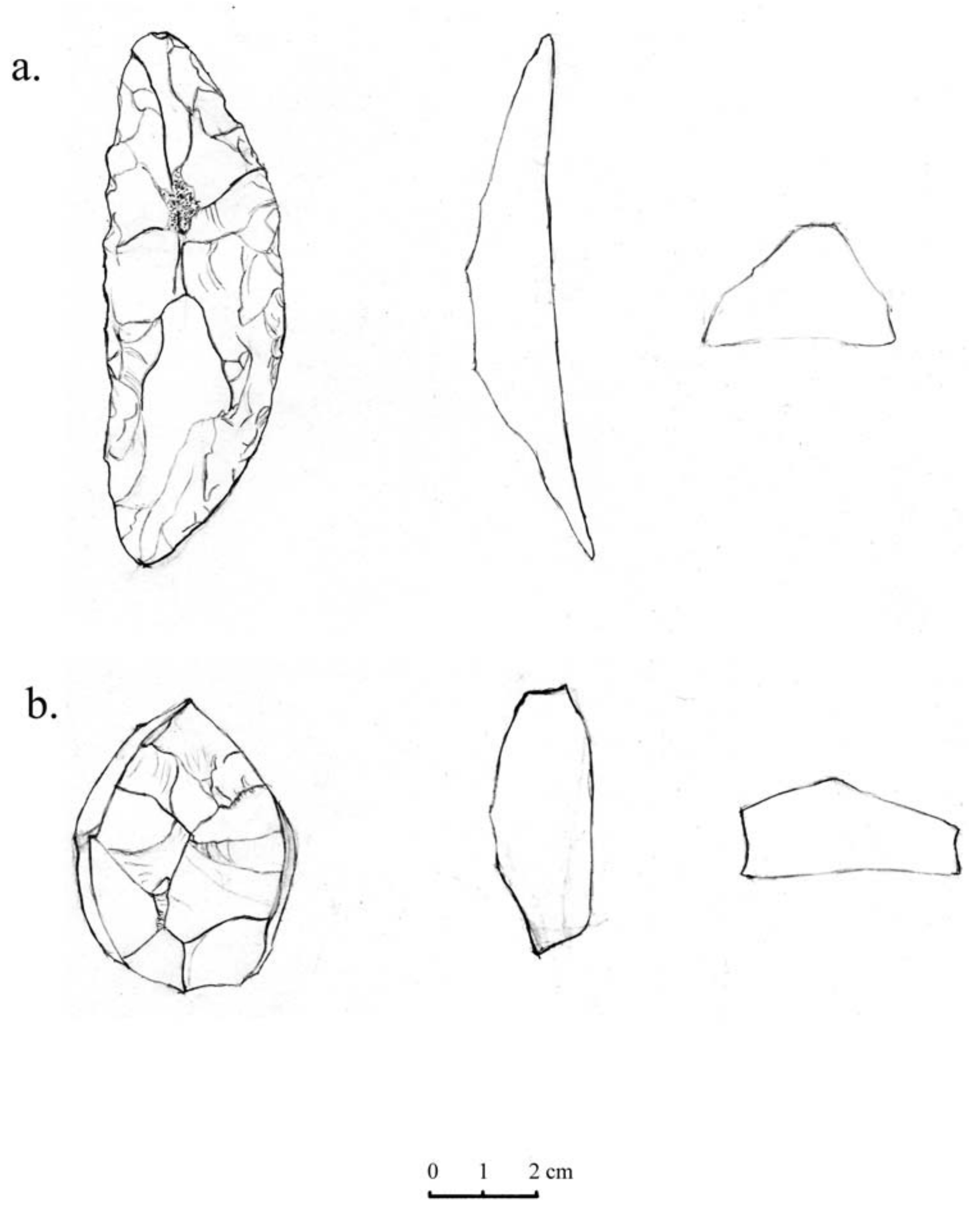


Figure 8.17. Unifaces, a. Small Thin Uniface, lot CAN 13-125-1, b. Domed Uniface, lot CAN 13-127-1 (drawings by Walter Burgos).

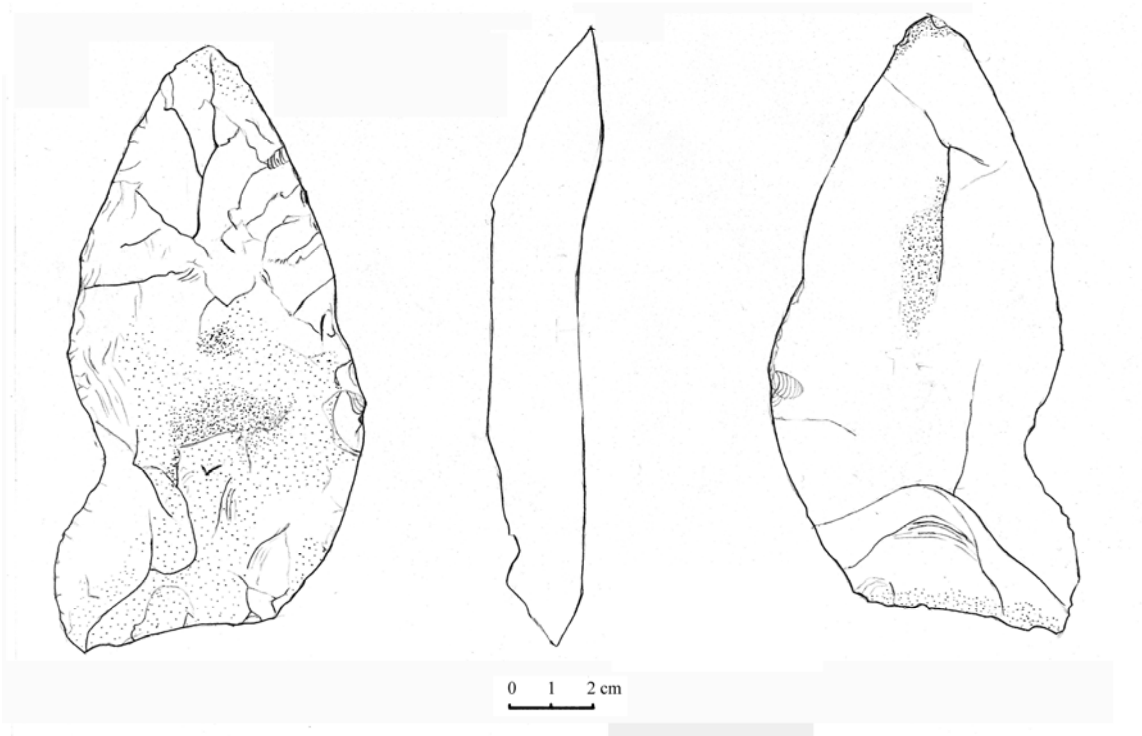


Figure 8.18. Uniface Preform, lot CAN 40-38-2 (drawing by Walter Burgos).

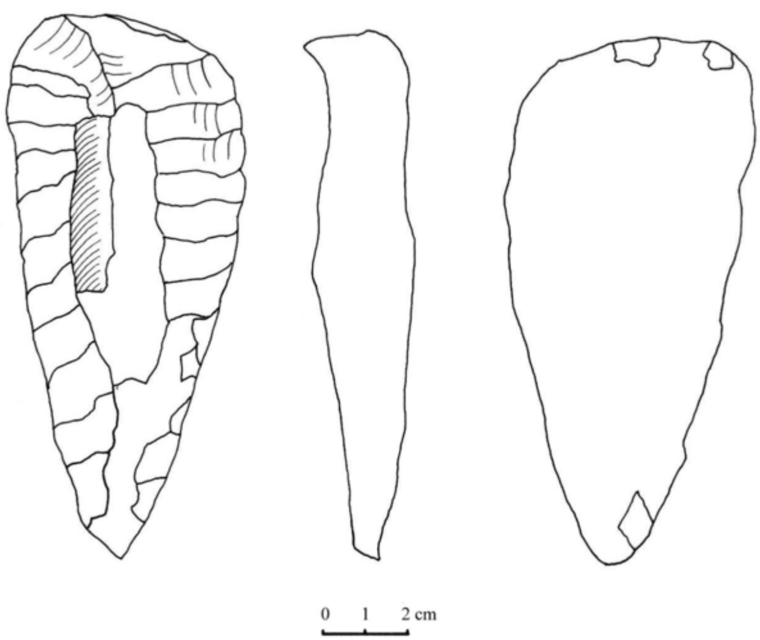


Figure 8.19. Large Uniface, lot CAN 25A-38-3 (drawing by author, inked by Luis Fernando Luin).

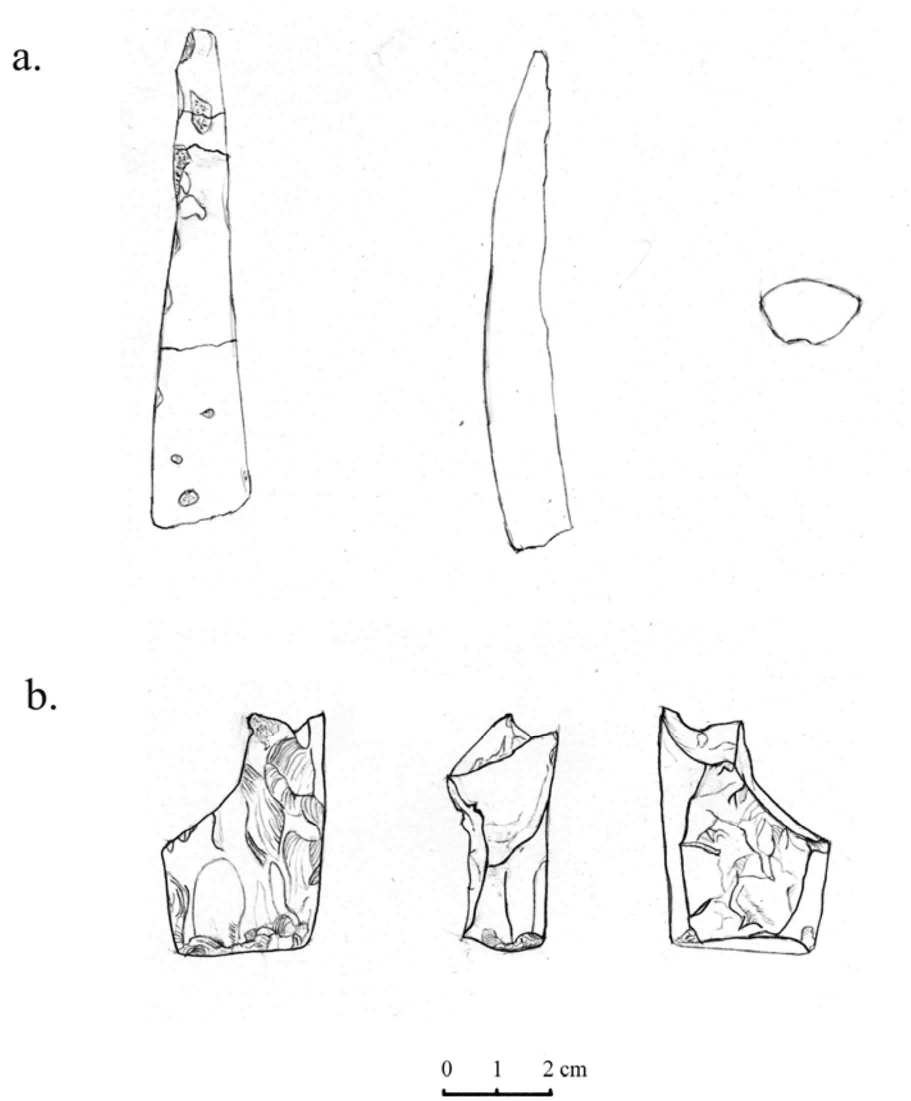


Figure 8.20. Elongate Unifaces, a. lot CAN 13-0-0 (Structure K6-34), b. lot CAN 14-0-0, (drawings by Walter Burgos).

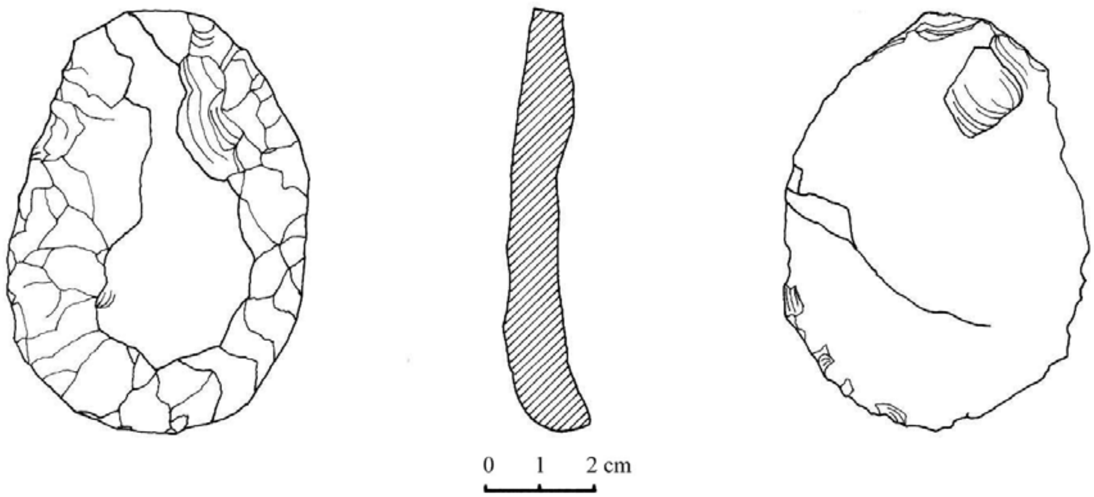


Figure 8.21. Round Edge Flaked Uniface, lot CAN 39A-21-1 (drawing by Walter Burgos, inked by Luis Fernando Luin).

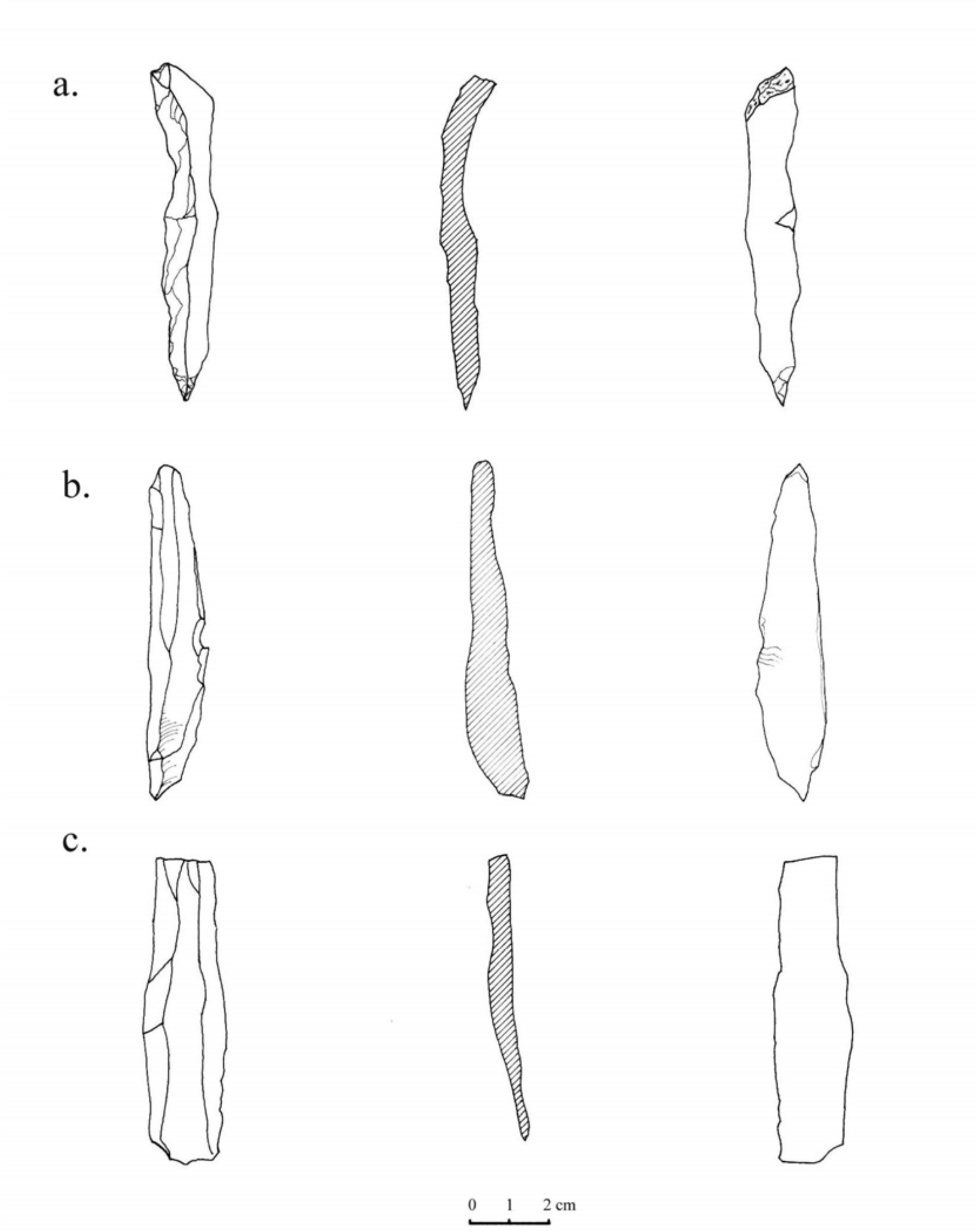


Figure 8.22. Chert Blades, a. Crested Blade with modified distal < 1 cm, lot CAN 39A-56-2, b. Crested Blade, lot CAN 39A-13-13, c. Multifaceted Blade, lot CAN 39A-13-1 (drawings by Walter Burgos, inked by Luis Fernando Luin).

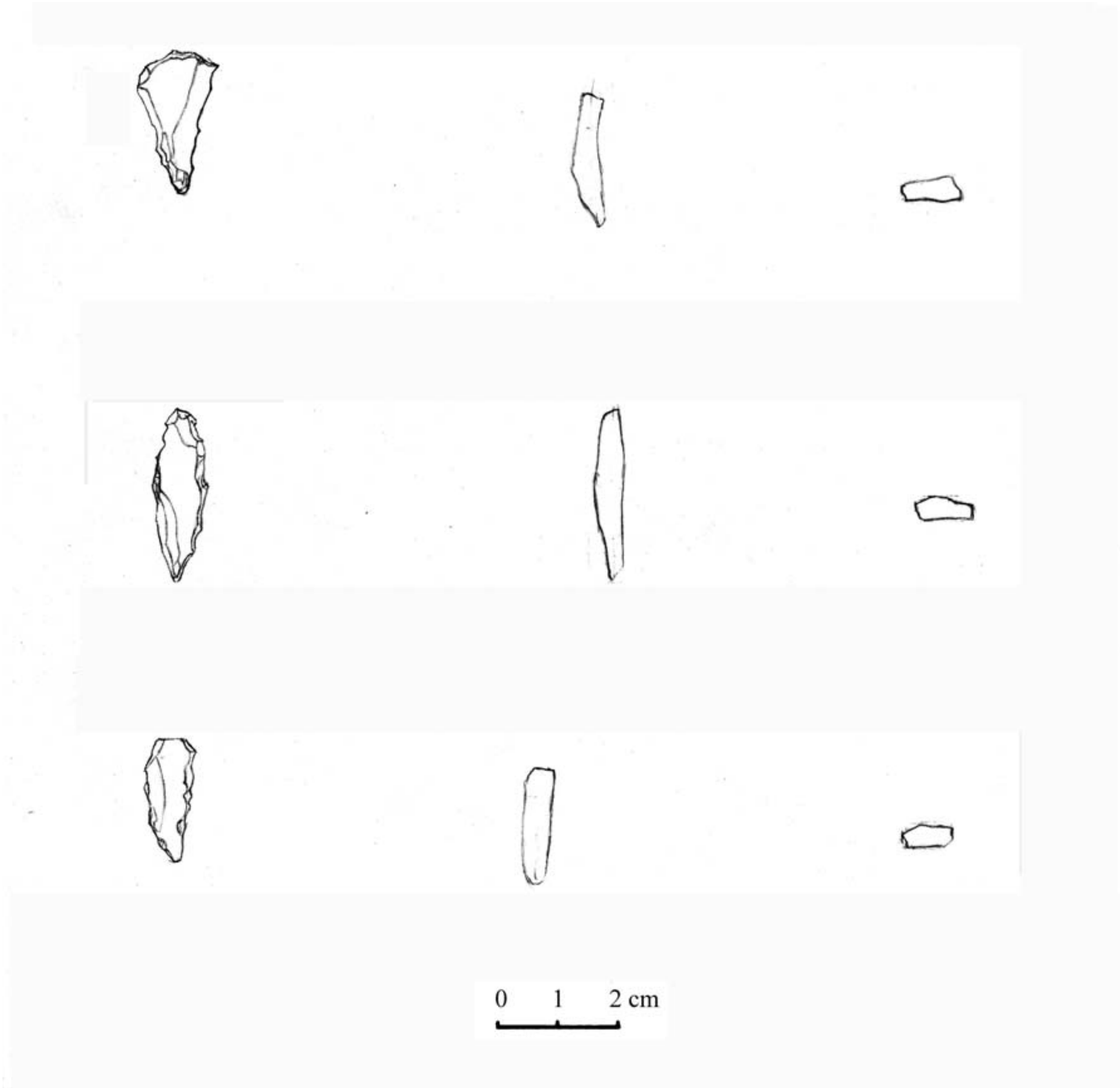


Figure 8.23. Triangular Broken Flake Tools, lot CAN 13-76-1 (drawings by Walter Burgos).

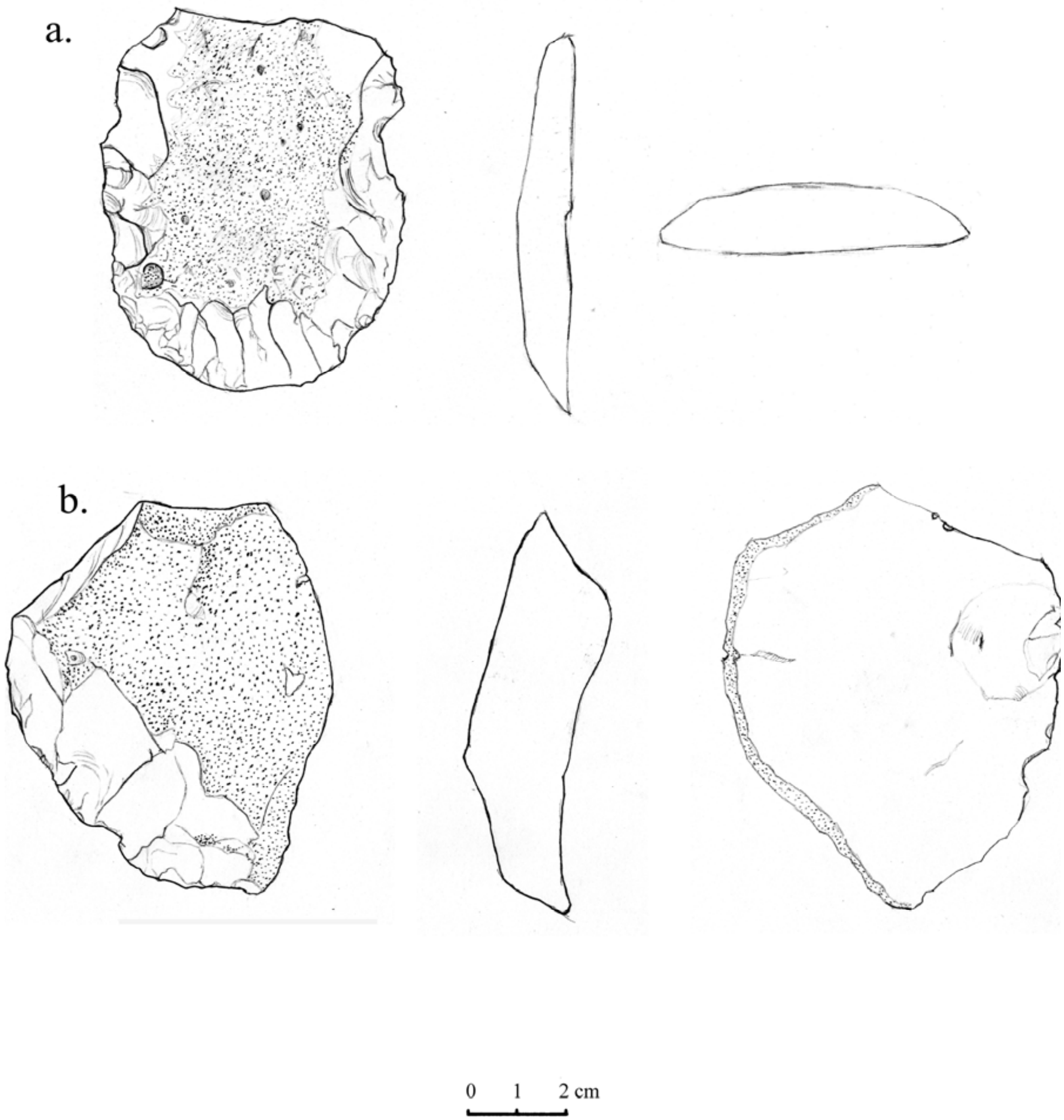


Figure 8.24. Edge Modified Flake Tools ("scrapers"), a. lot CAN 13-160-1, b. made on decortication flake, lot CAN 19A-36-2 (drawings by Walter Burgos).

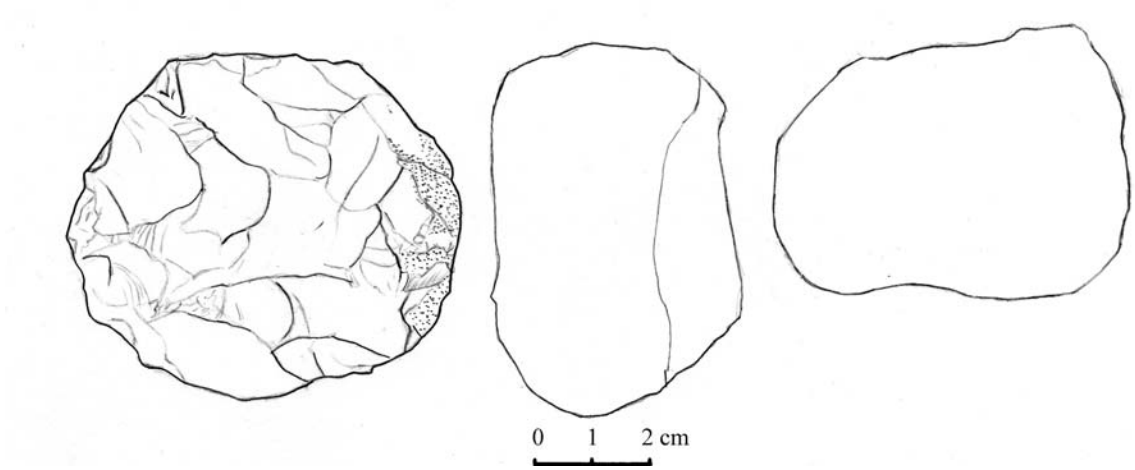


Figure 8.25. Flaked Core Tool (hammerstone), lot CAN 14-0-0 (drawing by Walter Burgos).

Figure 8.26. Edge Bite Flake (photo by author).

Figure 8.27. Potlid Flake (result of fire; photo by author).

Figure 8.28. Multidirectional Flake Core (photo by author).

Figure 8.29. Multidirectional Flake Cores, lot CAN 6-9-1 (not to scale; photo by Andrew Demarest; Used with the permission of the Cancuen Archaeological Project).

Figure 8.30. Multidirectional Flake Core from Figure 8.23, lot 6-9-1 (photo by author).

Figure 8.31. Multidirectional Flake Core of banded chert, later reused as Flake Core Tool (photo by author).

Figure 8.32. Unidirectional Flake Core, also probably used as Domed Uniface (photo by author).

Figure 8.33. Flake/Blade Core (photo by author).

Figure 8.34. Thin Ovate Biface (photo by author).

Figure 8.35. Thin Ovate Biface (photo by author).

Figure 8.36. Thin Ovate Biface (photo by author).

Figure 8.37. Thin Ovate Biface (photo by author).

Figure 8.38. Thick Ovate Biface (photo by author).

Figure 8.39. Thick Ovate Biface (photo by author).

Figure 8.40. Thick Ovate Biface (photo by author).

Figure 8.41. Thick Rounded Biface (photo by author).

Figure 8.42. Thick Rounded Biface, recycled Ovate Biface (photo by author).

Figure 8.43. Thick Rounded Biface (photo by author).

Figure 8.44. Thick Ovate Biface Preform (photo by author).

Figure 8.45. Thick Elongate Biface (photo by author).

Figure 8.46. Thick Elongate Biface (photo by author).

Figure 8.47. Thin Elongate Biface (photo by author).

Figure 8.48. Thin Elongate Biface (photo by author).

Figure 8.49. Chert Eccentric (photo by author).

Figure 8.50. Chert Eccentric (photo by author).

Figure 8.51. Chert Eccentric (photo by author).

Figure 8.52. Chert Eccentric (photo by author).

Figure 8.53. Chert Eccentric (photo by author).

Figure 8.54. Chert Eccentric (photo by author).

Figure 8.55. Shouldered Stemmed Biface (photo by author).

Figure 8.56. Shouldered Stemmed Biface (photo by author).

Figure 8.57. Shouldered Stemmed Biface (photo by author).

Figure 8.58. Shouldered Stemmed Biface (photo by author).

Figure 8.59. Side Notched Shouldered Stemmed (photo by author).

Figure 8.60. Tapered Stemmed Biface (photo by author).

Figure 8.61. Tapered Stemmed Biface (photo by author).

Figure 8.62. Tapered Stemmed Biface (photo by author).

Figure 8.63. Rounded Tapered Stemmed Biface (photo by author).

Figure 8.64. Rounded Tapered Stemmed Biface (photo by author).

Figure 8.65. Triangular Tapered Stemmed Biface (photo by author).

Figure 8.66. Triangular Tapered Stemmed Biface (photo by author).

Figure 8.67. Corner Notched Stemmed Biface (photo by author).

Figure 8.68. Corner Notched Stemmed Biface (photo by author).

Figure 8.69. Thin Uniface (photo by author).

Figure 8.70. Thin Uniface (photo by author).

Figure 8.71. Thin Uniface (photo by author).

Figure 8.72. Thin Uniface (photo by author).

Figure 8.73. Thick Uniface (photo by author).

Figure 8.74. Thick Uniface (photo by author).

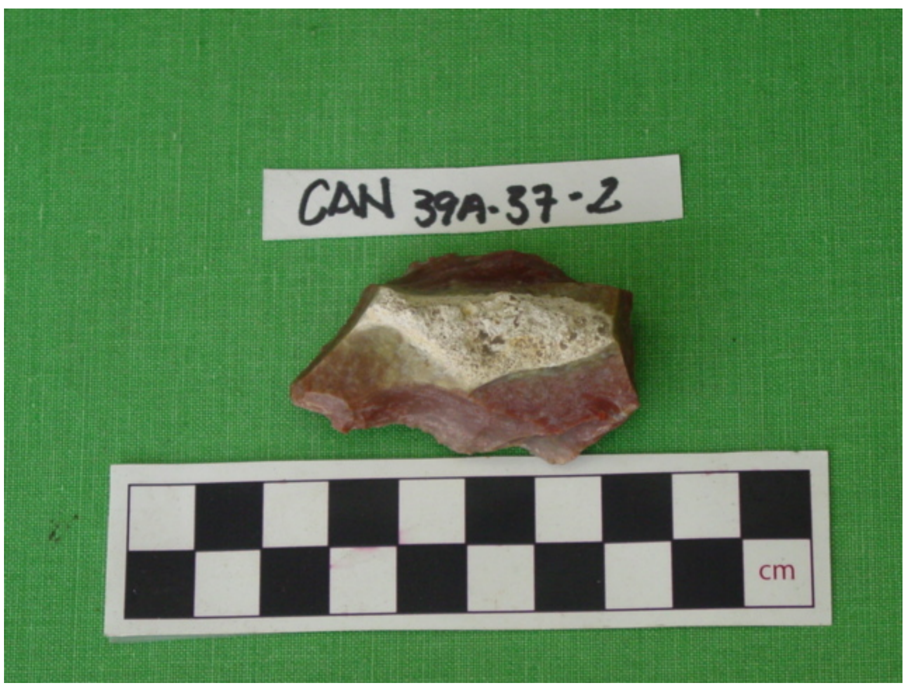


Figure 8.75. Domed Uniface (photo by author).

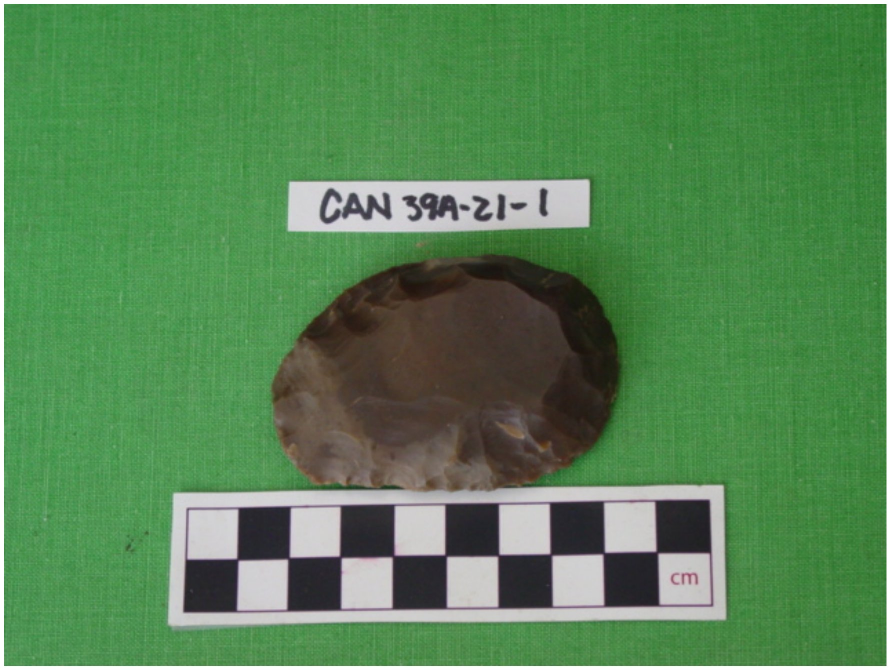


Figure 8.76. Rounded Edge Flaked Uniface (photo by author).

Figure 8.77. Complete Flaked Round Uniface (photo by author).

Figure 8.78. Small Round Unifaces (photo by author).

Figure 8.79. Elongate Uniface (possible pigment grinders; photo by author).

Figure 8.80. Elongate Uniface, ventral side (photo by author).

Figure 8.81. Elongate Uniface, dorsal side (photo by author).

Figure 8.82. Thick Uniface Preform (photo by author).

Figure 8.83. Chert Macroblade (photo by author)

Figure 8.84. Chert Crested Blade (photo by author).

Figure 8.85. Macroblades, crested blades, pressure blades, and fortuitous blades from Structure M10-7 and M10-4 (photo by author).

Figure 8.86. Multifaceted Blade with dorsal scars from previous blade removal (photo by author).

Figure 8.87. Modified Flake Tools in (center) and Triangular Broken Flake Tools on right and left ends, lot Can 24, Structure M10-4 (photo by author).

Figure 8.88. Triangular Broken Flake Tools from Structure K7-24 (photo by author).

Figure 8.89. Edge Modified Flake Tool ("scraper"; photo by author).

Figure 8.90. Nodule Tool (used, unmodified nodule; photo by author).

Figure 8.91. Flaked Core Tool (photo by author).

Figure 8.92. Flaked Core Tool (photo by author).

Figure 8.93. Edge Flaked Core Tool (“pounder”; photo by author).

Figure 8.94. Edge Flaked Core Tool (“pounder”; photo by author).

Table 8.1. Chert debitage by structure type including totals.

Chert Debitage	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***Totals***
Decortication Flake	14	42	98	237	11	19	**421**
Hard Hammer Flake	93	248	445	957	81	155	**1979**
Soft Hammer Flake	89	257	275	793	18	141	**1573**
Pressure Flake	0	13	5	56	0	0	**74**
Bipolar Flake	7	8	10	15	11	0	**51**
Chunk	7	36	79	119	0	24	**265**
Shatter	0	7	8	36	0	1	**52**
Crushed Platform Flake	36	142	139	372	17	66	**772**
Fragment (undet. Tech.)	100	424	479	1406	43	202	**2654**
Potlid Flake (fire damage)	5	10	55	27	6	23	**126**
Unworked Nodule	0	0	0	2	0	0	**2**
Multidirectional Core	30	32	51	98	6	23	**240**
Unidirectional Core	1	12	14	8	1	1	**37**
Bipolar Core	0	3	5	7	0	0	**15**
Bipolar/Multidirectional Core	0	2	3	1	0	0	**6**
Flake/Blade Core	1	3	4	16	1	3	**28**
Pressure/Flake Core	0	12	0	0	0	0	**12**
Fire Damaged Core	10	2	45	23	1	16	**97**
Totals	**393**	**1253**	**1715**	**4173**	**196**	**674**	**8404**

Table 8.2. Chert debitage relative percentages by structure type.

Chert Debitage Percentages	*% Type 1*	*% Type 2*	*% Type 3*	*% Type 4*	*% Type 5*	*% Type 0*
Decortication Flake	3.99	3.54	6.15	5.90	5.88	3.01
Hard Hammer Flake	26.50	20.89	27.93	23.82	43.32	24.56
Soft Hammer Flake	25.36	21.65	17.26	19.74	9.63	22.35
Pressure Flake	0.00	1.10	0.31	1.39	0.00	0.00
Bipolar Flake	1.99	0.67	0.63	0.37	5.88	0.00
Chunk	1.99	3.03	4.96	2.96	0.00	3.80
Shatter	0.00	0.59	0.50	0.90	0.00	0.16
Crushed Platform Flake	10.26	11.96	8.73	9.26	9.09	10.46
Fragment (undet. Tech.)	28.49	35.72	30.07	34.99	22.99	32.01
Potlid Flake (fire damage)	1.42	0.84	3.45	0.67	3.21	3.65

Table 8.3. Chert tools by structure type including totals.

Chert Tools	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***Totals***
Bifaces							
Undetermined Bifaces-Thin	36	20	98	141	8	15	**318**
Ovate Bifaces-Thin	10	26	6	9		1	**52**
Undetermined Bifaces-Thick		4	10	17	4	2	**37**
Ovate Bifaces-Thick	6	12	8	39		3	**68**
Rounded Bifaces-Thick	2	2	6	6			**16**
Biface Preforms-Thick		3	1	9		1	**14**
Elongate Bifaces-Thick				5		1	**6**
Elongate Bifaces-Thin			3	2			**5**
Eccentrics	2		2	4		1	**9**
Shouldered Stemmed Bifaces	2	2	5	8	1		**18**
Side-Notched Shouldered Stemmed				2			**2**
Tapered Stemmed Bifaces	1	2	5	9		2	**19**
Rounded Tapered Stemmed Bifaces		2	2	4			**8**
Triangular Tapered Stemmed Bifaces		1		1	1		**3**
Corner Notched Bifaces			1	1			**2**
Unifaces							
Uniface on Flake-Thin	1	3	2	1		3	**10**
Uniface on Flake-Thick	6	10	11	10			**37**
Undetermined Uniface Fragment		4	15	17			**36**
Domed Uniface	5	4	25	24	1	4	**63**
Edge Flaked Round Uniface	2	2	3	4			**11**
Complete Flaked Round Uniface				2			**2**
Round Uniface-Small		1		12			**13**
Elongate Uniface			1	1		3	**5**
Uniface Preform	2	1		1			**4**
Blades							
Macroblade	1	1				1	**3**
Crested Blade	5	15	25	3	2	4	**54**
Blade with Modified Distal < 1cm		4	10	61			**75**
Bipointed Blade		4	1	14			**19**
Blade with Modified Distal > 1cm		3	2	4			**9**
Blade with Rounded Distal				5			**5**
Blade with Multifaceted Dorsal	1	2	20	3			**26**
Fortuitous Blade	1	2	8	14	2		**27**
Flake Tools							
Flake Modified to Point	14	4	31	50	2	7	**108**
Triangular Broken Flake Tool	1	161	17	178	4	27	**388**
Edge Modified Flake	1	4	9	19	1	1	**35**
Core Tools							**0**
Nodule Tool	3	9	3	77		3	**95**
Flake Core Tool	2	6	5	18			**31**
Edge Modfied Nodule Tool	3	2	1	8			**14**
Totals	**107**	**316**	**336**	**783**	**26**	**79**	**1647**

Table 8.4. Chert tools relative percentages by structure type.

Chert Tools Percentages	*Type 1 %*	*Type 2 %*	*Type 3%*	*Type 4%*	*Type 5%*	*Type 0%*
Bifaces						
Undetermined Bifaces-Thin	33.64	6.33	29.17	18.01	30.77	18.99
Ovate Bifaces-Thin	9.35	8.23	1.79	1.15	0.00	1.27
Undetermined Bifaces-Thick	0.00	1.27	2.98	2.17	15.38	2.53
Ovate Bifaces-Thick	5.61	3.80	2.38	4.98	0.00	3.80
Rounded Bifaces-Thick	1.87	0.63	1.79	0.77	0.00	0.00
Biface Preforms-Thick	0.00	0.95	0.30	1.15	0.00	1.27
Elongate Bifaces-Thick	0.00	0.00	0.00	0.64	0.00	1.27
Elongate Bifaces-Thin	0.00	0.00	0.89	0.26	0.00	0.00
Eccentrics	1.87	0.00	0.60	0.51	0.00	1.27
Shouldered Stemmed Bifaces	1.87	0.63	1.49	1.02	3.85	0.00
Side-Notched Shouldered Stemmed	0.00	0.00	0.00	0.26	0.00	0.00
Tapered Stemmed Bifaces	0.93	0.63	1.49	1.15	0.00	2.53
Tapered Rounded Stemmed Bifaces	0.00	0.63	0.60	0.51	0.00	0.00
Triangular Tapered Stemmed Bifaces	0.00	0.32	0.00	0.13	3.85	0.00
Corner Notched Bifaces	0.00	0.00	0.30	0.13	0.00	0.00
Unifaces						
Uniface on Flake-Thin	0.93	0.95	0.60	0.13	0.00	3.80
Uniface on Flake-Thick	5.61	3.16	3.27	1.28	0.00	0.00
Undetermined Uniface Fragment	0.00	1.27	4.46	2.17	0.00	0.00
Domed Uniface	4.67	1.27	7.44	3.07	3.85	5.06
Edge Flaked Round Uniface	1.87	0.63	0.89	0.51	0.00	0.00
Complete Flaked Round Uniface	0.00	0.00	0.00	0.26	0.00	0.00
Round Uniface-Small	0.00	0.32	0.00	1.53	0.00	0.00
Elongate Uniface	0.00	0.00	0.30	0.13	0.00	3.80
Uniface Preform	1.87	0.32	0.00	0.13	0.00	0.00
Blades						
Macroblade	0.93	0.32	0.00	0.00	0.00	1.27
Crested Blade	4.67	4.75	7.44	0.38	7.69	5.06
Blade with Modified Distal < 1cm	0.00	1.27	2.98	7.79	0.00	0.00
Bipointed Blade	0.00	1.27	0.30	1.79	0.00	0.00
Blade with Modified Distal > 1cm	0.00	0.95	0.60	0.51	0.00	0.00
Blade with Rounded Distal	0.00	0.00	0.00	0.64	0.00	0.00
Blade with Multifaceted Dorsal	0.93	0.63	5.95	0.38	0.00	0.00
Fortuitous Blade	0.93	0.63	2.38	1.79	7.69	0.00
Flake Tools						
Flake Modified to Point	13.08	1.27	9.23	6.39	7.69	8.86
Triangular Broken Flake Tool	0.93	50.95	5.06	22.73	15.38	34.18
Edge Modified Flake	0.93	1.27	2.68	2.43	3.85	1.27
Core Tools						
Nodule Tool	2.80	2.85	0.89	9.83	0.00	3.80
Flake Core Tool	1.87	1.90	1.49	2.30	0.00	0.00
Edge Modfied Nodule Tool	2.80	0.63	0.30	1.02	0.00	0.00

Table 8.5. Grain size of chert (fine, medium or coarse) by structure type.

Grain Size of Chert Debitage	*Type 1*	*Type 1%*	*Type 2*	*Type 2%*	*Type 3*	*Type 3%*	*Type 4*	*Type 4%*	*Type 5*	*Type 5%*	*Type 0*	*Type 0%*
Fine	295	79.73	916	76.78	1210	75.25	2979	73.94	137	73.26	480	76.31
Medium	46	12.43	179	15.00	210	13.06	563	13.97	23	12.30	67	10.65
Coarse	29	7.84	98	8.21	188	11.69	487	12.09	27	14.44	82	13.04

Table 8.6. Cortex present on chert debitage by structure type.

Cortex on Chert Debitage	*Type 1*	*Type 1%*	*Type 2*	*Type 2%*	*Type 3*	*Type 3%*	*Type 4*	*Type 4%*	*Type 5*	*Type 5%*	*Type 0*	*Type 0%*
0%	243	69.03	795	66.36	979	63.53	2715	67.30	96	51.61	437	69.15
0-25%	63	17.90	204	17.03	284	18.43	656	16.26	40	21.51	94	14.87
0-50%	19	5.40	87	7.26	120	7.79	244	6.05	21	11.29	42	6.65
50-75%	13	3.69	43	3.59	60	3.89	112	2.78	11	5.91	24	3.80
75-100%	14	3.98	69	5.76	98	6.36	307	7.61	18	9.68	35	5.54

Table 8.7. Visible use on chert debitage by structure type.

Visible Use on Chert Debitage	*Type 1*	*Type 1%*	*Type 2*	*Type 2%*	*Type 3*	*Type 3%*	*Type 4*	*Type 4%*	*Type 5*	*Type 5%*	*Type 0*	*Type 0%*
None	217	61.47	703	58.68	1056	65.14	2875	71.06	118	41.11	374	59.18
Light	52	14.73	277	23.12	293	18.08	656	16.21	142	49.48	169	26.74
Medium	63	17.85	133	11.10	167	10.30	316	7.81	21	7.32	66	10.44
Heavy	21	5.95	85	7.10	105	6.48	199	4.92	6	2.09	23	3.64

Table 8.8. Errors in chert tool production by structure type including totals

Errors in Chert Tool Production	*Type 1*	*Type 2*	*Type 3*	*Type 4*	*Type 5*	*Type 0*	***Totals***
Edge Bite	3	7	4	4	1	3	**22**
Soft Hammer Flakes Total	89	257	275	793	18	141	**1573**
Percentage	**3.37**	**2.72**	**1.45**	**0.50**	**5.56**	**2.13**	**1.40**
Hinge Terminations	22	57	61	169	14	23	**346**
Hard Hammer, Soft Hammer and Pressure Flakes Total	218	660	864	2178	116	362	**4398**
Percentage	**10.09**	**8.64**	**7.06**	**7.76**	**12.07**	**6.35**	**7.87**

Table 8.9. T-Test of mean weight of decortication flakes between "Elite" and "Nonelite" structure types (Types I and II vs. Types III, IV, V, and 0). Null hypothesis: There is no significant difference in mean weight of decortication flakes between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Decortication Flakes-Mean Weight		
	"Elite"	*"Nonelite"*
Mean	19.89	12.66971
Variance	321.215	264.1177
Observations	42	274
Hypothesized Mean Difference	0	
df	52	
t Stat	2.460396	
P(T<=t) one-tail	0.008619	
t Critical one-tail	1.674689	
P(T<=t) two-tail	0.017237	
t Critical two-tail	2.006645	

Table 8.10. T-Test of mean weight of hard hammer percussion flakes between "Elite" and "Nonelite" structure types (Types I and II vs. Types III, IV, V, and 0). Null hypothesis: There is no significant difference in mean weight of hard hammer percussion flakes between the structure types.

t-Test: Two-Sample Assuming Unequal Variances

Hard Hammer Percussion Flakes- Mean Weight		
	"Elite"	*"Nonelite"*
Mean	11.2172	9.580958
Variance	148.4063	156.0428
Observations	218	1200
Hypothesized Mean Difference	0	
df	306	
t Stat	1.817153	
P(T<=t) one-tail	0.035086	
t Critical one-tail	1.649848	
P(T<=t) two-tail	0.070172	
t Critical two-tail	1.967746	

Table 8.11. T-Test of mean weight of soft hammer percussion flakes between "Elite" and "Nonelite" structure types (Types I and II vs. Types III, IV, V, and 0). Null hypothesis: There is no significant difference in mean weight of soft hammer percussion flakes between the structure types.

t-Test: Two-Sample Assuming Unequal Variances
Soft Hammer Percussion Flakes-
Mean Weight

	"Elite"	*"Nonelite"*
Mean	5.14491	3.790268
Variance	23.06719	25.33752
Observations	167	596
Hypothesized Mean Difference	0	
df	277	
t Stat	3.187264	
P(T<=t) one-tail	0.0008	
t Critical one-tail	1.650374	
P(T<=t) two-tail	0.001601	
t Critical two-tail	1.968565	

Table 8.12. Measurements for chert debitage including mean length, width, thickness, weight and standard deviation, if there is no measurement, no artifacts of that type were observed, if there is no standard deviation, only one artifact was present and it could not be calculated.

Chert Debitage Measurements		***Type 1***	*St. Dev.*	***Type 2***	*St. Dev.*	***Type 3***	*St. Dev.*	***Type 4***	*St. Dev.*	***Type 5***	*St. Dev.*	***Type 0***	*St. Dev.*
Decortication Flakes	mean length	**4.37**	9.08	**3.59**	12.59	**3.49**	14.86	**3.1**	11.79	**2.54**	7.14	**3.36**	9.21
	mean width	**4.22**	13.9	**3.8**	13.78	**3.22**	13.64	**3.17**	12.22	**3.15**	9.55	**3.46**	9.97
	mean thickness	**1.23**	4.49	**1.1**	5.73	**1.09**	5.32	**0.95**	4.4	**0.89**	2.38	**1.04**	4
	mean weight	**24.17**	12.61	**17.97**	19.75	**15.75**	20.97	**11.65**	14.68	**6.82**	4.44	**12.32**	8.01
Hard Hammer Flakes	mean length	**3.47**	12.66	**3.43**	12.89	**3.18**	13.86	**3.03**	12.08	**3.02**	11.76	**2.99**	11.47
	mean width	**3.04**	10.87	**3.22**	11.1	**3.06**	12.05	**3.02**	11.15	**2.87**	9.16	**2.84**	9.73
	mean thickness	**0.85**	4.24	**0.94**	4.1	**0.91**	4.18	**0.88**	4.17	**0.98**	4.68	**0.84**	8.85
	mean weight	**10.09**	11.79	**11.64**	12.35	**11.05**	16.12	**9.27**	11.13	**10.06**	11.61	**7.6**	8.27
Soft Hammer Flakes	mean length	**3.59**	11.02	**3.38**	12.14	**2.94**	12.52	**3.19**	13.52	**2.8**	8.08	**3.22**	10.71
	mean width	**3.02**	11.04	**2.6**	9.01	**2.4**	9.34	**2.55**	10.47	**2.11**	6.59	**2.36**	8.98
	mean thickness	**0.6**	3.76	**0.46**	2.09	**0.39**	1.73	**0.43**	2.07	**0.34**	0.74	**0.41**	1.7
	mean weight	**6.94**	6.14	**4.35**	3.86	**3.13**	3.24	**4.17**	5.9	**2.1**	1.46	**3.29**	2.6
Pressure Flakes	mean length			**1.5**	4.79	**1.62**	6.34	**1.32**	4.41				
	mean width			**1.52**	3.28	**1.41**	3.71	**1.22**	3.7				
	mean thickness			**0.29**	1.1	**0.21**	0.35	**0.23**	0.81				
	mean weight			**0.5**	0.25	**0.54**	0.23	**0.32**	0.16				
Bipolar Flakes	mean length	**3.13**	5.5	**2.7**	6.56	**3.62**	16.15	**3.23**	8.89	**2.43**	9.61		
	mean width	**2.57**	7.67	**2**	5.75	**2.62**	16.25	**2.01**	8.26	**1.52**	6.26		
	mean	**0.75**	3.75	**0.95**	4.19	**1.23**	3.49	**1.12**	2.31	**1.05**	3.79		

	thickness												
	mean weight	**6.52**	4.81	**4.26**	2.67	**12.8**	17.53	**7.59**	4.39	**4.22**	3.47		
Chunks	mean length	**2.69**	3.89	**2.84**	9.36	**2.54**	8.44	**2.49**	9.72			**2.02**	5.84
	mean width	**2.07**	4.41	**1.96**	6.47	**1.89**	6.26	**1.92**	6.68			**1.58**	6.32
	mean thickness	**1.16**	5.32	**1.28**	4.76	**1.28**	4.49	**1.21**	4.59			**1.19**	4.06
	mean weight	**9.51**	2.56	**6.93**	4.4	**6.33**	6.03	**6.32**	5.88			**3.96**	3.37
Shatter	mean length			**1.82**	3	**1.45**	3.51	**1.37**	2.33			**1.37**	
	mean width			**0.95**	1.58	**1.07**	1.8	**0.87**	2.65			**0.92**	
	mean thickness			**0.49**	0.79	**0.71**	2.08	**0.52**	1.41			**0.62**	
	mean weight			**0.74**	0.25	**1.06**	0.52	**0.59**	0.33			**0.6**	
Crushed Platform Flakes	mean length	**3.91**	13.3	**3.09**	13.46	**2.94**	11.43	**2.95**	10.88	**3.36**	13.34	**2.93**	11.58
	mean width	**2.8**	8.67	**2.43**	9.07	**2.53**	10.47	**2.33**	7.92	**2.47**	9.92	**2.24**	8.55
	mean thickness	**0.7**	4.4	**0.43**	2.02	**0.41**	1.88	**0.4**	1.58	**0.43**	1.94	**0.39**	1.63
	mean weight	**8.69**	8.92	**3.75**	3.53	**3.68**	4	**2.96**	2.57	**3.92**	3.81	**2.5**	1.84
Potlid Flakes	mean length	**2.74**	13.22	**0.71**	7.09	**2.5**	9.77	**2.4**	8.18	**2.25**	3.61	**2.55**	7.03
	mean width	**2.1**	6.49	**0.7**	7.02	**2.06**	7.14	**2.15**	8.21	**2.65**	4.88	**1.8**	6.13
	mean thickness	**0.89**	5.22	**0.41**	4.13	**0.64**	2.75	**0.65**	3.23	**0.63**	3.01	**0.61**	2.38
	mean weight	**8.43**	4.08	**2.9**	2.9	**3.85**	4.6	**3.9**	3.38	**3.48**	2.64	**2.7**	2.11
Raw Nodule	mean length							**6.92**	21.01				
	mean width							**5.75**	22.01				
	mean thickness							**4.48**	11				
	mean weight							**275.55**	232.57				
Multidirectional Core	mean length	**6.39**	21.05	**5.91**	22.6	**5.18**	27.32	**4.31**	25.35	**3.98**	11.05	**4.34**	21.69

	mean width	**4.54**	13.54	**5.18**	24.59	**4.34**	19.1	**3.77**	16.95	**3.45**	5.09	**3.32**	15.56
	mean thickness	**3.55**	11.53	**3.24**	13.83	**2.68**	10.32	**2.53**	9.91	**2.07**	2.98	**2.4**	16.19
	mean weight	**130.45**	134.83	**161.39**	272.67	**82.49**	10.53	**60.67**	76.4	**32.45**	13.98	**82.72**	192.84
Unidirectional Core	mean length	**2.9**		**4.33**	19.49	**2.93**	10.33	**3.2**	16.94	**3.86**		**2.19**	
	mean width	**7.49**		**4.42**	20.02	**2.56**	8.16	**4.09**	15.31	**4.37**		**2.42**	
	mean thickness	**3.5**		**2.61**	10.45	**2.17**	11.53	**2.63**	17.89	**2.7**		**3.41**	
	mean weight	**74.9**		**70.5**	65.46	**19.99**	24.18	**62.4**	95.62	**44.8**		**16.4**	
Bipolar Core	mean length			**7.67**	23.9	**3.25**	23.38	**4.23**	17.05				
	mean width			**7.01**	14.14	**3.2**	16.54	**3.17**	9.65				
	mean thickness			**2.82**	7	**2**	11.08	**2.24**	9.58				
	mean weight			**195.5**	122.14	**40.74**	63.22	**46.06**	63.64				
Bipolar/Multidirectional	mean length			**8.71**	0.64	**4.51**	9.55	**5.75**					
	mean width			**7.09**	26.44	**4.28**	6.4	**2.51**					
	mean thickness			**2.26**	1.2	**2.39**	4.97	**2.5**					
	mean weight			**128.2**	50.62	**45.6**	19.19	**33.8**					
Flake/Blade Core	mean length	**7.79**		**5.75**	10.32	**5.2**	12.53	**4.91**	11.84	**4.01**		**3.07**	2.01
	mean width	**6.92**		**3.05**	10.72	**2.98**	14.7	**3.33**	8.65	**2.96**		**3.02**	4.32
	mean thickness	**3.73**		**1.87**	2.77	**2.13**	8.34	**1.64**	4.2	**0.98**		**1.08**	1.07
	mean weight	**155**		**42.87**	29.69	**37.05**	27.2	**28.89**	16.43	**14.7**		**8.67**	2.22
Flake/Pressure Core	mean length			**4.84**	20.11								
	mean width			**1.69**	4.89								
	mean thickness			**0.84**	3.74								
	mean weight			**11.09**	17.55								

		Type 1	St. Dev.	Type 2	St. Dev.	Type 3	St. Dev.	Type 4	St. Dev.	Type 5	St. Dev.	Type 0	St. Dev.
Fire Damaged Core	mean length	3.9	18.66	1.68	9.93	3.35	16.07	3.87	13.74	3.45		3.38	15.13
	mean width	2.73	13.5	2.1	7.49	2.81	11.4	2.7	9.55	2.37		2.81	9.5
	mean thickness	1.7	5.71	1.04	3.14	1.65	6.09	1.73	6.54	1.79		1.7	7.2
	mean weight	24.25	31.06	3.6	3.25	19.56	26.7	21.73	20.35	15		23.01	32.67

Table 8.13. Mean Measurements of chert tools including mean length, width, thickness, weight and standard deviation, if there is no measurement, no artifacts of that type were observed, if there is no standard deviation, only one artifact was present and it could not be calculated (when possible complete artifacts were used for the measurements, if not, the fragmentary measurements are indicated by an asterisk*).

Chert Tool Measurements		Type 1	St. Dev.	Type 2	St. Dev.	Type 3	St. Dev.	Type 4	St. Dev.	Type 5	St. Dev.	Type 0	St. Dev.
Bifaces													
Ovate Biface-Thin	mean length	5.83	18.58	5.55	27.84	9.92	35.01	8.61	15.56	*2.97	15.01	10.54	
	mean width	3.34	3.43	3.16	8.15	3.75	7.57	2.74	3.75	*3.43	7.98	4.14	
	mean thickness	0.76	2.34	0.75	1.94	0.76	1.34	0.7	2.13	*0.82	3.31	1.35	
	mean weight	15.21	5.21	14.44	9.01	33.1	25.4	18.17	8.18	*10.1	7.92	56.9	
Ovate Biface-Thick	mean length	*4.95	15.7	*6.04	23.68	10.5	18.28	12.38	14.87	*4.3	3.79	11.82	21.14
	mean width	*5.18	14.8	*4.55	19.87	5.9	3.89	6.65	4.67	*4.4	9.18	7.22	12.49
	mean thickness	*2.19	4.07	*2.1	7.46	2.19	5.97	3.52	11.73	*2.29	3.52	2.4	1.55
	mean weight	*59.35	28.07	*76.13	64.2	144.67	50.79	313.33	116.76	*51.7	17.05	224	82.15
Biface Preforms	mean length	*3.03	11.68	7.08	34.38	*4.94		*5.62	37.26			12.35	
	mean width	*3.15	10.66	4.72	16.44	*4.51		*5.1	22.97			9.05	
	mean thickness	*0.50	0.35	1.68	2.43	*1.78		*2.15	11.19			4.74	
	mean weight	*4.9	0.28	53.67	38.84	*39.3		*135.19	304.52			791	
Round Biface-Thick	mean length	5.65	12.03	6.64	6.45	6.29	6.78	5.88	11.72				

	mean width	**4.69**	8.98	**5.95**	5.56	**5.61**	12.56	**5.27**	7.05				
	mean thickness	**2.36**	0.57	**2.96**	5.75	**2.24**	5	**2.48**	5.62				
	mean weight	**61.9**	32.39	**160.8**	61.09	**99.72**	44.28	**98.23**	45.68				
Elongate Bifaces - Thick	mean length							**10.02**				**6.3**	
	mean width							**4.43**				**4.17**	
	mean thickness							**3.25**				**5.88**	
	mean weight							**115.7**				**5.6**	
Elongate Bifaces- Thin	mean length					**134.34**	9.35	***4.87**	12.02				
	mean width					**1.73**	3.95	***1.93**	1.24				
	mean thickness					**1.03**	2.67	***0.73**	1.84				
	mean weight					**34.4**	23.54	***8.95**	3.89				
Eccentrics	mean length	***3.53**	20.17			***4.47**	23.99	***8.57**	12.8			***2.98**	
	mean width	***3.31**	11.1			***2.55**	11.37	***4.78**	2.09			***4.17**	
	mean thickness	***0.69**	2.47			***0.72**	0.43	***0.89**	2.9			***0.58**	
	mean weight	***8.5**	9.33			***8.7**	8.34	***27.03**	12.38			***5.6**	
Shouldered-Stemmed	mean length			**6.51**		**11.9**	14.7	**9.08**	10.32	***2.85**			
	mean width			**2.55**		**4.25**	12.56	**4.16**	4.8	***3.58**			
	mean thickness			**0.68**		**1.2**	3.82	**1.17**	1.7	***1.04**			
	mean weight			**10.5**		**64.7**	41.57	**45.3**	15.56	***10.9**			
Side Notched Shouldered-Stemmed	mean length					***4.4**		**10.33**	50.94				
	mean width					***4.2**		**4.3**	2.9				
	mean thickness					***1.71**		**1.12**	1.07				
	mean weight					***37.68**		**51.56**	35				

Tappered Stemmed	mean length	***4.49**		***7.28**	22.48	**5.09**	20.04	**7.85**	20.99			**9.1**	
	mean width	***3.61**		***3.08**	0.03	**2.73**	1.88	**2.82**	6.15			**3.34**	
	mean thickness	***0.73**		***1.01**	6.72	**0.92**	3.2	**0.7**	1.2			**1.04**	
	mean weight	***13**		***20.85**	3.89	**11.48**	5.04	**18.16**	9.95			**30.2**	
Rounded Tappered Stemmed	mean length			**6.46**		***2.68**	1.91	**12.58**					
	mean width			**5.95**		***2.82**	6.94	**3.06**					
	mean thickness			**2.96**		***0.72**	0.49	**0.72**					
	mean weight			**160.8**		***6.21**	2.14	**34.7**					
Triangular Tappered Stemmed	mean length			**5.41**				**4.64**		**7.39**			
	mean width			**2.62**				**2.3**		**3.58**			
	mean thickness			**0.56**				**0.46**		**1.04**			
	mean weight			**5.9**				**3.5**		**10.9**			
Corner Notched	mean length							***4.24**					
	mean width							***1.74**					
	mean thickness							***0.51**					
	mean weight							***4.5**					
Unifaces													
Uniface on Flake-Thin	mean length	**10.19**		**7.68**	14.72	**7.41**	36.42	**8.75**					
	mean width	**4.97**		**3.96**	7	**3.64**	1.36	**3.41**					
	mean thickness	**1.39**		**2.01**	1.74	**1.87**	5.37	**2.39**					
	mean weight	**84.1**		**65.5**	28.25	**5.38**	28.94	**74.9**					
Uniface on Flake-Thick	mean length			***6.59**	33.92	***5.44**	10.61	**10.1**				***4.94**	22.5
	mean width			***5.15**	18	***4.68**	6.05	**5.54**				***5.89**	9.38
	mean thickness			***1.86**	5.76	***1.87**	2.7	**1.78**				***1.9**	6.28
	mean weight			***82.11**	102.78	***58.58**	24.39	**123**				***60.26**	32.3

Domed Uniface	mean length	**4.94**	6.96	**4.64**	12.51	**4.02**	12.35	**3.35**	13.91	**7.39**		**2.58**	10.31
	mean width	**3.51**	7	**3.13**	8.53	**3.41**	13.05	**2.56**	9.24	**4.76**		**2.13**	4.79
	mean thickness	**1.96**	3.05	**1.85**	6.12	**1.8**	6.2	**1.57**	6.46	**2.43**		**1.38**	3.9
	mean weight	**32.82**	5.75	**32.45**	17.89	**27.84**	22.17	**18.66**	19.76	**106.9**		**7.75**	3.59
Edge Flaked Round	mean length	**5.57**	0.63	**5.98**	8.23	**4.61**	17.41	**6.02**	6.88				
	mean width	**3.59**	15.43	**4.28**	14.78	**3.21**	11.91	**4.39**	12.03				
	mean thickness	**0.75**	0.13	**6.51**	1.44	**1.32**	5.2	**1.3**	5.34				
	mean weight	**18**	8.2	**24.35**	10.54	**27.72**	33.93	**38.33**	17.64				
Complete Flaked Round	mean length							**6.83**	9.04				
	mean width							**6.73**	6.84				
	mean thickness							**2.17**	0.72				
	mean weight							**113.05**	22.56				
Round Uniface-Small	mean length			**1.18**				**1.5**	4.64				
	mean width			**1.18**				**1.45**	4.41				
	mean thickness			**2.03**				**0.48**	1.22				
	mean weight			**0.3**				**1.68**	1.25				
Elongate Uniface	mean length					**9.25**		***5.17**				***2.9**	15.29
	mean width					**1.83**		***3.77**				***2.52**	5.07
	mean thickness					**1.22**		***1.48**				***1.37**	5.51
	mean weight					**23.5**		***6.6**				***13.93**	13.35
Uniface Preform	mean length	***13.24**	14.93	**13.66**				**7.42**					
	mean width	***8.64**	23.79	**10.02**				**4.84**					
	mean thickness	***4.55**	22.8	**3.9**				**2.5**					
	mean weight	***453.5**	224.15	**476**				**92.8**					
Blades													

Macroblades	mean length	*4.86		*2.93				7.18	2.35			*4.26	
	mean width	*5.23		*3.70				2.18	2.28			*3.17	
	mean thickness	*1.54		*0.97				1.2	2.3			*1.17	
	mean weight	*42.1		*9				2.39	7.18			*14.7	
Crested Blades	mean length	*3.83	7.35	8.56	18.39	5.37	15.25	3.4	11.68	6.43	5.9	4.66	12.61
	mean width	*1.49	4.2	1.25	1.02	1.53	6.29	1.08	3.48	1.48	6.05	1.31	4.6
	mean thickness	*0.67	1.92	0.66	0.83	1.06	4.42	0.63	2.12	0.94	4.47	0.97	3
	mean weight	*4.54	2.07	8.37	3.06	9.5	6.36	2.95	2.16	10	8.2	5.8	1.75
Blades with Modified Distal <1cm	mean length			4.43	13.1	4.93	16.05	4.11	17.3				
	mean width			1.23	1.96	1.1	4.12	1.13	3.26				
	mean thickness			0.8	2.16	0.68	1.77	0.62	1.77				
	mean weight			4.58	2.26	3.92	2.36	3.24	2.26				
Bipointed Blade	mean length			6.1	35.26	7.63		4	19.11				
	mean width			1.22	2.5	1.15		1.15	3.52				
	mean thickness			0.71	2.15	0.86		0.62	2.03				
	mean weight			5.48	4.5	8.7		3.15	2.49				
Blades with Modified Distal >1cm	mean length			3.84	11.28	4.13	14.88	5.6	14.43				
	mean width			1.3	1.43	1.31	3.76	1.2	2.98				
	mean thickness			0.66	0.6	0.62	2.56	0.79	1.39				
	mean weight			3.07	1.39	8.7	0.85	6.18	2.97				
Blade with Rounded Distal	mean length							5.56	11.85				
	mean width							1.11	1.95				
	mean thickness							0.71	1.07				
	mean weight							4.47	1.92				

Multifaceted Blade	mean length	**4.09**		**3.84**	6.3	**4.27**	15.62	**3.96**	13.26				
	mean width	**1.68**		**1.4**	0.86	**1.22**	2.01	**2.29**	3.05				
	mean thickness	**0.6**		**0.68**	0.01	**0.64**	1.81	**0.67**	2.14				
	mean weight	**5.9**		**4.5**	2.2	**4.33**	2.6	**6.24**	2.98				
Fortuitous Blade	mean length	**5.66**		**4.38**	21.28	**4.79**	11.31	**6.37**	11	**4.15**	4.4		
	mean width	**2.96**		**1.3**	5.4	**1.83**	4.37	**1.65**	4.74	**1.83**	2.4		
	mean thickness	**0.53**		**0.56**	1.65	**0.77**	3.16	**0.55**	2.82	**0.53**	0.63		
	mean weight	**8.5**		**2.95**	2.9	**6.19**	2.15	**4.06**	3.16	**4.5**	1.84		
Informal Flake Tools													
Flake Modified to Point	mean length	**2.78**		**2.26**	6.75	**3.26**	8.59	**3.69**	12.94	**3.84**	0.02	**3.36**	9.28
	mean width	**2.26**		**0.98**	4.26	**2.28**	7.46	**2.29**	8.23	**2.46**	0.28	**1.9**	1.83
	mean thickness	**0.46**		**0.37**	1.02	**0.51**	1.92	**0.67**	3.66	**1.39**	2.28	**0.49**	1.41
	mean weight	**4.05**		**1.03**	1.35	**4.03**	3.03	**6.24**	7.27	**10.3**	2.12	**3.19**	1.44
Triangular Broken Flake	mean length	**2.84**		**2.34**	3.1	**2.5**	6.32	**1.95**	3.97	**2.9**	9.76	**2.24**	4.44
	mean width	**1.33**		**1.18**	4.1	**1.13**	4.37	**0.87**	2.43	**1.03**	2.59	**0.91**	3.06
	mean thickness	**0.4**		**0.47**	2.27	**0.47**	1.85	**0.35**	0.77	**0.36**	0.98	**0.38**	0.9
	mean weight	**2.3**		**1.48**	1.05	**1.57**	1.36	**0.75**	0.39	**1.1**	0.65	**0.91**	0.44
Edge Modified Flake	mean length	**6.22**	24.76	**6.46**	26.61	**4.26**	12.16	**3.62**	14.47	**1.8**		**3.24**	
	mean width	**6.34**	17.45	**6.24**	26.16	**4.07**	21.17	**3.49**	19.45	**2.84**		**4.05**	
	mean thickness	**2.37**	4.91	**2.11**	8	**1.49**	4.54	**1.19**	6.64	**0.55**		**1.57**	
	mean weight	**100.45**	91.28	**121.6**	121.74	**36.42**	39	**24.74**	36.81	**3.7**		**20.3**	
Informal Core Tools													
Nodule Tool	mean length	**6.33**	10.44	**6.28**	11.77	**5.58**	29.67	**6.83**	12.26			**6.35**	6.24
	mean width	**6.57**	16.89	**5.59**	11.91	**5.13**	21	**5.9**	10.71			**6.04**	11.12

	mean thickness	**3.26**	13.08	**4.3**	16.5	**4.23**	17.13	**4.46**	11.12			**5.28**	7.5
	mean weight	**177.57**	149.83	**185.04**	167.27	**188.53**	153.88	**243.24**	142.18			**308.33**	164.56
Flake Core Tool	mean length	**5.69**	1.77	**6.15**	9.76	**6.13**	2.34	**7.35**	11.09				
	mean width	**4.64**	7.18	**5.68**	7.04	**5.08**	9.18	**5.88**	12.65				
	mean thickness	**3.7**	5.45	**3.76**	8.78	**3.94**	11.82	**4.72**	13.59				
	mean weight	**113.2**	60.52	**151.38**	5.2	**166.14**	65.51	**279.89**	209.18				
Edge Modified Nodule Tool	mean length	**6.5**	12.27	**5.8**	1.56	**6.55**		**5.94**	13.12				
	mean width	**7.12**	13.06	**6.72**	10.09	**5.26**		**6.06**	10.39				
	mean thickness	**3.38**	4.43	**4.19**	0.57	**3.33**		**3.72**	5.65				
	mean weight	**185**	61.44	**172**	70.71	**126**		**170.38**	72.05				

CHAPTER IX

STATUS AND IDENTITY IN HOUSES AT CANCUEN: MATERIAL CULTURE COMPARISONS

> On all levels of social life, from the family to the state, the house is therefore an institutional creation that permits compounding forces which, everywhere else, seem only destined to mutual exclusion because of their contradictory bends. Patrilineal descent and matrilineal descent, filiation and residence, hypergamy and hypogamy, close marriage and distant marriage, heredity and election: all these notions, which usually allow anthropologists to distinguish the various known types of society, are reunited in the house, as if…this institution expressed an effort to transcend, in all spheres of collective life, theoretically incompatible principles.
>
> Claude Lévi-Strauss 1982:184 [cited in Gillespie 2000d:32]

Introduction

This chapter will investigate patterns of craft production and access to important social symbols on a site wide basis through the discussion of several horizontally excavated houses of each type from the architectural typology. In addition to the jade, pyrite, obsidian, and chert data presented in the preceding chapters, this chapter will incorporate geochemical, ceramic, groundstone, and interment evidence when possible in order to demonstrate differences in activities, status, and identities in houses throughout the site. Multiple activities took place in the houses of Cancuen, some related to subsistence activities, some to crafting, some to domestic ritual, and others combining these spheres to form an identity for the residents of the household. Certain artifacts that may have marked status and identity were more restricted to the most elite, while some markers of status and identity were more widespread and used by multiple layers of the society. These differences in activity and identity allowed a basis for power and separation of the elite class, but also the basis for contested relations of power and status from nonelite artisans.

The structures discussed here represent a small fraction of the 107 structures sampled for this dissertation. The previous chapters (5-8) included data collected from all of the sampled structures. This chapter will focus on 8 of the 37 horizontally excavated structures because artifact assemblages and number of units excavated are more directly comparable than those sampled with test pits or trenches. While these structures represent a small sample of the total structures investigated, patterns of architecture, grave treatment, and artifact distributions are not contradicted by other currently sampled structures at the site. Geochemical data has only been collected for certain structures and therefore has limited comparative use, but does highlight the multiple activities taking place within these households.

All of the structures presented here were occupied from A.D. 770-800 and abandoned around A.D. 800-810. While all of the structures were occupied during the later part of the Late Classic period, Cancuen's fluorescence under the king *Tah Chan Akh*, many have construction phases from the earlier part of the Late Classic, and at least one has evidence of occupation that dates back to the Preclassic. Ceramic analysis is not yet complete, but limited comparisons of some highly visible chronological and tradeware markers, such as Chablekal Fine Gray, as well as the broad distinction between utilitarian and fine wares, can be used to help infer construction phases and relative percentages for structure types.

Type I Structures

Type I Structures have a high investment of labor in construction, with standing masonry walls, vaults, and staircases. Some of these structures also had stucco façades or associated carved monuments and tombs (see Chapter 2). Artifacts associated with several of these structures that are located throughout the site, M9-1, N10-1, L7-9, include limestone earflare polishers for jade, barkbeaters, “doughnut stones” (see below), jade finished products from burials, jade and pyrite inlayed teeth, and often much higher amounts of groundstone and storage vessels compared with other structures (possibly used for elite feasting). While craft activity was certainly present, it may have been related to the final stages of production or scribal activity that would have required an esoteric knowledge possessed by the elite (Inomata 2001). Some of these structures were not *dwellings* in the sense of places where families lived, they are considered here as parts of households, at times possibly royal households, as structures in a household represented numerous functions (economic, domestic, ritual, political, etc.; see also Chapter 2). These structures are important for inferring what may be interpreted as “elite” material culture, and therefore presented here. Future work by Tomas Barrientos, Erin Sears, and others will help to further elucidate specific functions for these structures.

Structure M9-1 (CAN 25E)

A limestone ear flare polisher was associated with the largest structure of the group, M9-1, a six room structure with standing masonry walls and corbelled-vaults (see Figures 2.4 and 5.25; Jackson 2003, 2006). This evidence suggests not only that the elites of Cancuen were consuming jade finished products, but that the final stages of production of jade artifacts may have been carried out by elite artisans in elite residences (cf. Inomata 2001).

A barkbeater fragment (Figure 9.1) was also uncovered from beneath wall fall of the structure. Recently, Gonlin (2007) has argued that barkbeaters are often found as part of nonelite artifact assemblages as well as elite assemblages and can be representative of nonelite domestic ritual. In this specific case, it seems that barkbeaters were only recovered from Type I Structures, suggesting that at Cancuen, they were a marker of elite activity (i.e., paper making and scribal activity), and did relate to domestic ritual, but possibly that restricted to the elite. The esoteric knowledge linked to scribal activity as well as final stage jade production appears to be concentrated in "elite" structures.

One whole and two fragmentary "doughnut stones" were also recovered from this structure (see Figure 9.3). The interpretation of use and context for these artifacts has also been challenging. Some have argued that these were agricultural tools used with digging sticks to more effectively poke holes in the ground for planting seeds (Kidder, Jennings, and Shook 1946:141-142, Figure 159a), or net weights (Rovner and Lewenstein 1997:57, Figure 22g). Inomata et al. (2002) have suggested that these tools were used as grinding stones in elite structures at Aguateca, as four were found stored associated with groundstone manos in the "House of the Mirrors." Still others (see Willey 1972) have argued that these doughnut stones were banner or standard holders, marking elite lineages. Some, also called "ring-stones" have been found to be decorated with geometric patterns at sites like Seibal (Willey 1978) and Altar de Sacrificios (Willey 1972), although none of the Cancuen specimens were decorated. Their ornamentation and heavy battering lead Moholy-Nagy (2003:48) to argue that they may have been maceheads at Tikal. While the function of these stones is unclear at Cancuen, they only appear in Type I residences such as M9-1, N10-1, and the Royal Palace. Most contexts at other Maya sites include refuse and construction fill instead of caches or burials, also seen at Cancuen (e.g., Kidder, Jennings, and Shook 1946; Moholy-Nagy 2003; Willey 1972, 1978). Nevertheless, these ring or doughnut stones were found only in Type I structures at Cancuen (Chart 9.1).

A vaulted tomb was present in structure M9-1 (Jackson 2003), which indicates a very different interment pattern for Type I structures when compared to Types III, IV, V, and 0. A cyst style vaulted burial (see Welsh 1988) was present in a Type II structure (see below), and some burials in Types III, IV, and V did have limestone capstones, or were buried on top of limestone *lajas*, but vaulted tombs were restricted to Type I structures. Other burials in the structure include two children, one with a shell, bone, and jade bead necklace, although they were simple interments within structure fill, not in tombs or cysts.

The ceramic assemblages of Type I Structures also differed from that of other structures, not only as in the presence of fine wares or imported ceramics, but also what have been deemed "utilitarian" ceramics (Chart 9.3). Again in this case, the ceremonial/utilitarian distinction may not hold up, as these undecorated wares were certainly integral to ritual and feasting. The presence of Encanto Striated body sherds (12 and 18% of all Cambio body sherds in CAN 25E-33-1 and CAN 25E-36-1 respectively) is quite anomalous to the usual frequency patterns of Cambio type ceramics at the site (cf. 0.28% for midden associated with Structure M10-4). Another area where a similar pattern occurs is in refuse middens immediately outside structure N10-1. While the higher frequency of these ceramics in the most elite structures suggests ties to lowland centers where these types were popular (see Callaghan and Bill 2003), it may also represent liquid and food storage for feasting or simply subsistence of a large number of elite residents; nevertheless, these frequencies stand in contrast to those in Types II, III, IV, and V structures. This hypothesis is also supported by the high amount of groundstone present in middens and associated areas of M9-1 when compared to the amounts of groundstone in other houses (see Chart 9.1 and Figures 9.4 and 9.5), e.g., n=90 in M9-1 versus n=16 in M10-7/M10-4 and n=14 in M6-12 (Type IV structures, see below).

Another potential indicator of socio-economic status specific to the site of Cancuen is the frequency of Chablekal Fine Gray ceramics in burial, midden, cache, house-floor, and construction fill contexts of Type I – V and 0 structures. Chablekal Group Fine Gray material has been proven significant not only for its unique chemical signature and stylistic modes, which isolate its production locale to the middle Usumacinta and Greater Palenque region, but for its appearance and limited distribution in the Pasion River Region between A.D. 750 and 830 (Foias 1996; Foias and Bishop 1997; Sabloff et al. 1982).

Although an obvious long distant import, Chablekal Fine Gray does not appear to have been a highly valued elite ceramic ware at Cancuen, it has not been found in burials within Type I or II structures and is not present in great quantities within middens associated with these structure types during the later part of the late Classic for Cancuen (A.D. 770-810). Chablekal Fine Gray material in many of the “elite” structure middens only comprises 1% of all fine ware rims (Chart 9.2). In comparison to frequencies of

Chablekal in Type IV structures during the later part of the Late Classic (Tepeu 2 ceramic phase) (between 15-35% of fine ware rims in some middens; Charts 9.5 and 9.6) (see Callaghan and Bill 2003).

The consistent paucity of Chablekal in “elite” or Type I structures points to 2 possible explanations for the distribution of Chablekal at Cancuen: 1) limited distribution by access or choice and 2) differential occupation of parts of the site. Turning first to the issue of limited distribution, it is possible that Chablekal material was exchanged through market or redistribution mechanisms at Cancuen (Callaghan et al. 2003; Kovacevich 2003a). It is possible that these craftspeople (involved in the preliminary stages of prestige good production) may have had access to Chablekal material in a more open market exchange system at Cancuen during the later part of the Tepeu 2 phase. This would explain the ability of inhabitants of *every* architectural type at the site to have access to Chablekal ceramics (Hirth 1998). Furthermore, although an import, perhaps Chablekal material was not as highly valued by Cancuen elites.

On the other hand, distribution patterns could result from the redistribution of Chablekal by elites. This hypothesis may also support the assumption that Chablekal Fine Gray material was not highly valued among elites and was given away as gifts. However, because Type I and II structures consistently lack Chablekal material in excavation contexts (burial, midden, cache, house-floor, and even construction fill) there is no apparent evidence of elite storage of Chablekal for use in redistribution, making this hypothesis less plausible. However, if redistribution were present in some manner, it does not preclude the existence of simultaneous market exchange.

One final explanation for the distribution patterns of Chablekal could involve elites rapidly abandoning the site prior to the import of large quantities of Chablekal Fine Gray. Although we cannot completely determine the exact date of abandonment, it appears many households of all types performed termination type rituals sometime at the beginning of the ninth century at Cancuen (Barrientos et al. 2003; Barrientos et al. 2000; Bauer 2002; Jackson 2003; Kovacevich, Quintanilla, and Arriaza 2003; Kovacevich and Pereira 2002). This would argue again for a more or less even abandonment of the site. Finally, aside from the larger frequency of Chablekal material, Type IV middens appear to contain similar distributions of other types of utilitarian ware ceramics and even some fine wares as Type I middens. The evidence seems to suggest elites did not abandon the site before the import of large amounts of Chablekal material. It is possible that Chablekal simply may not have been as important of an import for the residents of Type I and II Structures.

Structure N10-1

Structure N10-1, located approximately 600 meters north of the royal palace, was identified as a Type I structure with masonry platform, standing walls, a post and lintel roof, and monumental stairway on the southern side. The structure was also decorated with a stucco façade with iconography very similar to that found in the royal palace, although this structure does not appear to have been vaulted (Rudy Larios, personal communication 2003; see Figure 2.2 for reconstruction example). The south side of the structure appeared to be the presentation side of the structure, with monumental stairway, doorways, and elaborate stucco façade. The north side of the structure did not appear to have doorways leading to the enclosed courtyard that N10-1 shared with the other structures in the mound group. This may suggest a more public and less domestic function for the structure. The structure may have had ritual or feasting functions. Feasting is also supported by the presence of animal bone left on the floor within the excavated room and on the stairs, the presence of large amounts of groundstone, and the presence of large storage vessels within the garbage found strewn on the southern stairway (Kovacevich, Quintanilla, and Arriaza 2003).

It is probable that this structure was related to the jade working area in grid square M10 excavated in 2001 and 2002 as the presentation side of the structure faces the workshop areas across the *bajo*. This may have been a probable point of control for production. The presence of raw and worked jade debitage within and outside the structure also supports this conclusion (Kovacevich, Quintanilla, and Arriaza 2003). Raw and worked jade debitage was also encountered strewn along the stairway, but in much fewer numbers (n=20) when compared to the workshops of the M10 group of Type IV structures (n=3,259).

No direct evidence of jade finished products or the finishing of jade products comes from this structure as it did in M9-1, but this is probably because the vaulted tomb associated with this structure was looted prior to excavation (Figure 9.7). The tomb itself was still intact, and contents were screened to find that the looter's had left nothing behind. The presence of relatively little jade debitage when compared to Type IV structures (i.e. n=20 vs. n=3,259) also suggests participation in production on a smaller scale, probably that related to the final stages (see Tables 5.4-5.8).

Turning to the surface middens present on one of the terraced landings of the monumental white block staircase on the eastern side of structure N10-1, a similar ceramic frequency pattern as that found in the surface middens outside M9-1 is revealed. Chart 9.7 shows the frequency of ceramic types for CAN 40-41-1. Utilitarian ware rim and body sherds greatly outnumber fine ware rims and bodies. As part of the fine ware assemblage, only one body sherd of Chablekal Fine Gray was recovered from all excavations.

Again, high amounts of groundstone (n=32; see also Chart 9.1) were recovered from the exterior of this structure, mostly scattered on top of the stairs in what appears to be a final termination ritual. Three trenches were excavated along the length of the main stairway of this structure, which uncovered only one-third of the entire façade and stairway. Therefore, had the entire front stairway been excavation, we could expect to see as much as 90 pieces of groundstone (nearly identical to that recovered for M9-1 which was more thoroughly excavated).

Also recovered from the stairway were large amounts of animal bone (not yet quantifiable or identified as to species), two broken barkbeaters (see Figure 9.2), ten broken greenstone axes (Figure 9.6) comparable to the seven greenstone axe fragments found associated with M9-1. Also recovered from the interior fill of the third room of Structure N10-1 was half of a ring stone (Figure 9.3). All of these material culture characteristics, high amounts of storage/ "utilitarian" vessels, groundstone, animal bone, barkbeaters, ring stones, etc. seem to differentiate Type I Structures from others at Cancuen in activities related to subsistence, ritual, and crafting.

The Royal Palace, L7-1 and L7-9

These structures are mentioned here primarily to demonstrate the presence of an "elite" material culture in the form of caches and crafting activities. Excavations beneath the Royal Throne (Structure L7-1) of Cancuen revealed the most elaborate cache yet discovered at the site (Callaghan and Barrientos 2005) and the highest status residence excavated (in this work the palace will be considered the royal household, although Tomas Barrientos will follow with more detailed interpretations of the function of specific buildings and rooms in the palace). The cache contained symbols of status and royal authority, ritual items, and exotic items. These artifacts defined and reinforced the identity of the royal members of the Cancuen court. One of the offerings was a 5.22 kg (11.5 lb.) string sawn nodule of light green jade with several thin plaque blanks already sawn off and one beginning the sawing process (see Figure 5.34). This was a certain indicator that the raw materials and all stages of its production were sacred, and controlled by the elites.

Also recovered was a headdress ornament (see Figures 5.21 and 5.22), surely a royal insignia similar to those described by Duran (1994 [1588]:208-210) for the Aztecs as a "royal diadem" (gold in that case). These diadems may have been similar to the "jester god" diadems frequently depicted in portraits of rulers during the Classic Period (Schele and M. E. Miller 1986) and found in alabaster at Aguateca (Eberl and Inomata 2001; Inomata 2003). It is also interesting to note that the god (probably God K) depicted on the palace diadem is wearing the same style headdress as those ornaments found in Burial 50 (see Figures 5.30 and 5.31) representing corn cobs (Karl Taube, personal communication 2003, 2006), all certainly symbols of royalty, fertility, and power.

A small jade face probably was also a symbol of royalty (see Figures 5.35 and 5.36), similar to that described by Freidel (Schele and Freidel 1990) for Cerros, and only found in elite or ceremonial deposits at Cancuen.

The large earflare with a bead (see Figure 5.29; possibly a "hairflare" or an item meant to wear in the hair), was probably an actual ritual tool itself, symbolic of the power of the possessor to conjure gods and ancestors (see Chapter 5; Taube 2005).

A counterpart of this ritual tool was the complete prismatic obsidian blade interred with the cache, certainly used as a bloodletting tool, probably in a conjuring ritual (Schele and Freidel 1990).

While bloodletters were a male, phallic symbol (Freidel et al. 1993), the two exotic *Spondylus* shells included in the cache were the female counterpart (Ardren 2002; Josserand 2002; Joyce 1996; Looper 2002). Both male and female properties were important symbols of Classic Maya royal and ritual authority, as the original creators were "mother-fathers" (D. Tedlock 1985). Similarly, the maize god was often shown with both male and female characteristics, as well as rulers themselves, for example, 18-Rabbit of Copan (Gustafson and Trevelyan 2002). No other *Spondylus* shells were found in Types III, IV, V, or 0 structures.

The whole cache was covered in cinnabar, its red color symbolic of blood, the most valued and life-giving force for the ancient Maya. Cinnabar could also convert to mercury, similar to a watery, mirror-like entrance to the underworld, as well as the life-sustaining properties of water.

Structure L7-9, also called the "House of the Portraits" because of its stucco representations of the royal line of Cancuen (Barrientos et al. 2003) was primarily an entrance for visitors and foreign dignitaries. Not many artifacts were recovered on floors or staircases, but within the construction fill, another sandstone earflare polisher was also recovered from the fill beneath the floor (see Figure 5.24; Barrientos, Larios, and Luin 2003:53; Kovacevich et al. 2004), indicating participation in the final stages of jade production for residents within the palace. Jade artifacts and jade production were clearly part of the identity of the elite of the site and a basis for status and power, but as we will see, it was not completely restricted to the elite.

Summary

Type I structures in general represent those with highest investment of labor in construction, often with the presence of vaulted tombs and/or stucco façades, carved jade, earflares, ringstones, and barkbeaters. The material culture of these structures separated them from the rest. The residents of these structures had access to a large labor pool, commanded and controlled certain types of craft production and demanded tribute. They were also engaged in crafting activities, often associated with the symbols of elite status and ritual paraphernalia that reinforced their power.

Type II Structures

While Type II structures had less investment in construction than Type I structures, they were still composed of masonry platforms, often with finely cut stones, also sometimes including staircases and benches. Many of the hallmarks of elite status and culture were found in these residences, including carved panels, carved jade plaques, jade earflares, and elaborate grave treatment. Again, the frequencies of Chablekal Fine Gray ceramics were not high.

Structure K7-3

This structure was constructed with a large investment of labor—including masonry base, low level masonry walls, a staircase, and a bench. A cyst style burial was discovered beneath the floor of Structure K7-3 (Sears 2002), the cyst was about 50 cm wide with an earthen floor and a small vault of undressed flat limestones that were capped with larger limestones with hieroglyphic Panel 2 located on top of the cyst. Panel 2 depicts the Cancuen Ruler handing over power to his son *Taj Chan Ahk* and certainly points to the elite (if not royal) status of the Structure K7-3 (Sears 2002). This burial (Burial 50) contained two large jade beads, one of imperial green color, two light green jade ear flares with jade counterweights, and two intricately incised headdress ornaments carved out of light green jade with a vein of imperial green, 1.89 mm thick (see Figures 5.30 and 5.31; Sears 2002).

Refuse associated with the structure was scarce. Certain elite structures seem to have had different refuse disposal patterns or were in the process of reconstruction at the time of abandonment. Residents of Types III, IV, V, and 0 Structures often threw their garbage directly behind their houses or to the sides of activity areas where it was easy to discover. This structure and others also provide a contrast to structures like M9-1 and N10-1 where it seems that large scale termination rituals were performed that involved the breakage and surface deposition of their artifact assemblages.

As discussed in Chapter 8, a chert workshop dump located beside a low wall near this structure may be the result of craft production in K7 mound group. The numerous (n=161) Triangular Broken Flake tools were probably used for drilling of some kind, possibly bone or shell, although no debitage evidence for any craft activities were found in these structures.

Structure M9-15/M9-16

Structure M9-15 is located in the same group as M9-1 and situated above one of the northern ports, just north of the palace (see Figure 2.1). The structure is composed of a masonry platform with low standing walls, staircase, and possible perishable superstructure. Structure M9-15 was extensively excavated in the 2001 and 2002 field seasons by Sarah Jackson (2002, 2003) who suggests that M9-15 was a residential structure occupied by non-royal or royal elites.

The ceramic frequencies from a sealed midden-fill layer, CAN 25A-81-6, discovered in the center of the building are visible in Chart 9.7. A small quantity of Chablekal Fine Gray material is present (7% of fine ware total sherds, but no rim sherds).

The elite status for these residents is also supported by the burial goods found in Structure M9-16, a masonry platform with perishable superstructure, which contained a burial with four jade inlayed teeth, a light green jade ear flare with a bone counterweight, and a light green bead (Figure 9.8). In the same mound group, another dark green jade ear flare was associated with a midden context of structures M9-17 and M9-18.

Summary

The material culture present in these structures again supports an elite status for the residents. Evidence of crafting may be indirectly present in some of these structures, as is the case for the special lithic deposit by the wall near Structure K7-3. The small triangular tools may have been used as drills in some crafting activity, although direct evidence of crafting in any Type II structures is lacking at this point. Burial 50 may have been a royal person (possibly *Tah Chan Akh* himself), marked by the elaborate headdress ornaments, representing maize, life, and therefore power. While architectural styles may be different between Types I and II structures, it cannot be said that the structure types represented a royal elite/non-royal elite distinction. Most of the statistical analyses performed in previous chapters had more strength when these two structure types were grouped together. The evidence does support a privileged and elite status for residents of Types I and II structures.

Type III Structures

These structures represent a dramatic shift in construction technique from Types I and II structures. Many of these are low mounds, but some have a good deal of earthen fill with a stone retaining wall (see Figures 2.8 and 2.9). Many of these structures were associated with crafting or production of some sort. The following are examples of pyrite production and food production. Some of these structures did have elaborate figurines present in their burials (all simple interments), a feature not present in Types I and II structures. Hallmarks of elite culture were not present, such as carved jade plaques, earflares, hieroglyphic inscriptions, etc.

Structure K6-34

This structure was less than a meter high, with a very low, square, retaining wall surrounding the earthen platform (Figures 2.8 and 2.9). It seems to have been of a single construction phase pertaining to the late Tepeu 2 phase because of the presence of Chablekal Fine Gray sherds (Barrientos et al. 2000). Evidence of pyrite mirror production in Type III structures at Cancuen includes raw pyrite nodules, half-finished mosaic pieces, broken mosaic pieces, finished mosaic pieces, and stone and ceramic mirror backs (see Figures 6.1, 6.2, 6.7, 6.8, and 6.9). At many other Maya sites mirrors have generally been associated with elite/ritual structures or tombs (e.g., Boggs 1982; Coe 1988; Flannery 1983; Kidder, Jennings, and Shook 1946; Mata 2003; Triadan 2000; Zamora 2002; see also Chapter 6), while at Cancuen to date the items involved in mirror production (i.e. nodules and half-finished pieces) have only been associated with Type III and IV structures (see Chart 9.1), and not in burial contexts. K6-34 has the most evidence of mirror production of all structures at Cancuen, including two mirror backs (one fragmentary), four raw nodules, five unfinished mosaics, twelve finished mosaics, sixteen broken mosaics, and a string saw anchor. Barrientos (Barrientos et al. 2000:126) also notes that some of the *lajas* or flat limestones associated with the floor of the structure showed signs of battering, possibly from percussion or polishing of artifacts, further support for craft production in the structure.

The structure also has evidence of pigment grinding in the form of an Elongate Uniface chert tool, with a highly polished reddish tint on the non-flaked side, which had also been burned, possibly in a termination ritual. A burned chert eccentric was also recovered. Thirty one figurine fragments were associated with the structure, and one whole warrior figurine with interchangeable mask (possibly representing God N) and helmet (CANF 472) was recovered (Sears 2000). One ceramic earflare was also found (Sears 2000:267), indicative of status, but made of a common material, probably because of ritual proscriptions against the wearing of jade earflares by the residents of these structures. Jade beads were present (n=5), mostly associated with floor and wall fall contexts. The beads themselves were not of very high quality in initial appearance. Three had a hardness of 6.5 and two a hardness of 5 (see Chapter 7 for hardness tests), suggesting that they may not have been pure jadeite or of the higher quality and size of pieces in Structure K7-3. One of the beads was a light white/green color, probably composed primarily of albite, as it tends to be more whitish, two were grayish green, one grass green, and the fifth light bluish.

Structure L6-1

Structure L6-1 is located just south of the royal palace at Cancuen and was constructed of a large earthen platform with retaining wall on the north side of the structure (Figure 2.8a). Group L6 was excavated by Lucia Moran in the 1999, 2000, and 2002 field seasons. In her excavations, Moran identified what she believed to be two occupation phases of Structure L6-1 (Moran 2003).

L6-1 seems to demonstrate specialization of another type. Moran found that the second occupation of L6-1 contained a very high percentage of utilitarian to fine ware ceramics especially associated with a large fire pit in the center of the structure. The structure may have served as a kitchen, possibly producing food for palace inhabitants. Interestingly, in contrast to Type I structures, groundstone tools were not present in large numbers (n=3), possibly suggesting that certain structures may have specialized in certain parts of the food production process as well.

Burials associated with both of these Type III (K6-34 and L6-1) structures were simple interments, but one did contain finely crafted figurines, and these structures may have been involved in figurine production. The figurines from Burial 7 included a warrior with a removable jaguar headdress, a shaman with a removable hat and jaguar tail, a male individual with a deer headdress, a ballplayer, and a warrior with a square shield and a weapon in his hand, the figurine itself was also a flute (Sears 2000). Also included with the burial were three ceramic vessels. These are very elaborate grave goods, but again jade was not a common grave good in Type III structures. Interestingly, the individual interred seems to have been a child 5-8 years old (based on dental development) of undetermined sex (Berryman et al. 2003).

Moran's second occupation, represented here by frequencies from CAN 7-28-5, is continuous with what she identified as an exterior fire-pit in units CAN 7-18, CAN 7-23, and CAN 7-24 (ibid). Moran notes that this lot contains a greater percentage of utilitarian to fine ware ceramics. She believes that sometime in the early Tepeu 2 period the previous inhabitants moved out of the structure and the building became a kitchen, possibly producing food for the palace. Ceramic frequencies point to a slight change in chronology. While Saxche-Palmar group forms become slightly more biased against plate forms and no fine paste ceramics are present, cream ware and black ware frequencies drop drastically from the previous phase and Moran believes this suggests that the people who worked or lived in L6-1 during this time were of a lower socio-economic status, possibly servants or cooks (ibid). Evidence suggests that the structure was occupied in the early Tepeu 2 period and that the structure function changed and became a food preparation area around A.D. 770, the period of elite fluorescence at Cancuen (Charts 9.8 and 9.9; Moran 2003). This structure itself may not have functioned as a residence during the later phase, but it was part of a housemound group, seemingly a household in the L6 grid square, and these activities were part of that household.

Summary

While burials in some Type III structures contained some of the most elaborate figurines recovered at the site, there were no vaulted or cyst style tombs in these structures. These structures where often differentiated from Types I and II structures in statistical analyses (especially that of bead size, as well as mean blade width and chert flake size). Jades were limited to poorly formed beads of impure jadeite, and in one case (Stucture K6-12) a burial with jade inlayed teeth. No carved jade plaques or earflares were included in burials. Chablekal Fine Gray did appear in some burials in these structures (e.g., Burial 6; Barrientos et al. 2000). Crafting and food production were some of the activities that took place in these structures. Domestic ritual was also performed, signaled by the presence of Elongate Unifaces (probably used in pigment grinding) and chert Eccentrics. Crafting and domestic ritual were part of the social identity of the inhabitants of these structures. Their imported and elaborate grave goods attest to a heightened status, yet still lacking some of the most elite material culture markers.

Type IV Structures

The Type IV patios provide a special opportunity to analyze ancient activity and craft production at the site of Cancuen. These patio floors contain at times *de facto* refuse that appears to have been left during the abandonment of the site or termination ritual deposits, as well as high density middens directly adjacent to the floors containing lithic production refuse mixed with domestic refuse. These communal activity areas have provided excellent studies of craft production at Cancuen as the refuse is either directly on or adjacent to the production area, a feature not common at many other lowland Maya sites (e.g., Moholy-Nagy 1990, 1997).

Structures M10-7 and M10-4

Excavations in map Grid Square M10 have revealed the largest scale evidence of jade production found at Cancuen (see Figure 2.1). The buildings in this group include Types III, IV, and V structures, but production evidence comes primarily from the Type IV structures, M10-7 and M10-4 (see Figure 2.10 and 2.11; Kovacevich 2003b; Kovacevich et al. 2002).

Jade

Excavation of units in these structures produced a total of 3,259 pieces of greenstone debitage with a weight of over 170 pounds. Thirty-two of these pieces, most of them with evidence of string-sawing, including a twenty pound boulder, were left on the patio floor of structure M10-4. Also recovered embedded in the patio floor of structure M10-4 were large quantities of jade and quartzite microdebitage (used as an abrasive), which as primary refuse is an important indicator of lithic workshop production (Moholy-Nagy 1990). Tools directly associated with jade working on the floors and middens include slate and greenstone polishing tools (West 1963), chert, greenstone, and quartzite hammerstones, chert and chalcedony drills, and string-saw anchors. Also recovered were five spindle whorls, which could have been used in the production of textiles, but also may have been used as flywheels for pump drills for drilling jade (Figure 5.19; Digby 1964).

Although only the early stages of jade production (i.e. percussion, sawing, and drilling) appear to have been carried out in these residences, the jadeworkers controlled all of the means of production of those artifacts. They also incorporated symbols of their part in their creation process as caches in construction fill of both Structures M10-7 and M10-3. Raw or string-sawn nodules were placed in the construction fill of the late Tepeu 2 (A.D. 770-800) phase construction of both structures, also corresponding to the fluorescence of Cancuen and the intensification of craft production. The working of jade was clearly linked to the identity of the residents of these structures through caching (Hendon 2001), although finished jade artifacts were not. The working of jade in the early stages was not seen as "grunt work" as it may seem to our Western sensibilities, it was valued and commemorated.

Wills (1964) notes that ethnographic studies of Chinese jade working techniques, especially sawing required the participation of three people, two to saw and one to collect and redeposit the wet sand used as an abrasive cutting agent. While string saws were probably wielded by a single person (Lothrop 1955; Figure 5.16), the application of an abrasive by another person would have reduced the time required for the sawing procedure dramatically. While the application of the abrasive would not have required a great deal of skill, the sawers may have switched off as it would have been a very tedious process. Drilling of beads or other objects, especially if they were small would have been facilitated by the participation of another person, but this cannot be substantiated. Larger beads or objects may have been secured with the feet as were obsidian polyhedral cores (see Clark 1989c). While there is no direct evidence that women and children participated in jade production, the activities were not carried out in separate facilities, jade was produced in the domestic sphere alongside the family and domestic work. The only mention of women and children involved in jade production that I could encounter came from the Maori (Chenault 1986:49; Wills 1964).

'Traditional' women's work, in the form of manos and metates for subsistence production, and spindle whorls for textile production (although cf. above), was represented in this house group. Lithic production and technology has largely been attributed to men throughout the history of archaeology, and contested by feminist archaeologists (Gero 1991; Nelson 1997:91). There is ethnographic evidence that women were makers and users of tools in Australia (Bird 1993). In Mesoamerica, male knapping and stone production is supported by ethnographic and ethnohistoric evidence from Mesoamerica (e.g., Clark 1989a, 1991; Clark and Houston 1998; see also ethnohistoric sources in Chapters 4 and 5). There is no direct proof that women or children produced jade artifacts, *but* when compared to activities such as obsidian or chert knapping, jade production is a highly involved, intensive, and time consuming process that may have incorporated multiple family members (see also Mills 2001 and Wright 1998 for additional examples of "hidden" labor of women).

Ceramics and Figurines

Chablekal Fine Gray made up 15-35% of fine wares in these structures (Charts 9.5 and 9.6). Cream-slip material is also well represented (comprising 13% and 17% of fine ware rims in CAN 24-58-5 and CAN 24-132-6 respectively), possible indicating political, trade, or kin relations to northern highland sites where cream slip material is more common (see Dillon 1979 and Smith 1952).

Other artifacts associated with these patio floors indicate that additional craft activities were carried out as well. These artifacts include a figurine face mold (Sears 2003), probably indicating production of figurines. The amount of figurine fragments recovered from middens in the group was high (n=109, 5 identifiable females according to Sears 2001 and 2002), however, these numbers are not among the highest at Cancuen, and no figurines were present in the burials of M10.

Chert and Obsidian

Obsidian prismatic blade production and chert tool production are also present in this area. Two exhausted polyhedral cores attest to the presence of core blade technology, but not at a level of production above domestic use. The chert tool assemblage was quite large, and included 61 chert blades, many possibly used for drilling jade, an amount higher than any other household chert assemblage at the site. Sixty chert hammerstones were also present, also probably related to production. Chert microdebitage was also embedded in the patio floor pointing to biface and chert tool production.

Evidence of subsistence activities is also present in the form of strainers (n=4 fragments) and large manos and metates probably used for maize processing (n=16).

Paleoecological data from the adjacent *bajo* are still pending and will be used to infer the degree of participation in food production. However, the presence of these artifacts already suggests that the residents of this mound group were not fully removed from the production or at least processing of food.

Geochemical Data

Geochemical analysis of soil from the house and patio floors has provided additional insights into past human activities at the site. Inductively coupled plasma mass-spectrometry (ICP-MS), performed by Duncan Cook of the Smithsonian Center for Materials Research and Education has identified elevated levels of heavy metals and rare-earth elements (RRE) many times greater than in the natural soil. The concept that chemical signatures of ancient activity may be preserved in sediments over long time-scales has been well established using a variety of analytical techniques (Barba and Ortiz 1992; Cook et al. 2006; Parnell et al. 2002; Terry et al. 2000; see also Kovacevich, Cook, and Beach 2004).

Several ancient activities may be credited with elevating heavy metal concentrations in soils. For example, high iron (Fe) concentrations may be found in areas of agave processing or animal butchering (Manzanilla 1996). Mercury, in the form of cinnabar, is commonly used as dye/paint in decoration and craft (Parnell et al. 2002), while both cinnabar and pure liquid mercury are commonly recovered from ceremonial contexts throughout the Maya world (e.g., Pendergast 1982).

Although the anthropogenic source of REE chemical input into the environment is essentially unknown, elevated levels are increasingly being reported at ancient occupation sites worldwide (e.g., Entwistle et al. 1998:64-65; Entwistle et al. 2000:300).

One potential source of REE chemical input at occupation sites may be human detritus, particularly teeth, bone and nails fragments, which concentrate REEs in trace concentrations. As such, records of REE enrichment are a powerful tool in the identification of past human occupation.

The entire floor of structure M10-7 is enriched in at least several of the REEs, while the central and southeastern portion of the patio has elevated concentrations in over 13 of the 16 REEs. The REE enrichment of M10-4 is concentrated in the southeastern corner of the floor (up to 15 elements), with lesser enrichment in the extreme northeastern corner and northern extent of the stone patio (Figure 9.9). This may be explained by a former concentration of human activity in this portion of the area.

Mercury (Hg) enrichment at M10-7 is concentrated towards the south-eastern corner of the patio floor with values up to 10 times above the established background, while values between 5 and 8 times above the background were detected in the north of the area (9.10). Extremely high levels of mercury were detected in structure M10-4, up to 40 times above the background. This mercury 'hot-spot' is concentrated in the northeastern corner of the excavation, while lower mercury enrichment is found across the entire area. The major source of this mercury is Cinnabar (HgS), which has a well-documented role in both jade production/decoration, and in Maya offerings and burials (particularly of the elite) due to its blood red color (Pendergast 1982: 533). The mercury 'hot-spot' in the northeastern corner is immediately south of a Burial 47, which contained two ceramic offerings and may have also contained cinnabar. As mercury was present in non-burial contexts on both floors (Structures M10-7 and M10-4), broader-scale mercury enrichment is best explained by craft production incorporating cinnabar. Parnell et al.

(2002) suggested high mercury concentrations in floors at Cerén may have been related to the use of cinnabar as a paint or dye.

The most surprising finding of this research has been the detection of elevated concentrations of gold of up to 150 times above the natural background (Figure 9.11). The site of Cancuen was abandoned AD 830-900, with no subsequent human occupation until the 20th century. Maya archaeological scholarship purports that the Maya did not use gold. This is despite the discovery of a gold-based object in an Early Classic context at Altun Ha, Belize (Pendergast 1970:117).

The source of the gold enrichment of these soils therefore cannot be easily explained by conventional anthropogenic sources. One prospect may be that a particular kind of jade, 'Galactic Gold', which contains mineralogical inclusions with over 10% gold, was worked here. However, no debitage of ‘Galactic Gold’ jade has been identified to date. The most plausible explanation is that jade production often utilizes sand material of fluvial origin. Such sands commonly have elevated heavy metal concentrations (including gold), having their origin in rich ore deposits upstream. Techniques incorporating fluvial sand as an abrasive would significantly enhance floor areas in heavy metals. Further work into the potential source of the gold enrichment is needed though before any clear links can be established.

Structure M6-12

Structure M6-12, also a Type IV structure with a *laja* stone patio very similar to the jade workshop, is located approximately 200 meters south of the royal palace (Figures 2.12 and 5.37). While this and other structures at Cancuen have some evidence of jade production, none of them have the amount of debitage recovered from M10-7 and M10-4 (see Chart 9.1).

Artifacts

Excavation of 36 units by Michael Callaghan and Mirza Monterroso (Kovacevich, Callaghan, Ohnstad, and Monterroso 2003) over the patio floor and adjacent midden recovered 14 pieces of greenstone or jade including 4 beads, and 2 pieces that had been modified or cut. Six nodules of raw pyrite and 10 pieces of broken or half finished pyrite mosaic pieces were recovered, artifacts not present in the jade workshops of M10. Broken and pulverized quartzite was again present, possibly used in the jade and pyrite mirror production. Also exposed were 16 pigment balls within the midden, one chemically identified as cinnabar (Figure 9.12; Duncan Cook, personal communication 2003), as well as a groundstone mortar possibly for pigment grinding and what appears to be a small pigment bottle (Figures 9.13 and 9.14). Two elaborate *incensario* handles from the midden also point to domestic ritual, and also may have been some of the objects being painted. These artifacts suggest, at least a small scale craft and ritual activity with a focus on elite goods such as jade, pyrite mirrors, and elaborate incensarios.

Other artifacts include 14 pieces of groundstone and 4 greenstone axes. No spindle whorls were recovered. As in group M10, obsidian and chert working was carried out, as evidenced by one exhausted polyhedral core, as well as a chert assemblage that included microdebitage, chert blades, and bifaces.

Geochemical Data

ICP-MS analysis of soils from the floor of M6-12 suggests the area was dominated by different activities to those performed in sites M10-7 and M10-4. Very high levels of mercury were recorded across the entire patio area (Figure 9.15), with a distinct area of extremely high mercury recorded in the north-eastern corner. The south-eastern corner of the house-floor recorded the highest mercury concentration in M6-12 (13 times above background levels), while the remainder of the floor is without elevated mercury, this is consistent with the recovery of the 16 pigment balls of cinnabar from middens.

There was also one area in the northeast corner of the floor with a high concentration of iron (5 times higher than normal; see Figure 6.4), which could represent an area of pyrite mirror production (see also Inomata et al. 2002 for a similar interpretation). Unfortunately, sulfur cannot be detected in the geochemical studies to determine if pyrite was actually being worked or another high iron content material. The lack of sulfur also does not preclude an activity that produces large amounts of blood, such as animal butchering (Manzanilla 1996). However, the presence of nine pyrite mosaics and six raw pyrite nodules supports the interpretation that these residents were producing pyrite mirrors mosaics. The concentration of iron could also be due to craft production with hematite, often used as a red pigment.

In contrast to the jade-production areas, no elevated REE concentrations were detected in any samples from M6-12. Given that elevated REE concentrations in archaeological contexts are best explained by human-related inputs into the environment, this may suggest that M6-12 may have been less intensely occupied, or less utilized for production. Support for later explanation comes from the lower yield of debitage from the excavation.

Elevated gold concentrations are rare in M6-12, with none being recorded on the *laja* patio floor. Two samples contained elevated levels of gold, the greatest being nearly 30 times above the background level (see Figure 6.4). This sample located in the southern edge of the house-floor also recorded the greatest mercury concentration for the area. The lack of REE enrichment, and the broad mercury enrichment across the site paints a different picture of past human activity from that of the jade-workshops. The data suggests production involving cinnabar dominated the area (particularly the patio) rather than intense human occupation, while a presently unidentified activity left a concentrated imprint of heavy metal contamination in the rear of the house-floor area.

Ceramics

Chart 9.10 display ceramic frequencies from lots directly above the patio on the north side of the structure (lots CAN 14B-9-1 and CAN 14B-12-1). Chablekal Fine Gray material comprises 21% and 22% of fine ware rims in CAN 14B-9-1 and CAN 14B-12-1 respectively. Interestingly enough, cream ware sherds appear in relatively low frequencies in M6-12 in comparison to Group M10. These frequencies date occupation to the late Tepeu 2 phase.

Summary

Type IV structures all functioned to a great degree as activity areas for multiple types of material production, including utilitarian and prestige materials (Kovacevich, Cook and Beach 2004). Furthermore, these structures all seem to have been constructed, or at least heavily occupied, during the late Tepeu 2 period (A.D. 770-810). Ceramics from middens similarly suggest domestic activity, as the majority was mainly utilitarian in form, but also included high amounts of imported Chablekal Fine Gray. This import from the Palenque region was also present in (n=2) burials associated with Type IV structures along with highland creamwares (Figure 9.21). These structures contained the highest amount of Chablekal fine gray in the entire site, in middens and burials (15-35%; see also Chart 9.6 presenting totals for Structure K7-24, another Type IV structure). Interestingly jade was not prominently used as a grave good within these structures, although it did appear in one female burial (Burial 25) as three dental inlays (Berryman et al. 2003). All burials in these structures throughout the site were simple interments, one was associated with *laja* capstones. Again, domestic ritual activities seem to have been present as incensarios, figurines, pigment production, and chert Eccentrics all point to domestic ritual.

Geochemical and artifactual data from Structure M6-12 also suggest multiple activities. Some jade working and small bead production is present here as well, and use of pigments is again seen in midden and floor contexts, possibly related to painting of insensarios or figurines. In addition, the recovery of raw pyrite and mosaic fragments suggest mirror production at structure M6-12. Significantly, raw pyrite nodules have only been encountered in Type III or IV structures in Cancuen.

While construction type differed in Types III and IV structures, often material culture assemblages and grave treatment were quite similar. Statistical analyses often grouped these types together, especially in bead size and obsidian blade width. It does not seem that these two structure types formed distinct social groups or strata, but social identities may have been different based on the different types of crafts produced (i.e., jade vs. pyrite; see Chart 9.11) or food production. The differences between these structures may be further elucidated by future osteological and ceramic analyses. These analyses may demonstrate that these structure types represented different ethnicities or possibly migrants from other centers. For now, it does seem that the social identities of these groups were to a large extent characterized by the crafting activities and domestic rituals that were carried out within them. The resources of crafting may have been mobilized to enhance the status of these residents and provide them with a tool to contest the elite monopoly on certain types of ritual and symbols of status.

Type V Structures

Type V structures represent those with the lowest investment of labor in construction. Earthen fill was often used to create a mounded base, but no stones were used in construction. Many of the sampled mounds were not sufficiently excavated to determine if they were indeed Type V structures, and those mounds were classified as Type 0. No large scale crafting activities of jade and pyrite were discovered in these mound types, although chert and obsidian tool production was present in most structures. None were associated with large scale food production activities, and figurines, jade, or shell were not found in any burials in these structures.

Structure M6-17

Structure M6-17 is located southeast of the palace epicenter (see Figures 2.1 and 5.37). It is situated in the modern day Cancuen field camp and atop the escarpment above the Pasión River. The structure is composed of a simple low earthen mound with seemingly no signs of architecture, but a thin eroded stucco and pebble floor (see Figure

2.13; Kovacevich, Callaghan, Ohnstad, and Monterroso 2003). A high-density midden was found on the west side of the mound. A burial was found below the mound floor with two funerary vessels. One vessel was a small bottle with restricted neck and orange slipped exterior made on an orange carbonate-tempered paste. The other vessel was a Saxche-Palmar round-sided bowl with slightly outcurving rim. This bowl form is indicative of pieces made late in the occupation of Cancuen (Callaghan et al. 2003). The individual (probably female) also had a single drilled tooth (Berryman et al. 2003), but the inlay had either been lost or removed, so it is impossible to say what type of stone it once was.

The midden was excavated in arbitrary levels of 20 cm. At the bottom of the midden a handful of Late Preclassic or Early Classic sherds of Sierra Red type were discovered. Although it is difficult to determine if occupation of the structure was continuous, what can be determined is that there is a definite Late Classic Period occupation atop a Late Preclassic or Early Classic occupation. The early occupation of structure M6-17 was probably contiguous with that of other structures in the same area (Kovacevich, Callaghan, Ohnstad, and Monterroso 2003). It was on this river escarpment that the only evidence for an occupation earlier than the Late Classic Period was discovered at Cancuen.

The Late Preclassic and possibly Early Classic material was discovered in lots CAN 14A-26-5 and CAN 14A-26-6. The possible Preclassic material consists of 2 Sierra Red rims and 9 body sherds (Callaghan et al. 2003). The possible Early Classic material consists of one rim similar in form, paste, and surface treatment to 2 cache vessels found beneath Stela 2 by John Tomasic and Claudia Quintanilla in their 2003 excavations at Tres Islas, a nearby Early Classic site (Tomasic and Quintanilla 2004).

Obsidian artifacts were composed mainly of prismatic blade fragments (n=48 initial and final series), no exhausted cores were recovered from this structure, but two rejuvenation flakes were present. Cores were found nearby during camp construction, so it is possible that these residents produced prismatic blades. The chert assemblage did not contain a large amount of specialized tools, a flake blade core and a crested chert blade were among the artifacts, compared to the 61 blades of M10-7/M10-4. Other tools included laurel leaf biface and celt fragments (Ovate Bifaces, thin and thick), a domed Uniface, and four Triangular Broken Flake tools.

Structure M6-17 probably functioned as a nonelite residence. From the potentially earliest lots through the latest, there is a steady decrease in the percentage of Saxche-Palmar fine wares. There is a noticeable lack of cream-slipped ceramics in every lot. Fine paste ceramics are similarly underrepresented in later lots. Perhaps it can be said that inhabitants of M6-17 lacked consistent access to fine paste ceramics and cream-slipped ware, while they had access to local fine wares such as Polished Black wares and orange bowls with black rims (Callaghan et al. 2003). Lack of these materials could indicate an inability of the inhabitants of M6-17 to access trade wares because of socio-economic status. Furthermore, these two types of ceramic material have been found in greater frequencies in Type IV structures. As mentioned earlier, perhaps these types of ceramics were more heavily associated with workshop artisans involved in the preliminary stages of luxury goods production, possibly supporting a slightly higher degree of socio-economic status to inhabitants of Type IV structures than those of Type V structures. More will certainly be gained by further ceramic analysis.

Structure J6-3

This was a small mound with a midden located behind it, 13 excavation units exposed a whitish stucco floor that was at the time interpreted by Higginbotham to be a natural stratigraphic layer (Barrientos et al. 2000:120). Unfortunately, the floor was not broken in order to reach any burials or determine if it was indeed a floor, but the number of associated artifacts above the layer suggest that if the whitish layer was natural, this was a midden area for a nearby low mound without visible stone architecture from the surface. Eighty-seven figurine fragments were found associated with this mound (Sears 2000). Chert artifacts included five fragments of thin ovate bifaces, and three fragments of thick ovate biface, or celts, and three chert blades, no decortication flakes were present, but hard-hammer and soft-hammer percussion flakes were found, as well as 167 obsidian flakes and blade fragments.

Summary

Types V and 0 structures did not contain any evidence of large scale production of prestige goods thus far. Grave goods, usually in the form of ceramic vessels were present. One burial did have a drilled tooth, although no inlay was recovered. One chert Eccentric was recovered from a Type 0 structure, again pointing to domestic ritual. In some statistical tests, Types V and 0 can be differentiated from Types III and IV, although in others they cannot. Whether these structures represent a lower socioeconomic status than residents of Type III and IV structures, who many times participated in crafting activities, is not clear. In other words, whether or not there was a distinct “middle class” of artisans at Cancuen has not been completely demonstrated, but distinctions between Types I and II vs. III, IV, V, and 0 are significant in nearly all tests, supported by differences in architectural investment, grave treatment, and preliminary ceramic evidence. Future ceramic and osteological analysis will certainly shed more light on this patterning.

Conclusions

The material culture from these households helps to demonstrate that activities within and between households at Cancuen were far from homogeneous. Even within structure types differences in activities were present, although some broad patterns are apparent. The Type IV patios provide a special opportunity to analyze ancient activity and craft production at the site of Cancuen. While production activities are generally similar in M10-7/M10-4 to M6-12, differences in artifact assemblage suggest different foci (Chart 9.11). For structures M10-7/M10-4 the most apparent of these activities is production of jade objects with a focus on the early stages of production, such as percussion, sawing, and drilling. Finished products of jade were almost completely absent, suggesting production not for domestic use. Other craft activities seem to be present as well, suggested by the presence of the figurine mold and the high concentrations of mercury, probably cinnabar used as a pigment, within the floor. Production of chert may have been focused on production of special purpose tools for jade working, as well as for domestic use. The presence of manos, metates, and strainers suggests that they were at least processing their own food. Future paleoecological tests may help us to determine if they were removed from food production, but it seems highly unlikely.

Geochemical and artifactual data from Structure M6-12 also suggest multiple activities. Some jade working and small bead production is present here as well, and use of pigments is again seen in midden and floor contexts, possibly related to painting of incensarios or figurines. In addition, the recovery of raw pyrite and mosaic fragments suggest mirror production at Structure M6-12. Significantly, raw pyrite nodules have only been encountered in Type III or IV structures in Cancuen, but the finished products do not appear to have been used domestically; pyrite mirrors recovered in other sites are primarily found in elite or ceremonial contexts (Carlson 1981; Coe 1988; Kidder, Jennings, and Shook 1946; Mata 2003; Flannery 1976; and also Chapter 6).

The production evidence from these two structures suggests that prestige goods such as jade and pyrite were being produced on these floors, but may not have been for use within the structures. Nonelite specialists may have been involved with only the early stages of production of jade and pyrite artifacts, such as percussion, sawing and drilling, while the more intricate final stages such as incising may have been carried out by elites who may have been able to alienate the producer from the product through a monopoly on ritual and esoteric knowledge or sumptuary laws (Barber 1994; Childs 1998; Costin 1998; Inomata 2001; Reents-Budet 1998). This interpretation is also supported by the presence of earflare polishers, jade finished products, and barkbeaters associated throughout the site with Type I and II structures, and clear differences exist between artifact assemblages of Type I, II, III, and IV structures (Chart 9.1). In short, differences in activities and artifact assemblages do correlate to different structure types, possibly indicative of social status, social identity, and/or ethnic affiliation (the last factor is not clear at this point and may be determined by future studies).

Despite elite control of jade production, the specialization does not appear to be full-time, and the residents in these structures were involved in numerous activities including figurine production, obsidian blade production, chert tool production, use of pigments, and subsistence activities. Evidence from Aguateca suggests that elite or even royal producers of prestige goods were often involved in independent as well as attached specialization on a small scale (Inomata 2001), yet evidence from Cancuen differs in context and scale. At Cancuen there are clear differences in architecture and artifact assemblage between Type IV and Type I structures suggesting nonelite or at least lesser elite production of prestige goods on a large scale in some cases. Elites seem to have mobilized authoritative resources to conscript nonelite labor in the form of construction and craft production. These allocative labor and production resources may have provided a greater economic basis for power for the elite of Cancuen, while at the same time allowing these producers some measure of independence to produce items for domestic use or exchange and to negotiate their status in the social hierarchy. Crafting helped to define the social identities of many of the residents of Types III and IV structures, as seen in the incorporation of raw and worked nodules of jade in caches and the incorporation of figurines in burials, but it also defined the identities of Types I and II residents, serving to differentiate them from the rest. The different activities (including domestic ritual) represent the dominant and subdominant power strategies mobilized by the various social groups residing at Cancuen.

Power here is being discussed as the ability to mobilize resources, clearly the elite of Cancuen, those residing in Types I and II structures were mobilizing authoritative and allocative resources to legitimate their status and acquire goods that further promoted their symbolic capital. Residents of Types III and IV structures also were involved in the mobilization of resources, and seem to have been a part of an alternative prestige hierarchy (or even heterarchies within the site), in which different notions of value and social identity were created through new "traditions" (Barrett 1994, 2000; Pauketat 2000:115; Hodder 1991; Willey and Phillips 1958) as artisans and crafters, even if participation was in some cases restricted to the early stages of production. If these artisans were physically coerced into labor or tribute, I would expect that their artifact assemblages would appear impoverished (see also McAnany et al. 2002). However, this is not the case. While residents of these households did not have access to some of the most restricted forms of symbolic capital (i.e., hieroglyphic writing, carved jade plaques, earflares, monumental architecture, elaborate tombs), they were associated with exotic objects, objects of value, and ritual paraphernalia.

The prestige associated with these artifacts and the identification of these households with crafting, served as a basis for power in the form of social maneuvering and negotiation. As active agents, the residents of Types III and IV structures utilized their participation in crafting activities to establish a subaltern identity associated with prestigious goods, yet within the realm of the larger community identity dominated by the elite. As power is defined here as the capability to either reproduce or transform the existing social structure (Giddens 1979:88-94, see also A. Joyce 2000), the artisans at Cancuen were at once reproducing the existing social hierarchy, yet modifying and transforming their social position within it through the creation of a new social identity as artisans. Capital and/or resources can be accumulated in these areas and exerted even in the face of competition or resistance from a dominant or elite group, equaling changing power relationships (Münch 1994: Volume 1, 151). Power exists in every social interaction within society, in material, cultural, ideological, and mental structures. By conscripting labor in craft production from the residents of Cancuen, elites may have produced unintended consequences (e.g., Giddens 1984), providing opportunities for crafters to gain prestige, resources, and therefore social and economic power.

Social identity is much more complex than just status alone. These artisans seem to have been of lower status because of their material culture, but their social identity may have been formed by kinship, ethnicity, and other factors. Domestic ritual served as a basis for power and social resistance in the form of the persistence of small group traditions and identities within the larger community identity and dominant ideology (e.g., Barber and Joyce 2007; Gonlin and Lohse 2007).

Figure 9.1. Barkbeater recovered from Structure M9-1 (photo by author; Used with permission of the Cancuen Archaeological Project).

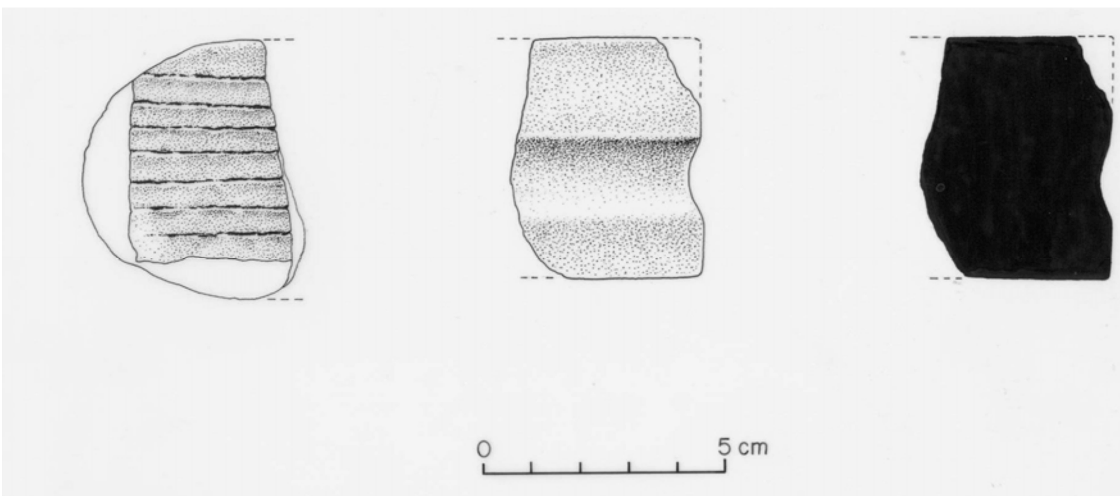


Figure 9.2. Fragmentary barkbeater recovered from Structure N10-1 (drawing by Luis Fernando Luin; Used with permission of the Cancuen Archaeological Project).

Figure 9.3. Fragment of “doughnut” stone recovered from structure fill of Structure N10-1 (photo by author).

Figure 9.4. Metate recovered from Structure M9-1 (photo by author; Used with permission of the Cancuen Archaeological Project).

Figure 9.5. Mano recovered from Structure M9-1 (photo by author; Used with permission of the Cancuen Archaeological Project).

Figure 9.6. Greenstone axe fragments recovered from stairway of Structure N10-1 (photo by author).

Figure 9.7. Vaulted tomb in Structure N10-1 (photo by author).

Figure 9.8. Jade earflare, bone counterweight, and bead from burial associated with Structure M9-15 (photo by Andrew Demarest).

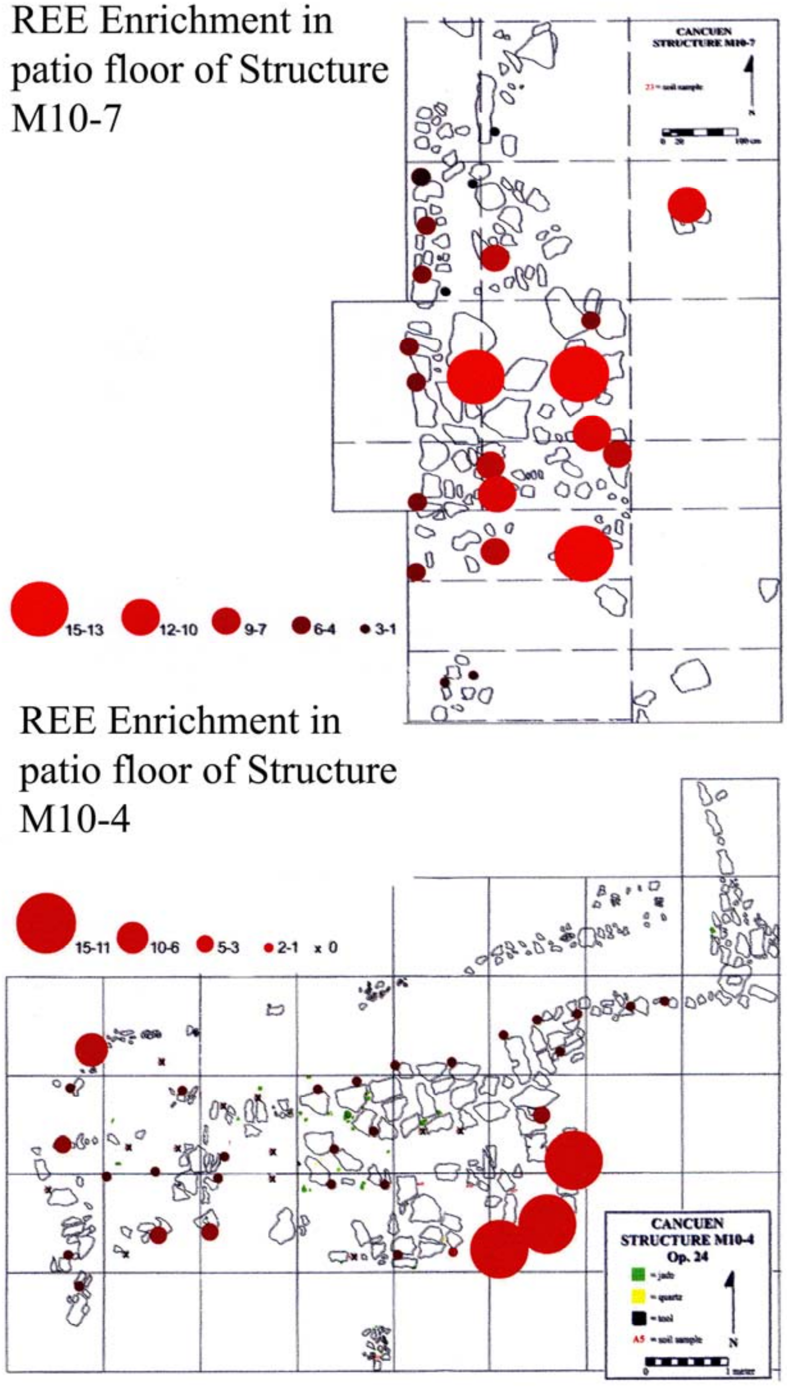


Figure 9.9. Enrichment of REE's (Rare Earth Elements) across the exterior patio floor of Structures M10-7 and M10-4, enrichment measures are expressed as the measured concentration relative to the mean background concentration (+SD) for the site (from Kovacevich et al. 2003; see also Cook et al. 2006).

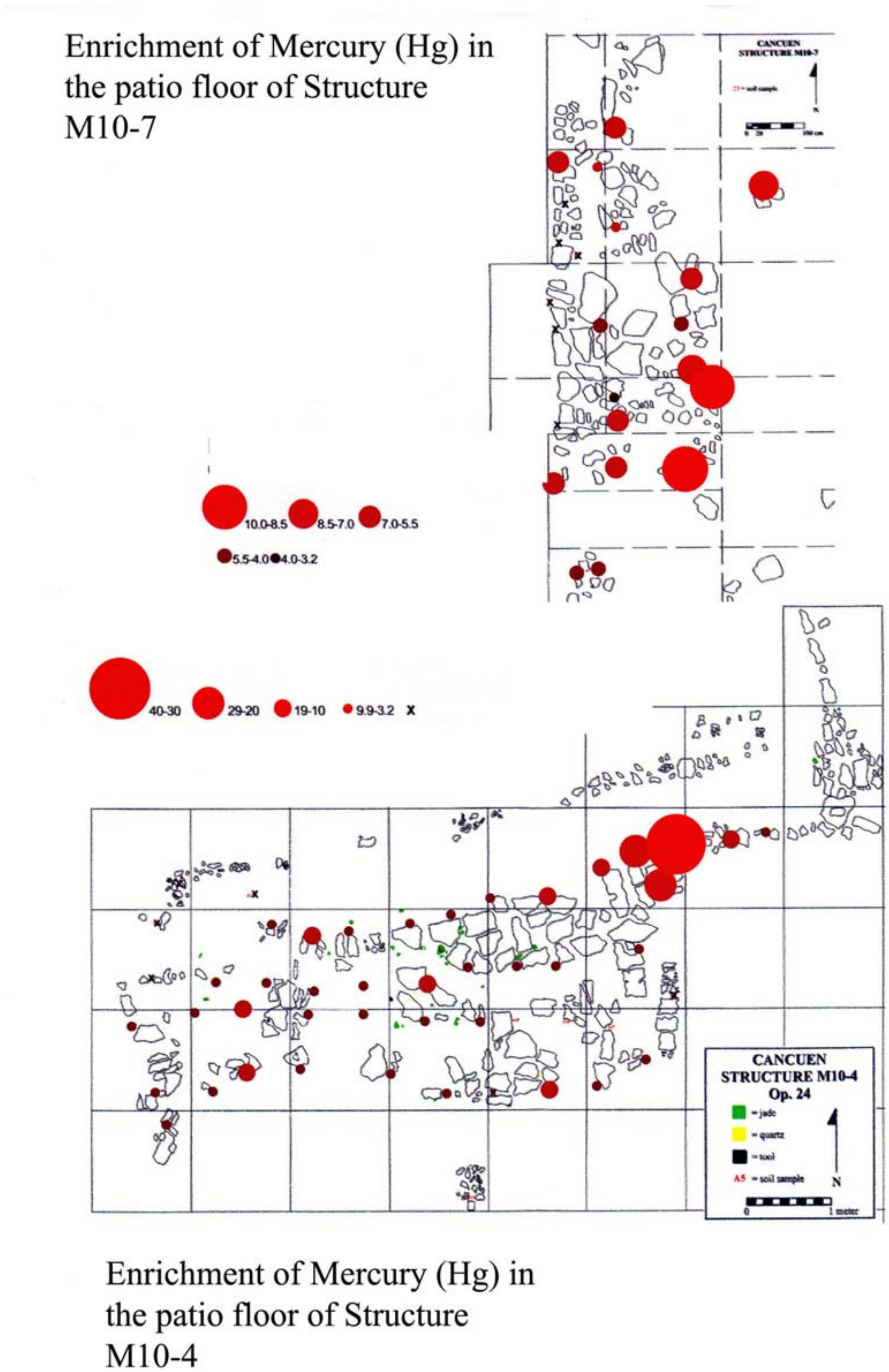


Figure 9.10. Enrichment of Mercury (Hg) across the exterior patio floor of Structures M10-7 and M10-4, enrichment measures are expressed as the measured concentration relative to the mean background concentration (+SD) for the site (from Kovacevich et al. 2003; see also Cook et al. 2006).

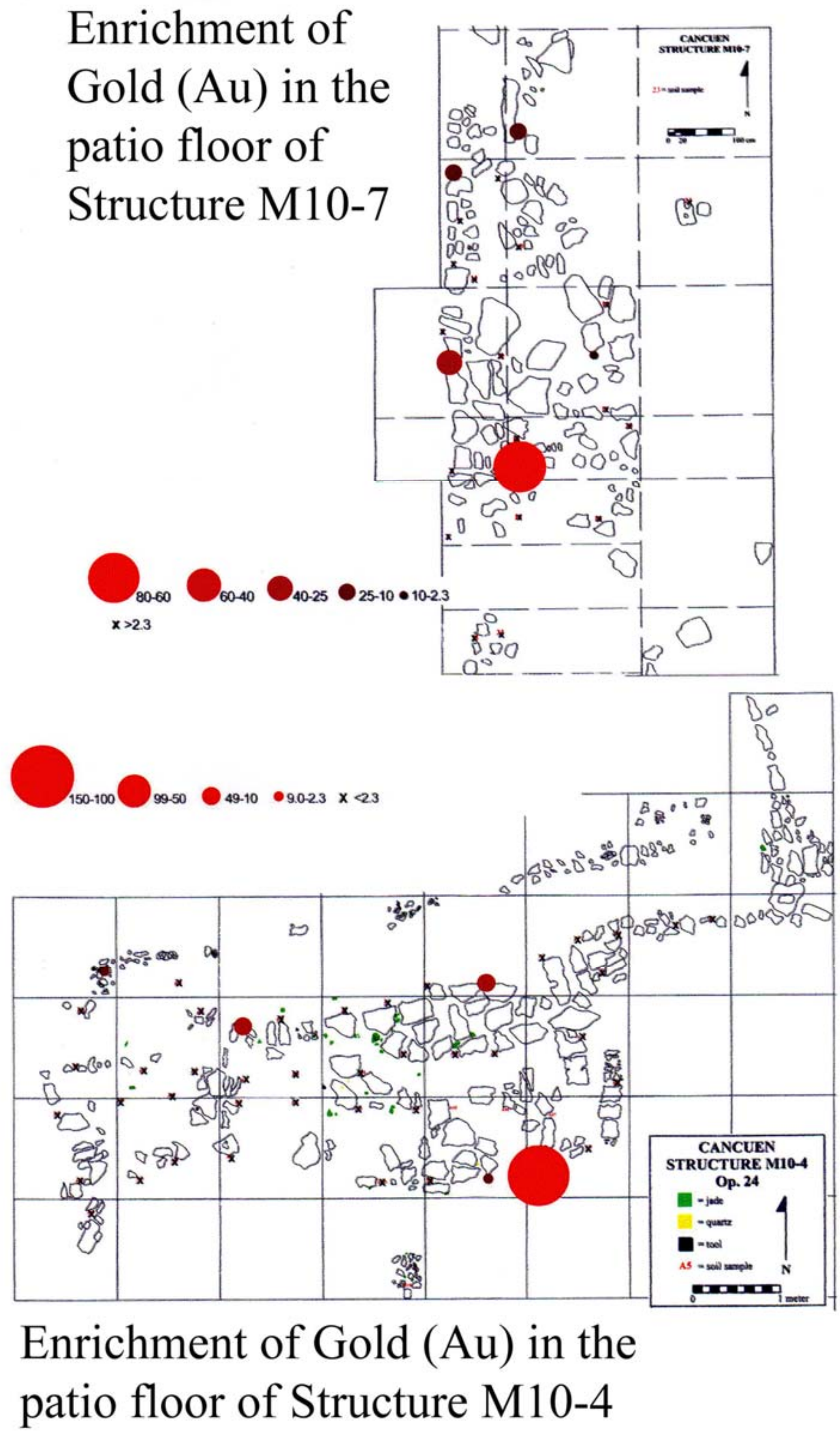


Figure 9.11. Enrichment of Gold (Au) across the exterior patio floor of Structures M10-7 and M10-4, enrichment measures are expressed as the measured concentration relative to the mean background concentration (+SD) for the site (from Kovacevich et al. 2003; see also Cook et al. 2006).

Figure 9.12. Cinnabar pigment ball recovered from midden of Structure M6-12 (not to scale, approx. 1.5 cm; photo by author).

Figure 9.13. Grinding mortar recovered from Structure M6-12 (photo by author).

Figure 9.14. Possible pigment jar recovered from Structure M6-12 (not to scale, approx. 3.4 cm in width; photo by author).

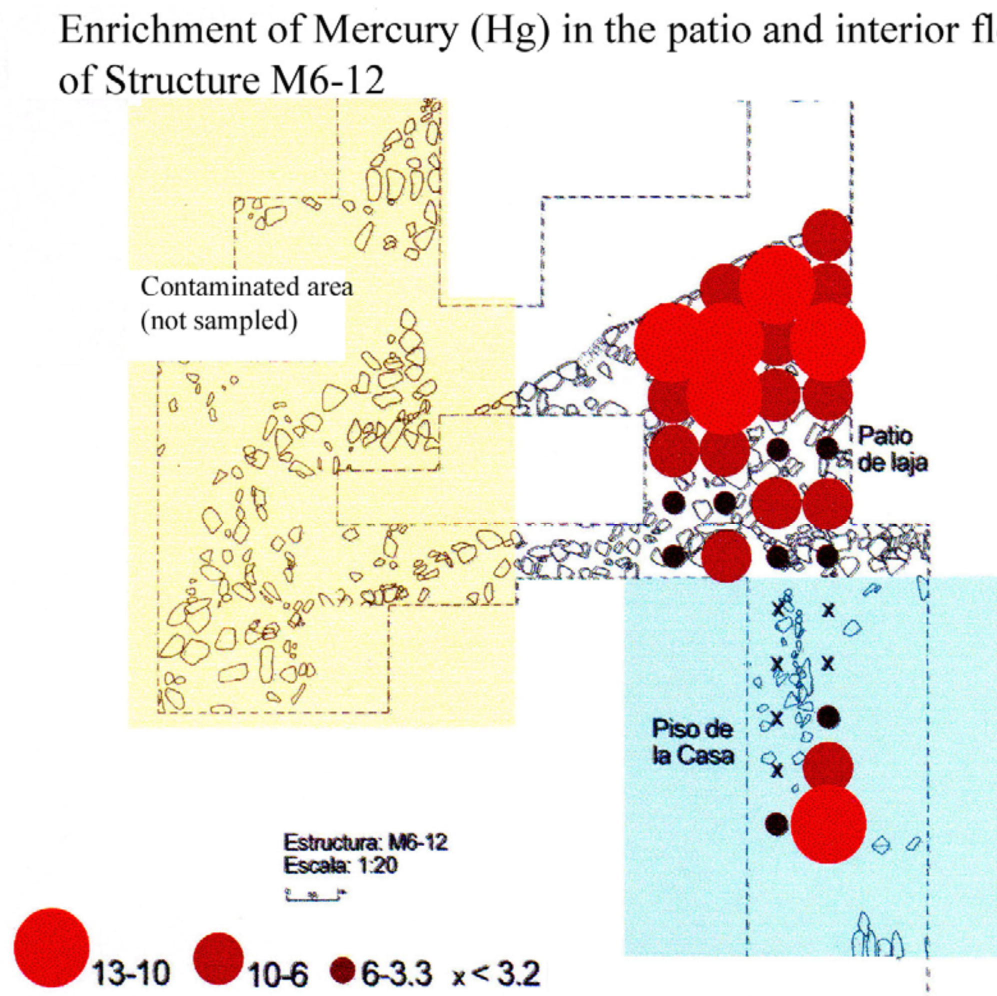
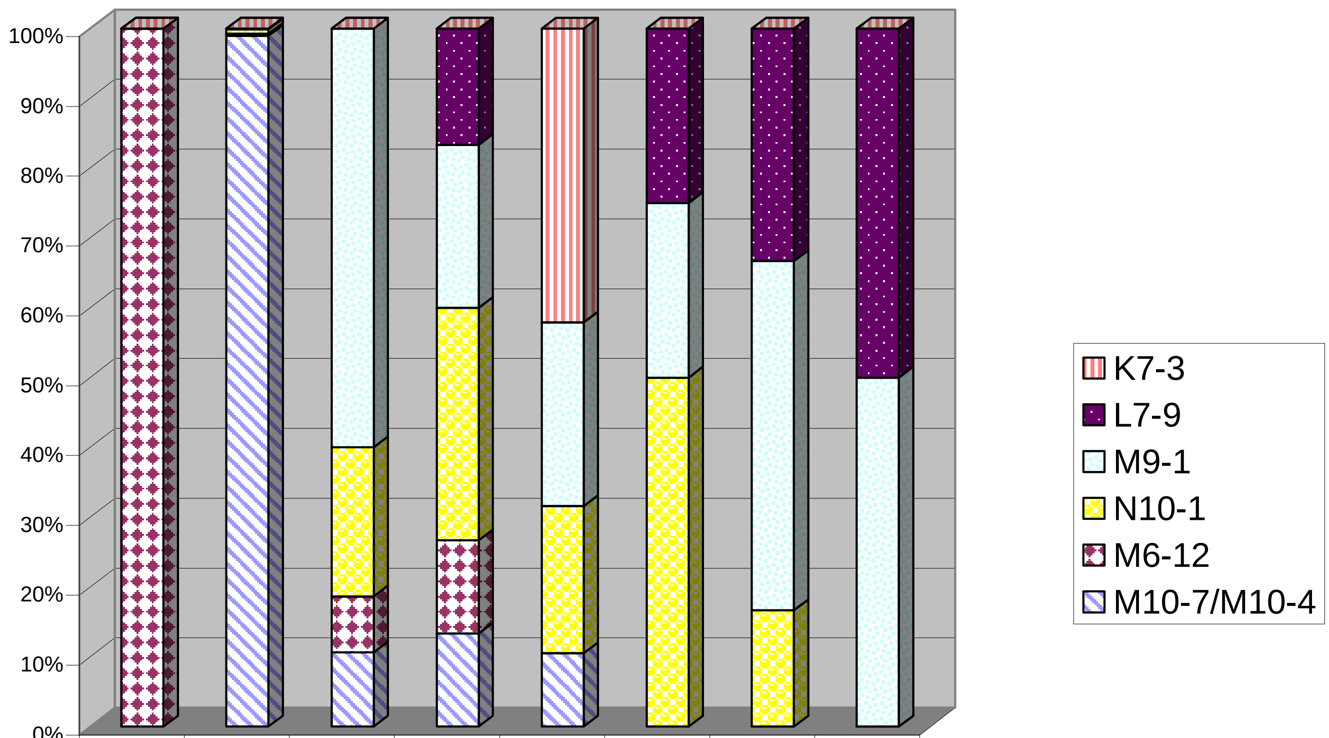


Figure 9.15. Enrichment of Mercury (Hg) across the exterior patio and interior floors of Structure M6-12, enrichment measures are expressed as the measured concentration relative to the mean background concentration (+SD) for the site (from Kovacevich et al. 2003; see also Cook et al. 2006).

9.1. Chart shows frequencies of certain artifacts in Types I (M9-1, N10-1, L7-9), II (K7-3), and IV (M6-12 and M10-7/M10-4).



	Pyrite Noduels	Jade Debitage	Groundstone	Greenstone Axes	Jade in Burials	Bark Beaters	Bannerstone s	Earflare Polishers
K7-3	0	0	0	0	8	0	0	0
L7-9	0	0	0	5	0	1	2	1
M9-1	0	5	90	7	5	1	3	1
N10-1	0	20	32	10	4	2	1	0
M6-12	6	10	12	4	0	0	0	0
M10-7/M10-4	0	3259	16	4	2	0	0	0

Chart 9.2. Distributions of Fine Ware ceramics in Structure M9-1 showing the low frequency of Chablekal Fine Gray.

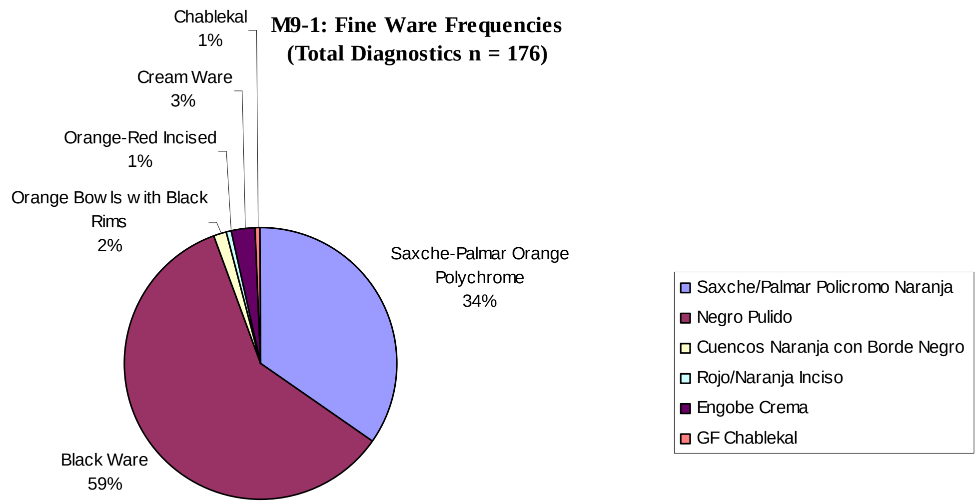


Chart 9.3. Total Utilitarian vs. Fine Ware sherds in Structure M9-1.

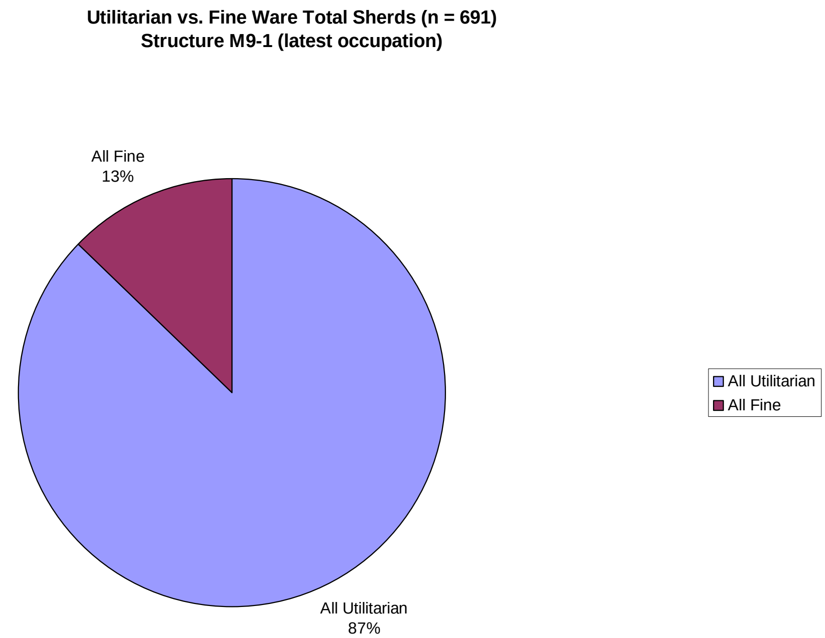


Chart 9.4. Fine Ware Frequencies for M9-15, showing low frequency of Chablekal Fine Gray.

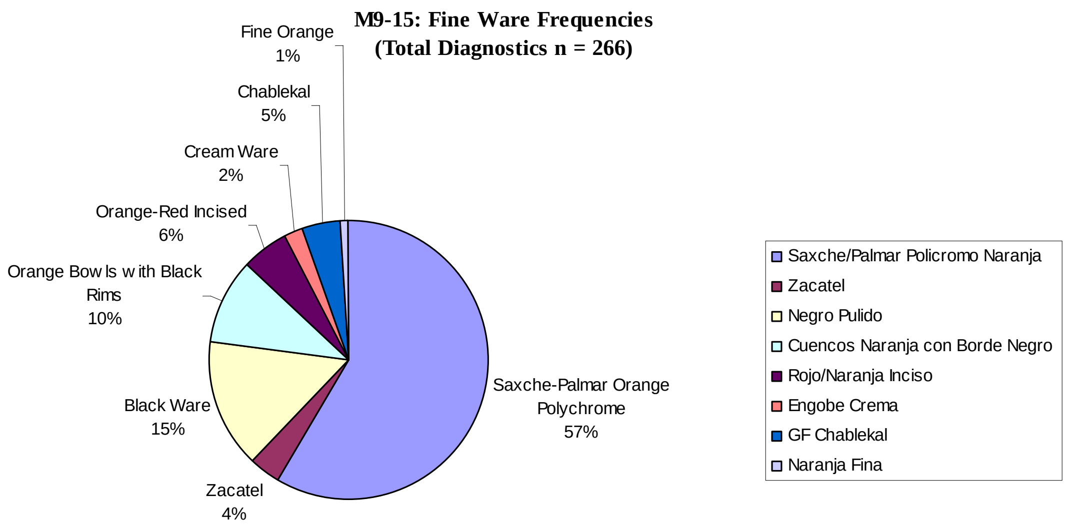


Chart 9.5. Fine Ware Frequencies for Structures M10-7 and M10-4 showing higher frequency of Chablekal Fine Gray.

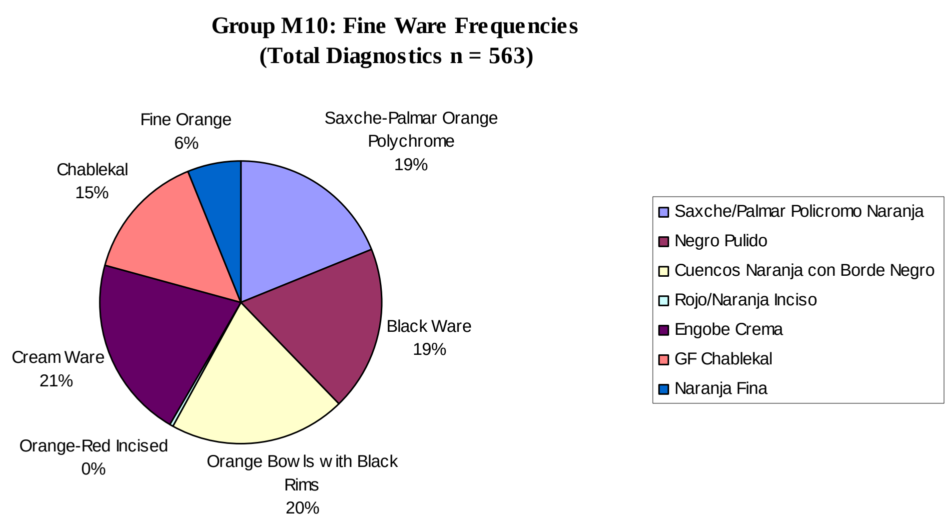


Chart 9.6. Fine Ware Frequencies for Structure K7-24 (Type IV structure) showing higher frequencies of Chablekal Fine Gray.

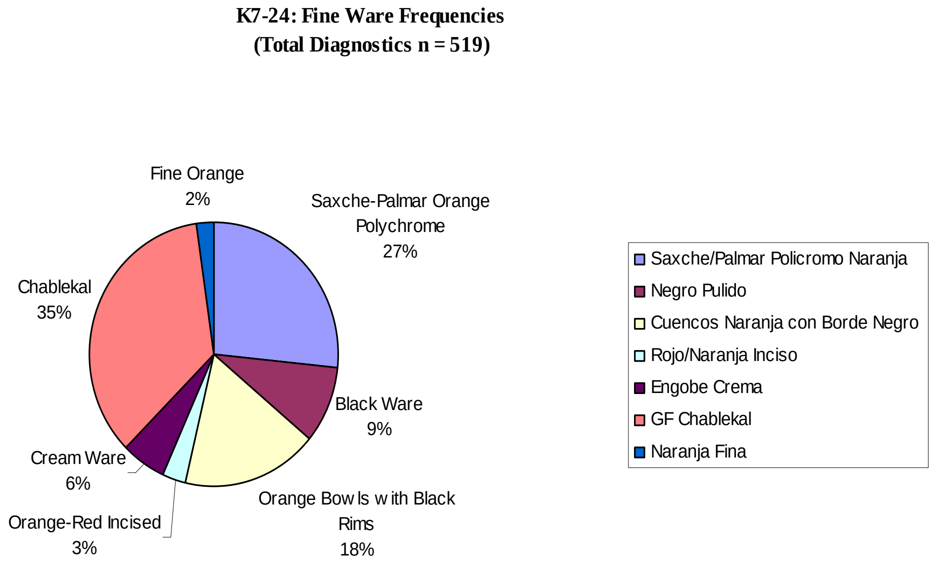


Chart 9.7. Utilitarian vs. Fine Ware sherds for Structure N10-1.

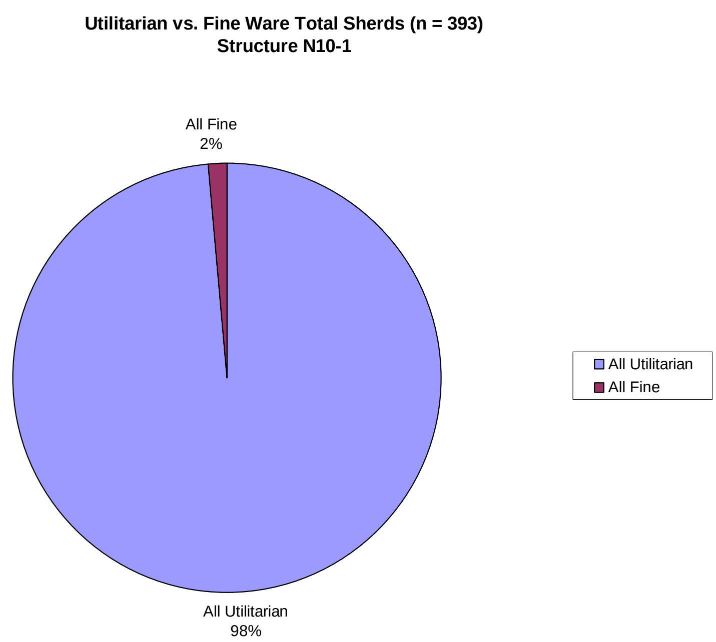


Chart 9.8. Utilitarian vs. Fine Ware Rim sherds for Structure L6-1, first occupation sequence.

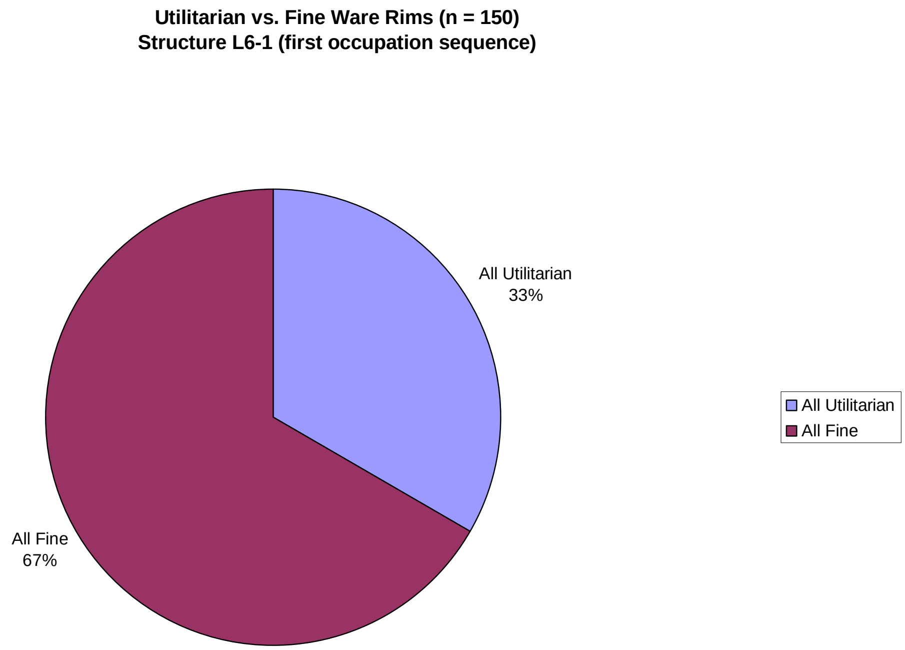


Chart 9.9. Utilitarian vs. Fine Ware Rim sherds for Structure L6-1, second occupation sequence.

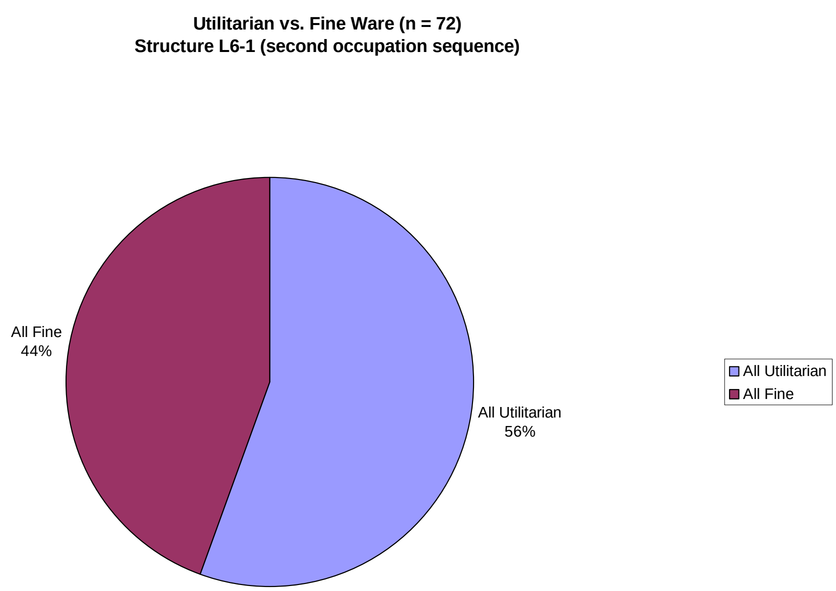


Chart 9.10. Fine Ware sherds for Structure M6-12 showing higher percentage of Chablekal Fine Gray and lower percentage of Cream-slipped Wares.

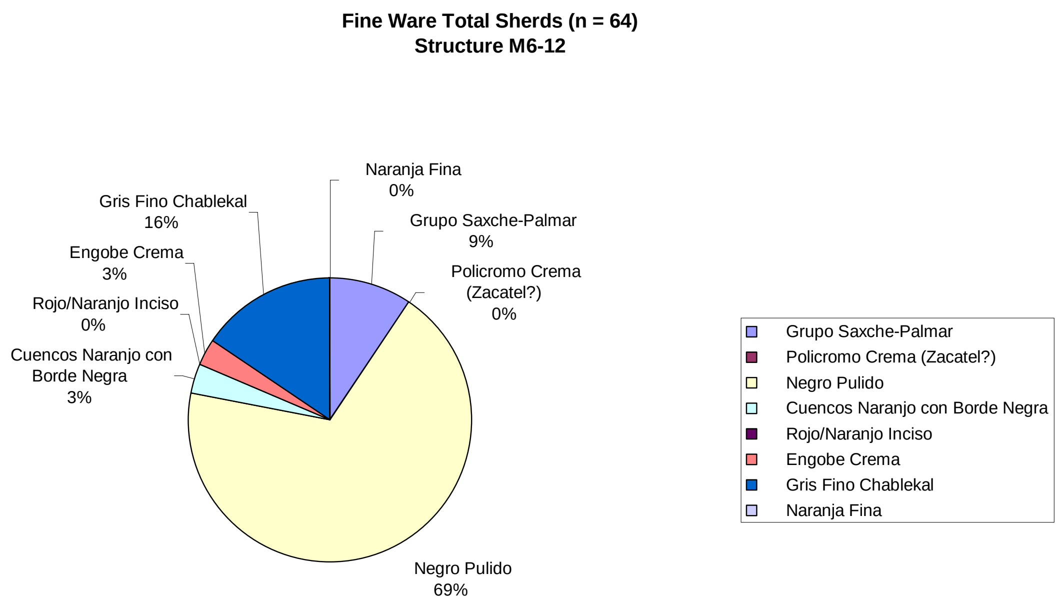
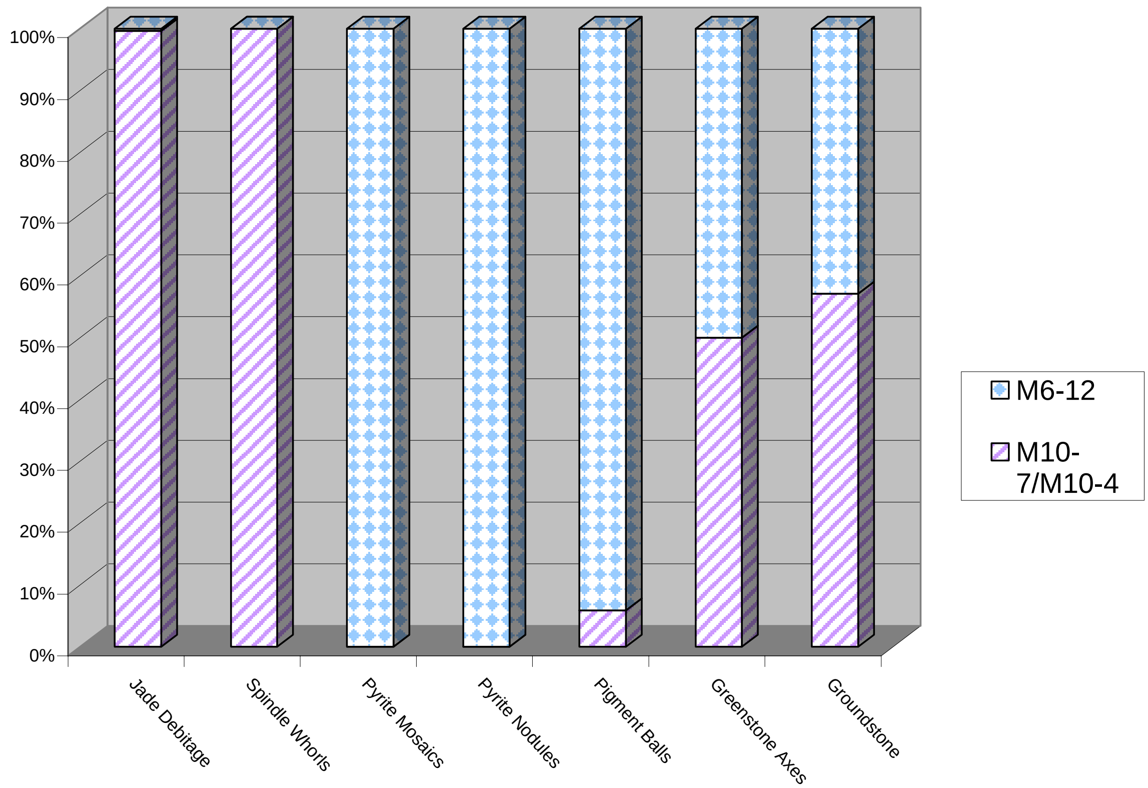


Chart 9.11. Chart shows differences in frequencies of crafted materials and tools between Type IV structures M6-12 and M10-7/M10-4.



CHAPTER X

SYNTHESIS

Men possess thoughts, but symbols possess men.

-Max Lerner

Introduction

This dissertation investigates issues of social status, social identity, power, the interplay between structure and agency, the nature of the political economy and how all of these factors relate to the production and exchange of stone tools and adornments during the Classic period at Cancuen. This chapter will serve to reiterate and synthesize these findings, providing a conclusion to the goals of this research. These goals included defining and comparing the resources mobilized as a basis for power of Maya rulers at Cancuen with other Classic-period polities and addressing the variability in that power from polity to polity. A second goal was to define the nature of production and exchange systems in comparison to other polities and other preindustrial societies. The social power and identity attached with economic and ritual production was also explored in relation to varying social groups at the site.

Settlement Patterns and Household Status

A part of these investigations was a test of household types based on architectural features as indicators of status, testing the notion that these types may represent elite and nonelite social groups. These differences in structure type, initially based on visual identification of features such as masonry platforms, perishable superstructures, retaining walls, and patio floors, were then compared with artifact distributions. These artifact distributions focused on the use of certain symbols and commodities in and around households as markers of status and social identity.

Occupation of these households was primarily restricted to the Late Classic period (A.D. 650-800), but the intensification of production in all structure types correlates to the period of fluorescence at Cancuen associated with the reign of the ruler *Tah Chan Akh* (A.D. 760-795). Cancuen continued to be occupied until around 800-810 under the rule of *Kan Maax*, although a ceramic distinction between these two political periods has not yet been made. Nevertheless, most of the evidence for production of lithic artifacts comes from the period of the reign of *Tah Chan Akh*, also corroborated by Chablekal Fine Gray ceramics which securely begin to be used around A.D. 760-770, and extended to the period of abandonment of the site, around A.D. 800.

In the case of jade, certain types of artifacts were restricted to Types I and II structures: carved jade plaques and earflares. Other jade artifacts such as axes, dental inlays, and beads, were more evenly distributed across structure types, and presumably statuses. Raw jade or jade worked by percussion or sawing was heavily biased towards Type IV structures, suggesting that production of jade in the early stages was completed in these structures. There were two manufacturing sequences of jade, one for Types III and IV structures (i.e. early stages) and one for Types I and II structures (i.e., finishing stages). Jade (or greenstone) artifacts that were present in all household types still presented significant differences between them. Mean bead weight was used as a statistical indicator of differences between the structures, and was found to be statistically significant in each case, bead size increased with structure type, seemingly correlating with increasing status.

In the case of pyrite, raw nodules and half-finished mosaics were only recovered from Types III and IV structures, suggesting that production of pyrite mirrors was restricted to those structure types. In this case, the size of pyrite mosaics was similar between structures, suggesting that mosaics for elites may have been produced by nonelites, but there were not significant indicators between structure types besides raw material and production distribution.

Obsidian sources and core blade technology were fairly equally distributed throughout the site, but differences in mean blade width did increase with increasing status residences, suggesting that elites may have had more access to obsidian than nonelites, or at least were not as concerned with maximizing the use of their obsidian raw materials.

Chert distributions differed primarily in tools related to craft production, which were not restricted to a particular structure type. Craft production, albeit different activities, occurred in some form in all of the different structure types. The mean weight of decortication, hard-hammer, and soft-hammer flakes did differ significantly between general “elite” structures (Types I and II) and nonelite structures (Types III, IV, V and 0), but were not significant between structures separately. These findings may suggest that elites had more access to larger chert nodules due to the ability of elites to mobilize authoritative and allocative resources, either in the form of tribute of larger nodules, or the conscription of labor to find and procure larger nodules. This may have been a function of elite power.

Other artifacts also indicate differences between structure types. Groundstone appears in greater numbers in certain elite (especially Type I) structures, possibly indicating the presence of elite feasting and reciprocity. This finding is also supported by the large presence of unslipped storage vessels (such as Encanto Striated and Cambio Unslipped jars) in some Type I structures. Chablekal Fine Gray was also present in the greatest numbers in middens and burials of Type IV structures (e.g., Bill et al. 2003; Callaghan et al. 2003). Specialized artifacts, like barkbeaters, jade earflare polishers, and doughnut stones (function still not completely determined) were recovered only from Type I structures.

Evidence from burials also suggests differences, in grave form and type, as well as grave goods. Vaulted tombs were only present in Type I structures. A cyst style tomb with carved jade headdress ornaments, earflares, and beads were among the grave goods. Simple interments were the only type of burial in Types III, IV, V, and 0 structures, but they sometimes were characterized by limestone *laja* capstones. The individuals rarely had jade dental inlays or small malformed jade beads. Furthermore, seemingly restricted jade artifacts like carved plaques and earflares were always absent.

Types V and 0 structures did demonstrate some evidence of specialized production in some cases, mainly in the presence of specialized chert tools. Jade beads were found in these structures, although not in burials. One burial from Structure M6-17 did have one drilled tooth where an inlay would have been, but was missing. In general, these structures did not have the large scale production refuse of jade and pyrite that were present in Types III and IV structures. In one case (Structure M6-17), ceramic evidence suggested a longer occupation than many other housemounds at the site (including the royal palace), suggesting that these people may have been some of the first local residents of the site of Cancuen. Artifact assemblages in general did seem to differ from Types I and II, as well as III and IV structures, suggesting that most specialized production activities did take place in structure types III and IV.

The data suggest that qualitative and quantitative differences may exist between Type I structures and Type II structures, but residents of both types may be members of the royal family or non-royal elites (see also Jackson 2005). While producers of jade and pyrite in Types III and IV structures demonstrate obvious differences in architectural investment, grave treatment, and artifact distribution, from Type I and II structures at Cancuen, it is still very difficult to say with certainty that they were an endogamous "class" of artisans (e.g. Marcus 2004). Enough variation does not exist between Types III and IV structures to say that they were separate social strata or classes, also because there was a good degree of variation within each group. Types V and 0 appear to have the least amount of architectural and grave elaboration, also the least amount of specialized craft activities when compared to all other structure types, but whether residents of structures in these households belonged to a distinct social strata is not clear.

Early arguments by Thompson (1942, 1966) created the basis for the two-class model of Mesoamerican society: basically, royals/elites and peasants/commoners (Becker 1979; Blanton 1979; Flannery 1983; Haviland 1970; Marcus 1983; Sanders 1981; Spores 1983; Webster 1985). Elites were those who had greater access to resources, exotic materials, communal labor, symbols of power and status, and inherited their social position through bloodlines and kinship. These characteristics would manifest themselves as larger, more labor intensive residences or ritual structures, imported trade goods, restricted classes of artifacts (including symbols of office like royal diadems), hieroglyphic inscriptions detailing bloodlines and legitimating heritage, and larger and more elaborate grave treatment. Nonelites had relatively less access to all of these things, although where to draw the line between these two social groups is often more difficult archaeologically (see Chase and Chase 1992; Marcus 2004).

Recent evidence and interpretations, however, have shown that Classic Maya social organization may have been more complex, with at least three or more strata, including a group of ‘secondary elite’ or a ‘middle class’ (Adams 1981; Chase and Chase 1992; Chase 1992; Palka 1995; Sabloff 1975b; Willey et al. 1965). Marcus (2004) has recently argued that there may have been some middle ground and variation within the two endogamous classes, but the existence of a third, endogamous social class is not supported by the archaeological evidence. The present evidence at Cancuen supports a more complex social structure than the simple division of two classes, yet it is difficult to say that a third endogamous class had emerged. Producers of jade and pyrite may have been lesser elites, but by definition, not everyone, or even the majority in the site should be defined as elite (Tourtellot et al. 1992). The finding that these crafters were involved in the early stages of production of prestige goods and alienated from the final product suggests that they were producing for some sort of tribute or labor required by elites. This may support the contention that they were not part of the elite class, who may have been exempt from these types of taxes. The main line of evidence that these crafters were not part of the elite class includes the lack of certain markers of status, including carved jade plaques inscribed with esoteric knowledge, monumental construction, tombs, inscribed monuments, as well as any ceramics with hieroglyphs or Primary Standard Sequence.

Evidence for a growing group of craft specialists in the Late Classic, would support McAnany's (1993) argument that some Late Classic populations may have turned to craft specialization due to land-disenfranchisement (see also Foster 1965 for ethnographic example from Mexico, although cf. Harry 2005 for Southwestern examples that do not show this relationship). Growing numbers of elite demanding tribute may have been the result of elite polygamy (Palka 1995), and possible migration of residents escaping escalating warfare during the latter part of the Late Classic period from regions such as the Petexbatun could have added to elite and nonelite populations (Demarest and Escobedo 1998). Evidence supporting this hypothesis could include socially heterogeneous plaza groups (McAnany 1993), which were often densely packed onto habitable land above *bajos* (seasonally inundated marshlands), as well as ceramic evidence for intensification of prestige good production in households during the latter part of the Late Classic period (Late Tepeu 2, A.D. 770-800). In addition, growing numbers of elite also may have caused intensification in ritual and the need for ritual paraphernalia and status reinforcing goods (see also Spielmann 1998 and Wells and Davis-Salazar 2007). In all, the heavy reliance on ritual as a basis for power of Maya rulers, elite polygamy and a growing elite class, and migration were all factors that could have contributed to the stimulation of nonelite craft specialization in prestige goods during the latter part of the Late Classic at Cancuen, as well as the growing prestige of some social groups involved in that production.

Social Identity and Domestic Activity

While variations in status are apparent beyond the "elite" and "nonelite" or "noble" and "commoner" divisions, it is nearly impossible archaeologically to define variations as separate "endogamous" middle class (see Marcus 2004). However, detailed future osteological analysis of genetic relatedness may help to shed light on this issue and reinforce architectural and artifact patterns. An important goal of this work is to recognize the different social identities that the different domestic activities at Cancuen may represent. I do believe that there was much variation apparent within the various social groups at Cancuen, and the artisans working with jade and pyrite in Types III and IV structures seem to have had a degree of social mobility.

While it has long been dismissed that pots represent people, recent research has shown the importance of collective symbolism, as well as technology as a representation of social identity, which may or may not correspond to broader notions of ethnicity (e.g., Bawden 2005; Dobres 2000; Dobres and Hoffman 1994; Dillehay 2001; Lemmonier 1986; Le Count 2006; Joyce and Gillespie 2000, eds.; Janusek 2002, 2005; Mills 2006; Reycraft 2005, ed.). There is no reason to presume that any class of artifacts is a marker of identity (Deitrich and Herbich 1998), and it is important to use multiple lines of evidence to examine social identity (e.g., Janusek 2002).

Janusek (2005:35) defines social identity broadly as, "subjective affiliation with certain people in relation to others based on perceived kinship, shared memory, manner of actions, place, gender, or cultural expression." Janusek goes on to point out that social identities can be multiple and nested depending on the context and social interactions at play. Janusek's (2002, 2005) findings at Tiwanaku share many relationships with patterns found at Cancuen. For example, craft production took place in certain compounds as opposed to homogeneously across the site (Janusek 2005:41). He also found that these compounds differed not only in craft and status, but also in social identity (Janusek 2005:48).

The process of crafting was an activity that was integrated into the *habitus,* or daily social praxis of individuals living in these households, forming part of their identity (see also Costin 1998). The habitus of individuals and therefore social groups is developed and established in every social practice preformed by an individual. It reproduces the social structure, while at the same time possibly transforming it (Bourdieu 1977). While the segmented manufacturing sequence of jade served to integrate and tie producers to the elites and elite power, it also created a separate identity nested within the collective state identity. These dual identities reinforced one another, and rather than a completely exploitative, extractive labor process, the process of crafting for elites in Types III and IV structures allowed the residents a measure of wealth and prestige (see also Janusek 2002:54). While they were involved mainly in the early stages of production, they still were part of the process of creation, and even early stage debitage was ritualized and cached reinforcing the collective identity of these houses revolving around their early stage production (see also below). This collective identity also allowed a measure of power to contest the existing social structure by gaining resources and prestige through production and crafting. While Type III and IV residents were still not allowed to affiliate themselves with certain badges and markers of social status, they were able to gain symbols of status and prestige including Chablekal Fine Gray wares, from a distant and exotic place. Some residents did have filed or inlayed teeth, probably not restricted to the noble class, but still a marker of social identity and status nonetheless.

For elites (Types I and II structures) crafting was also an important factor in the creation of social identity (see also Inomata 2001). Reents-Budet (1998) suggests that makers of elaborately painted ‘codex style’ vessels were imbued with the power of the gods of creation in the creation of these vessels. She suggests support for this lies in the various names given to the original creator couple Xpiyakok and Xmukane, including jeweler, carpenter, master craftsman, plate shaper, and bowl shaper (D. Tedlock 1996:63, 216), all suggestive of metaphors for the original creation. The very act of crafting was likened to the original creation, and crafters themselves likened to gods. The products that these elite crafters created required incredible skill, artistry, and esoteric knowledge possessed only by the elite class (see Figures 5.22 and 5.23). These artifacts were also restricted only to the elite and formed part of their collective and personal social identities as evidenced in their inclusion in caches and burials (see also below). Social identities were constructed not only through kinship, but also through ideological means and collective memories of group affiliation rituals and daily practice (such as crafting).

Social Identity and Memory

Hendon (1996) notes the similarities between burials and caches and storage containers, they mark areas that must be remembered and also confers that particular area with meaning. Caches and burials are out of sight, but not out of mind. The inclusion of symbolic artifacts (often forms of wealth, whether economic or symbolic) within these interments is often a way of removing possessions from circulation, but not from memory. Hendon (1996:49) argues that objects do not necessarily leave circulation as they enter into caches and ritual deposits, but become (or remain) inalienable (see also Mills 2004; Weiner 1992), making them an even more powerful identifier of group identity as they have been removed from the possibility of transfer to another group or individual to whom they would confer power, yet they are not completely forgotten, providing power and identity to the group or individual owner. If memory and object are separated, the memory itself can become a form of cultural capital (Hendon 1996:49), accessible to only certain members of society, but also “belonging” to only certain members of society, thus helping to form their social identity. Hendon (ibid.) argues that people become repositories or storehouses of knowledge themselves. Memory can serve as a powerful force which helps to shape social identity, along with other factors such as kinship, material culture, and daily practice.

Mills (2006) also argues that forgetting is as important as remembering for creating a collective identity and memory of particular objects and people. Certain objects are so ritually powerful and significant as inalienable possessions that they cannot be disposed of in the manner of other more mundane objects, they also represent the collective identity of the group participating in the remembering and forgetting. These objects were secreted away, filled, covered, as if to forget, but also to remember. Mills (2006) found that the retirement of ritually and socially charged objects in Chacoan society, such as altar pieces and staffs of office terminated certain practices while constructing social memories. As the memory transmission was dramatically reconstructed over time, the objects were in a way “forgotten.”

In Mesoamerica, costume ornaments (made of jade, shell, and other materials) often served as heirlooms, representations of a 'house' or a distinct social identity (R. Joyce 2000b), some, like the Piedras Negras jade plaque discussed in Chapter 5, ended up hundreds of miles from their owners ritually deposited in the Sacred Cenote of Chichen Itza (R. Joyce 2000b; Proskouriakoff 1944). Joyce argues that many of these heirlooms are inscribed not only with the name of the owner, but his or her genealogy, relating the object to the 'house' or the collective identity of the person's lineage. I would argue that these objects were also representations of the larger community identity, not only of the elites, but the community at large, the identities nested within each other. A similar argument has been made for ceramics (Le Count 2006) representing elite and community identity, with smaller nested group community identities represented by 'utilitarian' or more plain ceramics. A feeling of solidarity and community must complement any divisive and divisional strategies in order to effectively maintain power strategies (e.g., Barber and Joyce 2007; Gilman 1981; A. Joyce 2000; Kertzer 1988).

These elite styles are present at Cancuen in the form of heirlooms present in caches and burials. Carved jades are a significant marker of elite and community identity. These include headdress ornaments from Burial 50 representing maize (see Figure 5.30 and 5.31; Karl Taube, personal communication 2002, 2005), and the power of elites to control fertility and life in general. While these particular objects were included in a burial with a single individual, a second diadem or headdress ornament was included in a cache beneath the royal throne room, representing God K, the patron god of rulership, who also wears a similar maize diadem on his head (see Figures 5.21 and 5.22). This artifact was interred as an heirloom and a representation of collective royal identity at Cancuen, connected to the royal line as well as possibly an individual, but also representing the royal and ritual power of the community as a whole.

The Power of the Worked and the Unworked

Also included in this royal cache was a partially string sawn boulder of jade, attesting to the sacred nature of all stages of jade production, and the sacred nature of the raw material itself. This is similar to the findings of Mills (2006) for Chacoan society, where unworked shell, turquoise, and other materials were often treated in the same manner as finished products in ritual caching behavior in kivas. She argues that they were not just debitage or leftovers, but part of the materiality of production of ritual artifacts. Payson Sheets (1991) echoes this sentiment for chert found within the sacred cenote of Chichen Itza, as there were not only finished products, but debitage recovered, attesting to the *process* of production being ritually important, not just the finished product. This is also reinforced by the inclusion of production debris in tombs and special deposits at sites like Tikal (Moholy-Nagy 1997), Piedras Negras (Hruby 2006; Proskouriakoff 1965), Kaminaljuyu (Kidder, Jennings, and Shook 1946), and Cancuen (Barrientos et al. 2005). The elites in the case of Cancuen were obviously referring to their involvement in and power over all stages of production, as it also helped to define elite identity at the site. But nonelites also co-opted part of this identity as a function of their participation in the segmented manufacturing sequence or operational chain of jade.

While jade debitage was found in general household middens in Types III and IV structures, it was also found in ritually cached deposits. Structures M10-4 and M10-7 both contained a cached jade boulder, one sawed and one worked by percussion respectively, in the second phase construction fill correlating to the late Tepeu 2 period (A.D. 770-800). In Structure K7-24, a string sawn jade boulder formed a part of a termination ritual for the residential Type IV structure, the boulder was placed on the edge of the patio working floor with two metates placed on top of it. These caches represent early stage jade crafting as part of the household identity of the residents of these structures (see also Joyce 2000), nested within the larger communal identity of the Cancuen community and the presiding *K'uhul Ajaw*. These residents did not include finished, carved jade products in their caches and burials. While nonelites may have been prohibited from wearing or using the most ritually charged prestige reinforcing goods, they also knew of their participation in the production of a community heirloom, exemplifying its simultaneous divisive and integrative power as a communal object. LeCount (2006) argues that common pottery expressed social identity and affiliation just as much as elite pottery, in the same way, craft activities in nonelite structures at Cancuen express identity as much as elite crafting. The memory of these caching events helped to define the identity of these social groups. While the caches were sealed away in structure fill, they certainly were not forgotten (Hendon 1996), just as the cache beneath the throne was imbedded in the social structure of the royal residents of the palace.

Power, Ritual, and Social Identity

Le Count (2006) argues for the use of cooking and serving vessels in Classic Maya civic ceremonies as an important part of the formation of a larger social identity for all participants. Her argument is grounded in early anthropological works such as that of Durkheim (2001[1912]) and Eliade (1974). These feelings of community allow participants to order their world, especially if grounded in earlier traditions, and legitimize status differences and social hierarchy, while at the same time promoting community identity.

Public ritual performed by elites was an important source of power for Classic Maya elites (e.g., Demarest 1989; 1992; Fox and Cook 1996; Inomata 2001; Marcus 1983; Sanders and Webster 1988; Schele and Freidel 1990; Schele and M. E. Miller 1986; Sharer and Golden 2004; Stuart 1996, 1998; Taube 1998). This ritual was an important authoritative resource, which then allowed the mobilization of allocative resources in the form of control of labor and tribute. These rituals also reinforced the identity and status of elites as the primary intermediaries between humans and ancestors/gods. Those who did not directly participate in these rituals were not passive bystanders, but active recipients of the power of the ritual and community identity. Domestic ritual served to reinforce the subdominant identities of the many social groups that made up the community at Cancuen, and much of this ritual revolved around crafting.

The Organization of Production and Exchange at Cancuen

As discussed in previous chapters, much variation existed in preindustrial economic systems, and the organization of production varied greatly as well, even within a single site. The most effective approach to understanding the organization of production is to describe in detail these differences using descriptive tools like Costin's (2001:277) dimensions to elucidate that variation. While this information will be unique to the ancient Maya site of Cancuen, it can then be used and compared to other Maya sites and preindustrial cultures. Nonelite residences at Cancuen have shown evidence of specialized production of highly valued raw materials, such as jade and pyrite, while at the same time often producing utilitarian products such as chert stone tools and obsidian prismatic blades and participating in domestic rituals.

This approach combines both substantivist and formalist perspectives, considering the interplay between restrictive social structure and innovative individual behavior, examining how they affected economic developments. Clark and Parry (1990) have found that there can often be a number of different types of production in complex, state-level societies. This finding holds true for Cancuen, as elite and nonelite, male and female producers crafted products in attached, independent, and possibly even embedded spheres.

I will conclude by examining the nature of the organization of production at Cancuen utilizing Costin's (2001: 277) dimensions; i.e. *identity of the artisan, means of production, organization and social relationships of production, nature of objects created, relationships of distribution,* and *identity of the consumers*. I will be using the following definitions of specialized production as general guides to its identification. The definition of specialized production used in this work is that which is above the direct household needs of the producer (Clark 1986, 1995; Clark and Parry 1990; Inomata 2001), and is unevenly distributed on the social landscape (i.e. some are producing, while others are consuming) (Clark and Houston 1998; Costin 2001; Evans 1978). As many studies have shown (Ames 1995; Clark and Parry 1990; Clark 1995; Cross 1993; Janusek 1999), demand crowd and degree of dependence are not always effective indicators of specialized production. The distinction between attached and independent specialization will follow Clark and Parry (1990), as those who do, or do not control the rights of alienation over their products.

Identity of the Artisan

Specialized producers at Cancuen were both elite and nonelite, male and female. Traditionally it has been argued that males were the primary lithic crafters during the Classic and Postclassic periods (Clark and Houston 1998), but the possibility exists that women and/or children were involved in jade production as in the Maori case (Gump 1962), especially because it occurs in a domestic setting as opposed to a separate, non-domestic workshop. Spindle whorls recovered from structures M10-7 and M10-4 may represent flywheels for pump drills, but may also represent spinning and women's crafting (see also Inomata et al. 2002). Elite feasting and food production evidenced in Type I structures is another area of women's work that complemented craft production. Some domestic figurines in all structure types point to domestic ritual, but some in each structure also represent females, suggesting their prominence in household activities.

An important factor within the inquiry about the nature of the Cancuen economy lies in the status, agency, and social identity of the producers. The large-scale producers of jade at Cancuen may have been nonelites, as suggested by the architecture of their residences with low investment of labor (see also Chapters 2 and 9). The domestic, nonelite economy may have been articulated with the elite political economy, although nonelite producers still may have been able to negotiate their status within the social hierarchy at Cancuen through production of prestige goods for elite. While the finding of elite production of prestige goods contributes to recent findings in the Maya world showing that producers of prestige goods were often of high status, at times members of the royal family (Aoyama 1994; Ball 1993; Inomata 2001; Fash 1991; McAnany 1993:74-5; Reents-Budet 1998; Potter and King 1995), the finding of nonelite participation in this production is rare. Many have suggested that multiple stages were involved in the process of prestige good production. Inomata suggests that apprentices or other family members aided in production, and Ball (1993) and Potter and King (1995) suggest that nonelites may have also been involved, but this relationship has rarely been found or clearly defined in the archaeological record.

Means of Production

The raw materials utilized in prestige good production at Cancuen were exotic, lending themselves to control of import by elites (Flannery 1968; Renfrew 1982). In the case of jade, the raw material is heavy and difficult to quarry and transport (over 170 pounds of jade debitage were recovered from one production area) suggesting the need for coordination of import. At the same time, these large amounts of raw jade and pyrite debitage (the most found at the site) were located in nonelite domestic contexts, not easily controlled by elites once the jade reached the site. The procurement patterns could represent two possibilities: 1) that elites controlled the quarrying and import of jade raw materials and then redistributed them to domestic producers (although I would expect to find greater quantities of raw materials in Types I and II structures in this case), or 2) the artisans themselves may have been responsible for quarrying the raw materials, possibly because they had existing highland familial connections. Further osteological and ceramic analysis may shed light on these problems.

Either way, the raw materials of jade and pyrite have ritual value, but the esoteric and ritual knowledge needed to incorporate them into the political economy facilitated elite control and restricted use. The presence of large amounts of debitage in Type IV structures may indicate that elites may have been able to control production through the manipulation of restricted knowledge, technologies, and social prescriptions, very similar to Sinopoli's (1988, 1998) findings for Vijayanagara, India.

Complete finished products of jade or pyrite were not recovered within Types III and IV residences, suggesting that the producer was alienated from the product and distribution was controlled by the elite (Clark and Parry 1990). If the producer retained rights of alienation over the product, jade or pyrite finished products would be expected in caches or burials within these structures (as they were in Types I and II structures), which is not the case. Caches in Type IV residences/workshops do sometimes contain raw jade, but again, no finished products. Although this production occurred at varying distances from the palace (dispersed, not nucleated as Costin [1991] would argue for attached specialization), elites may have been able to alienate the producer from the product through a monopoly on ritual and esoteric knowledge (Barber 1994; Childs 1998; Costin 1998; Inomata 2001; Reents-Budet 1998).

The evidence suggests a segmented manufacturing sequence of prestige goods for the political economy in which residents in Types III and IV structures may have been involved with only the early stages of production of jade artifacts, such as percussion, sawing and drilling, while the more intricate final stages such as incising may have been carried out by residents of Types I and II structures. This type of segmented production of jade artifacts was also identified by Walters (1982) in the Motagua Valley workshop sites located directly adjacent to the Motagua jade source and has been recognized at other sites in Mesoamerica and beyond (Costin and Hagstrum 1995; Cross 1993; Urban and Schortman 1999). The lack of finished products in burial or other contexts in this mound group may suggest that the producers of jade were attached to elite patrons and alienated from the final product (Clark and Parry 1990), suggesting direct elite control, yet not in the form traditionally defined for "attached" specialization (e.g., Brumfiel and Earle 1987; Costin 1991; Evans 1978). The manufacturing sequence of jade at Cancuen may be reflective of the social structure and the social identity of the crafters (e.g., Dobres 2000; Dobres and Hoffman 1994; Lemonnier 1993), as it also corresponds to differences in architecture, grave treatment, and other material culture between Types I and II vs. III and IV structures.

The segmented manufacturing sequence of jade demonstrates the complexity of the economic system at Cancuen. This assembly line type of production is usually characteristic of *workshop industries* (e.g., Santley et al. 1989:109-110), in separate permanent state-controlled facilities. It is important to again reiterate that this production takes place in the household (not a separate workshop), and household production does not preclude complex economic and social relationships, or attached, elite controlled specialization (see also Feinman 1999).

Obsidian was also an exotic import, but is not considered to be a 'wealth' item in this study (see Rice 1987), although at times it played an important role in elite and nonelite ritual at the site. Obsidian blades were widely distributed throughout the site. Although core/blade technology (production of obsidian blades) does not appear to have been controlled by elites, as may have been the situation at Copan (Aoyama 1996;

although cf. Clark 2003) and other states like Tiwanaku (Giesso 2003). Distributions of obsidian sources were also fairly even throughout the site, again suggesting that elites did not have increased access to exotic obsidian, or at least that they were not controlling and redistributing certain sources. At the same time, the width of obsidian blades was significantly greater in elite residences, suggesting that they may have had more easy access to obsidian, or at least were not worried about procuring it, possibly because they were able to receive it through tribute or had the person power to obtain it when needed, not requiring maximizing behaviors.

Chert was a locally available resource accessible to all social statuses that was also evenly distributed throughout the site. Densities of debitage and tools do vary from household to household, which seems to be a function of production of tools for crafting rather than objects for exchange or tribute. Again elites seem to have had more access to large nodules, probably a function of elite power and prestige, but there is no evidence that nonelites were forced to use poor quality cherts, and elites do not appear to have redistributed chert resources.

The tools used in the production of jade, pyrite, obsidian, and chert were not exotic or necessarily state controlled. Most raw materials for tools were available locally, including chert and quartzite hammerstones, ceramic string-saw anchors, and quartzite pebbles from the river for abrasion, cutting and shaping. Quartzitic sand may have also been imported for these same purposes, as alluvial deposits near Cancuen were primarily mud and silt.

Organization and Social Relationships of Production

Production contexts at Cancuen and most other Classic Maya centers were domestic, along the lines of household industries as described by Peacock (1982) and van der Leeuw (1976), but it is important to note that domestic production does not preclude attached, large-scale, high-output specialized production (Costin 1998; Feinman 1999; Santley and Kneebone 1993; Sinopoli 1998; Wattenmaker 1994, 1998; Wright 1998).

Household production took place at many social levels and in many forms. Production was dispersed throughout the social landscape at Cancuen. Some of the specialized production may have been attached, for elites, but was not necessarily located in nucleated contexts near or directly in association with elite compounds (cf. Costin 1991). This dispersed pattern could still be characterized as attached because of elite control of ideology and sumptuary laws, which allowed control of production. Permanent features or workshops were not essential for elite control, and would have been expensive and unnecessary.

As Clark (1995) argues, at times there may have been no substantive compensation for this type of attached specialization. Reward may have been more in the form of relaxation of some social embargoes on status markers and occasional tax breaks or exemptions as Sinopoli (1988) found for the Vijayanagara of South India, which she classified as "centralized production," somewhere in between administered (attached) and independent production.

At the same time, specialists also produced utilitarian goods such as stone tools of chert and obsidian as independent specialists, some possibly producing for unrestricted local consumption (Costin 1991), or at times non-specialized household production.

Most households seemed to have access to core/blade technology, and access to chert, while less restricted, occurs in differential scales and outputs. Nonelite specialists may not have controlled the rights of alienation over some of their products, but they may have received some immaterial social rewards as discussed by Sinopoli (1988), or more material rewards in the form of prestigious exotic imported ceramics. Production of jade and pyrite are highly correlated with the presence of Chablekal Fine Gray, an imported fine ware from Palenque, possibly redistributed by elites or through independent trade (Kovacevich and Callaghan 2005; see also Chapter 9). Obsidian blade production, primarily from Chayal and Ixtepeque sources also is often found in conjunction with jade or pyrite production. These artisans were not at the bottom of the social ladder, they seem to have had more access to imported goods such as Fine Gray wares and figurines.

Producers in Types I and II structures, involved in the final stages of production of jade artifacts, demonstrated evidence of the control of the rights of alienation over those products in the form of plaques, headdress ornaments, and earflares. Most of these artifacts were recovered from burials and caches, attesting to the differences between the two statuses and/or identities of producers. Production by these elite artisans seems to have been similar to that described by Inomata (2001), attached but also independent, or possibly embedded specialization as discussed by Ames (1995) and also Janusek (1999).

Nature of Objects Created

Jade and pyrite were largely used to create prestige/ritual goods. Jade was used for plaques, beads, earflares, headdress ornaments, dental inlays, etc. Jade was an essential part of the ritual costume of the ruler, and sometimes a ritual tool (such as earflares, as argued by Taube 2005). The color and durability of jade represented the actual essence of life itself to the ancient Maya (Taube 2005; see also Chapter 4). Pyrite was used primarily for ritual mirror production, but also occasionally for beads and dental inlays. Pyrite mirrors were also used in ritual costumes of the elite, often emulating gods, and the mirrors representing portals to the underworld and pathways to communications with venerated sacred ancestors (Taube 1992a), but may have been used in domestic ritual. These objects were important to elite mobilization of both authoritative and allocative resources, hence the desire to control their production and distribution.

Obsidian and chert are both considered here generally to be utilitarian and ceremonial, although both were important to the Classic Maya elites and nonelites in mundane and ritual contexts, and could be used to produce ritual paraphernalia, especially for ritual bloodletting and also for warfare. The presence of chert eccentrics in all house types at Cancuen supports the existence of domestic ritual and the justification of a classification of these objects beyond 'utilitarian' functions. Import and/or production of these mediums does not appear to have been state controlled, as was also the case in the Postclassic period as described by ethnohistoric sources (see Sahagun 1952-1980: Book 9, Chapter 2).

Identity of the Consumers

The identity of consumers at Cancuen was mapped largely by finished artifact distributions, but also compared with production debris, tools used in production, and artifacts in various stages of production. Consumption patterns were compared between obsidian, chert, jade, and pyrite. This component of the investigation is important for assisting in the identification of attached or independent specialization, as well as status and/or social identity. Not only are presence/absence of things traditionally categorized as ‘prestige goods’ used to infer the status of the consumers, but relative frequencies of these goods used in combination with a number of other factors including investment and type of architecture, grave types, and grave goods. Restricted distributions of jade and pyrite finished products again suggests attached specialization, as opposed to unrestricted distribution of obsidian and chert. Identity of the demand crowd or consumer has traditionally been used to infer attached vs. independent production (Brumfiel and Earle 1987; Costin 1991). Attached production typically argued for a specific and restricted elite demand crowd, while independent production was argued to be for a general and non-specific demand crowd. In this case the identity of the consumers of jade and pyrite finished products appear to be elites (i.e., embedded specialization), who controlled the production and the distribution of these specific exotic materials (as opposed to obsidian and chert).

Relationships of Distribution

Studies have demonstrated that attached specialists can also work independently, while elites still derive wealth and/or power from the products produced (see Inomata 2001 and also Janusek 1999). Cancuen also seems to support this research with complex patterns of specialized production with domestic producers appearing to be attached to the state, producing prestige goods and at the same time independent, producing utilitarian goods. It is not only control of production that affords elite power, it is also control of distribution of the final product (Clark 1995; Smith 1976b). For Cancuen and elsewhere, a definition of attached specialization should include not only control over the production, but the distribution of the final product (Arnold and Munns 1994; Clark and Parry 1990; Costin 1996), because it is the distribution as well as consumption of prestige items by elite that reinforce power and prestige. The control over attached specialists can be afforded through mental and social processes, control of ideas, technologies, social laws and taboos (Baines and Yoffee 1998; Dobres 2000; Inomata 2001; Sinopoli 1998; see also Chapter 4).

The importance of control of distribution in Classic Maya economies is also expressed by David Freidel, who argues that this economic adaptation does not relegate the Maya to a lower level of sociopolitical complexity in a unilineal scheme:

> Superficially, the system would appear to be a simpler form of economic organization. Yet the range of products in Maya society is broad (Willey 1965), the magnitude of production is substantial, and the patterns of consumption reflect efficient distribution throughout the society. In brief, residential dispersion does not equal domestic autonomy among the Maya. On the contrary, vertical and horizontal economic integration in the face of residential dispersion must have required distribution systems for raw materials and finished products of great complexity and stability. Management of the economy by governments must have focused on control of distribution (Freidel 1981:377).

In many economies heavily dependent on ritual, the control of production of ritual goods does not promote the accumulation of material "economic" capital or wealth (Demarest 1992; Fox and Cook 1996; Sanders and Webster 1988). It is the concept of symbolic and cultural capital that was integral to the power base and success of Maya rulers (Bourdieu 1977). The use and control of ritual and ritual paraphernalia was a way of building symbolic capital, or more specifically what was in many cases cultural capital as it contained elements of an elite culture at times inaccessible to members of lower statuses (but still often grounded in earlier ideologies and traditions), and social capital in the form of connections and personal relationships with other powerful people. This social and cultural capital impresses and inspires peers and those of lower status, and can then be translated into political power, which affords elites the power to extract tribute in the form of labor. The labor extracted (for production of prestige items and monumental construction) was then further converted into symbolic capital in a cyclical manner. While Cancuen rulers would gain status and power from the gifting of prestige objects (many times inalienable possessions), the producers themselves may have been able to negotiate their status through their participation in the early stages of the production, and independent production of goods for exchange locally or regionally in an informal market. This type of market would coincide with Bohannan and Dalton's (1965:5) description of peripheral marketplaces where the "institution of the market-place is present, but the market principle does not determine the acquisition of subsistence or the allocation of land and other resources." Cancuen's strategic location may have created the opportunity for market exchange in the domestic economy, in which all households had access to basic commodities, as well as imported goods (Hirth 1998), while some of these households specialized in the production of goods to be traded (Sheets 2000).

According to Hirth's (1998) distributional approach for inferring market exchange from artifact distribution, market exchange may explain the even distribution of imported ceramics, such as Chablekal Fine Gray ceramics, as well as equitable distribution of obsidian from various Mexican and Guatemalan sources, easily attained by all social statuses in a market at Cancuen. While producers of jade plaque and earflare blanks would not have had the esoteric knowledge to transform them into meaningful ritual objects (Costin 1998; Reents-Budet 1998; Wright 1993), they would have access to large quantities of raw jade debitage not suitable for ritual good production and may have had the opportunity to produce beads for use as quasi-currency in a market. The symbolic value of jade would have increased its currency value (Freidel et al. 2002), and the lack of investment of esoteric knowledge in the production of beads may have allowed them to exist outside of sumptuary laws. Freidel (1993) also notes that jade, because of its intrinsic qualities, was probably both treasure and currency, crosscutting our western concepts of distinctions between the two mediums. This may have allowed these producers a measure of economic freedom to buy imported ceramics, other prestige goods, and/or utilitarian goods that would allow them to negotiate their status in the social hierarchy.

Conclusions

The type of production system of jade, segmented production with restricted technologies and restricted distribution of finished products is expressive of the social structure of Classic Maya society at Cancuen (see also Dobres 2000; Dobres and Hoffman 1994; Childs 1998). It seems that there were alternative systems of value for different goods and for different parts of the society. These valued items differed across structure types at Cancuen and may be reflective of different statuses, but most importantly different social identities.

Types I and II structures have similar material culture, and identified themselves with carved jade plaques, earflares, monumental construction, hieroglyphic inscriptions, and elaborate grave treatment. All of these markers (along with public ritual and legitimizing ideology) served to differentiate them from other social groups at the site. These symbols provided the authoritative resource base to extract allocative resources from others at the site. Those who seem to have provided that labor base seem to be residents of Types III and IV structures, who did not have the material culture markers listed above, but did sometimes identify themselves as crafters through the caching of the raw materials that they worked for elites. The material culture of these structures was more generally defined by more modest investment in construction and grave treatment, higher frequencies of Chablekal Fine Gray ceramics, higher frequencies of debitage and manufacturing waste, and figurines in burials. It cannot be definitively said that these residents represent a “middle class,” although the goods that they valued do seem to have been different from those in Types I and II structures. Types V and 0 structures to this point have not revealed evidence of large scale craft production and some of the other material culture identifiers associated with crafting in Types III and IV structures, but this may reflect social identity (including, kinship, ethnicity, etc.) instead of status. These differences may also represent the variation that occurred between status groups during the Classic Period (e.g., Marcus 2003; Palka 1997)

Elite public, communal ritual utilized many of the crafts produced at Cancuen (including jade plaques, earflares, and pyrite mirrors) and served to reinforce the power base of the elite. The control of production of those artifacts also further acted as a power resource for elites. Crafting at Cancuen was an authoritative and allocative resource of power for elites. At the same time, domestic ritual in Types III, IV, V, and 0 structures was also present, exemplified by chert Eccentrics, pigment grinding, incensarios, figurines, etc. The social identities of crafters also revolved around their participation in the segmented manufacturing sequence of these goods. Social identity was at once divided and unified by ritual and crafting.

APPENDIX A

ARTIFACT TYPOLOGY KEYS

GREENSTONE TYPOLOGY KEY

Structure Type

0. Undertermined, probably non-elite (non-masonry)
1. Elite, standing walls, corbelled-vaults
2. Elite, masonry platform, bench, staircase
3. Non-elite, earthen mound with stone retaining wall
4. Non-elite, earthen mound with stone laja patio floor
5. Non-elite, simple earthen mound

Type

1. macrodebitage
2. microdebitage
3. raw nodule
4. axe
5. axe fragment
6. bead
7. bead fragment
8. partially drilled bead
9. ear flare
10. undetermined worked
11. dental inlay
12. earflare fragment
13. plaque
14. plaque fragment
15. hammerstone
16. earflare counterwieght

Technology

1. shattered
2. pecked
3. polished
4. sawed
5. drilled
6. abraded
7. drilled/polished
8. drilled/polished/sawed
9. incised
10. incised/polished
11. incised/drilled
12. incised/drilled/polished

Cultural Context

1. humus
2. fill
3. wall fall

4. floor (int)
5. floor (ext)
6. midden
7. post-cultural deposition (natural soil)
8. fire pit
9. bench platform
10. backdirt
11. burial
12. looter’s trench

Color

1. dark forest
2. dark grey green
3. light green/white
4. grass green
5. light with imperial
6. apple
7. dirty green
8. light/bluish
9. light green
10. imperial
11. dark green/bluish

PYRITE TYPOLOGY KEY

Structure Type

0. Undertermined, probably non-elite (non-masonry)
6. Elite, standing walls, corbelled-vaults
7. Elite, masonry platform, bench, staircase
8. Non-elite, earthen mound with stone retaining wall
9. Non-elite, earthen mound with stone laja patio floor
10. Non-elite, simple earthen mound

Material

1. Pyrite
2. Hematite
3. Ceramic Mirror back
4. Stone Mirror back

Type

1. Nodule
2. Mosaic Piece (finished)
3. Mosaic Piece (unfinished)
4. Mosaic Piece (fragment)
5. Mirror Back
6. Mirror Back Fragment
7. Bead

Cultural Context

13. humus
14. fill
15. wall fall
16. floor (int)
17. floor (ext)
18. midden
19. post-cultural deposition (natural soil)
20. fire pit
21. bench platform
22. backdirt
23. burial
24. looter’s trench

OBSIDIAN TYPOLOGY KEY

Source
1. Chayal
2. Ixtepeque
3. San Martin Jilotepeque
4. Pachuca
5. Zaragosa (Black opaque)
6. Other (Describe)

Core Type
1. macrocore
2. perform
3. polyhedral core
4. exhausted polyhedral core
5. bipolar core
6. percussion core
7. nodule

Blade Part
1. proximal
2. medial
3. distal
4. whole

Blade Type
1. macroblade
2. small percussion blade
3. first series blade
4. final series blade
5. blade fragment (undetermined)

Flake Type
1. macroflake
2. flake (percussion)
3. rejuvenation flake
4. chunk
5. overhang removal flake
6. bifacial reduction flake
7. retouch flake
8. bipolar flake
9. pressure flake

Retouch

0. none
1. ventral
2. dorsal

3. bifacial
4. distal

Rejuvenation Type

1. proximal
2. distal
3. medial
4. platform
5. direct
6. lateral

Termination

1. feather
2. premature feather
3. hinge
4. step
5. overshoot (plunging/outrepassé)

Use

0. none
1. slight
2. moderate
3. heavy

Cortex

0. none
1. 0-25%
2. 25-50%
3. 50-75%
4. 75-100%

Platform Preparation

0. none
1. ground
2. scratched

Biface

1. whole
2. proximal
3. medial
4. distal
5. fragment

Specials

1. sequin (round artifact)
2. crested blade

CHERT TYPOLOGY KEY

Type

Debitage

1. Decortication Flake
2. Hard-Hammer Percussion Flake
3. Soft-Hammer Percussion Flake
4. Pressure Flake
5. Chunks
6. Shatter
7. Flakes with crushed platforms
8. Flake fragments
9. Potlid Flakes

Cores

1. Multidirectional
2. Unidirectional
3. Bipolar
4. Bipolar/Multidirectional
5. Flake/Blade Core
6. Pressure Blade Core
7. Fire Damaged Core

FORMAL TOOLS

Bifaces

1. Undetermined Biface-Thin
2. Ovate Biface-Thin
3. Undetermined Biface-Thick
4. Ovate Biface-Thick
5. Rounded Biface-Thick
6. Biface Preform
7. Elongate Biface-Thick
8. Elongate Biface-Thin
9. Eccentric
10. Shouldered Stemmed
11. Side-Notched Shouldered Stemmed
12. Tapered Stemmed
13. Rounded Tapered Stemmed
14. Triangular Tapered Stemmed
15. Corner Notched

Unifaces

1. Uniface on Flake-Thin
2. Uniface on Flake-Thick
3. Undetermined Uniface Fragment
4. Domed Uniface
5. Edge Flaked Round Uniface
6. Complete Flaked Round Uniface
7. Round Uniface-Small
8. Elongate Uniface
9. Uniface Preform

Blades

1. Macroblade
2. Crested Blade
3. Blade with Modified Distal < 1cm
4. Bipointed Blade
5. Blade with Modified Distal > 1cm
6. Blade with Rounded Distal
7. Blade with Multifaceted Dorsal
8. Fortuitous Blade

INFORMAL TOOLS

Flake Tools

1. Flake Modified to Point
2. Triangular Broken Flake Tool
3. Edge Modified Flake

Core Tools

1. Nodule Tool
2. Flake Core Tool
2. Edge Modified Nodule Tool

Whole/Fragmentary

Whole	0
Proximal	1
Medial	2
Distal	3
Undetermined end	4

Use

None	0
Slight	1
Moderate	2
Heavy	3

Cortex

None	0
0-25%	1
25-50%	2
50-75%	3
75-100%	4

Grain

Fine	1
Medium	2
Coarse	3

Material

Chert	1
Chalcedony	2
Flint	3

Color		**Munsell color**
1	Brown	(2.5Y 3/3, 4/2, 10YR 5/4)
2	Tan	(2.5Y 7/2, 7/3, 2.5Y 6/3, 6/4, 2.5Y 5/4)
3	White	(10YR 8/1)
4	Yellow	
5	Light Gray	(2.5Y 5/1, 5/2)
6	Dark Gray	(2.5Y 4/1)
7	Black	(7.5YR 2.5/1)
8	Pink	(10YR 8/1, 8/2, 7/3)
9	Red	(10R 3/4, 3/6)
10	Banded (Gray and White)	
11	Honey	(7.5YR 5/6, 5/8, 4/6)
12	Banded (Red and Gray)	
13	Gold	(7.5YR 7/8, 10YR 7/6)
14	Banded (Brown and Tan)	
15	Banded (Red and Tan)	

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