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The Organization of Chipped-Stone Economies at Piedras Negras, Guatemala

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ABSTRACT OF THE DISSERTATION

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The study examines patterns of chipped-stone production, distribution, and consumption during the Late Classic period at Piedras Negras, a medium-sized Maya polity located in the Middle Usumacinta region of the western Petén. The city center had a rich lithic tradition that crosscut spatial and temporal status boundaries. Most chipped stone goods made of obsidian and microcrystalline quartz were used in utilitarian capacities, but some were important in royal rituals, especially "eccentrics" (likely a type of god effigy), which were cached in temple and stela dedication contexts. This study is the first large-scale analysis of chipped-stone artifacts from this region, and one of the few carried out at a major Maya center that featured the full complement of Classic Maya culture traits: hieroglyphic history, royal palaces, the stela altar complex, and temple burials. Quantitative and qualitative data on technology, material type, use-wear, and in some cases, symbolism, were collected from nearly 10,000 chert and obsidian artifacts.

The sample was comprised of artifacts collected from the recent Piedras Negras Archaeological Project excavations and also the University of Pennsylvania excavations of the 1930s. Replication experiments were conducted to reproduce the local manufacturing traditions, and these data were used in the technological and symbolic aspects of the analysis. Ethnographic and ethnohistoric examples of ritualized production provided possible analogues for Classic Maya lithic traditions. Drawing from a combination of practice and economic theory, one of the main goals of the study was to examine the social role of craft production and craft producers in ancient Maya society. In particular, ideologies of production and the practice of ritualized production were theorized as important elements of the production and exchange of material capital, and the creation of symbolic capital. It was found that the system of production and exchange was inherently tied to symbolic and material capital, which had the effect of creating solidarity, at times, within the community through the ritual deposition of goods made by a number of experienced hands throughout the city center. The royal family at Piedras Negras attempted to control some forms of chipped-stone production, particularly obsidian and microcrystalline-quartz eccentrics used in royal rituals.

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CHAPTER 1

INTRODUCTION

Over the past three decades archaeologists have researched the economies of ancient Mesoamerican polities to better understand how governments gained wealth and influence locally and regionally (e.g., Clark 1987; Santley 1984). More recently, researchers have widened the scope of their studies to include household economies, the structure of inter- and intra-site exchange, and how production and consumption had a recursive effect on the creation of social identity (e.g., Clark and Houston 1998; Joyce 2000; Masson and Freidel 2002; Potter and King 1995). This study of Classic Maya Piedras Negras is directed toward the latter interests, but inserts the ruling elite into the equation as an economic force that interacted with the rest of the civic population (maximum population estimate = 2680; Nelson 2005:141). The relationship between chipped-stone workers and the royal family is of special interest, because it reveals how exchange, production, consumption, and individual identity changed through time. Close interaction between stoneworkers and the royal family suggests that political and economic "control" in the center was not a simple unidirectional economic process, but rather multiple socio-economic processes.

I created and tested four hypotheses about the nature of chipped-stone production and exchange at Late Classic Piedras Negras: (1) the production of obsidian and microcrystalline-quartz goods was restricted to a few residential groups; (2) production of microcrystalline-quartz goods was not connected to the production of obsidian goods; (3)

the royal palace had more access to production debitage than did other residential groups in the site; and (4) certain types of chipped-stone debitage had economic and symbolic value to royal and nonroyal inhabitants of Piedras Negras. I briefly summarize my findings as: (1) the production of microcrystalline-quartz goods was not restricted, while that of obsidian was restricted during certain time periods; (2) obsidian-blade production usually was associated with the production of microcrystalline-quartz tools (null hypothesis not rejected); (3) the royal palace had more access to production debitage if special deposits were included in the total, but not otherwise; and (4) specific types of obsidian and microcrystalline-quartz debitage had a symbolic meaning. I use these results to begin the task of reconstructing the organization of chipped-stone production and the practice of production at Piedras Negras (see Chapters 7 and 8 for a discussion of these results). I create a theoretical framework that can accommodate symbolic and economic elements of the chipped-stone economy in Chapter 1, and discuss general aspects of this theory, as well as the context of this study, for the remainder of Chapter 1.

Studies in the Maya area suggest that multiple economic systems were in play simultaneously, both within the same polity and between different political entities across the Maya lowlands. A review of recent literature on ancient Maya economics reveals that the organization of local economies may have differed as much between polities as their architecture and local religions did. In other words, the search for a Pan-Lowland economic system begins, but does not end, with the study of a single site or region. Research questions should recognize this heterogeneity and identify original elements of economic activity. The variation in local resources, political ties, and forms of production knowledge demand a detailed analysis of local economies that takes into account technology, material, use, style, quantity, distribution, and symbolic meaning, among others. In this way cross-site comparison may reveal regional patterns that change through time and space, as well as commonalities between polities that may have been overlooked in past studies.

In Maya archaeology the nature and existence of markets, class structure, tribute systems, gift exchange, and even production and consumption are heavily debated topics. Nevertheless, similarities between polities do appear to exist, for example, in the universal collection of tribute by the ruling elite. The socio-economic structures and practices of ancient Maya society appear to differ over space and time, and the plural nature of local economies is one likely origin of this variation. Rice (1987), McAnany (1995), and others have modeled a separation between elite and commoner exchange systems, and a tribute system based on land tenure and land ownership. The first system is concerned with the exchange of elite goods reserved for only one stratum of society, whereas the second system describes utilitarian items exchanged between commoners. A tribute system connects the elite to the commoners and their agricultural surplus through land tenure. Rice has argued that "rocks" and "pots" simply were not worth the time and effort of the ruler to control, but resource variability and specific historical contexts make this statement difficult to apply over the entire lowlands. This position begs the question, what rocks and what pots at what time? Determining what was controlled and what was not controlled, and by whom, is a difficult endeavor and one that has not been carried out with equal fervor in all areas of the Maya world. Furthermore, Clark (n.d.) recently argued that most studies intended to prove or disprove control over the production and exchange of chipped-stone goods, especially obsidian, have failed to construct tests that allow for a forceful argument in either direction.

I propose that redistribution, reciprocal exchange, and gifting were common economic practices associated with some chipped-stone goods at Piedras Negras. The present study explores gifting and its relation to tribute based on artifact distributions and production locales at Piedras Negras. Gifting can involve a symbolic element, especially when the goods being exchanged have a ceremonial function. Many chipped-stone goods at Piedras Negras fall into this symbolically-charged category because of how they were produced and the often iconic morphology of the goods, especially obsidian and microcrystalline-quartz eccentrics. I argue that the ideological and religious underpinnings of craft production were tied to the social identity of chipped-stone producers, those who used chipped-stone goods, and how those goods were exchanged (Hruby n.d.). Supply and demand, the basic tenets of the market system, are difficult to determine when symbolic aspects of production and consumption may have been as important as, or more so, than the actual materials used to make them.

Many models of ancient Maya economies are based on a purely economic perspective that emphasizes efficiency, high output, and competition. Increased productivity and the usual result of increased technological efficiency and change, however, did not occur in some Classic Maya crafting traditions. Although refinements in technology and style did take place in the lithic industries of Piedras Negras, a focus on the ideological elements of craft production appears to have inhibited large-scale technological change over a number of centuries. Inomata (2001:333) postulated an involutionary effect for elite craft specialization where crafting "involved elaboration and sophistication within essentially the same technological and organizational schemes" over time. I propose a similar scheme for lithic traditions of Piedras Negras in which a relative technological and morphological uniformity was maintained over time, partially due to the ideological nature of chipped-stone production. Competition between producers arose at times, however, because each group of crafters probably maintained their individual techniques and styles of production, as well as their esoteric production knowledge. The best evidence for competition comes from the Terminal Classic period just before the collapse of Classic Maya civilization.

This study suggests that competition may have existed between chipped-stone workers for royal favor and access to raw materials. The field for this competition may have been the manufacture of eccentrics for royal caches, and blades and flakes for bloodletting and burial events. In particular, I focus on obsidian-blade smiths and the imported cores they required to carry out their craft. Redistribution and gifting appears to be the best way to model the distribution of cores during much of the Late Classic period because of the small number of residential groups involved in production, low population estimates for the center, and unidirectional distribution of production debitage, especially obsidian eccentrics. The analysis of microcrystalline-quartz artifacts produced less definitive results, and production seems to have been a more widespread phenomenon due, in part, to easier access to raw materials (see Chapter 7 and 8).

The research presented here submits a mechanism whereby the royal family at times strove for control over craft production, craft products, and esoteric production knowledge. Drawing from the idea that craft specialization in the Maya area played an important role in social organization and the formation of individual identity (see Clark and Houston 1998), the relevance of this thesis moves beyond economic issues, to religious and political aspects of social organization. This perspective has implications for understanding how the ruling family attempted to exploit the "commoners," but also how people negotiated and manipulated local ideologies for their own benefit and the longevity of their own lineage or craft group. The proposed model attempts to avoid the use of hierarchical and heterarchical templates of social organization and instead posits more specific relationships between the ruling elite and the rest of the population by focusing on specific social practices.

1.1: THE SAMPLE AND THE ANALYSIS

Despite the large numbers of sites investigated in the western portion Maya Lowlands (e.g., El Cayo [Lee and Hayden 1989], Palenque [Johnson 1976], Altar de Sacrificios [Willey 1972]) very little is known about the production, distribution, and consumption of chipped-stone goods in this region. A combined ten years of excavations at the site of Piedras Negras, Guatemala provides an excellent lithic sample from royal and nonroyal contexts to expand our knowledge of this area. The chipped-stone artifacts of Piedras Negras represent a wide range of technologies, industries, and material types from throughout the Classic period (A.D. 250-900). Acknowledging the diversity in these technologies and materials can lead to more refined models of lithic economies. In many cases debitage resulting from the production of bifacial and core-derived artifacts is reduced to a single category of "debitage" in studies that focus on large Maya centers (e.g., Coe 1959; Moholy Nagy 1991, 1997; Willey 1972). Notable exceptions to this pattern include studies from northern Belize (e.g., Masson 2001), where debitage deposits are large, intact, and more systematically recorded (see Mallory 1984; Moholy-Nagy 1997 for a discussion). From a socio-cultural perspective, the analytical homogenization of chipped-stone artifacts has the effect of erasing a variety of ancient behaviors and denying the attribution of agency to the ancient craft producers. In this study I pay attention to subtle changes in production techniques through time. For example, the obsidian eccentrics at Piedras Negras shift from notched flake morphology to bifacially reduced, exhausted blade-cores over time. This observation has implications for understanding the economic parameters of obsidian eccentric production, but also social issues of style and symbolic content.

Small lithic samples, relative to Kaminaljuyú, Tikal, Colhá, and other sites, and a lack of production dumps at the site do not allow for a statistical analysis of product output for the ancient city of Piedras Negras. Instead, the location of unused flakes and production debitage is used to determine likely locales of lithic production per ceramic phase, a method similar to that created by Moholy-Nagy (1997) for Tikal. In addition, I also use the content of Piedras Negras caches, which were deposited in the most politically significant areas of the site, to understand the role of the ruling elite in the economic consumption of chipped stone. Exhausted obsidian blade-cores, biface-thinning flakes of microcrystalline quartz, and chalcedony-nodule fragments are a few of the mundane artifact types found in regal burials, temples, and caches. These artifact distributions suggest that the royal family at Piedras Negras had a keen interest, not only in microcrystalline quartz and obsidian raw materials, but also in the final products and the very process of their production.

It also is important to differentiate between chipped-stone material types because of their implications for outlining long-distance exchange networks, and local or regional procurement strategies. The most obvious categorical distinction used in Maya lithic studies is between microcrystalline quartz and obsidian, which is useful for designating a highland versus lowland origin for these materials. In addition, finer designations for microcrystalline quartz and obsidian material types can reveal distinct correlations between the qualities of those materials and the technologies used to reduce them (Aldenderfer 1991; see Chapter 5 here). However, some technologies can actually crosscut material type or quality, as in the case of microcrystalline quartz and obsidian blade-core industries (Hruby 1999). Ultimately, any lithic study that has the goal of locating specific technological traditions, as well as the residential groups in which those traditions were practiced, should account for most of the diversity in the archaeological record. A comparison of the frequency of these materials and their corresponding technologies may provide a more accurate picture of comparative value of chipped-stone goods.

1.2: OUTLINE OF THE STUDY

I begin this study with a review of relevant economic and social theories used in the Maya area and how they were, and are, applied to various archaeological datasets. A critical eye is turned to these previous studies with the goal of identifying gaps in knowledge, and places where an economic perspective could benefit from alternate forms of investigation and theoretical perspectives. Chapter 2 continues with a broader treatment of social identity and craft production. The general interest is in how economic activities are tied to social organization, ideology, and the formation of social identity. The role of ideology and religion in Classic Maya society is reviewed with special attention to the ways in which the state religion pervaded much of Piedras Negras society and how these may have integrated into craft producer ideologies. Finally, a synthetic perspective is submitted that seeks the middle ground between economic and social theories, and that can be applied fruitfully to Classic Maya archaeology. The intersection between economic activity, and ideology and religion, is argued to be an important aspect of ancient Maya economies and craft organization.

Chapter 3 situates the lithic craft producers and their technological traditions in the history of Piedras Negras. The historical changes in the ruling family are especially important for noting technological and symbolic changes in microcrystalline quartz and obsidian eccentrics through time. Previous artifact studies at Piedras Negras and the surrounding region also are described to highlight the differences between the present sample and other datasets. I further describe microcrystalline quartz (i.e., chert, flint, dolomite, etc.) and obsidian samples analyzed in this thesis and describe the methods whereby data were recorded. The hypotheses to be tested also are listed, and the basic assumptions used in the study are examined. These methods briefly are compared to those used in other lithic studies. In contrast to many other studies, a combination of artifacts found in households as well as royal-ritual contexts is utilized here.

The third, fourth, and fifth, chapters all address the most basic levels of analysis. Chapter 3 describes the geologic sources of the obsidian and microcrystalline quartzes used at Piedras Negras and their geographic relationship to the Piedras Negras population center. The sourcing methods also are described. Chapters 4 and 5 are concerned with the technological and morphological typologies used to categorize microcrystalline quartz and obsidian chipped-stone artifacts, respectively. A description of reduction techniques for Piedras Negras eccentrics also is included in both chapters.

I describe the distribution patterns of the chipped-stone artifacts across the site based on the data collected according to the above typologies. Chapter 7 presents a statistical analysis of the artifact distributions and tests the hypotheses presented in Chapter 3. Finally, Chapter 8 discusses the results of the tests, and the applicability of the theories proposed. An interpretation of the data and conclusions of the research are submitted. The connection between ideology, lithic technology, and economics is elucidated through concurrent patterns in lithic technology and archaeological context during the Late Classic period.

CHAPTER 2

THEORY AND MODELS

This chapter has a four-part structure that begins with a review of existing literature on ancient Maya economies. I use previous theories and models as a point of departure to discuss the ideological aspects of craft production, and occupation as an important element of social organization. I discuss the relevance of practice theory to understanding chipped-stone craft specialization, with a special focus on personhood and social identity. The chapter concludes with a synthesis of perspectives and a model for chipped-stone craft production at Piedras Negras.

2.1: ECONOMIC THEORY AND MODELS

The chipped-stone economy of the Classic Maya, the utilitarian aspect in particular, has been a topic of intense study by Mayanists for little more than two decades. Work relevant to the proposed research often falls in one of two largely opposing camps. One side of the debate contends that royals were not interested in utilitarian production and consumption (Masson 2001; McAnany 1992, 1993, 1995; Rice 1987), while the other sees a stronger role for kings in utilitarian economies (Aldenderfer 1991; Aoyama 1999, 2001; Moholy-Nagy 1997; Ross 1997). However, none of these studies has discovered control at all levels of a utilitarian economy (i.e., acquisition, production, distribution, and consumption). This apparent lack of control is important because the debate actually concerns whether or not there was any control of some aspects of utilitarian chipped-stone economies.

Further complicating our characterizations of utilitarian economies is determining what exactly "utilitarian" means. Obsidian, for example, can vary from a sumptuary good for elite consumption, to a ritual good for general consumption, to a utilitarian good for commoner consumption depending on political organization and social context (Rice 1987). Chert and other microcrystalline-quartz materials are assumed to be utilitarian commodities in almost all cases (McAnany 1992), because of their ostensible ubiquity in the Maya Lowlands. For ease of discussion I refer to the obsidian and chert economies as utilitarian economies, but with the recognition that major revision is necessary in extant conceptual and terminological dichotomies. Ultimately it is difficult to discern "control" over some aspect of an economy that is itself not clearly defined or understood. Regardless of some of these uncertainties, which are discussed at length below, the following sections review some previous models of chipped-stone and utilitarian economic organization with an emphasis on arguments for and against royal control of utilitarian production.

2.1.1: Models of Independent Lithic Economy

McAnany (1992a) made one of the strongest arguments for independent, noncentralized utilitarian production using data from the lithic-rich area of northern Belize (e.g., McAnany 1989; Shafer and Hester 1983). Following the argument that utilitarian craft production was independent of royal control (Rice 1987), McAnany

(1992a) maintained that utilitarian craft specialization usually occurred in households outside of royal jurisdiction. It apparently was not worth the time or effort of kings to control secondary, utilitarian production systems (McAnany 1992a:232). This view resembles that of Rice (1987:84) who argued that in Late Classic society "power rested in the genealogies of rulers, not their administration of production and distribution of utilitarian goods within their realm." Obsidian may have been considered more of a prestige good than chert (referred to below as microcrystalline quartz), but only because of the ubiquity of chert sources throughout the Maya Lowlands (McAnany 1992b:93). McAnany asserted that obsidian may have been traded as a prestige good under certain circumstances, but, like other elite sumptuary goods, it was not the primary mover in the political economy.

Drawing largely from a discussion of noncapitalist, class-stratified societies (Giddens 1981), McAnany (1992b:86-87) made a distinction between economic wealth derived from agriculture, and social power gained through genealogy. These two pillars of ancient Maya society allowed kings to establish rule over the population by legitimizing the primacy of their lineage, and by controlling arable land and the laborers needed to work it. Hypothetically speaking, elites could have gained social power by emphasizing blood-ties and control of esoteric religious knowledge, but did not have economic wealth (e.g., no arable land), and vice versa. The tension between these two forces accounts for much of the social structure and political history of the Classic Maya (see McAnany [1995] for a full explanation of the importance of ancestor veneration as an avenue to social power). In this model, however, there is little interest in the “technological-resource realm” for gaining economic wealth and social power. Chipped-stone production and other utilitarian crafts fall squarely in this category, and thus have little to do with the political economy.

For McAnany (1992b), the production of utilitarian chert artifacts in internally heterogeneous households exhibited some similarities to, and differences from, the production of sumptuary goods (e.g., carved jade). Like the production of sumptuary goods, utilitarian production was disconnected from the agricultural foundations of the economy. On the other hand, controlling the production and exchange of sumptuary goods was key in legitimizing social differentiation by royal families, while utilitarian production was not. The production of sumptuary goods was attached to elite households for the exchange and consumption by elites. Sumptuary goods of a ceremonial and ornamental nature were themselves not convertible to usable wealth or agricultural surplus, but were status markers often used in elite gifting strategies (McAnany 1992b:92; Moholy-Nagy 1997). The primary role of agricultural production and land tenure in the political economy underlies most arguments that downplay the role of utilitarian and sumptuary economies (e.g., McAnany 1995; Smith 1976). In sum, she described a tripartite plural economy[1], which was rather hierarchically organized: (1) the agrarian economy, which produced economic wealth and was based on land tenure and tribute to landholders; (2) the prestige economy, which produced goods that were emblems of social power; and (3) the utilitarian economy, which kept the system functioning, but produced no wealth or prestige.

According to this model, evidence for utilitarian production-activities should be widespread in both the core and periphery of site centers. Since access to resources and technical knowledge was relatively open, many households might have produced utilitarian goods to augment their trading capacity in low-level intra-site exchange. Evidence for the production of elite or sumptuary goods should be much more limited spatially, either to the royal household, or to a few residential groups within the site core.

Potter and King (1994) have written about a similar pluralistic economic system that was organized heterarchically and not hierarchically. Heterarchy, which subsumes hierarchy, is a model of social organization that takes into account vertical and horizontal differentiation in social organization (Crumley 1987; Potter and King 1994:17-18). The elites controlled production of highly valued ritual items, but utilitarian production was of little of interest to them. Sumptuary goods were made by tethered specialists who worked for royal families in the interest of gaining prestige. Using data from throughout the Maya Lowlands, but especially from Belize, Potter and King proposed that elites did not control utilitarian production, and that smaller city centers exploited various geographic zones for their natural resources beyond the watchful eye of the royal family. Aside from the rich data they collected from the eastern Maya Lowlands, they used three major examples from Tikal, Palenque, and Copán to argue that major city centers were consumers rather than producers of utilitarian craft goods.

Potter and King (1994) dismissed production debitage found in construction fill at Tikal (later elaborated upon in Moholy-Nagy 1997) as being significant workshop debris because the number of artifacts per meter is substantially lower than those from Colhá and another chert production locale, Xkichmook. For Palenque they noted that most of the clay sources used to make utilitarian ceramics were not of local origin (Rands and Bishop 1980), and at Copán they cited a large obsidian workshop found in the periphery instead of its center (Mallory 1984). In short, heavy utilitarian production in the hinterlands marks no interest, no control, and consequently no wealth. In making their argument against large-scale economic control, however, Potter and King overstated their case at the expense of understanding the economic structure of more complex city centers[2], such as Piedras Negras.

Lower rates of production debris in complex centers may mean that utilitarian items were indeed produced in these centers, and that royal groups were interested in the production of these utilitarian goods, but that the rates of production were lower due to relative demand and access to abundant raw materials. Although Colhá, for example, can easily be characterized as a large, if not the largest, natural chert outcrop in the lowlands, it should be noted that most complex centers in the Maya Lowlands, such as Tikal, Piedras Negras, and Xultun were located on or near substantial microcrystalline-quartz sources. In other words, Colhá should be considered as a special case, but perhaps in terms of scale and not organization. Furthermore, it is still unclear how production refuse at more complex site centers was disposed of and distributed, especially at sites located along rivers. These factors suggest that much work remains in outlining the role of utilitarian craft production in Maya centers of varying complexity. Furthermore, the socio-political organization of large and small sites is still little understood.

In another paper King and Potter (1995) discussed the organization of production at Colhá, noting differences between the Preclassic and the Classic periods. Using a heterarchical model once again, they argued that the chert craft specialists had a special role in Colhá society (see also Masson 1989). A Preclassic example of ritualized chert production suggests that chert crafters may have had an elevated status in society. The control of resources and technological skills indicates either that the ruling elites may have also been chert specialists, or that nonelites were involved in royal rituals (King and Potter 1995:81). This interesting observation slightly contrasts with their earlier thesis, that elites from major political centers did not control chipped-stone production and that the production of lithic goods was of little interest to them. If chipped-stone craft specialization conferred status on producers at Colhá, then why, by virtue of size or complexity alone, should other sites, such as Tikal or Piedras Negras, not be viewed in a similar way? Their argument suggests that scale alone determined the importance of a particular form of craft production.

Although agricultural production and labor appear to have led to greater wealth and power than utilitarian craft specialization, the importance of craft specialization in social organization cannot be left out of the equation. It is possible that individuals played many roles in society, as craft specialists, as well as landowners. Occupations such as craft specialist and other types of specialists (e.g., religious specialists), could have had real effects on the creation of social power, but also as political avenues to agricultural wealth. King and Potter (1995:83) made a similar point, stating "[Colhá] inhabitants carried out diverse activities, including chertworking and . . . the organization of these activities may in turn have given rise to first-echelon social differentiations within Colhá society."

As I discuss in Chapter 7, chipped-stone production occurred on the acropolis at Piedras Negras (quite literally, the royal seat of power) and chipped-stone goods were the most common materials used in royal ritual deposits. These patterns suggest that craft specialization may have been inextricably tied to the political economy, in more or less significant ways, and should not be factored out of large or small-scale economic models. Instead of asking whether royal groups controlled utilitarian production, a more fruitful set of questions would ask: how did the ruling elite influence utilitarian production, and what role did utilitarian production play in social organization? The road to land tenure may have been a winding path that went beyond the legitimization of one's ancestors (cf. McAnany 1995). Ultimately, one must ask the question: at what scale and type of social organization did utilitarian craft production become important to political power? Kazuo Aoyama addressed some of these concerns and also the chipped-stone economy of Copán as reconstructed by Mallory (1984).

2.1.2: Models of Dependent Lithic Economy

Aoyama (1999, 2001) made a forceful argument for royal control in utilitarian economies with evidence from the obsidian-rich lithic sample found at Copán. He asserted that the control of polyhedral-core distribution, through direct access to the source, was an important factor in the rise and maintenance of complex societies. Specifically, the centralized control of blade-core distribution augmented and maintained political power at Copán. For Aoyama (2001), the significant scholarly divide existed between opposing models of the Classic Maya state. Some researchers see the regional state capitals as "the urban loci for administered economies," while others believe Classic Maya states had "weak economic functions and that their power was heavily based on ideology" (Aoyama 2001:346). The distribution of cores to selected households in the Copán region created, strengthened, and maintained political relations of subservience to the Copán state.

Other studies suggest more centralized control of lithic economies. In the Petén Lakes region, Aldenderfer (1991:138) found that higher levels of lithic production took place near larger political centers than in their hinterlands. The systematic patterning of obsidian artifacts was attributed to the control of its distribution (Aldenderfer 1991:139). At Tikal a high degree of elite and royal interest was noted in both the distribution of obsidian cores and in blade production (Moholy-Nagy 1989, 1997). Lithic evidence from Tikal shows that nonceramic artifact production and use within a major Classic Maya city was quite complex (Moholy-Nagy 1997). Moholy-Nagy (1997:308) viewed chipped-stone production as closely tied to elite demand, and that there was a "more flexible relationship between attached and independent production than is proposed in the literature." Royal or elite intervention in the distribution of obsidian has also been argued for the Naco Valley (Ross 1997). However, the intended goal was not political dominance through the control of production, but rather to "perpetuate social inequalities" through the distribution of obsidian cores.

Most of these studies are somewhat vague as to what "control" actually means (see Clark n.d.), and as a result most of them have a tendency to speak past one another. The analytical techniques and methods also vary, which in combination with various assumptions about the definition of elite and spatial relationships with elite households, results in contrary conclusions even at the same site (cf. Aoyama 2001; Mallory 1984).

2.1.3: Summary

Knappers in the independent model reacted to their environment and carried out their craft largely as a response to subsistence needs and the demand for everyday agricultural and household tools. The ruling elite did not appear to be interested in managing these kinds of production as long as it produced the desired result: agricultural wealth. McAnany (1992b) went further by characterizing utilitarian producers as largely nonelite attached specialists who, through no access to arable land, became subservient to heads of heterogeneous households. This focus on agricultural production and wealth had the effect of overshadowing other forms of production that may have been more socially valuable in the context of the Classic Maya center, and possibly elsewhere. What remains is a rather simplistic view of social organization that consists of the "haves" and the "have-nots".

King and Potter (1995) brought up two issues, which are central to this thesis (i.e., the symbolic nature of production and the organizational importance of craft production); however, their focus remained on agriculture as the driving force in social organization. The reactionary nature of knapper agency in these independent models of chipped-stone crafting emphasizes the heads of households as economic entities striving for control of land and labor, but de-emphasizes the implications of craft specialization on social organization. Most research that attempted to demonstrate the lack of royal interest in utilitarian craft specialization was a reaction against studies that overstated the importance of chipped-stone production in the political economy of Mesoamerican states (e.g., Santley 1984). Understanding the nature and organization of chipped-stone specialization was not necessarily the goal of these works, but rather to show that Mesoamerican kingdoms did not rise in power by controlling tool production alone, or even primarily. The ruling elite and the nature of their rule remained an unspoken focus of the study. Since chipped-stone production was not found to be the prime mover in the political economy, alternative ways in which crafting could have structured and influenced the political economy were not thoroughly explored.

The dependent model emphasizes the agency of the king, who controls the raw materials necessary for the production of utilitarian goods. In these examples the royal family influenced some forms of craft production and distribution if it expanded their legitimacy and social power. Thus, royal influence and control penetrate into the technological-resource realm discussed by McAnany. The symbolic importance of the knapper and the production process was considered, but there was little explanation of how craft producers (i.e., stone knappers) fit into society, or the exact mechanism of exchange between the king and the producer. In one sense, both models argue the same point, that the agency of the ruling elite was primary in determining what materials were socially valuable. Although this proposition could have been more or less true, one consequence of this perspective is that the socio-economic mechanism of interaction between various players in Maya society is often overlooked or reduced to broad, nonspecific terms.

Regarding the problem of royal control over utilitarian economies, it is proposed here that neither of the above perspectives is entirely wrong, but rather, each case illuminates local patterns in areas that had unique access to resources, political history, social organization, and religious expression. It is possible that control of any economic system could have changed through time, because many Classic Maya polities had unstable political fortunes with very real effects on material expression (e.g., art, architectural, and writing style). Ultimately, royals were interested in so-called utilitarian economies, and probably what most Westerners would consider mundane natural elements, but the degree to which they manipulated them was contextually dependent. Some materials may have had more intrinsic value than others, but again, local conditions influenced how a material was valued at any given time. This is not to say that the ruling elites were the only factor in determining meaning and value of goods and producers. Local conditions include forces outside of elite purview (e.g., nonelite religious beliefs and large, openly accessible natural resources) and ultimately stem from a combination of social and environmental factors that may not have been connected to the extant, burgeoning, or declining realm of kingly power and influence. It is thus important to reconstruct, as much as is possible, the history of relative value per site, before making general statements about the role of any material type in Maya society (Mitchum 1981).

2.1.4: Previous Studies as a Point of Departure

The pluralistic economies proposed by King, Potter, Rice, McAnany, and others do indeed have validity, and it is clear that utilitarian production did not have the same impact on the political economy as did agrarian production. To say that utilitarian production had no relation to the political economy is an overstatement, however, and one that has been successfully investigated by Aoyama and Moholy-Nagy. I have also pointed out that the political economy concept, as McAnany (1992b) used it, is a powerful analytical tool in that it locates the basic parameters of social and economic reproduction, but it is too simplistic to reveal the complex, often messy, workings of socio-economic process. In these studies craft producers were either in or out of royal favor, were either attached or independent specialists, and either controlled esoteric production knowledge or did not. Although the royal family was the major force at ancient Piedras Negras, and their demand for products had a great effect on how goods were produced and distributed, I attempt to illustrate the possible roles chipped-stone producers played in structuring their niche in the political economy.

In the case of obsidian-blade production and producers for example, the boundaries between utilitarian and ceremonial, elite and commoner, and so forth are fuzzy and often lead to simplistic or incorrect interpretations of Lowland Maya political economy. The present study attempts to bring more specificity to our understanding of the role of craft specialization in Maya political economy and society. It must be noted, that I focus on Piedras Negras chipped-stone production and consumption, and am not attempting to make steadfast claims about the organization of the entire Maya world. This study is but one more building block towards a broader understanding of the Maya area as a whole.

A focus on practice, symbolism, ideology, and technology can broaden our understanding of what value, demand, and preference structure may have looked like for certain areas of the Maya Lowlands (see Section 2.3). In many cases "control" is simply too vague of a word, and with the plethora of data now available from the Maya Lowlands it is possible to reconstruct previously un-hypothesized elements of the economy. At Piedras Negras, kings were definitely interested in "utilitarian" economy, but in what ways, and to what extent they influenced the production and distribution of various kinds of goods is another matter (see Chapters 6 and 7).

Given the possible liminal status of chipped-stone producers in the Maya Lowlands, as both elite craft specialists and as utilitarian producers, the recently postulated importance of ideology in elite craft specialization requires us to investigate the role of ideas in Maya craft-specialization (e.g., McAnany 1992b; Reents-Budet 1998; Inomata 2001). By liminal status I mean that chipped-stone producers, the materials they used, and the objects they produced all crosscut status boundaries. The fact that nonroyal residential groups feature production evidence of utilitarian and ceremonial items, consumed by royals and nonroyals alike, indicates that their social roles were multifaceted[3]. Another part of this study tests the idea that some aspects of chipped-stone production were ideologically loaded and that some chipped-stone producers controlled esoteric production knowledge (see Chapter 1). <u>Esoteric production knowledge[4]</u>, as I use it here, describes the local reduction-techniques and strategies for the manufacture of chipped stone, and also the religious and ritual component that may have accompanied it, especially in the production of eccentrics for royal consumption. Consequently, Section 2.2 outlines some definitions of world view and ideology used in anthropological and archaeological literature and how those might be connected to craft production.

Before we depart into a discussion of the role of ideas and symbols in the organization of production at Piedras Negras, I take issue with a few basic concepts used in the past by McAnany (1989; 1992a; 1992b; 1995). My intention is to show how many of the concepts she has used throughout her publication history are used differently in this study. First, she viewed Classic Maya society as a two-class system, which is not necessarily a demonstrated fact of ancient Maya social organization (see Chase and Chase 1992). The concepts of elite and nonelite (i.e., the upper- and under-class) are loosely used without providing a firm definition and archaeological corollary to illustrate this basic distinction. I am not criticizing class analysis here, but rather am pointing out that the elite/nonelite dichotomy is difficult to apply to all Maya centers, especially since they vary widely in size and political organization through time and over space. However, I do not offer a better framework for categorizing status here. Here I avoid using the elite to nonelite distinction as much as possible, by focusing on the royal family as a distinct social group, which contrasts with the rest of the population. I do not make any outright assumptions about the comparative wealth or status of the residing population. This distinction has the effect of bringing the analytical focus on the ruling elite to the household level, and as one of many players in ancient Maya society. It also avoids the problem of how to characterize the various statuses of households at ancient Piedras Negras, and I do not try to accomplish this feat here.

McAnany (1992b:88) also used a very narrow definition of political economy that she briefly defined as the "appropriation of a stimulated surplus or corvee labor," which is inherently connected to a two-class system. I prefer a broader definition that characterizes the political economy as those aspects of the economy for which laws and regulatory policies are recorded or written. The political economy, then, describes all economic activities that have an effect on political organization and power. This perspective allows the researcher to move beyond discerning who had land and who did not, and attempts to look at the structure of intra-site political, social, and economic relationships. Since a goal of this research is to study social organization, then a two-class structure and a narrowly defined political economy do not offer many avenues to understand the complexity of occupational specialties and the many roles of ideology in society.

McAnany (1995) argued that her model of social power and economic wealth successfully integrates the social, political, and economic elements of society, but the social element of the equation remains under-theorized. I envision, and also discuss in Section 2.4, rather two basic organizational principles in the Classic Maya center. One is based on kinship (e.g., ancestor reification, blood ties, and fictive kin relations) and is clearly elaborated by McAnany (1995) as a means to social power, and the other based on occupation, which would overlap her bi-partite characterization of the political economy (i.e., social power and economic wealth). The occupational aspect of social organization is not necessarily tied to the kinship system, but can be derived from a variety of means, such as apprenticeship, inheritance, and even by divinatorial or calendrical means. The occupational system of organization, which I call the oficio[5] system for the Maya, describes what people did in society and largely determined their personhood and social identity through their activities (see Section 2.4). At times occupation overlapped with status distinctions, and occupation could be used as an avenue to prestige, wealth, and power positions. I do not propose that chipped-stone craft specialization, for example, led to political power and land ownership, but rather that a combination of kinship (i.e., inherited status and wealth) and oficio (i.e., often skill-driven, largely uninherited status and prestige) were the key to integrating all groups in society, and was also a source of competitive tension between social groups.

From a Marxist perspective, this view of Classic Maya social organization served to differentiate the "elite" class from the "nonelite" class by introducing hegemonic (uncognized or nondiscursive), and more ideological forms of oppression, which allowed the population to be satisfied with its role in society. Like true hegemony itself, which may never have existed during the Late Classic period, the occupational system could have been a means to naturalize difference in society. Alternatively, outside of a hegemonic situation, the oficio system may have provided a field in which to compete for and gain political and economic capital. After all, most people in modern and ancient Maya society had an occupation, be it flint-knapper, potter, weaver, cook, farmer, landscaper, architect, scribe, sculptor, religious specialist, ajaw (literally, "he who speaks"), mid-wife, hunter, wood-worker, warrior, and many others. Many people could, and probably did, have multiple occupations. Some of these occupations are directly connected to high status positions that were often inherited, but others crosscut status boundaries, and chipped-stone specialization may have been one of these occupations (see Section 2.2 for a full explanation).

Finally, the model proposed by McAnany does not entirely account for how new households were created. New households and lineages were begun in previously unsettled areas (McAnany 1992:86), or living family members inherited old households. As we know from the glyphs, however, lineages were often replaced, even at the dynastic level, and how this was accomplished is not well known. Usurping foreign dynasties and pretenders to inheritance are often used as explanations, but internal political shifts also played a significant role in the transfer of power when the inheritance system broke down. This eventuality undoubtedly happened in the case of dead lineages, but competition for land also likely occurred in other ways. How were these politics played out in creation of new households, lineages, and dynasties? I propose that one locus for social change, competition, and the legitimization of land ownership could be occupation; the prominence of scribes at Copán and chert-workers at Colhá are a few examples of how occupation can lead to social success. One way of legitimizing one's craft as socially significant is by emphasizing the ideological origins and religious nature of that craft (see Section 2.3). I am not proposing a Mesoamerican version of the European guild system here, but the analogy points out some possible bonds between members of a particular craft oficio, and how those bonds could have been a source of socio-economic power (see Section 2.4).

2.1.5: Bourdieu and the Role of Practice Theory in this Study

Practice theory, as initially laid out by Pierre Bourdieu (1977), is useful for examining the relationship of ideas to action and material as mediated through practice. The study of the practice of production creates new ways to look at how producers related to their work, and how others in society may have viewed and related to those practices, especially in the attribution of status and the exchange of material products. One benefit of practice theory perspective in archaeology is that the structure of socio-economic relationships are not assumed and are not based on an existing definition of craft-producer categories, as attached, independent, or otherwise. Instead, the focus moves to how craft producers produced their goods, and how those goods were distributed and used. The previously mentioned concepts of ideologically-loaded production, and esoteric production knowledge, also require a symbolic analysis of practice that is not accessible using extant economic models.

I believe ancient Maya craft production and exchange had a heavy symbolic content. Giving tribute, carving and painting stelae, and making eccentrics for caches, for example, were tied to Maya world views that partially structured how these practices were carried out. I discuss some of the evidence for the symbolic nature of social organization for the Maya in the remainder of this chapter. The reconstruction of production and exchange systems for chipped-stone goods requires a consideration of these symbolic elements. A focus on practice, and especially the concept of symbolic capital (Bourdieu 1977), allows the researcher to figure the value of symbolism in the production and exchange of material items. Since the value of goods depends on demand for them, but also the status of who made those goods, who exchanges those goods (see Mauss 1990:8), and on social norms regarding the use of those goods, it is impossible to create a complete economic model that does not account for these symbolic and cultural elements.

Symbolic capital, albeit too general a concept in many ways (see Wacquant 1993), provides a useful tool for conceptualizing some of the symbolic side of ancient Maya economies. Although Bourdieu (1977:172) argued that the symbolic and cultural elements of economic exchange to be a mask on "economic realities," I tend to see the symbolic nature of production and exchange to be integrated with, and thus not separable from the movement of material through society (see Dobres 2000). Economic realities did not always exist apart from the symbolic and cultural elements of production and exchange. In other words, I do not agree with the Marxist strain of thought that runs through much of Bourdieuvian theory, which focuses on ideology as a means to exploitation and inequality (see Section 2.2).

Other aspects of practice theory that are useful for examining the symbolic nature of economics are doxa, heterodoxy, and orthodoxy (see Section 2.3 for further discussion). These ideas are useful for conceptualizing the degree to which social practices are carried out discursively, and how those practices related to economic and power relations. For Bourdieu, doxa, or doxic experience, describes those practices that are carried out nondiscursively, and by virtue of the unconscious, playing out of daily routines, the status quo of inequality is maintained. Inequality exists in the social relations between those in positions of dominance, and those who do not realize they are in a less advantageous socio-economic situation, or simply do not wish to change or challenge the status quo. At times, doxic dispositions are realized, challenged, and brought into social discourse. Contestation is then created between those who seek higher status and economic wherewithal, and those who have it. Bourdieu called this dynamic a field of cultural production.

In the field of cultural production the dispositions and practices of the "Newcomer" are considered to be heterodoxic, and those of the dominant individuals, orthodoxic. Bourdieu (1993:83) described this relationship with an example of the French art market, which opposes small producers to large commercial enterprises.

> Those in Dominant positions operate essentially defensive strategies, designed to perpetuate the status quo by maintaining themselves and the principles on which their dominance is based. The world is as it should be, since they are on top and clearly deserve to be there; excellence therefore consists in being what one is, with reserve and understatement, urbanely hinting at the immensity of one's means by the economy of one's means, refusing the assertive, attention-seeking strategies which expose the pretensions of the young pretenders. The dominant are drawn towards silence, discretion and secrecy, and their orthodoxic discourse, which is only ever wrung from them by the need to rectify the heresies of the newcomers, is never more than the explicit affirmation of self-evident principles which go without saying and would go better unsaid. 'Social problems' are social relations: they emerge from confrontation between two groups, two systems of antagonistic interests and theses. In the relationship that constitutes them, the choice of the moment and sites of battle is left to the initiative of the challengers, who break the silence of the doxa and call into question the unproblematic, taken-for-granted world of the dominant groups. The dominated producers, for their part, in order to gain a foothold in the market, have to resort to subversive strategies which will eventually bring them the disavowed profits only if they succeed in overturning the hierarchy of the field without disturbing the principles on which the field is based. Thus, their revolutions are only ever partial ones, which displace the censorships and transgress the conventions but do so in the name of the same underlying principles.

Thus, heterodoxy describes those dispositions and practices that challenge the norm, which represents nondiscursive practices (i.e., doxa). Orthodoxy is those dispositions and practices that are carried by people in a position of dominance.

Eagleton (2005:270) criticized the naturalized ideas and practices denoted by doxa, and argued that doxa did not leave room for more cognized aspects of everyday practice that nevertheless legitimate the existing social relations. Bourdieuvian theory does not describe how multiple positions can be held simultaneously by a single individual, or how different points of view are expressed in many ways by a number of individuals in the same group. It appears as a Marxian dialectic of class struggle. In the passage above Bourdieu hints at this struggle by creating a dichotomy between those in power and those who want it. Other situations can be more complex wherein many individuals, with different personal ideologies, vacillate between discursive and nondiscursive practice, and who "challenge" or do not "challenge" the established order in a predictable or group fashion. The Bourdieuvian model, however, remains a useful hermeneutic device for understanding the ways in which discursive practice can interact with existing, possibly dominant, doctrines. I do not see every action as a conscious or unconscious attempt to secure material or symbolic capital (i.e., ultimate economic benefit). Instead, the framework discussed by Bourdieu describes the possible ways that economic reality can be changed through discursive action and also how rare this might be.

For the ancient Maya the symbolic aspects of production and exchange were emphasized, not simply as a cosmological framework for crafting practices, but also to effect some kind of result or gain. In these instances practices are brought into the heterodoxy, whereby a craft is elevated to discourse and enters the realm of competition in a field of production. Symbolic and cultural capital achieve a special importance in the production and exchange of material goods when heterodoxy exists because the symbolic aspects of value can be manipulated. The doxa/heterodoxy/orthodoxy distinction is useful for conceptualizing the way in which practices can become more or less discursive, but not necessarily the structure of power relations in the society.

When ideas and practices are more directly related to power, and not simply uncontested (or relatively so) doxic experiences, then further conceptual tools are needed to describe the realm of ideas. In the following section I describe some of the differences between world view and ideology as ways of describing the role of ideas in society. These concepts are useful counterparts to doxa, heterodoxy, and orthodoxy for explaining the relationship between practice and power.

It appears that Bourdieu believed that his theory of doxa would effectively remove the need for a theory of ideology, a term which he believed was vague and misused (Eagleton 2005). Ideology, however, brings the focus of analysis to the individual, as personal ideology, and differentiates it from world views, which constitute doxic representations of the natural and supernatural world.

2.2: DEFINING CATEGORIES OF IDEAS

Rising interest in practice theory and recent debates on the role of agency in cognition, learning, and intentional action demands that social theorists clarify the definitions of ideas they use in modeling social organization. World view, ethos, ideology, hegemony, and similar concepts are often used unproductively in archaeological interpretation because they are not clearly related to one another in a coherent theoretical framework. Although these concepts do overlap, their relationships to one another remain unclear, and their usefulness questionable, especially in the face of practice-theory frameworks. World view and ideology are important to this study because it is proposed that ideas were an important aspect of ancient Maya technologies and crafting traditions, and hence, economy. Ideologies and world views not only situated craft production in social meaning and identity, but also added value to the finished products of crafters. Thus, when constructing socio-economic models of production, exchange and value, these categories of ideas should be clearly defined.

Social scientists have created and used definitions of world view, language, ideology, and hegemony in ways that reflect their own theoretical frameworks and research agendas. The result has been a plethora of definitions, overlapping categories, and confusion, especially when cross-cultural studies are undertaken. Of particular interest are the concepts of world view and ideology, because they explicitly or inexplicitly contrast rational conscious action with less cognized forms of action. The world view concept, though often not clearly defined, usually is used to describe unquestioned and widely held indigenous philosophies, while ideology often refers to ideas created by individuals and groups as a force in power relations. An uncritical use of world view concept tends to marginalize the role of the individual, and coordinated individual actions, in the production, erasure, or maintenance of a world view. On the other hand, ideology has been more broadly defined category, ranging from ethnophilosophy, cosmology, and religion (cf. world view), to ideas used by the ruling class as a means to mask and perpetuate social inequality from the masses (cf. hegemony).

Differences in categorical meaning and definition originate from long held debates concerning the relative importance of idea versus material in determining the structure of past and present societies. A practice theory perspective emphasizes the role of ideology and world view as sets of commonly held views produced and maintained through everyday activity. Socio-cultural reproduction is brought down to the level of the individual, but also groups, fields, and classes of individuals struggling for success in their own society. In these frameworks ideology is often freed from a purely functional role as an instrument of the ruling class, and calls into question the utility of the world view concept. The role of power and rational action in world view and ideology is central to the reconsideration of these concepts.

2.2.1: World View

According to Geertz (1973:89), world view is the "picture a people have of the way things in actuality are, their most comprehensive ideas of order." It can extend to the general structure of the universe, how the world was created, and how society is structured. Geertz (1973:89) contrasted world view with the idea of ethos, which he described as "the tone, character and quality [of a people's] life, its moral aesthetic style and mood." For Geertz, these are the norms and ethic considerations of a people, while world view encompasses more metaphysical concerns. However, ethos and world view can overlap through religious and social practice, confirming that "ethos is the approved style of life and world view is the assumed structure of reality" (Geertz 1973:125). Through practice, the self is situated "correctly" in the world, but Geertz pointed out that that this process is often not reflected upon and world view and ethos usually fall into what Bourdieu termed as doxic knowledge or experience (i.e., taken for granted as true).

Kearney (1984) outlined a much broader definition of world view as an ethnophilosophy, and as a concept, which encompasses ethos and world view (see Geertz 1973). This version of world view sees individual moods and the perception of self as part of a continuum in line with the cosmological understanding of the structure of the world. For Kearney, the foundation of world view is a relationship between the 'self' and 'other,' as part of world view universals. The world view framework proposed by Kearney can be related to what Bourdieuvian (1977:169) concepts of habitus, doxic experience (i.e., describable, but not necessarily reflected upon in practice), but also heterodoxic knowledge, which may be argued or contested beliefs.

The world view concept is a nuanced and textured category that reflects a body of both doxic and heterodoxic knowledge, perhaps best differentiated by Silliman (2001) as practical politics. Practical politics describes the grey area between doxic and heterodoxic experience where world view is cognized and used for small-scale personal gain or negotiation. Although the model of beliefs proposed by Bourdieu (1977:198), doxa/heterodoxy/orthodoxy, is useful for describing cognition in social practice, it cannot stand alone as a descriptive device for different kinds of ideas. These concepts have a tendency to remain vague, and are difficult to related to larger movements of social change. Sommer (2001) recently stated: “we need to work at developing the link between agency, identity and structure, and the general processes of social development.”

Of key interest is the theoretical depth of the world view concept, which posits relationships between the conscious and subconscious thought. Kearney (1984) investigated how world views are contested in California Indian and Zapotec cultures in the face of colonial powers. He posited that everyday practices are a platform for class struggle, and that world view can be a political tool if it is brought into the consciousness of actors and is used as a way to contradict orthodoxies enforced by colonial or state rule. Similar to the overlapping nature of ethos and world view, the introduction of power and politics reveals how ideology and world view share common ground.

2.2.2: Ideology

Ideology, which overlaps conceptually with world view, appears to be a well-suited category to deal with reflective thought more directly related to power and wealth. Ideologies are not exclusive to the ruling elite, however, and can be created and maintained by any person in society, but with varying degrees of acceptance and potency in social negotiation. This version of ideology differs from traditional definitions by Althusser (1977) and some other Marxist thinkers that view ideology as a false consciousness or as an elite tool used maintain the status quo (McGuire 1992). Conversely, Sharer and Ashmore (1993:510) described ideologies and ideological systems as “the means by which human societies codify beliefs about the natural and supernatural worlds.” Although this definition is reminiscent of the world view concept, the codification of belief implies social relations, and hence, political or power relations. This broader definition of ideology appears fit better in a framework that includes ethos and world view. The main distinction, then, between world view and ideology is that ideologies may be more cognized and reinforced for political gain. This is not to say that ideological thought is always reflected on or argued over (i.e., as heterodoxic belief). Ideologies should then be considered as subsumed under the rubric of world view, as those aspects that are indelibly tied to power relations. Ideology, as it is used here, is not something created and controlled by one group in society.

From a practice theory perspective, ideologies and world views cannot exist apart from the minds and practices of individual agents. What we describe as a world view or ideology of a culture is in fact a conglomeration of more or less shared concepts by each person in society. Even if certain beliefs or ideas are codified and canonized in text or law, each individual cites these ideas in a unique way (Butler 1993:15). Different groups can advocate and emphasize specific elements of these ideologies and world views, sometimes for personal gain, or the gain of their group. Ideologies based on some shared world views can be constructed to effect many different results, such as social schism, community solidarity, and resistance to other social groups. This development increases the difficulty of making archaeological interpretations and generalizations about the belief system of a society. Thus, the question should be asked: are discussions of ideology and world view valid, analytically powerful, and useful for describing social organization? Practice theorists contend that the doxa/heterodoxy/orthodoxy distinction is sufficient for describing the ways that individuals and groups practice belief and experience the world. This move toward anti-Cartesianism, embodiment, and critical assessment of the mind versus body (see Meskell and Joyce 2003) dichotomy requires that traditional anthropological categories of ideas must be reexamined, but for the purpose of this thesis I use the above distinction between world view and ideology.

2.3: IDEAS, TECHNOLOGY, AND SYMBOLISM: THE SOCIAL SIDE OF CRAFT PRODUCTION

The concepts of doxa, orthodoxy and heterodoxy allow for a discussion of the role of ideas in long-term practices, and expose technological and symbolic change through time (Bourdieu 1977; Silliman 2001; Sommer 2001). Doxic experience implies an uncontested form of belief and knowledge that is reproduced through daily crafting practice, and is a concept associated with hegemonic forms of control that tend to mask social difference (Comaroff and Comaroff 1990). In politicized or contested fields of cultural production, however, the naturalized inequality achieved by hegemonic control can collapse doxic dispositions and beliefs (Bourdieu 1983). As Silliman (2001:194) noted: “when the unquestioned orders of doxa are no longer shared or when individuals try to reify doxic reality, opinion and action schism into orthodoxy and heterodoxy.” Orthodoxy and heterodoxy denote particular ideologies of production that are contested and politicized as either cognized forms of the previous doxic experience (i.e., orthodoxy), or as a point of view that opposes existing beliefs (i.e., heterodoxy). When a hegemonic aspect of social control is questioned, a field of cultural production emerges, and platforms for the social negotiation of symbolic power open up to various groups or individuals in society. Wacquant (1993:134) described a field of cultural production as:

> [A] relatively autonomous and structured space of positions and position-takings defined by force lines and struggles for the monopoly over specific forms of cultural authority, within which the logic of the economy has been suspended and even inverted, and whose very functioning produces and reproduces the belief that culture is a separate and "sacred" realm.

I argue that the field of craft production in ancient Maya society was an equally contested arena of interaction in the competition for material and symbolic capital, possibly to the level of individual or group ideologies. Symbolic capital, in particular, is an important element of economic exchange in ancient societies because the social side of economic interaction has an effect on the way goods are produced and consumed; that is, social norms, mythologies, ritual elements of production not only mask the economic truth of production, but also change the way goods are produced and exchanged (see Flad and Hruby n.d.).

For Bourdieu (1977:178-179) symbolic capital is a nonmaterial form of wealth (e.g., honor and prestige) that through social interaction can have a value that is again convertible into material capital or tangible valuables. He contended that a material-symbolic-material conversion takes place in which material wealth is invested to produce symbolic capital that can later be reconverted into material wealth at key moments in time. This conversion is a means whereby archaic societies socially repress economic realities: "practice never ceases to conform to economic calculation even when it gives the appearance of disinterestedness by departing from the logic of interested calculation . . . and playing for stakes that are nonmaterial and not easily quantified" (1977:177). Given the complex intersection between the material, nonmaterial, and agent in technological practice as embodied experience (Dobres 2000), a formulaic "comprehensive balance-sheet of symbolic profits" (Bourdieu 1977:181) may not hold for all societies. The shortcomings of symbolic capital are that it encompasses too many social phenomena under one rubric, and that it reduces human experience to a competition for wealth and status (Dreyfuss and Rabinow 1999; Wacquant 1993:137).

Dobres (2000) brought a further dimension to the accumulation of symbolic and material capital by stressing the inherent connectedness between people and the world through the practice of technology. She elaborated the connection between the Heideggerian notion of being-in-the-world and how technology (i.e., the knowledge and practice of craft production) is necessary to the formation of social relationships and identities (Dobres 2000). In her discussion of the embodied practice of technology, Dobres (2000:128) elucidated the complexity of technological engagement with the world:

> [A]n especially important feature of the "human-technology equation" is the sensuous bodily experience of making and using material culture, because the corporeal body is the mindful and social link between the making and using of things, the making and use of practical knowledge and cultural knowledge, the making and unmaking of subjects, the making and breaking of social relations, and the making and transformations of the body politic.

Throughout her work she emphasized the importance of everyday technological practice (i.e., the dispositions of habitus) in the bringing about of these kinds of social changes and for "expressing and materializing larger cultural epistemologies, ontologies, identities, and differences" (2000:139). However, Dobres also noted that the multifaceted nature of technology and that "differences in experience, skill, knowledge, and one's awareness of being-in-the-world, as well as differences in explicitly articulated goals and how they should be accomplished, all become resources through which political interests materialize" (2000:140; my emphasis). This position brings her closer to the Bourdieuvian notion of competition for material and symbolic capital in contested fields of cultural production, but in technological practice, the transformation of the material world is inseparable from production knowledge.

Dobres (2000:140) went on to argue that technology can be firmly entrenched in the world views of a given society: "[t]he world views that structure detailed ways in which people materially engage with and make their mark on the world also are embodied in origin myths, principles of social organization, and even proscribed rules for accessing the physical landscape and its resources." This position is important in conceptualizing the practice of ritualized production and the employment of mythological charter (i.e., the framing of practice in mythological concepts) in technology, two concepts employed in this study.

In some societies technological practices are related to local mythologies as part of being-in-the-world and the creation of personhood and social identity. The practice of the technological agent is thus explicitly connected to world view. An often related, but distinct aspect of technological performance is ritualized production whereby elements of world view, religion, and/or mythology become an indelible part of that performance. Ritualized production, then, is one of the most elaborate examples of ideologically-loaded production, and exemplifies how technology embodies the relationship between people and the material world. It is a form of action, however, that is not necessarily tied to a cultural field of production (i.e., orthodoxy or heterodoxy), and can be a part of everyday, less cognized types of activities (i.e., doxa; cf. Monaghan 1998).

In a contested field of cultural production, one way to negotiate the dominance of a given technology is by emphasizing a connection between that technology and local mythology. A preexisting mythological charter may surface from doxic experience and be more or less consciously understood to be valuable in social negotiation. In this sense, it can become ideological in nature; that is, a suite of ideas that become related to politics and power. Although the practice of rulership is an obvious example of the intersection between mythology and political ideology, it demonstrates how mythological charter can legitimize a particular social station. Inomata (2001) emphasized this kind of relationship for technological agents by modeling an ideologically-loaded form of craft production. Ideologically-loaded production binds particular mythologies with technology and legitimizes the exclusive practice of certain forms of production, and can thus embody an exclusionary tactic to monopolize a certain body of cultural capital, or esoteric production knowledge. According to Inomata, ideologically-loaded production for elite craft specialists has the effect of creating and maintaining social difference. This is true, of course, as long as the society as a whole withstands this form of social differentiation (orthodoxy), or this social distinction is naturalized and becomes a part of doxa (i.e., a successful form of hegemonic control).

Ritualized production can similarly come to the foreground in fields of cultural production. The combination of ritual prowess and technological skill may have been a resource for negotiation during times of crisis and social change (see the concept of practical politics as proposed by Silliman [2001]). In these cases ritualized production can be considered as another form of ideologically-loaded production. However, ritualized production should not be understood as an entirely preconceived act to delegitimize other forms of technological practice, but only as a point of intersection between lived experience and political action. Since ideas and material are so closely intertwined in technological practice (Dobres 2000), a state of heterodoxy and orthodoxy surrounding a set of technological practices necessarily involves contested dispositions, but also transformation or stasis in the material realm. Social negotiation so closely bound with the material side of production should reproduce extant material traditions or produce new ones (Sommer 2001:250). These forms of social change have an effect on the archaeological record (ibid.). One way to identify possible instances of ritualized production or the use of mythological charter in the archaeological record would be to locate a tight correlation between religious symbolism and technology.

The production of obsidian eccentrics at Piedras Negras is an example of such a correlation. But before turning to that case, I review cross-cultural examples of ritualized production that emphasize the importance of this practice in certain forms of craft specialization and demonstrate the link between ritual knowledge and production in other parts of the world. Furthermore, the ritualization of lithic craft specialization in Mesoamerica is demonstrated by direct historical evidence from ethno-historic sources. I consider these analogous data together with information on Maya mythology to suggest that mythological charter may have been common for many types of in craft production, perhaps beyond elite forms of craft specialization (cf. Inomata 2001; Reents-Budet 1998).

2.3.1: Ritualized Production

John Monaghan (1998) has recently argued that ritual activities were an integral aspect of production in Oaxaca, and Takeshi Inomata (2001) has elucidated the role of ideology in elite craft specialization for the Classic Maya. These important studies urge an investigation of the role of ritual and ceremony in the production and use of both material and symbolic products in ancient Mesoamerica. In a similar way, Spielmann (1998) argued that the production of goods used in rituals and ceremonies can confer heightened status on the producer (see also DeMarrais et al. 1996). Spielmann (1998:153-154) referred to the materialization of ideologies (i.e., the production of goods used in rituals, and ideologically imbued objects) as ritual craft specialization. I draw a distinction between ritual craft specialization and ritualized production in that the former refers mainly to the nature of the product and how it is consumed after production, and the latter refers to the practice of production. In ritualized production the product can be a "mundane," "utilitarian," "prestige," "ceremonial," etc. object, but the process of production is itself a ritualized activity. This is not to say that ritual craft goods are more likely produced in a ritualized manner by ritual specialists (Spielmann 1998:156), but the focus here is on the intersection of world views and religion with the practice of production. Furthermore, the practice of ritualized production does not always include prayers or chants carried out during the actual process of production. Ritual circumscription, in which production activities were marked by a series of rituals before, after, and during important steps of the production process, however, may have been commonplace (cf. Childs 1998). Ritualized production is not necessarily a constant part of crafting practice but may be employed periodically during particularly important times of the year (ibid:115).

The melding of craft production with religious ceremony and ritual can have a profound effect on how personhood and identity is developed and, in part, shapes the way the economy is structured. Ritualized production is one possible means to exclude others in society from access to the esoteric knowledge necessary to carry out certain forms of production (see Childs 1998; Herbert 1984; and Schmidt 1997), but it also may be key in passing down production knowledge to the next generation (Clark 1989). Research on textile production in the Andes conducted by Thomas Patterson, for example, revealed the importance of ideology in guarding esoteric production knowledge (personal communication 2001). In this case, ritual and ceremony do not mask economic realities, but are a real factor in economic organization. Ideologically-loaded forms of craft production also can be embodied experiences that give meaning to life and community (Dobres 2000).

Specialized craft production in many contexts shows that crafting is often ritualized, and that the goods produced have a significant role in society. The many metallurgical practices in Africa with symbolic and ritual natures (e.g., Childs 1998; Childs and Dewey 1996; Herbert 1984) provide a substantial body of information to discuss ritualized production. Herbert (1984) emphasized the unique social role of master smiths in these contexts, where the smith is viewed as apart from the rest of society: "feared, revered, despised smiths are separate from the rest of mankind by the nature of their work and common endogamy within smithing families" (Herbert 1984:33). Herbert cited some examples of African kingship in which smelting and smithing is a marker of the royal family. Like agricultural production and land ownership, the production of metal goods can be a politically potent practice. In the Kongo tradition, the ancestry of kings is closely tied to the ownership of ore resources, but more importantly, with the esoteric knowledge of smelting and smithing (i.e., the transformation of soils into workable tools usually used in warfare and agriculture).

In many African societies the metal smith takes on the role of a diviner or a controller of essential magic that brings about prosperity (Herbert 1984:41). A smith also may be an owner of a mine, but more importantly, he controls the necessary esoteric ritual and technological knowledge needed for the socially proper creation of metal goods. The forms of mine ownership vary as much as ritual treatment of metallurgy does, but for the Katenga, royalty maintained control of mines. In other locations use of the mine was free for local inhabitants, but outsiders were required to pay a tithe to use or extract ores from them (for the Kimbe see Herbert 1984:44). In some cases, competitive processors of the ores were fended off, not only by control of mine resources, but by ritual and technological specialists who controlled the esoteric knowledge of smelting and forging processes. Heightened specialization increased social power through the control of that esoteric knowledge. Herbert noted: "one is born a smith, but becomes a jeweler." The acquisition of social ties and technological knowledge can ultimately lead to positions of power within the society. Childs (1998:134) explained this relationship for the Western Ugandan Toro:

> [R]ituals employed during manufacture took time and effort away from the technical tasks at hand. Such rituals also involved additional skills and responsibilities in the production sequence that had to be mastered during the apprenticeship and followed during production. These rules and rituals were used to minimize risk and maximize success during an operation, to prevent harm to iron workers, and to promote social and economic dependency on the iron workers within the community rather than realize the Western value of efficiency. If the taboos were not met or the rituals were not performed, however, the resulting disasters would certainly reduce the efficiency of Toro iron production.

The forge, bellows, and other "utilitarian" tools and features used in metal good production in Africa also are highly symbolic, and essential aspects of social identity (Childs 1998:119). In addition to rituals carried out upon the creation of a forge and bellows, they also are decorated with male and female icons of sexual fertility. Many of the objects smiths produce are imbued with the prestige and symbolism of the source, production area, and producer of their origin. Tools, features, and products may be tied to the same strain of esoteric knowledge controlled by the producer, and have implications for production and consumption of iron goods (Helms 1993). Childs (1998:119) argued that finding links between technologies and religious symbolism was an important archaeological avenue to identify ritualized production in the past.

In Mesoamerica production also appears to have been ritualized. The most obvious examples of ritual associated with human craft production are dedicatory caches deposited during particular phases of architectural construction. Monaghan (1998) has recently conceptualized dedicatory and caching ritual practice as <u>production</u>, after observations from his ethnographic work in Oaxaca. For Monaghan, the "ritual" aspects of production are so ubiquitous at most levels that they are indelible aspects of material production, and thus economy and religion cannot be separated in a clear and concise manner. Monaghan (1998:48) noted that:

> It is usually the case that the terms translated as "ritual" refer either to specific ceremonies or to a class of acts—such as "ordering," "feeding," or "planting"—that are not confined to religious ceremonies. Moreover, in the Mixtec-speaking town of Santiago Nuyoo, people do not separate the creation of objects into "practical" versus "ritual" aspects.

In an example of house building, Monaghan (1998:48) observed the importance of making offerings to the earth god before a terrace is excavated. However, this aspect of production is so important to the overall process that, according to one informant, "not making an offering would be like putting down shingles without nailing them to the crossbeams" (1998:48), which suggests a doxic or "taken for granted" form of ritualized production. However, it should be pointed out that Monaghan argued that "the classification of any behavior as "ritual" in relation to other activities is impossible" (1998:48), which renders the analytical category of "ritual" as useless. I continue to use the term <u>ritualized</u> in the present argument, however, in order to stress the importance of the interconnection between the material and symbolic in production activities in Mesoamerica.

Ethnohistoric evidence suggests that ritualized production was carried out in other Mesoamerican contexts. Brumfiel (1998:148) noted that elite Aztec craft specialists were trained in temple schools and that feather workers, for example, "assert[ed] that their craft required the same spiritual and intellectual qualities as governing." Feather workers, pulque makers, oil makers, and mat makers purchased slaves to sacrifice to their patron deities as a form or ritual circumscription of production activities (Brumfiel 1998:149).

Another Aztec example indicates that the production of chipped-stone goods was also ritualized. Elaborate rituals were conducted to pass down lithic production knowledge to the next generation of craftsmen.

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

Blades also were removed in Aztec marketplaces, perhaps to ensure customers that the blades were freshly made, and to demonstrate the ritual component of their manufacture, thus augmenting the symbolic value of the product. The previous example suggests that certain periodic production ceremonies required ritual action. The blades themselves were often used in both bloodletting and manufacturing contexts, which marks them as symbolically potent goods. Ritual activity was a way of maintaining traditions, controlling esoteric production knowledge, and producing social identity.

Mayan stone tool production involved similar ritual aspects. As Clark (1989:305) pointed out, the Lacandon Maya were obliged to observe rites before their knapping activities, because "an integral part of the 'technique' [of arrow head production] was chanting to the flint and fasting before the actual knapping." Furthermore, they carried out production in a temple or "god house" where they were compelled to recite chants to successfully complete the task. These chants were key in memorizing production techniques. This case may constitute another example of a doxic practice of ritualized production. It also has implications for understanding how ritual was an important aspect of the transmission of technological knowledge from one generation to the next. Integral to such transfer of knowledge was incorporation of world views and mythologies, as important aspects of ritualized production. World views and myths can become tied to the production process as a form of charter and authority.

2.3.2: Mythological Charter and the Creation of Social Identity

Although he did not explicitly argue that elite craftwork was ritualized, Inomata (2001) contended that ancient Maya craft specialization was a potent form of ideologically-loaded production. The manufacture of particular goods, such as those featuring hieroglyphic inscriptions, had the effect of creating social distance between the royal family and the rest of society (Inomata 2001). Reents-Budet (1998) took a similar stance in her description of Late Classic polychrome vessel production. Both argued that craft producers might have couched their work in terms of creation mythology, thus connecting the producer and their products to sacred space and time. I describe this form of privilege and authority gained by virtue of supernatural association as mythological charter. For elite or royal status groups, the guarding of esoteric production knowledge should be considered an important aspect of royal control. This understanding should not only be applied to elite artisans, but also other status groups in society that situate their social role in relation to local mythologies.

It is argued here that forms of craft specialization other than writing also were ideologically loaded, but perhaps without the same level of politicization as that of royal craft specialists. The role of mythology is important because it not only sanctions the production practices of the elites (Inomata 2001) but also, at least according to contact period documents, charters other forms of craft specialization and helps define the social role of nonroyal members of the community. This form of mythological charter has two readily apparent effects: (1) it creates and concretizes social difference between disparate social strata; and (2) it reinforces social cohesion by defining social roles and creating a common connection between various individual world views in the community. Through repetitive and periodically enacted social practices, myth is reaffirmed and made real to the whole of the community.

The Popol Vuh reflects the connection between craft production and mythological charter through its retelling of the gods first crafting of living things on earth: "It hasn't turned out our names have been named. Since we are their mason and sculptor this will not do" (Tedlock 1996:67). Creator gods are called upon by the "Maker, Modeler", to create human beings out of mud, wood and corn: "So be it, fulfill your names: Hunahpu Possum, Hunahpu Coyote, Bearer twice over, Begetter twice over, Great Peccary, Great Coati, lapidary, jeweler, sawyer, carpenter, plate shaper, bowl shaper, incense maker, master craftsman, Grandmother of Day, Grandmother of light" (Tedlock 1996:69). Hence, many different forms of craft production are at the core of world creation metaphor in Quiché world view (see also Reents-Budet 1998). Classic period hieroglyphic writing indicates that similar metaphors were prevalent. The verb pat, which means, "to form," was used to describe the creation of gods and also ceramic vessels (see potting as pat for the Yucatec Maya; [Clark and Houston 1998]). The verb tzutz, used most extensively for describing the completion of long periods of time, also is the most common verb used to describe the completion of a textile (Hruby and Robertson 2001).

As the gods in the Popol Vuh sought to create human beings, and ultimately succeeded by using maize dough (Tedlock 1996), their goal was to themselves be reified by humans so that they would not be forgotten. The production of idols in contact period Yucatan is another good example of this practice wherein craftspeople conducted ritualized production to properly and safely, from a spiritual standpoint, bring off the production of a mask or idol for worship. "Among the occupations of the Indians were pottery and wood-working; they made much profit from forming idols of clay and wood, in doing which they fasted much and followed many rites" (a translation of Landa by Gates [1978:37]). Landa went into further detail, describing the intense nature of the practice of ritualized production:

> One of the things, which these miserable people regarded as most difficult and arduous, was to make idols of wood, which they called making gods. And so they fixed a particular time for this and it was this moth of Mol, or another month if the priest told them it was suitable. Therefore, those who wished to make some consulted the priest first, having taken his advice, they went to the workmen who engaged in this work. And they say the workmen always made excuses, since that they feared that they or someone of their family would die on account of the work, or that fainting sickness would come upon them. When they had accepted, the Chacs whom they had also chosen for this purpose, as well as the priest and the workmen, began their fastings. While they were fasting the man to whom the idols belonged went in person or else sent someone to the forests for the wood for them, and this was always cedar. When the wood had arrived, they built a hut of straw, fenced in, where they put the wood and a great urn in which to place the idols and to keep them there under cover, while they were making them. They put incense to burn for the four gods called Acantuns, which they located and placed at the four cardinal points. They put what they needed for scarifying themselves or for drawing blood from their ears, and the instruments for sculpturing the black gods, and with these preparations, the priests and the Chacs and the workmen shut themselves up in the hut, and began their work on the gods, often cutting their ears, and anointing those idols with the blood and burning their incense, and thus they continued until the work was ended, the one to whom (the idol) belonged giving them food and what they needed; and they could not have relations with their wives, even in thought, nor could any one come to the place where they were. [Tozzer 1941:159-60]

Although this passage describes a special event, it demonstrates how production could involve much more than economic efficiency. To understand the economic and social interactions involved in this ritual requires more than an application of Western economic theory.

The Pan-Maya practice of recreating mythical and historical events reveals the essential role of humans in perpetuating the gods, both through everyday ritualized practice and special, large-scale ritual events. This process had the recursive effect of reaffirming social roles in the community and clarifying personhood and social identity (Clark and Houston 1998; Joyce 2000). It is equally possible that the "profit" gained by craft specialists could have spurred on horizontal of competition between craft producers in the same field. Ritual knowledge would have been an important element of this competition.

The intersection between craft production and personhood recalls the description of the contact period oficio in ethnohistoric sources (see Clark and Houston 1998:39):

> The final step of this developmental process of selfhood involved individual achievement and office . . . Craft specialties were also considered oficios and would have been a principal identifier of a person' particular achievement. In short, one became a full person by carrying out one's station or oficio.

During the ceremony of the month of Mol, Landa noted that children were ritually beaten "so that they might become skillful workmen in the professions of their fathers and mothers" (see Tozzer 1941:159). Hence, craft production was the bridge between ritualized mythological reenactment and the individual in society, whereby individuals from different economic spheres formed social bonds and reaffirmed their world view.

Craft production puts one in the role of the gods as a creator being, probably enhanced by trance and deity impersonation during ritualized production, but with an understanding of the human origins of their products. As Landa stated: "[a]s regards to the images [the idols], they knew perfectly that they were made by human hands, perishable, and not divine; but they had honored them because of what they represented and the ceremonies that had been performed during their fabrication . . ." (see Gates 1978:47).

Even though ideologically-loaded production for elite artisans was important in exclusionary tactics and elite identity during the Classic period in the Maya area (Inomata 2001), it also is necessary to look at how identity and personhood are formed in other areas of society. Ideologically-loaded production appears to have extended to other social groups in society. Although they may not have commanded the same power, respect, and ultimately, symbolic capital as elites, production by nonelites may have been important in socio-economic negotiations with the higher status groups, as well as in horizontal social relations (e.g., Hendon 1991).

2.4: AN ALTERNATIVE MODEL FOR THE CHIPPED-STONE ECONOMIES OF PIEDRAS NEGRAS

Preliminary analyses of chipped-stone artifacts from Piedras Negras suggest that local cherts and chalcedonies were internally flawed and difficult to work (Hruby 1999), and quantities of imported, high-quality cherts and obsidians generally were quite low. This resource characterization of Piedras Negras microcrystalline-quartzes contrasts with those of other parts of the lowlands, which often have an abundance of high-quality local materials, such as the central Petén (Moholy-Nagy 1991) and northern Belize (Shafer and Hester 1983), or others that had more direct access to obsidian sources (see Copán: Aoyama 1999). The political history and local religion of Piedras Negras also are unique, and they differ from sites in northern Belize or in the Copán River valley. Architectural traditions and settlement patterns also are markedly different from these other regions. In other words, there are many indications that the economic, political, and religious differences between regions may be vast. Thus, previous models of Lowland Maya lithic economies, based on other regions, may not fit the Piedras Negras case.

I propose that royal and elite groups at Piedras Negras, and other cities in the Maya area, were interested in the economics of chipped stone, but to differing degrees depending on access to resources, local political history, and social structure. In addition, knappers and their families may have also been a force in centralizing and maintaining control over knowledge as social and symbolic capital, a process similar to elite Maya craft specialists outlined by Inomata (2001). A characterization of lithic economies of the Classic period, as well as their utilitarian components, should be more flexible, heterogeneous, and theoretically robust. The model should begin with the knapper and his social role in Classic Maya society.

The role of the knapper as moonlighter, "scrambler" (i.e., individual doing odd jobs to add increase income; McAnany 1992), or second-class attached specialist devoid of esoteric knowledge, may not hold in politico-religious centers with a more institutionalized social structure. The concept of craft oficio, or knapper oficio here, may be a useful archaeological category for the Classic period because it provides a mechanism for the uniform transmission of knowledge, restricted production pattern, and also systematic debitage locations throughout the city. Similar to a European guild system, the knapper oficio may have originally begun as an institution, constructed by royalty to more easily monitor and control craft production within the city. A political correlate for the Classic period may be the oficio of sajal[6], which was not prominent in the inscriptions of the Early Classic, but was created and used, ostensibly out of necessity, in the western region of the Maya Lowlands, especially during the Terminal Classic. During the Late Classic some oficios may have gained autonomy using their own mythological charters as leverage when government became less centralized. The oficio as a unit of analysis also may help explain how production patterns remained the same before and after the removal of centralized governance (i.e., the collapse). On an individual level, it may have been detrimental or advantageous to be associated with more than one oficio, and membership may have varied through time depending on political and economic circumstances.

Scant evidence of lithic production in palace contexts throughout the lowlands, suggests that the role of the knapper was disconnected from much of palace life and the high culture maintained there (Houston and Inomata 2001; Inomata 2001). However, the existence of eccentrics and other lithic goods in royal-ritual contexts reveals a dependence on knapping skill and products for high-profile ritual activities. Attached specialization may have occurred intermittently depending on the particular ritual needs of royal groups, similar to that described by Landa for "idol" production in the Yucatan (see Tozzer 1941:159). The oficio, then, can be viewed as a nexus of world views, emergent craft ideologies, and an opportunity for social success in Classic Maya society. Although knappers likely were tied to specific households, the oficio describes a different kind of organization that allows craft specialists from different, possibly competing households, to come together, share information, and possibly work together on large projects (e.g., the production of large caches, burials, or arms for an upcoming war).

Of course, there is an inherent risk in using postconquest concepts to interpret the Precolombian archaeological record. Oficio could have been a Spanish attempt to categorize and structure Maya society in ways that did not reflect Precolombian forms of social organization. On the other hand, oficio could have been a Spanish translation of a Maya concept, which was not recorded in contact period documents. In either case, the concept describes an organizational principle that existed at the time of Spanish contact, and appears to have existed in some form during the Classic period. The emphasis on occupational titles in ancient Maya writing is a good example of the structural importance of occupation, especially craft specialization. I believe the oficio concept remains useful for framing the relationship between craft producers, their practice, and society.

At Piedras Negras, chert and obsidian eccentrics usually were made of debitage (i.e., biface-reduction flakes, exhausted blade-cores, and percussion blades). Royal caches, burials, and temple constructions often contain other forms of debitage that derived from the production of bifaces and blades. In one royal tomb, Burial 10 at Piedras Negras, two finished bifaces were deposited on a basket or gourd of biface-reduction flakes probably removed in their manufacture. Furthermore, these royal deposits contain as much or more debitage than any other context in the site. Obsidian materials represent the best example of this pattern, where almost all of the large, core-derived debitage in the site was located in royal ritual contexts. The remainder of most small production debitage was found in residential groups distantly located from the royal palace.

These patterns, described in detail in Chapter 7, not only suggest that kings were interested in the process of chipped-stone production, but also that elaborate exchange relationships existed between kings and knappers. At Piedras Negras obsidian blade-cores may have been procured by royal groups through long-distance exchange and distributed to the knapping oficio, and in return kings would receive fine prismatic blades and eccentrics made from the large production debitage that are not in evidence in household contexts throughout the city. Particular chert materials may have been treated in similar ways, but perhaps involving access to the local chert source, which was located below the acropolis and site center. Use-wear patterns throughout the site suggest that biface-reduction flakes were valuable cutting tools, and that large deposits of biface-reduction flakes in royal ritual contexts were not a waste disposal mechanism (compare King and Potter [1995] and Moholy-Nagy [1997]).

Similar to the elite craft production of carved shells and mirror making outlined by Inomata (2001) at Aguateca, the chipped-stone production may have been ideologically loaded in its own right. Maintenance of their cultural and symbolic capital (Bourdieu 1973) by restricting forms of knowledge to a particular family, or group of artisans could have reinforced and reproduced the institution of knapper oficio over long periods of time. Forms of knowledge associated with chipped-stone production could have been guarded, but socially recognized as an important part of the living city. This is not to say that production, even ritualized production, was always a conscious attempt to win more symbolic and material capital, but that as ideologies and other forms of knowledge became heterodoxic, knappers likely used whatever was at their disposal to gain prestige. The act of chipped-stone production probably was not a normal royal activity, because there is so little evidence of these activities in the royal art and writing of the Classic Maya. Nonroyal craft oficios were nonetheless essential to the well-being of the city and its population, which required a structured set of relations between the ruling family and other households within the city.

CHAPTER 3

PREVIOUS AND PRESENT RESEARCH AT PIEDRAS NEGRAS

3.1: ARCHAEOLOGICAL RESEARCH AND HISTORY AT PIEDRAS NEGRAS

3.1.1: Lithic Research

Excavations carried out in Petén, Guatemala, by the University of Pennsylvania in the 1930s (Coe 1959; Proskouriakoff 1960; Satterthwaite 1943, 1954), and more recently by the Piedras Negras Project (Escobedo and Houston 1997, 1998, 1999, 2001; Houston et al. 1998, 1999, 2000a, 2000b), provide a sample of lithic artifacts and contextual information that cross-cuts temporal and spatial boundaries. The combined lithic samples are unique because they represent the largest systematically-collected sample from the western lowlands, and also the second largest sample of eccentrics made from microcrystalline quartz and obsidian materials (second to Tikal, Guatemala). In recent excavations at Piedras Negras, most of the major residential groups in the site core and in the near periphery have been thoroughly sampled, and many have been excavated extensively (e.g., Kovak and Webster 1999). In addition to these nonroyal household deposits, lithic samples from temples and palaces provide excellent information from royal contexts (e.g., Garrido 1999; Golden and Pellecer 1999). Seven new caches have also been discovered, all of which contain lithic artifacts, especially microcrystalline quartz and obsidian eccentrics (e.g., Escobedo and Zamora 1999). These new discoveries, however, were preceded by many years of excavation conducted by the University of

Pennsylvania that yielded an important artifact sample, which was also reanalyzed for this study. The sample collected by the University of Pennsylvania consists mostly of cache and burial objects because the focus of their excavation was on the royal palace and temples. It appears that obsidian and microcrystalline-quartz artifacts from general excavations were not usually saved because very few, except for a few obsidian blades and chert bifaces, remain in the collections of the Museo Nacional de Arqueología e Historia de Guatemala and the University Museum in Philadelphia. Previous studies of this material provide a point of departure for the present one.

William Coe (1959) systematically compiled and created typologies for the obsidian and chert artifacts of Piedras Negras collected by University of Pennsylvania. However, Coe did not have the benefit of witnessing and recording the excavation of these objects in the 1930s. Instead, the original contexts of the materials were reconstructed from field notes. Those notes lack contextual information because of the limited recorded methods of the day, which often did not include detailed illustration and photography of the cache objects in situ. Information necessary for an in depth analysis of caches and cache goods includes: (1) position of each object in the cache; (2) the location of each object in relation to other objects in the cache; (3) mapping multiple layers of cache objects in the same deposit; and (4) multiple drawings and photographs of each layer of the cache as it is excavated. This contextual information is useful for interpreting the symbolism of the cache deposit, as well as understanding the often complicated and sequential deposition of the cache goods. All of these data might have helped Coe date the deposits more precisely. His project was also hindered by a fire that destroyed much of the original provenance information and an unknown quantity of the actual artifacts (Coe 1959:6).

The format of the Piedras Negras monograph (Coe 1959) is similar to that of the artifacts of Uaxactun (Kidder 1947), but offers more of an in-depth analysis of the context and morphology of microcrystalline quartz and obsidian eccentrics. Coe compared symbolic forms between caches at Piedras Negras, but also conducted a path-breaking cross-site comparison of eccentric forms between excavated sites in the lowlands. He found that there was a tendency towards conservatism in the caches at Piedras Negras and noted that there was little change in the forms of eccentrics through time (Coe 1959:113). Although the focus of the present research is not necessarily on the caches of Piedras Negras, a large part of the study examines the technology and symbolism of the production of microcrystalline quartz and obsidian eccentrics. As is discussed below, the conservatism in symbolic content of Piedras Negras caches did not carry over into the technological realm, and it is precisely at this point that the study is of greatest value. Coe dated the caches to the best of his ability and was able to provide an important temporal framework in which to place newly discovered caches at the site. The detail of the analysis represented by the Piedras Negras monograph has only recently been equaled by that of Meadows (2001), who did an exhaustive analysis of cached eccentrics from Belize.

The dating system for caches created by Coe (1959:149-156) relies on a few outdated assumptions about Piedras Negras architecture in the western lowlands. I do not use these dates when possible, and refine them further only when ceramic and contextual information from new excavations is available. The strong point of the dating system proposed by Coe is that it relies mostly on monuments with Long Count dates, and the caches that were deposited directly below those monuments. Therefore, in this section and the analysis section in Chapter 7, I note the difference between firmly dated caches and those dated by architectural association. All of the recently excavated caches have either good ceramic information or are deposited with Long Count monuments.

Lee and Hayden (1988) carried out the only other published work on lithics from the Middle Usumacinta region based on the artifacts recovered from a cave near El Cayo. The El Cayo sample is useful but small. The cave context makes it unclear if the chipped-stone artifacts were in some way specially prepared for the cave deposit, or if they were household items. One technological trait of the microcrystalline-quartz artifacts from El Cayo was percussion blades made from blade cores (Lee and Hayden 1988). Although a few microcrystalline-quartz blades and cores were found in general excavations at Piedras Negras, their presence in two burials indicates that they may have had religious significance. Further archaeological reconnaissance in the Middle Usumacinta region may reveal more concrete technological and symbolic connections between sites and their corresponding lithic traditions.

3.1.2: General Excavations and Interpretations of Piedras Negras History

Settlement at the place known anciently as yokib or "entranceway" began during the Middle Preclassic (Child and Child 2001; Escobedo and Houston 2001; Forsyth and Hruby 1997; Muñoz 1999, 2001, 2002, 2003; Stuart and Houston 1994). Preliminary analyses suggest that the Piedras Negras polity was established during the Late Preclassic and possibly before, but the only Preclassic architecture found at the site can be securely dated to the Late Preclassic (Child and Child 2001; Escobedo and Zamora 1999, 2001a, 2001b; Forsyth and Hruby 1997; Muñoz 1999). The size of the Preclassic architecture in the South Group Plaza suggests that some of the structures during this period were used for ceremonial purposes and that there was some form of centralized governance in effect (Child and Child 2001; Escobedo and Zamora 2001b).

Excavation during the 2000 season, which focused on the South Group Plaza, produced the only substantial sample of artifacts from the Preclassic and Protoclassic periods. These deposits represent one of the only collections of Preclassic artifacts from the Middle Usumacinta region, and the lithic sample is unfortunately dwarfed by the relatively high quantities of ceramics. No lithic caches were found dating to the Preclassic period, but a lip-to-lip cache from the Late Preclassic (Abal phase) was found in the South Group Plaza (Castellanos 1997:42; Muñoz 2003). Low numbers of Protoclassic, or transitional Pom phase, sherds are the only evidence of an occupation at Piedras Negras for that time period (Forsyth and Hruby 1997; Muñoz 1999, 2001).

The first strong evidence of widespread monumental architecture, hieroglyphic texts, and large-scale occupation at the site occurred in the Early Classic or Naba phase (A.D. 350-560) (Proskouriakoff 1960; Satterthwaite 1943). Identifying the early rulers is somewhat problematic because few well-preserved Early Classic monuments have been discovered and Early Classic tombs and burials (Child and Child 2001) did not contain legible hieroglyphic texts. However, three or four kings, depending on the epigraphic interpretation, are mentioned on Early Classic monuments and also retrospectively in Late Classic hieroglyphic texts (Stuart 2000:499). Early monuments seem to have been used as fill in later pyramids within the site core (Satterthwaite 1943). Although Early Classic kings used virtually the same names as the Late Classic kings, these depositional behaviors and the lack of direct epigraphic evidence make the connection between Early and Late Classic rulers vague. Nevertheless, early monuments from Piedras Negras and the nearby site of Yaxchilan attest to an early and influential presence of Piedras Negras in the Middle Usumacinta region from an early date (Martin and Grube 2000:140; Stuart 1998).

The archaeological record also seems to reflect a substantial occupation and political presence at the site during the Early Classic (Child 1997; Child and Child 2001b; Escobedo and Houston 1998, 1999, 2001; Escobedo and Zamora 1999, 2001a; Garrido 1998, 1999, 2001; Golden and Pellecer 1999; Houston et al. 1998, 1999, 2000). Although iconographic and artifact evidence is weak, it is clear that Early Classic Piedras Negras was influenced by Central Mexico, either directly or indirectly by way of the Guatemalan Highlands, Tikal, or some other route. During the Naba phase, green obsidian appears for the first time, and at least one monument, Panel 12, depicts a Piedras Negras king in Teotihuacan-style warrior garb (Taube personal communication 2001). The actual nature of Central Mexican influence is unclear, but the Talud-Tablero-style architecture of some structures, such as R-2[7], suggests that the Early Classic elite were mimicking Teotihuacan-style architecture on a small scale. Like their Preclassic counterparts, it is clear that they still exploited the local chert source, which is located on the riverbed below the site core (Hruby 1998, 1999, 2001). The deposition of microcrystalline quartz and obsidian eccentrics also began during this time. Even though extensive excavations took place in the Early Classic palace area, as well as in the South Group, only a relatively small sample of Early Classic artifacts was recovered. A good understanding of Early Classic economy must await further archaeological excavation in the area.

Monumental Early Classic construction at Piedras Negras is focused in the South Group where some Preclassic structures were used as foundations for Early Classic pyramids. According to the apparent burial pattern of Early Classic tomb placement in the South Group (see Burial 10 and Burial 110 in Coe [1959:126-127] and Child and Child [2001b:401], respectively), it appears to be the first major burial place for Early Classic kings. The second large-scale Early Classic building program was carried out in the West Group Plaza, and consisted of an extensive palace complex located directly below the Late Classic Acropolis structure (Golden 1998). The Early Classic Cache K-5-8 discovered in the 1930s (Coe 1959:94), and Cache R-16-1 (Escobedo and Zamora 2001c:370) suggests that the use of obsidian and microcrystalline-quartz eccentrics began in earnest at this time. The location of these caches is similar to Late Classic caches. R-16-1 was found at the top of the pyramid in the temple floor, and K-5-8[8] was located in a cache bowl near a column altar. Caching practices during the Early Classic likely acted as templates for caches deposited during the later Balche, Yaxche, and Chacalhaaz phases. As discussed below, however, the symbolic forms deposited in these caches were substantially different from those found in Late Classic deposits, and although they can be interpreted as being structurally similar, their symbolic content appears to have differed.

At around A.D. 603 the site once again began a new and ambitious building program that leveled much of the Early Classic architecture, save the pyramids and a sweat bath in the South Group (Child 1997; Garrido 1998, 1999, 2001; Golden 1998; Houston et al. 1999, 2000). The residents of Piedras Negras dismantled most of the Early Classic construction in the West Group Plaza and in the early acropolis to create vast plazas and bulk up the acropolis for larger, more elaborate royal living quarters. This shift in construction can largely be attributed to the first two Late Classic rulers of the center: Ruler 1[9] and Ruler 2, or Yo'nal Ahk and Itzam K'an Ahk (Houston 1983; Martin and Grube 2000; Proskouriakoff 1960). According to hieroglyphic texts, a dynasty of seven consecutive Late Classic kings ruled the site up until the collapse of the city, including the earliest, Ruler 1, to the last, Ruler 7. The Late Classic kings produced one of the most extensive historical records in the New World, and their history provides a detailed background for artifact analysis.

The transition between Early and Late Classic times began with the Balche ceramic phase, during the middle of which Ruler 1 acceded to the throne and started his reign. It is clear that he did not introduce the panel, stelae, or column altar styles of monument erection, but he certainly formalized the burgeoning stela complex at Piedras Negras. Furthermore, Ruler 1 established the frontal style pose for stela monuments, and continued to depict Teotihuacan-style regalia. Although Ruler 1 continued the ancestral burial cult in the South Group, he also began construction of the K-5 pyramid and other temples in the West Group Plaza, which foreshadowed the architectural construction patterns of his children (Houston et al. 2001).

According to Muñoz (2001:Section 04), Piedras Negras ceramic change during Balche times "appear[s] to be the result of diversification of vessel form and decorative modes as influence from the Central Petén wanes and Piedras Negras begins to develop into the primary site and major political power for the region." While this is the case for the ceramic traditions of Piedras Negras, lithic and technological data suggest that there was an intense and close relationship with the Central Petén during and after the Balche phase. Microcrystalline quartz and obsidian eccentrics from Piedras Negras resemble those from Tikal. In some cases they are symbolically and technologically identical to Tikal eccentrics, including stylistic details. Although Piedras Negras may have been autonomous with respect to lithic traditions during the Early Classic, Tikal and Uaxactun must have directly influenced their Late Classic caching practices during the "hiatus" period.

The style and placement of stelae during the Late Classic period indicate that the figures on these monuments were meant to address the public, perhaps as effigies. Ruler 2, Ruler 3, Ruler 4, and probably Ruler 5, Ruler 6 (Ha' K'in Xok) and Ruler 7 all erected their stelae in front of the burial mounds of their fathers. In the case of R-5, Ruler 2 placed his monuments in front of the probable tomb of Ruler 1. The monuments erected for Ruler 1also are in the South Group suggesting that his ancestors, or de facto ancestors, had made pyramids and had been buried in that same spot (Stone 1989). Ruler 2 made the South Group even more personal, however, by placing his stelae in plain view of his father, if we can consider the stone renderings of Ruler 1 as a living effigy to that same man.

The stelae system at Piedras Negras legitimized kingly status through the depiction of rulers doing historically significant activities in front of the burial mounds of their fathers. In the case of the South Group Plaza, the stelae of Ruler 1 and Ruler 2 were placed opposite one another. The stelae of Ruler 1, then, "viewed" his son perform all of the necessary war-related efforts and period completions that he himself had accomplished in front of his own burial mound. The trend continued with Ruler 3, Ruler 4 and Ruler 5, but without the direct confrontational display created in the South Group. A similar plan for stelae style and placement would follow for the next 100 years or so.

The symbolic connection with Central Mexico continues on the J-1 platform in front of the acropolis where the stelae, two representing kings in full Central Mexican regalia, are placed in front of an architectural representation of Teotihuacan-style mountains (Figure 3.1). When viewed from the West Group Plaza, all of the standing kings and queens depicted on the stelae are symbolically situated in Central Mexico, possibly as a mythical place of origin. The importance of these patterns for the present study is that Central Mexican symbols are often also used in the caches associated with the monuments, pyramids, and platforms at Piedras Negras. The microcrystalline quartz and obsidian eccentrics of the O-13 Pyramid are a good example of this, where effigy atlatl points, a form typical to caches at Teotihuacan itself, are a main component of the cache goods. Figure 3.2 depicts a large biface, which is often called an effigy atlatl dart-point because it retains the general morphology of a dart point, but is much too large to function as such.

During and after the reign of Ruler 1 the stelae tradition continued at a great pace at Piedras Negras. Stelae were often associated with column altars (Figure 3.3), which also were loci of cache deposition. Although similar eccentric forms were used throughout the Late Classic caches, changes in technology and cache composition occurred after the death of Ruler 4. After the death of Ruler 7, the last known k’uhul ajaw at the site, cache content changed once again (see Chapter 7), and column altars appear to have been used in different ways, disassociated from stelae.

Once Rulers 5, 6 and 7 began to focus their ritual attention on Pyramid O-13 in a possible attempt to demonstrate their connection to Ruler 4, the caching ritual changed substantially. The changes in the technologies used to make obsidian eccentrics during this time also occur at Tikal, suggesting that shifts in local politics may not have been the only force driving these changes (Hruby 2005). The 57 caches found in the O-13 Pyramid undoubtedly were deposited under the reigns of all three of the latter kings, and possibly after. However, these caches and their contents are all similar to each other in form and content. In terms of elite caching traditions examined by Coe (1959) and earlier archaeologists, three general periods of eccentric production and deposition can be delineated. These three periods can be divided into early (Naba phase), middle (Balche, Yaxche, and early Chacalhaaz phase), and late (Early Chacalhaaz, Late Chacalhaaz, and Kumche). The caching traditions can then be separated by symbolic and technological content, and there is a rough correlation that occurs with the stelae that accompany them.

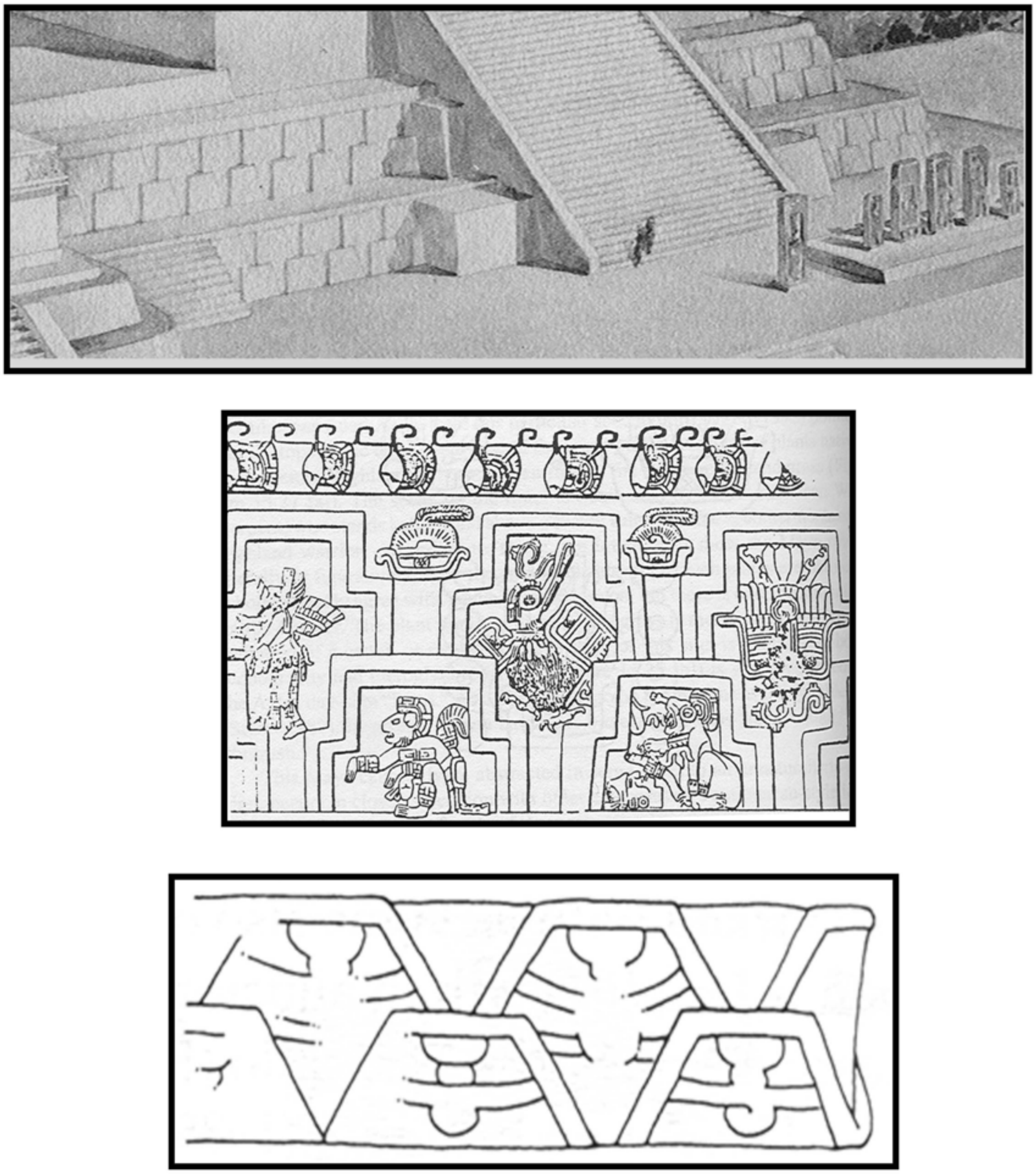


Figure 3.1: Teotihuacan-style mountains on the façade of the acropolis at Piedras Negras (Proskouriakoff 1946), above; Acanceh (detail from Seler 1902-23 V:400), middle; and at Copán (Taube 2004:Figure 13.16a).

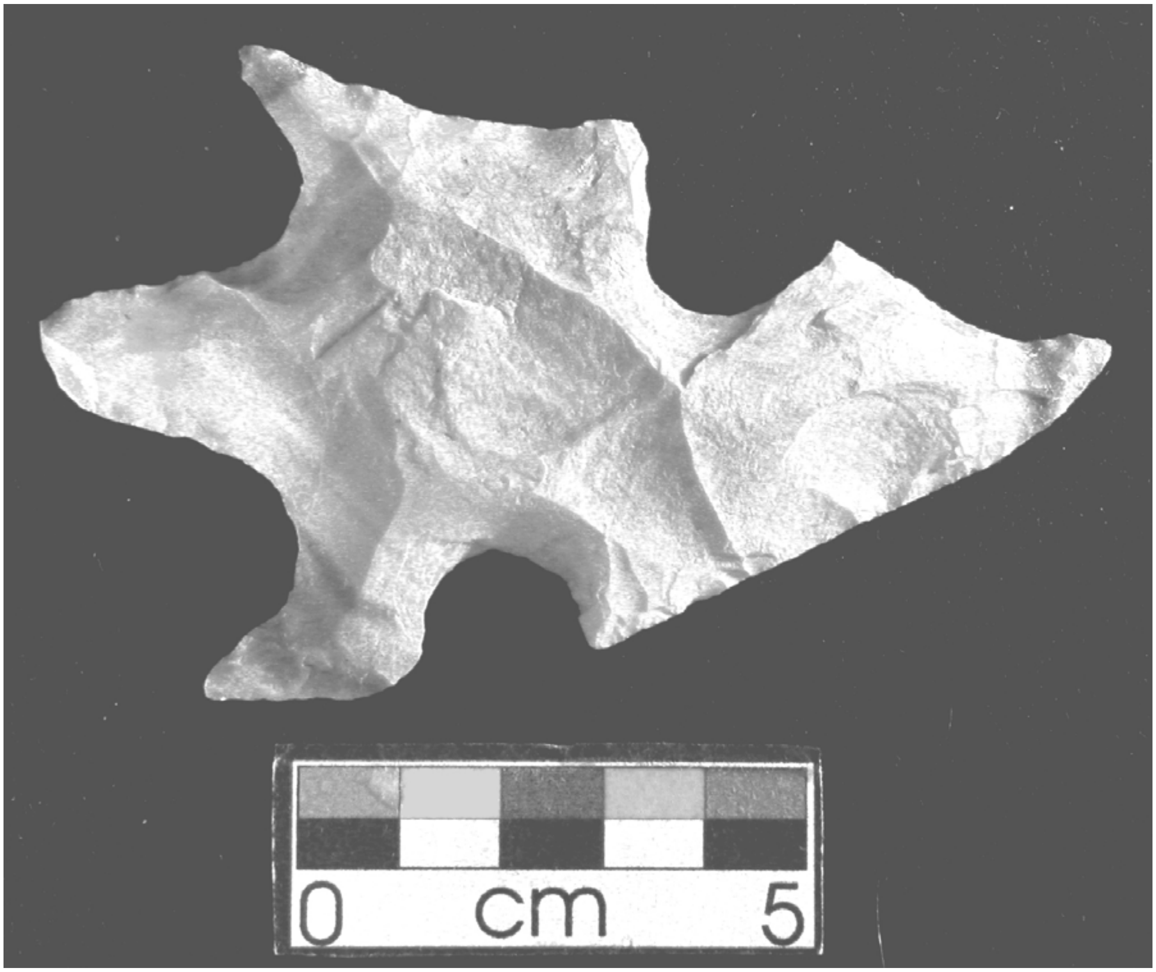


Figure 3.2: Effigy atlatl dart points from Piedras Negras Cache O-13-57. Photograph by Zachary X. Hruby.

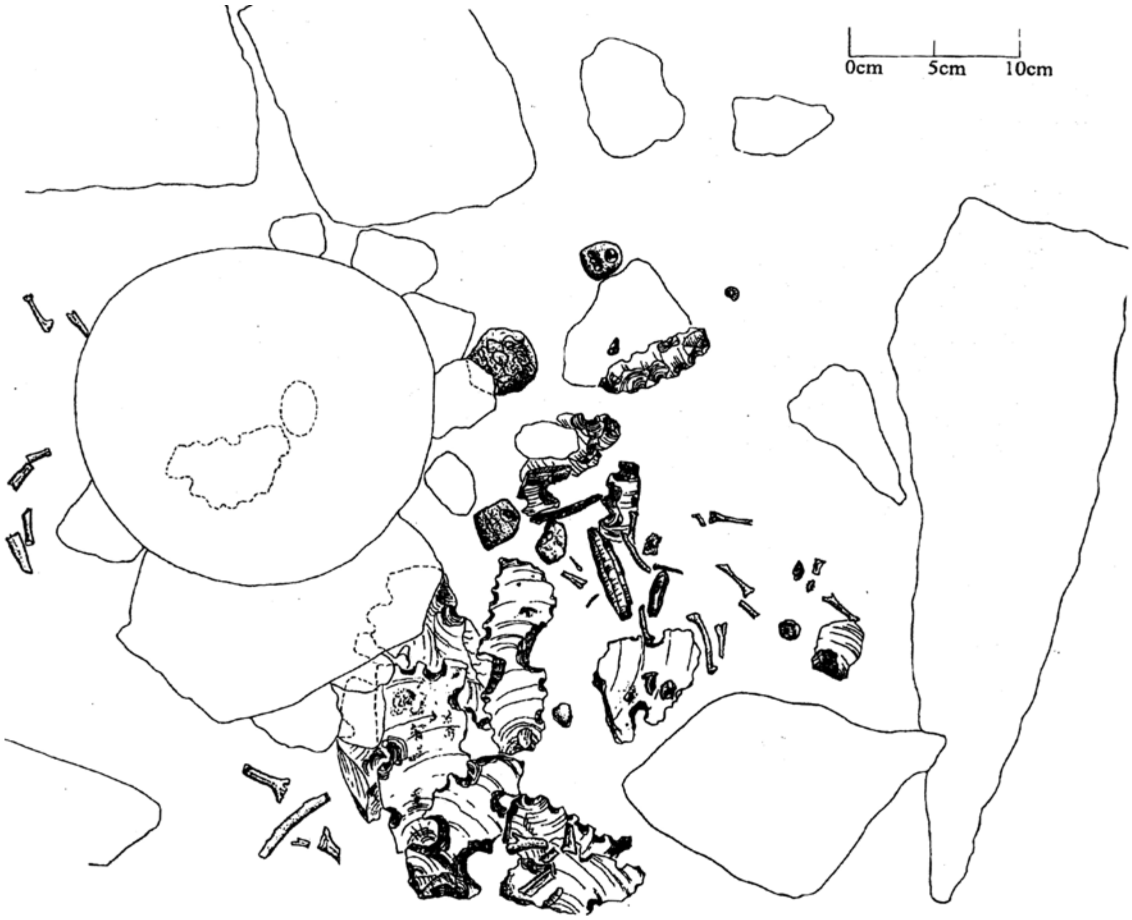


Figure 3.3: Column altar Cache R-5-4 at Piedras Negras. Drawing by Zachary X. Hruby.

These basic stylistic categories are once again discussed in Chapter 7 with supporting technological data.

Epigraphic evidence from Yaxchilan suggests that Piedras Negras suffered a defeat from that polity in A.D. 808, and that Ruler 7 may have been vanquished at that time (Stuart 1998:389-392). Although the production of carved stone monuments did not continue after this defeat, the city did not cease to function entirely (Muñoz 2003). In fact, the acropolis continued to be occupied after A.D. 808, and other major residential groups in the site core and in the near periphery continued to be occupied through late Chacalhaaz times. The end of the Terminal Classic, or the Kumche ceramic phase, signaled further decrease in population, but it is important to note that the final stucco work on the back of O-13 contained Kumche phase ceramics (Muñoz personal communication 2001). These patterns indicate that the Maya of Piedras Negras continued to maintain some of the major ritual centers of the city, and that in O-13 at least, some caching activity may have continued up through part of the 10^{th} century. A ceramic cache found in the collapse of the P-7 sweatbath marks, perhaps, an even later ritual treatment of the buildings at Piedras Negras.

This review of the archaeology and history of Piedras Negras certainly is not all-inclusive, but rather focuses on the discoveries made during earlier excavations and studies that have an effect on our understanding of the lithic traditions of Piedras Negras. The sample collected during much more expansive and systematic excavations carried out by the Piedras Negras project (1997-2000) provides evidence of much larger systems of production and consumption by the royal family and other residential groups within the city. Since the ceramic chronology has been refined, the present study focuses on this Late Classic (Balche > Yaxche > Chacalhaaz > Kumche) production of chipped-stone goods at Piedras Negras.

3.2: THE TESTS AND METHODS

The present research is based on a more refined and diverse technological analysis than has been used previously in the context of a Classic Maya political center. The technological and material data collected on the chipped-stone artifacts of Piedras Negras were analyzed statistically according to their date and location. The results of this analysis were used to test a series of hypotheses about the organization of production at Piedras Negras. Specifically, I attempt to locate production and consumption locales based on frequencies of production debitage (see Hypotheses 1 and 2 below). The goal is to reconstruct the production and exchange systems for chipped-stone goods at Piedras Negras.

The obsidian and microcrystalline-quartz artifacts are analytically separated into two different material classes, which contain a variety of technologically distinct artifact types. The artifact types roughly correspond to the material classes, as well as to the variation within material classes (i.e., chert, flint, chalcedony, and dolomite as discussed in Chapter 3). Blade-core technology usually was restricted to obsidian materials, while biface, uniface, and flake-core technologies were executed in microcrystalline-quartz materials. Technological overlap only rarely occurred during the reduction of blade-cores made from microcrystalline quartz, and also in the production of obsidian bifaces for royal cache deposits.

Although there is a high probability of different procurement strategies for locally or regionally available materials versus purely imported ones, they were used in some similar ways. Obsidian and microcrystalline quartz crosscut elite and nonelite contexts in use, as cutting and scraping tools and as ceremonial goods. Both also were reduced using a combination of percussion and pressure techniques, which may have placed them in similar emic categories for the knappers and the consumers of the finished products. It should also be noted, however, that obsidian and microcrystalline quartzes were symbolically distinct throughout the history of the Maya world and, as previously mentioned, they were reduced in different ways. This idea is supported by the use of obsidian and flint oppositions in the caches at Piedras Negras and elsewhere in the Maya area. Thus, part of this research can address the problem of the division of labor based on material, technology, and location by isolating the degree to which different materials were reduced independently of one another by one or more groups of stone workers (see Hypothesis 2 below).

I make distinctions between all technologies and forms (both "utilitarian" and "ceremonial"), because it is precisely the broad archaeological category of "chipped-stone producer" that is one of the main foci of this study. If relatively large amounts of microcrystalline quartz and obsidian debitage come from one particular household group, it is impossible to determine if that household group housed a "jack-of-all-trades" stone worker, or a number of culturally distinct kinds of craft specialists. On the other hand, if some residential groups feature more of one kind of production evidence, then alternate interpretations may be necessary. The specificity in the proposed analysis may help to determine: (1) whether chipped-stone production in both obsidian and chert were connected activities, or conversely, whether artisans adhered closely to a set of materials or technologies; (2) how widespread a particular reduction system was practiced; and (3) whether raw material availability affected the restricted or open nature of production.

Some aspects of the recently excavated lithic-sample from Piedras Negras reveal its importance for understanding the lithic economy at Piedras Negras. First, all special deposits and household excavations were thoroughly recorded. Second, all lithic artifacts were collected for analysis, and finally, it is the largest lithic sample from the western lowlands to crosscut royal and nonroyal contexts. Even though all time periods are addressed in this study, the Late Classic period sample is substantially larger than that of the Early Classic or Preclassic samples, and remains the central focus of investigation. The relatively high frequency of caches containing large amounts of lithic materials provides new opportunities for discussing the role of royal groups in the procurement and distribution of lithic goods at Piedras Negras. One advance of this research is to place the production of chipped-stone goods from royal, ostensibly ritual, contexts within the same theoretical and methodological framework as those created in “utilitarian” production systems from household contexts. As discussed in Chapters 6 and 7, the production of chipped-stone tools in residential groups may be related to the production of elite cache and burial goods.

Determining whether or not the royal family controlled lithic production, however, is a difficult empirical endeavor, and one that cannot be demonstrated with the present data. Instead, I reconstruct the possible exchange and production systems to infer the social roles of producers and consumers alike. Hypothesis 3 is constructed to reveal where production debitage was used, and by whom, through time. In contrast to the common perception that production debitage is "waste" or refuse, this research explores ways in which production debitage was valued and used in symbolically potent ways. Hypothesis 4 further tests this idea by looking at specific ways in which technology and ideology overlap in royal debitage deposits throughout the site.

3.2.1: Parameters of Analysis and Assumptions

Various lines of evidence have been used in the past to model the organization of production and consumption in ancient Maya cities, usually with the intention of arguing for or against royal control of lithic economies. Use-wear studies (Aldenderfer 1991), production debitage (Fedick 1991), consumption-related debitage (McAnany 1989), workshop dumps and debris (Masson 2001), and frequencies of lithic material in general (Moholy-Nagy 1997) are among only some of the employed methods. Although I collected all of these types of data for Piedras Negras, the focus of this study is on production locations that are identified by frequencies of production debitage.

As mentioned previously, I shift the focus to artifact technology and context in order to bring more specificity to discussions of royal control and types of specialized production. It is not sufficient to state that since the majority of production occurred away from the seat of power by many different hands lithic production was not of interest to the royal family and had no relation to the political economy (see McAnany 1989). Chipped-stone production likely did not "make" or "break" the political economy of the ancient Maya, but it was part of the political economy as defined broadly in Chapter 2. Lithic distribution also may reflect larger systems of exchange, such as the organization of agricultural production and tribute. Furthermore, on the smaller scale of intra-site politics, lithic production, distribution, and consumption could have played a large role in social organization (see Chapter 2 and 3). In this regard, Aoyama and Potter and King, for example, may be "speaking past one another," because lithic exchange probably did not have a direct effect on the sustainability of the political economy (e.g., agricultural surplus), but the ruling elites may have had interest in controlling some aspects of the chipped-stone economy for reasons of increasing their prestige within the city.

Potter and King (1995) suggested that it is not worthwhile to discuss the systematic production of chipped-stone goods without massive primary and secondary production debris deposits. Large deposits of production debitage demonstrate that massive production occurred at secondary sites. However, this observation offers no suitable range of interpretations that account for the production debris that occurs in large city centers, or an explanation of how and why production activities took place there (cf. Moholy-Nagy 1997). The truth is that all major Lowland Maya cities featured lithic production of some kind, and this production has implications for understanding the organization of production and the local economy of political centers. Chipped-stone goods were imported to Piedras Negras, but this does not mean that regionally imported goods were more or less valuable than locally produced ones. The discussion of symbolic capital in Chapter 2 outlines how goods can achieve a higher value based on who made them, as well as where, and how, they were made.

Production and consumption areas can be identified by the existence of certain types of recognizable debitage (e.g., Fedick 1991; McAnany 1989; Moholy-Nagy 1997). I use frequencies and distributions of production debitage from both household and civic-ceremonial architectural contexts as my primary dataset, differentiating between evidence for different stages of production and consumption. For microcrystalline quartz and obsidian artifacts, three basic stages of reduction are considered, including initial reduction, final reduction, and the resharpening or reworking of finished tools. I examine the initial reduction of microcrystalline-quartz nodules for blanks and preforms by focusing on the material correlates for these behaviors, such as: nodule reduction chunks, nodule reduction flakes, production failures of blanks and preforms, and early-stage biface-reduction flakes. Next, I surmise the final reduction of blanks and preforms into finished tools and ceremonial goods by identifying middle- and late-stage biface-reduction flakes, notching flakes, pressure flakes, late production failures, and hammerstone flakes made through use. Finally, the acts of resharpening and rejuvenation of used and broken chert tools are identified with resharpening flakes (retouch flakes) and resharpening failures. Since the focus of this study is on production locale, only the first two categories of data are used in the distributional analysis.

Varieties of microcrystalline-quartz stones are recorded in the study to illustrate the correlation between material types and artifact types (Hruby 1999). Fine microcrystalline quartzes were reserved for small bifaces and prismatic blades, medium-grade cherts and chalcedonies were used for mid-size bifaces (knives and spear heads), and coarse-grained cherts and chalcedonies were used for large bifaces, especially celtiform axes (see Chapters 3 and 4). Large indirect percussion notching flakes of fine and medium grained materials are used to identify the production of microcrystalline-quartz eccentrics, however few of them actually exist. Of course, there are always exceptions, but the general trend of tougher stones for harder kinds of tasks tends to hold at Piedras Negras.

The production of obsidian goods is identified by only a few technological types because the morphology of imported polyhedral-cores was relatively homogeneous and the techniques for preparing them for reduction by pressure varied little (see Chapter 6). Nevertheless, specific stages of reduction can be identified through flake, blade, and core morphology. The initial preparation of imported cores can be identified largely through the existence of percussion blades and flakes that were removed to regularize the face of the core (i.e., removing irregularities created through transport, natural inclusions, or original production flaws). Early first- and second-series pressure-blades, and also late-stage pressure blades that often overshot the distal end of the core mark the production of prismatic blades. Other debitage types consist of distal, lateral, and platform rejuvenation flakes, crested blades, and exhausted cores. Finally, the production of obsidian eccentrics can be identified primarily by the existence of fragments of bipolarly reduced, exhausted pressure-blade cores, irregular percussion flakes, and notching and pressure flakes unrelated to blade-core technology. No examples of bipolar flakes used as tools were found at Piedras Negras, indicating that bipolar reduction was reserved for the manufacture of blanks used in the obsidian eccentric industries.

3.2.1.1: The role of use-wear in the study. The existence of use-wear on debitage can confuse the identification of production loci, since certain types of debitage could have been moved or traded outside of the household group where they were originally manufactured. However, Moholy-Nagy has (1997) suggested that the existence of certain kinds of debitage in a dated context can provide good evidence for production activity by a given household at a particular time. Thus, flakes without use-wear, and other unused types of debitage, which traditionally were not transformed into tools, are used as primary evidence of production location somewhere within the general vicinity of a residential group (Hayden and Cannon 1983). Heavily used microcrystalline-quartz debitage, for example, is discounted as production evidence because biface reduction-flakes were important cutting and scraping tools to producers and nonproducers alike. Nevertheless, the existence of unused debitage, possibly in conjunction with used flakes, aids in identifying production locales.

I divided use-wear by the degree of use, be it cutting or scraping, into very soft, soft, medium, hard, and very hard categories. I then gave each group a numerical value of 0-5. For example, a flake that was used on two sides as cut-medium and scrape-hard received a flake-use total of 7. A flake that was not used received a zero flake-use score. In selecting flakes as production evidence, I only used debitage with a flake-use total of 2 or less for obsidian and 4 or less for microcrystalline quartzes, but excluded flakes that received these scores from moderate to heavy use-wear on only one side of the flake. For example, I removed flakes with "scrape-medium" on one side and "zero" use on the other sides (3+0=3), which would fit numerically into the production evidence category, but was in fact moderately used. Since the goal is to locate debitage that was not used, I retained flakes and blades that were used "very softly" for obsidian and at least "softly" for microcrystalline quartzes. I kept these pieces of debitage as production evidence because of the possibility that light use-wear markings on both microcrystalline quartz and obsidian debitage may have gotten there by some other means, not related to actual tool use (e.g., by being tread upon or from contact with other objects). This ranking system is crude, but the goal is not to gather detailed information about how tools were used (cf. Aoyama 1998), but rather to determine the relative intensity with which the debitage was used, and, of course, where the bulk of unused debitage was found at the site.

3.2.1.2: Identifying production locales. Because no large-scale production dumps (as at Colhá, see Shafer and Hester [1976]), or in situ workshops were found at Piedras Negras, I use the frequency and distribution of the previously mentioned kinds of production debitage in middens, fill, and special deposits. This method makes determining frequency of production and total output of lithic goods questionable, so I do not attempt to calculate these aspects of production here. I do, however, reconstruct minimum and maximum numbers of finished artifacts for some debitage deposits, such as biface-thinning flake deposits in royal burials. The goal here is simply to reveal further symbolic meanings associated with ritual deposits.

I devised a subjective grading system to rank various kinds of debitage as more or less strong evidence for production activity in a given locale. I separated production evidence into first-, second-, and third-degree groupings, with third-degree production evidence representing the strongest evidence for production activity. The validity of these groups are based on two main assumptions: (1) small and awkwardly shaped pieces of debitage were not valuable trade items and, thus, were not traded from the place of their creation; and (2) unused pieces of production debitage likely were not traded far from the place of their manufacture. Since production debitage does not appear to have been deposited in “dumps” around households, and likely was removed to other locations, remnant production debitage on abandoned floors, in fill, and in middens remain the only markers of production at Piedras Negras.

First–degree production evidence in microcrystalline quartzes include unused or little-used biface-reduction flakes of early, middle, or late stage. Other biface-reduction flakes, such as those removed to raise a margin and alternating flakes removed to eliminate a square edge on the production blank, were included in the first-degree production evidence category. Second-degree production evidence includes little-used nodule-reduction flakes and hammerstone flakes. Nodule-reduction flakes indicate that blanks for large- and medium-sized bifaces and unifaces were being produced and that the residential group had access to those raw materials. Hammerstone flakes, which were produced unintentionally through use of the hammerstone (Figure 3.4), also are

Figure 3.4: Two examples of hammerstone use-flakes from Piedras Negras (Operation 41). Upper flake, PN41E-34-1/1: dorsal, profile, and ventral views. Lower flake, PN41E-33-2/2: dorsal and ventral views.

considered as second-degree evidence. The existence of hammerstone flakes, which were rarely used as tools themselves and likely were not exchanged as cutting or scraping tools, suggest that production activities occurred nearby. The third-degree production evidence includes various kinds of shatter, especially nodule shatter that was produced during the reduction of nodules and blanks. Shatter, or irregular flakes and chunks that do not feature normal flake morphology, was almost never used as cutting and scraping tools and probably was not removed from the residential group of its origin for exchange of any kind.

Obsidian blade and flake debitage is categorized in a similar manner into first-, second-, and third-degree production evidence. These designations run under a different set of assumptions because the primary intended product was fine, prismatic pressure-blades, and not some other tool made from pressure blades. First-degree production evidence includes little used or unused third-series blades (see Chapter 6 for a full explanation of obsidian debitage types). The assumption is that a producing household had more access to blades, and was not forced to use every piece of available obsidian. Furthermore, production areas may feature more blade fragments resulting from the failure to remove a complete blade from the core. These kinds of blade fragments may not have been used, but rather thrown away along with other small blade-production debitage.

Second-degree production evidence consists of third-series flakes and rejuvenation blades, second-series blades and flakes, distal rejuvenation pressure-blades, and exhausted cores. Since small third- and second-series pressure flakes were often not used, they probably had a lesser exchange value. Second-series blades, third-series rejuvenation blades, and rejuvenation pressure-blades removed from the distal end of the core were all useful cutting and scraping tools, but since they feature irregular cutting surfaces and overall morphology, they may not have been exchanged away from the original area of their production. Exhausted blade-cores and blade-core fragments also are not direct evidence for production activities, but the assumption is that these debitage types likely remained near their original locus of manufacture.

Finally, third-degree production evidence consists of percussion flakes and blades, first-series pressure blades and flakes, and other small and unused core-maintenance flakes. These debitage types represent the earliest stages of blade-core preparation, or little-used flakes and ribbon blades that probably were not valued as tools. Since similar debitage types have been found in large production dumps from the Maya area, such as the Ojo de Agua deposit studied by Clark and Bryant (1997) and the production deposit from site 272-136 of the BRASS survey in Belize studied by Marc Hintzman (2000), they are considered to be good markers for production activities.

The average production value for a given excavated operation, which in most cases represents excavations carried out in a single residential group, is used to identify that operation, and by extension, that residential group, as a more or less likely production locale. Using simple parametric statistics I calculated the standard deviation of average production values per operation (i.e., residential group) during a given time period. I then produced a z-score for each household and removed residential groups that fell below 90% probability. In this way, I discarded residential groups that had statistically insignificant production values. In addition to statistically significant production values as a marker of production locale, quality of the production evidence also is noted, such that all of the previously stated forms of production evidence must be present for its identification as a plausible production locale. For example, a household group that featured many unused third-series blades, but none of the second- or third-degree production evidence, would not be considered as a production locale for a particular time period. In short, the residential group must have a full range of production debitage and a statistically significant percentage of production debitage in its excavations to be considered as a production locale in this study.

3.2.1.3: Identifying ideologically-loaded production. The method used to analyze burial and cache goods is based on a comparative approach to interpreting symbolism of icons and material objects. Although I do not attempt to interpret the symbolic meaning of each eccentric type in the present study, I use a refined version of the eccentric typology proposed by Coe (1959) to determine which symbolic forms are repeated in caches through time. Of course, some eccentric forms appear to be unique, but the repetitive nature of the caching tradition at Piedras Negras allows for a comparison of most symbolic forms, especially during the Late Classic period. In the case of chipped-stone burial goods, I examine their spatial arrangements within the burial context to determine if there is a symbolic pattern to their placement.

Once the symbolic patterns are determined, I analyze the specific technologies used to make each lithic artifact. These of technologies are laid out explicitly in the typology chapters of this study, but to review briefly here they include: (1) the use of indirect-percussion, direct-percussion, and pressure-flaking techniques for microcrystalline-quartz eccentrics; and (2) indirect percussion and pressure flaking on pressure- and percussion-blades for obsidian eccentrics. For large debitage deposits in tombs, I conduct refit studies to determine how the debitage may or may not have related to the production of a particular series of finished products. This research not only reveals how technology of cache and burial goods may have changed through time, but also determines whether there was a symbolic component to the production of those goods. If there is a tight correlation between the morphology of the chipped-stone products and the technologies used to create them, especially if they are not related to efficiency, then the process of production as a symbolically loaded activity is a significant aspect of the symbolism and value of the finished product. This relatively novel analytical method may have implications for understanding the symbolic or ideologically-loaded nature of other forms of craft production in the Maya Lowlands.

3.3: HYPOTHESES

I test two distinct sets of hypotheses. The first set of hypotheses infers the parameters of production per time period based on the distribution of production evidence. The second set examines the nature of production and consumption at Piedras Negras. I look at where debitage is deposited at the site and use comparative contextual and morphological data to elucidate the possible ideological connections between the knapper, the royal family, and the rest of the city.

3.3.1: Hypothesis Set 1: The Organization of Production

The first hypothesis is that the production of obsidian and microcrystalline-quartz goods was limited to a few residential groups during any single time period. Evidence for the production of chipped-stone goods should be restricted to a relatively small number of residential groups over time. I use the production value number (discussed above) from operations with significant numbers of artifacts to reject the null hypothesis. The null hypothesis is that the majority of excavated residential groups have significant amounts of production evidence. Each household group is designated as a likely chipped-stone production area if it had a significant ratio of production debitage to nonproduction-related debitage, as reflected in the total production value number. The implication of this test is that the production of chipped-stone goods was restricted, either by the royal family, or by the craft specialists who made those goods.

The second hypothesis is that production of microcrystalline-quartz goods was not connected to the production of obsidian goods. The null hypothesis is that residential groups with significant production values for microcrystalline-quartz materials will co-occur with significant production evidence for obsidian. The implication is that knappers who worked in obsidian were a distinct group of craft specialists from those who worked in microcrystalline-quartz materials. If the null hypothesis is not rejected, then hypothesis 2 may still be true, but it is impossible to define statistically.

It is important to note that I am not testing the idea that the royal family controlled lithic production and distribution outright. The interest here is simply to determine the degree to which lithic production was restricted and whether obsidian and microcrystalline-quartz production were related activities. The consumption of microcrystalline quartz and obsidian eccentrics appears to be restricted to the elites, and the distributional analysis indicates that this is actually the case. It may be possible to determine whether the royal family controlled certain elements of chipped-stone distribution at Piedras Negras, but demonstrating control over production is even more difficult. Demonstration of control can only follow from an interpretation of the distribution data, and secondarily from the results of this first set of hypotheses.

3.3.2: Hypothesis Set 2: Ideology and Value

The third hypothesis is that the royal palace had more access to production debitage than other residential groups in the site. That is, the total production evidence from the palace, and royal caches and burials will be significantly greater than anywhere else during a given time period. The null hypothesis is that all production locals will have similar ratios of production evidence to nonproduction evidence. The implication is that the royal family had greater access to production debitage than other households in the city center. The result is counterintuitive because production debitage has traditionally been understood to be of little value and interest to the ruling elite.

The fourth hypothesis is that certain types of chipped-stone goods not only had economic value, but also had symbolic value and meaning to royal and nonroyal inhabitants alike. Consequently, particular artifact forms and the resulting debitage were perceived and distributed differently based on their functions and symbolism. The symbolic value of the object derived from its form and material, but also from the knapper who produced it and the cultural capital he or she possessed. Thus, there should be a tight correlation between the technologies used to create chipped-stone goods and the symbolism of the chipped-stone goods themselves. Since cache and burial goods, such as microcrystalline quartz and obsidian eccentrics, probably were the most symbolically rich type of chipped-stone goods, they are the primary sample used to test this hypothesis. However, I also examine, as much as possible, the contexts in which eccentric production debitage was found in general excavations. Aside from citing the obvious symbolic potency of cache goods, I take a technological approach to test the idea that certain lithic techniques were ideologically loaded and cannot be explained by mere economic efficiency (see Dobres 2001). As previously mentioned in the theory section (Chapter 2), the goal of testing this hypothesis is to examine the intersection between local ideologies and economics, but also to determine how the practice of lithic technology may have played a role in determining the value of the finished products.

3.4: SUMMARY

The long, well-recorded history and archaeology of Piedras Negras provides an opportunity to examine the organization of lithic production at a large Maya center. Previous studies have been key for understanding the cache and burial traditions at Piedras Negras, but new analyses performed here, as well as newly excavated deposits, shed light on how those goods were produced. This study takes one step further in examining production and consumption patterns throughout all contexts of the city.

Furthermore, general patterns of production and consumption are related to cache and burial goods to determine whether there was a cultural and economic connection between them.

CHAPTER 4

LITHIC RESOURCES AND THE PIEDRAS NEGRAS SAMPLE

The two major material types discussed in this chapter are microcrystalline quartzes and obsidian. However, there is much variation within each basic material type and the goal of this chapter is to clarify these differences. I begin with a description of microcrystalline quartzes used at Piedras Negras, and follow with a discussion of obsidian sources.

4.1: MICROCRYSTALLINE-QUARTZ MATERIALS

The term microcrystalline quartz refers to siliceous stones that were formed through sedimentary geological processes. Historically, cherts, flints, chalcedonies, jaspers, and other microcrystalline quartzes have been characterized as either chert or flint depending on the era and area of study (cf. Willey 1972; Shafer and Hester 1983). Each material should be recognized as geologically distinct, but also analytically distinct, because each material was reduced using a particular suite of chipped-stone technologies. Nevertheless, microcrystalline quartz is still valuable as a material category, since these individual sets of technologies are related by similar bifacial and unifacial reduction strategies. Microcrystalline quartzes were reduced in ways that obsidian usually was not, and they have different material properties, including their heightened toughness. The formal variability and variety of microcrystalline-quartz bifacial and unifacial tools in the Maya Lowlands requires a more systematic and broad typology than has been proposed previously (see Chapter 5). A typology that includes all bifaces allows for a better understanding of the total lithic tradition at any given site.

4.1.1: Local Resources

Subsidiary sites of Piedras Negras (El Cayo, Macabilero, and El Porvenir) are all located near modest chert sources on the riverbank with sparse resources in between (Hruby 1999, 2000, 2001; Lee and Hayden 1989). The Piedras Negras source is by far the largest and has the most varieties of chert (Hruby 1999). This pattern suggests that the existence of chert sources may have been a deciding factor in the settlement of Preclassic centers. Tool stone was needed for construction, agriculture, warfare, and hunting. It is telling that other political centers such as Tikal, Nakbe, San Bartolo, Altar de Sacrificios, and many others are all located on, or near, substantial microcrystalline-quartz sources.

The most common microcrystalline-quartz types used at Piedras Negras are a locally available nodular chert, imported nodular chert, and a chalcedony, which probably is local, but an exact source location is not known. The local nodular-chert was procured from a quarry located directly below the site center along the Usumacinta River. Figure 4.1 depicts the location of most of the chert nodules below the site center. The nodules typically have a highly visible black or brown cortex (for which the site is named), and are embedded in a hard, sometimes dolomitic limestone. The color varies from white to dark grey, but the norm is light grey with inclusions. Material traits range widely within

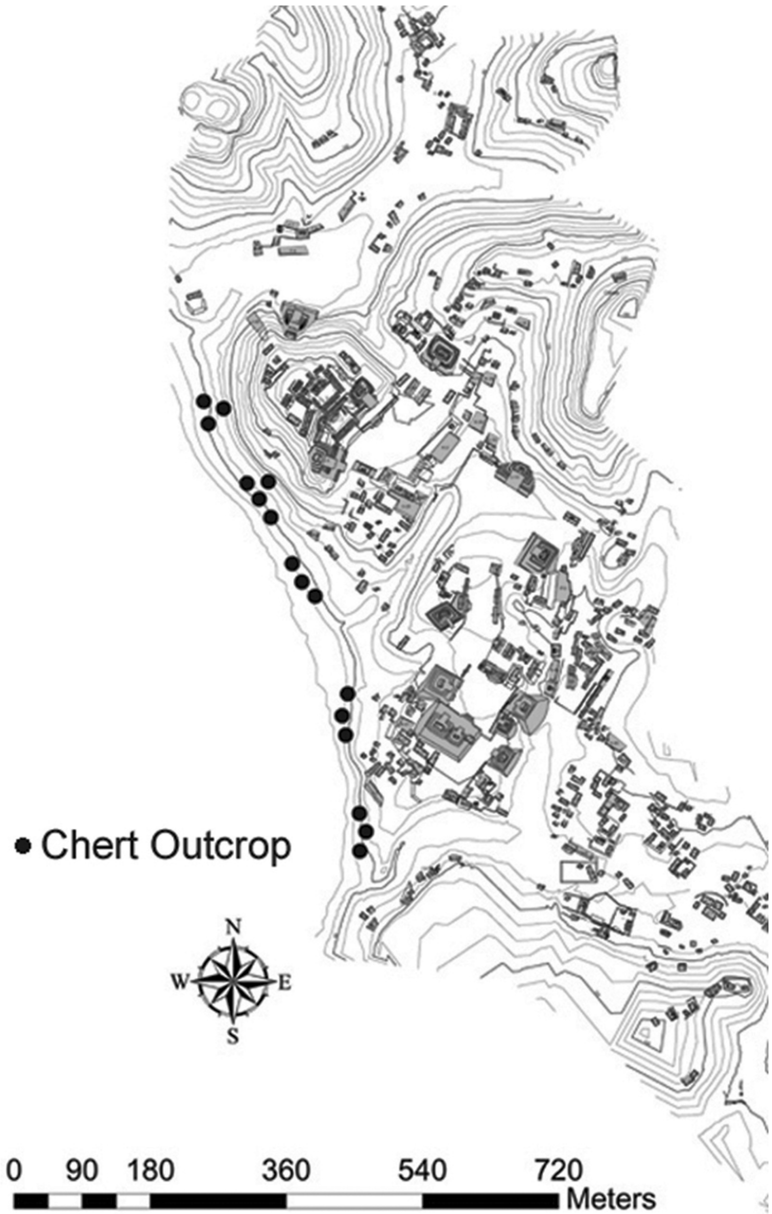


Figure 4.1: Map of Piedras Negras and known chert outcrops below the site center, and along the river. Based on a map by Nathan Currit, Timothy Murtha, and Zachary Nelson, and prepared by Zachary Nelson.

and between nodules, which were selected for different tool trajectories. Finer cherts were used for smaller bifaces and eccentrics that required pressure flaking reduction strategies, and medium-grade, or grainier cherts were used for medium- and large-size tools. Coarse-grained, and tougher cherts usually were reserved for large, thick bifaces used for heavier work. Overall, the chert can be classified as low quality because of the large numbers of quartz crystal faults in the nodules, poor conchoidal fracture pattern, and high degree of knapping difficulty. The ubiquity of chalcedony and chert hammerstones at the site suggests that the local limestone was not durable enough to provide effective hammerstones to work the local material.

Nodular and tabular cherts were collected from the limestone riverbank directly below the site core. Chert quarrying probably was done seasonally, because the river covers the source during the wet season. This may have also been true for architectural construction, because much of the stone used to build the pyramids consists of river-worn limestone cobbles. In addition, many of the facing stones, lintels, and monuments were cut from limestone beds located on the river bar (Hruby 2001). It follows that the acquisition of construction materials was in some way connected to quarrying of chert materials from the same source, since one action cannot be carried out without the effect of the other. The connection between chert and limestone is found in the geology, but also in ancient Maya art, in which microcrystalline quartzes and limestone appear with the same motifs, but, nonetheless, with distinct names–<u>took'</u> and <u>tuun</u>.

The chalcedony used at Piedras Negras was locally or regionally procured, but the actual source was not found among the local riverine stone outcrops within a two kilometer radius of the site center. The ubiquity of cortical nodule reduction flakes and nodule fragments, however, indicates that the source was nearby. The lack of river-worn cortex suggests that the source may have been located inland, away from watercourses. It can be characterized as translucent white to blue in color, but it develops an opaque white patina through time. It is very difficult to work, and the quality is largely heterogeneous. Heat treatment processes can explain variability in the color and quality of both the chalcedony and chert. However, evidence to prove the systematic use of this technology has not yet been compiled.

Other local materials consist of pebbles and cobbles washed out from arroyos and the Usumacinta River itself. These materials can be described as chalcedonies, jaspers, and other sedimentary and metamorphic rocks that produce a conchoidal fracture pattern. The colors are quite diverse and can range from bright red to green. Water-washed or –rolled materials do not seem to have been commonly reduced at the site, but can be identified by remnant river-worn cortex. They were used sparingly for flake cores and small bifaces at Piedras Negras, but seem to be much more common at the secondary sites of El Cayo (Lee and Hayden 1989) and Macabilero (Golden et al. 2004). Macabilero, in particular, seems to have had extensive biface and flake-core industries using creek-worn cobbles.

4.1.2: Imported Microcrystalline Quartzes

Materials that likely were imported from outside the region consist of fine grey, fine pink, and fine brown, and extremely coarse-grained microcrystalline quartzes. Some of these materials are nodular flints, marked as such by decortication flakes and finished tools with remnant chalky cortexes[10]. The material also has a fine, waxy gloss. If these materials are local, the source has not yet been identified. The existence of fine nodule decortication flakes suggests that nodules may have been traded intra- and inter-regionally, and not just finished flakes or bifaces. The fine, imported microcrystalline-quartzes resemble those from other areas of the western Maya Lowlands. Opaque, dark brown flints are very similar to those found along the Pasión River, such as microcrystalline-quartz eccentrics from Altar de Sacrificios. Some bifacial points made of fine grey cherts (Figure 4.2) are similar to those made at Cancuen (Kovacevich 2003). It is possible that sites with ready access to fine microcrystalline quartzes, such as Cancuen and Altar de Sacrificios, produced fine bifaces for exchange beyond their own polities. Similar exchange systems have been described for the fine honey-brown cherts of the chert-bearing zone of northern Belize. The main products produced for trade in that area, however, were celtiform axes, eccentrics and macroblades. None of these artifact types, nor any Colhá-type materials, have been found at Piedras Negras.

Some extremely coarse-grained materials and nonlocal cherts also are common at Piedras Negras and may represent one or more unidentified tool-stone sources of regional importance. A medium-grained cream-to-tan chert is particularly common, and tools made of this material, and other imported coarse-grained microcrystalline quartzes, represent over half of the entire sample. It is clear that some of the imported materials arrived as nodules because of the frequency of decortication flakes and early biface-

Figure 4.2: A stone tool from Piedras Negras made from grey chert: plan and profile views. Photographs by Zachary X. Hruby.

reduction flakes found at the site (see Chapter 7). Another extremely coarse-grained chert, may be more accurately characterized as dolomite or dolomitic limestone, which is not a microcrystalline quartz. I classify this material as a microcrystalline quartz for the present study, because I am unsure of its mineralogical composition. The locations of these sources may be determined through further survey of the Middle Usumacinta region and with a more systematic visual characterization of microcrystalline quartzes from elsewhere in the Maya Lowlands.

In summary, the microcrystalline quartzes used at Piedras Negras can be considered to have come from a potpourri of geological sources. They arrived at the site in several different forms, and perhaps via several exchange systems. The Piedras Negras Maya relied on their local materials, but also on the importation of nodules and finished tools from other locales. Clearly, the inhabitants of Piedras Negras did not produce all of their own chipped-stone tools, but production evidence from caches, burials, and household contexts suggests that knappers did indeed work on-site. The distribution of this production evidence is described in Chapter 7.

4.1.3: Morphology and Quantity of Chert Samples

According to replication studies and debitage found in the archaeological record, chert nodules can produce (1) angular shatter of a small size; (2) mid-size chunks usable for flake cores; and (3) the desired result: workable cobble sections and flakes used for the three main tool systems found at the site. The common tool types are the celtiform biface, medium-sized laurel leaf biface, and small laurel leaf biface (see Chapter 5). Most of the eccentrics from the site are derivations from the mid-size biface trajectories of both local and imported materials, but some are made by slightly modifying biface-thinning flakes and nodule reduction flakes. Unifacial knives, unifacial scrapers, blade cores, and flake cores also are present at Piedras Negras, but they are largely eclipsed by bifacial technologies. The two less functionally desirable types of debitage from nodule reduction, and also biface-thinning flakes, were often deposited in elite burial and cache contexts at Piedras Negras. This pattern resembles those from other sites in Mesoamerica, such as Teotihuacan and Tikal (Moholy-Nagy 1997).

At Piedras Negras 4,557 chert artifacts and debitage pieces were found in commoner and elite contexts. More than 100 newly discovered chert eccentrics, mostly from cache deposits in royal structures, also are included in this total. Only one possible workshop dump of ~3,000 flakes was found in the South Group (Operation 15), but they consist of late-stage, biface percussion-flakes and pressure flakes from biface reduction and resharpening. The only deposits containing debitage taken directly from a large-biface workshop were from royal architectural and burial contexts. The majority of biface thinning flakes and other production debitage comes from household fill and detritus left on abandoned house floors. Specific flakes mark production activities, and visual sourcing indicates whether that material was of local or nonlocal origin.

4.1.3.1: Distribution of microcrystalline quartzes. The materials I recorded for the Piedras Negras artifacts were chert (C), silicified limestone (SL), chalcedony (CH), dolomite and dolomitic limestone (D), petrified wood (PW), flint (F), and quartzite (QZ).

Table 4.1: Percentages by artifact count and weight of all the microcrystalline quartz materials at the site.

Materials from General Excavations	Artifact Count	Total Weight in Grams	Percentage of Total by Artifact Count	Percentage of Total by Weight	Artifact Count	Total Weight in Grams	Percentage of Total by Artifact Count	Percentage of Total by Weight
Quartzite					37	5060.65	0.88%	3.92%
Petrified Wood					4	124.4	0.10%	0.10%
Flint					101	1109.85	2.40%	0.86%
Dolomite?	191	10498.8	4.53%	8.13%				
Dolomite	381	17873.35	9.05%	13.84%				
Dolomite Total					572	28372.15	13.58%	21.97%
Silicious Limestone					121	3900.25	2.87%	3.02%
Chalcedony					725	26311.95	17.22%	20.38%
Chert?	98	5720	2.33%	4.43%				
Chert	2552	58531.33	60.62%	45.33%				
Chert Total					2650	64251.33	62.95%	49.75%
Total from General Excavations					4210	129130.6	100.00%	100.00%
Materials from Caches								
Chalcedony					23	810.7	6.63%	6.60%
Chert					324	11464.8	93.37%	93.40%
Total from Caches					347	12275.5	100.00%	100.00%

Continues next page.

Table 4.1 continued.

Material	Artifact Count	Total Weight in Grams	Percentage of Total by Artifact Count	Percentage of Total by Weight	Artifact Count	Total Weight in Grams	Percentage of Total by Artifact Count	Percentage of Total by Weight
Materials from All Excavations								
Quartzite					37	5060.65	0.81%	3.58%
Petrified Wood					4	124.4	0.09%	0.09%
Flint					101	1109.85	2.22%	0.79%
Dolomite?	191	10498.8	4.19%	7.43%				
Dolomite	381	17873.35	8.36%	12.34%				
Dolomite Total					572	28372.15	12.55%	
Silicious Limestone					121	3900.25	2.66%	
Chalcedony					748	27122.65	16.41%	
Chert?	98	5720	2.15%	4.04%				
Chert	2876	69986.13	63.11%	49.50%				
Chert Total					2974	75706.13	65.26%	53.54%
Grand Totals								
Total from General Excavations					4210	129130.6	92.39%	91.32%
Total from Caches					347	12275.5	7.61%	8.68%
Grand Total					4557	141406.1	100.00%	100.00%

Table 4.1 depicts the percentages by artifact count and weight of all the microcrystalline-quartz materials at the site. The quantities described in the table are not exact, largely because of the tendency of Piedras Negras artifacts to acquire white patina, which obscures the true color of the stone. The categories that feature a question mark contain those materials that were difficult to identify visually. I describe the available information based on my visual analysis. Of the total 4,557 microcrystalline-quartz artifacts, which weigh 141,406 g, 347 were from cache deposits (12,276 g, 8.68% by total weight). All of these artifacts were made of either chert or chalcedony, but the chert artifacts were much more common at 93.37% by count. While the materials used to produce cache goods were of relatively high quality, they were never made from very fine imported flint materials. Most of the eccentrics were made from what appear to be local materials.

The remaining 4,210 microcrystalline-quartz artifacts, which weigh 129,131 g, were found outside of cache contexts. The majority of the artifacts were chert according to both weight and count (62.95% and 49.75%, respectively). As the percentages indicate, however, artifacts made of chalcedony and dolomite were both larger and denser than their chert counterparts. Chalcedony and dolomite are by nature tougher stones, and were often reserved for thicker, more durable tool forms. Chalcedony and dolomite were the second and third most common materials at Piedras Negras, while flint, quartzite, and silicified limestone were considerably less so. Petrified wood, probably collected from the local streambed was the least common material used for chipped-stone production.

Table 4.2: Percentages of microcrystalline quartz variability through time.

Counts of Microcyrstalline Materials by Phase

Phase	Other	Chert?	Chert	Chalcedony	Flint	Dolomite	Dolomite?	Quartzite	Total
Kumche	3	8	71	26	4	14	8	6	140
Chacalhaaz	59	57	1331	336	56	226	109	14	2188
Yaxche	17	6	393	74	15	71	32	2	610
Balche	14	2	60	63	2	8	1	0	150
Naba	3	0	15	10	0	1	1	2	32

Percentages of Microcyrstalline Materials by Phase

Phase	Other	Chert?	Chert	Chalcedony	Flint	Dolomite	Dolomite?	Quartzite	Total
Kumche	2.14%	5.71%	50.71%	18.57%	2.85%	10%	5.71%	4.29%	100.00%
Chacalhaaz	2.70%	2.60%	60.80%	15.40%	2.60%	10.30%	5%	0.60%	100.00%
Yaxche	2.80%	1.50%	64.40%	12.10%	2.50%	11.60%	5.20%	0.30%	100.00%
Balche	9.33%	1.33%	40%	42%	1.33%	5.33%	0.67%	0%	100.00%
Naba	9.38%	0%	46.88%	31.25%	0%	3.13%	3.13%	6.25%	100.00%

Percentages of Microcyrstalline Materials by Phase (Totals)

Phase	Other	Chert Total		Chalcedony	Flint	Dolomite Total		Quartzite	Total
Kumche	2.14%	56.42%		18.57%	2.85%	15.71%		4.29%	100.00%
Chacalhaaz	2.70%	63.40%		15.40%	2.60%	15.30%		0.60%	100.00%
Yaxche	2.80%	65.90%		12.10%	2.50%	16.80%		0.30%	100.00%
Balche	9.33%	41.33%		42%	1.33%	6%		0%	100.00%
Naba	9.38%	47%		31.25%	0%	6.26%		6.25%	100.00%

Table 4.2 depicts microcrystalline-quartz variability through time. The general pattern of material frequencies discussed above hold for the Yaxche and Chacalhaaz phases, but differ slightly for Naba, Balche, and Kumche times. The smaller sample sizes for the latter three phases may be partially responsible for the material variation. For the earlier Naba and Balche phases chalcedony seems to be much more common than for the Late Classic phases (31.25% and 42% of the total by count, respectively). Dolomite and flint, which are not local stones, appear to be less common during the Naba and Balche phases. This pattern may indicate that inter- or intra-regional exchange of microcrystalline quartzes shifted at the onset of the Yaxche phase. Piedras Negras may have had greater access to imported microcrystalline-quartzes during the Late Classic than for other periods. Other than a slight increase in the use of quartzite, the Kumche materials are similar to the Yaxche and Chacalhaaz phases.

4.2: OBSIDIAN SOURCES AND SAMPLES

Although a few obsidian source studies have been carried out on samples from the western area of the Maya Lowlands (e.g., Johnson 1976a, 1976b; Nelson et al. 1977, 1983) and others have made general observations of Usumacinta artifacts (Coe 1959; Lee and Hayden 1989), there have been few instrumental- or visual-sourcing analyses of obsidian artifacts from the middle Usumacinta region. The present study represents the first of its kind to systematically source obsidians from Piedras Negras.

X-ray fluorescence (XRF) conducted by Fred W. Nelson (BYU laboratory) was used to predict the probable source of the obsidians found at the site. Although it is not

100% accurate, the technique has been widely accepted as a reliable way to identify geologic source for obsidian (Bettinger et al. 1984; Clark and Lee 1984:241-243, 1990). Although some scholars have rejected visual sourcing as a viable method (Cann et al. 1970:581-582; Jackson and Love 1991:51; Rovner 1989:428; Zeitlin 1979:183-190), Aoyama (1991:80-82; also see Aoyama et al. [1999]) and others have achieved a high degree of success with a combination of visual and chemical sourcing. A similar method was used by John Clark and the author (Hruby, Clark, and Nelson ms.). We have connected the chemical types to visual types, and have succeeded in producing a sourcing method for obsidian from Piedras Negras that has a 95% success rate (cf. Aoyama 1991).

The obsidian sourcing began in 1997 when obsidian artifacts recovered from test-pit excavations were visually sourced. John Clark and the author initially separated the artifacts into 12 categories based on distinct suites of visual characteristics, and surmised a possible source for each. These artifact groups were then tested by Nelson using X-ray fluorescence spectroscopy (XRF). The first round of visual sourcing proved to be a failure because the extreme variability in the El Chayal source was not accounted for. The test revealed that all the categories but three represented the El Chayal source. The other sources represented at Piedras Negras were Ixtepeque and San Martín Jilotepeque in Guatemala, and Zaragoza in Mexico.

For the second test, we accounted for the variations within the El Chayal source and the number of categories was increased to fourteen. Eleven visually distinct groups of El Chayal obsidian were created, as well as three others for Ixtepeque, San Martín Jilotepeque, and Zaragoza. The test revealed that the fine, clear brownish obsidian came from Ixtepeque, the opaque black corresponded to Zaragoza, and the grainy clear material containing black fleck inclusions represented the San Martín Jilotepeque source. The second round of XRF resulted in an 80% success rate for the pieces tested. Nine of the fourteen visual categories were correctly determined to be El Chayal and two others represented the Ixtepeque and Zaragoza sources. The three remaining categories were all some gradation of grainy, clear-to-grey obsidian that could not be identified as San Martín Jilotepeque or El Chayal with complete certainty. Because this ambiguous obsidian, which confounds a visual determination of some kinds of San Martín Jilotepeque obsidian, made up such a small fraction of all obsidian at Piedras Negras (<2%), we could achieve a 95+% success rate with visual sourcing for the rest of the sample.

4.2.1: Obsidian Sources of Piedras Negras Artifacts

Using this preliminary study, I proceeded to use a visual method of determining source for all obsidian artifacts from new and old excavations. A similar pattern of geological sources was found to exist at Piedras Negras for the rest of the analyzed sample (see Chapter 3). There is an unusually high level of El Chayal obsidian without respect to time period. The dated obsidian from general excavations, not special deposits, revealed that 96.43% came from El Chayal by artifact count. The total percentage of El Chayal obsidian for all obsidian deposits, dated and undated, is 96.51% by count and 95.74% by weight (see below for full description). Nonetheless, there also is a diversity of other sources represented at the site, including Ixtepeque, San Martín Jilotepeque, Ucareo, Pachuca, and Zaragoza. The analysis revealed lower percentages of Ixtepeque, Zaragoza, and possible San Martín Jilotepeque than previously thought (Table 4.3). Two other sources, Pachuca and Ucareo, were discovered in the remainder of the excavations. These sources were identified using comparative samples from other Mesoamerican sites.

El Chayal obsidian featured the greatest variety of visual characteristics differing in both texture and color. The most common variety is smoky grey, translucent obsidian with grey or black bands, but it also can appear with red banding, as opaque gray, as nearly transparent, or with a combination of these characteristics. A small quantity can feature small black specks or inclusions, which makes it difficult to differentiate from San Martín Jilotepeque. However, San Martín Jilotepeque often has a bluish-black hue that is rarely found at El Chayal. Ixtepeque obsidian can resemble the transparent variety of El Chayal, but it has a brownish, “bottle glass” color that does not occur at other sources. Ixtepeque obsidian also is extremely fine and has a glass-like quality. The Mexican obsidians found at Piedras Negras all have very distinctive visual characteristics that make them relatively easy to identify visually. Furthermore, the Mexican blades feature some technological traits that separate them from the blades made in Guatemala, such as extremely regular trapezoidal cross sections. Zaragoza obsidian at Piedras Negras is always a completely opaque, jet-black color, Pachuca obsidian is green in color, and Ucareo obsidian is a cloudy blue color with a fine texture.

Tables 4.4 through 4.6 describe the total counts and weights from all excavations (general excavations, caches, and total counts) at Piedras Negras in order to get a general

Source	# of Artifacts	Weight (Grams)	% of Total Artifacts	% of Total Weight	# of Artifacts	Weight (Grams)	% of Total Artifacts	% of Total Weight
General Excavations								
Zacualtipan?	1	0.5	0.02%	0.01%				
Zacualtipan	0	0	0%	0%				
Zacualtipan Total					1	0.5	0.02%	0.01%
Zaragoza?	7	4.8	0.12%	0.11%				
Zaragoza	11	14.3	0.18%	0.30%				
Zaragoza Total					18	19.1	0.30%	0.41%
Ucareo?	0	0	0%	0%				
Ucareo	5	4.7	0.08%	0.10%				
Ucareo Total					5	4.7	0.08%	0.10%
San Martín Jilotepeque?	52	39.1	0.86%	0.83%				
San Martín Jilotepeque	28	32.5	0.46%	0.69%				
San Martín Jilotepeque Total					80	71.6	1.32%	1.52%
Pachuca?	0	0	0%	0%				
Pachuca	18	9.3	0.28%	0.20%				
Pachuca Total					18	9.3	0.28%	0.20%
Otumba?	6	14.1	0.10%	0.30%				
Otumba	1	0.4	0.02%	0.01%				
Otumba Total					7	14.5	0.12%	0.31%
Mexican?	1	6.5	0.02%	0.14%				
Mexican	0	0	0%	0%				
Mexican Total					1	6.5	0.02%	0.14%
Ixtepeque?	29	19.3	0.48%	0.41%				
Ixtepeque	53	54.3	0.87%	1.16%				
Ixtepeque Total					82	73.6	1.35%	1.57%
El Chayal?	137	103.8	5.74%	6.47%				
El Chayal	5728	4391.8	94.26%	93.53%				
El Chayal Total					5865	4495.6	96.51%	95.74%
General Excavation Total					6077	4695.4	100.00%	100%

Table 4.3: Counts and percentages of obsidian sources at Piedras Negras.

Source	# of Artifacts	Weight (Grams)	% of Total Artifacts	% of Total Weight	# of Artifacts	Weight (Grams)	% of Total Artifacts	% of Total Weight
Caches								
Ucareo?	2	39.4	0.43%	0.97%				
Ucareo	0	0	0%	0%				
Ucareo Total					2	39.4	0.43%	0.97%
San Martín Jilotepeque?	2	37.8	0.43%	0.93%				
San Martín Jilotepeque	4	19.2	0.85%	0.47%				
San Martín Jilotepeque Total					6	57	1.28%	1.40%
Otumba?	1	18.6	0.22%	0.46%				
Otumba	0	0	0%	0%				
Otumba Total					1	18.6	0.22%	0.46%
Ixtepeque?	0	0	0%	0%				
Ixtepeque	1	1.7	0.21%	0.04%				
Ixtepeque Total					1	1.7	0.21%	0.04%
El Chayal?	0	0	0%	0%				
El Chayal	458	3955.4	97.86%	97.13%				
El Chayal Total					458	3955.4	97.86%	97.13%
Cache Total					468	4072.1	100.00%	100%
Cache Total					468	4072.1	7.15%	46.45%
General Excavation Total					6077	4695.4	92.85%	53.55%
TOTAL OBSIDAN					6545	8767.5	100%	100%

Table 4.3 continued.

Source	# of Artifacts	Weight (Grams)	% of Total Artifacts	% of Total Weight	# of Artifacts	Weight (Grams)	% of Total Artifacts	% of Total Weight
All Obsidian								
Zacualtipan?	1	0.5	0.02%	0.01%				
Zacualtipan	0	0	0%	0%				
Zacualtipan Total					1	0.5	0.02%	0.01%
Zaragoza?	7	4.8	0.11%	0.05%				
Zaragoza	11	14.3	0.17%	0.16%				
Zaragoza Total					18	19.1	0.28%	0.22%
Ucareo?	2	39.4	0.03%	0.45%				
Ucareo	5	4.7	0.08%	0.05%				
Ucareo Total					7	44.1	0.11%	0.50%
San Martín Jilotepeque?	54	76.9	0.83%	0.88%				
San Martín Jilotepeque	32	51.7	0.49%	0.58%				
San Martín Jilotepeque Total					86	128.6	1.31%	1.46%
Pachuca?	0	0	0%	0%				
Pachuca	18	9.3	0.26%	0.11%				
Pachuca Total					18	9.3	0.26%	0.11%
Otumba?	7	32.7	0.11%	0.37%				
Otumba	1	0.4	0.02%	0.00%				
Otumba Total					8	33.1	0.12%	0.38%
Mexican?	1	6.5	0.02%	0.05%				
Mexican	0	0	0%	0%				
Mexican Total					1	6.5	0.02%	0.05%
Ixtepeque?	29	19.3	0.44%	0.22%				
Ixtepeque	54	56	0.83%	0.64%				
Ixtepeque Total					83	75.3	1.27%	0.90%
El Chayal?	137	103.8	2.09%	1.18%				
El Chayal	6186	8347.2	94.51%	95.19%				
El Chayal Total					6323	8451	96.61%	96.37%
Total					6545	8767.5	100%	100%

Table 4.4: The total counts and weights of obsidian artifacts from all excavations.

Site	Op.	# of Artifacts	Phase	Total Weight (grams)	Average Weight (grams)	Average Length (mm)	Average Width (mm)	Average Thickness (mm)
PN	1	1	Yaxche	0.40	0.40	15.00	19.00	3.00
PN	1	5	Kumche	34.30	6.86	50.12	20.14	9.20
PN	5	1	Kumche	0.50	0.50	15.00	12.00	3.00
PN	5	1	Chacalhaaz	1.35	1.35	26.00	15.00	3.00
PN	5	3	Balche	4.20	1.40	37.33	11.00	3.00
PN	10	9	Yaxche, Late	4.50	0.50	No Data	No Data	No Data
PN	10	1	Yaxche	0.50	0.50	No Data	No Data	No Data
PN	10	2	Kumche	1.00	0.50	No Data	No Data	No Data
PN	10	5	Chacalhaaz	2.00	0.50	No Data	No Data	No Data
PN	10	5	Balche	2.50	0.50	No Data	No Data	No Data
PN	11	1	Yaxche, Late	0.50	0.50	No Data	No Data	No Data
PN	11	4	Yaxche	3.10	0.78	22.25	10.75	3.00
PN	11	5	Naba	2.25	0.45	22.20	8.60	2.00
PN	11	8	Chacalhaaz	5.45	0.68	19.00	12.13	2.75
PN	11	9	Balche	2.85	0.32	14.89	10.11	2.56
PN	12	2	Yaxche	4.00	2.00	38.90	10.10	3.15
PN	12	13	Naba	9.20	0.71	24.26	10.04	2.45
PN	12	3	Chacalhaaz	5.60	1.87	29.07	15.37	4.57
PN	12	2	Balche	1.50	0.75	28.30	13.20	2.40
PN	13	1	Chacalhaaz	0.50	0.50	No Data	No Data	No Data
PN	13	1	Balche	0.50	0.50	No Data	No Data	No Data
PN	14	1	Yaxche		0.50	No Data	No Data	No Data
PN	15	1	Yaxche	0.45	0.45	14.00	12.00	3.00
PN	15	4	Naba, Late	2.55	0.64	20.00	9.50	2.63
PN	15	7	Chacalhaaz	5.90	0.84	18.86	9.86	2.79
PN	17	19	Kumche	9.50	0.50	No Data	No Data	No Data
PN	17	1	Balche	0.50	0.50	No Data	No Data	No Data
PN	20	1	Naba	0.50	0.50	No Data	No Data	No Data
PN	20	6	Kumche	3.00	0.50	No Data	No Data	No Data
PN	20	4	Chacalhaaz	5.15	0.50	No Data	No Data	No Data
PN	22	1	Chacalhaaz		0.50	No Data	No Data	No Data
PN	23	7	Yaxche, Early	5.10	0.73	22.71	9.79	2.71

Table 4.5: Obsidian totals by operation.

Site	Op.	# of Artifacts	Phase	Total Weight (grams)	Average Weight (grams)	Average Length (mm)	Average Width (mm)	Average Thickness (mm)
PN	23	17	Yaxche, Late	16.45	0.97	20.00	11.41	2.82
PN	23	45	Yaxche	41.15	0.91	23.50	11.06	2.88
PN	23	12	Kumche	4.50	0.38	15.25	10.08	3.08
PN	23	65	Chacalhaaz, Early	45.65	0.70	20.92	11.18	2.65
PN	23	19	Chacalhaaz, Late	31.60	1.66	29.24	12.18	3.31
PN	23	337	Chacalhaaz	216.85	0.64	21.58	10.17	2.64
PN	23	11	Balche	11.05	1.00	27.63	10.51	2.73
PN	24	26	Yaxche, Early	24.70	0.95	22.85	10.23	3.08
PN	24	14	Yaxche, Late	12.20	0.87	25.07	11.07	2.68
PN	24	3	Yaxche	1.85	0.62	19.00	10.67	2.50
PN	24	65	Yaxche	51.10	0.79	21.60	11.05	2.98
PN	24	9	Kumche	6.60	0.73	20.33	10.00	3.22
PN	24	3	Chacalhaaz, Early	2.50	0.83	28.00	10.33	2.33
PN	24	67	Chacalhaaz	55.70	0.83	21.24	10.97	2.59
PN	24	2	Balche	0.80	0.40	14.00	9.00	2.50
PN	25	1	Yaxche	0.30	0.30	12.00	8.00	2.00
PN	25	2	Naba	2.90	1.45	29.50	13.00	3.50
PN	25	25	Chacalhaaz	21.30	0.85	24.72	10.40	2.80
PN	26	5	Yaxche, Early	1.45	0.36	11.20	6.80	1.90
PN	26	13	Yaxche	15.50	1.19	24.15	10.85	3.46
PN	26	13	Chacalhaaz	12.60	0.97	23.38	10.46	3.15
PN	26	1	Balche	0.30	0.30	21.00	8.00	1.00
PN	27	6	Chacalhaaz	4.65	0.78	26.50	10.67	2.67
PN	28	5	Yaxche	2.90	0.58	17.80	12.20	2.80
PN	28	4	Chacalhaaz	2.55	0.64	16.50	12.25	2.38
PN	28	2	Balche	1.55	0.78	27.00	9.50	3.75
PN	29	7	Chacalhaaz	5.55	0.79	20.71	11.00	2.64
PN	30	1	Chacalhaaz	0.30	0.30	12.00	11.00	2.00
PN	30	10	Balche	51.75	5.18	34.18	15.44	4.74
PN	31	2	Yaxche	1.00	0.50	23.00	9.00	2.00
PN	31	9	Chacalhaaz	8.60	0.96	21.33	12.00	3.11
PN	31	2	Balche	1.15	0.58	19.00	9.50	2.00

Table 4.5 continued.

Site	Op.	# of Artifacts	Phase	Total Weight (grams)	Average Weight (grams)	Average Length (mm)	Average Width (mm)	Average Thickness (mm)
PN	32	2	Yaxche, Early	1.50	0.75	23.40	9.70	2.80
PN	32	2	Yaxche	1.55	0.78	22.25	11.45	2.30
PN	32	3	Chacalhaaz, Early	1.50	0.50	21.33	10.37	2.20
PN	32	1	Chacalhaaz	0.50	0.50	17.00	11.00	3.00
PN	33	15	Yaxche, Early	10.05	0.67	20.63	10.73	2.47
PN	33	85	Yaxche, Late	48.38	0.57	19.09	11.30	2.49
PN	33	56	Yaxche	41.85	0.75	20.50	10.46	3.63
PN	33	145	Kumche	117.18	0.81	19.93	10.71	2.70
PN	33	370	Chacalhaaz, Early	250.67	0.68	19.11	10.57	2.60
PN	33	190	Chacalhaaz, Late	135.65	0.71	19.76	10.89	2.87
PN	33	949	Chacalhaaz	689.57	0.73	19.48	10.84	2.78
PN	33	17	Balche	11.20	0.66	22.74	9.74	2.62
PN	34	5	Yaxche	3.55	0.71	21.80	10.40	2.80
PN	34	1	Chacalhaaz	0.20	0.20	16.00	9.00	2.00
PN	34	1	Balche	2.40	2.40	54.00	12.00	3.00
PN	35	7	Yaxche, Early	5.80	0.83	24.23	11.51	2.53
PN	35	7	Yaxche	2.55	0.36	16.16	9.10	2.07
PN	35	24	Chacalhaaz, Early	18.80	0.78	22.67	10.88	2.70
PN	35	10	Chacalhaaz	3.70	0.37	13.86	9.48	2.21
PN	36	5	Kumche	3.05	0.61	20.80	10.00	2.60
PN	36	44	Chacalhaaz	33.35	0.76	21.20	10.66	2.82
PN	37	6	Yaxche	3.15	0.53	19.33	9.67	2.42
PN	37	16	Chacalhaaz	11.00	0.69	21.06	10.88	2.56
PN	40	2	Yaxche, Late	1.70	0.85	25.90	10.45	3.35
PN	40	2	Yaxche	2.20	1.10	30.55	10.45	2.65
PN	40	1	Balche	1.10	1.10	38.30	8.70	2.40
PN	41	1	Yaxche, Early	0.50	0.50	33.40	5.80	1.60
PN	41	5	Yaxche, Late	1.50	0.30	13.50	9.28	2.18
PN	41	2	Yaxche	0.80	0.40	15.10	8.15	2.50
PN	41	3	Naba	1.30	0.43	21.13	8.07	2.47
PN	41	22	Kumche	10.30	0.47	18.12	10.57	2.17

Table 4.5 continued.

Site	Op.	# of Artifacts	Phase	Total Weight (grams)	Average Weight (grams)	Average Length (mm)	Average Width (mm)	Average Thickness (mm)
PN	41	200	Chacalhaaz, Early	126.40	0.63	19.88	10.75	2.48
PN	41	80	Chacalhaaz, Late	58.10	0.73	21.32	10.65	2.53
PN	41	231	Chacalhaaz	169.80	0.74	21.18	10.57	2.54
PN	42	1	Yaxche, Early	1.10	1.10	26.70	12.30	2.50
PN	46	21	Yaxche, Early	20.30	0.97	23.68	10.10	2.70
PN	46	9	Yaxche, Late	6.20	0.69	21.00	9.56	2.50
PN	46	18	Yaxche	9.30	0.52	18.64	8.79	2.31
PN	46	18	Kumche	15.00	0.83	23.64	10.83	2.64
PN	46	68	Chacalhaaz, Early	52.45	0.77	20.98	10.74	2.76
PN	46	77	Chacalhaaz, L	49.10	0.64	19.38	10.30	3.12
PN	46	91	Chacalhaaz	76.30	0.84	21.31	10.94	2.79
PN	47	17	Abal	9.70	0.57	17.85	11.84	3.21
PN	49	2	Yaxche	1.90	0.95	24.20	10.35	3.10
PN	49	1	Naba, Late	0.20	0.20	14.60	9.50	2.00
PN	49	6	Chacalhaaz, Late	2.00	0.33	16.24	9.14	1.86
PN	49	12	Chacalhaaz	14.50	1.21	28.13	11.44	2.73
PN	50	5	Chacalhaaz	1.70	0.34	13.74	9.48	2.36
PN	50	3	Balche	1.30	0.43	15.47	11.00	2.23
PN	51	2	Yaxche	0.60	0.30	13.50	9.55	1.75
PN	52	2	Chacalhaaz	2.70	1.35	40.35	10.25	2.90
PN	52	6	Balche	8.00	1.33	30.70	13.32	2.80
PN	53	5	Chacalhaaz, Late	2.50	0.50	18.04	9.92	2.40
PN	54	16	Yaxche, Early	8.00	0.50	19.59	9.78	2.16
PN	54	11	Chacalhaaz	6.80	0.62	18.64	10.64	2.47
PN	55	2	Yaxche	2.30	1.15	17.80	15.15	4.70
PN	55	2	Pom/Naba	0.40	0.20	11.00	9.25	2.00
PN	55	2	Abal	1.40	0.70	22.40	10.30	2.55
PN	56	1	Balche	0.2	0.20	10.40	9.30	2.10
PN	57	35	Chacalhaaz	20.10	0.57	18.99	10.48	2.86
PN	59	1	Naba, Early	0.90	0.90	26.50	12.50	2.00
PN	59	5	Kumche	2.70	0.54	21.60	10.40	2.10

Table 4.5 continued.

Site	Op.	# of Artifacts	Phase	Total Weight (grams)	Average Weight (grams)	Average Length (mm)	Average Width (mm)	Average Thickness (mm)
PN	62	4	Yaxche, Early	2.50	0.63	22.28	8.85	2.70
PN	62	20	Yaxche, Late	12.00	0.60	20.80	9.57	2.83
PN	62	2	Yaxche, Late	1.10	0.55	21.00	9.90	1.90
PN	62	29	Yaxche	20.40	0.70	21.52	10.48	2.53
PN	62	3	Naba	1.30	0.43	15.70	11.93	2.47
PN	62	12	Kumche	8.50	0.71	22.45	10.18	2.44
PN	62	20	Chacalhaaz, Early	16.00	0.80	22.23	10.93	2.62
PN	62	7	Chacalhaaz, Late	3.05	0.44	16.03	9.40	2.43
PN	62	57	Chacalhaaz	29.50	0.52	17.13	10.42	2.26
PN	62	5	Balche	2.10	0.42	16.48	9.06	2.34
RS	6	1	Naba/Balche	0.40	0.40	10.00	14.00	2.00
RS	6	168	Chacalhaaz	127.96	0.76	20.29	11.15	2.82
RS	7	6	Chacalhaaz	4.40	0.73	24.00	11.00	2.25
RS	10	2	Yaxche	1.10	0.55	29.00	8.50	2.25
RS	10	4	Chacalhaaz	2.00	0.40	18.00	10.00	2.20
RS	11	5	Chacalhaaz	3.10	0.62	26.60	8.60	2.50
RS	13	1	Chacalhaaz		1.00	24.00	12.00	3.00
RS	16	13	Chacalhaaz	10.45	0.80	23.54	10.23	2.65
RS	17	1	Chacalhaaz		0.60	20.00	10.00	2.00
RS	18	2	Chacalhaaz	4.10	2.05	38.50	13.50	3.50
RS	20	13	Chacalhaaz	6.50	1.29	31.00	11.25	2.88
RS	22	8	Chacalhaaz	4.70	0.59	20.13	9.00	2.38
RS	24	2	Chacalhaaz	0.40	0.20	15.50	8.50	2.00
RS	26	119	Chacalhaaz	153.85	1.29	25.23	11.09	2.92
RS	27	1	Yaxche	7.40	7.40	43.70	25.30	7.30
RS	27	59	Chacalhaaz	76.60	1.30	27.43	11.01	2.95
RS	28	5	Kumche	6.00	1.20	26.00	12.30	2.70
RS	28	83	Chacalhaaz	58.95	0.71	21.16	10.77	2.63
RS	29	1	Kumche	0.80	0.80	20.10	11.00	2.30
RS	29	27	Chacalhaaz	23.23	0.86	22.17	9.94	2.77
RS	30	1	Kumche	0.70	0.70	9.00	9.00	2.50
RS	30	5	Chacalhaaz	3.20	0.64	10.00	10.00	2.90

Table 4.5 continued.

Phase	Other	Pachuca	Ucareo	Zaragoza	Ixtepeque	San Martín Jilotepeque	El Chayal	Non-El Chayal	Total
Abal (# of Artifacts)						7	12	7	19
% of Total						36.84%	63.16%	36.84%	
% of Source Total						11.11%	0.27%		
Naba (# of Artifacts)		1				1	34	2	36
% of Total		2.78%				2.78%	94.44%	5.56%	
% of Source Total		8.33%				1.59%	0.77%		
Balche (# of Artifacts)	1		1	2	1		79	5	84
% of Total	1.19%		1.19%	2.38%	1.19%		94.05%	5.95%	
% of Source Total	14.29%		25%	12.50%	1.64%		1.80%		
Yaxche (# of Artifacts)	2	5	2	4	6	10	510	29	539
% of Total	0.37%	0.93%	0.37%	0.74%	1.11%	1.86%	94.62%	5.38%	
% of Source Total	28.57%	41.67%	50%	25%	9.84%	15.87%	11.59%		
Chacalhaaz (# of Artifacts)	4	6	1	10	48	44	3503	113	3616
% of Total	0.10%	0.17%	0.03%	0.27%	1.33%	1.22%	96.88%	3.13%	
% of Source Total	57.14%	50%	25%	62.50%	78.69%	69.84%	79.63%		
Kumche (# of Artifacts)					6	1	261	7	268
% of Total					2.24%	0.37%	97.39%	2.61%	
% of Source Total					9.84%	1.59%	5.93%		
Source Total (# of Artifacts)	7	12	4	16	61	63	4399	163	4562
% of Total	0.15%	0.26%	0.09%	0.35%	1.34%	1.38%	96.43%	3.57%	

Table 4.6: Obsidian totals by ceramic phase.

Counts and percentages of obsidian sources by ceramic phase and Late Classic subphases

Phase	Other	Pachuca	Ucareo	Zaragoza	Ixtepeque	San Martín Jilotepeque	El Chayal	Non-El Chayal	Total
Abal (# of Artifacts)						7	12	7	19
% of Total						36.84%	63.16%		
Naba (# of Artifacts)		1				1	34	2	36
% of Total		2.78%				2.78%	94.44%		
Balche (# of Artifacts)	1		1	2	1		79	5	84
% of Total	1.19%		1.19%	2.38%	1.19%		94.05%		
Early Yaxche (# of Artifacts)		1				3	100	4	104
% of Total		0.96%				2.88%	96.15%		
Late Yaxche (# of Artifacts)	1		1		1	2	157	5	162
% of Total	0.61%		0.61%		0.61%	1.23%	96.91%		
Early Chacalhaaz (# of Artifacts)	1	3		2	12	8	726	26	752
% of Total	0.13%	0.40%		0.27%	1.60%	1.06%	96.54%		
Late Chacalhaaz (# of Artifacts)			1		8	2	373	11	384
% of Total			0.26%		2.08%	0.52%	97.14%		
Kumche (# of Artifacts)					6	1	261	7	268
% of Total					2.24%	0.37%	97.39%		

Table 4.6 continued.

understanding of material percentages. The rows with question marks next to them are obsidians that were guessed at due to unusual variations in visual characteristics. All of the non-El Chayal obsidians are only found in small quantities with Ixtepeque (1.7% by count and .9% by weight) and San Martín Jilotepeque (1.31% by count and 1.46% by weight) representing the other two most prominent sources. The percentage of El Chayal obsidian from general excavations (96.51% by count and 95.74% by weight) is slightly lower than for cached obsidian (97.86% by count and 97.13% by weight), with a total of 96.61% by count and 96.37% by weight for all recorded obsidian artifacts. Obsidian from caches represents 7.15% of all obsidian by count and 46.45% by weight, while obsidian artifacts from general excavations are 92.85% by count and 53.55% by weight. The reason for this great disparity is that exhausted cores and other large pieces of production debitage were used to make the eccentrics at Piedras Negras. This pattern is discussed further in Chapter 7 and 8.

Other patterns are revealed when the materials are examined by area of the site (Table 4.5), and by ceramic phase (Table 4.6). The general tendency is that non-El Chayal, Guatemalan obsidians appear to be imported with less frequency over time, such as San Martín Jilotepeque obsidian. However, Ixtepeque obsidian becomes more frequent over time, especially in the Chacalhaaz phase. With the onset of the Late Classic, Mexican obsidians become more frequent at the site, but then disappear with the end of the Chacalhaaz phase and the possible decline of the royal dynasty. These basic patterns resemble others from the Maya area (Clark and Nelson 1998), though with a higher percentage of El Chayal obsidian than most places.

According to the three spatial groups I created for Piedras Negras (the acropolis, the city center, and the near-periphery), the distribution of obsidian materials is not constant (Table 4.7). The quantities of obsidian are relatively similar between the acropolis (8%) and the near-periphery residential groups (11.38%), though a much smaller area was excavated in the acropolis. The majority of obsidian artifacts were found in the residential groups from the city center (80.82% of all obsidian material), as well as a majority of non-El Chayal obsidians (87.73% of all non-El Chayal obsidian). Of particular interest are the two residential groups to the south and west of the South Group Plaza, represented by Operations PN10, PN23, and PN33 (dubbed the U-Group and the R-Group). These operations yielded more obsidian than any other area of Piedras Negras (51.75% of all the dated obsidian from the site), and also the most non-El Chayal obsidian, except for San Martín Jilotepeque obsidian, which was more widely distributed. The U-Group and the R-Group had access to more imported obsidians than other areas of the site, and also had the longest history of blade production at Piedras Negras. According to the present data, it appears that blade production began and ended in the U-Group (see Chapter 7). Burial 66 in the R-Group contained four blades from four different obsidian sources, indicating that the people who lived in this area may have had a special knowledge of obsidian and of the various obsidian sources. The residential groups located around the South Group may have housed the most prominent obsidian-workers at Piedras Negras.

	Area	Area	Pachuca	Ucareo	Zaragoza	Ixtepeque	San Martín Jilotepeque	El Chayal	Non-El Chayal	Totals
	TOTAL	7	12	4	16	61	63	4399	163	4562
# of Artifacts	Near-Periphery		1			3	5	510	9	519
% of Total Artifacts	Near-Periphery		0.19%			0.58%	0.96%	98.27%	1.73%	
% of Material Type	Near-Periphery		8.33%			4.92%	7.94%	11.59%	5.53%	
# of Artifacts	Site-Center	7	11	3	15	53	54	3544	143	3687
% of Total Artifacts	Site-Center	0.19%	0.30%	0.08%	0.41%	1.44%	1.46%	96.12%	3.88%	
% of Material Type	Site-Center	100%	91.67%	75%	93.75%	86.89%	85.71%	80.56%	87.73%	
# of Artifacts	Acropolis			1	1	5	4	354	11	365
% of Total Artifacts	Acropolis			0.27%	0.27%	1.37%	1.10%	96.99%	3.01%	
% of Material Type	Acropolis			25%	6.25%	8.19%	6.35%	8.05%	6.75%	
# of Artifacts	Site-Center/S. Group	6	8	3	12	35	24	2273	88	2361
% of Total Artifacts	Site-Center/S. Group	0.25%	0.34%	0.13%	0.51%	1.48%	1.02%	96.27%	3.73%	
% of Material Type	Site-Center/S. Group	85.71%	66.67%	75%	75%	57.38%	38.10%	51.67%	53.99%	

Table 4.7: Obsidian totals by site area.

4.2.2: Color and Quality of El Chayal Obsidian at Piedras Negras

Another interesting pattern in types of obsidian can be found in quality and color. Table 4.8 depicts the colors and quality types for El Chayal obsidian. I conducted a similar study for El Chayal obsidian at Holmul (2005). The goal was to determine if different areas of the El Chayal source were exploited through time and whether a particular part of the site had access to finer obsidians than others. In the case of the Holmul study area, which has a much greater time depth than Piedras Negras, or at least a larger sample from each time period, differences were found in the kind and quality of El Chayal obsidian through time.

The basic color varieties found at the El Chayal source were separated into two types with subtypes, which include “smoky” obsidian, and smoky obsidian with specks, grey bands, and black bands, and “clear” obsidian with specks, grey bands, and black bands. Extremely high-quality obsidians marked by a high luster and flawless glass-like quality were marked as “fine” obsidians. It is possible that much of the fine-quality smoky obsidians come from the La Joya part of the El Chayal source that features a large quantity of this color and quality type. These designations are largely subjective in nature and only represent a preliminary attempt to look at source exploitation through time and space.

The El Chayal obsidian from Cival (Preclassic) and Holmul (Late and Terminal Classic) were similar in the percentages of smoky to clear color groups, and also in the percentages of fine obsidians (marked with an “F” in Table 4.9).

Table 4.8
Color And Quality Counts and Percentages for El Chayal Obsidian at Piedras Negras

Phase	sm	smgr	SMTotal	clbl	clgr	CLTotal	Total	sm%	smgr%	SMT%	clbl%	clgr%	CLT%	fine	fine%
Kumche	62	64	126	98	11	109	235	26.383	27.234	53.617	41.702	4.6809	46.383	87	37.021
Chacalhaaz	1204	742	1946	1166	354	1520	3466	34.737	21.408	56.145	33.641	10.214	43.855	1064	30.698
Yaxche	130	115	245	211	51	262	507	25.641	22.682	48.323	41.617	10.059	51.677	175	34.517
Balche	31	13	44	17	11	28	72	43.056	18.056	61.111	23.611	15.278	38.889	27	37.5
Naba	15	5	20	10	3	13	33	45.455	15.152	60.606	30.303	9.0909	39.394	5	15.152

Early Chacalhaaz	149	83	232	115	25	140	372	40.054	22.312	1039.8	11.06	226.05	61.935		
Late Chacalhaaz	259	150	409	258	59	317	726	35.675	20.661	1979.6	13.033	452.69	70.026		

sm=smoky
smgr=smoky with grey
SMTotal=all obsidian with some smoky color
SMT%=percentage of total smoky material
clbl=clear with black
clgr=clear with grey
CLTotal=all obsidian with some clear (I.e., no color)
CLT%=percentage of total clear material
Total=total count
fine=fine obsidian

Table 4.9

Color And Quality Counts and Percentages for El Chayal Obsidian at Holmul

Site	smsp	smgr	smbl	sm	SMTotal	SM%	clsp	clgr	clbl	cl	CLTotal	ECTOT	CL%	fine	fine%
Cival	4	11	5	38	58	52	7	5	33	9	54	112	48	27	24
La Sufricaya	3	44	13	152	212	74	4	12	45	15	76	288	26	113	39
Holmul	2	16	13	77	108	58	2	8	59	8	77	185	42	43	23

sm=smoky
smgr=smoky with grey
smsp=smoky with specks
smbl=smoky with black
SMTotal=all obsidian with some smoky color
SM%=percentage of smoky material
clbl=clear with black
clgr=clear with grey
clsp=clear with specks
cl=clear only
CLTotal=all obsidian with some clear (I.e., no color)
ECTOT=total counts of artifacts made of El Chayal obsidian
CL%=percentage of clear material
fine=fine obsidian

The La Sufricaya site differed from both of these, however, in both color and quality. La Sufricaya features 39% fine material and 74% of smoky colored obsidian, which suggests that La Sufricaya may have had greater access to obsidian from the La Joya part of the El Chayal source during the Early Classic period. It may be significant that the Holmul study area had heightened interaction with Tikal during the Early Classic. Fine and Mexican obsidians at Sufricaya may indicate that the Holmul study area enjoyed some of the economic success of Tikal before the "hiatus," a destructive event known to have occurred at Tikal in the Middle Classic (Martin and Grube 2001). The relative lack of production evidence at Holmul during the Late Classic suggests that the Maya in this area did not have great access to high-quality obsidian and blade cores as they did during the Early Classic. The lack of obsidian eccentrics at Holmul also indicates that they did not share in the same lithic traditions as the Central Petén. This being said, there was one Late Classic obsidian eccentric cache found at Holmul, which may coincide with a defeat in warfare by Tikal in the 8th century.

Braswell and Glascock (n.d.:32) have noted that Tikal likely was a major obsidian trade post.

> That so much obsidian reached Tikal from points south, and that so little left it and entered the Calakmul kingdom and other polities in the north-central and northern lowlands, strongly suggest that the distribution system of Tikal was firmly bounded, most probably in the form of an administered market economy. Tikal may have enjoyed a special exchange relationship with highland polities such as Kaminaljuyú, which also may explain the abundance of obsidian at the lowland city.

Although the texts at Piedras Negras do not address any clear political relationship between Tikal and Piedras Negras, the similarity in the obsidian and microcrystalline-quartz eccentrics from the two sites indicates a close relationship. If the quality of El Chayal obsidian is any indicator of this relationship, as it may have been at Holmul, then Piedras Negras should have relatively high percentages of fine quality obsidian. Indeed, this appears to be the case.

Table 4.8 reveals that, although the sample is quite small, Early Classic (Naba phase) obsidian was not of unusually high-quality, but that the Balche obsidians were (37.5% of the total). The Balche phase is precisely when the Tikal-style obsidian-eccentric tradition began in earnest at Piedras Negras. Non-El Chayal obsidians also become more common in the Balche phase, which recalls the Early Classic situation at La Sufricaya. The quality of the obsidian decreased during Yaxche and Chacalhaaz times, as did the percentage of smoky-grey obsidian, but the quality remained much higher than the Late Classic sample for Holmul. Braswell and Glascock (n.d.) characterized Tikal as an "obsidian hub," an assertion that may be further illustrated with an analysis of obsidian quality at Tikal itself. It is possible that close political and economic ties with Tikal could have garnered the recipient polity more, and higher quality, obsidian.

4.2.3: Overview of the Piedras Negras Obsidian Sample

Except for three examples bifaces made of Mexican obsidian, the majority of obsidian artifacts at Piedras Negras were originally created through the process of blade-core reduction. The obsidian eccentrics from Piedras Negras were made by further modifying core-derived debitage (see Chapter 6). The larger debitage from the preparation and rejuvenation of blade cores, especially during the Balche and Yaxche phases, was used for the production of eccentrics. At least two residential groups, which were distantly located from the royal acropolis, contained bipolar and irregular pressure debitage consistent with eccentric production. Some eccentric blanks were chipped from exhausted prismatic-blade cores, which were first broken in two segments by bipolar percussion. These are only preliminary observations, and analysis must be conducted to determine the true nature of the household deposits, but the pattern suggests that blade-producing households also may have been involved in producing eccentrics for royal rituals. A similar system of household production may have existed at Tikal (Moholy-Nagy 1997:300).

4.3: SUMMARY

The material variability at Piedras Negras can be explained by changes in the exchange systems through time. The Piedras Negras data do not allow for a reconstruction of all, or even most, of these exchange relationships, but rather provide a good starting point for future studies of regional and inter-regional exchange. It also is clear that local materials played an important role in the development of the site through time. The local chert source, however low in quality it may have been, likely provided basic tool-stone for the center throughout its history. Coarse-grained cherts and chalcedony probably were locally or regionally available to the inhabitants of Piedras Negras. Fine flints and cherts, on the other hand, may have come from more distant sources, such as those at Altar de Sacrificios, Cancuen, or the eastern lowlands. A more systematic sourcing program for microcrystalline materials is necessary to better understand these routes of exchange.

Although obsidian source percentages are similar to other lowland sites, Piedras Negras does feature a higher frequency of El Chayal than other tested sites. The Late Classic, instead of the Early Classic as at Holmul, appears to have been a time of increased obsidian importation at Piedras Negras, both in terms of variety and quality of obsidian. It may be that Piedras Negras had a close exchange relationship with Tikal during the Late Classic, at least in the exchange of chipped-stone goods, and possibly the sharing of styles and reduction techniques. Chapter 7 elucidates some of the technological and stylistic similarities between the obsidian eccentrics of Piedras Negras and Tikal.

CHAPTER 5

MICROCRYSTALLINE-QUARTZ ARTIFACT TYPES

This chapter describes the morphologies and technologies of the various microcrystalline-quartz artifacts found at Piedras Negras. The first section takes an in-depth look at the bifacially and unifacially reduced tools at the site through what I term a morpho-technological typology. The second section describes the forms and technologies of the microcrystalline-quartz eccentrics found in royal caches at the site. Although I do not discuss the complete symbolic content of the eccentric morphologies here, I do describe the basic technological patterns that appear through time. Finally, I review the various kinds of debitage that are produced through the manufacture of “tools” and “eccentrics” at the site.

5.1: A MICROCRYSTALLINE-QUARTZ TOOL TYPOLOGY

The microcrystalline-quartz artifacts of Piedras Negras represent a wide variety of technologies and forms that resemble those from other lowland sites (e.g., Tikal and Uaxactun). Nevertheless, many common biface and uniface types are not found at Piedras Negras, indicating that some centers or regions maintained unique knapping traditions at particular times. The goal of this chapter is to categorize bifacially- and unifacially-worked tools made from microcrystalline quartz in a way that can facilitate cross-site comparison of chipped-stone artifact assemblages. In an attempt to remove factors of material, skill, and function from my typological scheme, I present a morpho-technological typology that focuses on the ideal, or finished product, before it entered the realm of use or consumption. Although the idea of "finished product" is problematic because it is unclear at what point the ancient Maya would have considered a product as such[11], I use it here to describe the object that left the hands of its original producer before it was used by someone else (i.e., the consumer).

Classic period microcrystalline-quartz tools from Piedras Negras were made according to a limited number of technological and morphological templates that were repeated by knappers for centuries. The final forms of these artifacts vary considerably, often because of the so-called "Frison Effect" (see Frison 1968), which is the rejuvenation, reuse, and reworking of primary forms. These post-initial-production activities may not have been related to the form originally intended by the producers of a community. Since much of the "post-production" variability is disregarded in this study, the total number of types is comparatively low (cf. Rovner and Lewenstein 1997). In the process of describing the technological and morphological diversity at Piedras Negras, I provide an extensive list of equivalent type-names used in previous studies. This guide may be helpful to researchers interested in conducting cross-site artifact comparisons.

Although I do not include the so-called "eccentric flints," referred to here as microcrystalline-quartz eccentrics, in this typology, many of the forms discussed in this chapter were deposited in caches and burials along with eccentrics, and must have carried a similar symbolic load (Hruby 2002). Furthermore, most eccentric forms are based on the tool forms presented here, suggesting that there is a social and cultural relationship between the morphology of both tools and eccentrics (Hruby 2002). Piedras Negras eccentrics also show great formal continuity through time, indicating that a rigorous transfer of knowledge from one producer to the next may have taken place.

I first provide a setting for this study by way of describing the chipped-stone traditions at Piedras Negras, and the role of chipped-stone goods and knappers in Piedras Negras civic society. I then move to the specific focus of this chapter and outline previous typological schemes used for Maya stone tools. Early archaeologists used morphology as the main organizing factor in their typologies, but they did not recognize technological traits. Later researchers made unsystematic use of technological or morphological nomenclature. Consequently, the variety of type names used in the literature is immense and can lead to confusion in cross-site comparisons of microcrystalline-quartz artifacts. The Piedras Negras typology proposed here uses new and old terms to create a "level playing field" on which to compare regional traditions of stone tool production and use. The primary goal of this chapter is to accurately describe the basic technologies and morphologies of biface and uniface tools made from microcrystalline quartz materials at Piedras Negras. I begin with a review and critique of other typologies used for bifacially- and unifacially-worked microcrystalline-quartz tools from the Maya area, and follow with a description of the typology proposed above.

5.2: CHIPPED-STONE TYPOLOGIES IN THE MAYA AREA

Studies of chipped-stone artifacts were not published separately from those of other artifact types and materials in the Maya area[12] until the 1970s. Early in the history of Maya archaeology, ceramics eclipsed lithic materials for their usefulness in establishing chronologies, and also for their apparent artistic content. Chipped-stone artifact analyses, consisting largely of artifact description, occupied little more than comments and appendices in larger volumes on architecture and ceramics (Rovner and Lewenstein 1997:5). Furthermore, little distinction was made between obsidian and microcrystalline quartzes and their corresponding technologies. The focus was decidedly on sculpture, writing, and architecture.

Early adventurers and archaeologists avoided more common tools, and strove to define the mysterious "eccentric flints" found in their temple excavations (e.g., Blom and la Farge 1928; Gann 1918, 1930; Gann and Gann 1939; Gruning 1930; Joyce 1932; Joyce et al. 1928; Lane Fox 1857; Linné 1934; Maler 1908; Mason 1935; Price 1897-99; Rice 1909; Ricketson 1929; Ricketson and Ricketson 1937; Stephens 1870; Thompson 1939). Microcrystalline-quartz eccentrics posed an analytical problem because they did not seem to have an apparent function. Mayanists had a difficult time attaching a function or meaning to these cryptic symbolic forms beyond calling them "ceremonial." Thompson posited, perhaps out of frustration, "there seems to have been a competition to see who could make the most elaborate design in flint" (1963:265). Other archaeologists, such as Teobert Maler (1908), considered the possibility that they were mosaic elements attached to wooden masks or decorative elements based on Maya iconography and formal characteristics of other Mesoamerican mosaic fragments. Although this has proven to be true in some cases (Hruby 2002), the function, symbolism, and meaning behind the majority of eccentrics cannot be determined in a single-faceted manner, and indeed, require a detailed theoretical and iconographic framework in which to describe them properly (see Meadows 2001). Gann and Gann (1939:157) had a more conservative view of eccentrics, specifically that all attempts to assign a function to them, aside from a broader “ceremonial” one, are useless because of their apparent lack of use-wear.

Archaeologists from this early period of investigation (1850-1947) were largely disinterested in artifacts thought to be utilitarian in nature; this trend continued into the early 1970s. In one of the most influential descriptions of Maya chipped-stone artifacts, Coe (1965:594) stated “it is the fact that certain objects do not conform to opulent standards that classifies them as utilitarian . . .” Regardless of their disdain for the so-called mundane tools, early Mayanists enjoyed speculating about the importance of tools and materials in trade; for example: “obsidian must have been one of the commonest, and at the same time most useful materials employed by the Maya in the manufacture of their tools and weapons” (Gann 1929:174). That obsidian projectile points or lance heads (i.e., weapons) are far from common in household contexts in Belize, and the Maya Lowlands in general, shows interpretation without analysis can be far from accurate.

A special place was also given to the interpretation of stone tools as carving implements for architectural features and sculpture (Joyce 1914:305). In the early 1920s Gann (1929:56) was one of the first to use ethnohistoric information (i.e., Landa) in interpreting a large chipped-stone artifact deposit from Xunantunich. Gann (ibid.) asserted:

> Now here we have what can be nothing else than the stock-in-trade of an ancient jeweler, and I think the inference is fairly obvious that the individual buried beneath, whether on the summit, or . . . in a chamber at the base, was a jeweler and worker in flints, ivory and precious stones.

Aside from these speculative accounts of stone tools, microcrystalline quartz and obsidian eccentrics remained the chipped-stone artifact of interest until the publication of the Uaxactun artifact typology created by Kidder (1947).

According to most Mesoamerican lithic analysts, it was Alfred V. Kidder (1947) who helped transform the way Mayanists classified, collected, and recorded lithic artifacts. The extensive illustration and description of Maya stone tools excited Mesoamerican scholars, and recording all artifacts from a site helped shift interest toward the behavior of individuals. Kidder (1947), however, concretized a rather unhelpful, preexisting dichotomy between utilitarian and ceremonial classes of artifacts as an organizational scheme. This system was duly criticized by Irwin Rovner (1975), and also Payson Sheets (1978:9-10), who pointed out that distinctions made between utilitarian and ceremonial categories require an initial inference about function. The classification scheme proposed by Kidder (1947) is based on function, or specifically, morphology and function. The morpho-technological typology presented here does not presume to dictate the function of a tool (e.g., chopping, stabbing, cutting, etc.), without systematic use-wear analysis or replicative experimentation. Rovner and Lewenstein (1997:6) stated: "[a]ny conclusions about function and cultural importance derived from such a classification are tainted by circular reasoning: assumptions made for the initial classification wind up as interpretations in the final analysis." This concise and important point, however, is not reflected in their own typologies and analysis.

Gordon Willey (1972) and William Coe (1959) continued to use the style of classification created by Kidder (1947), and were able to make marked improvements on the thoroughness of publication and artifact illustration. However, technological issues continued to be of little interest in artifact typologies until Sheets (1975), Shafer and Hester (1983), Rovner (1975), and others began to focus on how chipped-stone artifacts were made.

Sheets (1975) isolated the important aspects of what a technological typology should be, and set guidelines for what could be done with lithics, lithic analysis, and archaeological theory. He (1975:1) laid out eight possible areas of inquiry that could be addressed with artifact typologies. His main assertions were that (1) an analyst should have a question or problem in mind before a typology is constructed; and that (2) the typology must be consistent throughout. He used the term behavioral to describe the particular typology he had created for blade-core reduction, because each piece of debitage represented a specific behavior carried out by the blade producer. Since the structure of the typology was more useful for categorizing specific kinds of debitage than previous typologies, other lithic analysts used it for their artifact assemblages (see Clark and Lee 1979). In 1983 Clark and Bryant (1997) revised the typology, renaming it a technological typology, because every behavioral trait and specific mistake was not considered in its nomenclature. This revision of the Sheets typology is still commonly used today[13], and aside from some regional variations (Hintzman 2000), most Mesoamerican lithic analysts accept the basic flake, blade, and core types presented by Clark and Bryant (1997:Figure 4.1). The reason for the prominence of this typology is that it has logical and nominal consistency. The terms used to describe artifacts are a combination of morphological and technological attributes, but with the specific goal of defining one specific industry.

Rovner and Lewenstein (1997; based on the unpublished doctoral thesis of Rovner) produced the most detailed typology for the full range microcrystalline-quartz tools from an entire region. Each type name has a morphological and a technological aspect (e.g., tapered stem, biface), but in some cases, a name bearing functional implications is used, such as “dagger” and “chisel.” The result of these studies was to assign a type name to artifacts that imposed a function, but without the benefit of an exhaustive use-wear analysis. Specific morphological attributes of small bifacially and unifacially worked tools also were recorded in type names, but seem to vary according to the time period in which the artifact was produced. This inconsistency in nomenclature led to a large number of type names for bifaces and unifaces in the northern Maya Lowlands.

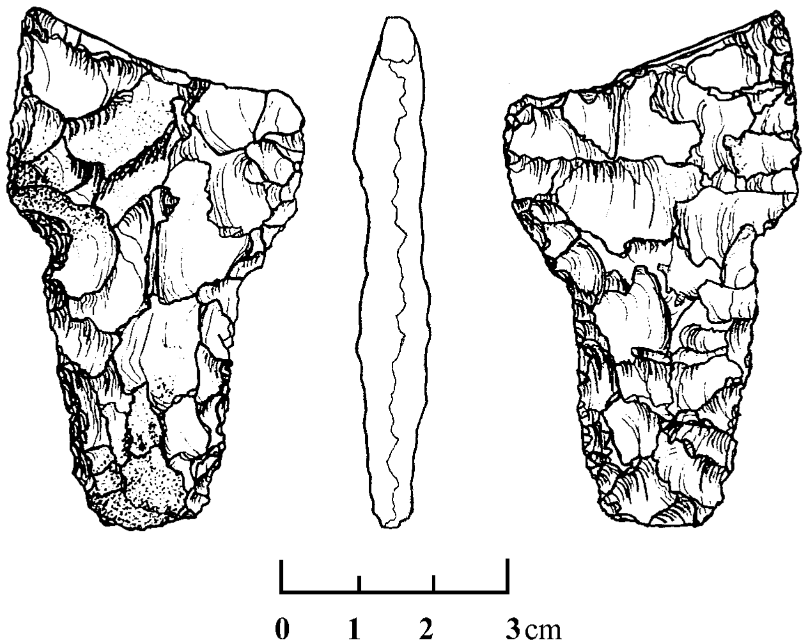


Figure 5.1: Stemmed biface from Piedras Negras. Drawing by Zachary X. Hruby.

Shafer and Hester (1983) also created a widely used typology for chipped-stone artifacts from Colhá, Belize. This typology was geared toward describing production systems or industries at Colhá, but not with the secondary goal of comparing them to lithic traditions from other regions of the lowlands. The nominal system was not systematic, and the difference between a "celt axe" and a "large oval biface," for example, is not recorded in the type name. The large oval biface is actually smaller than the celt axe, but retains a largely celtiform, or "petaloid" morphology. Other than trends in outline, the main difference between the celt axe and the oval biface seems to be thickness.

5.3: MORPHO-TECHNOLOGICAL TYPOLOGY AND VARIABILITY

The types presented here are more inclusive than those used in earlier typologies (see Kidder 1947; Willey 1972). The goal is to exclude the variability caused by resharpening and reworking (see Rovner 1976), but also skill level and raw material. The desired effect of such a typology is to reveal socio-cultural patterns related to the practice of stone tool producers, and to isolate technological, morphological, and stylistic difference that can be attributed to ancient Maya knappers over time and through space. More subtle morphological traits of chipped-stone tools, however, are sacrificed in this framework in the hope that wider production patterns over time are revealed.

Another possible effect of the typology is that broader production traditions passed down through generations of knappers can be isolated from consumer modifications to stone tools after the initial production has taken place (see also

McAnany 1989). Resharpening or reworking techniques may have been disconnected from a body of common knowledge about proper tool form, or template, commanded by chipped-stone producers in a given region or political center. The validity of this proposition is strengthened by the idea that consumer and producer households existed anciently, and that chipped-stone producers were not ubiquitous throughout the site. However, an assumption is made that producers within the city were in communication with each other, and that knowledge was shared among chipped-stone producers. Given the uniformity of lithic forms at Piedras Negras and other sites during the Classic period, this may have been a likely scenario.

Function is not a factor in type designations in this study. Although suites of material, technological, and morphological traits often correlate with a particular function (e.g., a thick, laurel leaf biface as pick or chisel), use-wear studies are better equipped to answer specific questions of function. Furthermore, use-wear studies may not reveal the "primary function" of a tool, especially if secondary use-wear obliterates earlier patterns. Thus, this typology acknowledges that the primary function of a small, stemmed biface was to pierce things as a projectile point, but it does not impose that function on its type name. In the following typology neither function nor time period figure into type nomenclature, and morphological and technological characteristics are used binomially as type designations.

Ultimately, the proposed typology attempts to avoid large numbers of type names by disregarding possible morphological variation caused by use and reworking (see Flenniken and Raymond [1986], and Flenniken and Wilke [1989] for discussion). Rovner (in Rovner and Lewenstein 1997:23), for example, created a typology of celtiform bifaces that records the variation of angles between distal and proximal ends of the tools. Since variability in the thick celt, biface form at Piedras Negras is largely attributable to the degree the tool was resharpened and used, I have chosen not to create a separate type for bifaces with excessive use-wear. A specific typology for heavily used celts and other bifaces should be conducted independently from the typology proposed here. The present morpho-technological typology, which does not account for either use-wear or function, makes it possible to align the incongruence among the many Maya tool-type names.

Morphological variability from reuse and reworking (Frison 1968), the Frison Effect, is evident at Piedras Negras in almost all tool types. Evidence of resharpening or rejuvenation after breakage is ubiquitous. If there is evidence that a particular form would not have existed as such without use or ad hoc modification, then it is excluded from this typology. Although many circular-shaped bifaces, for example, began as celts, and then were reworked or used into a circular shape, there also is evidence that circular bifaces were made initially to be circular bifaces. Thus, I have included this form in the typology, and when I classify actual artifacts from Piedras Negras I differentiate between used celts and circular bifaces. In this framework a type must represent a tool form with its own production trajectory from flake or nodule, to blank, to finished tool. In an alternate example, I do not differentiate between a long- or short-bodied, stemmed biface (see also Kidder 1947:8), because there is no concrete evidence at Piedras Negras, or any other site, that a short-bodied stemmed, biface (Figure 5.1) was ever initially produced by ancient Maya knappers. Although short-bodied stemmed, biface production traditions may have existed in the Maya Lowlands, there is no concrete evidence to support this hypothesis, such as artistic depictions of hunting and warfare equipment made by the Maya themselves.

I focus on technological and morphological attributes of the distal or hafting end of the tool to differentiate between kinds of distal preparation, such as stemmed, side-notched, celtiform, stemmed, tanged, and so forth. These sorts of modifications may be more representative of a particular regional knapping tradition and hafting technology than modifications to length caused by resharpening.

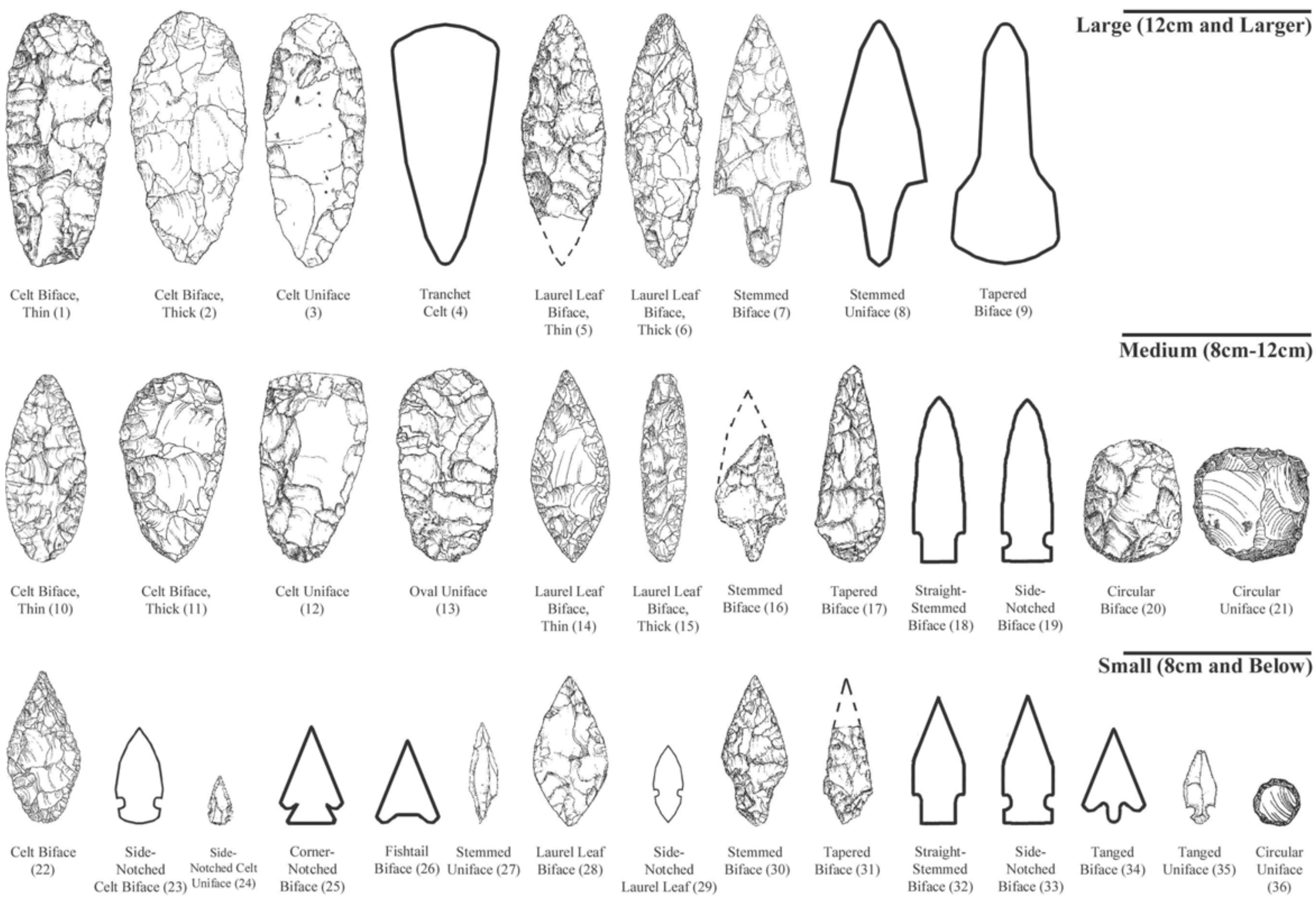
5.3.1: The Structure of the Typology

All of the types presented below are defined by their basic technological and morphological attributes. The first part of the type name is its size group: small, medium, or large. The three size categories are based on patterns consistent with chipped-stone assemblages from Piedras Negras other lowland sites. These are large, for tools with a length of 12 cm and greater (full hand size); medium for lengths of 8 cm to 12 cm (palm size); and small sizes of about 8 cm and smaller (finger size). The reason for using these size designations is somewhat arbitrary, but stems from a general correlation between the length of a tool and suites of morphological traits[14]. These patterns also may correlate with the function of the tool, but without consistent use-wear studies, questions of function are beyond the scope of this study. The second part of the type name is morphological, and describes the chief diagnostic morphological feature, usually the outline of the piece, such as celt or laurel leaf. The third part of the type name is the primary technological trait, such as biface, uniface, or tranchet. In cases where thickness is a key defining attribute, thin or thick is added to the type name. An example of a type name would be large celt biface, thick.

The typology (Figure 5.2) is organized according to the three size categories (small, medium, and large) marked on the right side of the diagram. Large tools are placed at the top, with smaller sizes placed below them. The types are arranged generally from left to right according to basic morphological characteristics and tool width. Celts are placed to the left, laurel leafs are located in the center, and stemmed or end-modified artifacts are placed at the right[15]. When possible, types with similar morphological attributes are placed in vertical columns (e.g., the celts and laurel leafs).

Each type has its name located beneath it. The number placed next to the name is arbitrary, but links that type to Table 5.1, which lists other names given to that basic type in other chipped-stone studies and typologies. The point of Table 5.1 is three-fold: (1) it provides the history of nomenclature for each of the types; (2) it reveals what types are not present in the archaeology of Piedras Negras, and conversely, what lithic traditions are shared with other sites; and (3) to create an open framework to place new assemblages, or ones from studies not listed here, if future analyses require it. It should be noted that a temporal framework is not implied here. Cross-site studies of temporal

Figure 5.2. **A Morpho-Technological Typology of Cryptocrystalline Biface and Uniface Chipped Stone Tools from Piedras Negras**



#1–Large Celt Biface, Thin

Kidder 1947:5	Uaxactun, Guatemala	General utility tool, extra fine
Hammond 1975:336	Northern Belize	Straight-sided axe
Hester 1985:197	Colhá, Belize	Large oval biface
Mitchum 1986:106	Cerros, Belize	Large oval/ biface celt
Shafer and Hester 1990:283	Albion Island, Belize	The "Puleston axe"

#2–Large and Medium Celt Biface, Thick

Ricketson and Ricketson 1937:184	Uaxactun, Guatemala	Pointed at one end, rounded at the other (pick axe)
Kidder 1947:5	Uaxactun, Guatemala	General utility tool, standard form
Coe 1959:11	Piedras Negras, Guatemala	Chopper, one end rounded, other pointed
Coe 1965:0	Piedras Negras, Guatemala	Core, bifaced percussion-flaked implement
Willey, et al. 1965:423	Belize Valley, Belize	Standard chopper, biface
Willey 1972:157	Altar de Sacrificios, Guatemala	Chopper or celt, general utility form
Hammond 1975:36	Northern Belize	Convex-sided a
Hester 1976:13	Colhá, Belize	Chopper, general utility tool
Andreson 1976:162	Northern Belize	Chopper
Wilk 1977:58	Barton Ramie, Belize	Chopper, general utility tool
Stoltman 1978:24	Becán, Mexico	Standard Maya biface
Shafer and Hester 1985:298	Colhá, Belize	General utility biface
McAnany 1986:202	Northern Belize	Standard Maya biface
Fowler 1987:7	El Mirador, Guatemala	Large oval biface (but thick)
Mitchum 1986:106	Cerros, Belize	Standard biface, large oval/ biface celt
Thompson 1991:121	Becán, Mexico	Celt
Aldenderfer 1991:129	Petén Lakes Region, Guatemala	Contracting base biface
Mitchum 1991:46	Cerros, Belize	Oval biface celt
Rovner and Lewenstein 1997:5	Dzibilchaltún, Becán and Chicanná, Mexico	Cordiform
Lee and Hayden 1989:57	El Cayo, Guatemala	Cordiform biface

Triangular

Shafer 1983:221	Pulltrouser Swamp, Belize	Large oval biface, retouched form
Aldenderfer 1991:128	Petén Lakes Region, Guatemala	Triangular, expanding base
Rovner and Lewenstein 1997:5	Dzibilchaltún, Becán and Chicanná, Mexico	Subtriangular

Table 5.1: Concordance of published works, sites, and tool types.

#3–Large Celt Uniface

Hester 1976:13	Northern Belize	Chisel-like tools
Wilk 1977:67	Barton Ramie, Belize	Adze, small variety, plano-convex
Mitchum 1986:107	Cerros, Belize	Adze, oblique multiple blow bit
Mitchum 1986:107	Cerros, Belize	Adze, irregular bit
Potter 1993:26	Northern Belize	wedge-shaped adze

#4–Large Tranchet Celt

Hester 1976:13	Northern Belize	Adze, chisel-like
Mitchum 1986:107	Cerros, Belize	Tranchet blow bit, Adze (or "orange-peel adze")
Shafer 1991:33	Colhá, Belize	Tranchet bit tool
Shafer 1991:33	Colhá, Belize	T-shaped implement (tranchet)
Rovner and Lewenstein 1997:17	Dzibilchaltún, Becán and Chicanná, Mexico	Tranchet Axe

#5–Large Laurel Leaf Biface, Thin

Ricketson 1937:11	Uaxactun, Guatemala	Bi-pointed knife
Willey 1972:165	Altar de Sacrificios, Guatemala	Laurel Leaf Blade, large
Hester 1985:202	Colhá, Belize	Lozenge and lenticular biface
Shafer and Hester 1991:155	Colhá, Belize	lenticular biface
Rovner and Lewenstein 1997:20	Dzibilchaltún, Becán and Chicanná, Mexico	Dagger, Biface

#6–Large Laurel Leaf Biface, Thick

Ricketson 1937:6	Uaxactun, Guatemala	Chisel
Ricketson and Ricketson 1937:184	Uaxactun, Guatemala	pointed at both ends, crude
Kidder 1947:5	Uaxactun, Guatemala	Pecking or pounding tools, standard form
Kidder 1947:5	Uaxactun, Guatemala	Rubbing tools, chisel-like
Andreson 1976:169	Northern Belize	Pick-like tool
Fowler 1987:8	El Mirador, Guatemala	large elongate biface, bipointed
Fowler 1987:8	El Mirador, Guatemala	Large elongate biface, squared-end
Aldenderfer 1991:128	Petén Lakes Region, Guatemala	Parallel-sided biface
Aldenderfer 1991:128	Petén Lakes Region, Guatemala	bipointed biface (same as parallel, but exhausted)
Rovner and Lewenstein 1997:25	Dzibilchaltún, Becán and Chicanná, Mexico	Lanceolate, celt biface

Table 5.1 continued.

#7–Large, Stemmed Biface

Hester 1985:194	Colhá, Belize	Biface point
Hester et al. 1991:73	El Pozito, Belize	Stemmed Biface
Rovner and Lewenstein 1997:77	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Biface Dagger

#8–Large, Stemmed Uniface

May also describe Medium, Stemmed Unifaces

Ricketson and Ricketson 1937:186	Uaxactun, Guatemala	Dagger, implements with no chipping on one or more major faces
Gann and Gann 1939:Pl. 1	Corozal District, Belize	Flint Spearhead
Lee 1969:155	Chiapa de Corzo, Mexico	Reworked blades, Lance Points
Andreson 1976:169	Northern Belize	Large stemmed point made from a macroblade
Hester 1985:194	Colhá, Belize	Stemmed Blade Point
Lewenstein 1987:138	Cerros, Belize	Chert Stemmed Macroblades

#9–Large Tapered Biface

Hester 1985:201	Colhá, Belize	Tapered Biface
Aldenderfer 1991:129	Petén Lakes Region, Guatemala	Lobed Biface

#10–Medium Celt Biface, Thin

Willey 1972:173	Altar de Sacrificios, Guatemala	Straight-based knife

#11–Medium Celt Biface, Thick

See #2		

#12–Medium Celt Uniface

Andrews and Rovner 1973:85	Muna and Dzibilchaltún, Mexico	Adze Biface

#13–Medium Oval Uniface

None recorded elsewhere		

Table 5.1 continued.

#14–Medium Laurel Leaf, Thin

Coe 1959:13	Piedras Negras, Guatemala	Projectile Points or Knives
Willey 1972:168	Altar de Sacrificios, Guatemala	Bipointed Knives and Laurel Leaf Blades
Hester 1985:202	Colhá, Belize	Lozenge and Lenticular Biface (also used for large type)
Shafer and Hester 1985:290	Colhá, Belize	Laurel Leaf Biface
Hester and Shafer 1991:155	Colhá, Belize	Lenticular Biface

#15–Medium Laurel Leaf Biface, Thick

Kidder 1947:Fig.61	Uaxactun, Guatemala	Pecking or pounding tools, blunt ended, Standard form
Pendergast 1971:66	Altun Ha, Belize	Biface, Heavy Ovate Blade
Andrews and Rovner 1973:85	Muna and Dzibilchaltún, Mexico	Parallel Gouge
Also see #6 for description		

#16–Medium Stemmed Biface

Kidder 1947:Fig.65	Uaxactun, Guatemala	Projectile Points or Knives, Tapering Stem, Long Blades

#17–Medium Tapered Biface

Willey 1972:165	Altar de Sacrificios, Guatemala	Broad and Narrow Tapered Stem Biface

#18–Medium Straight-Stemmed Biface

Kidder 1948:Pl.24	Uaxactun, Guatemala	Straight Stem
Pendergast 1971:66	Altun Ha, Belize	Biface Stemmed Blade
Willey 1972:164	Altar de Sacrificios, Guatemala	Straight Stem
Rovner and Lewenstein 1997:73	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Biface Point

#19–Medium Side-Notched Biface

Kidder 1947:0	Uaxactun, Guatemala	Projectile Points or Knives, Expanding Stem
Kidder 1948:Pl.24	Zacualpa, Guatemala	Expanding Stem
Willey 1972:163	Altar de Sacrificios, Guatemala	Expanded Stem, Long Blade

Table 5.1 continued.

#20–Medium Circular Biface

Rectangular		
Kidder 1947:5	Uaxactun, Guatemala	General Utility Biface, Standard Form, Re-Used
Coe 159:11	Piedras Negras, Guatemala	Rectangular Chopper
Willey et al. 1965:Fig.271	Belize Valley, Belize	Chopper pounder
Willey 1972:Fig.139	Altar de Sacrificios, Guatemala	Chopper pounder
Shafer and Hester 1983:233	Colhá, Belize	Battered biface
Aldenderfer 1991:128	Petén Lakes Region, Guatemala	round ended, parallel-sided biface

oval or "circular"

Ricketson and Ricketson 1937:186	Uaxactun, Guatemala	Turtle-backed, flint object
Ricketson and Ricketson 1937:186	Uaxactun, Guatemala	Pecking stones
Hammond 1975:336	Northern Belize	Chopper or Adze
Andreson 1976:162	Northern Belize	Fine bifacial scraper
Shafer and Hester 1983:221	Colhá, Belize	Large Oval Biface, medial fragment
Shafer and Hester 1983:229	Colhá, Belize	Biface Pick
Shafer and Hester 1983:229	Colhá, Belize	Biface Celt, broken
Fowler 1987:8	El Mirador, Guatemala	Recycled large oval biface
Mitchum 1986:109	Cerros, Belize	Hammerstone
Mitchum 1986:109	Cerros, Belize	Bifacial Scraper

#21–Medium Circular Uniface

Kidder 1947:7	Uaxactun, Guatemala	Scraper, Turtleback

#22–Small Celt Biface

Willey 1972:172	Altar de Sacrificios, Guatemala	Round-based knives
Willey 1972:174	Altar de Sacrificios, Guatemala	Stemless straight-based projectile points or knife
Sievert 1992:126	Chichén Itzá, Mexico	Lanceolate Projectiles
Rovner and Lewenstein 1997:75	Dzibilchaltún, Becán and Chicanná, Mexico	Oval Biface Point

Table 5.1 continued.

#23--Small Side-Notched Celt Biface

Sheets 1991:170	Chichén Itzá, Mexico	Lanceolate Biface

#24–Small Side-Notched Celt Uniface

Rovner and Lewenstein 1997:77	Dzibilchaltún, Becán and Chicanná, Mexico	Side Notched Point-on-Blade

#25–Small Corner-Notched Biface

Pendergast 1971:66	Altun Ha, Belize	Biface Corner Notched Blade
Sheets 1991:172	Chichén Itzá, Mexico	Corner-Notched Biface
Sievert 1992:121	Chichén Itzá, Mexico	Corner-Notched Projectiles

#26–Small Fishtail Biface

Willey 1972:163	Altar de Sacrificios, Guatemala	Fishtailed Point

#27–Small Stemmed Uniface

Hester and Shafer 1983:194	Colhá, Belize	Stemmed Blade Point
Rovner and Lewenstein 1997:30	Dzibilchaltún, Becán and Chicanná, Mexico	Point on Blade, Unifacial

#28–Small Laurel Leaf Biface

Coe 1959:12	Piedras Negras, Guatemala	Unstemmed Projectile Points
Willey 1972:172	Altar de Sacrificios, Guatemala	Stemless, Straight-Based, or Bipointed Laurel Leaf Bladed
Rovner and Lewenstein 1997:31	Dzibilchaltún, Becán and Chicanná, Mexico	Lanceolate Biface Point
Rovner and Lewenstein 1997:31	Dzibilchaltún, Becán and Chicanná, Mexico	Ovate Biface Point

#29–Small Side-Notched Laurel Leaf Biface

Proskouriakoff 1962:36	Mayapan, Mexico	Side-Notched Round- and Straight-Based Arrowheads
Andreson 1976:164	Northern Belize	Side-Notched Arrow Point, Round and Straight-Based Types
Shafer et al. 1991:83	El Pozito, Belize	Arrow Point

Table 5.1 continued.

#30–Small Stemmed Biface

Ricketson and Ricketson 1937:185	Uaxactun, Guatemala	Stemmed Point
Kidder 1947:Fig. 65	Uaxactun, Guatemala	Projectile Point or Knife, Tapering Stem, Short Blade
Kidder 1947:Fig. 65	Uaxactun, Guatemala	Projectile Point or Knife, Tapering Stem, Long Blade
Kidder 1948:Pl. 24	Zacualpa, Guatemala	Tapering Stem
Coe 1959:13	Piedras Negras, Guatemala	Stemmed Projectile Point
Willey 1972:166	Altar de Sacrificios, Guatemala	Narrow, Tapered Stem Projectile Point
Andreson 1976:168	Northern Belize	Stemmed Projectile Point
Aldenderfer 1991:130	Petén Lakes Region, Guatemala	Narrow Contracting Stemmed and Eared
Sievert 1992:126	Chichén Itzá, Mexico	Stemmed Projectiles
Rovner and Lewenstein 1997:31	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Biface Point
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Lanceolate Biface Point
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Tapered Stem Biface Point
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Squat Biface Point
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Tapered Stem Biface Point
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Ovate Biface Point

#31–Small Tapered Biface

Kidder 1948:123	Zacualpa, Guatemala	Triangular Butt
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Oval/Diamond Biface Point

#32–Small Straight-Stemmed Biface

Sheets 1991:168	Chichén Itzá, Mexico	Tanged Biface
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Lanceolate Biface Point
Rovner and Lewenstein 1997:76	Dzibilchaltún, Becán and Chicanná, Mexico	Shouldered Broad Biface Point

Table 5.1 continued.

#33–Small Side-Notched Biface

Kidder 1948:Pl. 48	Zacualpa, Guatemala	Expanding Stem?
Willey 1972:163	Altar de Sacrificios, Guatemala	Expanded Stem, Short Blade
Hester and Shafer 1991:157	Colhá, Belize	Side-Notched Dart Points
Sheets 1991:184	Chichén Itzá, Mexico	Side-Notched Biface
Sievert 1992:125	Chichén Itzá, Mexico	Side-Notched Projectiles

#34–Small Tanged Biface

Kidder 1947:11	Uaxactun, Guatemala	Straight of Tapering Stem, barbed shoulders (only in obsidian, not in chert)
Willey 1972:161	Altar de Sacrificios, Guatemala	Expanded Stem, Long Blade, specifically Figure 140b
Willey 1972:167	Altar de Sacrificios, Guatemala	Narrow Tapered Stem, Long Blade type, Slightly-Barbed variety (Fig. 148d
Bryant 1982	Yerba Buena, Mexico	Las Rosas Oblique Shoulder Type
Clark 1988:98	Yerba Buena, Mexico	Las Rosas Oblique Shoulder Type–cited
Clark and Bryant 1991:85	Yerba Buena, Mexico	Projectile Point
Rovner and Lewenstein 1997:77	Dzibilchaltún, Becán and Chicanná, Mexico	Winged/Notched Biface Point

#35–Small Tanged Uniface

Not recorded elsewhere		

#36–Small Circular Uniface

Not recorded elsewhere		

Table 5.1 continued.

typological variation also may stem from this framework, but tighter chronological control between sites is required.

5.4: TOOL TYPES AT PIEDRAS NEGRAS

In the following section I describe the tool types found at Piedras Negras. Types not found at Piedras Negras are drawn in black outline (Figure 5.2), but they are not described in detail, because they are thoroughly described in their own site reports (see Table 5.1). Materials and basic technological descriptions are included to emphasize the local character of Piedras Negras tool assemblages. I begin with a description of the microcrystalline quartzes found at Piedras Negras, including local and nonlocal stones.

5.4.1: Morphological and Technological Description of Tool Types

A variety of tool forms are were made of microcrystalline quartzes. The other chipped-stone material most commonly used at Piedras Negras, obsidian, was worked in much more predictable ways because of the limited number of techniques used to reduce it. Polyhedral cores reduced by pressure represent the majority of obsidian artifacts found at the site. Bipolar reduction was the only other technology used on obsidian, but it was reserved for percussion blades and exhausted cores to make obsidian eccentrics[16], and rarely for platform rejuvenation (see Chapter 6). Pressure flaking was also used to make the final eccentric forms.

In contrast, the major microcrystalline-quartz bifaces and unifaces used at Piedras Negras were created with a wider variety of technologies and reduction techniques than obsidian. Generally speaking, large tools were reduced using direct percussion, and pressure flaking was used or small tools. Medium tools could be formed through a combination of both of these reduction techniques, including indirect percussion. Indirect percussion, however, was a much less common technology, and was often reserved for microcrystalline quartz and obsidian eccentrics (Titmus and Woods 2003.

I use the more general term of bifacial reduction instead of bifacial thinning, because, for many bifaces, thinness was not a desired quality. For thick celts and laurel leafs, for example, a biface-thinning flake would reduce the strength, stability, and longevity of the use-life of a tool.

Finally, I also describe tool types that are not found at Piedras Negras. My goal is to provide basic type descriptions for the entire Maya Lowlands that may more easily enable cross-site comparison. I wish to show which tool morphologies were not selected by the Maya of Piedras Negras in the hope that future studies may reveal why this may be the case.

5.4.1.1: Large-sized artifacts (12 cm and longer in length).

5.4.1.1.1: Large celtiform biface, thin (see Figure 5.2 #1). Artifacts of this type were manufactured by direct percussion. They are at least 12 cm long, and are wider at the distal end than the proximal. Some of the edges may be finished with pressure flaking. A thick, diamond-shaped cross section was not a desired result of the reduction process.

This form is thoroughly described in lithic reports from Belize (see Table 5.1), and is often used as a temporal marker for the Preclassic (Shafer and Hester 1990). Only a few possible examples of this form were found at Piedras Negras (Figure 5.3.1), but none of these is securely dated to the Preclassic period. These few examples may represent curated pieces or a Late Classic resurgence of this form in the western area of the Maya Lowlands, but it is clear that the materials and technology are different from all other large, bifacial celts found at Piedras Negras. The material is relatively fine and light in color (i.e., white, cream, pink, and purple), indicating that local material may not have been used in the manufacture of these tools. These celts are thinner than other Classic period celts (1-2 cm) and are about as long as those described by Shafer and Hester (1983) for the Preclassic celt or "oval biface." There also is evidence of pressure flaking or fine percussion work on the lateral areas of the piece, a markedly different pattern from the large celtiform biface, thick type (Figure 5.3.2). Typical Classic-period celts are thicker, made of a grainier material, and were reduced without the goal of thinning the biface.

5.4.1.1.2: Large and Medium Celtiform Biface, Thick (see Figure 5.2 #2 and #11). These types were manufactured by direct percussion. They are at least 12 cm long for the large type and 8 cm for the medium type. It is wider at the distal end of the tool than the proximal. Some of the artifacts in this category feature a polished bit on the distal end. A thick, diamond-shaped cross section was a desired result of the reduction process.

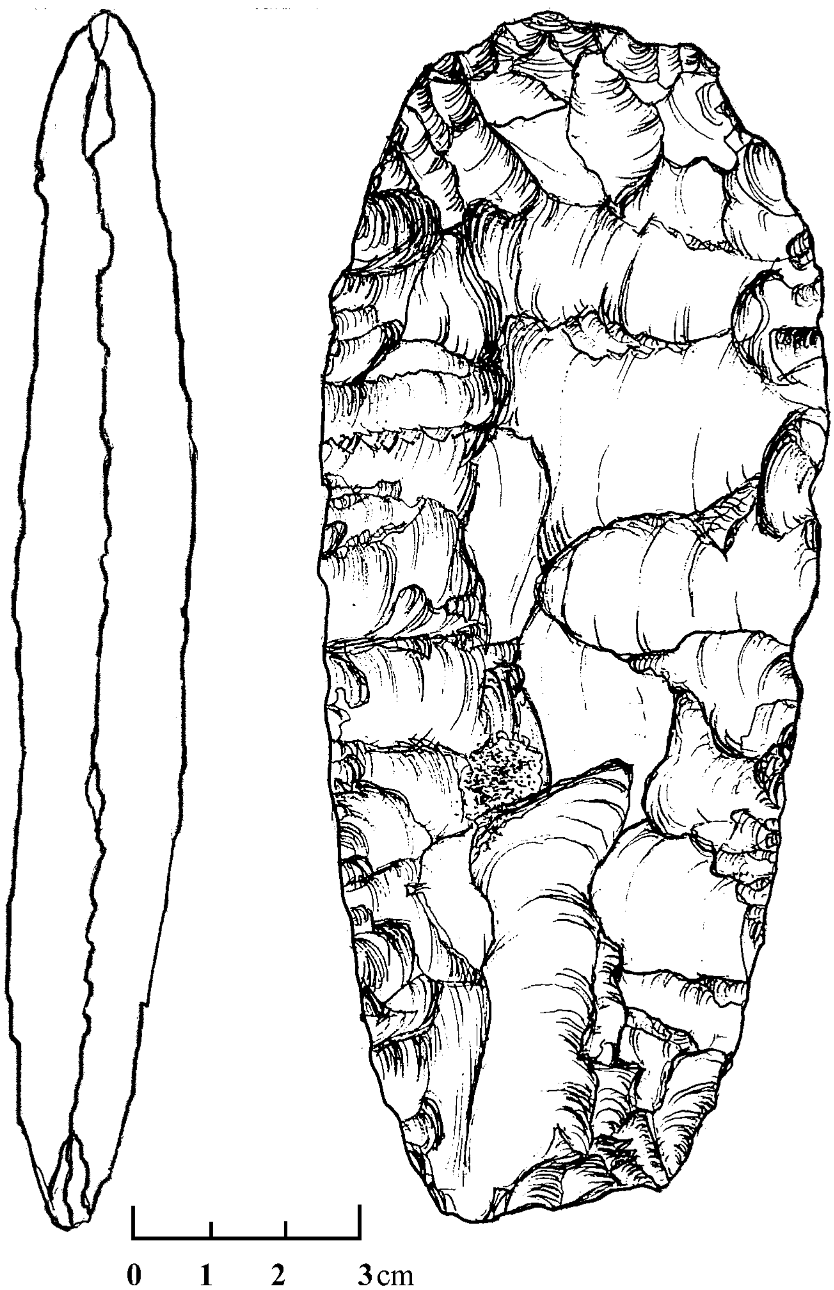


Figure 5.3.1: Example of a thin celtiform-biface from Piedras Negras. Drawing by Zachary X. Hruby.

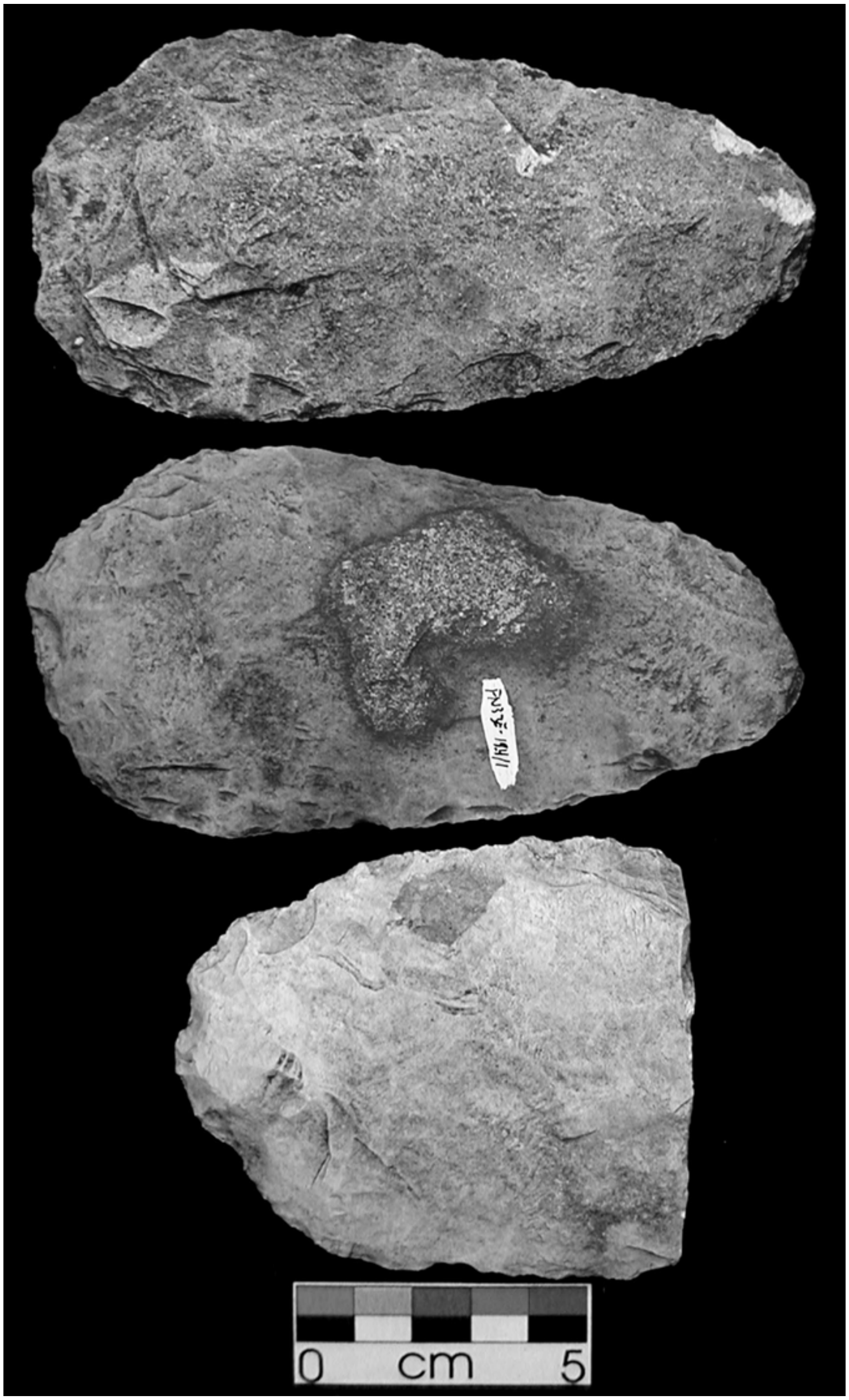


Figure 5.3.2: Examples of thick celtiform-bifaces from Piedras Negras. Photograph by Zachary X. Hruby.

The term celtiform is used to describe a morphological trait, and not a specific function, similar to how jade plaques are referred to as celts without having the function of an axe. Celtiform refers to a petaloid form that is larger at one end than at the other. This tool type is by far the most common biface at Piedras Negras, and can be found in all stages of reduction and reuse. Indeed, impact fractures and polished bits at the distal ends of these tools suggest that many were used as axes at one point in their use-life. Thick celtiform-bifaces usually were made of a coarse- to medium-grained material that was reduced with a direct-percussion technique by hammerstone. The rounded bit is sometimes ground (see Figure 5.4), but usually is prepared by direct percussion. Use-wear is highly variable, but the distal end usually shows evidence of the most intense use, resharpening, and rejuvenation behavior. In rare cases, there is evidence of hafting polish, or even pecking in the hafting area of the tool. The thickness of this form, and apparent crudity of workmanship, can probably be attributed to the extreme durability of the raw materials used, but also to the functional attributes required of the tool. The hard work usually performed with this tool (the cutting of earth, stone, and wood) required both thickness and durability.

Flakes removed in the creation of the thick celt should be referred to as biface-reduction flakes, because the goal in removing them is not to thin the piece (cf. biface-thinning flake). The term may be more efficacious, because the goal in removing them is to produce the desired outline and to create a working bit that can be resharpened many

Figure 5.4: A celtiform-biface fragment with polished bit at the distal end (bottom). Photograph by Zachary X. Hruby.

times. Complete examples of this form are relatively rare at the site, but fragments are easily identifiable because of their thickness.

The medium celtiform biface, thick type resembles the large type manufactured along a smaller trajectory. They are often difficult to differentiate from resharpened, large celts. This biface often features a finer flaking pattern, which suggests that a different reduction strategy was used for a tool that could be used for finer or more delicate work. All are manufactured by direct percussion and usually are made from coarse cherts, but sometimes finer material for a cleaner, more refined, bit. Similar to their greenstone counterparts, medium celts may have been more useful in the finer working of wood and stone. Heavy, hammering wear-patterns on the proximal ends of some of these tools suggest that they could have been used as chisels.

5.4.1.1.3: Large and medium celtiform uniface (see Figure 5.2 #3 and #12). These types were manufactured by direct percussion, but on only one face of the tool. The dorsal surface of a nodule reduction flake was the usual locus of reduction. The ventral surface of the flake-blank was not worked. They are at least 12 cm long for the large type and 8 cm for the medium type. It is wider at the distal end of the tool than the proximal.

Only a few examples of these artifacts were found at Piedras Negras, but some were made of local materials, suggesting that they were not always imported from elsewhere. The term uniface is somewhat of a misnomer for two reasons: (1) because all stone tools have two or more sides; and (2) because there usually is some modification of the ventral side of the tool (Figure 5.5). I retain the term because it most accurately describes the technology and morphology of these artifacts. Furthermore, most of the ventral surface of the original flake-blank remains, suggesting that this "flat" surface was essential to the function and morphology of the tool. The ventral surface probably was retained to maintain an acute angle close to the ventral surface, where resharpening could easily be executed. The percussion scars on the dorsal side of the flake-blank were completely removed by percussion, perhaps to maintain a curved working bit. Most of these tool forms are referred to as adzes in published works (see Andrews and Rovner 1973). The working bit was sometimes polished (e.g., the medium celtiform uniface; Figure 5.2, #12). The medium-sized versions of this form seem to have had their own production trajectory. At other times, however, what appear to be medium celtiform unifaces were actually the product of the resharpening of large-biface fragments. These pieces are made using direct, hard-hammer percussion, and with coarse-to-medium grade cherts.

5.4.1.1.4: Large, tranchet celtiform biface (see Figure 5.2 #4). This type was manufactured by direct percussion (see Shafer and Hester 1983 for a detailed description of the reduction process). They are at least 12 cm long, and are wider at the distal end of the tool than the proximal. The sharp, distal bit of the tool was made by laterally removing a long, curved flake from the biface preform. A razor-like bit was a desired result of the reduction process.

Tranchet technology is what defines this type, which is only found in the eastern area of the Maya Lowlands, especially in northern Belize, during the Preclassic period.

Figure 5.5: Minor working on the ventral surface of a celtiform uniface from Piedras Negras. Photograph by Zachary X. Hruby.

The working bit is produced by a side blow, which produces a very sharp cutting edge with an acute angle. This efficient reduction-strategy is most commonly known for the Acheulean hand axe, but is relatively complicated compared to normal biface-reduction techniques. The bit resembles the less efficient celtiform uniface bit described above, and has, for this reason been called an adze in some publications (Andrews and Rovner 1973:85). No examples of this form were found at Piedras Negras.

5.4.1.1.5: Large laurel leaf biface, thin (see Figure 5.2 #5). This type was manufactured with a direct percussion technique. It is at least 12 cm long, and is symmetrical with tapered points on either end of the biface. The proximal end, if one exists, is slightly wider than the distal end, and may feature remnant cortex. The edges were often finished with a pressure-flaking technique. A thin, lenticular cross section was a desired result of the reduction process.

Whole examples and fragments of these tools are rare at the site, except in cache contexts. They are made of fine- to medium-quality cherts and chalcedonies, and they were used as knives or spearheads. Use-wear patterns suggest that they were often used in both capacities. Since most examples of this form have use-wear of moderate-to-intense cutting, the laurel leaf form may have been used as cutting instruments only after its use-life ended as a spearhead, either through breakage or other cultural processes and circumstances. The large laurel leaf, thin type was made using hard-hammer, and possibly soft-hammer percussion[17], but usually was finished with moderate pressure flaking. The precise flaking-pattern of these bifaces may have required heat-treated or fine-grained materials to bring about the desired result. These forms also are a common aspect of cache deposits at Piedras Negras, and like all of the basic forms described here, must have had their own attached symbolic meaning.

5.4.1.1.6: Large and medium laurel leaf biface, thick (see Figure 5.2 #6 and #15). The large type was manufactured with a direct percussion technique. It is at least 12 cm long, and is symmetrical with tapered points on either end of the biface. The proximal end, if one exists, is slightly wider than the distal end, and may feature remnant cortex. A thick, diamond-shaped cross section was a desired result of the reduction process.

These tools are less common at the site than the large and medium celtiform biface, thick types but, like the thick celts, were produced to perform hard tasks. They were made of tough chert, chalcedony, and dolomite materials that often had crystal and shell inclusions in the matrix. Use-wear studies indicate that these tools were used for rough picking and chiseling activities, but microscopic analysis has not confirmed this for the Piedras Negras examples. These forms also were sometimes deposited in royal caches, and in one notable instance, two specimens were deposited in an Early Classic royal tomb (Burial 10) along with some of the biface-reduction flakes removed during their creation.

The smaller medium-sized version of this tool was made using direct, hard-hammer percussion. Use-wear analysis suggests that these tools were used in similar ways to the large laurel leaf, thick form, such as picking and chiseling, but on a smaller scale. They are often made of medium- to coarse-grained cherts.

5.4.1.1.7: Large stemmed biface (see Figure 5.2 #7). The preform for the large stemmed biface type was manufactured with a direct percussion technique. It was at least 12 cm long. The proximal end features a finely crafted stem, which was shaped with a pressure-flaking technique. The shoulders, or tangs, of the biface were notched by pressure flaking or by indirect percussion. The margins were finished with a pressure flaker. A thin, lenticular cross section was a desired result of the reduction process.

Few examples of this form exist at Piedras Negras, and none of the surviving examples are complete. The fragments are often thin in cross section and finely chipped. However, they are made from nonlocal flints indicating that they could have been made outside of Piedras Negras. This form features small shoulders, and a somewhat tapered stem (Figure 5.1). Other, more robust pieces have been found in a cave context near Piedras Negras, and also from La Pasadita, which is a subsidiary site of Yaxchilan located on the Guatemalan (eastern) side of the Usumacinta River (see Figure 5.2 #**7**). These cave samples have more accentuated shoulders and may have been used for ritual deposition rather than for cutting or hafting. Large stemmed bifaces are sometimes found in Piedras Negras caches, but they were often notched to create different symbolic meanings. In ritual caches, stemmed bifaces probably acted as markers of foreign affiliation, since stems were not a common morphological trait at Piedras Negras. Stemmed bifaces, especially those with accentuated "tangs," may have been created to imitate large, effigy atlatl points from Central Mexico (Hruby 2000). The large, basally hafted, biface of choice at Piedras Negras was the large laurel leaf, thin type.

5.4.1.1.8: Large stemmed uniface (see Figure 5.2 #8). This type was made from a large, percussion blade, which was removed from a percussion-blade core as described by Shafer and Hester (1983) for the Colhá site in northern Belize. The proximal end of the blade was bifacially chipped into a stem. The distal end was often partly modified to create a sharp point. They usually are longer than 12 cm in length.

This artifact type may better be described as a partially-bifaced macroblade, because the stem can vary from unifacial working to complete bifacial reduction. However, since one side usually is worked more than the other, I have created a type for it here. Very large versions usually are found only in Preclassic contexts, and are common to the northern Belize region of the lowlands (Shafer and Hester 1983). This form does not exist at Piedras Negras, but smaller versions are found during all time periods.

5.4.1.1.9: Large tapered biface (see Figure 5.2 #9). This type was created by bifacially chipping one end of a microcrystalline-quartz nodule. It is above 12 cm in length.

This form seems to be common in the central and eastern lowlands, but is not represented at Piedras Negras. Often made out of a microcrystalline-quartz nodule, only the upper two thirds of the nodule are reduced. This tool may have been used as a hand pick because of the ready-made grip on its proximal end. The tip (i.e., the distal end) often has evidence of impact damage. The term <u>tapered</u> refers to the pointed, working end of the piece.

5.4.1.2: Medium-sized artifacts (8 cm to 12 cm in length).

5.4.1.2.1: Medium celtiform biface, thin (see Figure 5.2 #10)**.** This type was manufactured with a direct percussion technique. It is between 8 cm and 12 cm in length, and is wider at the proximal end than the distal. The margins were finished with a pressure-flaker. A thin, lenticular cross section was a desired result of the reduction process.

Often called a teardrop point, these bifaces have the same celtiform outline as larger versions, but technology, morphology, and often material, are not the same. Function also is different in most cases with the focus of use moving to the proximal end rather than the distal end. In some cases, however, the proximal end does not have a finished point, which may suggest that these celtiform bifaces were used more often as knives than as spearheads. One possibility is that these bifaces, and their smaller counterparts, small and medium laurel leaf bifaces, were first used as projectile points or atlatl dart-points, and were then later transformed into knives and chisels when the fine edge was removed through breakage or resharpening. For example, in a peripheral household group where hunting and military protection may have been important activities (Operation R6; Webster and Kovac 1999), bifaces that appear to be projectile points were intensely used as knives and scrapers. Reworked impact fractures and bending breaks found on some examples add credence to this argument (see Figure 5.6 for a reworked example). Thin, celtiform bifaces are one of the most common medium-sized, fine bifaces at the site, but

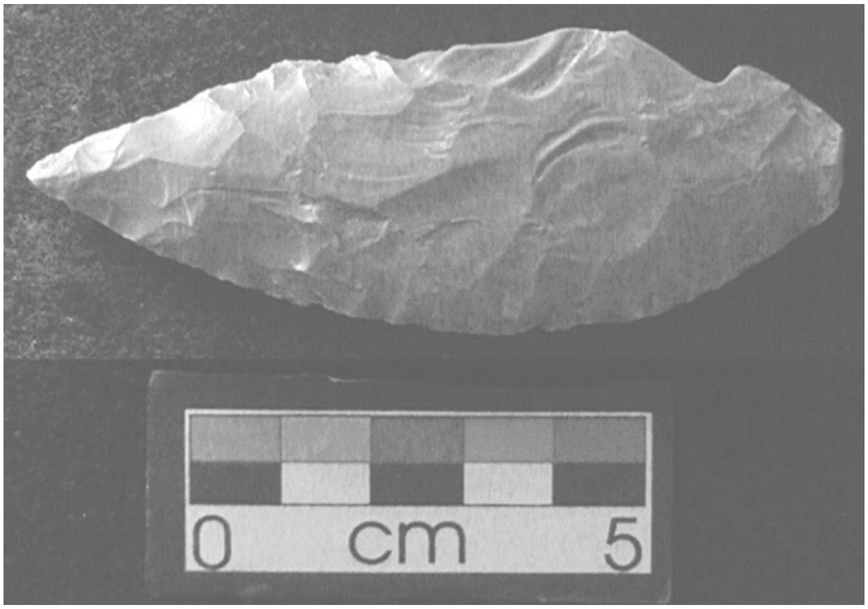


Figure 5.6: A partially reworked impact fracture on a medium-sized celtiform biface. Photograph by Zachary X. Hruby.

based on proximal or medial fragments it is impossible to tell the difference between a medium-sized celtiform biface and a medium-sized laurel leaf.

These bifaces usually are made of fine microcrystalline quartzes including flint, fine-grained cherts, and heat treated materials. They usually are quite colorful in comparison to larger bifaces because of the wide range of materials used to make them. They probably were reduced using direct, hard-hammer percussion, and also soft-hammer percussion. Both lipped and nonlipped biface-thinning flakes of these sizes and colors indicate that both types of hammers were used. However, very few antler billets have been found that could have been effective percussion instruments for these materials. Wood may be a likely candidate for billets since none of the bone artifacts feature hammer-type wear-patterns. Limestone, possibly in the form of broken manos, could have been used as percussors, but there was no conclusive way to confirm this possibility. On the other hand, lipped biface-reduction flakes are not very common, suggesting that chert and chalcedony hammerstones were the normal percussion implement used at Piedras Negras. The biface was finished with a collateral pressure-flaking technique. Pressure flaking was also used for resharpening the cutting edge, except in rare cases of direct-percussion resharpening. If the piece was made from a flake, then the proximal end of the flake, often a cortical platform, was retained as the proximal end of the tool. The function of this cortical element is unknown.

5.4.1.2.2: Medium celtiform biface, thick (see Figure 5.2 #11; see Section 5.4.1.1.2 for description).

5.4.1.2.3: Medium celtiform uniface (see Figure 5.2 #12; see Section 5.4.1.1.3 for description).

5.4.1.2.4: Medium oval uniface (see Figure 5.2 #13). This type was manufactured by direct percussion, but on only one face of the tool. The dorsal surface of a nodule reduction flake was the usual locus of reduction. The ventral surface of the flake-blank was not worked. They are between 12 cm and 8 cm long, and are slightly wider at the distal end of the tool than the proximal.

This tool type is rare at Piedras Negras (2 examples) and is unattested at other sites examined in this study (Figure 5.7). They are made of a medium-grained, cream colored chert that probably was not locally procured. The flaking pattern is very fine on the dorsal face, and the ventral flake scar is retained. The flaking pattern and material type make it impossible to tell whether hard- or soft-hammer percussion was employed. They could have been used as large cutting or scraping tools (Aoyama personal communication 2003). Macrovisual use-wear analysis of the Piedras Negras examples is inconclusive.

5.4.1.2.5: Medium laurel leaf biface, thin (see Figure 5.2 #14). This type was manufactured with a direct percussion technique. It is between 8 and 12 cm in length, and is symmetrical with tapered points on either end of the biface. The proximal end, if one exists, is slightly wider than the distal end, and may feature remnant cortex. The margins

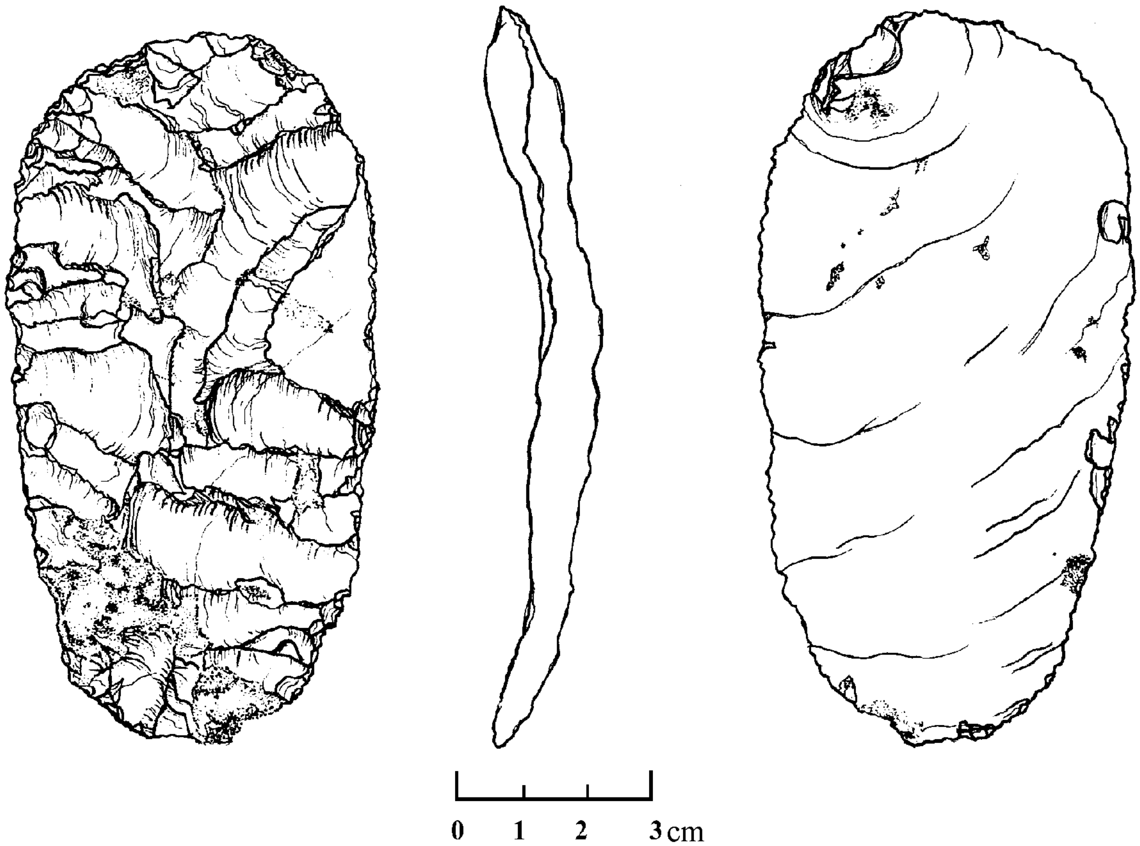


Figure 5.7: Medium-sized oval uniface from Piedras Negras. Drawing by Zachary X. Hruby.

were finished with a pressure-flaker. A thin, lenticular cross section was a desired result of the reduction process.

The medium laurel leaf biface, thin type differs from the medium celtiform biface, thin type in that it has two pointed ends, and each point usually is equidistant from the center point of the piece. However, in many cases it is possible to discern a difference between the working tip and the hafted end of the biface because of variable use-wear patterns or tip preparation. They are made with the same materials and techniques as the medium-sized, thin celts, but the proximal platform of the original flake blank is removed to create a second tapered or pointed end. Fine- and medium-grade microcrystalline quartzes were necessary to create the evenly chipped edge exhibited on most examples.

These bifaces also were used as both spear points and knives, but again, the order in which this occurred, or if it occurred within the same tool, is not well known. Because of the lack of a readily identifiable distal end, broken biface fragments of this size grouping are difficult to categorize. The benefit of a laurel leaf on a military campaign, or during a hunt, might be that the point could be reoriented 180 degrees, and then rehafted in the event of breakage. Nevertheless, some examples show a difference between the working end and the hafted end of the laurel leaf. The hafted end does not always have a sharpened point.

The medium laurel leaf biface, thin type also is common in caches at Piedras Negras. They represent a potent symbolic form that has connections with Central Mexico, and also with Maya concepts of the sun and celestial heat, especially when they are made of flint or other microcrystalline-quartz materials (Hruby 2001). Some examples of medium-sized, laurel leaf unifaces were found, but only in cache deposits. Furthermore, these examples are often notched around the centerline of the piece, probably to express some further symbolic meaning, or as an alternate hafting mechanism.

5.4.1.2.6: Medium laurel leaf biface, thick (see Figure 5.2 #15; see Section 5.4.1.1.6 for description).

5.4.1.2.7: Medium stemmed biface (see Figure 5.2 #16). The preform for the medium stemmed biface type was manufactured with a direct percussion technique. It is between 8 cm and 12 cm long. The proximal end features a finely crafted stem, which was shaped with a pressure-flaking technique. The shoulders, or tangs, of the biface were notched by pressure flaking or by indirect percussion. The margins were finished with a pressure flaker. A thin, lenticular cross section was a desired result of the reduction process.

The stem in these pieces represents another hafting strategy, but there is substantial variety in the way the stem has been manufactured. For most of the examples, the stem is quite short, and varies from a tapered stem to a nearly straight stem (Willey 1972:163). The medium-sized stemmed bifaces were made of medium- to fine-grained microcrystalline quartzes and were reduced using a soft- or hard-hammer, direct-percussion technique. First, either a celtiform or laurel leaf biface was produced, and then, using a pressure-flaking technique, the point was sharpened and the stem was formed. Although the stem may have been chipped using an indirect-percussion technique, there is not much evidence for this (e.g., wide semicircular notching scars), suggesting that a handheld pressure-flaker was normally used. At times, manufacturing a stem may have been a way to salvage broken laurel leaf and celtiform bifaces for different hafting methods. The stemmed biface is not appear with great frequency at Piedras Negras, suggesting that stems may have been modifications after initial production had occurred, and that different hafting methods and point preparations were preferred.

5.4.1.2.8: Medium and small tapered biface (see Figure 5.2 #17 and #31). The preform for the medium and small tapered biface types was manufactured with a direct percussion technique. They are between 8 cm and 12 cm long for the medium size and 8cm or less for the smaller. The proximal end is tapered, and was shaped with a pressure-flaking technique. The margins were finished with a pressure flaker. A thin, lenticular cross section was a desired result of the reduction process.

Like other stemmed types, the medium and small tapered bifaces are not very common at Piedras Negras. The term tapered in this case refers to the proximal base of the biface, and not the working, distal end of the tool (see description of large tapered biface). Other archaeologists have referred to them as tapered-stem or tapered-based projectile points or knives (see Table 5.1 for citations). The few examples from Piedras Negras appear to have been modified after basal breakage, and were tapered after the initial production process. These tools may have been stemmed at one time, but were then reworked after the stem had broken off. There also is some overlap between the medium and small tapered biface types, and the medium- and small-sized, celtiform and laurel leaf bifaces, which also can be partially tapered at the base. The points are made of medium- to fine-grained materials using soft- or hard-hammer percussion, and then finished with a nonpatterned, more or less colateral, pressure-flaking technique.

5.4.1.2.9: Medium and small straight-stemmed biface (see Figure 5.2 #18 and #32). The base of this biface is chipped into a straight stem, probably by pressure, and features relatively small shoulders or tangs. This type is not in evidence at Piedras Negras, but seems to be common to the Pasión region (see Willey 1972), during the Late Classic. A different hafting technology may be indicated by the stem preparation. The medium-sized tools may have been used as spearheads, or less likely as knives, while the smaller ones may have been used as dart points. Other straight-stem forms occur later in the northern Yucatan, possibly as a marker for the Postclassic period. They are often pressure flaked, revealing heightened skill on the part of the knappers who made them.

5.4.1.2.10: Medium and small side-notched biface (see Figure 5.2 #19 and #33). These types appear to have been made by notching a bifacially-worked, laurel leaf form. This type has not been found at Piedras Negras, and like the straight-stemmed modification, it implies a slightly different hafting technology. For both the side-notched and straight-stemmed bifaces, it is unclear whether they were intended to be knives or points. Analysis of the breakage pattern and use-wear would be necessary to properly identify a function for these pieces.

5.4.1.2.11: Medium circular biface (see Figure 5.2 #20). This type was manufactured by direct percussion. It is 8 cm to 12 cm in width. A thick, diamond-shaped cross section was the desired result of the reduction process.

These tools are common in the Piedras Negras sample. The term "circular" is somewhat of a misnomer because while some of these artifacts are circular, most are better described as oval-shaped. Nevertheless, "oval" has been used to refer to various kinds of celtiform bifaces elsewhere (e.g., Shafer and Hester 1983), and is thus avoided here to reduce confusion in the present typology. These bifaces were made from blanks prepared specifically for the production of circular bifaces. A great number of uses have been proposed for these tools (see Willey 1972:160). Macrovisual analyses of circular bifaces from Piedras Negras suggest that they may have been used for chopping, cutting, scraping, hammering, and pecking, probably for architectural blocks and metates made of limestone. The term general utility biface created by Willey (1972:157) seems to fit well here as a functional description of these tools. They are made of the same coarse-grained materials as the thick, celtiform-biface types, and a thin cross section was not a desired trait of the finished product. It is sometimes possible to distinguish this form from resharpened, celtiform bifaces by identifying incongruous flaking patterns on one end of the tool.

5.4.1.2.12: Medium and small circular uniface (see Figure 5.2 #21 and #36). These types were manufactured by direct percussion, but on only one face of the tool. The dorsal surface of a nodule reduction flake was the usual locus of reduction. The ventral surface of the flake-blank was not worked. The medium-sized examples are 12 cm to 8 cm long, and the small-sized examples are below 8 cm in length.

There is a small sample of these artifacts from the site center, and also from the near-periphery. Use-wear on these pieces indicates that they were used as scrapers, but microscopic use-wear analysis is necessary to confirm it. These objects also may have been placed in architectural façades or in large, stucco masks as "eye" elements. Larger examples of this type were made from nodule decortication flakes of medium-grained chert, and finished with direct, hard-hammer percussion. Smaller examples of this type can best be described as discs. They usually are modified, biface-thinning flakes. Small, circular unifaces were often deposited in pairs for burials, and likely were used as costume or headdress elements. Very small microcrystalline quartz and obsidian, circular unifaces could have also been figurine decorations.

5.4.1.3: Small artifacts (8 cm or less in length).

5.4.1.3.1: Small celtiform biface (see Figure 5.2 #22)**.** This type was made from a small nodule reduction flake or a large, biface-thinning flake. It was reduced by pressure, and was finished with pressure. It was 8 cm or less in length. The distal end is wider than the proximal end. A thin, lenticular cross section was the desired result of the reduction process.

These small bifaces are rare and probably were produced as projectile points, perhaps as small spear or dart points. These points overlap with the so-called tapered stem points (e.g., Willey 1972:163), and at times have somewhat straight margins on the distal end, instead of the true "tear drop," or celtiform outline described for medium-sized examples. These points are often made of fine-grained materials, and are nicely pressure-flaked. The tapering of the biface may be a result of consumer modification to fit a particular haft. They also are commonly resharpened, and like most bifaces at Piedras Negras, they are often used as knives at some point before they enter the archaeological record.

5.4.1.3.2: Small notched celtiform biface (see Figure 5.2 #23). No examples of this form were found at Piedras Negras, and it usually is a marker for the Postclassic period (see bifaces from Chichén Itzá in Kidder 1947:9; and Sheets 1991:175). It usually is thin and could be used as an atlatl dart point. Somewhat larger versions were found at Late Classic Uaxactun (Kidder 1947:fig 65, b1), but these are thicker and are not common anywhere in the lowlands.

5.4.1.3.3: Small notched celtiform uniface (see Figure 5.2 #24). This type was made by notching a small, biface-thinning flake. The tip was bifacially worked with a small pressure-flaking device. It usually is well below 8 cm in length.

The only example of this point is quite small, and probably was used as an arrow point. This uniface is more accurately described as a worked, or retouched flake, but may, in some cases, be thoroughly chipped on one side. The one example from Piedras Negras measures 2 cm long (Figure 5.8) and falls with in the viable size-range for an arrow point (Rovner and Lewenstein 1997:27). It was made of a nonlocal chert, and was found in Operation 41, which featured Terminal and Postclassic remains in the surface strata.

5.4.1.3.4: Small corner-notched biface (see Figure 5.2 #25). These bifaces, probably used as dart or arrow points, seem to occur late in the archaeological record, and can be dated mainly to the Postclassic period. None occur at Piedras Negras.

5.4.1.3.5: Small fishtail biface (see Figure 5.2 #26). This form is quite rare in the Lowlands, except in the Pasión region with a few examples from Altar de Sacrificios. They are likely the result of stem breakage, and subsequent reworking of the broken biface, but this idea is untested. No examples of this form were found at Piedras Negras.

5.4.1.3.6: Small stemmed uniface (see Figure 5.2 #27). This type was made from a small percussion- or pressure-blade. It is 8 cm or less in length. The proximal end of the blade was chipped by pressure into a stem configuration.

Only two of these artifacts were found in general excavations at Piedras Negras, and both were made of chert (or flint) prismatic, percussion blades. The existence of polyhedral, blade-cores made from local microcrystalline-quartzes at Piedras Negras suggest that these blades were produced locally. Examples from Belize were made from blades that were produced from a blade core (see Shafer and Hester 1983), but not a polyhedral blade

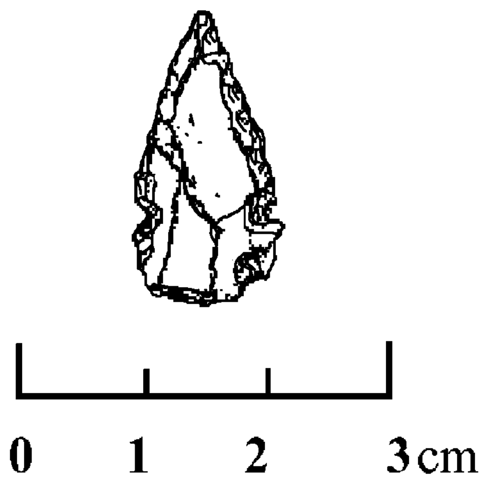


Figure 5.8: Small, side-notched celtiform uniface, or arrowhead, from Piedras Negras. Drawing by Zachary X. Hruby.

core such as is used in the Middle Usumacinta region (Lee and Hayden 1989). Similar unifaces have been recorded for the northern Maya Lowlands (Rovner and Lewenstein 1997:34), but these may have been made from percussion flakes, and not blades. The few Piedras Negras examples were made from blades, and were reduced by a pressure-flaking technique that only moderately affected the original blade. Some examples from outside the Piedras Negras area, which appear to be projectile points, may have also been used as drills, but microscopic use-wear analyses are needed to confirm these two functions.

5.4.1.3.7: Small laurel leaf biface (see Figure 5.2 #28). This type was made from a small nodule reduction flake or a large, biface-thinning flake. It was reduced by pressure, and was finished with pressure. It was 8 cm or less in length. The distal and proximal ends are pointed and roughly symmetrical. A thin, lenticular cross section was the desired result of the reduction process.

This biface is the most common small biface at Piedras Negras and may have been used as a small knife, spear point, or as an atlatl dart point, especially for smaller versions. Some examples are small enough to be hafted as arrowheads, but none have been found in Postclassic contexts where arrow technologies might have existed in the Usumacinta region. Specimens from the Piedras Negras sample show use-wear evidence of cutting, which suggests that even the smallest laurel-leaf bifaces also were used as knives at one point in their use-life. They are finely pressure flaked and are made of fine microcrystalline quartzes, including heat-treated local cherts and chalcedonies.

5.4.1.3.8: Small side-notched laurel leaf biface (see Figure 5.2 #29). These are not produced at Piedras Negras as tools. However, obsidian versions are quite common in cache contexts. Larger flint unifaces of this style also are found in caches at Piedras Negras. One possible example from Uaxactun (Kidder 1947:Figure 65, b2) might fit this description, but the type name used here refers to a probable arrow point commonly found in the northern, Postclassic Yucatan. The cached eccentrics from Piedras Negras are unrelated to these much later tools.

5.4.1.3.9: Small stemmed biface (see Figure 5.2 #30). This type was made from a small nodule reduction flake or a large, biface-thinning flake. It was reduced by pressure, and was finished with pressure. It was 8 cm or less in length. The stem was finely chipped by pressure. A thin lenticular cross section was the desired result of the reduction process.

The small stemmed biface is one of the most common small bifaces in the Maya Lowlands, but like other stemmed bifaces, they are rare at Piedras Negras. I use the term "stemmed" to refer to any protrusion that tapers from "shoulder" elements at the base of the tool. Other typologies (e.g., Rovner and Lewenstein 1997) have classified tapered stems in a variety of ways that emphasize other minor characteristics, such as pointed shoulders, flat stemmed bases, or rounded shoulders (see Table 5.1). All of these characteristics can be present in a single sample of small, stemmed bifaces from any given site, and also can be explained by breakage. I do not propose that minor variations in stem or shoulder configuration do not reflect traditions of a particular area, but these must be left for a separate study.

The small stemmed biface type also differs from the small tanged biface, which has shoulders that protrude beyond the line where the stem and body of the tool meet. The stemmed biface can range in quality and may have been the result of a number of different production trajectories. A stemmed biface can originate from a small tanged biface with broken tangs, a small laurel leaf biface a preform, or a small celtiform biface preform. The preforms were carefully notched at the base to produce the stem.

While the small stemmed biface is very common at Uaxactun and Altar de Sacrificios, it is not common at Piedras Negras. The hafting preparation of choice at Piedras Negras appears to be minor tapering at the base of a laurel leaf or celtiform biface. The small stemmed biface is found throughout the lowlands during the Early and Late Classic periods.

5.4.1.3.10: Small tapered biface (see Figure 5.2 #31; see Section 5.4.1.2.8 for description).

5.4.1.3.11: Small straight-stemmed biface (see Figure 5.2 #32; see Section 5.4.1.2.9 for description).

5.4.1.3.12: Small side-notched biface (see Figure 5.2 #33; see Section 5.4.1.2.10 for description).

5.4.1.3.13: Small tanged biface (see Figure 5.2 #34). This type was made from a small nodule-reduction flake or a large biface-thinning flake. It was reduced by pressure, and was finished with pressure. It is 8 cm or less in length. The stem was finely chipped by pressure. A thin, lenticular cross section was the desired result of the reduction process.

This form was not found in general excavations at Piedras Negras, but notched, eccentric versions were found in cache contexts. It is similar to the stemmed biface, except for the tangs (i.e., overhanging shoulders), and also for its smaller size. Clark and Bryant (1991) have conducted the most thorough study of this projectile point type from Yerba Buena, Chiapas, Mexico.

The small tanged biface type generally is not common in the Maya lowlands, and many examples are from Early Classic contexts. It is possible that the trend of tanged-biface manufacture was adopted from Central Mexico, and Maya examples may have been produced to emulate imported, tanged obsidian-bifaces. Imported Mexican points found at Uaxactun (Kidder 1947:Figure 64a), Tikal, and other sites were made with a transverse parallel pressure-flaking technique not common to the Maya Lowlands. At Piedras Negras, a few obsidian bifaces were reduced by pressure flaking in a transverse-parallel style, a marker of Central Mexican lithic technology. However, the lack of distal portions of these bifaces makes it impossible to determine if they were tanged. The obsidian points, like their chert counterparts from the Maya area, probably were atlatl dart points. The symbolic potency of the tanged dart-point for the Maya seems to have been great, because of their inclusion and repetition in many ritual cache contexts from Piedras Negras and other major Maya sites (Figure 3.2). The lack of tanged bifaces in the domestic archaeological record at Piedras Negras suggests that they were not made there. If the atlatl was used at Piedras Negras, the dart points probably were of laurel leaf form.

5.4.1.3.14: Small tanged uniface (see Figure 5.2 #35). One point of this type was found at Piedras Negras. The specimen was made of a dark greenish flint. The blank was a percussion blade, but it is unclear from what kind of blade core it was originally removed. The term uniface is used loosely, once again, because both faces are partially worked but with emphasis on one side. The piece is extremely light and could have been used as a dart point. There also is an impact fracture at the tip of the point. Since the material, blade technology, and tool morphology is unique at Piedras Negras, it is assumed that the small tanged uniface was imported, and not made locally.

5.4.1.3.15: Small circular uniface (see Figure 5.2 #36; see Section 5.4.1.2.12 for description).

5.4.2: Observations and Discussion

The microcrystalline-quartz tools described here represent many different forms and reduction techniques, but in comparison with other sites from the lowlands, Piedras Negras was rather conservative. This conservatism may be related to shared lithic traditions with the Central Petén, as is evidenced by similarities in eccentric forms between the two areas. Some forms appear to be relatively unique to Piedras Negras, such as the medium oval uniface, but they are few. Other forms common throughout the Maya

Lowlands, such as medium- and small-sized, stemmed bifaces are rare at Piedras Negras. In fact, many of the stemmed bifaces at Piedras Negras appear to be the result of post-breakage reworking. Another trend related to the lack of stem morphology at Piedras Negras is the absence of tangs on stemmed bifaces. Most other lowland sites feature tangs on local bifaces at one time or another. Nevertheless, tanged bifaces of all sizes are present in caches from throughout Piedras Negras. In this case the Piedras Negras Maya may have been emphasizing tanged bifaces as a marker of foreign affiliation at the royal level, because they are not part of local hafting traditions and technologies.

Very few Preclassic and Postclassic forms were found at Piedras Negras. This pattern corresponds to the small ceramic samples (i.e., small populations) from these time periods. However, a small sample of non-Classic artifacts were discovered, including the small side-notched celtiform uniface marking Postclassic trends, and also a finely made large celtiform biface, thin example that probably dates to the Preclassic. Similar to the lithic sample from the Pasión region, no tranchet celts were found at Piedras Negras, indicating that materials, tools, and production knowledge were not traded from the chert-bearing zone of northern Belize. The lack of readily identifiable “honey brown” Belizean cherts suggests that eastern chert trade-networks did not extend to the Middle Usumacinta region. Of all the studied areas of the Maya Lowlands, the tool types and technologies used at Piedras Negras most resemble those from Tikal and the Central Petén Lakes region. Furthermore, microcrystalline quartz and obsidian eccentrics at Tikal closely resemble those from Piedras Negras, and are less similar to eccentrics from the Pasión and northern Belize regions. During the Late Classic period Piedras Negras appears to be most closely related to Tikal with regard to chipped-stone traditions.

The most common bifaces and unifaces at Piedras Negras are, of course, the least valuable as temporal markers. The relatively small sample of small and medium bifaces from Piedras Negras in general, and from the Preclassic and Postclassic periods in particular, makes a lithic "sequence" for Piedras Negras difficult to produce. Variations in Classic-period lithic style at Piedras Negras and other sites throughout the lowlands have been notoriously difficult to discern, but a more detailed temporal analysis of the artifacts discussed here may reveal previously unnoticed patterns. More rigorous illustration and description is necessary if microcrystalline-quartz artifact studies in the Maya area are to progress.

5.5: MICROCRYSTALLINE-QUARTZ ECCENTRIC TYPES

The range of techniques used to make microcrystalline eccentrics throughout the lowlands can only be described as highly varied and complex. For this study, I address the reduction techniques and strategies used to make microcrystalline-quartz eccentrics at Piedras Negras. These eccentrics also are quite varied, but are nevertheless reducible to four basic technological types. Eccentric types include pressure-notched flakes, indirect-percussion notched flakes, partially-worked bifaces, and fully-worked bifaces. There also is variability within each type that could be recorded to produce a more detailed typology. Some of these variations include: (1) bifaces with or without a pressure-flaked finish; (2) indirect-percussion notched flake types that also show signs of direct-pressure notching; and (3) bifaces that feature both pressure and indirect-percussion notching. The observations used to create these types came from an analysis of the technology and morphology of the cached eccentrics, and from replicative experiments. The goal of using the general types proposed here is to track changes in the basic reduction strategies through time. It is possible that each eccentric type may mark a specific reduction strategy of a group of knappers. An eccentric form may be produced using a variety of reduction strategies and techniques. Variation through time is discussed in Chapter 7.

5.5.1: Pressure-Notched Flake

This type of eccentric (Figure 5.9) required the least amount of knapping skill to create. Nodule reduction flakes and biface-reduction flakes were modified with a handheld pressure-flaker of some kind (e.g., antler, wood, or bone). This type usually is 12 cm or less in length, but larger examples made from extremely large, biface-reduction flakes do exist. Notches often were created by removing flakes from only one face of the flake-blank. However, some specimens show that a bifacial margin was created in the removal of the notching flakes. In many cases, the flakes produced during this kind of modification would not have a discrete morphology, but rather would appear as minute pieces of shatter. While the technique itself is not difficult to master, the outline of the piece may have required detailed measurements. Since most of the pressure-notched flake eccentrics depict silhouettes of Classic Maya gods, and other elaborate naturalistic forms, the creation of those forms would have required knowledge of ancient Maya artistic standards.

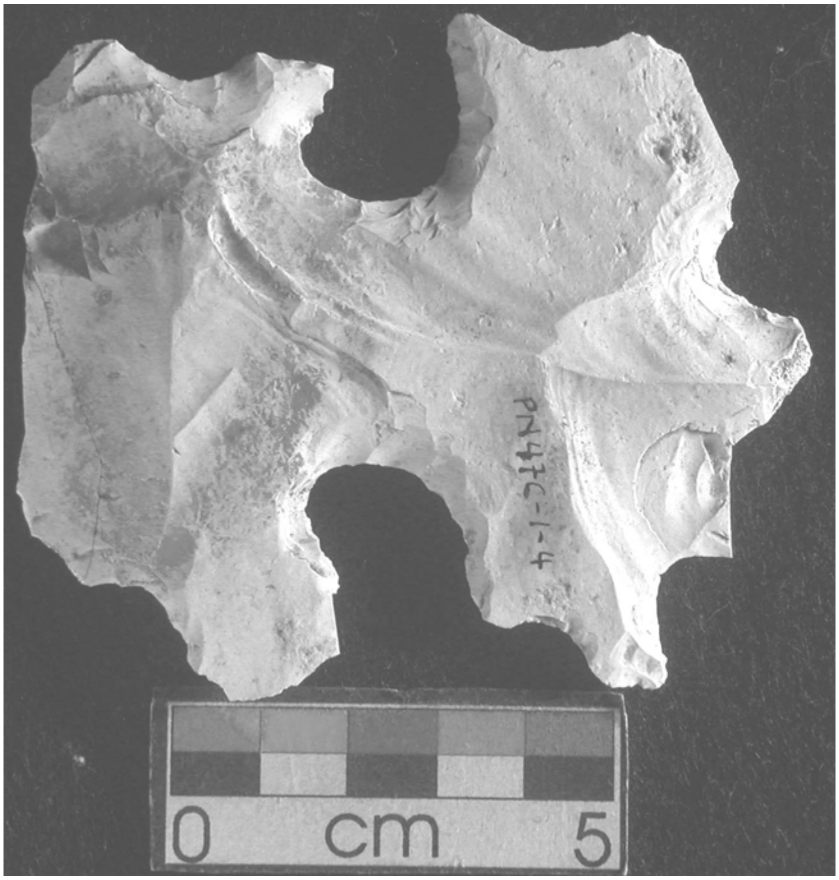


Figure 5.9: Microcrystalline-quartz, notched-flake eccentric from Cache R-5-4.
Photograph by Zachary X. Hruby.

5.5.2: Indirect-Percussion Notched Flake

These eccentrics would have been more difficult, physically and technically, to produce than the pressure-notched flake type. Since this reduction technique requires more force, thicker, wider, and less fragile flake-blanks were used. These eccentrics usually are 12 cm or less in length. The flake of choice usually was an early- or middle-stage, biface-thinning flake, or a nodule-reduction flake. The end result of the reduction process was a relatively large eccentric, but with a cruder outline than the pressure-notched type. This type features rather simplistic outlines, and had fewer naturalistic forms, such as god silhouettes, and more symbolic or iconic forms (e.g., the double-notched laurel leaf; Figure 5.10). Direct pressure-flaking was often used to smooth out the contour of the margin. Replicative experimentation shows that indirect percussion produces flakes that are wider, and scars that are deeper, than those made by pressure (see Titmus and Woods 2003).

5.5.3: Partially-Worked Biface

This category is similar to the fully-worked biface eccentrics in that purely symbolic or iconic forms usually were the intended product (Figure 5.11). The distinction is important, however, because the partially-worked biface eccentrics are not as symmetrical and have a crooked margin, which retains the curvature of the original flake or blank. Biface reduction was carried out with a combination of percussion and pressure techniques. The Maya may not have made a distinction between the fully worked and partially worked biface-eccentrics, because they were often deposited together as though

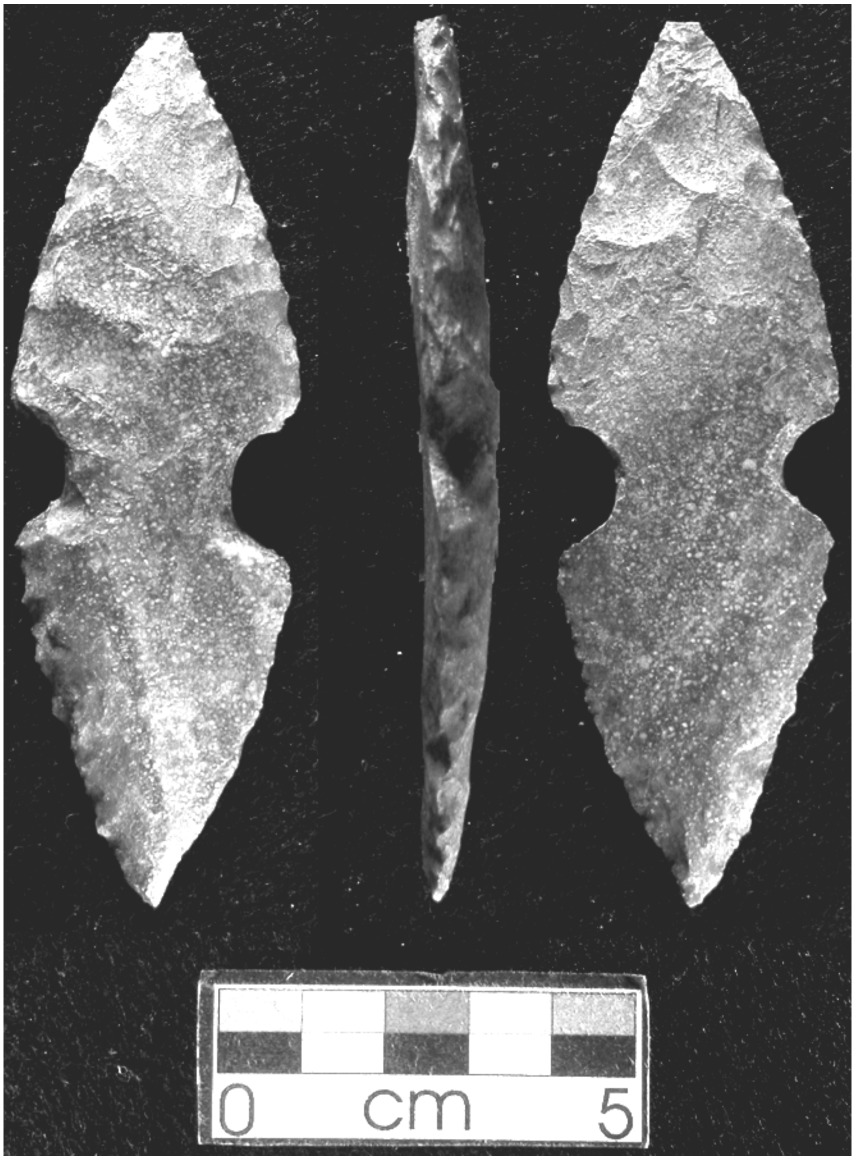


Figure 5.10: Unifacially-worked laurel leaf with side-notches from Cache C-13-2. Photograph by Zachary X. Hruby.

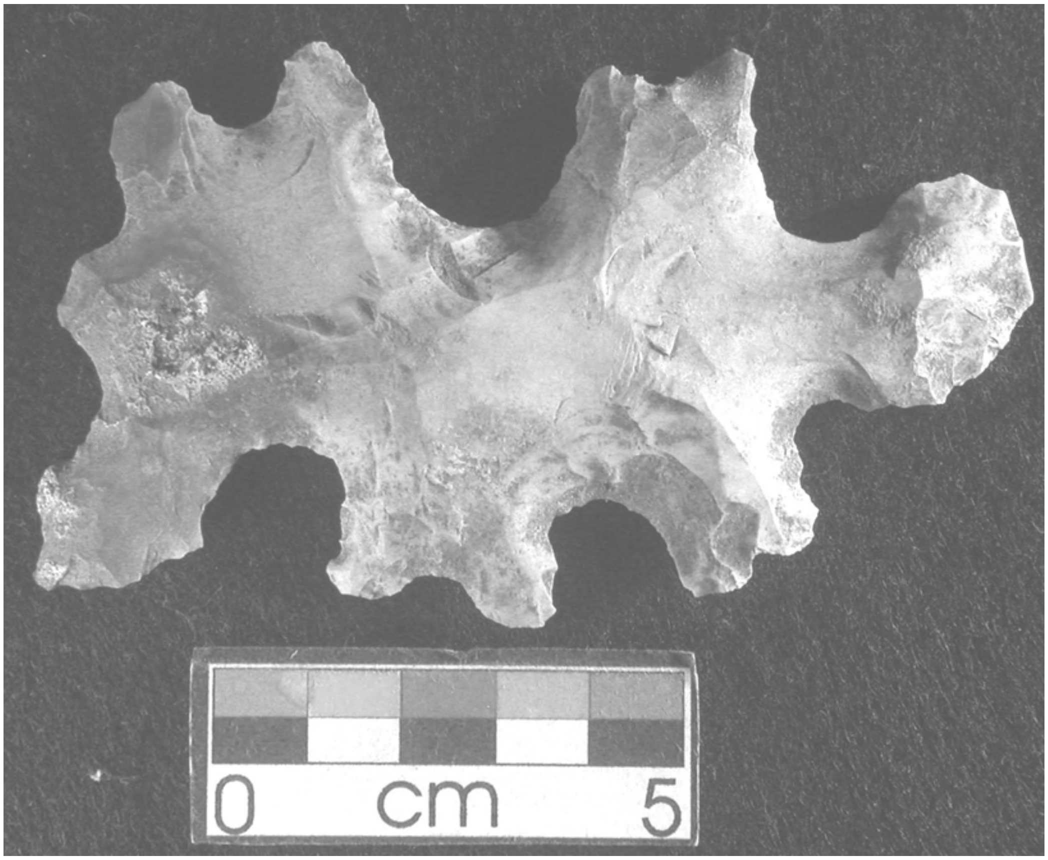


Figure 5.11: Partially-worked biface eccentric from Piedras Negras. Photograph by Zachary X. Hruby.

they had the same meaning and value. This type varies greatly in size, but no examples have been discovered above 15 cm in length at Piedras Negras.

5.5.4: Fully-Worked Biface

Finally, the most elegant, time-consuming, and, by most archaeological standards, well-executed eccentrics are the fully-worked biface eccentrics (Figure 5.12). The knapper would begin with a partially- or fully-worked biface of either laurel leaf or celt morphology. The thinness and fine percussion scars of many specimens suggest that a soft-hammer was used in the reduction process. If notches, crescents, or stems were desired, then an indirect-percussion technique often would be used. Finally, direct pressure-flaking was used to finish the form and remove smaller notching flakes. These eccentrics usually were chipped into iconic forms, rather than naturalistic forms. This type varies greatly in size, but no examples have been discovered above 21 cm in length at Piedras Negras.

5.6: DEBITAGE TYPES

During the production of the previously described microcrystalline-quartz tools and eccentrics, technologically diagnostic flakes, blades, and chunks were removed. It should be noted, however, that large flakes, blanks, and preforms might also have been used as biface- and multidirectional-flake cores. Multidirectional flake-cores are the second most common source of microcrystalline-quartz cutting tools. Consequently, so-called waste flakes cannot be claimed to be such without proper contextual information.

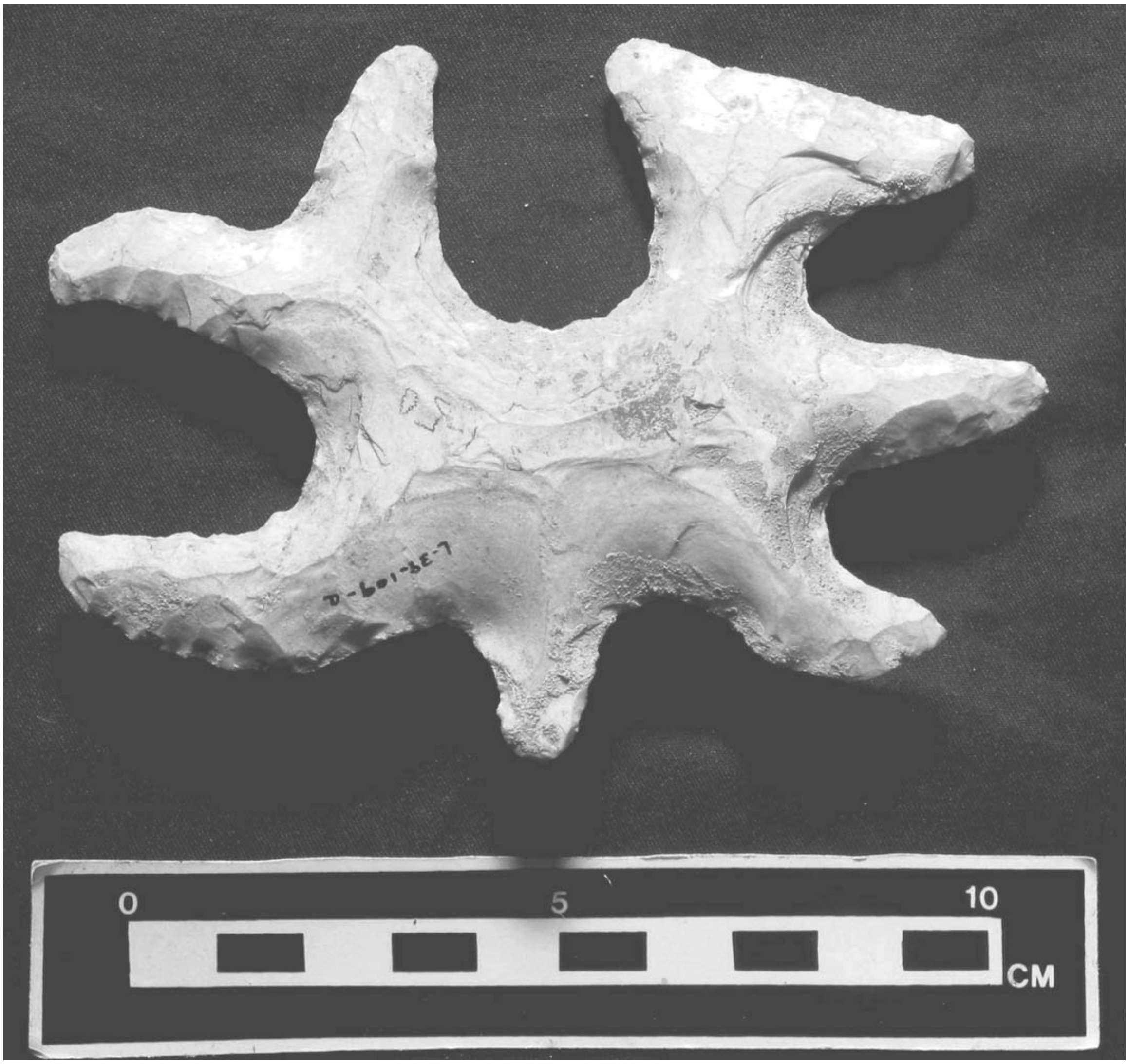


Figure 5.12: Fully-worked biface eccentric from Piedras Negras. Photograph by Zachary X. Hruby.

At Piedras Negras biface-reduction flakes were the primary microcrystalline quartz cutting-tools, and cannot automatically be considered as waste from the production of biface tools. That said, there is no firm evidence of the curation of bifacial flake-cores. It is more likely that debitage removed during the production of bifaces and unifaces was saved for flake tools.

This section describes the various kinds of flakes and other debitage that were produced at Piedras Negras, and also the ad hoc tool technologies of multi-directional flake cores. Although it is impossible to link every debitage type with a particular end product, some general correlations between tool type and debitage type exist that allow for an interpretation of debitage deposits. For example, a large, celtiform biface would have a much different debitage "signature" than that of a small, laurel leaf biface. Throughout the analysis of Piedras Negras debitage I recorded metric and technological traits. I begin with a description of early-stage debitage types that cannot be attributed to any one finished product, and continue with more specialized debitage types.

5.6.1: Nodules, Nodule Reduction Flakes, and Chunks

Although they are not very common, complete nodules were found at the site. Nodules of local chert, imported, coarse-grained cherts, and imported flints usually are elongated and oval in cross section. Locally or regionally available chalcedonies are roughly spheroid in form. Large nodule-reduction flakes and cobble sections from these materials reflect the structure and size of the original nodules. Whether nonlocal materials were imported as cobble sections or as roughly prepared nodule reduction-flakes, either from other workshops or from the river bar below the site, is not clear at this time. Nodules were reduced using a large hammerstone that produced flakes with large platforms. Nodule reduction flakes are characterized here as cortical, partially cortical (i.e., flakes retaining some cortex).

Due to the abundance of natural seams and fractures in the microcrystalline quartzes from the Middle Usumacinta region, some of the most common debitage types are chunks and shatter (see Figure 7.26). These angular pieces of debitage can retain percussion scars, cortex, and also quartz crystal seams that feature no conchoidal-fracture pattern on their surfaces. The removal of inclusions and quartz seams during the initial reduction of nodules was of great importance to the successful production of a biface. Chunks and shatter, however, occur in all material types, and are considered to be a good marker for production activities, especially since they are rarely used as tools. However, they do appear with some frequency in royal caches and dedication rituals.

Once a suitable nodule, cobble section, or nodule reduction flake was reduced with biface- or uniface-tool trajectories in mind, cortical and noncortical reduction-flakes were removed. Unless the nodule was extremely small, the flakes were large (>12 cm) to medium (8-12 cm) in size. Platform preparation increased with each stage of reduction, and depending on the form of the flake or blank, later nodule reduction-flakes would have more or less cortex remaining on the dorsal surface. In many cases, the platform may be multifaceted, and appear to be a biface-reduction flake, but without any actual bifacial (bi-directional) scarring pattern on the dorsal surface. Flakes from this stage in the reduction sequence make it impossible to tell what was the intended, finished product.

The goal of reduction would be to produce a workable blank for thin or thick bifaces and unifaces. Many late-stage, nodule reduction flakes were used as knives and scrapers.

5.6.2: Biface- and Uniface-Reduction Flakes

Biface-reduction flakes are separated into early-, middle-, and late-stage reduction flakes. Early-stage biface-reduction flakes feature few flake scars, or facets, on their dorsal surfaces (usually two or three) and the platforms are not very complex with only two-to-three facets. Early-stage biface-reduction flakes are likely to have cortex remaining on the dorsal surfaces. Middle-stage biface-reduction flakes are less likely to have cortex, but depending on the size of the nodule, cortex may be evident at all stages of reduction. Middle-stage biface-reduction flakes often feature multiple percussion scars on their dorsal surfaces, and the platforms tend to have more facets (>2), but like early-stage flakes, the platform-to-dorsal surface angle usually is quite wide. Late stage biface-reduction flakes are often thinner, look "more refined," and have multiple flake scars and platform facets. The frequency of remnant cortex is quite low, but, nevertheless, extant on some specimens. Indeed, many finished bifaces and unifaces retain cortex on their surfaces, often at the distal end of the tool.

Biface-reduction flakes are separated into three size categories, which are roughly based on their length: <u>Large</u> (>7 cm), <u>Medium</u> (5-7 cm), and <u>Small</u> (<5 cm). These sizes are somewhat arbitrary, but correlate to the basic size categories described above for the morpho-technological eccentric- and tool-typologies. I infer the possible tool trajectory of a flake based on the material and technological type of that flake. For example, a large, biface-reduction flake made of a rough-texture material likely was derived from the production of large- and mid-sized, thick bifaces. Large- and medium-sized, thick bifaces, usually celtiform, are never made of fine microcrystalline-quartz materials. If the material is fine-grained, then it is possible to infer that the flake was part of a thin-biface trajectory.

The most indicative types of flakes are late-stage biface-reduction flakes because they carry the most information about the final product. Late-stage biface-reduction flakes are identifiable by (1) well-prepared multi-faceted platforms; and (2) a fine flaking pattern on the dorsal side of the flake. More flake curvature and a wide, platform-to-dorsal-surface angle indicate that the flake was removed from a thick biface. When a flake features less curvature, which is uncommon at Piedras Negras, and the material is fine-grained, the end product probably is a thin biface. Finally, if the material is of a normal-to-fine texture, and the flake is small in size, the end product likely was a medium- or small-sized thin biface.

Uniface-reduction flakes are not common at Piedras Negras, and they are difficult to identify, but they do have a number of distinct technological traits. The first is the platform, which should be single-faceted, but not have any traces of a negative bulb. There usually is no cortex on the platform because the striking area should be the ventral side of the flake-blank. Although I differentiate between the sizes of the flakes (i.e., small, medium, and large), it is impossible to determine the form of the end product. The easiest uniface-reduction flakes to identify feature well-developed, bi-directional flake-patterns on the dorsal surface.

5.6.3: Notching Flakes: Indirect Percussion and Pressure

Indirect-percussion flakes are found at Piedras Negras, and they are good markers for the production of microcrystalline-quartz eccentrics and stemmed bifaces. Relatively small in size (<5 cm), notching flakes have a semi-circular platform with a rather obtuse platform to dorsal-surface angle. They also feature accentuated percussion rings and usually have well formed scar-patterns on the dorsal surface. Notching flakes made by pressure serve the same function as indirect-percussion flakes. These kinds of pressure flakes are similar to indirect-percussion notching-flakes, but are much smaller and less wide. The cone of force created by indirect percussion tends to travel a greater distance through the material than those created by pressure.

5.6.4: Pressure Flakes

When samples are large enough, pressure flakes can be categorized as early- and late-stage based on the morphology of the dorsal surfaces of the flakes. Late-stage pressure flakes tend to feature pressure scars on the dorsal side of the flake. A large sample of pressure flakes is necessary to differentiate between production stages because material variety can change the appearance of pressure- and percussion-scars. They usually are small, and were removed during the production of medium- and small-sized bifaces and eccentrics. The materials identified in the field are of a fine, and sometimes normal texture.

5.6.5: Blades, Core Reduction Debitage, and Cores

There is sparse evidence that microcrystalline-quartz polyhedral cores were reduced at Piedras Negras. A small sample of possible exhausted-cores (N=3) appears to have been polished and transformed into awls or chisels. Figure 5.13 depicts one of these possible cores, which is marked as such by the multifaceted platform and remnant blade scars on the face of the piece. Rejuvenation flakes and percussion blades also are found at Piedras Negras (Figure 5.14). It is unclear by what means the blades were produced because the sample is too small. Microcrystalline-quartz blades, however, do appear in burial contexts indicating that they were of some value to the local population. Percussion blades and polyhedral cores from a cave site near El Cayo (Lee and Hayden 1989) indicate that microcrystalline-quartz blade technology was a regional phenomenon.

5.6.6: Ad Hoc Cores and Flakes

The most common ad hoc flake-core technology at Piedras Negras was the multidirectional flake-core, but there also is evidence of unidirectional flake-core reduction. Multidirectional flake-cores usually were made from nodule fragments, and thick, short nodule-reduction flakes that were unusable for the production of bifaces. The cores are often spherical or discoid in shape, and often are made from rough-texture microcrystalline quartzes. The flakes are short and thick. The dorsal scarring pattern can resemble those of biface-reduction flakes, but the platform is larger, poorly prepared, and often angular. Based on hammerstone morphology at the site, multidirectional flake-cores were a common “blank” for hammerstones, which were further rounded through use.

Figure 5.13: Evidence for the reduction of microcrystalline-quartz polyhedral cores at Piedras Negras: a possible blade-core, which was heavily polished. Photograph by Zachary X. Hruby.

5.14: Evidence for the reduction of microcrystalline-quartz polyhedral cores at Piedras Negras: percussion blade fragments. Photograph by Zachary X. Hruby.

5.6.7: Resharpening, Rejuvenation, and Use Flakes

Resharpening and rejuvenation flakes have a readily identifiable morphology. Resharpening percussion- and pressure-flakes feature a platform with use-wear on the original biface margin. Remnant margins can be polished through use, and these wear patterns usually extend to the dorsal side of the flake. Polished margins indicate that the biface had been a ground celtiform axe. In most cases, resharpening flakes reveal what type of biface was retouched for continued use. Pressure flakes retain similar characteristics but on a smaller scale. The platforms can reveal other forms of use-wear, such as hammering or pecking, cutting, scraping, and agricultural polish. Resharpening pressure-flakes are more difficult to identify because the degree to which platforms were prepared, before normal pressure-flake removal, cannot be known without a large sample of flakes.

Rejuvenation flakes are a form of alternate flake that can reveal what kind of break the original biface had suffered before it was repaired. Once a biface breaks, the remaining fragments are left with a square margin that cannot easily be removed. Alternate flaking removes the squared edge by alternately removing flakes from the ends of the break. The platform angle usually is wide and retains the long flat or irregular surface of the break on one side of the flake. Although these flakes are often thick, they feature a finely flaked dorsal surface that marks the original biface surface.

Finally, what I term use flakes are those flakes that come off during the use of a tool, usually during pecking, hammering, and chopping activities. The flakes are initiated upon impact with a hard surface. The most common forms of this flake type are hammerstone use-flakes and celt use-flakes. The bulb of force features a sheared cone similar to that found in bipolar reduction (Figure 3.4). Thus, the ventral surface is angular and does not have the same morphology as the rejuvenation or resharpening flake. Nevertheless, the platform shows heavy use-wear, usually attributable to pounding or chopping activities, and in the case of celt use-flakes, the dorsal side of the flake reveals a fine scarring pattern. Hammerstone use-flakes can be identified by the severe incipient-cone scars on the platform and on the ventral surface of the flake. Hammerstone flakes, however, feature no fine, biface-flaking pattern on the dorsal surface.

5.7: SUMMARY

This chapter has reviewed the morphologies and reduction techniques associated with microcrystalline-quartz artifacts at Piedras Negras. I have emphasized aspects of microcrystalline-quartz artifacts that may reflect local and nonlocal chipped-stone traditions. The morpho-technological tool typology, in particular, has been structured for easy reference. It is hoped that the structure will facilitate future cross-site comparisons of microcrystalline-quartz tools.

CHAPTER 6

TYPOLOGY OF OBSIDIAN ARTIFACTS

This chapter discusses the obsidian artifacts recovered at Piedras Negras. The Piedras Negras Maya used a variety of obsidian-working techniques that have not been discussed thoroughly in archaeological literature. The implications of these techniques for understanding the Maya practice of obsidian working, and the role of bladesmiths in ancient Maya society, are addressed in this chapter. Four basic categories can be used to describe the technologies used to work obsidian at Piedras Negras: (1) percussion- and pressure-reduction of obsidian pressure-blade cores; (2) the notching of pressure flakes and blades, percussion flakes and blades, and exhausted pressure-blade cores; (3) bipolar reduction of blades, flakes, and pressure-blade cores; and (4) bifacial reduction of flakes, blades, and pressure-blade cores, usually done with pressure. Each category has a substantial amount of variety within it and is described in the following sections. The majority of the artifacts fit into the first technological category, and although the latter three categories are related to blade-core reduction, they are almost always used to produce elite cache goods (e.g., obsidian eccentrics). I begin with a discussion of the possible blade-core reduction techniques encapsulated in the first category and continue by describing the latter three categories.

6.1: BLADE-CORE TECHNOLOGY AND REDUCTION TECHNIQUES

No unworked or partially reduced blade-cores can be found in the Piedras Negras sample, but exhausted cores, flakes, and blades allow for a reconstruction of the basic blade-core technologies used at the site through time. Some of these technologies have been replicated through experimentation by the author and by other lithic analysts (see Clark and Bryant 1997; Flenniken and Hirth 2003; Hintzman 2000; Titmus and Clark 2003; Wilke 1996). Three basic blade-core reduction strategies that may have existed at Piedras Negras can be characterized as (1) cylindrical or conical cores prepared by percussion, which were reduced by pressure on one or more sides, but not in the round; (2) cylindrical or conical cores prepared by percussion, which were reduced by pressure in the round, or on all sides of the core; and (3) very small pressure-blade cores, which were reduced in the round. Each of these strategies may roughly correspond to the three types of exhausted cores found at Piedras Negras: exhausted "flat" cores (exhausted cores of a lenticular cross section, which retain original percussion scars on one face; Figure 6.1, upper row), exhausted cylindrical cores (cores with a cylindrical cross section, which were reduced by pressure on all sides; Figure 6.1, middle row), and small "bullet" or microblade cores (cores with a length of 3 cm and less that were reduced by pressure on all sides; Figure 6.1, lower row). However, the three reduction strategies can be carried out using a myriad of blade-making techniques that may or may not reflect the actual structure of pressure-blade industries at ancient Piedras Negras. Furthermore, none of these cores were necessarily reduced in the round from the beginning of its reduction to the end. In other words, while "flat" exhausted cores are direct evidence that cores were not reduced in the round, cylindrical exhausted cores are not direct evidence that they

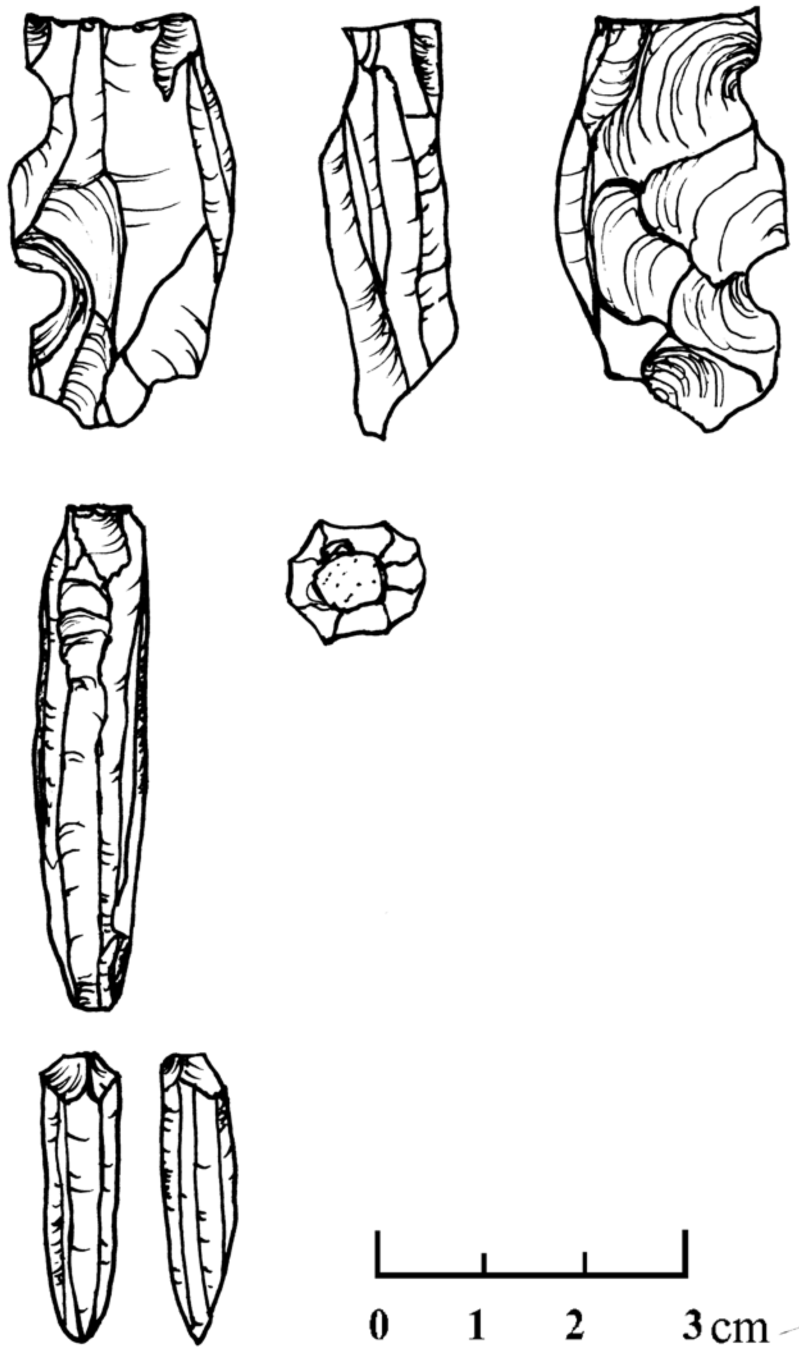


Figure 6.1: Exhausted obsidian blade-cores at Piedras Negras. Above: obsidian blade-core reduced by pressure on one or more sides, but not in the round (also notched as an eccentric); center: obsidian blade-core reduced by pressure in the round, or on all sides of the core; below: very small pressure-blade cores reduced in the round. Drawings by Zachary X. Hruby.

were reduced in the round throughout the use-life of the core. Furthermore, bullet cores likely represent the reworking of exhausted flat or cylindrical cores, and not a separate core reduction strategy. I discuss the relevant published replications of these techniques and then submit my own technique, which is a good fit for the archaeological record at Piedras Negras and possibly other lowland sites.

6.1.2: Previously Publications on Blade-Core Reduction Techniques and Blade Cores at Piedras Negras

The first replicable blade-core reduction technique, which was substantiated by the archaeological and ethnohistoric record, was carried out by Clark (1982) and has been dubbed the Mexica technique. Titmus and Clark (2003) recently published a revised version of this technique. The Mexica foot-held technique requires that knappers sit on the ground and immobilize the core with their feet as lateral support. The blade-core is planted with the distal end of the core into hard-packed soil, sometimes with a wooden distal support for vertical stability (Titmus and Clark 2003:Figure 5.8). Finally, a long, wooden pressure device is used with a combination of arm and upper-body strength to remove blades from the core (see Clark 1982:Figure 8; Titmus and Clark 2003:Figure 5.8). The core is rotated after a series of blades is removed from the available surface until it can no longer be held between the feet (i.e., core exhaustion) or the core was destroyed (i.e., core death). The resulting core is worked by pressure on all sides of the core and usually is cylindrical in cross section.

Exhausted cylindrical cores are found at Piedras Negras, but they were likely were too small to be held between the feet. Exhausted cylindrical-shaped cores were found in household contexts, as well as in royal caches. The platforms were lightly ground in most cases, but there are some examples of completely ground platforms. The highly ground platforms appear to be a late phenomenon at the site. In some cases the medial and distal surfaces of the exhausted cores also were ground and probably were used as polishers, small pigment grinders, or pestles.

It is possible that the exhausted, cylindrical core resulted from the reworking of a core of lenticular cross section (i.e., an exhausted core that resulted from the pressure reduction of a blade core on only one or more sides, but not in the round). There is no evidence at this point to determine whether a fully developed "in the round" reduction strategy actually existed at Piedras Negras. Although both cylindrical and "flat" exhausted cores were used to make eccentrics, the exhausted core of lenticular cross-section was a more common blank. It is possible that one of the goals, among several, of retaining a lenticular cross section was to produce blanks more amenable to the manufacture of obsidian eccentrics.

Hintzman (2000) described another core reduction technique that focuses primarily on one working-face of the blade core. The core is placed with the distal end down and one face leaned against two parallel stakes or supports probably made of wood (see Hintzman 2000:Figure 3-5). The knapper stands over the core and uses a long wooden pressure-flaker with a hard bit to remove blades. A combination of upper body strength and body weight is used to press the blades from the core. The downward pressure of blade removal also helps stabilize the core. This technique can result in an exhausted core that retains original percussion scars on the "back" side of the core. The exhausted core can have a lenticular or "flat" cross section, similar to those found at Piedras Negras and other Mesoamerican sites. Pelegrin (2003) and Pastrana (personal communication 2004) have come up with similar techniques using wooden blocks of various kinds that produce similar results.

Later stages of core reduction also can be carried out in the hand, especially when the core diameter is less than 4 centimeters (Flenniken and Hirth 2003). The viability of various hand-held techniques has been demonstrated by Wilke (1996) and more recently by Flenniken and Hirth (2003). It is difficult, however, to archaeologically determine if handheld methods were used. The typical exhausted core at Piedras Negras is ~4 cm long (Figure 6.1), but other, smaller blade-cores also are in evidence. It is likely that these smaller "bullet cores" or microcores (3 cm long or less) were made by further reducing exhausted flat and cylindrical cores in the hand. In a few cases, microcores feature a flat distal end, suggesting they were made from exhausted prismatic-blade cores, which had been sectioned (Figure 6.1, lower row). These cores were small enough that it would be virtually impossible to immobilize them with the feet. Antler pressure-flakers may have been used for this kind of reduction, but a smaller bone or wood implement could have worked also (cf. Flenniken and Hirth 2003; Wilke 1996). A few possible pressure-flakers made of antler were found at Piedras Negras (Figure 6.2). The core platform was only lightly ground before blade detachment, but small platform-faceting flakes were removed by pressure as discussed by Wilke (1996) and also Flenniken and Hirth (2003).

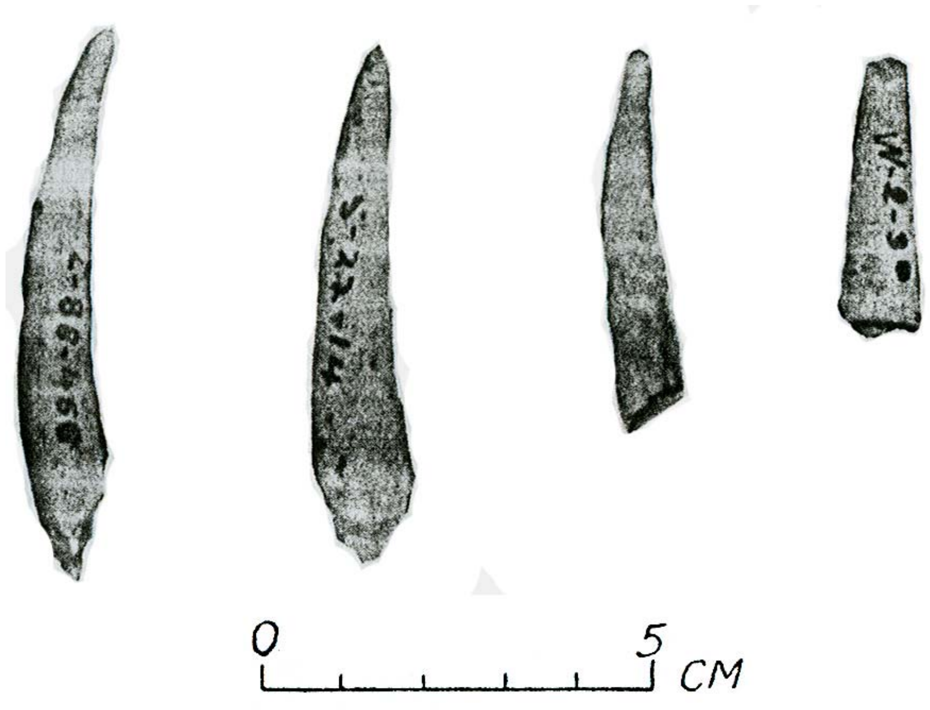


Figure 6.2: Examples of possible pressure-flakers and bits from Piedras Negras (After Coe 1959:Fig. 57).

Microcores were only rarely deposited in royal caches, and instead, were discarded in household contexts. A larger percentage of microcores are found in the near-periphery of the site (see Webster and Kovac 2000) suggesting that the city center could have had more access to obsidian and that microcore reduction techniques were reserved for areas that needed to conserve obsidian.

6.2: GENERAL ELEMENTS OF CORE PREPARATION BY PERCUSSION

Since most of the percussion debitage, which usually was deposited in royal caches, rarely exceeds 10 cm in maximum dimension, and the dorsal surfaces often feature older (i.e., patinated) and ground percussion-scars, it is likely that many of the cores from Piedras Negras were imported as small polyhedral-cores (Figure 6.3). It is unknown if these cores were directly imported from the source or if they were traded down-the-line (or rather, up the river) from the volcanic highlands of southern Guatemala. Roughly 96% of all obsidian artifacts from Piedras Negras appear to be made from El Chayal material originating in the highlands of Guatemala. Although there is scant evidence, in the form of a few reduction flakes and blades, that a pittance of cores from San Martín Jilotepeque were imported to Piedras Negras, the complete lack of production debitage of Ixtepeque, Zaragoza, Ucareo, and Pachuca obsidian indicate that these materials, where present, were imported as finished blades (Hruby 1999). Furthermore, characteristics of blades made of Mexican obsidians are morphologically distinct from the majority of blades found at Piedras Negras, suggesting the former were produced elsewhere.

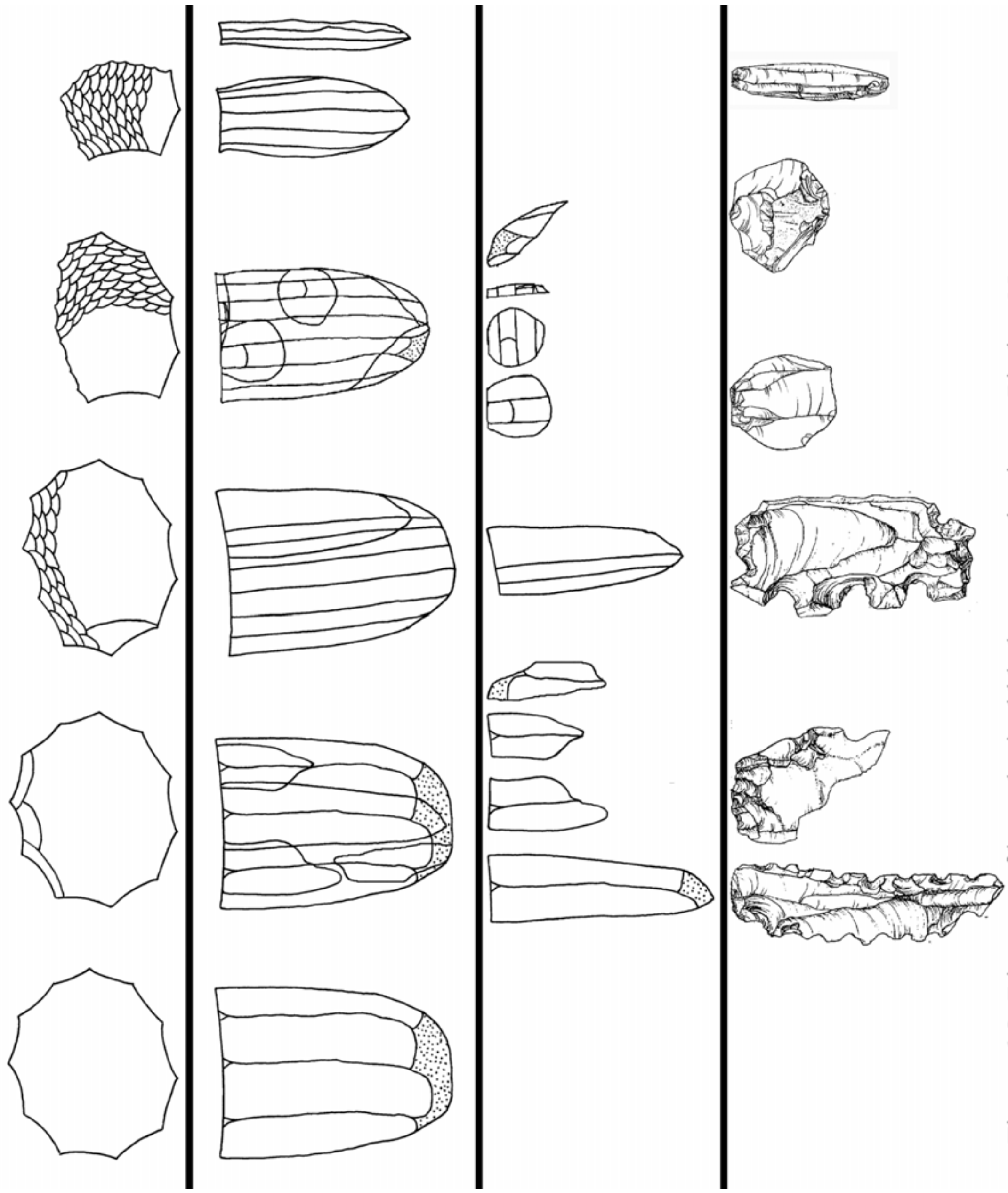


Figure 6.3: Diagram of hypothetical blade-core reduction at Piedras Negras.

Percussion-prepared cores were further reduced by percussion at Piedras Negras to regularize the facets of the core for pressure-blade production. Obsidian eccentrics and other obsidian artifacts indicate that the initial reduction of imported cores was systematic, and that particular kinds of early percussion flakes and blades had specific functions in the reduction of polyhedral cores from El Chayal (described below). Obsidian workers at Piedras Negras preferred a rounded working face and a lack of original percussion scars (i.e., remaining percussion scars from initial core production elsewhere, probably at the El Chayal source) before they began the blade-making process.

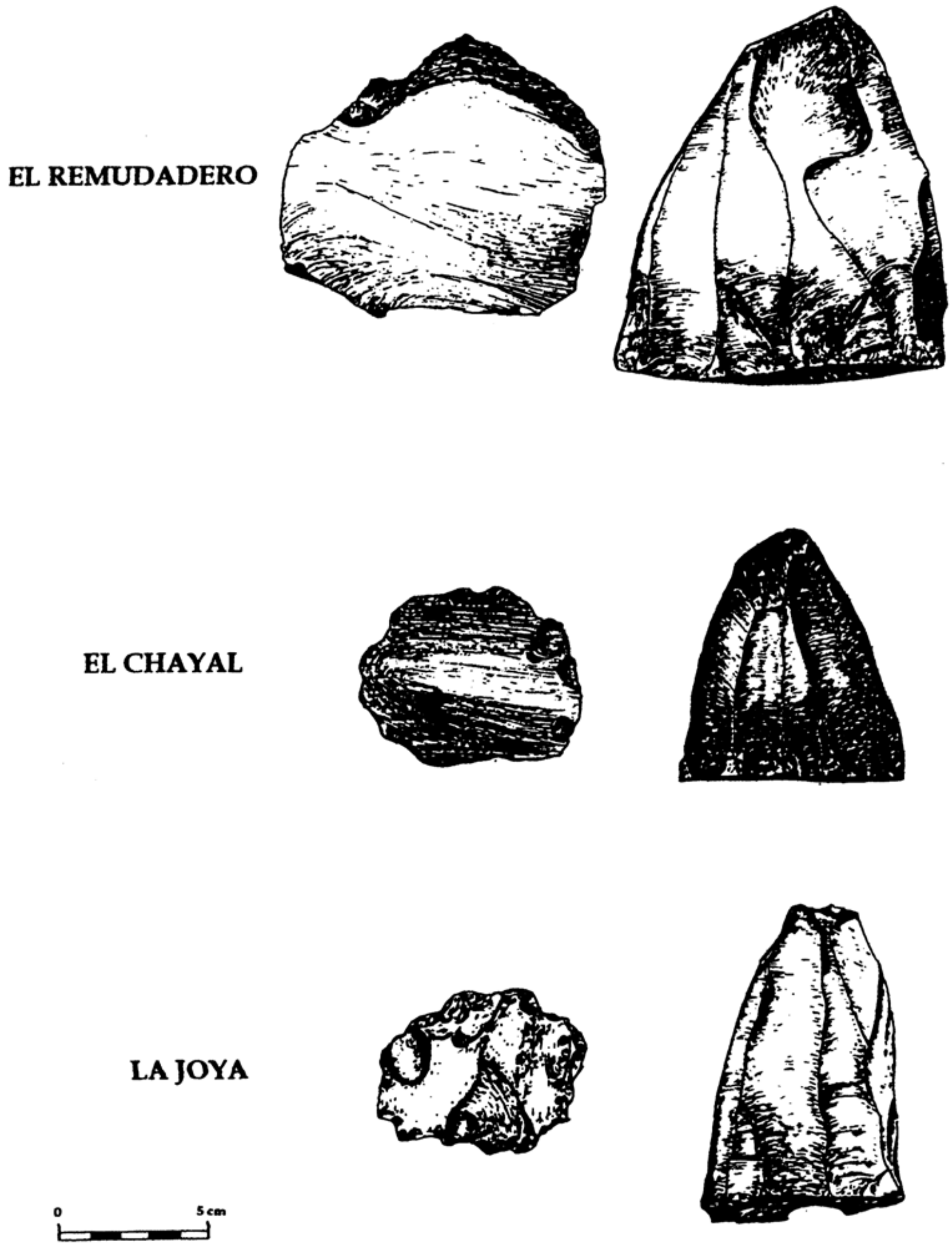
Small percussion flakes and blades (Figure 6.3) were removed to regularize the face of the core. They represent removal of undulations, cortex, and hinge terminations that remained on the face of the imported core from its initial production at the El Chayal source (Figure 6.4). When possible, blades were removed to create straight facets extending from the platform to the distal end of the core. If the blade stopped short or ended in a hinge termination before the detaching fracture reached the distal end of the core, knappers at Piedras Negras removed distal flakes and blades to complete the regularization. However, early distal rejuvenation blades (Figure 6.3) appear to have been removed as a basic regularization technique that created long, smooth facets prior to pressure reduction. Most distal rejuvenation blades and flakes were not part of the two-step process outlined by Clark and Bryant (1997:116), wherein a flake was removed from the distal end of the core to create a platform for distal rejuvenation blades taken from the face of the core. Clark and Bryant (1997:116) did mention the occurrence of one-step distal modification but did not discuss it in detail.

While the proper removal of a prismatic blade from a core can be considered a difficult endeavor, it is by no means the most complicated or the most crucial aspect of blade production. In fact, core preparation, platform preparation, and core maintenance are much more time-intensive and require a great deal of learned skill to perform. The removal of initial percussion flakes and blades to regularize the core are among the most important and demanding steps in the blade-making process. An error at this stage could endanger the bulk of the core, and greatly reduce the number of blades produced from it. These initial flakes and blades were among the most common blanks used for obsidian cache eccentrics.

6.3: BLADE-CORE REDUCTION ON ONE OR MORE SIDES OF THE CORE

This section describes a reduction technique of imported blade-cores on one or more sides, but not in the round (i.e., the reduction of pressure-blade cores in a more or less circular or centripetal fashion on all sides of the core). I begin by outlining the percussion strategies used to regularize the percussion-prepared cores imported to the site and continue with the pressure techniques.

Most of the blade-cores exported from the highland Guatemala sources were roughly circular in cross section (Figure 6.4). There are no examples of bifacial or flat blade-cores prepared by percussion from either El Chayal or San Martín Jilotepeque. Hence, it is most likely that cores imported to Piedras Negras began with a circular cross



6.4: Examples of polyhedral cores and macrocores from various outcrops at the El Chayal source in highland Guatemala (Mejía and Suyuc 2000:Fig. 12).

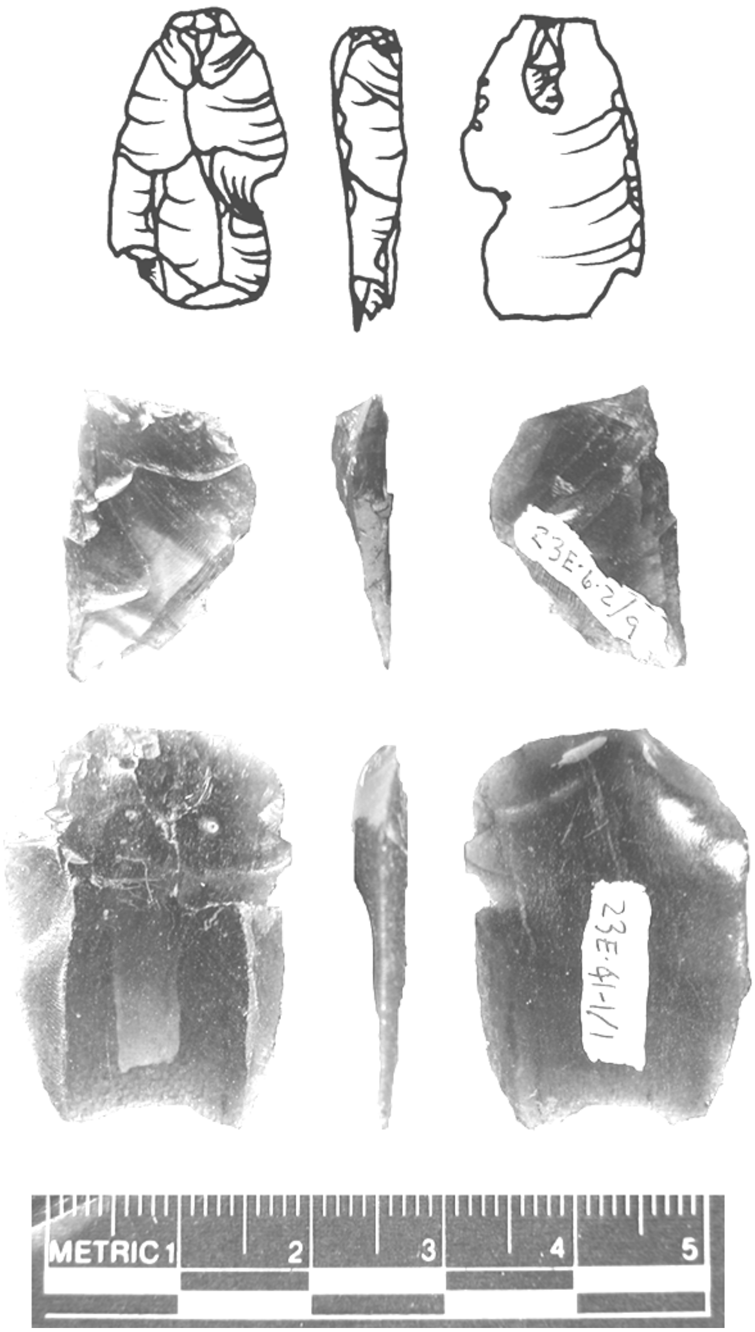


Figure 6.5: Percussion flakes removed to regularize and prepare the central face of the core for pressure reduction. Drawings by Shuji Araki and photographs by Zachary X. Hruby.

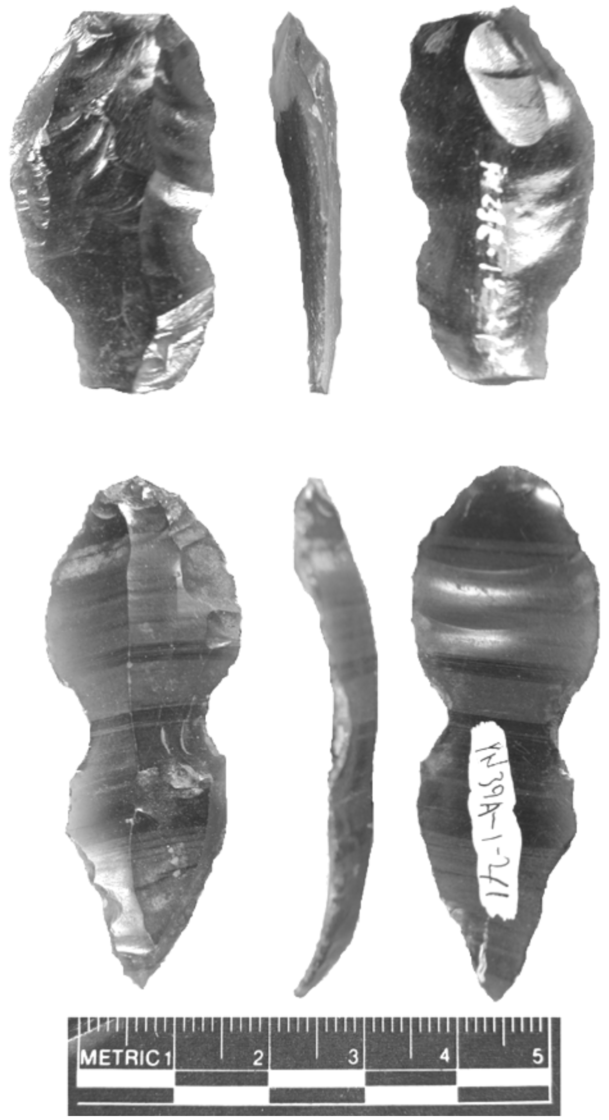


Figure 6.6: Percussion blade removed to prepare the central face of the core. Photograph by Zachary X. Hruby.

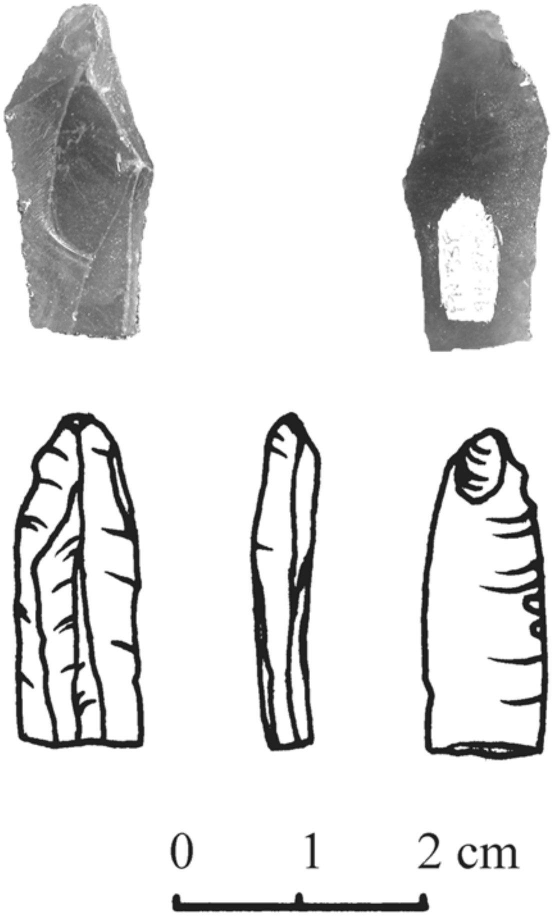


Figure 6.7: Distal rejuvenation blades removed to regularize the face of the core. Drawings by Shuji Araki and photographs by Zachary X. Hruby.

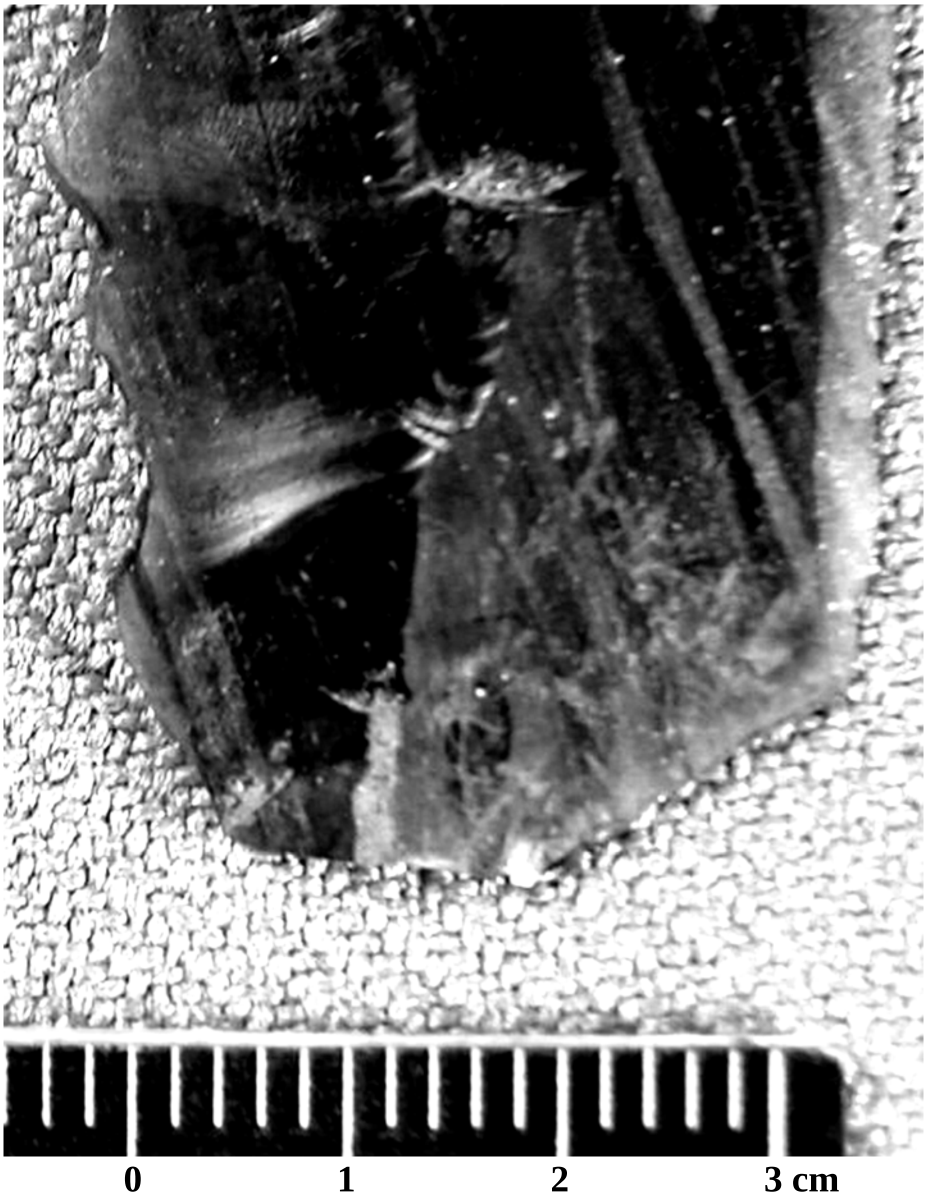


Figure 6.8: Original percussion scars on the dorsal surface of a percussion blade. Photograph by Zachary X. Hruby.

section, and then were prepared and reduced in a number of (Figure 6.3) different ways.

One of the most popular ways Piedras Negras knappers reduced imported cores was the pressure reduction of blade-cores on one or more sides. The best evidence for this reduction strategy is exhausted cores that feature a lenticular cross section with pressure scars on one face of the core and percussion scars on the other (Figure 6.1, upper row). Consequently, the cross section of the core changed through its use-life, probably most often from circular to oval, and finally, to a nearly lenticular or "flat" morphology. Small percussion flakes and blades were removed during the initial preparation of the core and after pressure reduction had already begun.

Percussion blades and flakes from household fill and royal caches, which were further modified into eccentrics, indicate that there was a systematic method of core preparation and core maintenance at Piedras Negras. First, wide percussion flakes were removed from one face of the core (Figures 6.3 and 6.5) to isolate a centrally located platform (Figure 6.3). Next, a long, thin blade was removed from the central working face of the core (Figure 6.6). If necessary, flakes and blades were removed from the distal end of the core to complete regularization (Figure 6.7). This spare regularization strategy was all that was required to begin the pressure reduction of the core. The best examples of these kinds of initial production-debitage come from Yaxche period caches. Since the obsidian eccentrics from this time are little modified, they retain much of the original evidence of blade production and core preparation on their dorsal surfaces (Figure 6.8).

These larger pieces of production debitage do not seem to have been thrown in typical trash dumps, but rather reserved for obsidian eccentric production.

One face of the core was reduced by pressure, and then further percussion blades were removed from the sides of the core that were not initially regularized (Figures 6.3 and 6.9). These blades and flakes feature dorsal surfaces, which have pressure scars and older, heavily worn, percussion scars. All of these debitage types are evident in the obsidian eccentrics found at Piedras Negras. The result of this reduction technique was exhausted cores with an oval or lenticular cross section, with one side reduced by pressure, and the other retaining its original percussion scars--probably remnants from the original manufacture at the source (Figure 6.8).

Another marker for the reduction of a blade core on one or more sides is the earliest pressure blades and flakes removed from the core (Figures 6.10 and 6.11). These blades are termed first- and second-series blades (1s and 2s blades) by Clark and Bryant (1997). According to Clark, first-series blades are the first pressure blades removed from the core and can feature both pressure and percussion scars on their dorsal surfaces, but the percussion scars are found along the entire length of the blade. Second-series blades and flakes tend to have pressure scars on the proximal end of the flake or blade and percussion scars on the distal end (Figure 6.11). It should be noted that first- and second-series flakes and blades do not necessarily mark early stages of reduction of a core on one or more sides, because reduction extending into the sides or edges of the working face of the core (i.e., facets still featuring percussion scars) happens throughout the use-life of the

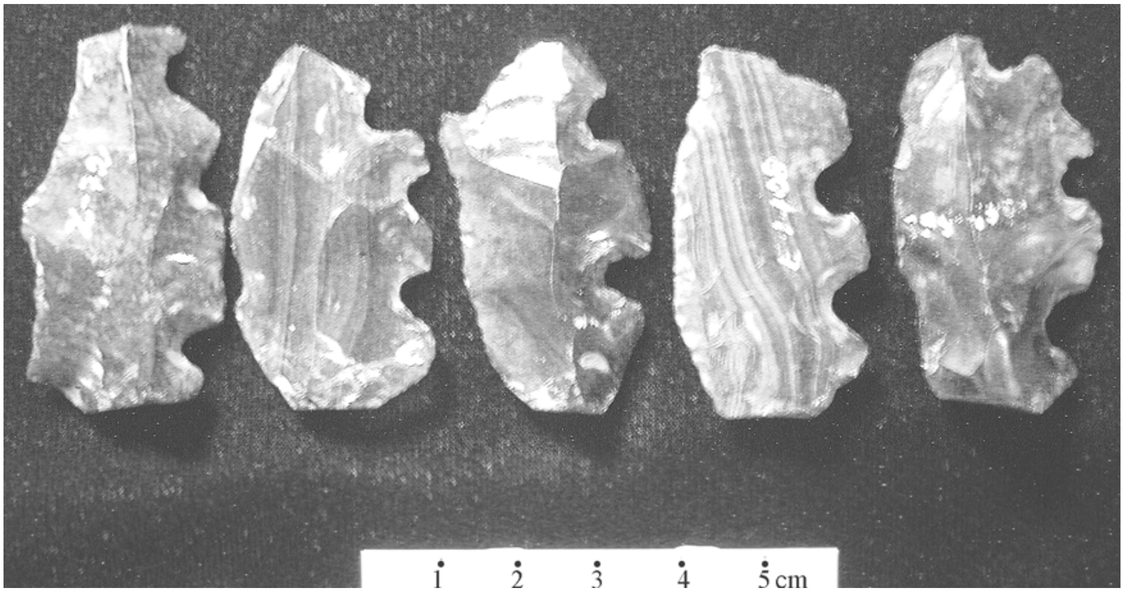


Figure 6.9: Obsidian eccentrics that were made from percussion blades removed from the side of the core after pressure reduction had begun. Photograph by Zachary X. Hruby.

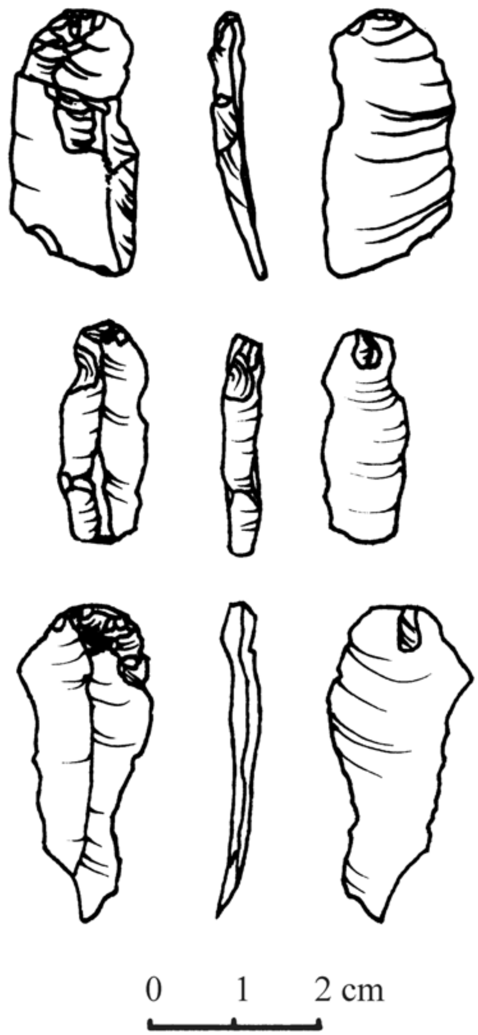


Figure 6.10: First-series pressure blades from Piedras Negras. Drawings by Shuji Araki.

Figure 6.11: Second-series pressure blades and flakes. Photograph by Zachary X. Hruby.

core. Nevertheless, wide pressure facets, in combination with percussion scars, indicate that the blade came off earlier rather than later in the reduction process.

Third-series blades, or prismatic blades, are blades with only pressure scars on the dorsal surface (Figure 6.12). Third-series blades, which are often seen to be the primary or intended product of blade-core reduction, tend not to be markers for any specific blade-core configuration because they feature no remnant flake scars of previous core modifications. Some examples of third-series blades feature a canted platform, suggesting that the platform of the core was, at times, also canted (i.e., the platform of the blade is not perpendicular to the pressure scars on the dorsal surface of the blade). It is likely that these blades were removed from the side of the core. Furthermore, late third-series blades with small, closely spaced pressure facets are found with percussion scars or even cortex on a single margin of the blade. This pattern suggests that some blade cores at the site were not reduced in the round from early stages of core reduction. Although these blades should technically be identified as second-series blades according to the Clark and Bryant typology, they are more of an indicator core reduction on only one or more sides of the core than of an early stage of blade-core reduction.

6.3.1: Blade Production and Core Rejuvenation at Piedras Negras

Once the core was prepared it was positioned according to one of the immobilization techniques described above. Although this process could have been a one-person operation, assistants could have helped by repositioning the core, preparing platforms, and maintaining a proper tip on the bit of the pressure device. Since most blade-core platforms at Piedras Negras were at least lightly ground, the knappers must have periodically prepared the platform of the core as well as specific areas with platform overhang or irregularities[18].

If an error was made, such as a step or hinge termination near the platform or elsewhere on the face of the core, a potentially risky set of procedures were used to fix the problem. At Piedras Negras there are six readily identifiable rejuvenation and maintenance techniques with corresponding debitage types. The first four types can be described as rejuvenation procedures and the last two are better characterized as core maintenance procedures. First, irregularities and errors on or near the platform margin were corrected by removing either a faceting flake (Figure 6.13.1), or a single tabular flake that created an entirely new platform (Figure 6.13.2). The flakes were struck from the core by direct percussion with a hammerstone, using the proximal end of a pressure-blade scar as a platform. The greatest dangers in this technique are deep hinge terminations, or overshot terminations that can destroy an entire side of the platform. A second procedure removes a step or hinge termination, caused by a blade detachment failure, by direct percussion at the proximal end of the core (Figure 6.14). The force of the blow is meant to drive under the irregularity and the blade or flake removes the termination failure. The downsides to this maneuver are that it can remove a relatively large portion of the core and has a high probability of failing at the same termination it was meant to ameliorate.

Third, if the termination was not too wide or deep, medial rejuvenation was carried out with a pressure-flaking device (cf. Clark and Bryant 1997). The hinge or step

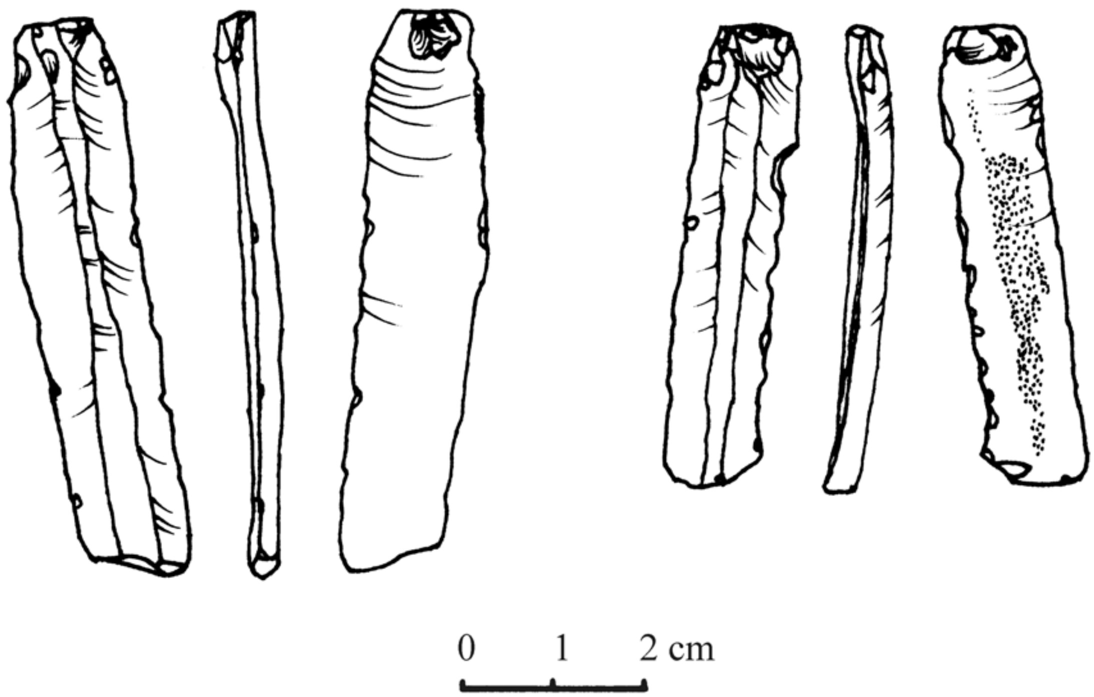


Figure 6.12: Third-series blades that feature platform planes, which are not perpendicular to the pressure scars on the dorsal surface of the blades. Drawings by Shuji Araki.

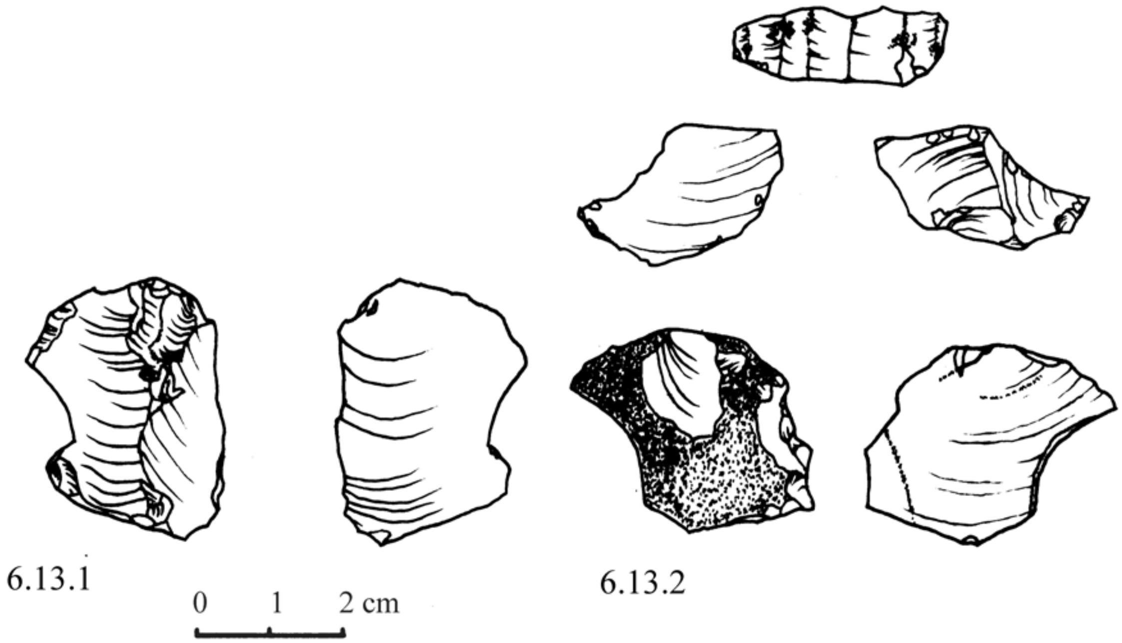


Figure 6.13.1: Platform rejuvenation flake, faceting; 6.13.2: Platform rejuvenation flake, tabular. Drawings by Shuji Araki.

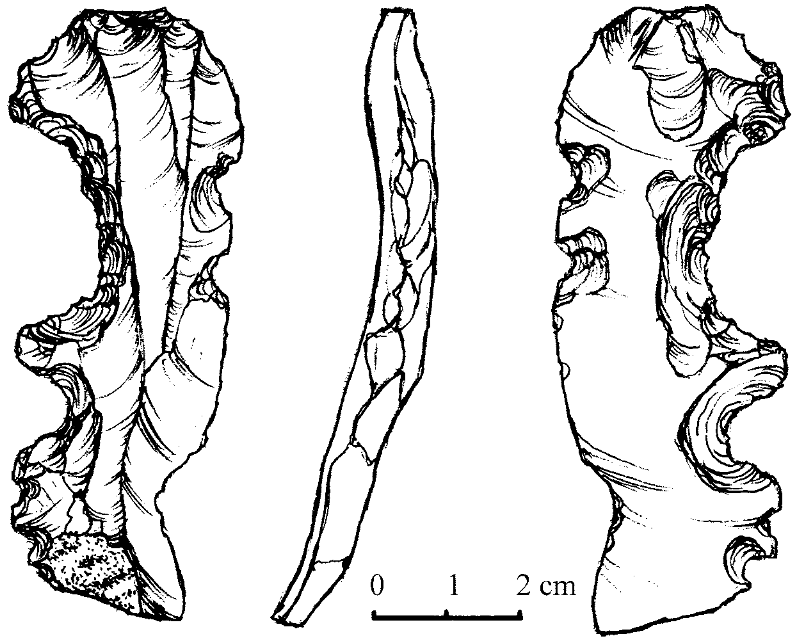


Figure 6.14: Obsidian eccentric made from a core rejuvenation blade, which was removed by percussion. Drawing by Zachary X. Hruby.

termination was used as a platform for a blade removed midway down the face of the core (Figure 6.15). Fourth, there is some evidence of lateral rejuvenation where flakes are removed perpendicular to the face of the core. The most advanced form of this technique creates a crested ridge (Clark and Bryant 1997; Figure 6.16 here) that is finally removed by direct percussion at the proximal end of the core. The result is a crested blade, an artifact not common at Piedras Negras. The example illustrated in Figure 6.16 is the only crested blade that exhibits lateral working along the entire length of the blade. The extant lateral rejuvenation flakes found at the site curiously were detached at, or near the platform (Figure 6.17), and the exact function of their removal is not known. Most of these rejuvenation techniques have been discussed at length by Clark and Bryant (1997) and do not need to be reviewed in detail here.

The last two procedures are concerned more with core maintenance, but still occur after the core has been transformed into a prismatic-blade core. The fifth procedure is carried out by percussion, but away from the working face of the core. These percussion blades modify the back of the core, or more accurately, the sides of the back of the core (Figure 6.9). The function of these blades is unclear, but they may allow for continued reduction of the core on previously inaccessible areas.

At Piedras Negras, distal rejuvenation flakes (Figure 6.18) appear to have had the effect of regularizing the face of the core and preventing <u>outre passé</u> terminations, or overshots (Figure 6.19). In fact, there are no clear examples of distal rejuvenation flakes (primary distal rejuvenation flake) or blades (secondary distal rejuvenation flake) (see Clark and Bryant 1997) being used to remove a hinge or step termination. The focus of

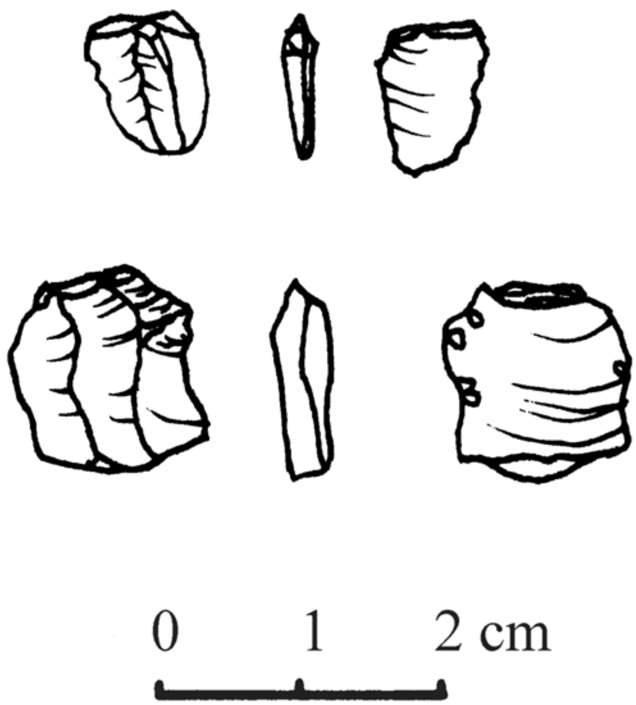


Figure 6.15: Medial rejuvenation pressure-blade fragment (bottom) and flake (top). Drawings by Shuji Araki.

Figure 6.16: Crested blade from Piedras Negras. Photograph by Zachary X. Hruby

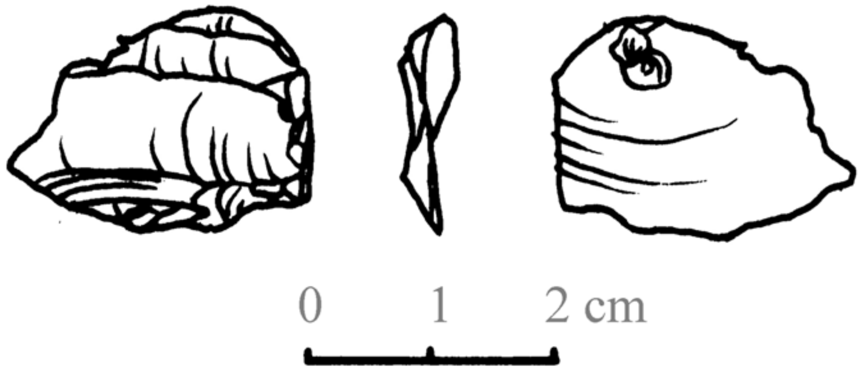


Figure 6.17: Lateral rejuvenation flake from Piedras Negras. Drawing by Shuji Araki.

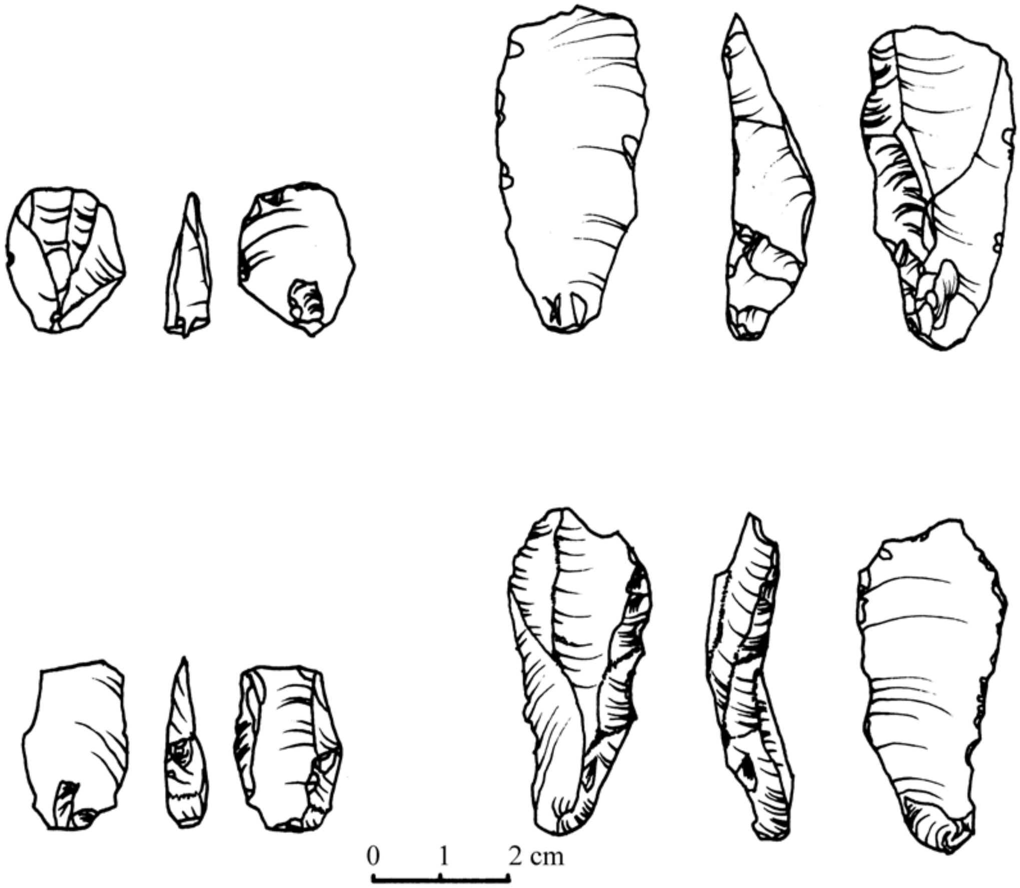


Figure 6.18: Distal rejuvenation flakes (left) and blades (right) from Piedras Negras. Drawings by Shuji Araki.

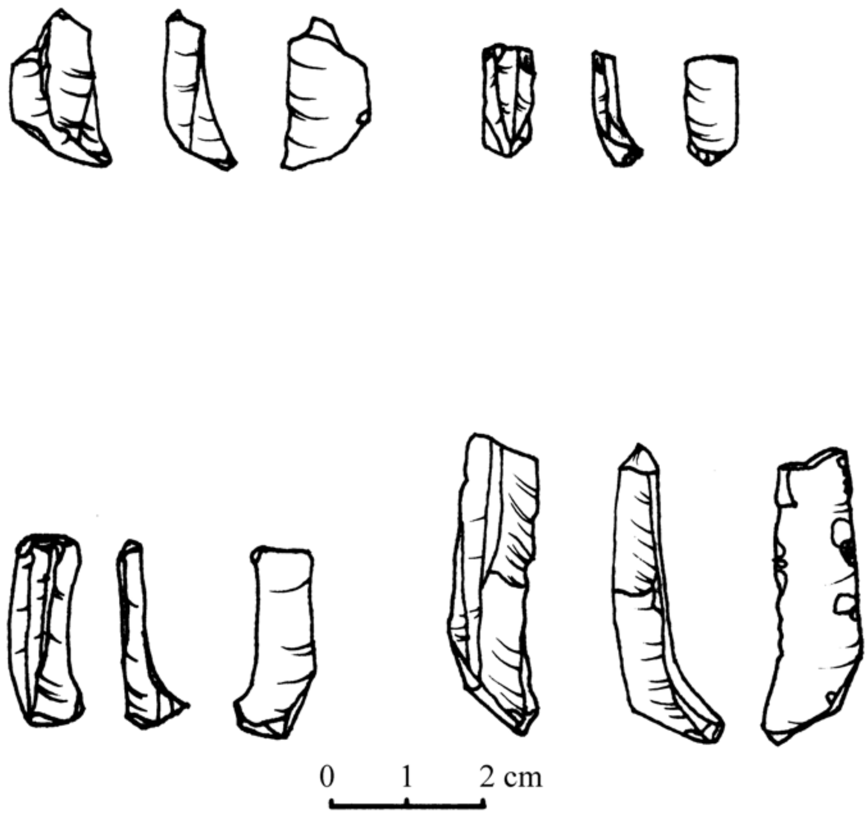


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Figure 6.19: Evidence of overshot termination on pressure blades from Piedras Negras. Drawings by Shuji Araki.

this technique is on transforming the very distal end and not necessarily the entire face of the core (Figure 6.18). Although blades removed from the frontal working face tend not to overshoot, the sides or edges of the core feature pronounced and acutely angle blade scars that tend to guide the fracture plane of the following blade into an overshot termination. An overshot at the edge not only causes loss of total core length, but also can create the possibility of further overshot termination errors. Distal rejuvenation flakes were often removed at a diagonal from the distal end, not to fix an error, but to remove the curved end of the distal portion of the core (Figure 6.18 and 6.3). Thus, one possible goal of distal modification is to reduce the chance of overshot. This sort of distal modification also accounts for the reverse percussion rings at the distal ends of some pressure blades. This observation remains hypothetical at this point, since there may have been other, previously unrecognized, functional advantages to distal modification.

All of these rejuvenation procedures represent a dangerous point in the life of the core, and their success determines whether it can be used in the further production of blades. These types of debitage also are found in royal caches, along with exhausted cores, first- and second-series blades, and extremely fine third-series blades, possibly used for bloodletting (Clark and Bryant 1997:Figure 5). Blades and flakes also were symbolically potent and reveal the importance of the production process in determining the meaning of cache goods (Hruby 2002). All of these debitage types have been used to categorize the lithic debitage from Piedras Negras.

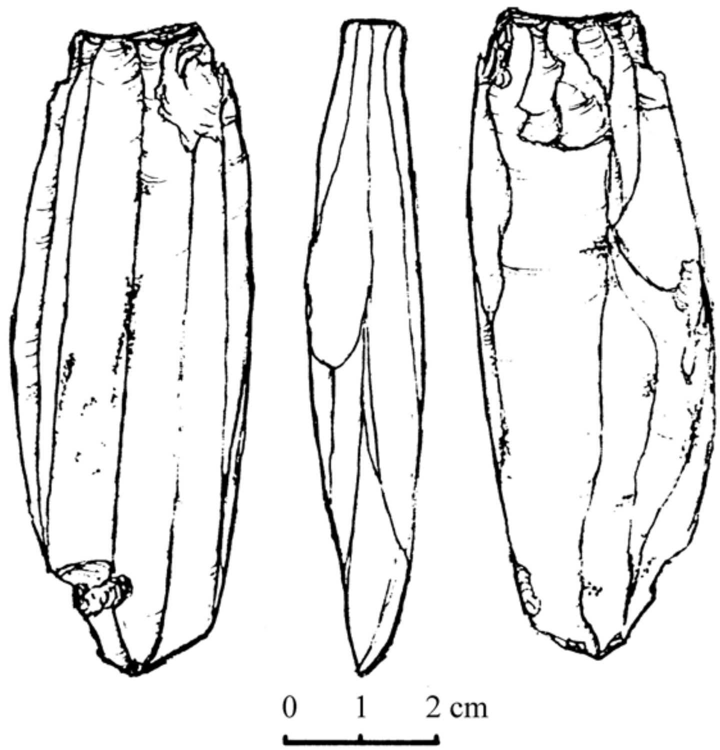


Figure 6.20: Exhausted obsidian-core from Tres Islas that was reduced on one or more sides, but not in the round (Tomasic et al. 2005). Drawing by Zachary X. Hruby.

6.3.2: Some Implications of Single-Side Reduction for the Practice of Production

It is clear that a variety of obsidian techniques and reduction strategies were being used simultaneously during the Late Classic, but they may have all been related. The reduction of blade-cores on one side could have been a result of poor preparation or original polyhedral core morphology, but likely represents a lowland tradition that began in the Early Classic or possibly before. Exhausted "flat" cores from an Early Classic cache from Tres Islas near Cancuen suggest that reducing the core on one or more sides was not only a relatively early phenomenon, but was also widespread (Figure 6.20; Tomasic et al. 2005). Recent research at the Parque Cerro de los Muertos of Kaminaljuyú (Hruby 2004) indicates that reduction on only one side of the core was not normally carried out in this region of the highlands, and may not have been common to Highland Maya blade-reduction techniques in general. No exhausted cores with a lenticular cross section were reported for the Early Classic Ojo de Agua deposit (Clark and Bryant 1997), but since few of the cores were illustrated, it is unclear whether any cores of this type were found in the deposit. On the other hand, they do appear in the Belizean debitage deposits described by Hintzman (2000). The kind of distal truncation discussed by Hintzman, however, does not appear in any form at Piedras Negras. The pecking involved in this method (Hintzman 2000) is not in evidence at Piedras Negras.

Over time and through space, these technological patterns suggest that blade-core technologies varied throughout the lowlands and that local traditions may have arisen. Large cores for example rarely, if ever, arrived at Piedras Negras as they did at Tikal, and even varying core size may have had an effect on how local industries developed. It should be noted that blade-core reduction techniques probably were passed down carefully over the centuries from knapper to knapper. The lack of obsidian in the lowlands likely would not allow for the independent invention and mastery of obsidian blade-core technologies, and it may be possible to track the transmission of this kind of knowledge back to the Preclassic using indicative debitage types.

The number of cores imported every year to sites like Piedras Negras likely was very small (Sheets 1991). Low production rate and low numbers of cores could have increased the value of blades, but also the labor of blade makers. Although obsidian blades obviously were used for various kinds of food preparation and craft production (Aoyama 1999), it also is true that blades played an important role in ritual activities, and blade production debitage was essential to royal caching rituals. Consequently, blade production may have been an important social event that was ritually performed, perhaps during special times of the year, such as the month of Mol in Yucatan, when craft specialists celebrated their occupations.

The relative rarity of blades at Piedras Negras may have increased their trade value and they likely were not viewed as simple utilitarian goods, at least in the early stages of their use. Their producers gained prestige from the manufacture of eccentrics and prismatic pressure blades (Hruby n.d.). In this sense, obsidian blades appear to have been goods that crosscut social and economic boundaries in terms of value and symbolic meaning. On one hand, blades can be considered to be highly valued import goods, but on the other they were distributed to everyone in society. Obsidian blades may have had the effect of bringing social groups together in some cases, and creating heightened social differentiation in others. This is not to say that obsidian blades were the most valuable portable goods, even chipped-stone goods, at Classic Piedras Negras, but they cannot be easily classified as either utilitarian goods or luxury goods (see Chapter 2).

6.4: A TECHNOLOGICAL TYPOLOGY OF OBSIDIAN ECCENTRICS

Obsidian eccentrics have long been of interest for their rich symbolic content (e.g., Blom and la Farge 1928; Gann 1918, 1930; Gann and Gann 1939; Gruning 1930, Joyce et al. 1928; Maler 1908; Mason 1935; Meadows 2001; Price 1897-99; Rice 1909; Stephens 1870; Thompson 1939), but less attention has been paid to how they were made and to basic technological patterns over time and space (Clark 1996). Since Piedras Negras features one of the largest samples of obsidian eccentrics, it is an excellent place to examine issues of style and technology. The obsidian eccentric tradition at Piedras Negras begins in the Early Classic period. The sample for this time period is quite small and it is unclear if the few available examples have a direct historical connection to the symbolism of Late Classic eccentrics. There is a technological pattern, however, in that notched blades and flakes are typically found in the Balche and Yaxche phase deposits and biface eccentrics tend to be restricted to the Chacalhaaz phase (see Chapter 7 for details).

Obsidian eccentrics can be categorized into two basic technological types, including: (1) notched cores, flakes, and blades, which can be further divided into pressure-notched blades and flakes (Figure 6.21), and pressure and indirect-percussion notched-cores (Figure 6.22); and (2) bifacially worked blades, flakes, and cores, which can be further divided into partially bifaced flakes and cores (Fig. 6.23), and completely

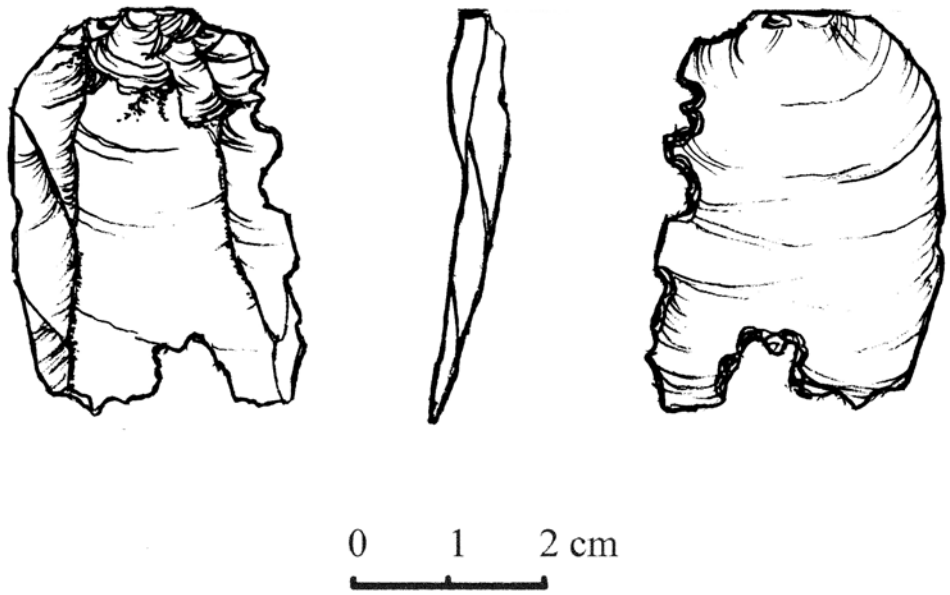


Figure 6.21: Pressure-notched flake. Drawing by Zachary X. Hruby.

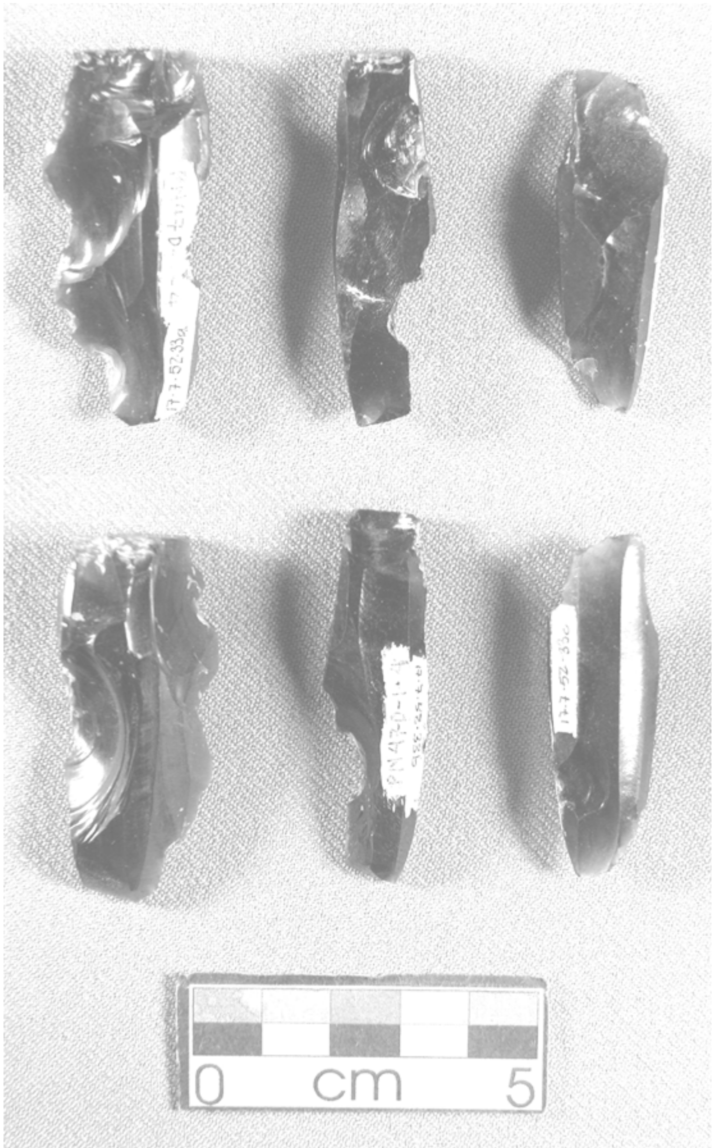


Figure 6.22: Cores notched by pressure and indirect-percussion (two views of three eccentrics separated by upper and lower series). Photograph by Zachary X. Hruby.

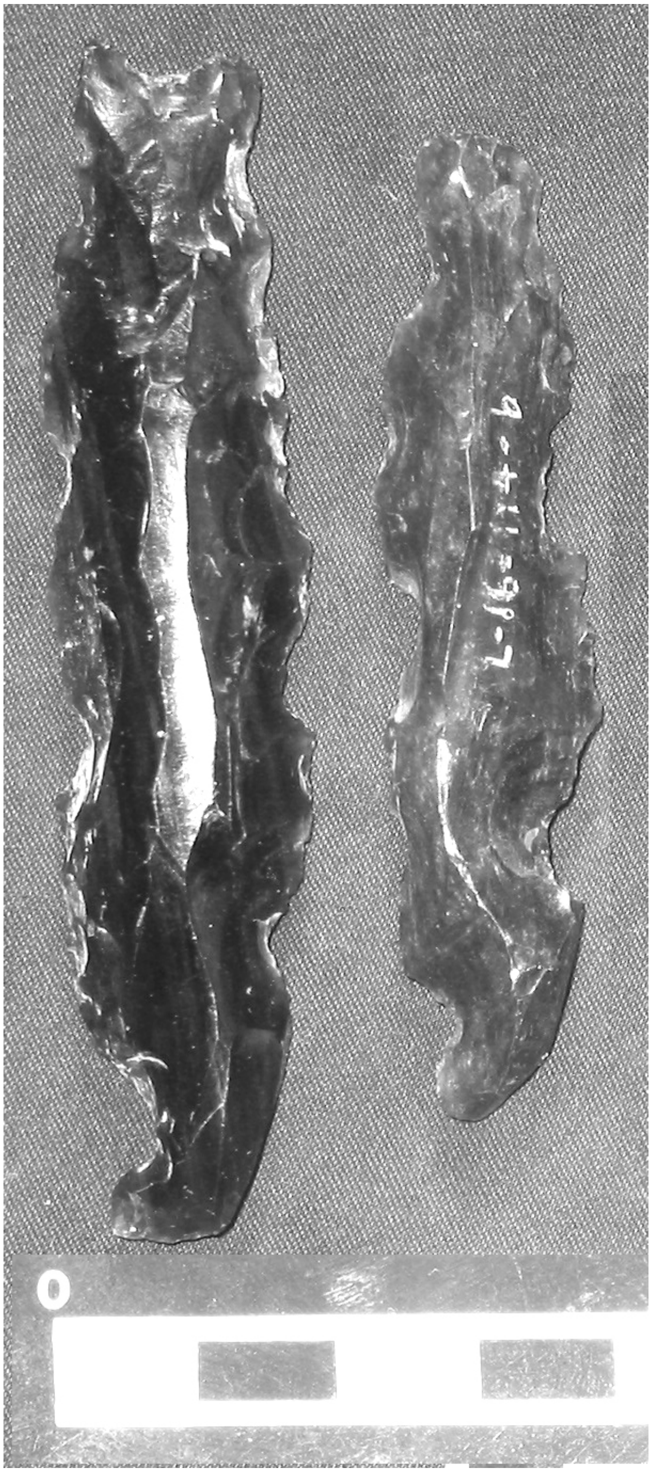


Figure 6.23: Partially-bifaced cores. Photograph by Zachary X. Hruby.

Figure 6.24: Completely-bifaced flakes and cores. Photograph by Zachary X. Hruby.

bifaced flakes and cores (Fig. 6.24). Similar to microcrystalline-quartz eccentrics, obsidian eccentrics at Piedras Negras can be divided between naturalistic and purely symbolic forms. Naturalistic forms often depict the silhouettes of particular gods, people, and objects, while the symbolic forms appear to be iconic, such as a crescent or star shape. Although various techniques were used to create both styles of eccentric, there do appear to be some general correlations between technological type and symbolic type. Each type corresponds to a particular time period, and these patterns are discussed in Chapter 7.

6.4.1: Notched Blades and Flakes

As mentioned earlier, notched flake and blade eccentrics first appear at Piedras Negras during the Early Classic period, and continued through to the collapse of the dynasty in the early-to-middle ninth century. Their symbolic forms varied through time, however, as did their frequency at any given moment during the Classic period. Notched blade and flake eccentrics likely are the simplest, technologically speaking, to create. There was little-to-no margin preparation and the final form was largely based on the flake or blade morphology. The notching was done with a handheld pressure flaker and usually was reduced unifacially (i.e., worked on only one face of the blank). In a few cases, notches were created bifacially. This technique, however, requires a thorough knowledge of blade-core technology and religious iconography, and thus cannot be interpreted as an unspecialized form of craft production. The evidence for this is that specific types of debitage, only recognizable to a craft specialist, correspond to particular symbolic forms.

6.4.2: Notched Cores

These eccentrics were made from exhausted cylindrical cores and flat cores. If a cylindrical core was used as an eccentric blank, Piedras Negras knappers could have used either pressure or indirect percussion to notch the cores. The angle, width, and shape of the notching scars suggest that indirect percussion was the most common technique used to notch the cores (Figure 6.22). The deep, wide, step terminations that remain in some notch margins could not be replicated by the author using a handheld pressure-flaker, but more experiments might reveal the parameters of this notching technique. If a pressure technique was used, then a very wide pressure-flaker must have been used, because this class of eccentrics rarely feature fine pressure flaking patterns. In some cases, the core was reduced by bipolar percussion in order to thin the piece, but also to create a platform from which to remove notching flakes (Figure 6.25). The exhausted core appears to have been placed vertically on an anvil stone, and struck by a small hammerstone. Thinness, however, does not appear to be a desired trait for this kind of eccentric. The goal appears to have been the creation of rough symbolic forms that featured only two or three notches. Indeed, these eccentrics can be described as more crudely formed than other eccentric types.

When cores with a lenticular cross section were notched, their thinness enabled the knapper to use pressure techniques that allowed for more elaboration than is evident

Figure 6.25: Evidence for the bipolar reduction of exhausted blade-cores. Drawings by Shuji Araki.

for cylindrical cores. The edges of flat cores supplied ample amounts of usable platform space. Pressure notching was carried out using a handheld pressure-flaker, while indirect percussion notching probably required a small antler punch and wooden percussor. The results of both notching techniques are wide semicircular notches that feature sharp angles to the working surface. This pattern indicates that thinning was not of interest, and also that the implements used to carry out the notching were thick and wide at the tip. In eccentrics made from both notched flakes and notched cores, there is no evidence of bifacial thinning. The notching techniques have no association with the biface-thinning procedures used for microcrystalline-quartz tools. Some possible explanations for why notched-core eccentrics were not worked with a fine bifacial reduction technique include: (1) the eccentrics could have been made with great speed and a lack of care, but may have had no mastery of bifacial technologies; (2) they could have been produced by knappers who were proficient in blade making; (3) the thick form may have been important to the symbolism or function of the eccentric.

6.4.3: Bifacially Worked Eccentrics

These eccentrics largely are a late phenomenon, and partially bifaced obsidian pieces appear in Piedras Negras caches before the completely bifaced eccentrics. It is possible that partially bifaced, obsidian blade-cores represent a technological form, which was transitional to those that are completely worked on both faces (i.e., no remaining blade scars on either face). Regardless, both technological types were used to create purely symbolic types of eccentrics. Naturalistic forms do not appear to have been made by bifacial reduction. The only real technological differences between the partially-bifaced eccentrics and the fully-bifaced eccentrics are ones of symmetry, "quality," and, of course, whether the piece was completely reduced using bifacial pressure flaking. All of the bifacially-worked eccentrics were reduced with bifacial pressure-flaking using a handheld pressure flaker.

Although some thicker, cylindrical cores were bifacially reduced, the most common blanks used for bifaced obsidian-eccentrics were exhausted cores with a lenticular cross section and percussion flakes and blades. A margin was created using an alternating pressure-technique, whereby flakes are removed in an alternating fashion from both sides of the core. For unknown reasons, some of the original platform was retained on the proximal end of the eccentric. For both types of bifaces a bifacial margin was created around the majority of the piece, but the primary goal of the partially-bifaced eccentrics was to produce the outline of the symbolic form, rather than to thin the piece. Fully-bifaced eccentrics, however, indicate that thinning was an important stylistic element to some knappers. The fully-bifaced eccentrics most resemble the microcrystalline-quartz eccentrics found at the site. Thus, it is possible that (1) blade-makers during later times also practiced bifacial reduction of microcrystalline quartzes; or that (2) exhausted cores were given to experts in biface-reduction techniques usually associated with microcrystalline-quartz materials. The shift to bifacial reduction of obsidian at the site suggests that different lithic traditions gained popularity among the royal family after the demise of Ruler 4, and that political alliances may have given different groups of knappers access to participate in royal rituals.

The debitage from the production of obsidian eccentrics is indicative and is markedly different from the debitage produced from normal prismatic-blade production. Thus, pressure and indirect-percussion notching flakes, bipolar flakes, and biface-thinning flakes are all considered evidence for the production of obsidian eccentrics. Although no eccentric production dumps were found, particular residential groups feature higher percentages of eccentric production-flakes (see Chapter 7).

CHAPTER 7

DISTRIBUTIONAL ANALYSIS

A distributional analysis of the data collected on the chipped-stone artifacts is presented here. I only focus on the data distributions that directly relate to the hypotheses set forth in Chapter 3, including distributions of technological type, artifact weight, artifact counts, and, in some cases, use-wear analysis. The chapter is structured around the hypotheses presented in Chapter 3, and each section is further divided into microcrystalline quartz and obsidian artifact sections. I begin with a brief description of the excavated residential groups and their location in the site of Piedras Negras. Next, I describe the data distributions as they relate to the first set of hypotheses regarding the nature of chipped-stone production at Piedras Negras. I continue with the second set of hypotheses regarding the symbolism of production, especially related to the production of obsidian eccentrics.

7.1: EXCAVATED RESIDENTIAL GROUPS

A great number of mound groups were excavated with test pits, and Nelson (2005) described these excavations in detail. However, this study focuses on thoroughly excavated mound groups with a full range of artifacts made of bone, stone, and ceramic materials and are best described as residential groups (e.g., Jackson 2001; Nelson 2001; Wells 1998, 1999). The excavated residential groups can be separated into three spatial categories, all of which are largely subjective in nature, based on the distance from what is understood to be the site core. These categories are (1) acropolis excavations, which are designated as royal and the residence of the ruling elites; (2) city center excavations, which encompass residential groups located close to monumental architecture; and (3) near-periphery residential groups that are located a greater distance from civic-ceremonial architecture (Figure 7.1).

Much of the acropolis can be considered as a large living facility for the ruling elite of Piedras Negras. Although the rooms of the palace structures have been cleaned out by archaeologists, and the ancient Maya themselves, a series of excavations carried out by Charles Golden, Monica Pellecer, and Fabio Quiróa focused on Patio 3 and the smaller structures located on the north side of the acropolis. These excavations, dubbed Operations PN11, PN46, and PN54 (Figure 7.2), yielded the best evidence of lifeways located above the rest of the city (literally and figuratively). It is unclear if the royal family lived in the smaller residences on the north side of the acropolis, but attendants, cooks, and other craft specialists may have inhabited it.

The residential groups within the city are not as clear-cut in terms of status. While Jackson (2001, 2005) and others noted that Operation PN15 and PN41 were likely subroyal-elite residences, other households appear to have been less affluent with regard to time investment in architecture and other status markers. I do not address the issue of status differences between residential groups except for the previously mentioned distinction between the palace excavations and the rest of the city. The operations and associated residential groups discussed in this study are PN15, PN20, PN23, PN24 (same as 10C), OPN25, PN26, PN33, PN35, PN41, PN57, and PN62. The locations are marked

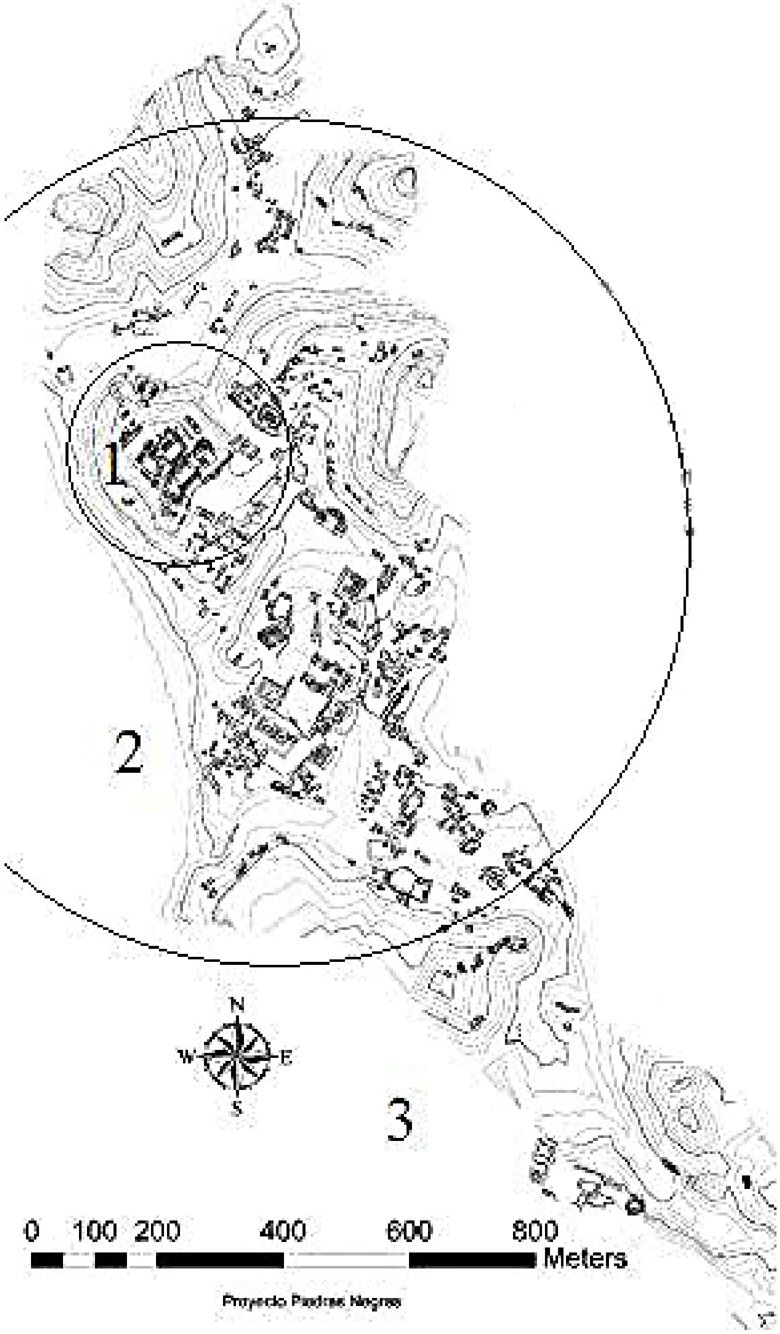


Figure 7.1: Map of Piedras Negras depicting the spatial groupings used in this study (1=Acropolis; 2=City Center; 3=Near Periphery). Based on a map by Nathan Currit, Timothy Murtha, and Zachary Nelson, and prepared by Zachary Nelson.

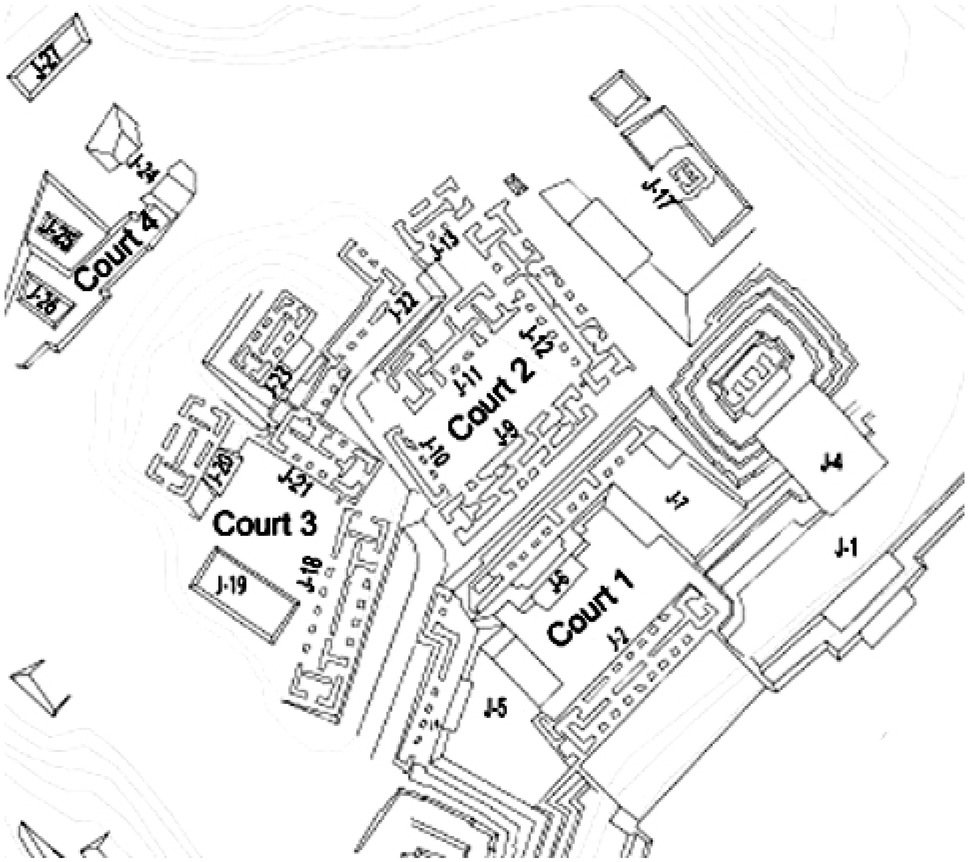


Figure 7.2: Map of the acropolis at Piedras Negras (after Golden 2002:Fig. 5.1).

on the map in Figure 7.3. Operations PN41 and PN26 are located in the low area north of the acropolis and Pyramid J-29, and can be considered to be well planned and constructed. Operation 41, in particular, probably was the household of a subroyal elite, marked as such by the existence of an eroded hieroglyphic panel, fine architecture, caches, and burials, which contained high-status items (see Figure 6 in Guillot, Hruby, and Muñoz 1999). Operation 15 also may have been a subroyal elite household, but it is located in the South of the city (Figure 7.3). Operations PN20, PN23, and PN33 are located to the south and west of the major civic-ceremonial architecture of the South Group Plaza. PN24 and PN25 are both smaller residential groups flanking the West Group Plaza, PN24 to the west and PN25 to the east close to Pyramid K-5. Operations PN57 and PN62 also are small residential groups, but they are more distantly located from the site center. These groups are nevertheless part of the continuous settlement that extends south from the South Group.

Finally, a number of households were excavated in the near-periphery of the city. These residential groups, largely excavated by David Webster and Amy Kovac, are somewhat disconnected from the site core, and appear to have some architectural differences from those in the city center. Most of these sites are located on hills, unlike other residential groups around the heavily modified environs of the civic temples. The most thoroughly excavated groups are RS6, ORS16, RS26, RS27, RS28, and RS29. All of these groups are located in the valley south of the city center, with RS6 representing the possible edge of large-scale habitation of the immediate population-center.

Figure 7.3: Map of Piedras Negras depicting excavated areas of the site (Zachary Nelson 2005). Based on a map by Nathan Currit, Timothy Murtha, and Zachary Nelson, and prepared by Zachary Nelson.

7.2: HYPOTHESIS SET 1: THE ORGANIZATION OF PRODUCTION

7.2.1: Hypothesis 1

This hypothesis states that the production of obsidian and microcrystalline-quartz goods was limited to a few residential groups during one time period. Of the tested residential groups, 17 were chosen for this study based on their spatial organization, dated ceramics, and artifact content. The distributional analysis of production debitage shows that 14 of these residential groups produced chipped-stone goods at some point in the history of Piedras Negras. The first aspect of the test eliminated household groups as chipped-stone producers based on statistically significant amounts of production debitage per time period. The weighted production values of certain kinds of production evidence were added together and averaged per household group, which are referred to by the operation number for the remainder of the chapter. The second method used to eliminate a household group as a production locale was to assess the character of the production debitage. Households that did not feature the full range of production debitage were marked as nonproducers. I begin by describing the result for microcrystalline-quartz artifacts and continue with the obsidian artifacts.

7.2.1.1: Distributional data for microcrystalline-quartz artifacts. Some residential groups have a longer history of production activity than others, and the acropolis is one such case. The operations from the first spatial grouping, located on Patio 3 and the north side of the acropolis, can be dated back to Naba phase. The acropolis was continuously inhabited up to the Kumche phase, and the complete abandonment of the site. All of the dated samples of microcrystalline-quartz artifacts come from PN11 and PN46 and not from PN54 (Figure 7.2). These operations are located on the top of the acropolis and mostly represent small residential groups located outside of the monumental palace architecture to the south. PN11 and PN54 did not yield any significant quantities of microcrystalline-quartz production debitage (see Table 7.1), nor did they feature the full range of debitage types. Patio 3 and PN54 do not appear to have been production areas for microcrystalline-quartz goods. PN46, on the other hand, reveals a long history of production activities. Although there is no firm production evidence for the Balche phase, Yaxche, Chacalhaaz, and possibly Kumche phase deposits contain the full range of production debris expected for microcrystalline-quartz biface manufacture. The Chacalhaaz-phase evidence is the strongest, and includes a full complement of early-, middle-, and late-stage biface-reduction flakes, nodule-reduction flakes, production shatter, and hammerstone flakes. These production activities continued on this part of the acropolis after the demise of Ruler 7 and beyond into Kumche times. This continuity suggests that the residential groups of PN46 maintained the practice of chipped-stone production for much of its history.

The second spatial grouping includes all of the nonacropolis residential groups from the city center. The tested residential groups to the north of the acropolis were PN26 and PN41, but only PN41 revealed strong evidence of production activities. A low number of flakes were found in Yaxche and Kumche deposits, but they do feature a variety of production debitage. While the small Yaxche sample may be due to a lack of

Site	Operation	Phase	Production Value	# of Artifacts	Production Debitage Total	Z-score based on artifact count	Z-score based on weight	Flake Use Number
Obsidian Production Evidence								
RS	16	Chacalhaaz	0.7692	13	6	0.5806	1.6068	2.6154
RS	6	Chacalhaaz	0.4345	168	45	-0.577	-0.587	2.8512
PN	46	Yaxche	0.7083	48	19	1.1756	1.2146	3.0833
PN	46	Chacalhaaz	0.7034	236	91	1.144	1.1555	2.8771
PN	41	Chacalhaaz	0.4481	511	168	-0.49	-0.473	3.1663
PN	33	Yaxche	0.6026	156	55	0.4985	0.451	2.9679
PN	33	Kumche	0.5724	145	52	0.3055	0.3394	2.8828
PN	33	Chacalhaaz	0.5752	1509	550	0.3234	0.3233	3.0159
PN	26	Chacalhaaz	0.6154	13	4	0.5806	0.6161	3.6923
PN	25	Chacalhaaz	0.6	25	9	0.4821	0.5171	3.04
PN	24	Yaxche	0.3241	108	22	-1.284	-1.26	3.8241
PN	23	Chacalhaaz	0.5938	421	169	0.4425	0.4467	2.7815

Table 7.1: Microcrystalline quartz and obsidian production evidence by area.

Site	Operation	Phase	Production Value	# of Artifacts	Production Debitage Total	Z-score based on artifact count	Z-score based on weight	Flake Use Number
Microcrystalline Quartz Production Evidence								
RS	28	Kumche	1.125	16	10	1.6875	1.375	0.3083
RS	28	Chacalhaaz	1.0098	102	62	1.5392	0.9706	-0.045
PN	62	Yaxche	1.05	40	32	1.6	1.075	0.0782
PN	62	Kumche	1.5	6	6	2.1667	1.1667	1.4586
PN	62	Chacalhaaz	1.025	80	63	1.65	1.3625	0.0015
PN	46	Yaxche	0.8636	22	17	1.2727	2.8636	-0.493
PN	46	Chacalhaaz	1.0254	118	74	1.6017	0.7458	0.0028
PN	41	Yaxche	1.625	16	13	2.3125	1.1875	1.842
PN	41	Kumche	1.0556	18	14	1.5556	1.3889	0.0953
PN	41	Chacalhaaz	1.1614	347	256	1.7406	1.1066	0.4199
PN	35	Chacalhaaz	1.3256	43	34	1.9767	0.907	0.9236
PN	33	Yaxche	1.18	50	41	1.86	1.18	0.477
PN	33	Kumche	1	28	16	1.4643	1.5357	-0.075
PN	33	Chacalhaaz	0.9847	391	316	1.509	1.821	-0.122
PN	24	Yaxche	1.0357	28	23	1.5	2.2857	0.0344
PN	23	Yaxche	0.64	25	17	0.88	2.92	-1.179
PN	23	Chacalhaaz	0.9053	169	92	1.3432	2.2249	-0.366
PN	20	Balche	0.5556	18	10	0.8333	2.1111	-1.438
PN	15	Chacalhaaz	0.75	24	13	1.0417	3	-0.842

Table 7.1 continued.

deep vertical excavation in the group, large horizontal excavations revealed only a modicum of Kumche lithic material, which suggests that production activities were not common at that time. The best evidence for production comes from the Chacalhaaz phase where 256 dated pieces of production debitage were found.

PN25, located to the east of the acropolis, was only partially excavated and PN24, located to the west of the acropolis, was more extensively excavated. PN 25 revealed no evidence of microcrystalline-quartz tool production, but scant artifacts from PN24 suggest that production activities occurred there during the Yaxche phase and perhaps into Chacalhaaz. Low numbers of microcrystalline-quartz artifacts from PN24 and other excavations from the West Group Plaza suggest that this area was not a major producer of chipped-stone goods.

Operations PN20, PN23, and PN33, located off the western part of the South Group Plaza, yielded the greatest number of microcrystalline-quartz artifacts. PN20 can be described as an operation that was later subsumed by PN33 excavations and they should be considered as the same residential group. PN33 and PN20 show that microcrystalline-quartz production activities probably began in Balche times and continued through to the abandonment of Piedras Negras after the Kumche phase. A full range of production debris is in evidence for the Yaxche phase (excepting hammerstone flakes), but the emergence of this household group as one of the major chipped-stone producers occurred during the Chacalhaaz phase. Some Chacalhaaz burials from PN33 and PN23 feature stone tools that did not occur in other burials from the site (Figure 7.4), suggesting that there may have been a focus on chipped-stone craft production in this area of the city. PN23 also appears to have been involved in production activities, but according to dated deposits, these activities were restricted to the Yaxche and Chacalhaaz phases.

Operation PN15 has been described as an elite residential group in the southern area of the city. Poorly preserved ceramics made it difficult to date many of the microcrystalline-quartz artifacts from this group, but the few flakes from Chacalhaaz times suggest that production activities occurred there. One deposit excavated by Jackson and the author (2001) yielded close to 4,000 small percussion flakes and pressure flakes. Found relatively close to the surface, this secondary production dump suggests that small, fine bifaces were produced and resharpened in this household group during Yaxche or Chacalhaaz times. It is a unique deposit at the site, and may have been discovered as a result of finer screening-techniques.

PN 57 and PN62 are located further from the city center in the southernmost portion of the site (Figure 7.1). Although these residential groups were not thoroughly excavated, it appears that microcrystalline-quartz tools were produced at a relatively great distance from the site center. PN57 did not reveal evidence of production, but PN62 yielded the full range of microcrystalline-quartz production debris. Balche materials were discovered in PN62, but the bulk of extant production evidence appears to be restricted to the Chacalhaaz and Kumche phases. PN62 is among the partially excavated residential groups that would most benefit our understanding of microcrystalline-quartz production activities through further excavation.

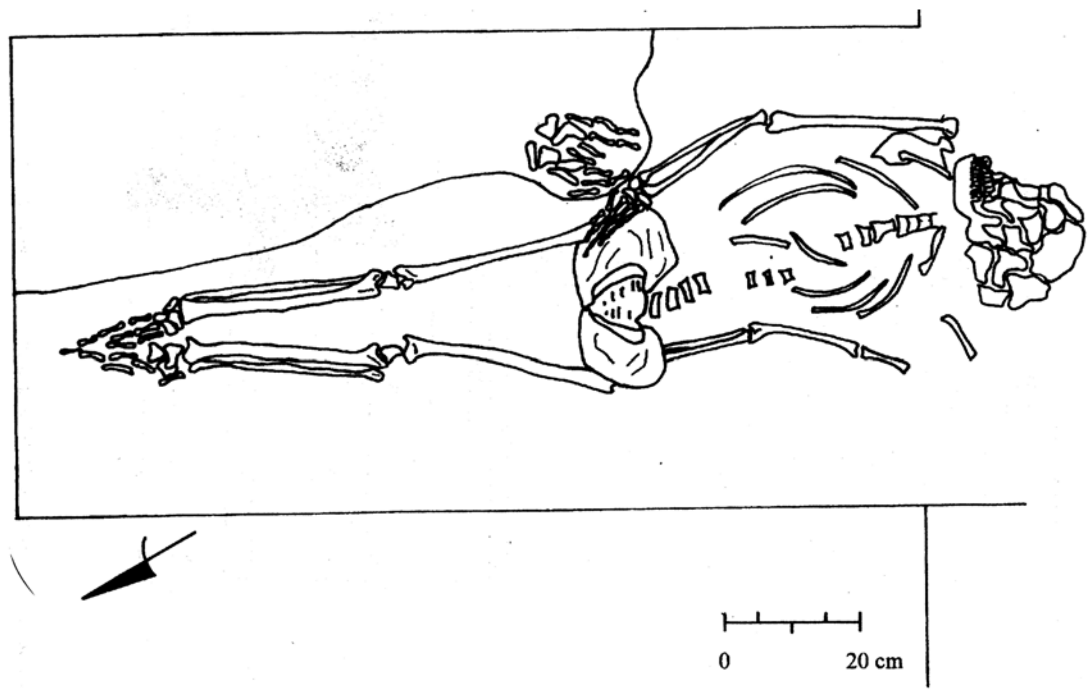


Figure 7.4: Burial 66 from the R Group at Piedras Negras. Drawing by Luis Romero.

The third and final spatial grouping includes residential groups excavated in the near-periphery by Kovak and Webster. These residential groups tend to have qualitatively different lithic samples, both in content and technology (see below). Since most of the ceramics from the near-periphery excavations were not well preserved, it is unsure how early settlement began in this area. A large proportion of the recognizable ceramics and lithic deposits date to the Chacalhaaz phase, with only one lithic sample securely dated to the Kumche phase. Of the residential groups excavated in the near-periphery, only RS26 and RS28 appear to have produced microcrystalline-quartz stone tools. These deposits were dated to the Chacalhaaz phase, and only RS28 appears to document production activities into Kumche times. The residential group named RS6 is the best example of a lithic consumer with absolutely no evidence of production debitage in the excavations. These microcrystalline-quartz artifacts were all heavily used and resharpened with a high number of projectile- and spear-points, probably used in hunting and warfare activities.

To summarize the production data on microcrystalline-quartz artifacts, there does not appear to be a great level of restricted production. The null hypothesis, that most households were involved in the production of microcrystalline-quartz goods, holds during the Late Classic at Piedras Negras. Except for some special deposits, such as the biface-reduction flakes in Early Classic Burial 10, which probably is a royal tomb, and the nodule fragments and shatter from the Early Classic R-5 Platform, there is no evidence for Preclassic or Early-Classic production locations at the site. In PN20, which is the same residential group as PN33, there is evidence of production activity during Balche times, but this is the earliest direct evidence of household-based lithic production available for Piedras Negras. There are many reasons why this might be the case (e.g., depth of excavations, variable discard patterns, etc.), but only future excavations may be able to address production at early Piedras Negras. For the Yaxche phase, there is production evidence from PN23, PN24, PN33, PN41, PN46, and PN62 (see Figure 7.5), but no evidence from the near-periphery at this time. These household groups crosscut status and spatial boundaries, and like the rest of the Late Classic, do not indicate that production was restricted in any way.

Production evidence for the Chacalhaaz phase is even more widespread with PN15, PN23, PN33, PN35, PN41, PN46, PN62, and RS28 all indicated as production locales (Figure 7.6). Moving through time, patterns of possible production traditions begin to emerge. The residential group designated as PN33 appears to begin production during Balche times and continued as a producer of microcrystalline-quartz goods until the site was abandoned. The excavations of PN62 and PN41 indicate that microcrystalline-quartz tool production occurred in those groups during the Yaxche, Chacalhaaz, and Kumche phases. These household groups, which had long-standing stoneworking traditions, contrast with that of PN24, which produced tools for only a short period of time. Finally, as the Kumche phase began, populations dwindled, and the production of microcrystalline-quartz goods subsided. Morphological changes also occurred in the types of stone tools produced at this time. It is unclear how the ethnic makeup changed after the end of the royal dynasty in Chacalhaaz times, and what their

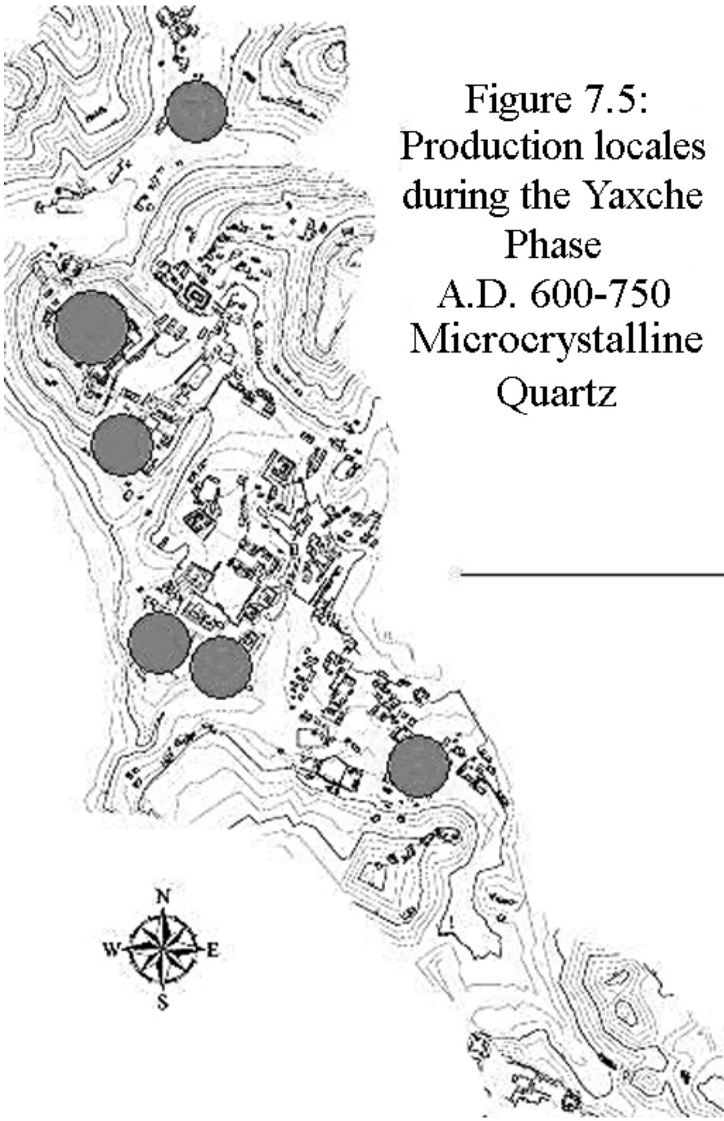


Figure 7.5:
Production locales
during the Yaxche
Phase
A.D. 600-750
Microcrystalline
Quartz

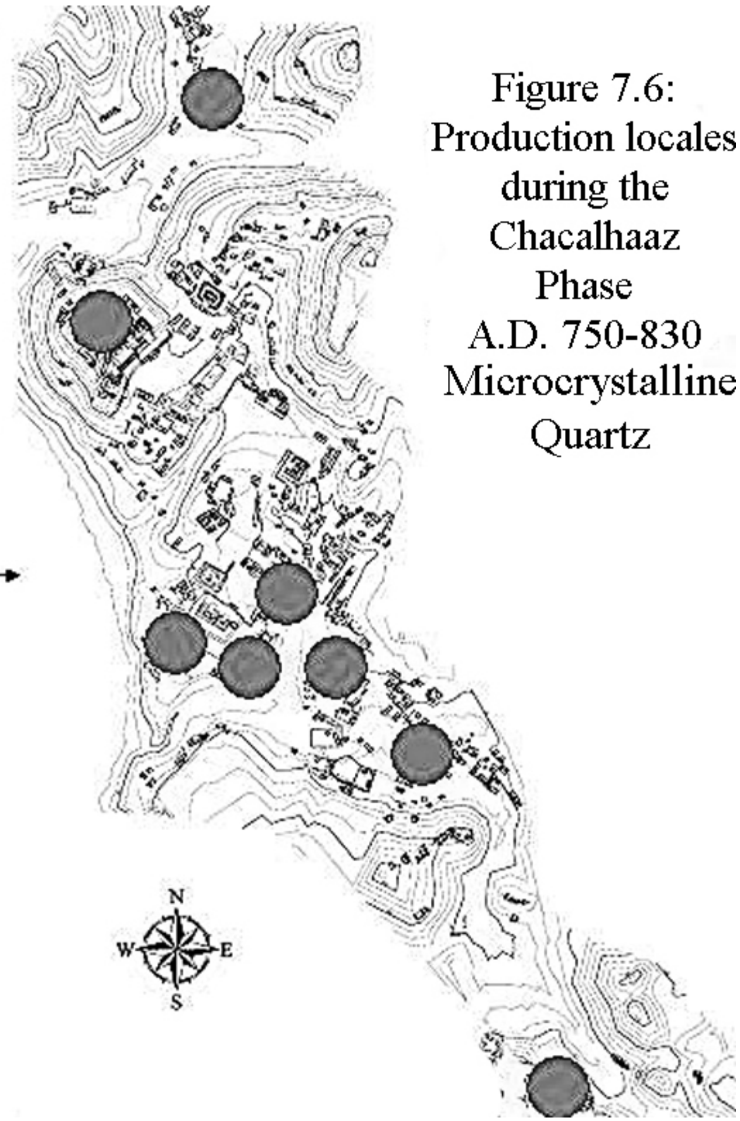


Figure 7.6:
Production locales
during the
Chacalhaaz
Phase
A.D. 750-830
Microcrystalline
Quartz

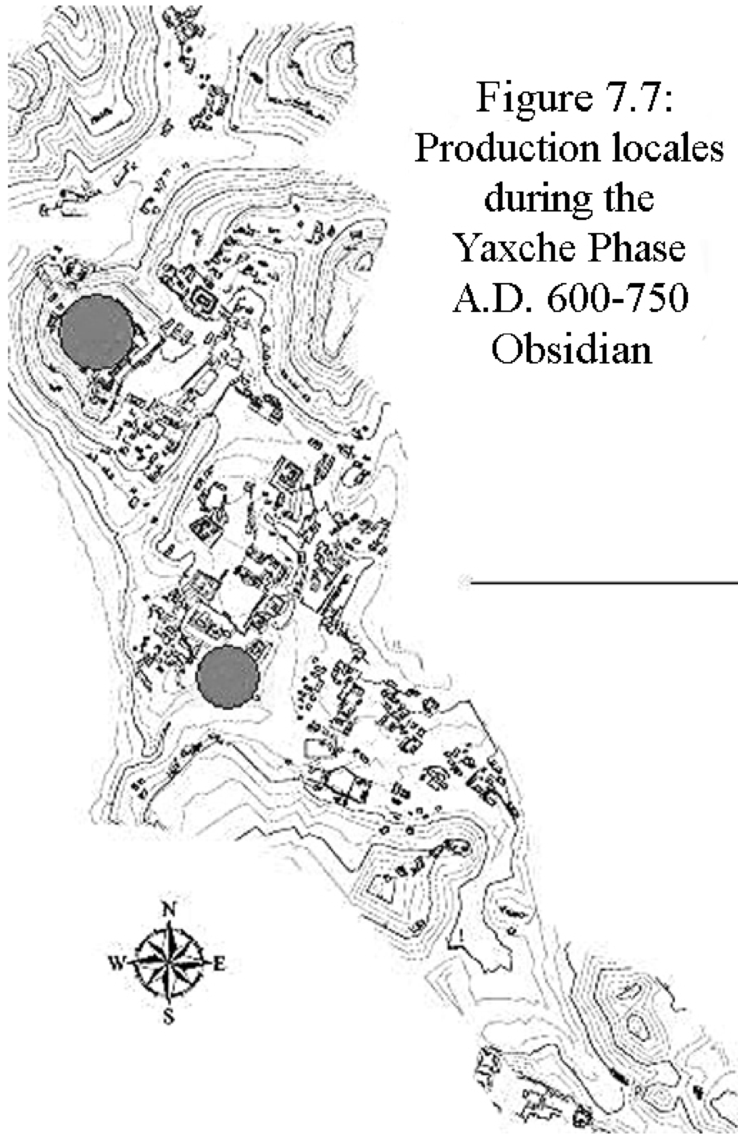


Figure 7.7: Production locales during the Yaxche Phase A.D. 600-750 Obsidian

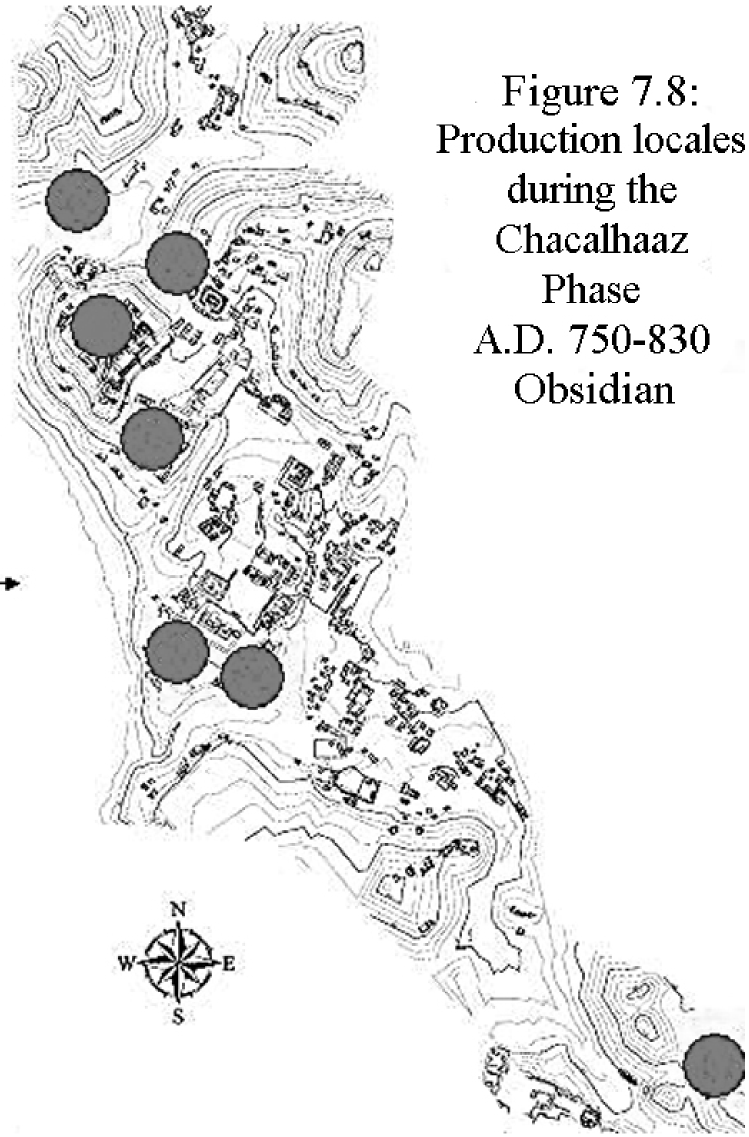


Figure 7.8: Production locales during the Chacalhaaz Phase A.D. 750-830 Obsidian

historical connection to previous inhabitants of Piedras Negras was. It is possible that some Piedras Negras families with a long history of living in the city maintained their households, and, thus, may not be properly characterized as “squatters” (cf. Muñoz and Golden 2005).

7.2.1.2: Obsidian distributional data. The obsidian production evidence from the acropolis group came almost entirely from the PN46 excavations. No significant evidence of production was found in PN11, and PN54, which had a small lithic sample, did not produce a full range of production debitage. PN 46, however, features a relatively substantial obsidian artifact sample, which dates to the Yaxche and Chacalhaaz phases. The residential group of the PN46 excavations was an obsidian-blade producer from the Yaxche to the Chacalhaaz phase, but not into the Kumche phase. They were using obsidian on the acropolis, however, until the site was abandoned (Muñoz and Golden 2005).

The second spatial group, residential groups in the city center, also contains evidence of the production of obsidian goods. In the northern portion of the site, PN26 and PN41 feature little obsidian-blade production evidence. PN26, which only was not thoroughly excavated, appears to have been a possible production locale during the Chacalhaaz phase, but there are too few obsidian artifacts to state this with confidence. PN 41 yielded a relatively large number of obsidian artifacts, especially during the Chacalhaaz phase, but the lack of much production debitage make it unclear whether this residential group was involved in blade production. If blade production did occur here, it probably was on a smaller scale than other production locales in Piedras Negras at that time. These residential groups do not appear to be involved in obsidian blade production at any other time.

In a similar way, PN24 and PN25 do not provide strong evidence of obsidian-blade production at any time. PN25, which is located on the east side of the acropolis, may have been involved in blade production during the Chacalhaaz phase, but only further excavation in this group can determine whether the initial production pattern holds. For this study, however, PN25 is marked as a blade producer during Chacalhaaz times. PN24 is problematic in the sense that there is such a low proportion of production debitage in the lithic samples. It is possible that the residential group of PN24 was involved in blade production during the Yaxche phase, but it has a low production value score, and a low proportion of blade-production debitage to other obsidian artifacts. One possible explanation for the existence of scant production debitage in the PN24 excavations is that it was closely connected to the acropolis during Yaxche times (see Fitzsimmons and Muñoz 2001; Golden and Muñoz 2005). Royal garbage was deposited around this household group, and the production debitage may have originated from acropolis. PN24 remains problematic as a producer for the Yaxche phase, but is an excellent example of a blade consumer during Chacalhaaz times.

In contrast to the PN24 excavations, the residential groups of PN23 and PN33 appear to have been involved in obsidian-blade production over a long period of time, and perhaps with a greater intensity than other areas of the site, especially the U Group (Operation PN33). The U Group yielded almost three times more obsidian artifacts than any other residential group at Piedras Negras. Although there is no evidence that the U group was producing blades before Yaxche times, there is strong evidence for production activities, which spanned from the Yaxche times to the abandonment of the site. Scant evidence of obsidian-eccentric production was also found in PN33 excavations (see below), indicating that the U Group was involved in the production of a variety of chipped-stone goods. The R Group, designated by Operation PN23, does not appear to have been a blade producer during the Yaxche phase, nor the Kumche phase, but like other households during Chacalhaaz times, it features strong evidence for prismatic-blade production. A few burials in this household group are interred with prismatic blades, and in one case, a range of imported obsidian blades, suggesting that this residential group had access to fine obsidian products. PN23 likely received the majority of its blades from the nearby PN33 household group.

Little or no evidence of blade production was found in PN15 excavations, nor in the more distantly located residential groups represented by the PN57 and PN62 operations. It is possible that further excavations in the PN57 household group could yield secure evidence of production, especially for the Chacalhaaz phase, but at this time there is not the full range of production debitage present in this area. Although PN15 appears to have been involved in the manufacture of small bifaces by pressure during the Late Classic, it is clear that this group was not involved in a pressure-blade industry.

The near-periphery excavations uncovered a strange variety of obsidian artifacts and the there is much variation between the samples of these households. Although the residential groups investigated in the rural survey (RS) are situated close to one another, they all have unique architectural schemes and site layout. While reason for these differences is unknown at this time, the obsidian variability adds to the characterization of these household groups as functionally and historically distinct locations.

First, the cutting-edge-to-mass ratios are more variable than other closely situated residential groups at the site. Cutting-edge-to-mass (CE:M) ratios have been interpreted as an efficiency rating for blade production because knappers of greater skill should be able to produce thinner and longer blades (Mitchum 1989). It may also mark different core reduction strategies. In the near periphery, the CE:M ratio for RS29 is only 4.84, which is the lowest in the site, and RS6 is 6.17, which is akin to the rest of the producing residential groups (Table 7.2). This variation may indicate that (1) more than one producer supplied blades to the near-periphery; (2) that they were importing ready-made blades; or (3) a variety of blade reduction techniques were used in this area. Of the RS residential groups that feature obsidian production evidence, only RS6 yielded a full range of production debitage. The general lack of first-series blades at these sites may indicate that they received cores that were partially reduced by pressure. The technological differences between obsidian samples indicate that the near-periphery groups used obsidian in different ways than those in the site center. In sum, the irregularity of the obsidian sample shows that blade production was not common in this area, and that exchange and production of obsidian goods here was unique. It is possible that more households in this area were involved in blade-production during Chacalhaaz times, but they do not fit the pattern set out in this study, nor do they resemble other producing households from the city center. It is possible that itinerant blade-makers were

Phase	Cutting Edge to Mass Ratio	Average Weight Per Piece (g)	Average Length (mm)	Average Width (mm)
Abal	12	0.2667	18	7.8
Naba	7.1	0.5682	21.345	9.8091
Balche	6.43	0.5559	19.324	9.4147
Yaxche	6.53	0.6125	19.552	10.16
Chacalhaaz	6.2	0.6042	18.591	10.191
Kumche	6.17	0.62	18.517	10.362
Abal	12	0.2667	18	7.8
Naba	7.1	0.5682	21.345	9.8091
Balche	6.43	0.5559	19.324	9.4147
Yaxche, Early	6.77	0.6034	20.302	9.4492
Yaxche, Late	7.36	0.5259	18.393	10.745
Chacalhaaz, Early	6.07	0.5575	18.183	10.231
Chacalhaaz, Late	6.23	0.5793	18.654	10.212
Kumche	6.17	0.62	18.517	10.362
Total	6.23	0.6046	18.715	10.179

Table 7.2: Cutting edge to mass ratio for obsidian blades at Piedras Negras.

working in the outskirts of the city, and that an obsidian-blade specialist did not live there.

In summary, the production of obsidian goods at Piedras Negras was quantitatively and qualitatively different from the production of microcrystalline-quartz goods for most time periods. Obsidian-blade production appears to be less common and more restricted than the production of microcrystalline-quartz tools during most phases. Although there is no evidence for production for early time periods, PN33 and PN46 appear to have a longer tradition of obsidian-blade manufacture, especially PN33, where production continued into Kumche times. The lack of obsidian evidence for Preclassic and Early Classic deposits suggests that obsidian-blade production was not a widespread activity during those times. Only PN33 and PN46, which designate residential groups in the city center and acropolis, feature evidence of blade production for the Yaxche phase (Figure 7.7). This pattern also holds if the Early and Late Yaxche phases are analyzed separately. Production evidence from the Chacalhaaz phase indicates that residential groups that produced blades during the Yaxche phase, continued to do so in the Terminal Classic. However, other residential groups began blade production during the Chacalhaaz phase. Production became less widespread during Kumche times, but this ostensibly was after dynastic centralized control had already dissolved. The restricted nature of production during Yaxche times does not appear to be a factor of sampling, since this pattern can be illustrated in two other ways. The first is that the quantity of obsidian used in Chacalhaaz versus Yaxche phase caches is quite low, and the CE:M ratio becomes lower through time. The last statement requires some clarification.

An analysis of CE:M ratios and blade widths indicates that there were indeed variable reduction strategies and changes in efficiency over time. Table 7.2 reveals how CE:M ratios decrease, indicating that obsidian was reduced more efficiently in earlier times than later on. A number of explanations can be made for this pattern, such as: (1) obsidian became increasingly available over time; and (2) the general skill-level of knappers in the city declined over time. This pattern seems counterintuitive, because there is less evidence that percussion-prepared cores were imported to the site at the onset of the Chacalhaaz phase. Fewer eccentrics were made out of percussion blades and flakes with original percussion scars on their dorsal surfaces, and one would expect that blade efficiency would increase if the cores were imported to the site already reduced by pressure. However, this does not appear to be the case. Skill level appears to decline, according to CE:M ratios, and the cause may be more widespread reduction of blade-cores, by less-skilled laborers, in the city center during the Chacalhaaz phase.

Another interesting pattern is that blades from producing household groups tend to have a higher CE:M ratios. One possible reason, other than higher skill-level, is that sturdier blades may have been more valuable in trade interactions, and smaller, thinner blades may have been less valuable and, hence, were retained for use within the producing household. The correlation is tight for Chacalhaaz times, but the Yaxche phase reveals no such pattern. Anomalies in the CE:M ratio for Yaxche are difficult to understand, and may be due to smaller samples for this time period. In any case, the correlation between CE:M and producing residential groups may be significant, but this idea requires further study.

Site	Op	Phase	Artifact Type	Modification
PN	15	No Date	Exhausted Core	Bipolar
PN	15	No Date	Notched 3s Blade	Ground Arris
PN	23	Early Chacalhaaz	Exhausted Core	Bipolar
PN	33	Chacalhaaz	Platform Rejuvenation Flake	Bipolar
PN	33	Chacalhaaz	Pressure Flake	
PN	33	Chacalhaaz	Percussion Flake	Partial Notch
PN	33	Chacalhaaz	Notching Flake	
PN	33	Chacalhaaz	Notched 3s Blade	
PN	33	Chacalhaaz	Notching Flake	From Proximal End of Core
PN	33	Chacalhaaz	Distal Rejuvenation Flake	Bipolar
PN	33	Chacalhaaz	Percussion Blade	Failed Eccentric
PN	33	Chacalhaaz	Bipolar Flake	
PN	33	Chacalhaaz	Exhausted Core	Bipolar
PN	33	Late Chacalhaaz	Distal Rejuvenation Blade	Bipolar
PN	33	Late Chacalhaaz	Pressure Flake	
PN	33	Late Chacalhaaz	Platform Rejuvenation Flake	Bipolar
PN	33	Late Chacalhaaz	Bipolar Flake	
PN	33	Early Chacalhaaz	Platform Rejuvenation Flake	Failed Eccentric
PN	33	Early Chacalhaaz	Exhausted Core	Bipolar
PN	33	Early Chacalhaaz	Bipolar Flake	Burin Spall?
PN	33	Kumche	Distal Rejuvenation Flake	Failed Eccentric
PN	33	Kumche	Notching Flake	
PN	33	Yaxche	Platform Rejuvenation Flake	Bipolar
PN	33	Yaxche	Distal Rejuvenation Blade	
PN	37	Yaxche	Pressure Flake	
PN	39	No Date	Percussion Blade	Possible notching

Table 7.3: List of production evidence for obsidian eccentrics.

Site	Op	Phase	Artifact Type	Modification
PN	46	Chacalhaaz	Percussion Blade	Notched
PN	46	Chacalhaaz	Pressure Flake	
PN	46	Late Chacalhaaz	Percussion Blade	Bipolar
PN	46	Late Chacalhaaz	Distal Rejuvenation Flake	Partial Notch?
PN	46	Early Chacalhaaz	Percussion Blade	Bipolar
PN	46	Early Chacalhaaz	Exhausted Core	Bipolar
PN	47	No Date	Percussion Blade	Notched
PN	47	No Date	Exhausted Core	Notched
PN	52	No Date	Notching Flake	From Biface
PN	54	No Date	Failed Eccentric	
PN	59	No Date	Distal Rejuvenation Blade	Ground Arris
PN	59	No Date	Lateral Rejuvenation Flake	Partial Notch

Table 7.3 continued.

Finally, Table 7.3 lists the production evidence for obsidian eccentrics at the site. The only residential groups that feature obsidian eccentric production evidence are Operation 33 and 46. These groups also happen to be those that feature the longest history of obsidian blade production. It is possible that other residential groups also manufactured obsidian eccentrics, but no evidence has yet been discovered. During the Yaxche phase, Operation 33 has the only sample of eccentric production evidence with three flakes. Operation 46 and 33 both yielded eccentric production evidence during the early and Late Chacalhaaz subphases. These results show that the royal palace and residential groups from the site center were involved to an unknown degree in the production of obsidian eccentrics for royal consumption.

7.2.1.3: Summary of production evidence. The production of chipped-stone goods appears to have been restricted during some time periods, but it is relatively rare. Obsidian in particular was restricted during the Early and Late Yaxche subphases, and also during the Kumche phase. During the Yaxche phase, residential groups on the acropolis and in the U Group were the only major blade-producers thus far identified (Figure 7.7). It is important to note that the production of chipped-stone goods crosscut status boundaries, and was not solely a royal or commoner craft. The number of production locales increased during the Chacalhaaz phase (Figure 7.8). Production continued in the U group and the acropolis, but also occurred in other households throughout the city center and into the near periphery. The Chacalhaaz phase reveals a marked increase in the frequency of obsidian debitage, which can be explained in a number of different ways. According to CE:M ratios during the Chacalhaaz phase, more obsidian may have been entering the site, population increased, the morphology of imported cores shifted, and obsidian was used differently in royal caches. The economic structure and the organization of production clearly shift during this phase. At the onset of the Kumche phase, after the demise of the royal dynasty, blade production continues in some areas of the site, including Operation 33, but with less intensity than the Chacalhaaz phase.

The production of microcrystalline-quartz goods was never a highly restricted activity during the Late Classic period (Figure 7.6), but may have been so during the Early Classic and Early Late Classic. Again, the paucity of data for Naba and Balche deposits may explain this lack of production evidence, or alternatively, the organization of production in the city could have shifted greatly at the onset of the Yaxche phase (Figure 7.5). It is clear, however, that different households used and produced different kinds of microcrystalline-quartz goods, but that the production of small bifaces may have been restricted.. In the end, the range of specificity sought for in differentiating different kinds of production activities in microcrystalline quartzes yielded no secure results.

7.2.2: Hypothesis 2

This hypothesis states that the production of microcrystalline-quartz goods was not connected to the production of obsidian goods. The distribution of producing residential-groups shows that obsidian-blade production is often associated with the production of microcrystalline-quartz goods. Hence, the null hypothesis was not rejected.

Residential groups that produced obsidian blades, from all time periods, also featured production evidence in microcrystalline quartzes 67% of the time. Residential groups that produced microcrystalline-quartz tools also produced obsidian blades 42% of the time. Since the Balche Phase deposits only yielded evidence of one microcrystalline-quartz tool producer and none for obsidian, there is no correlation for that time. During the Yaxche phase, however, 100% of the obsidian-blade producing residential groups, if we accept that PN24 was producing blades, also produced microcrystalline-quartz tools. Exactly 50% of the residential groups associated with the production of microcrystalline-quartz tools also had evidence of obsidian-blade production. The Chacalhaaz phase shows more differentiation with 50% of obsidian-blade producers associated with microcrystalline-quartz tool production. The only blade-producing group during Kumche times was associated with the production of microcrystalline-quartz tools, but three others featured no evidence of obsidian-blade production.

The null hypothesis, that residential groups with significant production values for microcrystalline-quartz material will co-occur with significant production evidence for obsidian, was not rejected. Of course, the results are more complicated than this. For the Yaxche and Kumche phases, obsidian-tool production was always accompanied by the production of microcrystalline-quartz tools. During the Chacalhaaz phase, however, co-occurrence only happened 50% of the time. A single model cannot be created to explain the entirety of this pattern. When a household group produced obsidian blades it was likely that they also produced microcrystalline-quartz goods, but the Chacalhaaz data shows that this is not a necessary relationship.

It is true, however, that the major production locales for chipped-stone goods, PN33 from the South Group and PN46 from the acropolis, feature evidence of production in both obsidian and microcrystalline quartz materials during the Late Classic period. This pattern indicates that there may have been close relationship between both kinds of craft specialization. Two of many possible explanations for this pattern are that (1) chipped-stone producers could have been conversant in both kinds of technology, but were could not gain access to cores during most time periods; or (2) both kinds of production could have been distinct, but wealthy residential groups could have afforded to maintain both kinds of craft specialization. It is not possible to gain more specificity with the present data. However, the obsidian pattern suggests that obsidian-blade production was more restricted, and that it was not necessary to produce microcrystalline-quartz goods in order to produce obsidian ones.

The differentiation during the Chacalhaaz phase must have been associated with some kind of economic reorganization that occurred at that time. Since many households of differing status had access to obsidian blade cores, which are necessary for blade production, it is likely that most obsidian blade producers had a working knowledge of various microcrystalline-quartz reduction techniques, but that not all microcrystalline-quartz tool producers had access to enough obsidian to master pressure-blade production. The implications of this pattern are discussed in the synthetic section of the conclusions.

7.3: HYPOTHESIS SET 2: SYMBOLISM AND VALUE OF DEBITAGE AND CHIPPED-STONE ECCENTRICS

7.3.1: Hypothesis 3

The third hypothesis is that the royal palace had more access to production debitage than did other residential groups in the site. That is, the total production evidence from the palace and from royal caches and burials was significantly greater than anywhere else during a given time period. For this test I examine ratios of production evidence from the palace, royal caches, and burials to the production evidence from the remainder of Piedras Negras. Based on production evidence from general excavations alone, the acropolis does not stand out as a depository for production debitage. For obsidian production debitage, the acropolis ranks among the highest in percentages of production to nonproduction-related artifacts (39.58% for the Yaxche phase and 38.56% for Chacalhaaz times), though not in overall total debitage count[19] (see Table 7.6). The situation is similar for microcrystalline-quartz materials where 77.27% of the PN46 artifacts were identified as production debitage for the Yaxche phase and 62.71% for the Chacalhaaz phase. Production debitage counts also were average (see Table 7.5).

Although scant pieces of eccentric production evidence were found on the acropolis, the majority of these rare artifact types (see Section 6.4.3 and Table 7.3) came from Operations PN23 and PN33 from the South Group Plaza area. The same pattern is found with the even less-common examples of debitage from the production of microcrystalline-quartz eccentrics. Only a few notching flakes made of microcrystalline-

Site	Operation	Phase	Area	Non-production Debitage Count	Production Debitage Count	% of Production Debitage from Total
RS	16	Chacalhaaz	Near-Periphery	13	6	46.154
PN	23	Chacalhaaz	Site-Center	421	169	40.334
PN	46	Yaxche	Acropolis	48	19	39.583
PN	46	Chacalhaaz	Acropolis	236	91	38.559
PN	33	Kumche	Site-Center	145	52	36.62
PN	33	Chacalhaaz	Site-Center	1509	550	36.594
PN	33	Yaxche	Site-Center	156	55	36.424
PN	25	Chacalhaaz	Site-Center	25	9	36
PN	41	Chacalhaaz	Site-Center	511	168	32.749
PN	26	Chacalhaaz	Site-Center	13	4	30.769
RS	6	Chacalhaaz	Near-Periphery	168	45	26.786
PN	24	Yaxche	Site-Center	108	22	20.37

Table 7.4: Percentage of obsidian production-debitage per operation.

Site	Operation	Phase	Area	Non-production Debitage Count	Production Debitage Count	% of Production Debitage from Total
PN	62	Kumche	Site-Center	6	6	100
PN	24	Yaxche	Site-Center	28	23	82.143
PN	33	Yaxche	Site-Center	50	41	82
PN	41	Yaxche	Site-Center	16	13	81.25
PN	33	Chacalhaaz	Site-Center	391	316	80.818
PN	62	Yaxche	Site-Center	40	32	80
PN	35	Chacalhaaz	Site-Center	43	34	79.07
PN	62	Chacalhaaz	Site-Center	80	63	78.75
PN	41	Kumche	Site-Center	18	14	77.778
PN	46	Yaxche	Acropolis	22	17	77.273
PN	41	Chacalhaaz	Site-Center	347	256	73.775
PN	23	Yaxche	Site-Center	25	17	68
PN	46	Chacalhaaz	Acropolis	118	74	62.712
RS	28	Kumche	Near-Periphery	16	10	62.5
RS	28	Chacalhaaz	Near-Periphery	102	62	60.784
PN	33	Kumche	Site-Center	28	16	57.143
PN	20	Balche	Site-Center	18	10	55.556
PN	23	Chacalhaaz	Site-Center	169	92	54.438
PN	15	Chacalhaaz	Site-Center	24	13	54.167

Table 7.5: Percentage of microcrystalline quartz production-debitage per operation.

Obsidian-Eccentric Types

	Yaxche	Chacalhaaz	Balche	Yaxche, Early	Yaxche, Late	Chacalhaaz, Early	Chacalhaaz, Late
Notched Flake	30	22	3	25	3	8	12
Notched Blade	42	31	1	27	13	6	25
Notched Core	10	17		5	2	11	2
Mostly Bifaced	3	16		0	0	11	5
Fully Bifaced	7	90		0	1	81	8
Microcrystalline-Quartz Eccentric Types							
	Yaxche	Chacalhaaz	Balche	Yaxche, Early	Yaxche, Late	Chacalhaaz, Early	Chacalhaaz, Late
Painted Flake		28					28
Notched Flake	39	37	2	31	5	3	29
Mostly Bifaced	25	52	5	14	7	29	12
Fully Bifaced	30	122	3	11	8	68	21

Table 7.6: Frequency of obsidian eccentric types through time at Piedras Negras.

quartz materials were found at Piedras Negras. This paucity of production evidence for microcrystalline-quartz eccentrics makes it unclear whether cached eccentrics were made on site. The frequency of eccentrics made from local materials, however, suggests that at least some were made in the vicinity of Piedras Negras. The technological and symbolic similarities between obsidian and microcrystalline-quartz eccentrics also suggest that they were formulated by local artisans and were not a mix of imported eccentrics made elsewhere. Greater formal variability may be found in the Piedras Negras sample if eccentrics were imported for caching rituals. Finally, the general lack of most types of imported goods (of any material) at Piedras Negras suggests that Piedras Negras elites may not have had the capability to import large quantities of prestige goods, such as the eccentrics found in the many caches at the site.

If production debitage from caches and burials is added to debitage totals from the acropolis, then royal access to production debitage is much greater than any other spatial grouping. This is true for both microcrystalline quartz and obsidian materials for the three main phases of the Late Classic period (Balche, Yaxche, Chacalhaaz). The royal Burials 13 and 10 both contain a relatively large quantity of biface-thinning flakes, and the majority of microcrystalline-quartz eccentrics for the Yaxche phase, and obsidian eccentrics from all time periods were made out of production-related debitage. Thus, if all of these factors are considered, then the royal family did have more access to production debitage than any other group in the city. Whether they produced that debitage, however, is an entirely different question.

Since a number of residential groups produced obsidian blades, and in some cases obsidian eccentrics, a likely scenario is that the royal family would accept obsidian production debitage and eccentrics from various production locales, probably as tribute items for royal caching rituals. The microcrystalline-quartz evidence is even less strong, however, and it is impossible to draw any conclusions about the production of microcrystalline-quartz eccentrics, or where the royal family secured its production debitage. As with some obsidian blades, it is likely that many bifaces were produced outside of the site and imported to Piedras Negras. At this time I am unable to determine where the imported microcrystalline-quartz tools were made. Many of the microcrystalline-quartz sources have not been found, and as yet, preliminary excavations in the Piedras Negras hinterland have not yielded any large-scale production locales other than the ones in the political center.

It is possible to model a redistribution form of exchange for the chipped-stone economy of the city, where the acropolis was responsible for pooling and redistributing resources of various kinds throughout the city. As the shifts in production evidence have shown, there likely was a reorganization of the economic system at Piedras Negras, especially during the onset of the Chacalhaaz phase. This occurs in obsidian materials, and also in microcrystalline-quartz materials (see Chapter 8 for a full discussion).

7.3.2: Hypothesis 4

This hypothesis states that certain types of chipped-stone goods not only had economic value, but also had symbolic value and meaning important to both royal and nonroyal inhabitants of Piedras Negras. Consequently, particular artifact forms and the resulting debitage were perceived and distributed differently based on their function and symbolism. The value of the object derived from its form, material, history, and use, but also from the knapper who produced it and the symbolic capital he or she controlled. The relationship between the producer, symbolic capital, and the exchange value of the product would have been most evident at the time of the first exchange after initial manufacture. Unless the object was signed (i.e., nametagged), as is the case with some ceramic vessels and carved bones, the value conferred upon an object by the status of the producer likely would have declined after this initial exchange.

If there were a connection between the production process and the value of an object, then it would be most evident in the symbolism related to the technological practices that created the object. In the present case, there should be a tight correlation between the technologies used to create chipped-stone goods and the symbolism of the chipped-stone goods themselves. I have found symbolic connections to flake type, ritual use of sequential production-debitage in burials, and the ritual deposition of so-called mundane artifact types in regal caches. These patterns suggest that aspects of the production process were ideologically loaded, and that, in the case of blade-core reduction and obsidian eccentric production, the practice of production at times may have been ritualized.

I review some of the most obvious examples of this pattern to “test” this hypothesis. The subjective nature of this study does not allow for a wholly empirical treatment of the data, but hopefully the following examples illustrate that, in some cases, debitage had a symbolic and economic value. I begin with a discussion of two caches from the R-5 pyramid, and continue with examples from elsewhere in the site.

7.3.2.1: A comparison of Caches R-5-4 and R-5-6. Technological and contextual analyses of obsidian eccentrics and production debitage from the Piedras Negras have identified flaking patterns that indicate a connection between production techniques and the symbolism of the eccentric. The form and technology of the eccentrics embody an elaborate symbol system rendered in stone. Many classes of eccentrics represent natural and supernatural elements and beings (Figure 7.9) that were deposited ritualistically during the production of temples and carved stone monuments (Escobedo and Hruby 2002; Meadows 2001; Schele and Freidel 1990). At Piedras Negras and Tikal, in particular, symbolic forms repeat in local caches over a period of centuries. Elaborate production techniques also are repeated, suggesting that traditions probably were passed on from one generation of knappers to the next.

For example, two caches from the R-5 pyramid, excavated by Héctor Escobedo (Escobedo and Zamora 1999, 2000; Escobedo and Hruby 2002), contain two sets of nine obsidian eccentrics of the same symbolic form, probably evoking specific gods (Hruby 2001, 2003). These caches, R-5-4 and R-5-6, were found in the platform of Temple R-5, the likely burial place of Ruler 1. The obsidian eccentrics from these caches reveal the importance of the relationship between the flake and the symbolic form of the notched flake and blade eccentrics. The caches were deposited as part of two distinct rituals--as a substela cache of Stelae 37 (Figure 7.10), and as a column altar cache[20] (Figure 7.11)--

Figure 7.9: Nine incised obsidian eccentrics from Tikal (after Coe 1965).

anywhere from one to twenty years apart. In other words, they were not simultaneous caching events and the eccentrics probably were not made at the same time. These caches were part of an obsidian eccentric tradition that extended from the reign of Ruler 1 to that of Ruler 4 (A.D. 605-757). Although Early Classic obsidians were unifacially notched, they do not adhere to the same formal outline as those from the early Late Classic, and those from Ruler 5 to Ruler 7 (i.e., A.D. 757-808; rulers who were responsible for the construction of the later phases of Temple O-13) use a similar symbolic form, but were made largely from exhausted cores; a tradition less common during the middle period (A.D. 605-757). It may be possible that the obsidian eccentrics made from A.D. 605 to 757 were manufactured by a few local knappers who passed their knowledge down through three or four generations. Given the similarity to obsidian eccentrics from Tikal (Figure 7.12), it is possible that the creation and use of this style was not an autochthonous development.

Although formal and technological similarities exist between all caches during the Yaxche phase at Piedras Negras, the two caches from R-5 provide an excellent test case with which to compare two almost identical groups of obsidian eccentrics. The first cache, R-5-4, is a substela cache of Stela 37 (early seventh century) that was deposited in a limestone cist located behind the support-shaft of the stela. The second cache, R-5-6, was deposited around a cylindrical column altar located to the side of Stela 37 in the same northeast platform of R-5. Even though the contexts are different and there is variation between the deposition style and that of nonobsidian cache goods, for unknown reasons, the symbolic forms of the obsidians are repeated. The first clear difference

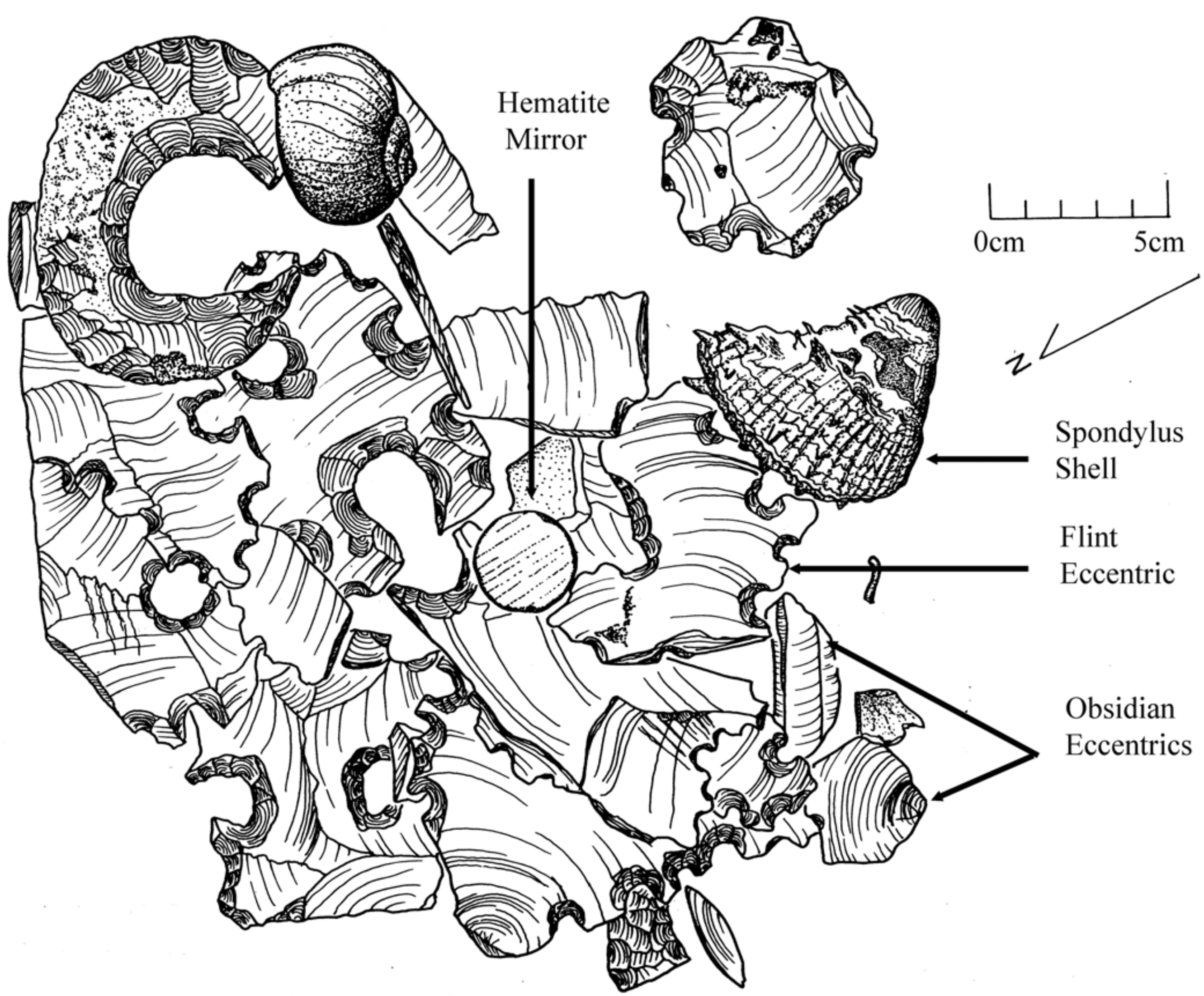


Figure 7.10: Substela Cache R-5-4 from Piedras Negras. Drawing by Zachary X. Hruby.

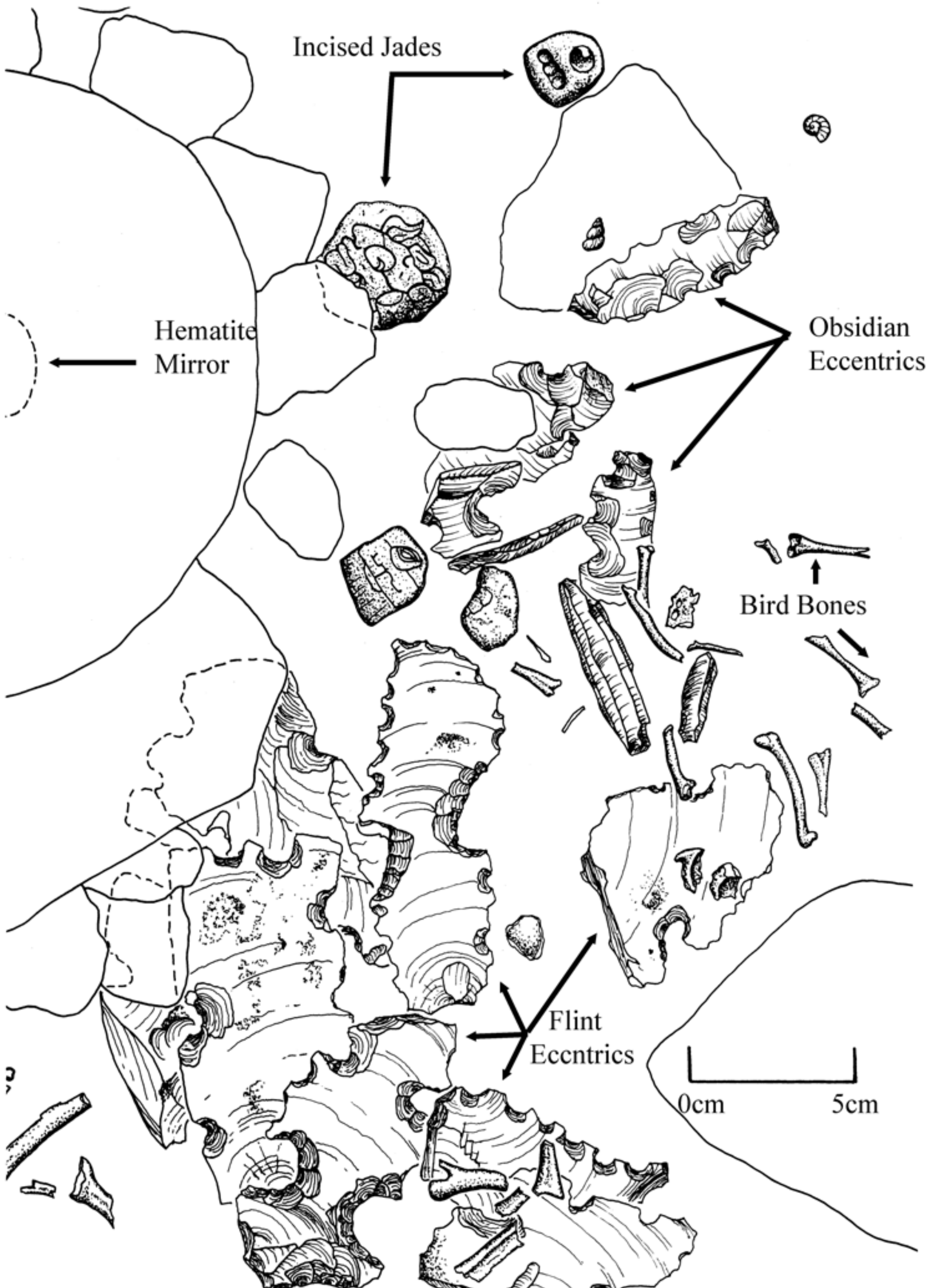


Figure 7.11: Column altar Cache R-5-6 from Piedras Negras. Drawing by Zachary X. Hruby.

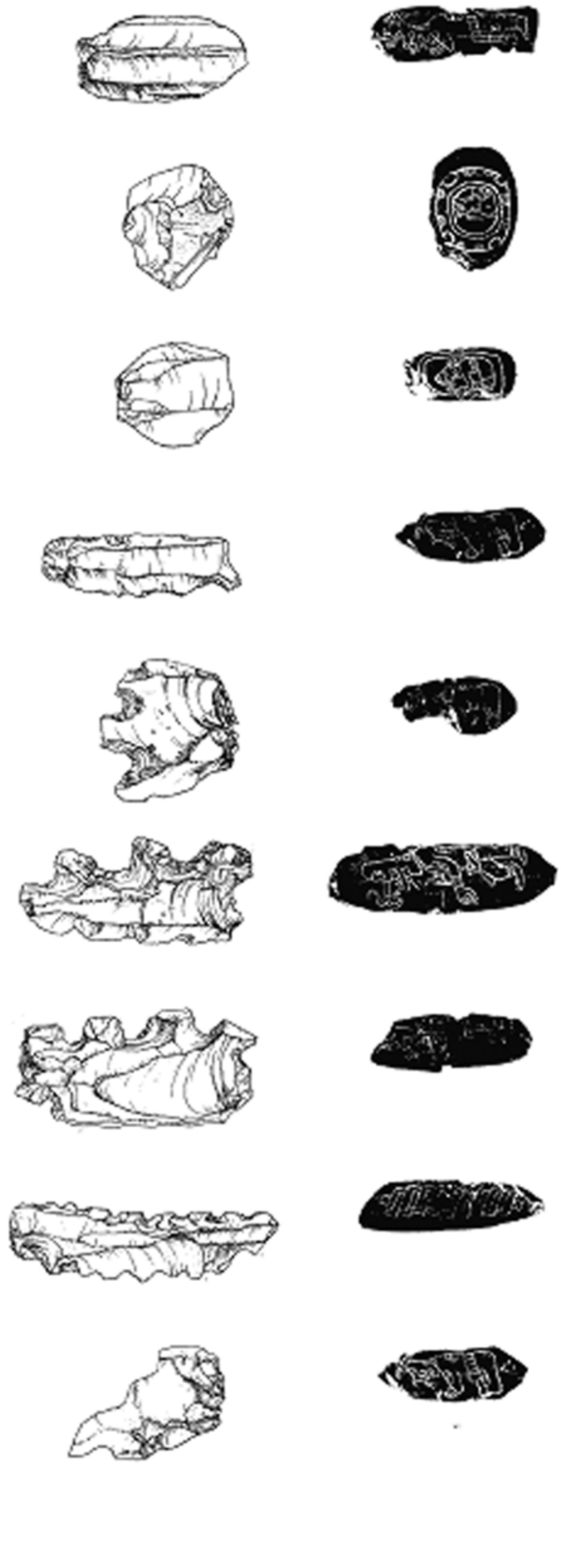


Figure 7.12: A comparison of obsidian eccentrics from Piedras Negras (above) and Tikal (below).

between the two samples of obsidian eccentrics from Caches R-5-4 and R-5-6 is that the column altar eccentrics are smaller than their substela counterparts (Figure 7.13). The second is that the forms are not exactly the same. In most cases, however, the notching is carried out at the same points of each corresponding flake or blade. The closest similarity between the two groups actually involves the blades and flakes used to create each corresponding form.

Figure 7.13 represents a comparison between the nine obsidian eccentrics in each cache with numbered columns marking each distinct form. Based on a comparison with other obsidian eccentrics from Piedras Negras and incised obsidians from the Central Petén, notched obsidians from R-5-4 and R-5-6 appear to represent a series of god effigies common to caches from both of these areas. Most common among the represented gods and symbols are the lightning god, K'awiil, the Jester God of the Three-Stone-Hearth, the sun and moon gods, the mat sign (pop), God C, and the Principal Bird Deity. Certain gods also are repeated at Tikal as either standing or sitting and are thusly repeated in each cache. Instead of full-body representations of gods, profile silhouettes of their heads were notched into flakes at Piedras Negras--a pattern also found for notched, microcrystalline-quartz eccentrics (Figure 7.14). Representations of the sun and moon are not usually knapped as profiles but are left as either rounded discs or as notched crescents. The symbolism of some notched obsidians, such as the double-notched blade or laurel leaf form remain to be understood, but probably correlate to one of the common gods represented on Tikal incised obsidians. The social function of these eccentrics is difficult to determine, but their placement near monuments of calendrical importance

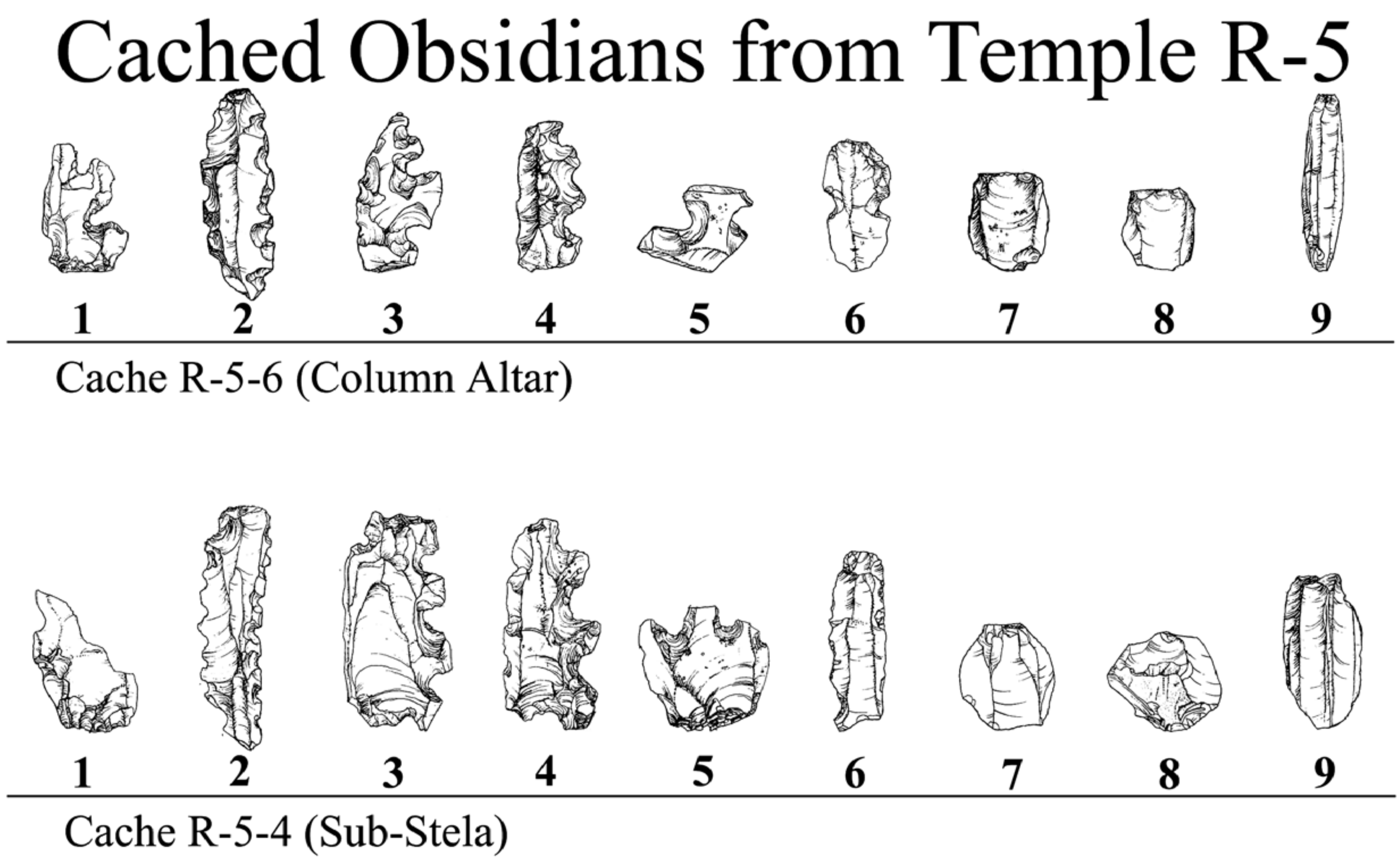


Figure 7.13: A comparison of the obsidian eccentrics from Caches R-5-4 and R-5-6.

indicates they may have been associated with the symbolic representation of time or with the movement of celestial bodies.

The following is a description of the eccentrics from R-5-4 and R-5-6 using the format of Figure 7.13 to compare symbolic and technological forms. Thick, wide, percussion blades (designated as small percussion-blades according to Clark [1989]) removed to regularize the sides of the working face of the core (Figure 6.9) were used for the eccentrics in Columns 3 and 4. These eccentrics probably represent a silhouette of the Classic Maya lightning god, K'awiil. K'awiil-shaped eccentrics can be identified by a long snout, an open mouth, and a central torch element emanating from the "forehead" area of the silhouette. Thinner, longer, percussion blades removed from the central portion of the working face (Figure 6.3, 6.6, and 7.13) were chosen for the "centipede"- or "pop"-style eccentrics in Column 2. Although centipedes do appear on Tikal incised obsidians, the pop or mat sign is much more common, and the symmetry of the Piedras Negras eccentrics suggest that the pop sign probably is the intended symbol. There may be some symbolic overlap between the two forms, however. Column 1 eccentrics, representing the Jester God, were made from wide percussion flakes removed from the sides of the blade core, probably to isolate the platform of the blade to be removed from the central face of the core (Figures 6.3, 6.5, and 7.13; described in detail above). The Jester God form is similar to K'awiil forms but usually feature a pointed element that represents the top of the head (Figure 7.15).

The disc-like eccentrics in Columns 7 and 8 probably represent the sun god and the moon goddess, since rounded flakes usually are reserved for the sun disc and the

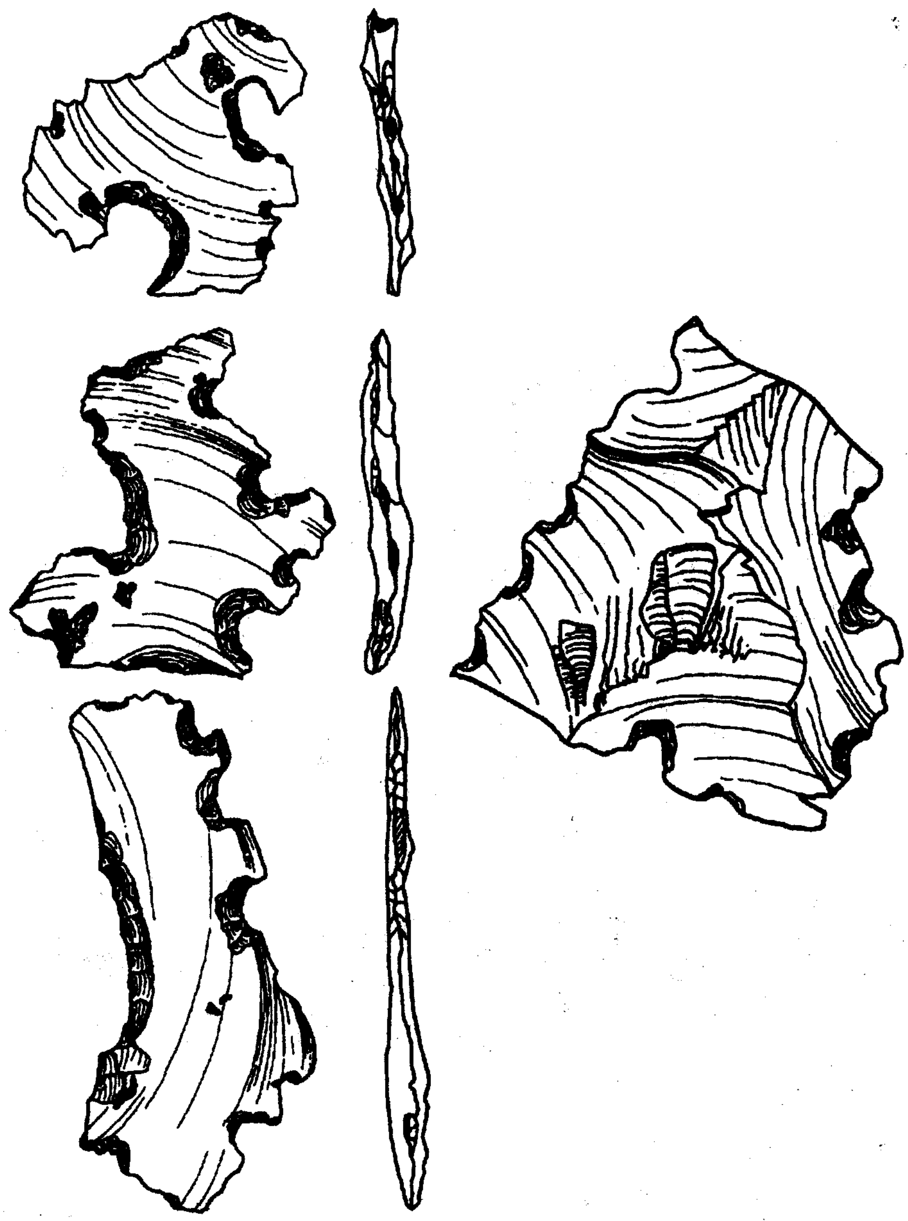


Figure 7.14: Microcrystalline-quartz eccentrics in the form of Classic Maya gods (from Cache R-5-4). Drawings by Zachary X. Hruby.

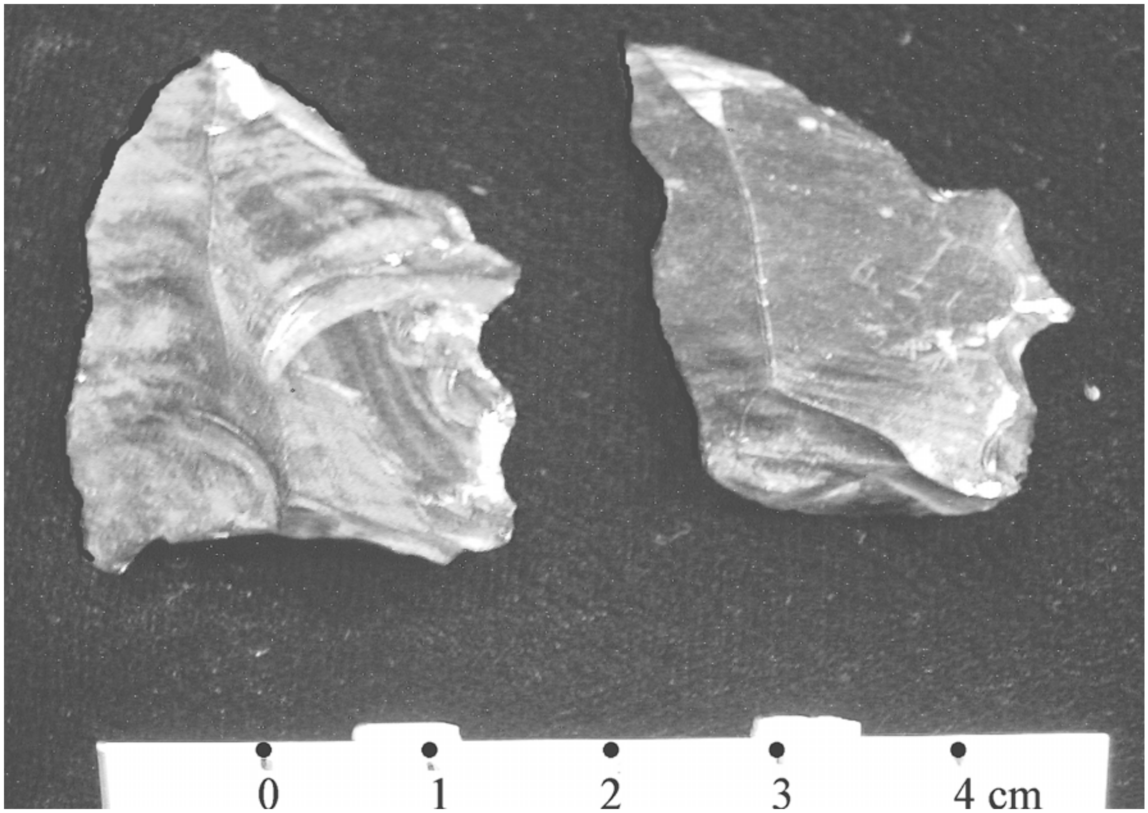


Figure 7.15: Obsidian eccentrics in the form of the Jester God. Photograph by Zachary X. Hruby.

moon crescent. While the blanks used to make Column 7 eccentrics were percussion flakes that ended in hinge terminations, Column 8 eccentrics are generally round in shape, but there is no technological correlation between them. The R-5-4 eccentric from Column 8 is a distal rejuvenation flake and the other from Cache R-5-6 is a proximal fragment of a percussion blade or flake. This technological incongruence may be due to a lack of the desired flake at the time the cache was deposited, but it also may represent an unrecognized pattern. It is important to note, however, that the rounded forms were derived from flakes removed from either the proximal or distal end of the core. Medial fragments of flakes and blades were not chosen for disc-shaped eccentrics.

Column 5 eccentrics were made from step- or hinge-removal percussion flakes and represent a common trefoil form at Piedras Negras that has no known symbolic meaning. Similarly, meanings are not known for Columns 6 and 9, but they may correlate with some of the other deities on incised Tikal obsidian eccentrics (Figure 7.9) because they also are common in Piedras Negras caches. The double-notch forms from Column 6 are made from first-series pressure blades, and Column 9 eccentrics are made from exhausted cores. Ultimately, the flake and blade appears to be an integral aspect of the finished eccentric, even when it represents the correction of an error in the normal blade-making process. These forms are repeated in other caches, but not in the same groupings of nine found in these two caches. Nevertheless, close to 150 years later, similar forms continued to be used at Piedras Negras in the temple Cache O-13-7 (Figure 7.16), but the technology had shifted primarily to the bifacial reduction of exhausted pressure-blade cores. Nevertheless, the same flake/blade correlation to symbolic type continued,

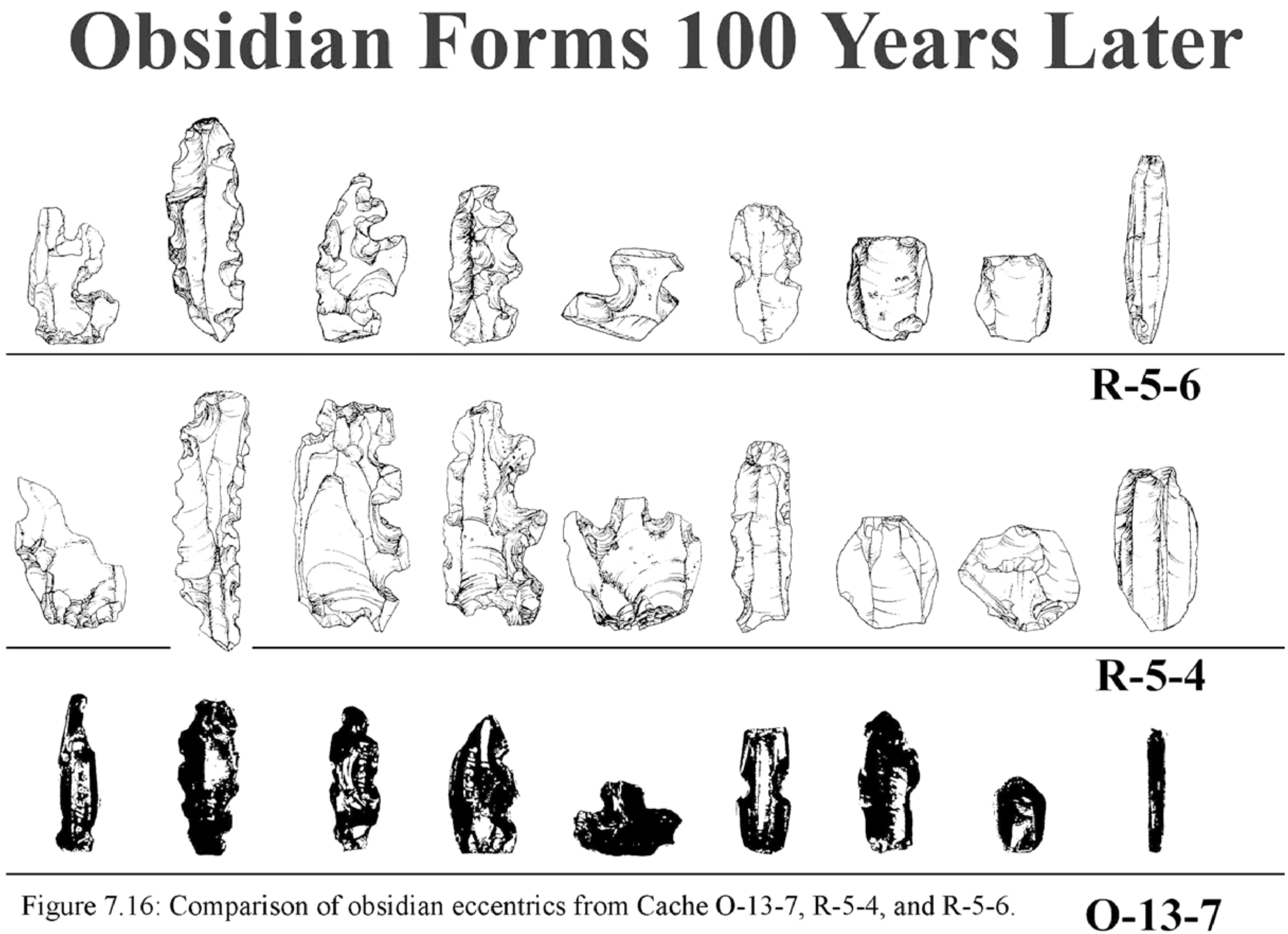


Figure 7.16: Comparison of obsidian eccentrics from Cache O-13-7, R-5-4, and R-5-6.

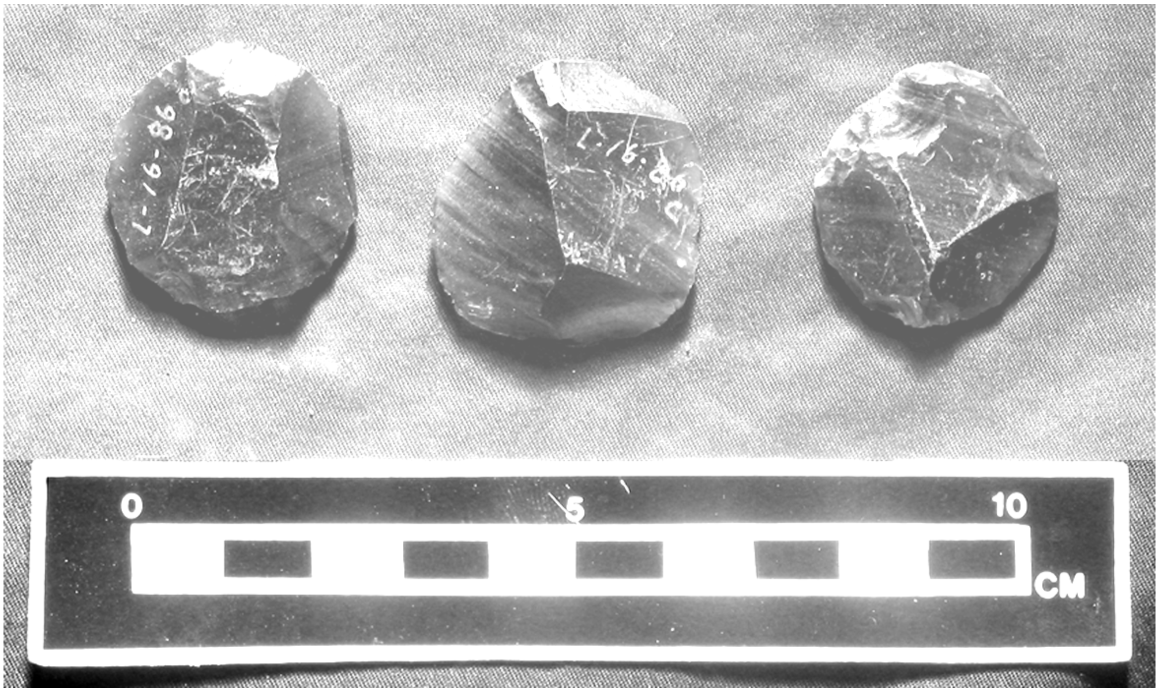


Figure 7.17: Disc-shaped obsidian eccentrics from Piedras Negras. Photograph by Zachary X. Hruby.

although in a diminished quantity, up until eccentrics were no longer used (Table 7.6). Figure 7.17 depicts a series of five disc-shaped eccentrics, all of which are made from distal rejuvenation flakes. Figure 6.9 shows that the correlation between the large K'awiil form and the percussion blade removed from the side of the pressure-blade core was repeated during the early Late Classic period and beyond. This pattern suggests that the kind of original obsidian debitage was key in embodying the complete symbolism of the eccentric, and also that the stages of blade core reduction at Piedras Negras also may have had a symbolic component.

A recent analysis of incised obsidian eccentrics from Tikal and Uaxactun by the author also may indicate ritualized production and an adherence to a relationship between symbol and technology, albeit slightly different from Piedras Negras flake types. Round distal rejuvenation flakes were reserved for the sun and moon gods, distal rejuvenation blades depict kneeling or sitting gods, while percussion blades were reserved for standing gods, the pop sign, and scorpions (Figure 7.9 and 7.18). Although flake and blade choice may have been an ad hoc use of correctly shaped flakes for particular gods, it also may indicate a tradition similar to that of Piedras Negras, where specific kinds of flakes were used for specific gods and entities.

At Piedras Negras and elsewhere it is possible that knappers had a folk knowledge of the core that related to Classic Maya deities (e.g., Figure 7.18). The directionality, position, and morphology of the core (i.e., proximal versus distal end of the core) may have been marked by where certain gods "resided" in the core as flakes and blades. This possibility does not seem too far-fetched given that objects and houses often were

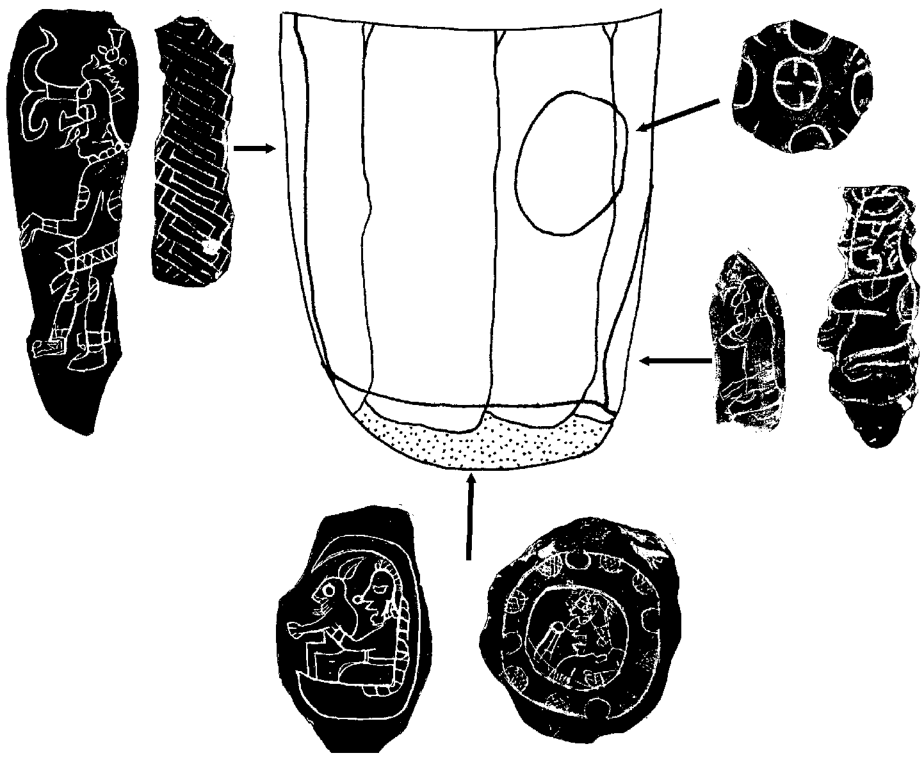


Figure 7.18: Possible correlation between flake type and deity at Tikal.

anthropomorphized or characterized as a cosmogram in Mayan cultures (Vogt 1998). When preparation flakes and blades were removed from the core, it likely was that the knappers had specific gods in mind as they were making them. These symbolic associations may have comprised part of the esoteric production knowledge controlled by blade makers. Thus, practice of production not only involved the production of "ritual" prestige goods, but mythological beings and elements were inherent to the flakes themselves. These flakes and blades also mark crucial and "dangerous" moments of core maintenance, similar to the staged ritualized production of the Toro iron-workers (Childs 1998).

As the ethnographic and ethnohistoric cases discussed above suggest, the production of eccentrics was a well-suited practice for the ritualization of production—the binding of esoteric ritual knowledge with technological practice. The repetition of particular god effigies in caches also suggests that there was an intense religious component to the eccentrics. This religious component may have tied into a mythological charter for obsidian crafters. Although there was another stage of production to finish many of the prestige lithics for caches (i.e., notching), the correlation between technology and symbolism suggests that it was the obsidian workers themselves that made the connection between the core, flake, and a given god. The final stage of production may have occurred just prior to a royal caching ceremony. Another salient point is that some of the flakes used for obsidian eccentrics were removed during the process of prismatic-blade production, not during the removal of first series of percussion flakes and blades. I propose that blade production as a whole also may have been ritualized or ritually

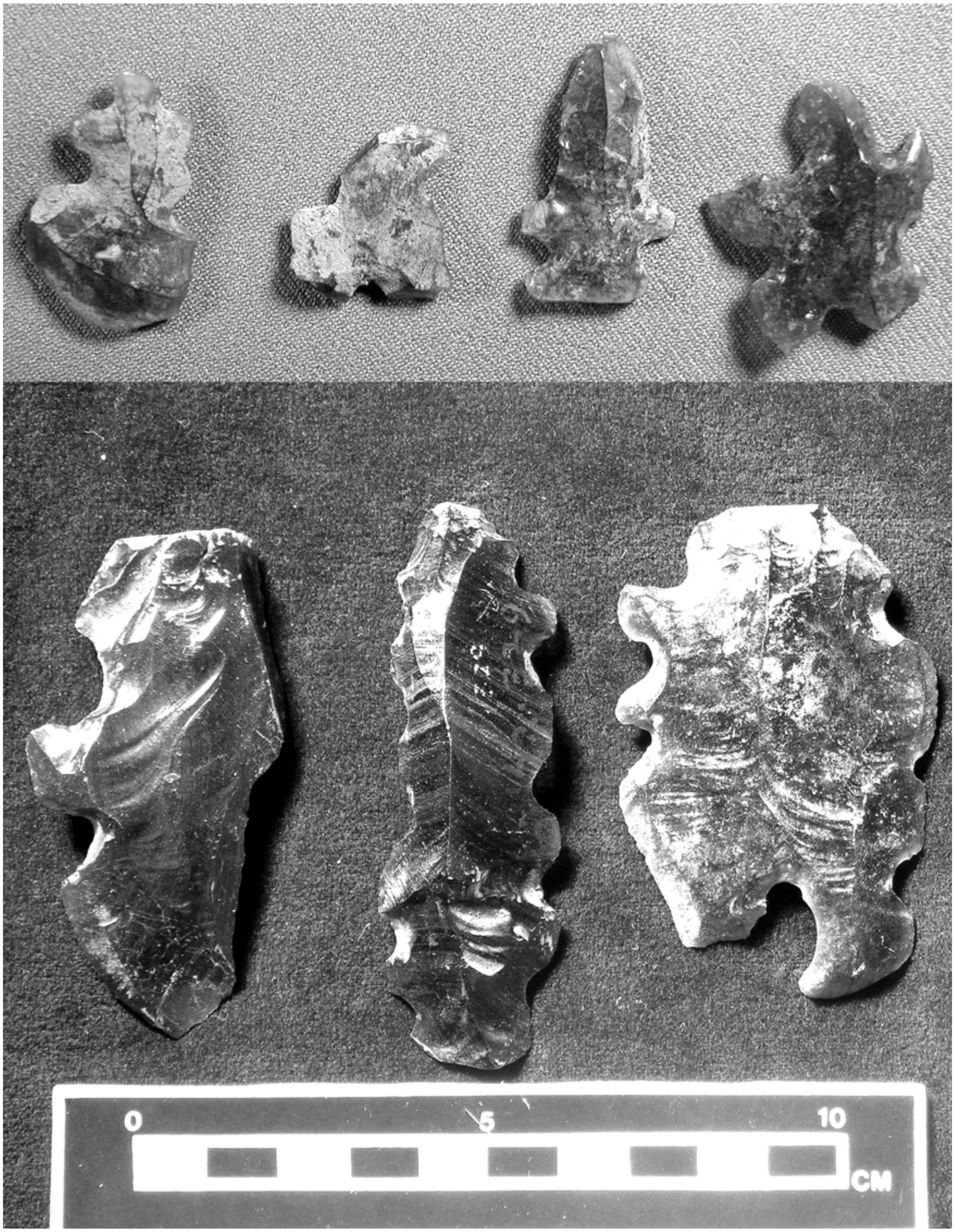


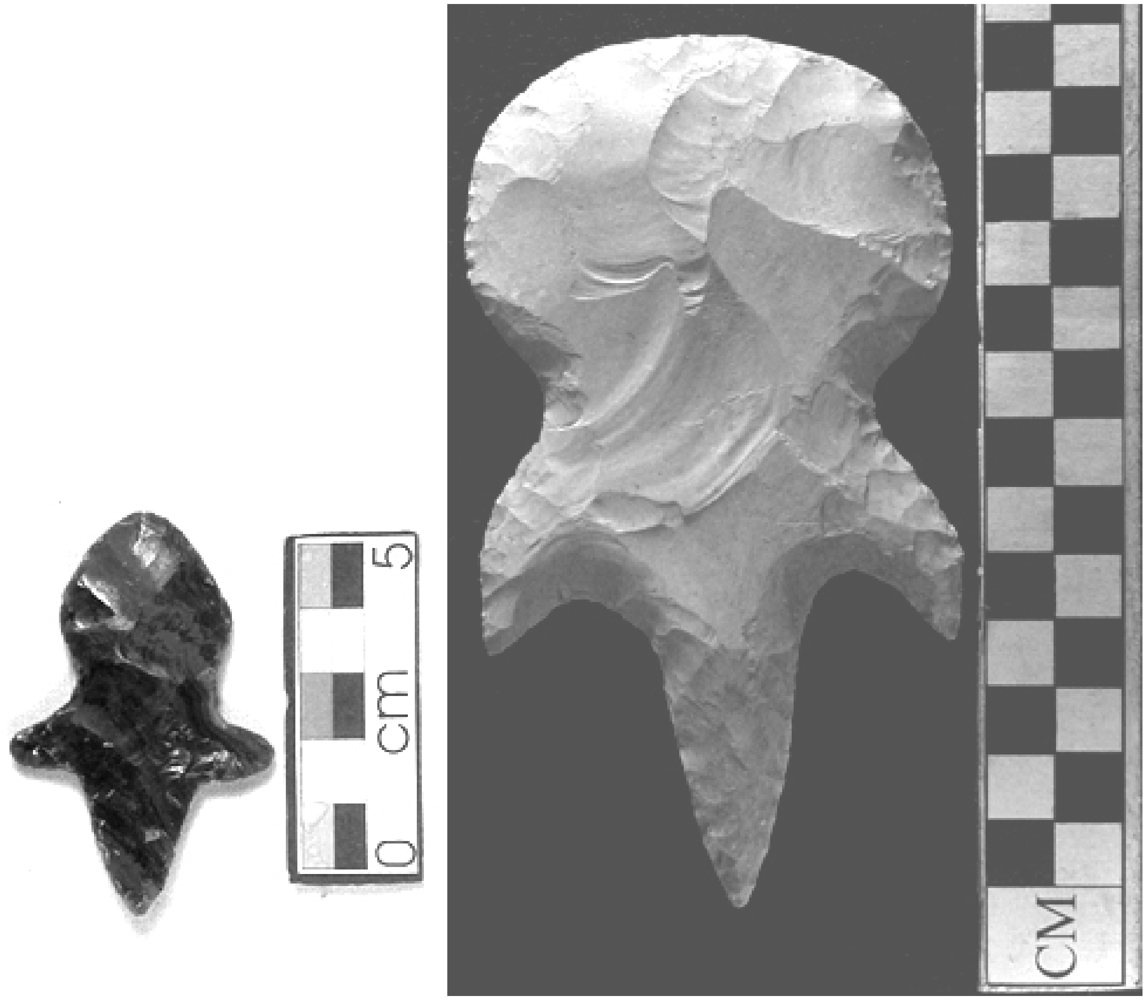
Figure 7.19: Obsidian eccentrics from Caches K-5-8 and R-16-2. Photographs by Zachary X. Hruby.

circumscribed, especially considering the often ritual tasks for which prismatic blades were used (e.g., bloodletting).

7.3.2.2: Technological change through time in Piedras Negras eccentrics. Balche-period eccentrics differed from Late Classic eccentrics both technologically and symbolically. Obsidian eccentrics from Caches K-5-8 and R-16-2 (Figure 7.19) reflect these differences. Obsidians from the Early-to-Late Classic transition (i.e., Balche phase) were made with a notching technique and may very well have symbolized various gods, but any connection to Yaxche phase obsidians is unclear. Obsidian eccentrics from Cache R-16-2 may actually date to the earlier Naba phase, in which case there appears to be little technological change from Early to Late Classic obsidians. The five-pointed star and the dart point (Figure 7.19), for example, may be distantly related to Terminal Classic versions symbolically, but they were made by notching a lateral rejuvenation flake and a stunted blade, respectively, instead of creating symmetry through complete bifacial reduction. The elaborate Balche obsidians indicate a symbol and technological system similar to that of other time periods, but their meaning remains opaque. Unlike the Central Petén, the notched flake tradition of the Balche phase, and likely before, appears to continue into the early Late Classic at Piedras Negras indicating some technological continuity, even though there may have been a shift in the symbolism of obsidian eccentrics. Technologically speaking, the lack of technological difference between the Naba- and Yaxche-phase eccentrics suggests that their development was one of slow change over time, and not massive innovation. This slow evolution of symbols and technology may mark the production of eccentrics as a doxic form of practice (see Chapter 8).

The early Late Classic period at Piedras Negras (A.D. 603-757, largely marked by the Yaxche ceramic phase), which is the topic of this discussion, reveals a continuation of the notched flake technology, but with adherence to a symbol system that differs from earlier obsidian eccentrics. Although the sample is quite small for the Balche phase, and may very well involve similar gods, the flake to symbol correlation is not in evidence. The two caches analyzed above should also not be considered the norm in terms of cache content. Tikal caches regularly contain a series of nine obsidians, which had technological and symbolic regularity between caches and over time (Coe 1965), but Piedras Negras caches appear to have been more varied. The same symbolic and technological forms appear throughout the Piedras Negras sample, but in differing numbers and combinations of eccentrics. The meaning and variation of cache deposits still remains to be understood, but it is clear that they are using combinations of the same eccentrics to express different cosmological meanings.

Sometime after the demise of Ruler 4 (A.D. 757) many of the same symbolic forms were retained, but the way obsidian eccentrics were made changed significantly. Biface technologies were introduced to the manufacture of obsidian eccentrics, and as a result, they became thinner and better defined (Figure 7.20). Before the Terminal Classic, eccentrics were produced with notching, indirect percussion, and bipolar technologies that could have been carried out by blade producers who knew and understood that type of reduction. At the onset of the Chacalhaaz phase, however, bifacial technologies,



Figures 7.20: Obsidian biface eccentric of a disc-point form from Cache O-13-57; 7.21: Microcrystalline-quartz eccentric of a disc-point eccentric from Cache O-13-57. Photographs by Zachary X. Hruby.

usually associated with the reduction of microcrystalline-quartz materials, were employed in the production of the majority of obsidian eccentrics. Bifacial reduction by pressure is not closely tied to the successful manufacture of Classic Maya prismatic-blades. Whether flint-knappers were made to produce obsidian eccentrics, or if obsidian workers gained new technological knowledge of bifacial reduction is unknown. In either case, however, the obsidian craft specialists of the Yaxche phase had to compromise with new ceremonial and political demands. In addition to the old symbolic forms, new ones also were introduced (Figure 7.21), indicating that both symbolic and technological shifts had occurred in how cache materials were meant to be produced.

Table 7.6 illustrates technological changes through time in obsidian eccentrics at Piedras Negras. The dominant technique for creating obsidian eccentrics during the Balche and Yaxche phases was to notch blades and flakes, and to a lesser extent, exhausted cores. The number of notched cores increased with the transition to the Chacalhaaz phase. The major shift, however, occurred during the early Chacalhaaz subphase where the number of bifacially-worked obsidians overshadowed other forms. After the early Chacalhaaz phase, and the decline of the dynastic line at Piedras Negras marked by the defeat of Ruler 7 by Yaxchilan, notched-flake eccentrics once again become the norm (Figure 7.22). However, these flaked eccentrics do not adhere to the system established during the Yaxche phase. Many of the same symbolic forms are retained during the Chacalhaaz phase (Figure 7.16), however, they are made with different techniques. Thus, Terminal Classic obsidian eccentrics can be best characterized as a potpourri of symbols and reduction techniques, which suggests that a number of knappers are involved in their creation.

The shift from Balche phase symbolism to Yaxche phase conservatism, and ultimately to Terminal Classic (Chacalhaaz phase) elaboration, suggests that there was indeed tension or contestation in the production of obsidian cache goods through time. Political changes, marked by the accession of rulers, appear to have had an effect on how cache goods were produced, a situation that drew obsidian crafters into a contested field of production. Around A.D. 750 (Chacalhaaz phase) population also rose dramatically at Piedras Negras and there was a corresponding rise in the number of obsidian production locales at the site (Hruby 2005). According to increased cache size and quantities of obsidian at the site, it appears that more obsidian was imported to Piedras Negras during Chacalhaaz times. Thus, a number of political, economic, and demographic forces may have created heightened competition between obsidian workers.

The changes in obsidian-eccentric production cannot be characterized as simple differences of aesthetic taste. The implications of symbolic and technological change through time suggest that different groups of artisans were responsible for producing cache goods for each period. Alternatively, the stability of technological practice for the early Late Classic indicates that particular groups of obsidian specialists maintained a specific ideology of craft production that was dominant for 150 years. The transition to the Terminal Classic shows that original groups of eccentric producers may have relayed certain elements of obsidian symbolism to the next group, but the dominance of their technological practice diminished. The fact that the notched flake and blade eccentrics

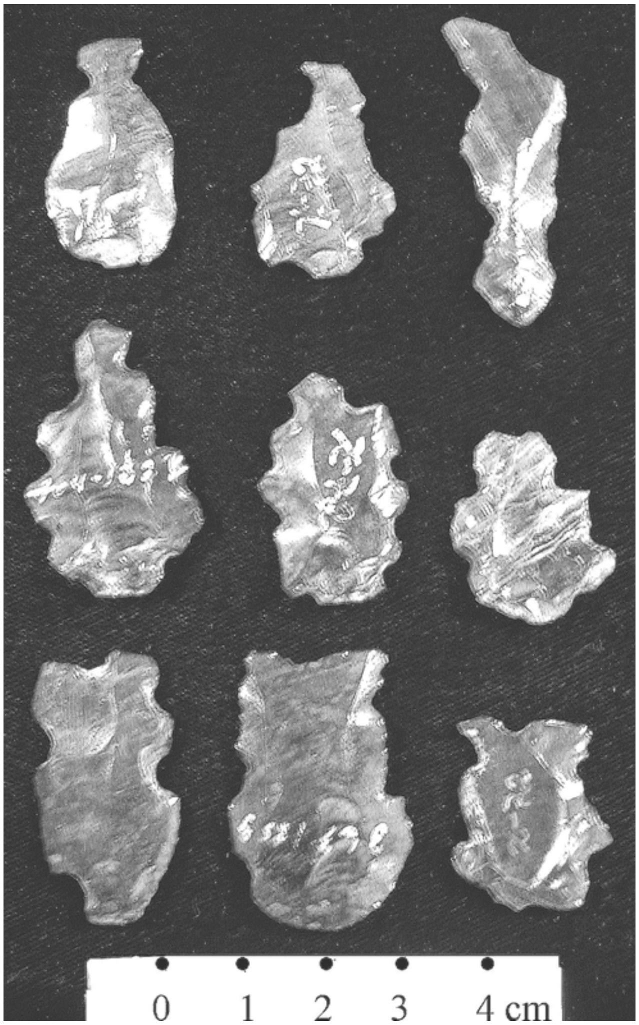


Figure 7.22: Notched-flake obsidian eccentrics from the Late Chacalhaaz phase. Photograph by Zachary X. Hruby.

continued, although in a minor way after the introduction of bifacially-reduced obsidian eccentrics (Figure 7.22), suggests that this tradition did survive, but was not the most valued product.

The final stages of collapse at Piedras Negras reveal an increase in caching ritual, especially in the O-13 pyramid. The inclusion of many notched-flake obsidian eccentrics, probably associated with auto-sacrifice (Joyce 1992), may mark a return to earlier obsidian practices, ideologies, and traditions. Regardless of changes in technology, symbolism, and ultimately, obsidian craft specialists through time, obsidian eccentrics continued as an important element of caching ritual up until the political demise of the center.

7.3.2.3: Other examples of the ritual use of debitage. No hieroglyphic texts were found in caches, but royal and elite burials often were interred with highly polished goods that featured hieroglyphic writing. The illustrious stone carvers and scribes of Piedras Negras incised jades and shells with images of Classic Maya deities, without any reference to the logosyllabic writing for which they were famous. These basic site-wide patterns suggest that burials at Piedras Negras were places of lived and recorded history, scribes, and the consumption of well-finished high-quality goods, while caches reflect concepts of primordial world creation through craft production; they reflect the early stages of certain kinds of craft production. Given the high quality and value of these goods in royal burials at Piedras Negras, the deposition of production debitage in these same deposits seems to be out of place. Two royal burials in particular, and Early Classic

Figure 7.23: Biface-reduction flakes from Burial 10. Photograph by Zachary X. Hruby.

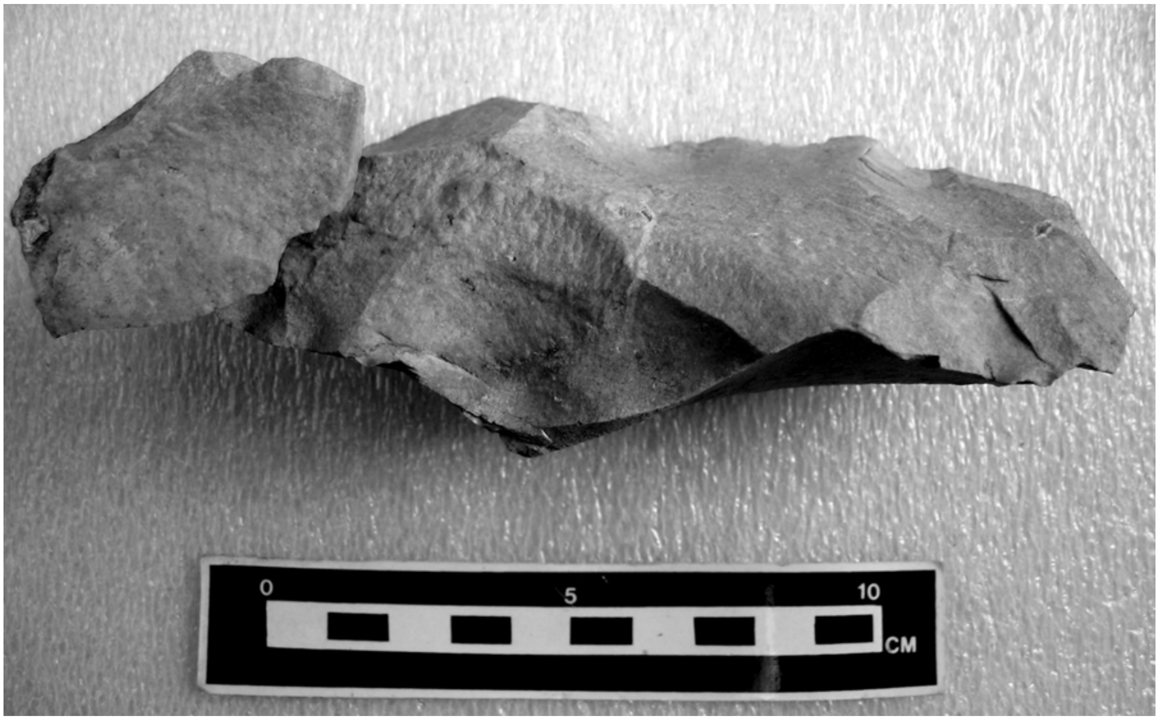


Figure 7.24: Refit of flake and biface from Burial 10 deposit. Photograph by Zachary X. Hruby.

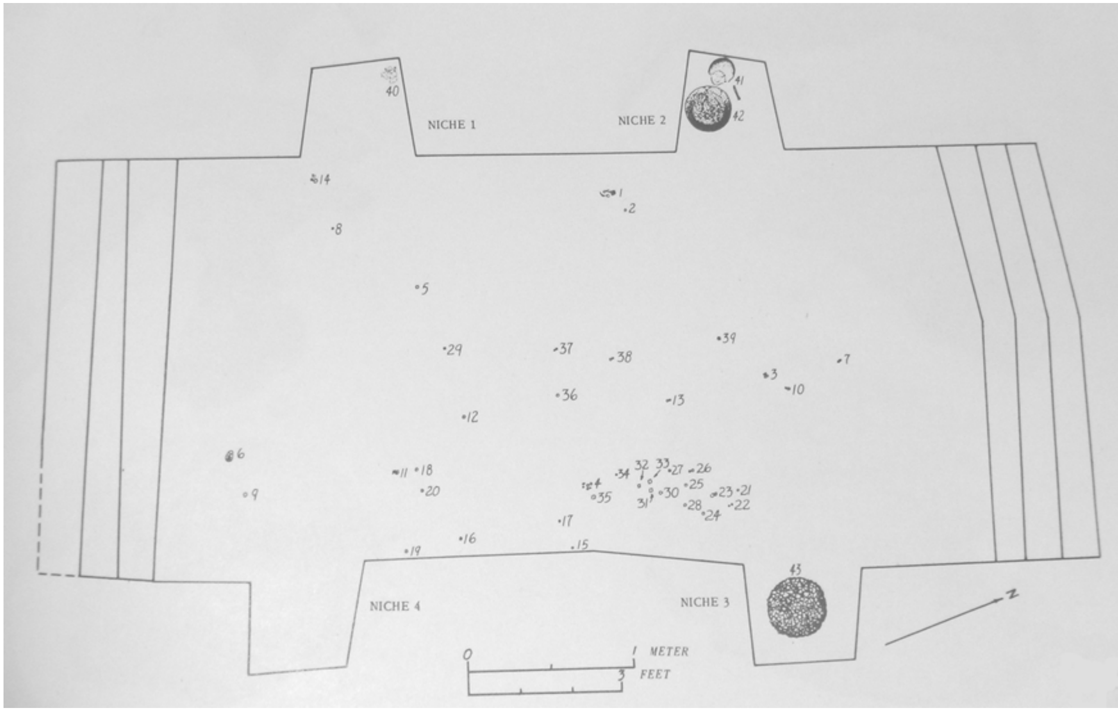


Figure 7.25: Drawing of Burial 10 (Coe 1959:Fig. 67).

tomb (Burial 10) and the tomb of Ruler 4 (Burial 13), reveal the importance of production debitage, and perhaps the process of production, in royal burial practice.

In Burial 10 (Figure 7.25) a basket of biface-reduction flakes was placed in a side niche of the tomb. Placed on top of this basket of hundreds of flakes were two bifaces, one an axe perform and the other a fully finished celtiform axe. According to refit studies (Figure 7.23) the flakes below the bifaces did not all result from the production of these two bifaces. However, some refits were made with the preform biface (Figure 7.24) indicating that the flakes were taken from the very production space in which the bifaces were manufactured. Thus, it was not the specific flakes from those bifaces that were symbolically significant, but rather it was the space and the content of that space in the process of production that were significant to the burial offering. The symbolism of the practice of production—flake-to-preform-to-finished product--was also a key element in the offering. The deposition of debitage that marked all phases of biface manufacture may symbolize the termination of a lifecycle or perhaps rebirth.

Burial 13 contained a scattered deposit of 253 nodule reduction and biface-thinning flakes. The total number of flakes may have been greater than 253 since the entire tomb was not excavated. They were not deposited over the entire tomb, but rather over a number of ceramic vessels located in the northwest corner of the crypt. It is unclear if the flakes were interred at the time of the original burial or when it was later reentered during a fire ceremony (see Houston et al. 1998). Although some refits were found among the flakes, it is unclear how the flakes were collected for the burial ritual. The majority of the flakes represent early stages of nodule reduction and biface thinning,

Figure 7.26: Early-stage production debitage (above) and chert nodules (below) from the R-5 pyramidal platform.

but some of them (N=34) were late-stage biface-reduction flakes, which were removed to finish the bifaces. According the colors and textures of the flakes, it appears that anywhere from 9 to 13 separate nodules were reduced for this deposit. It is unclear, however, if the flakes were made especially for the deposit or were collected from a random workshop area. The relatively small number of flakes indicates that they were not deposited as an elaborate waste removal system (cf. Moholy-Nagy 1997), and that they were instead interred for wholly symbolic purposes. The lack of small percussion and pressure flakes in the tomb suggests that larger flakes were selected for the burial.

Aside from the lack of smaller flakes, which could have been placed elsewhere in the tomb, a full range of biface-manufacture debitage is present in the deposit. Architectural dedication deposits reflect a similar process whereby chunks and early-stage reduction flakes of chert were placed underneath platform modifications, and around cache vessels. Cache J-1-2, which probably dates to the Late Yaxche or Early Chacalhaaz subphases, was almost certainly a dedication cache for the megalithic stairway of the acropolis. The cache vessel contained obsidian, chert, jade, and shell artifacts, similar to other vessel caches at Piedras Negras, but was surrounded by chunks and small nodules of local chert. The presence of chert nodules and nodule fragments in platform and stairway constructions also extends to the earlier Pyramid R-5. Underneath the platform of R-5, Héctor Escobedo discovered a neatly spaced layer of chert nodules and early-stage production debitage (i.e., chunks and nodule reduction flakes; Figure 7.26). These are the only known examples of chert nodules and production debitage located in the architectural constructions of the site. The chert clearly came from the riverbank directly below the acropolis, because some of it had been water polished and had the same visual characteristics as local cherts. In creating this burial pyramid, the Piedras Negras Maya appear to have recreated the basic structure of the hillside leading up the site center, with the chert at its foundation. The river-bar area was also a place that stone blocks were carved for major architectural construction and also where low quality local chert was worked for making bifacial axes (themselves used in the limestone quarrying). It is possible that they recreated their ancestral mountain while they recalled the processes of production that brought it into existence.

CHAPTER 8

CONCLUSIONS

8.1: SUMMARY OF TEST RESULTS

According to the tested hypotheses and the results of overall analysis at Piedras Negras, chipped-stone production and consumption were highly dynamic through time and involved all sectors of society at particular points in time. The production of obsidian goods appears to have been a restricted activity at the city during Yaxche times and likely before, at least during the Balche phase and possibly as early as the Naba phase (i.e., Early Classic). With the onset of Chacalhaaz times obsidian-blade production became more widespread and more eccentrics were deposited in caches. This increase was accompanied by additional styles of eccentrics and reduction techniques. These patterns suggest that more people became craft specialist in obsidian, and that more obsidian was imported to the site during the Chacalhaaz phase. The production of obsidian goods was restricted once again during Kumche times, but it is unclear whether this had any relationship to centralized distribution, because the local dynasty was long dissolved by that time. The nature of restricted obsidian production during Yaxche and pre-Yaxche times likely had some relationship to centralized control of material distribution, and also to the relative rarity of obsidian during this time.

Alternatively, the production of microcrystalline-quartz goods was never greatly restricted, and this probably is related to the availability of raw materials in the area. The relative poverty of the site throughout its history, marked by a lack of prestige goods such as jade (Kovacevich and Hruby 2005), may account for the intensive use of sumptuary items made of mundane materials. It must be noted, however, that the majority of microcrystalline-quartz debitage found at the site came from royal platform, burial, and cache deposits. This pattern indicates that microcrystalline-quartz debitage had some significant value to the ancient Maya of Piedras Negras, and that the economic value of debitage from throughout the Maya Lowlands is largely unknown. The fact that production debitage was such an important factor in burial and cache rituals, at Tikal for example, suggests that the value and utility of production debitage is not well understood. The dual role of production debitage, as a cutting and scraping tool and as a regal-ritual offering, may reflect the social role of chipped-stone specialists during the Classic period at Piedras Negras. Specialists in microcrystalline-quartz materials may have been commissioned at certain times of the year to get involved in high-status rituals.

There was a shift in the technology of microcrystalline-quartz eccentrics that accompanied the shift in obsidian eccentrics during the transition between the Yaxche and Chacalhaaz phases. The increase in population, which accompanied this shift, probably had an effect on the organization of craft production in the city. The reorganization evident in the Chacalhaaz phase, however, was more pronounced in the production of obsidian goods.

The production of obsidian and microcrystalline-quartz goods also often co-occurred, suggesting that some of the craft specialists in these materials overlapped in their expertise. The great differences in blade-core versus biface technology reveal that crafters who did work in both materials must have been extremely skilled. The fact that obsidian technologies differed from microcrystalline-quartz technologies for Yaxche eccentrics, indicates that there may have been a division of labor during that time. The florescence of bifacial technologies at the onset of Chacalhaaz times shows that there was an overlap between craft specialists and specialties.

The restricted nature of the obsidian-debitage distribution, marked by obsidian eccentrics in cache deposits, reveals that the royal family had a significant role of in some aspect of the chipped-stone economy and organization of craft production at Piedras Negras. That the royal family amassed relatively large quantities of debitage, but that it was only one among many of producing households, suggests that it was able to employ more than a few knappers in the manufacture of eccentrics and other materials for ceremonial purposes.

Based on these patterns I offer a reconstruction of the production and exchange of high-quality lithic materials. The relative rarity of obsidian and the lack of other prestige goods and materials at Piedras Negras, suggests that the royal family likely was responsible for the importation of obsidian cores, and possibly fine microcrystalline quartzes, and then took it upon themselves to redistribute these materials to selected households, especially during Yaxche times. In return, the royal family received eccentrics, exhausted cores, and fine prismatic blades from producers. Secondarily, this exchange system increased the prestige of all involved parties, maintaining social structure and social cohesion at times by involving multiple households in the site in royal caching activities. Thus, there was also a conversion of symbolic capital that accompanied the exchange of material capital between social groups in the city. The increase in participants in this system over time, however, reveals underlying tensions in the social structure of Piedras Negras near the time of the fall of the royal dynasty (see below). The production and use of chert goods do not appear to follow the strict patterns of obsidian with regard to distribution and value, but chert, and other microcrystalline quartzes, nevertheless retained much of the symbolic potency that obsidian did.

The production of obsidian blades became more widespread during Chacalhaaz times, but the largest pieces of production debitage still appear to have been reserved for the royal family as they were in Yaxche times. This pattern suggests to me that the royal family still had a role in material distribution at this time. The increased number of forms and reduction techniques in obsidian eccentric manufacture during the Chacalhaaz phase indicates that more producers were involved in the production of cache goods. The implication is that there was heightened competition between obsidian blade producers, and that royalty had less control over how the obsidian was distributed. However, the inclusion of more parties in cache good production would have brought more social groups together for cache and dedication events, and may have produced the <u>appearance</u> of wider social cohesion.

Finally, there is a symbolic and economic value to production debitage, especially to obsidian debitage during the early part of the Late Classic. The best evidence of this pattern is the correlation between flake type and symbol during the Yaxche phase and the inclusion of production debitage in royal caches. The technology and symbolism of notched flake and core eccentrics of the Yaxche phase developed slowly over time from techniques established in the Balche and possibly Naba phases. A change in economic organization at the end of the Yaxche phase is marked by a greater amount of obsidian imported to the site, new technologies used to make eccentrics, and possibly more competition between blade producers. Although new forms and reduction techniques were introduced in the Chacalhaaz phase, the notched-flake tradition of the Yaxche phase continued in a minor way up to the abandonment of the site. Thus, while socio-economic changes occurred, some knappers maintained their long-standing production techniques.

There may be a symbolic pattern in Chacalhaaz phase eccentrics and also in microcrystalline-quartz eccentrics, but these patterns have not yet been clarified. The fact that K'awiil is the most common god associated with late-stage biface-thinning flakes in microcrystalline materials suggests that symbolic patterns do exist. The deposition of production debitage in royal burials and pyramid platforms indicates that the symbolism and value of chipped-stone debitage is not well known at this time.

This systematic connection between production debitage and symbolic content indicates that the production of obsidian blades, and possibly other types of chipped-stone production, was a locus for ritualized or ideologically-loaded production. Ideologically-loaded production probably increased the value of chipped-stone products, but also the status of producers in Piedras Negras society. The slow development and maintenance of the notched flake and core eccentrics, which led to the Yaxche obsidian tradition, suggests that ideologically-loaded production may have been more of a doxic practice at that time. An increase in population and the involvement of more obsidian-blade producers in cache ceremonies led to a conflict of interests and competing production-related ideologies. Those who produced alternative forms of eccentrics during the Chacalhaaz phase represent heterodoxy in opposition to the orthodoxic practices of the dominant group. The actual membership in these groups may actually have been quite small, better conceptualized has having competing ideologies held by a few individuals, but the doxa/heterodoxy/orthodoxy distinction accurately describes the role of ideas in the rise of competition evident in the Chacalhaaz phase.

The organizational structure of the oficio system is evident in the large caches of the Chacalhaaz phase wherein deposited eccentrics were made by many different hands. Those in the knapping oficio were brought together, possible as a group, to create the goods necessary to bring off these semi-public ceremonies. At the same time, there was tension between those in the same oficio. As population increased at Piedras Negras and other regions of the Maya Lowlands, membership in other oficios also increased. Sajal and carver titles grow more common in Terminal Classic inscriptions, which suggests that certain oficios were becoming overcrowded. High-status occupations such as these were previously reserved for only a few individuals, and the data presented here suggest that lower-status occupations also were becoming more populated. More individuals competing over diminishing resources likely created social instability. This competition involved material and symbolic aspects, which were bound up in horizontal and vertical social relations. Ultimately, a combination of raw material redistribution by the ruling elite through the importation and gifting of polyhedral blade-cores, and the use and expression of esoteric production knowledge by blade producers, led to the patterns we find in the archaeological record at Piedras Negras.

The symbolic nature of chipped-stone craft specialization appears to be an ever-present element of the economy, and consequently, the notion of symbolic capital is useful in the reconstruction of ancient Maya craft organization. Craft oficios and their products may not have been important to the structure of agricultural production, but they do appear to have been a significant element in civic social-organization. Interaction between these two systems is a topic reserved for future research.

This study has not posited economy or society as the prime mover in shaping the chipped-stone economy, but rather a combination of the two. This socio-economic understanding of the lithic economy is essential if we are to move beyond simplistic descriptions of how and why people shaped the world the way that they did. Of key importance is access to raw materials and also control of esoteric production knowledge. The control of esoteric production knowledge may only have been possible when resources were not widely available, production took place in closed areas, and the transmission of particular forms of religious knowledge and language was not freely shared. Access to raw materials and esoteric production knowledge are perhaps the most important elements to understanding production and consumption at Piedras Negras. Hopefully, the detailed analysis here will be used at other Lowland Maya sites to continue cross-site comparison and increase the general understanding of lithic economies though time.

8.2: RITUAL PRODUCTION AND DEPOSITION OF CHIPPED-STONE GOODS

I offer an interpretation of these technological and symbolic patterns based on the theories of practice I outlined in Chapter 2. A combination of a direct historical approach, ethnographic analogy (see Chapter 2), symbolic interpretation, and lithic analysis shows that obsidian-eccentric production was an ideologically-loaded activity. Notched-flake eccentrics made of obsidian represent a form of effigy that was used in royal caches, but the symbolic content is not limited to the final form. The fact that flakes and blades from crucial stages in the blade making process were reserved for these ritually-deposited goods indicates that the process of blade production was related to the periodic creation of god effigies or idols, which, according to Landa (Tozzer 1941), were ritually produced. The rarity of obsidian at Piedras Negras may have heightened the importance of blade manufacture at the site. As the sole source of obsidian bloodletters and eccentrics, blade making, the passing on of production knowledge, and the display of the final products could have been important social events that required ritualization or ritual circumscription. Since the production of obsidian eccentrics was inherently tied to blade production, it is possible that blade production in general was also a ritualized and an ideologically-loaded activity. The fact that some residential groups produced blades over periods of centuries suggests that the transference of esoteric production knowledge was a guarded practice and was an important factor in creating social identity and personhood for craft specialists.

Context, technology, and symbolism are all important avenues for interpreting archaeological finds. These analyses should be done concurrently in order to elucidate previously unrecognized patterns of social and economic interaction. I have compared the obsidian eccentrics from two different caches to show the value of studying both the lithic technology and religious symbolism. New patterns arise by shifting the focus of analysis, which ultimately allows us to ask different questions about the symbolism of the artifacts and the role of the producers in society. Identifying possible social realms in which ritualized production the use of mythological charter were significant urges us to rethink previous models of craft production in ancient societies. One implication of this research is that understanding more about the identity of craft producers and their products brings us closer to an understanding of value.

I also attempted explain the possible reasons for technological and symbolic change over time. The connections between technological practice, mythology, and ritual are significant, especially if they are asserted as ideologies in a cultural field of production. I argue that different techniques and styles of eccentrics mark competition between craft producers, and that orthodoxic and heterodoxic practices are reflected in the differences between Yaxche-style eccentrics and newly introduced forms in Chacalhaaz times. Although the dominance of the royal family in consuming these symbolically potent goods appears to be total, technological and ritual practice associated with their production may have been important in attaining social success.

Chapter 7 illustrates the relatively static nature of obsidian eccentric production for the early Late Classic period of the Piedras Negras polity. Ritualized production of obsidian eccentrics at this time can be considered as largely doxic experience. In other words, the relationship between symbolism and technology may not have been consciously associated with power relations. World views and technological elaboration could have led to the creation of the eccentric forms of the early Late Classic. Competition between craft producers increased after the reign of Ruler 4, however, and craft ideologies may have been raised into discursive consciousness, typified by the contrast between contested orthodoxic and heterodoxic dispositions. In other words, mythological charter and ritualized production may have begun as a doxic reality, but the intensified political nature of Classic Maya polities provoked obsidian workers to reify symbolically potent aspects of their practice.

In the case of Piedras Negras, politics, as well as economic and demographic factors, played a role in the heightened competition during the end of the Late Classic period. Although the ruling family attempted to bring the ever-increasing number of specialists into public rituals, the internal competition between individuals may have already begun to destabilize the social organization of the center. The attribution of mythological legitimacy to local craftspeople may have led to the unintended consequence of endowed craft producers who ultimately detracted, through their own control of esoteric production knowledge, from the perceived political and religious supremacy of the royal ajaw. This is not to say that royal sequestering of chipped-stone goods and the practice of chipped-stone production were always contested acts of conscious, machiavellian posturing. Instead, at certain moments of political change, members of some craft oficios attempted to demonstrate to the royal family that their product, and the esoteric production knowledge needed to produce them, was the necessary for some public rituals. However, near the time of the collapse of the center the conversion of symbolic capital may not have garnered any long-term economic or material benefit.

The defeat of Ruler 7 in A. D. 808 may have constituted another blow to an already failing type of social organization. Nevertheless, production activities continued for decades after the demise of Ruler 7, often in the same residential groups. Hence, control of the civic economy by the king may not have been substantive during the Terminal Classic. Overall production declined, but the organization of craft production remained relatively static.

We should alter our theoretical frameworks to accommodate social aspects of production, and investigate ways that utilitarian activities may have been religious experiences, or at least, socially recognized and ideologically potent activities. These production techniques also have implications for the uses of products. Interpreting the distinction between ceremonial and utilitarian activities and objects should be reserved until rigorous analyses are conducted, or until a theoretical framework is constructed that supports those claims. This reconsideration should begin with the artifact typologies created and used by modern archaeologists and lithic technologists.

NOTES

[1] A plural or pluralistic economy is more than one economic system in play simultaneously. An example is our own plural economy, which features a regulated and sanction market economy as well as a black market economy, which functions according to different rules and laws (or lack thereof).

[2] I use the term complex city center here because "large city center" does not necessarily describe the basic differences between Colhá and Piedras Negras. Piedras Negras has more elaborate architecture, carved-stone monuments, and plaza groups than Colhá, even though the site and population size may have been similar. However, the problem of discerning what the actual organizational differences between a place like Colhá and a place like Piedras Negras still persists.

[3] The evidence for the ideological elements of production at Piedras Negras is almost entirely from the obsidian sample, and is associated with obsidian-blade manufacture. I use the more general term, chipped-stone producer and chipped-stone craft specialist because similar circumstances and social roles may have existed for the craft specialists working in microcrystalline-quartz.

[4] There are two different, but related forms of esoteric production knowledge involved in chipped-stone production at Piedras Negras: (1) prayers, chants, or rituals carried out before, during, and after production occurs, and (2) the morphology of the product and the symbolic elements associated with its use. Although I believe that there are actually many varieties of esoteric production knowledge, mythological charter being one aspect of this knowledge, I do not explore all of the possible forms of this kind of knowledge here.

[5] The term oficio is based on contact and colonial terminology from the Yucatan and describes an individual's social role and identity based on occupation (Clark and Houston 1998). It is possible, and even likely, that individuals could hold membership in one or more oficios at a time, especially if some political positions changed hands over time, or if a talented individual took part in multiple crafts.

[6] The sajal was apparently a title for nonroyal subsidiary lords who were often garrisoned on the periphery of major political centers, especially in the western Petén area of the Maya Lowlands.

[7] The buildings at Piedras Negras are named after the quadrant in which they are located. Each quadrant has a letter designation and the building names contain this letter in addition to an arbitrary number. Thus, R-5 was the fifth building named in the quadrant. I refer to the remainder of the buildings using this system, such as O-13, R-13, etc. The

cache name contains the name of the building in which it was deposited, as well as an additional number that designates the order in which the cache was discovered. For example the R-5-4 cache was discovered in the R-5 pyramid before Cache R-5-6.

[8] It is possible that K-5-8 is actually a Balche phase (i.e., Early to Late Classic transition period) cache based on new ceramic data.

[9] The reign of Ruler 1 actually started in the Balche ceramic phase, which should be considered as an Early to Late Classic transition period.

[10] Flint can be described as a cryptocrystalline quartz, but I retain the term microcrystalline to streamline discussions of technological variability at the site.

[11] Laurel leaf and celtiform bifaces may not have been considered to be finished, in some cases, because they also constitute a preform for other tools and types of eccentrics. It is possible that microcrystalline-quartz materials were traded in this preform state for further reduction by those who acquired them.

[12] Rovner and Lewenstein (1997), and others (Aoyama 1994; Hester 1976; Potter 1993; Sheets 1977) have reviewed the history of lithic typologies from the Maya area pointing out key developments in the creation of these classification systems.

[13] This typology is described in some detail in Chapter 6.

[14] I refer to lengths of the human hand because of the general propensity in Maya cultures to use body parts as systems of measurements (Houston personal communication).

[15] Inconsistencies in the organization of small bifaces are caused by spatial restraints.

[16] This does not hold true for the Preclassic when bipolar technologies were used for a much wider range of purposes.

[17] Soft-hammer percussion refers to the kind of percussor used in the reduction process. These hammers could have been made of wood, large bones, antler, or soft limestone, but none have been identified at Piedras Negras.

[18] The core is very accessible to the knapper in the step technique and an attendant may not have been necessary. Repositioning the core is simple, even for medial rejuvenation procedures (i.e., rejuvenation from the central portion of the core).

[19] It should be noted, however, that overall artifact counts were not a factor in determining production locales in this study. Artifact counts are only used to further describe a production locale as it is defined here.

[20] It is likely that column altar caches and stelae caches were conceptually connected since the cache contents associated with each usually are quite similar. Column altar caches may designate a completion of a short amount of time or other important periodic rituals.

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