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Lithic Communities of Practice and Daily life in the Northwestern Maya Lowlands during the Late Classic (700-850 A.D.)

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Lithic Communities of Practice and Daily Life in the Northwestern Maya Lowlands during the Late Classic (700-850 A.D.)

By

Flavio Gabriel Silva de la Mora

A dissertation submitted in partial satisfaction of the Requirements for the degree of

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In

Anthropology

In the

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Of the

University of California, Berkeley

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Professor Rodrigo Liendo Stuardo

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Abstract

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Abstract

This dissertation uses multiple lines of evidence to understand production, exchange and crafting in agrarian societies with a focus on the Northwestern Mayan Lowlands during the Late Classic Period (700-850 A.D.). The organization of production in Pre-Columbian times is poorly understood, yet exchange is believed to be critical to the development of sociopolitical relations in ranked agrarian societies, like those in Mesoamerica. This dissertation will examine how the material culture of everyday activities, especially those related to production and exchange, manifests in the archaeological context and reflects communities of practice. It will evaluate two models of control of production and exchange of craft products, primarily lithic products (stone tools) in state-level societies using evidence from regional surveys, household excavation, and archaeometric studies of stone tools. One model proposes that with the development of sociopolitical hierarchies, elites monopolize or centrally control production and circulation of craft goods, even when these productive activities continue to be practiced in decentralized locations, such as dwellings. The second model suggests that craft producers working in decentralized locations may have controlled most or all of the organization of production and distribution of craft products.

Through extensive regional study, I mapped terrestrial and fluvial communication routes and their relationship to settlement pattern and site distributions. I established the least costly, and thus most likely patterns of travel in the region using analytic tools such as GIS. Including excavation at a major site, Chinikihá. Preliminary research established the presence of areas of production of chipped stone tools in an independent residence outside the palace zone. The excavations sought to understand domestic production and local patterns of production and exchange and tested theories around daily practice and social learning. The study includes a larger sourcing analysis of obsidian stone tools and debitage done with Energy Dispersive X-Ray Fluorescence (EXDRF) to reconstruct the movement and exchange distribution. The resulting archaeological analysis and assemblages will reflect local techniques of production, the materials utilized, types of artifacts produced, and consumption practices that will result in a better understanding of the practices of procurement, production, exchange, consumption, social organization, and differentiation, as well as the communal practices in the region.
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Chapter 1

This dissertation examines lithic production, exchange, and consumption as a means to understand economy, social practices and relationships in ranked agrarian societies such as the Classic Maya. It investigates the lives of commoners and questions traditional interpretations about the extent of elite control within the socio-political hierarchy of the Chinikihá and Palenque area in the North Western Maya Lowlands (NWML). It contributes to a wide body of regional research that analyzes social, political and economic relations at the scale of territory and the specificity of a site from a perspective of communities of practice (Johnson 1976a; Lave and Wenger 1991; Liendo Stuardo 2002; Rands and Bishop 2002). This dissertation contributes to that regional knowledge base in three ways. First, it aims to recreate the histories of Maya commoners engaged in stone tool technology by examining the social practices used to teach and learn crafting from a perspective of traditional and experiential learning, grounded in local ways of doing (Hendon 2015; Hirth 2009b; Joyce 2012; Lave 1990). Second, it evaluates several models of economic organization and elite control in agrarian states (Masson and Freidel 2002; McAnany 2010; Rice 2009; Scarborough and Valdez 2009). Third, it links micro-analysis at the rural household and workshop level to a regional dynamic of sourcing, trade, craft specialization and consumption of stone tools, both by commoners and elites, during the Maya Late Classic from 700-850 A.D. It will contribute to the global understanding of social, economic and political relationships in ranked agrarian societies as manifest through stone tools.

Communities of Practice for Stone Tools

This study uses stone tools as the medium to understand production, crafting, technology, procurement, and movement of stone tools in the lives of commoners and how communities of practice were created through this materiality (Joyce 2012; Lave 1990; Lave and Wenger 1991). The focus on stone tool practices from the perspective of household archaeology is used to understand community based traditional forms of learning, grounded in peripheral participation and local ways of doing as means (Lave and Wenger 1991). The development of stone tool production is intimately woven with many aspects of social daily practice observed in the interaction between individuals in a community. This reflects fluid daily practices, where specialized knowledge and technology become one by learned repetition and situated participation through conscious and unconscious ways of doing things (Lave and Wenger 1991). The theoretical perspective of communities of practice allows considering learning and the location of activity in relationship to traditional ways of learning. This means viewing the materiality and location of activities as result of apprenticeship, where people become part of a community through participation in production by being an active agent in the learning process, basic ingredients of crafting, skill and technology appropriation (Clark 2003; Hendon 2015; Hirth 2009a; Lechtman 1977; Lemonnier 1986). The development of technologies, uses and even relationship of humans with stone tools is embedded in different aspects of social development which I intend to explore in the present study.

These materials serve as evidence of shared social practices, technologies, techniques, styles, and decisions. Preferences observed in both ceramic and stone production techniques (including for diverse uses –masonry, tools, and practice) were shared across settlements in the region.

Evidence presented in this dissertation supports the use of the concept of communities of practice, as a horizontal platform where the sharing and learning of stone tool technologies was not necessarily confined to the presence of elite groups or patronage. Thirty percent of the thirty-nine surveyed sites included evidence of production of prismatic obsidian blades, indicating a degree of crafting specialization and sophistication exceeding what was previously assumed for rural commoner households located on the periphery (Silva de la Mora 2012). Microanalysis of the tools allows for greater comprehension of social production, specifically how communities of practice were employed to support teaching and learning of stone tool crafting and how this knowledge was transmitted. In this sense the study explores materiality as a reflection of structured daily behavioral choices that became part of larger communities of practice (Giddens 1979; Joyce 2012; Joyce 2015; Lave and Wenger 1991; Swell 1992).

Lithic Production and Exchange

Stone is abundant and durable and used for a wide range of purposes (Shott 2014). Stone tools and the debitage generated though production and maintenance endure the passage of time, making them the most abundant and enduring type of evidence. The physical characteristics of geologic materials facilitate study via archaeometric and geoarchaeological methodologies (Shackley 2008; Waters 1996). Stone tools can thus help answer questions about human evolution, cognitive evolution, social organization, as well as symbolic and ritualized human behavior (Ingold 1993; Wynn 1993).

The ancient Maya were a cultural group who relied heavily on stone technology and the resulting social practices. This reliance on stone technology should not be mistaken for a default to the lack of potential metal technology. As there is evidence of metallurgy at ritualized contexts such as the deposition of objects (i.e. gold and copper) at places like Chichén Itzá dated to the end of the Late Classic, ca. 800 A.D. (Cockrell 2014; Pina Chan 1970; Thompson and Thompson 1938). Recent studies at Mayapán and Lamanai have also reported the recovery of smelting molds with debris from metallurgic production suggesting local smelting production (Meanwell, et al. 2013; Paris and Peraza Lope 2013). Evidence of the knowledge in techniques of metallurgy production in pre-contact Maya society.

Stone tool production and distribution within local communities in the study area and the site of Chinikihá serve as a case study on material distribution of stone tools. The aim of the study is to use lithic tools and debitage as a material embodiment of social relations created within and by local communities (Joyce 2006; Joyce 2015). I attempt to understand the local and regional lithic communities of practice, providing a regional perspective using lithics (i.e. obsidian, cryptocrystalline stones). I examine the place of stone tool production, a workshop, as well as the stone tools and debitage. I use the production context encountered at a stone tool workshop excavated at Chinikihá as the starting point to understand production and local traditions of stone tools. This bottom-up perspective focuses on the microcosm of an architectural complex as evidence of regional social practices (Ginzburg 2013; Ginzburg, et al. 1993). I use perspectives of communities of practice, technology, knowledge and learning to theorize about production and distribution at the level of site and region.
I also employed a behavioral approach to lithic technology to interpret the manufacturing behaviors embedded in the stone tools (Schiffer 1976; Sheets 1975). The lithic technology approach provides an analytical framework for the classification and examinations of stone tools and debitage, reflecting behavioral decisions and ways of producing daily tools (Shackley 1989; Sheets 2003). I combine the technological analysis with archaeological science tools like Energy Dispersive X-Ray Fluorescence (ED-XRF), to assign source provenance by analyzing the elemental composition of obsidian (Glascock 2011; Joyce 2011; Shackley 1998, 2008, 2011).

The study of stone technology can serve as a tool to understand the “reproduction sequences” or “chaîne opératoire” that can produce information regarding technological processes of production (Schiffer 1975; Shott 2003). This will help comprehend how stone tools were produced and the processes or steps of crafting in stone tools that can be used to understand some of the local traditions of production. Also, the study will attempt to understand reduction sequences, which can be part of continuous processes or the sequence of discrete stages (Bradbury and Carr 1999; Tostevin 2011). The study relies heavily on flake debris analysis (Ahler 1989; Andrefsky 2001). It considers some of the recent concerns on lithic debitage analysis, its downsides and advantages in current archaeological research. Part of the study also included experimental archaeology to understand the reduction sequences and the differences of geologic materials in relationship to stone tool results (Ahler 1989).

By excavating both a workshop and adjoining domestic areas and employing various analyses (e.g. soil chemistry, flotation and carbon dating), I gathered multiple lines of evidence about living and working space. Study of the domestic complex of a family that invested large amounts of time and energy into the production of stone tools resulted in a wealth of information about possible social practices and the life history of their dwelling, Group G at Chinikihá. The use of the different variables provided a lively perspective of daily life and practices from a stone tool perspective.

**Exchange and Economy**

“It remains for me to justify one last choice: that of introducing everyday life, no more no less, into the domain of history. Was this useful? Or Necessary? Everyday life consists of the little things one hardly notices in time and space”

(Braudel 1982: Vol I p 29)

Much of our understanding of the Classic Maya comes from fieldwork in major ceremonial centers characterized by monumental architecture, ball courts, and epigraphy. Prior research has expanded many aspects of elite life including genealogies, historic events, art, architecture, political influence, and ritualized events. A gap remains around Braudel’s “little things” that made up the lives of non-elite Maya—a gap I seek to fill. Without understanding commoners’ daily lives, the dichotomy between elites and non-elites, rural and urban, center and periphery, remains opaque. This can contribute to lopsided views of the Maya. I thus trace the pathway of social activities that underpin Mayan economy, the little things. This tracing illuminates a fuller range of participants in Maya production and exchange: women, children, rural dwellers, apprentices, and master crafters. The study will also illustrate how social learning fueled the transfer of technologies over generations and geographies.

Economies are based and organized around production, exchange, and consumption of goods within communities, yet urban excavations only give us a partial view of how those economies functioned (Costin 1991, 2001; Dobres 2000; 2006; Hendon 1996; McAnany 2010). Also, there
is little agreement on how Maya economic systems functioned and what were the basic forms of social organization that supported them (Hirth 2009a; Hirth and Pillsbury 2013; McAnany 2010; Scarborough and Valdez 2009). Everyone in society, from the ruling individuals to the commoners, required subsistence goods and resources such as obsidian, ground stone, and salt for basic everyday necessities. This study focuses precisely on commoner populations, the “99 percent” of the Maya society (Lohse and Valdez 2004; Marcus 2000).

Traditionally, the term political economy alludes to the ways in which power is utilized to control economic production and exchange in a given society (Masson and Freidel 2002; Rice 2009; Smith 1991, 2004). Michael Smith defines political economy as “polity-centered, decision-making activities of governing personnel that center around the management of resources deemed germane to the polity’s macro systemic welfare as located in the interdependency of those constituent sectors, groups, and factors that the information selected identifies as relevant to such activities and the aims intended” (Smith 1991: 34). This is a model or paradigm of the perfect type of political economic control, but economic power is not limited to the politically dominant. Instead, there is a dialectic relationship seen in many societies, where components of relative economic autonomy, prohibitive geography, and frail political control develop the social power of other sectors of society (Masson and Freidel 2002; McAnany 2010; Sheets 2000). Recent interpretations of Maya economy have considered the complexity derived from urbanism at sites like Caracol in Belize, with large populations and demand for goods (Chase and Chase 2014). To explain the need of large populations for different goods, researchers have used a market-based approach to account for the possible economic exchange of subsistence and prestige goods (Chase and Chase 2004, 2014; Dahlin, et al. 2007; Masson and Freidel 2002).

There seems to be an agreement on the existence of a prestige economy among the royal Maya and other elite groups (McAnany 2013; Rice 2009). This prestige economy included the production, distribution and consumption by elite individuals of certain goods, such as special foods, highly crafted goods (i.e. textiles, bird feathers, animal skins, flowers, perfume and incense), crafted goods made out of precious wood and stones, including jade or marine shells, or even access to valued stones like green stones (Freidel 1986; Sharer 2005). Sometimes the prestige economy models assume that elite groups controlled the production through the appropriation of highly crafted goods made by attached specialists (Inomata 2007). Also, the control and distribution of those goods has been interpreted to be an important element used in feasting, social gatherings that build political links in the elite group or ruling class (Demarest 2013; LeCount 2001; Rice 2009). According to this model long-distance exchange of resources used for daily consumption by all classes of Maya society, such as obsidian, ground stone, and salt, were also under elite supervision and patronage (Andrews 1983; Graham 1987; Rathje 1971; Sidrys 1976).

From the perspective of broader economic activity, larger urban or political centers have been considered to be consumers of everyday goods and perishable items, leading to the characterization of Classic Maya economic structure as a ring model, where the urban centers were consumers and distributors of such goods in a market economy (Ball 1993; Rands and Bishop 1980). Still the mechanisms for exchange by which urban populations acquired such objects or goods are not well understood (Freidel, et al. 2002). Archaeological research has delved into the discussion by documenting material remains corresponding to how material culture reflects such distribution (Braswell 2010; Garryaty 2010; Hirth 1996, 1998; Stark and Garryaty 2010).
An alternative perspective sees the Maya area and Mesoamerica composed of autonomous communities participating in local economies and taking part in production and exchange of goods (Halperin 2007; Hirth 2009a). This perspective suggests that such communities and their economic activities were not necessarily of interest for the elites that dwell in urban centers (Halperin 2007; Hirth, et al. 2009; McAnany 1993, 2010). This view sees the utilitarian economy of everyday production and exchange as somewhat autonomous from the prestige economy that gave power and wealth to elite groups (Feinman and Garraty 2010; Hirth and Pillsbury 2013; McAnany 2010). Regardless of the relative weight given to prestige goods or subsistence goods, studies in the production of utilitarian commodities have proven the importance of household production in Mesoamerica during all time periods (Ball 1993; Freidel 1981; Hirth 2009a; Masson and Freidel 2002; McAnany 2010).


The alternative decentralized subsistence goods model sees independent specialized producers of utilitarian goods engaged in exchange through local networks and market systems (McAnany 1993). Recently, this model has expanded to take into account social organization, agency, and the role of ritual in encouraging specific craft production and structuring exchange (Ball 1993; Hendon 1997, 2006; Hendon, et al. 2014; Joyce and Lopiparo 2005; McAnany 1993; Potter and King 1995). These models do not exhaust the diversity of economic relationships seen in ethnographic and historic accounts, and used in models designed for cross-cultural comparison (Costin 1991, 2001; Dobres 2000; 2006; Hendon 1996; McAnany 2010).

Nonetheless, these models provide a framework of clear alternative interpretations in the study of production, specialization, social organization, and scale of production. In this study such interests circumscribe the social practices of stone tool communities in relationship to grounded daily practice (Bourdieu 1977). Materiality is seen as a reflection of structured daily behavioral and choices on the part of larger communities of practice in the northwestern Maya lowlands (Giddens 1979; Joyce 2012; Joyce 2015; Lave and Wenger 1991; Swell 1992).

This study focuses on how rural Maya commoners lived, worked, traded and learned during the Late Classic period (700-850 A.D). It delves into the production, crafting, technology, procurement, and movement of stone tools in order to understand the lives of commoners and how communities of practice were created in the region (Masson and Freidel 2002; McAnany 2010). The application of a community of practice based approach includes key ideas of non-traditional forms of learning, grounded in peripheral and experiential participation which provides unique opportunities for exploration and interpretation in archaeology (Edens 1999; Joyce 2012; Lave 1990; Lave and Wenger 1991). In all these models, the movement of at least some goods from sources at a distance is critical. What are not usually considered are the routes of exchange, and the archaeological evidence that might exist for them.

**Routes of Communication for Stone Tool Production and Exchange**

This dissertation is a product of a long-term regional project aimed at comprehending the territory and the sites that comprised the landscape of Classic Maya polities, providing a bottom
up perspective that delves into the surrounding region and settlements of the better known site of Palenque (Liendo Stuardo 2002; Liendo Stuardo and Teranishi Castillo 2011). The region was part of an active network of roads that facilitated trade and movement of people integrating an economic system of exchange that extended far beyond the study area. The territory is characterized by landlocked topography where formal and informal routes connected the ancient settlements bordered by two permanent fluvial routes, the Tulijá and Usumacinta Rivers (Figure 1.1 map of study region). This landlocked topography created a network of intersite and intrasite roads which facilitated and bridged settlements locally and regionally (Silva de la Mora 2008, 2011).

Figure 1. 1: Map of study area illustrates the limits of survey and the location within the Maya Area; map PRACH-IIA-UNAM.

The study area has seen regional successive survey efforts starting in the 1960 to better understand the rural and surrounding communities of the site of Palenque (Johnson 1976a; Rands 1967a, 1976). These studies included the first regional surveys of the surrounding area of Palenque that led to the creation of a ceramic typology and a reconstruction of Palenque’s settlement pattern (Rands 1967b; Rands and Rands 1957). More recently, efforts to understand the political and economic integration in the region have facilitated the present study (Liendo Stuardo 2002). Initially, rural study was aimed to define the nature of local resource exploitation, manufacture and ultimately the consumption of ceramics consumed at Palenque (Rands and Rands 1957). Through ceramic compositional analyses the initial study identified the role of Palenque in the regional exchange system, opening a larger discussion around production, consumption and exchange (Rands and Bishop 1980). Palenque apparently acted as the main node for consumption of ceramic wares that were produced in the surrounding areas.

Adding to the work done by the PIPSP (Proyecto Integración Política en el Señorío de Palenque – Political Integration Project in the Palenque Province), the PRACH (Proyecto Arqueológico Chinikihá – Chinikihá Archaeological Project) has been investigating the site of Chinikihá and surrounding region since 2006. Chinikihá was initially reported in 1898 by Teobert Mahler (1901), who found two fragments of carved stone with text that serve as evidence of Chinikihá’s political importance at a regional level (Mathews 2001). Even though inscriptions on monuments are official history, they serve as a point of reference for the possibility of relationships between
the different sites within the area. They are valuable since they can record when ruling families had friendly relationships with ruling families in other settlements, many of which had economic implication. In other instances, the relationships were not as friendly, also having an economic impact, such as the request of tribute through conquest through the use of force and war (Berlin 1958; Marcus 1973; Martin and Grube 2000; Schele 1991).

Following Rands’ regional survey, other surveys began recording the settlement distribution and diversity of archaeological sites (Balcells Gonzalez 2011; Grave Tirado 1996; Liendo Stuardo 2002, 2004; Liendo Stuardo and Teranishi Castillo 2011; López Bravo 2013b; Ochoa Salas 1978; Rands and Bishop 1980). These studies focused on recording the location and physical characteristics of the sites and attempting to reconstruct the historic trajectory of settlement in the region. These prior research efforts, directly or indirectly, laid the foundations for the current study by focusing on rural communities and their surrounding areas. In order to connect regional sites and material culture, this study uses roads and lithics to reconstruct movement of goods and exchange, attempting to understand daily social practices and technology. Archaeological material evidence of roads in conjunction with a Geographic Information System (GIS) least-cost path analysis illustrates and reconstructs the physical routes people used to move and exchange goods (Allen, et al. 1990). An elemental sourcing analysis using ED-XRF was completed on a collection of 1338 obsidian artefacts from field surveys and surface collections in the study region that led to the designation of source. The obsidian collection was also vital in understanding socially constructed technologies used in the region, including prismatic pressure blade technology and production. By incorporating both lines of evidence of lithics and roads, the study seeks to reconstruct regional social practices and paint a fuller picture of Maya economy.

**Synopsis of Dissertation**

The dissertation begins with what I consider a very classical narrative in archaeological research, in the sense that it includes a good data set of field research and explorations done at different sites. The chapters represent different lines of archaeological evidence used to interpret daily life and social practices. The study begins by opening the theoretical background and considerations used throughout the study. Chapter 2 introduces the main concepts and theoretical background, the language used. This chapter introduces a focus on the study of social complexity in relationship to the regional integration, by using samples from commoner contexts at two different levels: the macro and micro levels. The aim is to analyze aspects of social complexity in relationship to stone tools. The emphasis on daily life in an attempt to point to the importance of situated learning and experiential participation in the relationship to group belonging and identity. Theorized through the daily activities that reflect the replication of a group technological knowledge. The daily and existential practice that generates high levels of skill and proficiency and are related to household production. Daily life and daily activities have a deep and profound effect on learning and the embodiment of that knowledge through daily socially based practice (Joyce 2012; Lave 2008).

The chapter introduces theoretical aspects of concepts and models used throughout the study, such as Maya economy, a vital aspect of daily life and which has been an integral aspect of interpretation and discussion of exchange relationships, control and distribution of goods (Masson and Freidel 2002; McAnany 1993; Scarborough and Valdez 2009). The study also introduces a regional perspective by using settlement distribution data in relationship to the roads
and the overall layout of the sites. The use of lithic technologies in relationship to daily life and the communities of practice will serve as the panoramic view at a regional perspective and as a localized perspective of constellations of practitioners (Lave and Wenger 1991; Wenger 1998). The chapter also explores the relationship between the local communities and technology in daily life, seeing some of the implications of knowledge and the value of experiential and referential participation within ancient communities (Hendon, et al. 2014; Joyce and Hendon 2000). It considers the importance of stone tool interpretation in relationship to gender and group identity, where tools and spaces can also demonstrate differentiated specialized activities (Joyce 2008). Because of the nature of the study, the life history of stone tools and the recovered materiality served as evidence of the intimate relationship of crafting, technology and skill in structured daily activities that determined ways of doing and learning (Edens 1999; Lave and Wenger 1991; Lechtman 1977; Lemonnier 1992; Stout and Khreisheh 2015).

Chapters 3 and 4 complement each other, introducing the study region and the material evidence. The regional material evidence serves as the indicator and material traces of different communities, part of a complex network of regional distribution of goods that were exchanged within and beyond the study area. As a general pattern sites like Palenque have seen a lot the archaeological research attention, resulting eventually in an increase interest in the surrounding region of Palenque and the greater northwestern Maya lowlands. This creates a caveat based on a wealth of research activity that have helped to understand a different narrative, where rural communities can be seen as part of the local exchange system and population expansion during the Late Classic (Anaya Hernández 2001, 2002; Campiani 2014; Jimenez Alvarez 2015; Liendo Stuardo 2002; Liendo Stuardo and Teranishi Castillo 2011; López Bravo 2013a; Miron Marvan 2014; Trabanino Garcia 2014). The chapter gives a general perspective on the previous history and archaeological background to the region from the perspective of stone tools and archaeological research (Johnson 1976b; Liendo Stuardo 2002; Liendo Stuardo and Teranishi Castillo 2011; Rands 2007a, b). Included in chapter 3 is a relevant review of literature on lithic technology in the area. It builds upon the previous lithic studies in the region, which also serve as evidence of existing recorded styles and techniques previously reported (Coe 1958; Hruby 2006). The chapter introduces the results of the regional communication routes study that includes the territory from the Usumacinta River to the Tulijá River. These routes connected the archaeological sites following a linear pattern created by the piedmont path and enclosed by the two rivers.

Chapter 4 introduces analysis of the regional obsidian collection, which was analyzed to understand technological aspects of production and attempt to observe some of the local patterns of production, distribution and use. Included in this chapter is the report of an elemental analysis using archaeometric tools, using Energy Dispersive X-Ray Fluorescence (ED-XRF) to assign the provenance and assign possible source (Shackley 1998, 2011; Shackley 2007). The study included an attribute analysis on each artifact to understand production, exchange, and distribution. The chapter also displays the results from analyses using a GIS (Geographic Information System), where the sites and the causeway were used to reconstruct the regional distribution of obsidian and the roads. The GIS data maps were used as a confirmatory tool by creating a cost path analysis and testing the archaeological data with a modern computer-predicting tool.

The following two chapters are interconnected as well and introduce the results of excavations at a domestic group at Chinikihá. Chapter 5 introduces the archaeological site and Group G, an
architectural complex where well-defined spaces were localized which presented the unique characteristics of a production area. The chapter presents the results from three different field seasons of inquiry to understand the local production of stone tools in relationship to the local communities. As other researchers have pointed out, studies in production areas in the Maya area are somewhat limited (Andrieu 2013; Hester and Shafer 1984; Mallory 1986; Moholy-Nagy 1990). The importance of workshop areas represents a unique opportunity to study different aspects of social organization and technological relevance (Kent 1984). The chapter introduces the architectural compound and the excavations. The excavation utilized techniques developed for household archaeology to better understand the use of spaces through the implementation of soil chemical analysis and paleoethnobotany.

Chapter 6 introduces the results from the lithic analysis and some of the social implications of production of the stone tools. The importance of material practices imprinted in the materiality at Group G are the main data utilized to study a commoner family that seems to have had a unique relationship with lithic technology. Also considered are the social implications of knowledge and technology in relationship to social practices. The two chapters, 5 and 6, delve into the subject by using a micro scale perspective to understand larger issues of social organization and communities of practice (Ginzburg 2013).

Finally, chapter 7 attempts to recreate a narrative of the local communities of practice of the northwestern Maya lowlands. This narrative is a story of the local communities and their unique relationship with stone tools, the region, and abroad. I also discovered the many different manifestations in the local economy of social knowledge of stone tool production and use. The regional study provided a unique opportunity to analyze the importance of rural communities and the materiality left behind. Bringing out the largest sector of the population through the study of stone tool technology and the communities that were created by that knowledge. A reflection of a very active and thriving economy materialized in the movement of many products. A Maya economy that was not static and not necessarily controlled by some groups of society. Such activity created communities and constellations of practice where the domestic groups were active participants and shared many social practices like traditional ways of learning, goods, and techniques.
Chapter 2: Theoretical and Cultural Background

While ample understanding of the social value of crafted products or the role of long distance acquisition of materials and commodities have been the subject of extensive study, contemporary researchers argue that the fundamental question of how production was organized in Pre-Columbian Mesoamerica is still poorly understood (Feinman 2004; Halperin 2007a; Speal 2009). For the Maya area, the best developed models explore elite control of economic production and exchange (Masson and Freidel 2002). For the Late Classic Maya, there has been a tendency to explain economic organization using a feudal model of organization (Adams and Smith 1981), which asserts the vertical obligations of the producing sector of society to an elite class in the form of taxation. An alternative model has been proposed that emphasizes specialized production and marketing mechanisms (Rice 1987; Scarborough and Valdez 2009).

For the Maya area, models of the economic control by the elite have thus been based on the assumption of elite control over craft production. Interpretative models based on the notion of restriction of knowledge to be exclusive of the powerful, those able to have attached specialists employed as a source of economic wealth. Combined with the control over exchange and distribution of goods that were used to legitimize political power and authority over a broader population (Earle 1982; Freidel 1981; McAnany 2010). Some of these models assumed craft production began as a result of control and influence by an elite group (Smith and Schreiber 2005). In contrast, other scholars call for attention to the crafters and the technical knowledge needed for crafting traditions to emerge and continue (Clark and Houston 1998; Lave and Wenger 1991). Inomata and Houston (2000) argue that attaining skill in flint knapping is not as dependent on access to specialized training as calligraphy, scribal artistry or other types of specialized knowledge based on social status and restricted to particular groups within society. However, some stone tool technology involves a highly skilled body of knowledge, such as that needed for the production of complex chipped stone objects (eccentrics) or pressure techniques (prismatic blades) made and used in Maya sites (Clark 2003, 2007; Costin 2001).

Socio-political factors and social relations should have been crucial to the organization of production, and the location, procurement, and acquisition of raw materials for the manufacture of goods (Costin 2001). Sites in the Maya area have access to multiple deposits of high-quality chert (Hester and Shafer 1991). Also, trade connections link locations in the Maya area to obsidian sources from different parts of Mesoamerica through complex systems of exchange and movement of goods (Arnauld 1990; Moholy-Nagy 2003). Studies of obsidian distribution have been used to assess measures of control of raw material by the rulers of the large archaeological sites (Masson and Freidel 2002; Rice 1987).

In order to evaluate the relative strength of models of Maya economy in which crafting within households produced goods whose distribution depended on the actions of centralized elites, then, this study will examine evidence of crafting in a single medium--chipped stone--within which knapping of locally available and exotic materials took place in the same contexts: households, adopting a comparison within the collections presented and the relationship to the region. I also present the results of the research at a typical commoner residence of stone tool crafters. The study will evaluate the degree to which stone tools were produced and distributed in the region, seeing if such distribution was uniform across these different segments of the population. Drawing on regional data from the settlement zone, the project will also assess the
degree to which the raw material and products moved throughout the region in ways consistent with central control of circulation. Because of the nature of the data collected by this study, a review of the theoretical perspectives to explain macro and micro studies will be considered.

Maya Economy

The nature of Mayan economies has been studied and examined from different perspectives, yet difference and discussion seems to be the best word for understanding the nature and function of this complex term. To elucidate Classic Maya economy prevailing views of how it functioned tend to circle around the behavior of political economies [i.e. centralized prestige goods model (McAnany 1995; Rathje 1972; Sheets 2000; Smith 1991) and decentralized subsistence goods model (Ball 1993; Potter and King 1995; Rice 1987), agentic approaches (Gillespie 2001; Hendon 2000; Joyce and Gillespie 2000), and ritual economy (Conrad and Demarest 1984; Demarest 1992; Hammond 1999; Hill and Clark 2001; Lesure 2002; Masson 1999)]. In the formulation of Mesoamerican economic theory, behavioral models for social change have played a unique influence on political economy approaches from the 1970’s (Earle and Erickson 1977; Hammond 1973; Service 1972; Smith 1976). Models influenced by substantivist work from the two previous decades emphasize the influence of social factors in economic patterns seen through production, distribution and ultimately consumption (Dalton 1967; Polanyi 1957; Sahlins 1965). The models consider and assess the importance of individual economic action related to the overall social structure of how institutions shape those economic arrangements (Wells 2006). Such models have been critiqued for not considering the importance of socially organized production (Wells 2006).

On this note, this study considers research that gives value to social organization, agency, and ritual in relation to economy (Hendon 2006; McAnany 2010; Rice 2009b). When conceptualizing economy, consideration should be given to the plethora of goods and even practices that fall under this category, including some of the specific mental processes and behaviors imbedded in economic action (Cowgill 1993). A wide range of activities could fall under this definition of economic practices, such as food production and consumption, trade, exchange, craft production, specialized knowledge, land ownership and even the use of routes of communication, so the topic has broad application (Cowgill 1993; McAnany 2010; Wells 2006).

Ongoing discussions on Mayan economy continue to question whether local economic activity was autonomous or centrally controlled (Masson and Freidel 2002; McAnany 2010; Rice 2009b; Shaw 2012; Wells 2006). Yet there seems to be agreement on the prestige economy of the royal Maya and other elites (Masson and Freidel 2002). Prestige economy included the production, distribution and consumption of certain goods such as special food like cacao, and highly specialized crafted goods, including imported items like green stones or marine shells like spondylus (Freidel 1986; Sharer 2005). The subsistence economy alludes to resources used for daily consumption of all classes of Maya society, including the distribution of many distinct goods to those groups (Freidel 1981; McAnany 1995; Rice 2009b). Everyone in society, from the ruling individuals to the commoners, required subsistence goods and resources for basic everyday necessities. How subsistence production took place, or how subsistence goods were distributed is not fully understood. The discussion around subsistence and prestige goods in archaeology also considers the distribution and production of certain goods, something that is less clear and which will discuss further below.
Traditionally, the term political economy alludes to the ways in which the power of leaders is utilized to control economic production and exchange in a given society (Masson and Freidel 2002; Rice 2009b; Smith 1991, 2004). Michael Smith (1991: 34) defines political economy as “polity-centered, decision-making activities of governing personnel that center around the management of resources deemed germane to the polity’s macro systemic welfare as located in the interdependency of those constituent sectors, groups, and factors that the information selected identifies as relevant to such activities and the aims intended”.

However this is a model or paradigm representing an idealized type of political economic control. As economic power is not limited to the politically dominant, but rather is a dialectic relationship seen throughout societies, where components of relative economic autonomy, prohibitive geography, and frail political control develop the social power of other sectors of society (Masson and Freidel 2002; McAnany 1995, 2010; Sheets 2000).

A different perspective sees the Maya area and Mesoamerica as composed of autonomous communities practicing local economies and taking part in production and exchange, suggesting that such communities and the economic activities of those communities were not necessarily of interest for the elites that dwell at the urban centers (Halperin 2007b; Hirth, et al. 2009; McAnany 1993, 2010; 2009a, b). Such views see the utilitarian economy of everyday production and exchange as somewhat autonomous from the prestige economy, which gave power to the elite (Feinman and Garraty 2010; Hirth and Pillsbury 2013; McAnany 2010).

Studies in the production of utilitarian commodities have proven the importance of household production during all pre-Columbian epochs (Ball 1993; Freidel 1981; Hirth 2009a; Masson and Freidel 2002; McAnany 2010). David Freidel (1981: 377) argues that the scope and extent of production during the Classic Maya period was effective in accomplishing horizontal and vertical integration of different groups of society. Others have published similar arguments about domestic autonomy and production in Mesoamerica (Ardren, et al. 2010; Halperin, et al. 2009; Hirth 2006; Hirth and Pillsbury 2013; Sheets 2000). It is also important to theorize on how materials were moving, who was producing, exchanging, or the relationship with market systems which manifested at the main nodes of population that were intimately related to the elite or ruling groups. In the Maya area Geoffrey Braswell has explored the idea of market based exchange for the highlands and lowlands of Guatemala (Braswell 2010). His interpretations used a distributional approach to attempt to identify market exchange correlates.

Another area of development has been the importance of ritual in daily practice. The use of ritualized practice in order to understand economic processes has been based on the concepts of Pierre Bourdieu’s habitus (1977) and Émile Durkheim’s (1965) notions of ritual practice as a way of channeling agency. The action orientation of economic activity questions the perception of ritual practice as it applies to cultural norms. Durkheim (1965: 466) notes that “only one form of social activity has not yet been expressly attached to religion: that is economic activity.” In other parts of the world, as in the case of European Neolithic studies, Richard Bradley (1998: 13) complains about the divide between ideology and economy, when in his opinion they are both related. Studies in anthropology have united ritual with economic processes, improving our understanding of the agentive nature of ritual and political economy (Spielmann 2002; Wells 2006). The household mode of production has converged with the economics of ritual practice in order to conceptualize belief and economic systems.
Roy Rappaport (1984: 410) has suggested the idea of a ritual mode of production, which considers the many relations among economy, power and agency in ritual. In this sense Christina Wells and Karla Davis-Salazar (2007) and Christina Wells and Patricia McAnany (2008) have used the notion of ritual economy, while Eric Wolf (1966: 7) used the term ceremonial fund.

An ongoing debate continues the attempt to define what is the Maya economy, and how the prestige goods, subsistence, and ritual economic sectors were integrated. At its most fundamental essence, there is no agreement on how Maya economic systems functioned and what were the basic forms of the social organization behind them (Hirth 2009a, b; Hirth and Pillsbury 2013; McAnany 2010; Scarborough and Valdez 2009). Recent interpretations of Maya economy examine the complexity derived from urbanism, where large populations had a greater need for exchange and produced goods. The result is a view of society where diverse systems of economic production and distribution were active at the same time, resulting in multiple forms of economic exchange arrangements (Hirth 2009a; McAnany 2010; Scarborough and Valdez 2009), and market-based economies (Chase and Chase 2004, 2014; Dahlin, et al. 2007; Masson and Freidel 2002). As recent analyses point toward the importance and strong presence of household production intended for marketplace exchange in local and long distance networks. A reflection of the multiple levels of connectivity of different communities that shared many similar daily practices and needs. Displayed in the preferent movement and exchange of goods that extended throughout Mesoamerica, Central America and even further places in the southern hemisphere. Recent interpretations are questioning the classic top-bottom political economy control model and the role in daily life of Maya populations (Feinman and Garraty 2010; Masson and Freidel 2012).

Some economic models have made the assumption that elite groups controlled production by appropriation of the knowledge and control of attached specialists, or the supervision and restriction of the distribution of certain goods, which allowed to support the feasting of elite groups (Demarest 2013; LeCount 2001; Rice 2009b). Following this model for subsistence economy, resources used for daily consumption of all classes of Maya society, such as obsidian (Sidrys 1976), ground stone (Graham 1987), and salt (Andrews 1983; McKillop 2002) were under elite supervision that controlled the long-distance exchange (Rathje 1971).

Previously larger urban or political centers were considered to be consumers of everyday goods and perishable items characterizing the economic structure of the Classic Maya as a ring model, where the urban centers were consumers and distributors of such goods (Ball 1993; Rands and Bishop 1980). Still the mechanisms for production and exchange by which urban populations acquired such objects or goods is not well understood (Freidel, et al. 2002). Archaeological research has delved into the discussion by documenting material remains corresponding to this type of control reflected through permanent storage facilities (Blanton and Fargher 2010) and differences in how material culture reflects such distribution (Barnhart 2003; Braswell 2010; Garraty 2010; Hirth 1996, 1998; Stark and Garraty 2010). In order to delve into production and distribution of stone tools, theoretical consideration must be given to the knowledge embedded in local communities at the levels of the household and daily practice.

**Social Organization and Production around Stones: Workshops**

How the distribution of raw material and the production of quotidian artifacts are part of a larger debate at the center of Maya archaeology for many decades (Andrieu 2013; Clark and Lee 1984;
Dahlin 2009; De Leon, et al. 2009; Demarest, et al. 2014; Dillian and White 2010; Earle 2010; Glascock 2002; Hirth and Pillsbury 2013; Masson and Freidel 2013; Nelson and Clark 1998; Rice 1987; Sidrys 1977; Tourtellot and Sabloff 1972). The initial archaeological study that examined stone tool production and exchange from the perspective of workshops and the community of producers was done at the site of Colhá in Belize (Hester and Hammond 1976; Hester and Shafer 1984, 1991). Up to this date, this workshop study stands as the most extensive and comprehensive research of stone tool production and exchange for the Maya region (Fedick 1991; Hester and Shafer 1992; Hester and Shafer 1984, 1991, 1994; Mallory 1986; McAnany 1991; Shafer and Hester 1983; Shafer and Hester 1991). Other studies on workshops in the Maya area and Mesoamerica have made an attempt to understand different aspects of these type of activity areas, studying their physical characteristics using different methodologies to study them (Anderson and Hirth 2009; Andrieu 2013; Coe and Flannery 1964; Healan 1992; Hester and Shafer 1992; Mallory 1986; Michels 1975; Moholy-Nagy 1990; Whittaker, et al. 2009).

The research at the Colhá workshops was fundamental in the development of the producer-consumer model, used to account for stone tool production and distribution in the surrounding areas (Dockall and Shafer 1993). Denoting a community-based specialized production of stone tools made from local chert with manufacture evidence dating back to the Late Preclassic and ending in the Terminal Classic (Hester 1982; Hester and Shafer 1984, 1991). The evidence points to the local crafting and production of agricultural stone tools distributed within the surrounding communities (Dockall and Shafer 1993; McAnany 1989). The model resulted in the proposal of two types of consumer sites: a primary consumer sphere located within a radius of 40-50 km and with no indication of local production (McAnany 1989). A second wider radius of 70 km that included the production of specialized crafted prestige items (Gibson 1989; Santone 1997). This interpretative model has only been applied to the Northern part of Belize and stands as an attempt to understand dynamics of exchange, production, distribution, and specialization of lithic communities. The accumulative research in the coastal plain of northern Belize is the best understood region from a perspective of stone tool communities in relationship to workshops and crafting techniques (Speal 2006).

The site and context at Colhá is the only known and studied example of community-based lithic producers in the Maya region, the producer-consumer model so widely used throughout the Maya region for lithic interpretation (Hester and Shafer 1984, 1994). At sites in Belize, where most research of lithic workshops has been done, the publish information illustrates the complexity of the relationships between the acquisition of stone tools and the producer sites, which not always fit a given model. At the site of Cuello in Belize, local production of stone tools was identified and recognized that only one type of artifact was being imported from Colhá (McSwain 1991; Speal 2006, 2009). All the stone tools were locally crafted and distributed. An interpretation of how Cuello did not have the conditions and level of specialization to the same extent as Colhá. However, the evidence found at Cuello indicates the importance of local production and distribution of stone tools, including the crucial set of crafting knowledge held by the residing communities. Similarly to Colhá, where the entire population was in one way or another connected to stone tool production and economy (Speal 2009).

A different approach and one that I find more in line with the context studied is a lineage-based production and exchange model Used to account for manufacture and distribution of daily goods, which considers independent crafters that operated within the boundaries of kinship relationships (Hendon 1991, 1996; Hendon, et al. 2014). An approach used in household archaeology to
theorize about the organization of production and distribution around a maison group through kinship relations (Gillespie 2000; Joyce and Gillespie 2000) or lineage (Hendon 1991) groups through kinship relations, which seem to have enjoyed economic freedom or independence (Hendon 1991; McAnany 1992). Under this model, a certain level of crafting or making of some utilitarian artifacts are manufactured in households and exchanged within reciprocal systems. Just like reported in the provincial production of ceramics, the local communities were active agents in the creation of daily stone tools and artifacts. Including a differentiation in the extent and level of production, as there is an indication that some groups were generating larger quantities of products that were to be employed in exchange. Whether the produced goods were exchanged locally or regionally is up for discussion, and something that should be known in the future as more analysis of lithic tools is carried out.

Another possible interpretation is the production from specialized crafters of certain types of tools that were made only to be distributed to members of the lineage (Abrams 1994: 122). The importance of lineages and kinship structure within Maya society does not necessarily translate to economic independence or dependence, yet opens the possibilities of interpretation (Fox 1988; Fox, et al. 1996; Lemonnier 2011; McAnany 1995). At the site of Chinikihá kinship relationships were probably not exclusive to elite groups, but also part of the community, which could have included specific skills and specific collective lithic knowledge. As it has been observed with the ceramic analysis, the dwellers at Group G seems to have had good access to service ceramic wares through the local economy.

Others have noticed the importance of elite patronage in the production of highly specialized artifacts (Lewis 1996: 359). In relationship to the risk levels and possible errors in association to the production of stone tools, considering the need for enough raw material that will permit for errors and mistakes in production. Also in considering the acquisition power needed to have enough raw materials available to allow the production. The idea that some of the raw material has to be brought in from distant places is connected to patronage as the answer to alleviate some of the cost involved in mistakes and the learning process. In the Maya area production areas or workshops for this type of production are unknown, and whether they were made by elite members (Aoyama 2009) or commissioned by lower status artisans (Lewis 1996) is part of an ongoing debate. Research on stone tool production and debitage, reports production of “specialized” eccentrics in an attempt to identify locations of production of such particular technology and production to understand those social differences (Titmus and Woods 2003: 141). It is also noticeable that reports on workshops are rarely studied or absent in the scientific literature in relationship to Maya ceremonial centers and main nodes of the population (Potter and King 1995; Rice 1987).

The lineage systems under this model are interpreted as vertical, reflecting the social stratification that divides the general society, from the lowest sector to the highest elite families. The means for the exchange and movements of specialized goods and even the level of production by the different levels of societies is also not fully understood. Also, the correlation between the material culture and aspects of lineages work has also been interpreted from a perspective of multicrafting, where households are actively seeing the production of many agents and many crafts (Carpenter, et al. 2012; Healan 2009; Hirth 2009c; Murata 2011). Moreover, multicrafting does not answer many of the questions regarding different aspects of the social organization surrounding the acquisition and movement of quotidian artifacts or their distribution. In this regard, the localization of the workshops at Group G serves as evidence to
study different aspects of daily life and daily practice in association to stone tool production. A workshop is defined as the location of crafting activities that produce goods in larger quantity than those needed by the producer’s consumption (Clark 1990, 1993). Also, the importance of daily activities and situated practice in the context of production is uniquely positioned to theorize about traditional ways of learning like an apprenticeship or mentoring (Högberg 2008; Lave and Wenger 1991; Mauss 1973; Stout and Khreisheh 2015). The manifestation of socially constructed knowledge that impacts many phases of daily life. Generating social value through a community of practice, where agents recreate the active network of cognitive structures that are regularly engaged in the process of participation and belonging.

A unique relationship with Stones

The study of stone tool production has many advantages for the archaeologist since it can reflect the traces daily life and shared practices by focusing on different aspects of stone tool production and consumption. The study of stone tools has seen many different “viewpoints” or theoretical perspectives in archaeology trying to understand the evidence between stone tool technology and our closest prehistoric ancestors (Carbonell, et al. 2007). The unique relationship of stones and humans resulted in the creation of tools so efficient, simple, inventive and ingenious that dates back to the first hominids and the original way of life (Elias 2012; Gibson and Ingold 1993; Perreault, et al. 2015; Plummer and Bishop 2016; Shott 2014). Throughout history, humans have developed a unique relationship with stone materials by developing unique technological manifestations to manipulate and craft tools, including assigning them with social value (Gibson and Ingold 1993; Ingold 1993). These cultural manifestations became social practices that have defined lithic technologies for hundreds and thousand of years. The use of specific geologic materials at different times in human history has been vital to the development of various cultural groups in antiquity, including the Maya who developed their own sets traditional technologies with geologic materials (Church, et al. 1995; Clark 2003b; Clough and Woolley 1985; Hayden 1979; Speal 2009; Villa and Soressi 2000).


Studies in cognition, language, and social organization have developed interpretations around the social value of production and learned technologies. Adding another layer to conceptualize the value of stone tool technology and the unique impact on daily life. Including having biological repercussions that changed the evolution and development of human brains as a result of the advancement of stone tool techniques and their use in daily practices (Wynn 1993). Different researchers are reaching similar conclusions finding evidence in the relationship between stone tool making and brain development that include the development of language and the
implications to social organization (Ingold 1990, 1993, 2000; Stout, et al. 2014; Stout and Khreisheh 2015). Those studies also delve into questions of learning and transmission of knowledge, techniques and technologies, as well as the importance of social interaction and traditional ways of learning.

Stone tools also have the benefit of providing traditional utilitarian goods widely used by all members of society regardless of social status. That presents a unique advantage archaeologically since stone tools are commodities used by everyone regardless of status. Evidence suggests that everyone had a basic knowledge of stone tool technology and practices. I believe that this unique placement of stone tools give a unique platform to understand social questions regarding past communities of stone workers and their daily practices.

**Household archaeology and materiality**

Different goods were produced and acquired through a complex system that included households and the surrounding activity areas. Places where archaeological traces reflect the daily habits, local crafting techniques, and the communities of practice generated. Households have been useful tools and served as indicators of larger sociopolitical change within society (Arnoud and Netting 1982; Hammel and Laslett 1974; Netting, et al. 1984; Wilk and Rathje 1982). The examination of the smallest grouping of people in social units and how those groupings interact within and between societies allows a view of human activity at a finer and more intimate scale (Bourdieu 1973; Goody 1972; Tringham 1995). This type of analysis can elucidate everyday practices around the economy, kinship, religion, and politics. Theorizing materiality in regards to craft production, daily practice, and its association with situated learning and technology.

The concept of materiality as traces of behavior has been used in archaeology to analyze the meaning of culture in order to explore more active aspects of the archaeological context such as “embodiment” or “materializing” of social relations and daily practice (Joyce 2015; Joyce and Hendon 2000; Tringham 2013). The concept of materiality used is based in a variety of social theories, not necessarily developed in archaeology, such as structuration theory (Giddens 1979) and practice theory (Bourdieu 1973, 1977; de Carteau 1984). Within archaeology its application has proven to be productive and rewarding by exploring social daily practice and consider behavioral choices and agency (Hendon 2000, 2006; Robb and Pauketat 2012; Robin 2002). Another developed field in archaeology has been generated by the ideas of Bruno Latour’s Actor-Network-Theory (Latour 2005; Martin 2005), and more recently, debates of new materialism (Bennet 2004, 2010) that I think are useful in understanding agentive problems.

The consideration in social theory to interpret everyday practices and communities of practice can be used to decode traces of activities left behind. The embodiment in the materiality of daily activities (visible and not visible) that can elucidate the ancient local ways of doing (Lave and Wenger 1991; Wenger 1998). The intention is to dissect the context excavated and the traces of activities (or materiality) recovered to theorize about craft production, skill, and ancient technologies in relationship to situated learning and communities of practice, allowing a bottom up perspective of a case study of stone workers and craft-masters (Hendon 2006, 2015; Hodder 1982; Joyce 2015; Joyce and Lopiparo 2005; Lemonnier 1986, 1992; Schiffer 2001).

The development of stone tool production is intimately woven with many aspects of daily practice that includes the continual interaction between many individuals. Theorized as a reflection of the fluid socially structured practices, where specialized knowledge and technology
become one through learned repetition and peripheral situated participation through conscious and unconscious ways of doing things (Lave and Wenger 1991). The theoretical perspective of communities of practice allows considering the importance of traditional ways of learning and the location of activity like workshops or houses. Spaces where many activities took place like the apprenticeships, the possible social interaction between agents, the generation of group identity, the sharing of crafting techniques, technology, the development of skill and craft mastership (Clark 2003; Hendon 2015; Hirth 2009a; Lechtman 1977; Lemonnier 1986).

**Communities of practice**

Learning theories (Lave and Wenger 1991; Wenger 1998) provides a useful frame for archaeologists (Hirth 2006, 2009a; Joyce 2012; Roddick 2016; Sassaman 1992; 2001; Varien and Potter 2008) to study ancient societies. The communities of practice approach examine the nexus of learning, daily practice, social organization, agency, and identity. Communal knowledge, including stone tool production, was shared through daily interactions and everyday practice within the community. The cognitive process of learning—and sharing of that learning between individuals—becomes manifest within material culture (Joyce 2012; Lave 2008; Lave and Wenger 1991; Matusov, et al. 1994; Varien and Potter 2008; Wenger 1998). Thus, the social phenomena of learning are reflected in stone tools and debitage. The communities of practice approach thus provide both a frame to understand and a language to describe the materiality recovered from a Maya commoner’s household compound (Joyce 2005).

To learn stone tool production, practitioners must observe and repeat the techniques associated with flintknapping. Overtime, this leads to craft knowledge and skill development (Aoyama 2007; Carballo 2013; Clark 2003; Costin 2001; Hirth 2009a; Tringham 1996). A process of learning that occurred through social mechanisms such as peripheral participation, apprenticeship and everyday interactions. Learning was embedded within daily life and occurred in domestic and mundane spaces. For example, stone workers in modern Oaxaca learn their craft through organized structures within the family and the home (Cook 1982). The informality of the setting masks formalized learning processes. Routine and repetitive actions are reproduced and embedded in daily practices. Social organization is embodied within the process of producing stone tools. Even social values influence the process of learning with certain practices favored over others (Lave and Wenger 1991; Wenger 1998).

Situated and peripheral learning supports the transfer of technology between generations of practitioners (Joyce 2015; Lave and Wenger 1991). For example, the same technology for obsidian prismatic blade production is found with the first evidence of corn in Oaxaca from circa 3500 BC (MacNeish, et al. 1967: 22) and at an isolated platform in the North Western Maya Lowlands from circa 700-850 AD. Spanish chroniclers also observed the Mexica using the same technology in Post-Conquest street markets or tianquiztli (Clark 1989b: Book X and XI; Sahagun 2006; Torquemada 1975). Communities of practice span generations and can cover extensive territory and different boundaries. As new members are integrated, certain technologies are passed down to the next generation of craftspeople while other less effective practices of lesser social value are discarded.

Traces of local crafting traditions and technologies are seen through the materiality recovered from ritualized or ordinary practices (Hendon 2015; Joyce 2015). The use of activity areas as a unit of archaeological inquiry has provided the opportunity to study the process of production
and similarly learning as an archaeological activity. Formal and informal information and training passed through means of apprenticeship and grounded in active training and learning that are embedded in social organization, a theoretical framework applied in ethnographic studies in modern context (Downey, et al. 2014; Lave 1993, 2011). The perspective has been utilized in ethnography as a tool to study communities and social practice (Hanks 1990, 1996; Watanabe 1997). In modern Guatemalan highland Maya Mam households use specific language in daily practice as a means of proving membership and belonging to specific communities (Watanabe 1997). Mam members continually reiterate their association to the community through social practices embedded in daily language, rituality, and spirituality (Watanabe 1997: 129).

A recent application of the perspective of community of practice was utilized to understand linguistics in relation to social and daily practices in contemporary Maya communities of Yucatan (Hanks 1990, 1996). William Hanks explored speech and language as a tool to examine social engagement through daily practice in reference to learning and participation in social activities. He demonstrated the use of social practices and speech as materiality of learning and the social significance in referential practice, which has a direct connection with many aspects of social life, like identity and group building or belonging, which opens the possibility of inquiry. In this sense speech and cognitive development have also be explored in relationship to stone production and the continuity of technologies and impacts on social life, crafting, daily practice (Gibson and Ingold 1993; Odland 2010) and material culture (Ingold 1993b; Joyce 2012; 2015; Stout 2002; Wynn 1993).

Situated learning theory allows the study of how people create communities of practice through the process of learning and participation in communal association (Lave and Wenger 1991: 49-50). The participant starts a type of apprenticeship, an introduction into local practices through a learning process that includes observation and peripheral participation in daily activities (Lave and Wenger 1991: 29-30; Wenger 1998). People are constantly being exposed to social behavior in doing things, the application of technologies in daily practice that creates communities of practice. Beginning a learning process through the grounded sharing of knowledge, through an initial introduction and inclusion in a group through regular social participation. Initially doing simple tasks and beginning an introduction into decision making of how to produce and make the necessary choices, occurs through a traditional education process that happens to be socially charged and socially constructed with the information on how things are done (Giddens 1979; Lave and Wenger 1991; Lemonnier 1986).

There are many aspects of the learning process grounded in daily practice, the routines and learned choices that lead to efficiency, proficiency, practice, and skill (Costin 2001; Hendon 2015; Stout 2002). The model of communities of practice has great potential for interpreting stone tool production, as an analytical adaptive structure which can be reconfigured depending on the context where activity takes place (Lave and Wenger 1991: 17-18). Individuals have the flexibility to adapt knowledge to the task at hand depending on the social practice and learned activity. There is a freedom that comes with repetitive action and being exposed to techniques and ways of doing through situated learning. Situated learning takes place in a context where everyday customs and ways of doing is part of the lived world, where everyday interactions help the transfer of knowledge (Lave and Wenger 1991: 35). Daily activities and practice grounded on peripheral participation are intertwined with situated learning, practice, knowledge and even identity of communities (Lave and Wenger 1991: 29-30).
The importance of situated learning in the construction of communities and their social identities through legitimate peripheral participation recognizes distinctive aspects of learning that can be of great utility for lithic studies considering production and domestic archaeology. Seeing the value in habitual and daily practice, production, consumption and techniques from a perspective on social practice as the significant entanglement of activities between individuals (master crafter-apprentice), the specific social practices (the embodiment of decisions), the social actors (practitioners) and specific ways of doing (technologies) through a process of inclusion (or exclusion) of new participants into communities and constellations of practice (Lave 2008; Lave and Wenger 1991; Wenger 1998). This model is a practice-based approach that legitimatized peripheral participation as a way of learning and creating communal practices, granting value to social structures and the place where the interactions occur (Lave and Wenger 1991: 29-30; Wenger 1998: 58). A process that integrates social practices, ways of doing, artifacts and identities creating bridges of exchange and flow of knowledge from one generation to the next by communal practice and ways of doing (Lave and Wenger 1991: 29; Wenger 1998: 58).

It is also fundamental to point out the value of traditional forms of learning, as Wenger points out, “the required learning takes place not so much through the reification of a curriculum as through modified forms of participation that are structured to open the practice to members” (Wenger 1998: 58). A community of practice considers the different relations generated through daily practice, activity and location of individuals of all ages, “the concept of community underlying the notion of legitimate peripheral participation, and hence of “knowledge” and its “location” in the lived-in world, is both crucial and subtle” (Lave and Wenger 1991: 98). For Lave and Wenger (1991: 98) a community of practice is “a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice… an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage”. As they explain, the need for action through practice within a social structure, ability, and the necessary conditions for legitimacy define the way learning occurs. Therefore a community of practice can be seen from a more fluid perspective that is not restricted to formal ways of instruction, but opens the door to the use of apprenticeships, and the abundance and varied situations of everyday activity, generating repetition and practice fundamental in individuals becoming proficient and mastering an activity, craft, skill and even social knowledge (Hutchins 1993; Lave and Wenger 1991; Matusov, et al. 1994; Stout 2002; Wenger 1998).

Others researchers have noted the importance of peripheral learning and social interaction, as the transmission of knowledge and how crafting skills are passed from generation to generation through learned social processes and techniques (Ingold 2000b: 353; Odland 2010). In relationship to tool use and the importance of social learning, Tim Ingold (1993b: 433) makes the case that “to understand the activities of tool-use and speaking, they must be seen not as the behavioral products of the operation of higher intellectual faculties, internal to their possessors, but rather as integral to the functioning of an entire system of perception and action constituted by the nexus of relationships set up by virtue of the immersion of the agent in his or her environment”. Communities are constituted by individuals that are part of functioning systems where one generation transmits not only the body of knowledge through a corpus of representations, but by introducing novices into situations that create specific opportunities for those actions and knowledge to be replicated (Ingold 2000b: 354). Ingold refers to scaffolding, areas where people can be introduced into those communities and become part of systems of
practitioners, communities of practice and constellations of practices (Lave and Wenger 1991; Wenger 1998).

Lave and Wenger stress the relevance of co-participation and practice in the broader organization of associations loaded with social meaning. This is something that happens through everyday interaction, such as practice, which can be seen as a constant negotiation of meaning, a process embedded in social engagement (Wenger 1998: 152). As Wenger (1998: 152) clearly states, “practice is about meaning as an experience of every day life” through processes of participation, reification and negotiation of meaning. This is how children learn not only how to speak, but also rules and social principles. Through peripheral learning and everyday practice, learning and becoming part of a group through a culture of acquisition (Lave 1990: 310). Learning can be seen as a process of acquisition through practice, and doing as the application of that knowledge (Ingold 2000b: 416). This underlines the importance of considering practice as an intricate part of learning and doing, the transmission of information and knowledge from one generation to the next, the “internalization of collective representations… enculturation” (Ingold 2000b: 416).

A theory of learning serves as a tool to understand the setting of practice that is indivisible from learning, a process of enskilment and enculturation, understanding and learning through practice (Ingold 2000b: 416). Knowledge is transmitted through the practical engagement that is “constituted in the settings of practice, based on rich expectations generated over time about its shape, is the site of the most powerful knowledgeability of people in the lived-in world” (Lave 1990: 323). Knowledge is constructed and transmitted at all times, from the way people start a fire, to the manufacture and use of a scraping tool or going through the process of lime production for household use. Learning is a “process of social reconfiguration. It transforms communities and economies of meaning” (Wenger 1998: 219).

**Considering Mesoamerican and Mayan communities.**

The use of the concept of communities in American archaeology began with Morgan’s studies in the southwestern United States (Morgan 1965; Varien and Potter 2008) and was initially used as an integral part of settlement pattern studies (Willey 1953). Those initial studies were vital at pointing out the importance of settlements and regional understanding of communities. Contemporary studies have shed light into the social foundation of social life of ancient communities as well as examining it as a concept (Adler 2002; Canuto and Yaeger 2000; Isbell 2000).

The discussion of what can be recognized as an archaic “community”, specifically when considering New World original nations of the Americas, in relationship to their political structure, social organization, and geographical boundaries is valuable in archaeological research (Marcus 2000b: 231). Using current definitions and terminology to account for social organization many years into the past can be problematic (Wylie 2002). We can only observe pieces of traces of communal activities left in the archaeological record, which we translate using and relying on ethnohistoric and ethnological research (Chambers and Young 1979). Research has pointed to the importance of continuity and the passage of knowledge, techniques, technology and cultural ways of doing things, analogous to the concept of a “hard core” or nucleo duro for Mesoamerica (Lopez Austin 2001). Even though the concept was created in reference to Mesoamerican religion and ritual, I think it is relevant on the plane of other social practices and habitual structures shared. The community organization is a basic concept found
throughout Mesoamerica and beyond its borders (Lopez Austin 2001). The long tradition of urbanism and barrio organization, with its formal multiplicity and diversity of attributes, is clear evidence of the many similarities observed in the main urban centers for prehispanic and even modern Mesoamerican communities (Cowgill 1997; Drewitt 1966; Manzanilla 1996; Manzanilla and Barba 1990; Vogt 1992). Architectural compounds with internal patios have been reported and are commonly found at all levels and types of archaeological sites in Mesoamerica and beyond. With many people using specialized locations, following uses and distribution accordingly to tradition, repeating customs and cultural structures embedded in practice and habitual use of space (Delvendahl 2005; Marquina 1964; Preucel 2000). The material culture found at archaeological sites reflects precisely the shared (or excluded) practices between a diversity of groups who had complex systems of exchange and movement within and beyond their borders, seen today as the evidence for contact and exchange of ideas and people (Trombold 1991b). The Spanish Cronistas or Chroniclers attest the importance and complex system of maritime exchange and vessels off the coast of Michoacán, Mexico that went up and down the coast arriving at the coast of Peru in South America (Corona Núñez and del Paso y Troncoso 1958; de Alcalá and Miranda 1980; Tudella 1956). The many roads and connection of people throughout the Americas can only serve as evidence of the movement and exchange of goods from communities in very different topographical region (Trombold 1991a). What I want to stress is the communication between communities and to a greater extent the generated constellations of practices through contact and exchange of goods, ideas and people. The materialization visible in the archaeological record of social practices and ways of living should serve as traces on ancient communal ways.

The use of indigenous models of community contribute to the potential of interpretation of archaeological materials and excavated areas with a study of communal life in prehispanic times (Marcus 2000a). The models of community are of special interest to archaeology since they can be focused on the study of commoner or non-elite communities, broadening our comprehension of the materiality and social practices of others sectors of society. Recent research has pointed to the need of archaeological research of multiple lines of evidence to try to get closer to the many individuals that were part of the social structure of a household, like women, men and children (Ingold 2007; Tringham 1994, 1995). For Mesoamerican communities there are a number of widely used sources of first accounts for original nations such as the Maya (de Landa 1986; Thompson 1991) or Mexico (Acosta 1940; Gibson 1964, 1971; Lockhart 1992), and even using comparisons to places like the Andes in South America (Acosta 1940; Avila and Urioste 1983; Cunow 1929).

The interpretation of what would be considered a Mesoamerican community has been rooted in different sources and studies that have established how we theorize and imagine the many different types of communities, their activities and daily life (Carrasco 1961, 1971; Marcus 2004). At the site of Chinikihá, I refer to communities that occupied the site at the end of the Late Classic (700-900 CE). Those communities constituted all the different levels of society, from commoners to elites, consumers to producers, women, men and children (Lohse and Valdez 2004; Marcus 2004).

The use of ethnography and ethnohistory to interpret and study archaeological societies is an important aspect of the discipline, rooted in Mesoamerican research that has been heavily dependent on accounts from the contact period and Spanish Colony (de Landa 1986; Sahagun 2006; Torquemada 1975) to the use of anthropological research in modern Mesoamerican
communities which happen to include many descendent groups (Chambers and Young 1979; Hanks 1990; Vogt 1973; Watanabe 1997). The study of ancient communities also considers the diverse manifestation of social organization and role of urban and rural communities in those dynamics, studying the structure of their populations, relationship to local economy and social structure (Flannery 1976; Marcus and Flannery 1996; Nichols 1996; Sanders 1979; Sanders 1968). The diversity of the communities within the Maya area must be taken into account since the implications could be different depending on the size of settlements and formal diversity. Such is the case of places like Palenque or Tikal in comparison to smaller rural communities such as La Cascada, Xupá or even Chinikihá, with a more dispersed distribution and much smaller populations.

The use of domestic architecture with very clear patterns can be seen as a reference to the value of communities and the shared social constructs of everyday practices. Modern ethnography has been able to observe recent Mesoamerican communities through the direct study of diverse aspects of communal organization of original nations living in Mexico and Guatemala (Chambers and Young 1979). Many of the studies have been generated through the observation of Maya communities, which makes them of special interest to this research (De Vos 2004; Hanks 1990; Pinkus Rendon 2010; Salazar Ledesma 2010; Vogt 1973, 1992). Defining the study of communities from a Mesoamerican perspective as “a group of people living nearby, most often in a place with recognized geographical or political boundaries. A community study may be the result of research devoted to a single place, or to a part of a community … or to the comparison of a number of recognized and bounded communities” (Chambers and Young 1979: 46).

Maya communities recognized different spaces and used distinctive terminology to allude to those areas, such as the family house, orchards, central patios, or shrines that were considered part of a house (Marcus 2000a, 2004). Below Figure 2.1 illustrates this point by showing an example of a modern Maya house compound in Zinacantán, Chiapas. The foundations of a community can be seen as the house, which also happens to be the basic unit of social organization and the starting point of this study. The house is also a very broad definition, as it can be used in reference to the big houses of the elite groups. Architectural complexes that were given names and dates of inauguration recorded in stone, which included rituals and specific social practices (Martin and Grube 2000; Schele 1990; 1999). It can also be a reference of corporate groups organized within a household structure (Joyce 2000; Marcus 2004). The Classic Maya word for house is na/NAJ, a term which is somewhat vague since it doesn’t denote specific attributes, while the more inclusive word translated as the household is nalil, which included everyone and everything in the house (Ciudad Real 1984: 337, 351; Montgomery 2003: 178). More recently modern Yucatec Maya refer to the house as nah and also make a distinction with ič nah ‘in the house’ to allude to the place where a single “marriage” unit or family lives (Hanks 1990: 325). This is the place where people sleep, keep valuable property, documents, jewelry, clothes, and the shrine with the Santo (saint’s image) including its offering made of flowers, water, food, candles and tobacco (Hanks 1990; Vogt 1992). The living space is socially constructed and composed of both materiality and daily practice. There is also a term for the traditional palm roof house, apsidal in shape, šâ?antih nah, usually with separate internal divisions made by using curtains which are moved throughout the day and night depending on the use or need since the area is usually of common use (Hanks 1990: 326).
Just like in archaic times, the floors of such houses might be made out of sahkap ‘limestone clay’ layers, which are cared for through the application of layers of limestone regularly. Another important term is the k’amul na / kamuulna an allusion to a guest house or a communal house, also a place where women gathered to weave (Ciudad Real 1984: 408). A household can be composed of several structures used for different activities and functions such as the family house, the shrine, roofed areas, storage, cooking and even gathering (Marcus 2000a: 235). Every house and every household cooked and had a kitchen or K’oób’en, traditionally seen as a female space, with specific attributes associated with food preparation and consumption, constructed with a bare earth floor where the fire is kept, and water for consumption (Hanks 1990: 330). Ethnographically they tend to be traditional palm-thatched structures, which allow for movement of air and ventilation for the fire and the cooks, rectangular in shape and where a great amount of time is spend for food preparation (Manzanilla 1987; Warfield 1992).

There is a great diversity in relationship to formal attributes, disposition or layout, size and internal composition of households (Arnoud and Netting 1982; Ashmore and Wilk 1988b; Hendon 1989, 2004; Laslett and Wall 1972). Structures can be formally organized around a central patio that may or may not be plastered, but more commonly an earthen courtyard; or they can have an informal distribution, with different types of structures not necessarily making central spaces like patios (Marcus 2000a, 2004; Montmollin 1995). In this sense the architectural compound studied at Group G would be considered a formal group, with good use of the topography creating a formal distribution around a courtyard. The courtyard and soólar are open spaces surrounding or delimited by architecture creating internal or external spaces, fundamental in daily life and production of customary practices. The widely used family altars can attest to some of the socially constructed daily practices that materialized through formal organization of architecture, of materiality and practices (including rituals) charged with meaning to the community. The use of a family altar located in the middle of a central patio is also a representation of the universe and a reiteration of communal belonging and practice in modern communities (Hanks 1990: 328).
Joyce Marcus makes a distinction among three different types of categories of Maya households: a) “isolates” or individual buildings; b) two to three structures forming a cluster but without a central patio; and c) the formal patio group or courtyard group which also should consider the possibility of many households sharing the patio (Manzanilla and Barba 1990: 44). Observe Figure 2.2 above and 2.3 below for examples of this type of arrangements. Similarly to Bourdieu's discussion in his study of the Berber house there is a relationship to the social construction of spaces (Marcus 2000a: 235). Yucatec Maya participate in referential practices grounded in location that include daily routines that give meaning to membership in a community (Hanks 1990).

The next level of organization in contemporary Maya communities in Yucatan will be the tzukub or neighborhood, and the kuch-teel meaning ward or district that could include at least five and up to twelve households in an area of at least 300 sq. m (Cancian 1992; Early 1992). Spatial distribution and physical distance between structures has been used to separate neighborhoods from one another archaeologically, but we don’t fully understand what this separation could actually mean, especially when considering the relationship of Maya households with the
surrounding areas, both the immediate spaces around houses and the surrounding agricultural fields (Marcus 2000a: 235). Neighborhoods can compose larger units for which the Yucatec word is pet kah or round village, considered equivalent to a hamlet. This might correspond to a cluster of houses that will ideally be identified archaeologically, although this can be difficult if the hamlet is part of different communities living in proximity (Liendo Stuardo 2002). The next larger structure indicated in Yucatec vocabulary of communities is the village or chanchan kah, with chan kah in reference to small towns, noh kah for larger towns or cities, and kanhab as a large town with lands, representing the extension of the community to the ownership of the natural environment, the populated place and the non-populated lands around it (Marcus 2000a). The surrounding areas, maize fields, orchards, and family gardens are also part of the household and the community. The domestic space includes all spaces where people live and work beyond architecture, including the fields, workshops, and social relationships, which constantly create and recreate communities through generation after generation of people that lived and belonged to the communities of practice in the region.

This discussion brings up the question of how to study or define the spatial areas making up a community. One of two ways to define a region is through the mental concept of the people living there, or the reality that exist in space, a place (Marcus 2000a; Miles 1957). The first will be a little harder to get to, while the second can be imagined through settlement distribution and topography. Joyce Marcus makes the case for the perspective of original populations and their view of community as a “network of interactions among families, residential wards, real and fictive kinsmen, trading partners, hamlets, and villages, occupied lands and orchards, perhaps even all the subjects of a local ruler” (Nir 1990: 59-60).

**Structuration and agency in stone tool studies**

Recent theoretical and technical developments have allowed for different paradigms for study and interpretation in lithic studies (Ashmore and Wilk 1988a; Canuto and Yaeger 2000; Healan 1993; Manzanilla and Barba 1990; Marcus 1993, 2000a). Studies have delved into social and economic organization in different parts of the world, looking at society from the perspectives of agency, technology, style, gender and even social identity to name some of these trends (Odell 2004; Shackley 2008). The interest in individual choice, ideology, and symbolism came along with the advancement of interpretive archaeology and opened routes for interpretation of material traces and social structures (Dobres 2000, 2009; Edens 1999; Shackley 2005). Such interest stimulated conceptual approaches and interest in the symbolic features of rocks as a raw material for socially constructed practices and technologies transmitted from generation to generation, also pointing toward the value of knowledge as a skill embedded in social structures and social practices (Shanks and Hodder 1995). These studies served to open an interest in the study of stone tools as markers of gender and the importance of agency in the construction and traces of decisions made by the producers and consumers of those technologies (Ingold 1990; Tilley 2004). Nevertheless these approaches received criticism for their Saussurean or semiotic approach that emphasized artifacts as a series of signs that minimized knowledge and skill of the individuals who used and consumed stone tools (Dobres 1995; Gero 1991; Sassaman 1992). The convergence on the study of meaning created a divide between studies concerned with stone tools as symbols and those studies interested in technical characteristics of stone tools (Dobres 2000; Thomas 1996).
As a result of this split in the study of materiality of stone artifacts other researchers began utilizing the notion of agency (Harrison 2010) based on the relationship between historical structures and human agency explored by Pierre Bourdieu (Kelly 1977; Sahlins 1981) and Antony Giddens (1977, 1990). For Bourdieu practice was conditioned by the habitus, or a system of historically produced structuring dispositions. This is important to archaeology, since it has directed study to people or dwellers in relationship to daily life and social practices. The materiality should be seen as a record of traces of social practices, of what people did or how they lived, their choices as individuals or groups, and how those choices helped them socially construct their realities. In this sense, the material remains are manifestations of the embodied decisions of individuals, their technologies, actions, and the resulting materiality that we as archaeologists can observe (1984; 1979). In this regard agency can be seen as a material form of reproduction that can be identified through excavation and survey and theoretically interpreted (Hegmon 2008: 220). The relationship between daily routines, the household, activity areas and individuals is the main body of theory of Bourdieu (Dobres and Robb 2005: 164). His approach to practice and learning takes into consideration the embodiment of traditional ways of learning, knowledge that is transmitted from generation to generation; defined as the doxa, a constant state of “objective order and the subjective principles of organization” that create a feeling the limits and rules, in daily action (Bourdieu 1977). Once the individual becomes aware of the doxa, it becomes a heterodoxy or orthodoxy (Bourdieu 1977: 154). The hexis therefore is the embodiment of the social structures of the daily routines of the habitus.

Bourdieu utilizes the analogy of a sport to explain how the habitus varies among people, yet action mediated by the habitus is regulated by a set of practices and conscious and subconscious decisions, “ones feel for the game is not infallible; it is shared out unequally between players, in a society as a team” (Bourdieu 1977: 168-169). The players take part in a game of shared practices. For Giddens (1984; 1979), the problem stems from a similar paradigm, as he developed the theory of structuration that defines the arrangements of conditions that intermediate between structure and practice to concede the transformation or reproduction of that structure (Bourdieu 1990: 86). Agency can be seen as social practice linked to the social structure dialectically. According to Giddens (1984) the structures create a medium for practice by both restraining and enabling the process and at the same time the structure is the result of human agency by the reproduction or transformation of those practices. Everyday practice and action enables continuity by creating change and stability through daily reproduction of social practices. Agents create power by being able to mobilize productive resources and material, as power is “generated in and through the reproduction of structures of dominance” (Shanks and Tilley 1992: 128).

Archaeologists have taken Giddens’s and Bourdieu’s work to characterize and elucidate the ways that technologies involve social relationships and engender meaning through the study of social practices and technology in relationship to knowledge and communities (Giddens 1984: 258). The study of technology is in the best position to explore practice theory and agency in relationship to social structures and structuration (Costin 2001; Dobres 1995, 2000; Hendon 2015; Lemonnier 1986, 1992). Dobres and Robb's (2005) research on agency in the archaeological record functions to grasp the continuity or stability and changes in technologies through time. According to these authors, Giddens considers the value of skill and knowledge embedded in daily social practice and how individuals retain and transmit the knowledge, pointing to the consciousness of agents in practice and their appraisal. The structures generated through the construction of daily practices and rituals that have greater political, economic,
social and ritual meanings within the cultural rules and structures. To Giddens, the enactment of agency was a reproduction of the structure (Dobres and Robb 2005: 164-165).

In this regard, the household and activity areas provide a unique opportunity to study the social construction of activities through the study of agency. The developed research in agency and household archaeology has provided a unique and intimate space to understand daily life and social practices. The place where people lived and made decisions or choices, is usually found with accumulation of depositional history represented through the daily practices and agency of the people who live there (Tringham 1991: 94). Studies focused on agency can be perceived as applying individualistic frameworks which can result in structural changes and transformation at the individual plane, that might not necessarily explain the entire structural reproduction (Hegmon 2008). The structure of daily practice and habitual behavior is simply what people do, how is it that people form the habitus and communities through sharing the structures of both conscious and subconscious doxa and choices of people, the skill and knowledge passed down from generation to generation. The structures of structuration can be seen in the way people do what they do, the technology they use and the importance of learning as part of communal living.

The study of materiality has been used to understand precisely agency and aspects of how people lived, where they carried out everyday activities, where they socialized, shared common spaces, grew up and created unique histories, and how they had choice and were part of the social web of knowledge (Hegmon 2008: 226). The study of stone tools and social agency has been expanded by the study of their life histories and afterlives (Dobres and Robb 2005; Gillespie 2001; Hegmon 2008; Joyce 2015; Swell 1992; Varien and Potter 2008). The study of stone artifacts' life histories includes the artifact period of manufacture, use and rejuvenation, in some cases even afterlives, in allusion to instances in which the artifact is recovered after being discarded, at which point it may well be curated or stay dormant before being rediscovered at some point in the future (Harrison 2010).

The focus of agency in stone tool research seems to stay on the process of stone tool manufacture, maintenance and discard represented by chaîne opératoire (Harrison 2010) and Michael Schiffer’s model of the life cycle of stone tools (Leroi-Gourhan 1993; Pelegrin 1990; Pelegrin, et al. 1988; Tixier and Inizian 1983). Changes in form are seen as different phases in the cycle of use of the artifact, and researchers tend to see stone tools as largely passive, used by an agency that is purely social (LaMotta and Schiffer 1999; Schiffer 1972).

**Technology in Mesoamerica**

Most anthropologists will consider technology as something fluid, seen as social knowledge people use through a kit of expertise that allow them to follow social structures and also lets them make choices (Lechtman 1977; Lemonnier 1986), as technology is constituted by many forms in both physical decisions and the formal object(s) or tools and knowledge (Hardy 2016). Technology can take on many forms and shapes. Urusula Le Guin (2004) defines “technology” as the “active human interface with the material world” and in archaeological studies we are in the best position to study the traces or materiality of those choices and application of technologies in the past.

Previous research in Mesoamerica has benefited greatly from information available through ethnohistoric and historic documents that give account and evidence of social organization and community composition before, during and after the time of contact with Europeans (Villa Rojas
The importance of such documents is their help in visualizing the evidence of social practices in relationship to original communities, including how the distribution of goods worked, values of commodities, rites, and even technologies (Alvarado 1934; Corona Núñez and del Paso y Troncoso 1958; Cortés 1985; de Alcalá and Miranda 1980; de Landa 1986; Gage 1946; Garza, et al. 1983 ; Ponce 1875; Tudella 1956). Other information can help us understand matters related to practices for which there might not be much physical evidence, for example the production and technology to produce stone tools. The production of obsidian prismatic blades is a great example to illustrate this point of how certain technological knowledge included a set of learned behaviors and choices to produce the blades (Sahagun 2006; Torquemada 1975).

From a technological perspective the experimentation and reproduction of some techniques has benefited enormously the study of stone tool production, for this accounts and has given unique body of information that has allowed to replicate and understand the chain of events and sequences of production, including proposing possible techniques, or tools used (Hirth and Andrews 2002). Yet, there are many cases for which we don’t fully understand some technological aspects of their production such as the Kaminaljuyu pressure technique, that resulted in very long blades that are considered unique in the Maya region (Clark 2012; Crabtree 1968; Hirth and Andrews 2002; Sahagun 2006).

Technology is also related to the mental schemes learned through tradition and observation of how objects should be produced and used (Hegmon 1992; Lechtman 1977; Lemonnier 1986, 1992). The interest in stone traditions and technology also happens to reflect social embodiment of relationships as the materiality transcends the vessel of the adaptation to the physical world, as the “ways” in which we do things and not just how we make them (Lemonnier 1993: 3). The crafting of anything requires a set of knowledge, of human understanding through knowledge, of how to do and be who we are (Bleed 2008). Such knowledge was usually part of the experience of communities, the social practices and social production of techniques (Bleed 2008: Ingold 2000b; Stout 2002). The traditions or mental processes that underline and dictate the actions on the material world are part of a larger symbolic system (Mauss 1973). Tim Ingold (1993a) explains how the use of the lasso of reindeer men in Salla northeastern Finland has been used for generations with a great level of success and skill to capture escaped or free-range animals, stressing the value of traditions and learned ways of using the lasso. He describes how the lasso becomes an extension of the reindeer men, where the technology and technique creates a tool that reindeer men have kept in use through tradition and the passage of techniques. Without this knowledge and skill, the structure or habitus of this community, the lasso does nothing, we would only think of it as a tool to tie or hold things. As Ingold mentions, the lasso becomes alive, transforming into a type of extension of the user and doing things that he never even imagined. Transformed by traditional ways of using the lasso, technique, technology and tradition form part of a community, which included important decision-making and sophisticated learned techniques.

Similar use of ethnography and studying descendent communities has given scholars a unique opportunity to understand techniques, technologies and daily practice of the Lacandones in relationship to stone tool traditions and customs (Bruce 1976; De Vos 1996; Marion Singer 1991) and modern stone tool production from an archaeological perspective (Clark 1989a, 1991; Nations 1989; Nations and Clark 1983). Among these modern Maya speaking people, Robert Bruce reports songs and chants unique for their ethnographic and technological value (Bruce 1976). More recently Marie-Odile Marion (1991) studied the cultural technological systems of...
Maya Lacandón and delves into their technologies, recording different aspects of daily practice such as hunting, tool production, and the importance of songs as part of the identity and technology of present day communities.

A song originally recorded by Bruce (1976: 24, 25) serves as reference for the importance of social knowledge and oral tradition in understanding ancient technologies, knowledge and practice of flintknapping:

**U K’AYIL TOK’**

La u nachuybân,  
\textit{ni bako’},  
\textit{châk p’okil!}

la in nach’ininobel,  
\textit{lâ kulen}  
in tsâst in to’ok’.

La u na ch’ibil in tok’,  
\textit{äh ch’ibixl}  
La u na ch’ich’il  
in tok’,  
kotmax!

La u na ch’ibil in tok’,  
\textit{la in na ch’ini’},  
\textit{la in na bak.}

\textit{P’ok’uk’un!}

La u na ch’ich’il  
in tok’.  
La u na ch’ibil in tok’  
\textit{la in ch’ini’},  
\textit{la in na bak.}

Witso, eh!  
La u na ch’ibil in tok’.  
\textit{la in chi’ni’},  
\textit{la in bak.}

**CHANT TO THE FLINT**

There are the good flint-flakers  
my antler punches  
!red headed woodpecker!

there is my good quartz hammer stone,  
all sitting there  
where I flame my flint

There is the good grain of my flint,  
\textit{äh ch’ibix palm!}

There is the good flething  
for my arrowheads,  
harpie eagle!

There is the good grain of my flint,  
there is my good quartz,  
there is my good antler punch.

Cresta eagle, p’ok’uk’un!

There is the good flething  
for my arrowheads.

There is the good grain of my flint,  
there is my quartz,  
there is my good antler punch.

Oh bald eagle!

There is the good grain of my flint,  
there is my quartz,  
there is my antler punch.

**Technology and technological style**

The concept of technological choice was initially expanded by Andre Leroi-Gourhan (1993) from original ideas developed by Marcel Mauss (1993) on his influential work of techniques of the body. His influence extends to the study of culture in relationship to the physical and
mechanical connection with the material world. Mauss argued for the study and observation of technical activities in their totality, as part of a social construct that includes habitual cultural processes. Taking into consideration the systemic character of material culture in technological behavior (Lemonnier 1986, 1993). Such a perspective viewed a relationship of technological practice and how people learn and create materiality, pointing toward the importance of the operational sequence and knowledge (Lemonnier 1986). The techniques are seen as social productions where the object created is socially constructed and elaborated through behavior and choices resulting from socialized logic and social learning (Bleed 2001). The importance of this French school of thought contributed on the discussion of technological practice within social structures.

American anthropologists also utilized analogous perspectives and reached a similar view for considering technological practice and society. Heather Lechtman (1990: 27) coined the term technological style, that includes characteristics such as form, function and decoration embedded in technological systems. For her, technologies are performances, communicative systems, and their styles are the symbols through which communication occurs. The relationship among the formal elements of technology establishes the style, which in turn becomes the basis of a message on a large scale. Lechtman was able to bring attention to the unique relationship between practical knowledge and technology in a context of nonverbal systems of expression that communicates basic ideas of the social order in a society. In this sense Lechtman (1977: 13) was able to socialize the role of technology in archaeological research, as she was able to incorporate in her own study cultural ideas and social processes through which systems of beliefs are reflected and produced. Both perspectives, Lechtman’s technological style and the French school of thought illustrated by Lemonnier’s work in culture and technique, see technology as active elements and part of social life. They constitute the human experience and are the result of social interaction, communication, and transfer of knowledge (Lechtman 1977, 1993).

Researchers continued using technology to understand material culture in archaeology (Conkey and Hastorf 1990). For Marcia-Anne Dobres (1995) people participate in and experience technology through their social actions, material and social interaction that happen as they engage in daily life. People and the material world are concurrently created, shaped and reshaped by one another. In this sense technology can be seen as practices that are socially created by which material objects generate their individual life histories (Conkey and Hastorf 1990). Technologies therefore bind together people, products, artifacts, landscapes, materials and meaning, as Dobres (Dobres 2000: 127) explains “agency and practice are no less the heart and soul of human technology”.

Discussion has been sparked about the efficiency of social agency through stone tools, arguing that stone artifacts have often remained apparently static in their designs or form through long periods of time during the past (Dobres 2000: 128). Archaeologists have argued that the answer is within the static nature of stone artifacts, as it is very remarkable to see a widespread effort to create stylistically similar stone artifacts using different raw materials with different knapping or flaking properties (Sassaman 2000; Wobst 2000). Stone artifacts can be seen as reference points in the past, reflecting the ways that humans chose or made decisions in the production of tools and developed technologies, as a response to specific situations in ancient times. The manufacture of stone artifacts can be thought of as an interference in specific situations, an intentional placement of a material object into a situation which the artisan wanted to influence or change by doing so (Wobst 2000: 47).
There has been a connection between archaeological explanations and technology to account for long-term cultural change by following the evolution of prehistoric technologies as seen through tool forms, innovations through time and manufacturing techniques (Wobst 2000: 42). As Marcia-Anne Dobres (2009: 115) explains, “to this day we characterize significant social and cultural transformations by the material technologies associated with them: that handy hominin, Homo habilis, by the invention of ‘extrasomatic’ stone tools; civilization by the advent of agricultural technologies such as the hoe and plow; the ‘Iron Age’ by the iron-smelting process; ‘the modern era’ by the printing-press—and we even speak of living in the ‘Computer Age’”. In the study of stone tools, different archaeologists have defined lithic technological organization in similar and yet different ways (Andrefsky 2006; 2008; Binford 1973; Nelson 1991; Shott 1996b; Torrence 1983). Up to now there is an agreement that lithic technology alludes to the way that humans organize themselves. There also seems to be an association of lithic technology organization with forager societies and their adaptive strategies in how stone tools are designed, produced, recycled and eventually discarded, including their link to land use practices, environment and resource exploitation strategies (Dobres 2009: 115).

Lithic technological organization can be described as the technological strategies that counterbalance economic and social concerns with regards to the environmental conditions and exploitation strategies (Binford 1979; Odell 2004; Shackley 1987, 2005; Torrence 1983). In this regard we can consider lithic technological organization as the strategies that deal in how people acquire, produce, maintain, shape and eventually discard stone tools within the daily lives, practices, choices and even decisions of the tool makers and consumers. A fundamental aspect of lithic technological organization is related to the life of a tool or the life history of stone tools that may or may not include tool reduction, re-sharpening and even recycling (Nelson 1991).

**Stones and histories**

Lithics are in the best position to be studied from a use-life approach that examines the morphological or functional characteristic of tools by considering the process of production to address social interaction (Hendon 2003, 2010, 2015; Joyce and Hendon 2000). The study of long-term histories through the traces of social practices in everyday activities in conjunction with research in households and activity areas can broaden the understanding of the human experience and used technologies (Jeske 1989; Sassaman and Rudolphi 2001; Schroeder, et al. 1997). The relationship between agency and people has been an important area of interest for researchers in the social sciences (Gosden 1999, 2004; Joyce 2015). A dichotomy that can provide an opportunity to study the archaeological traces from perspectives of life history of the artifacts or the use-life of artifacts (Coole and Frost 2010; Farnell 2000; Gillespie 2001; Joyce 2015; Martin 2005; Pauketat 2015), materiality and traces (Tringham 1994: 175) or technology and crafting (Hendon 2015; Ingold 2000a; Joyce 2015) to name some recent research and contribution to archaeology.

The study of the life histories of stone tools is associated with the unidirectional removal of flakes known as lithic reduction sequences first established by William Henry Holmes (Shott 1996). The stages of reduction sequences associated in the past with production phases, stages or continuum in the life span of an artifact (Speal 2009). In North America, the life history approach has been fundamental in the study of bifacial technology. Where the sequences of reduction have been considered from the acquisition of raw material, passing through the different stages of reduction and ending with fluting, notching or sharpening of the stone tool.
The inclusion of lithic tools and detached pieces, also known as debitage or debris is used to understand tool production activities, technologies, techniques and possible uses (Callahan and Dragoo 1979). Diverse sets of studies on lithic debitage have focused on the differences in debitage characteristics to understand technological practices (Ahler 1989; Andrefsky 2007; Clark 1991; Inizan 2012; Pecora 2001; Speal 2009) using behavioral analysis (Sheets 1975, 1978). These studies have focused on the relationship between production technology and platform angles in relationship to the striking platform and flake size to understand behavioral and technological materiality (Ahler 1989; Andrefsky 2001; Odell 1980, 1989; Pecora 2001).

Recent literature has also utilized approaches to the study of lithic reduction sequences from the concept of chaîne opératoire (Cochrane 2003; Davis and Shea 1998; Pelcin 1997). This includes a debate about whether chaîne opératoire comprises a wider scope of processes than the English term of reduction sequences or lithic tool production (Leroi-Gourhan 1964; Pelegrin 1990; Pelegrin, et al. 1988; Schlanger 2005; Sellet 1993; Shott 2003; Tixier and Inizian 1983). The concept of chaîne opératoire includes different stages a tool undergoes, starting at the procurement of raw materials, the stages of manufacture, use (including re-sharpening or curating) and finally discard, and in some cases there is possible later recycling back in the social context (Audouze 1999; Simek 1994).

Sellet (1993: 108) defines chaîne opératoire as a "technological approach that seeks to reconstruct the social organization of a technological system at a given archaeological site". It attempts to understand and describe cultural transformations through the different raw materials and technologies applied in the process of production and use. He has questioned whether the concept of chaîne opératoire is more encompassing than the notion of reduction sequences (Sellet 1993: 106). Very comparable is the study of lithic technology through a perspective intended to reconstruct the sequence of actions or events, daily practices printed within the life history of an object (Shott 2003). This attempts to do a reconstruction of the events and possible social interaction that took place during the different stages and steps in acquiring the raw material, manufacture, and re-sharpening of a tool, which can lead to a reconfiguration of the artifact (Schiffer 2001; Schiffer 1976).

Some artifacts are retouched as needed, resulting in morphological changes and transformation through use and re-sharpening (Brantingham and Kuhn 2001; Flenniken and Raymond 1986; Hiscock and Attenrbow 2003; Tomka 2001). The concept of retouch and curation of stone artifacts was first introduced in archaeology by Binford during the 1970s (Binford 1979). His ideas have been associated with different concepts to better understand the process of curation. Some archaeologists have associated curation with the transportation of stone tools (Binford 1973, 1979). Others have included production, maintenance, transport to multiple locations and even the recycling of tools in their interpretation (Gramly 1980; Nelson 1991). Archaeologist have added the notion of hafting elements, intricate flaking patterns, or even complex tools to the definition of curation and reuse (Bamforth 1986). Yet both concepts seem to be inclusive and consider the different stages of a stone tool production, technology, consumption and eventual discard of the artifact.

The study of life histories of stone tool curation led to a differentiation between curated tools from expedient tools. Curated tools were identified as having extensive retouch and are associated with foragers, while expedient tools had very little retouch and were associated with collectors (Hayden 1975). Later research led to the realization that such a simple relation was not
realistic and that there are many other factors that influence stone tool configuration such as raw material availability, form, and even functionality (Andrefsky 1991; Bamforth 1986). The study of behavioral procedures on stone tools and debitage was introduced and became an important part of archaeological analysis and interpretation (Andrefsky 1994; Bradbury and Franklin 2000; Kuhn 1991; Tomka 2001) and part of the foundation for the present analysis (Michels 1975; Sheets 1974, 1975).

Craft production

In an ethnographic study of pottery production in the highlands of Guatemala, Reina and Hill (1978) provide a model of continuity and shared practices, where the production of certain pottery items can go on with hardly any changes and continuity dating back multiple hundred years, demonstrating the replication of skill and knowledge passed down through generations. The importance of oral traditions and knowledge in traditional cultures is not restricted to stories, but also coins technological knowledge and skill shared and passed down from one generation to the next uninterrupted. There was a continuum in Maya production, entangled in ways of doing (costumbre or custom) or crafting and the specialization of economic production (seen as oficio or craft) in what they called a community heritage (Reina and Hill 1978). The knowledge is connected to memory that creates communities of practitioners. Individuals unified in a productive social unity of economics, ritual and religion. For the “Indian potters, religion and economics are not separate categories. Rather, they have become one; there is religion in pottery making, in selling, and in all aspects of existence” (Reina and Hill 1978: 273). Something similar is observed in stone tool production, where the same tools are seen used generation after generation.

Recently the concept of multicrafting, described by Kenneth Hirth (2006, 2009a) has been widely used in Mesoamerica as a theoretical frame to study social organization around craft production within neighborhoods or communities. Cathy Costin (Carpenter, et al. 2012; Healan 2009; Hirth 2009c) originally defined forms of craft production in terms of whether the producer was independent or under the sponsorship of someone else (attached craft production), and in terms of whether the craft producer was a full-time or part-time specialist. Hirth (1991) instead looks at the way craft production was organized by the residential group. He finds that it is common in Mesoamerican sites for households that engage in one form of craft production to also have evidence of other craft production, taking part in many economic activities. In addition to the examples that Hirth (2006a) studied in Xochicalco, he describes such places as the palaces at Dos Pilas where there is evidence of working of shell and bone into artifacts for scribal practice, along with textile production. These types of studies have helped visualize specialized production of elite groups during the Classic and Late Classic, providing a unique understanding in the use of space and crafting traditions of elite communities (Inomata 2001; Inomata and Houston 2000; Inomata and Stiver 1998).

Some studies have aimed to understand and identify production, in reference to the place where productive activities took place, time invested in the production, how the products are distributed and who controlled the exchanged goods (Hendon 2015; Joyce 2015). Multicrafting research has delved into the plethora of productive activities carried out within the domestic spaces, observing the households as a social unit (Clark 1995; Cobean 2002), while craft production studies have looked at the social aspect of production and learning, how people become part of productive
relationships between people, sharing technologies, knowledge, skill and create communities and constellations of practice in the past (Hirth 2009a).

Summary

This chapter was an introduction into the theoretical framework used in the study. The language used to interpret the material culture encountered. As mentioned earlier, the study uses multiple lines of evidence to understand better the local history and presence of communities living in the region. The appreciation of Maya economy coins a broad range of definitions and social practices that include fluid terms like knowledge, techniques and even styles. Research in the field of stone tools reflects the use of different lines of evidence and theoretical perspectives to better comprehend ancient stone tool technologies, applications and their producers behind the crafting. The studies of stone tools with time have polished ideas about the development of stone tool technology and its influence on the social interaction of individuals in everyday settings (Clark 1995, 2003; Clark and Houston 1998; Hendon 2015; 2009a, b). Furthermore, the recent publication of studies that look at the cognitive relationship of stone tools and language development, including theorizing about the long term biological repercussions of this relationship displays the complex interaction of stone technology and society (Gibson and Ingold 1993; Vaesen 2012) precisely. Other researchers have noted a correlation between social practices and agents, for instance, the knowledge and ways of using and working the many types of geologic materials and the techniques developed during those process of production (Hendon 2015; Schiffer 2001; Shimada 2007). The relationship between learning a craft, reproducing or producing tools and the ancient technologies required are intimately interwoven with the identity of a group (the way things are done and who they are), the personhood of an individual (identity), daily life (everyday activities), situated learning (the place where people live and how they do what they do) and the overall constellations of producers, craftsperson, and consumers.

The chapter also pointed to the importance of the domestic space, the basic unit of social organization, which is tied to other social aspects of daily life. The importance of household archaeology as a window into the analysis of social practices, crafting, and technology. Introducing the reader to the basic concepts of how a community of practice function and its importance from the household level, the community, and ultimately the constellations of practice generated. Also, stone tools can be seen as a reflection of agents that have their unique histories and can help us understand socially based traditional forms of learning and transfer of knowledge. The next chapter will introduce the region and the overall material culture used in the study.
Chapter 3: Settlement and Communication in the Northwestern Maya Lowlands

This chapter will introduce the study region in the northwestern Maya lowlands and discuss some general patterns about the different types of settlements, communication routes, and the local materiality. One of the oldest questions surrounding the northwestern Maya lowlands, specifically the study region, is how did goods and people move around? How did the ancient communities moved and interacted during the Classic and Late Classic? How were goods transported locally and regionally, and what was the means of transportation in the region (Del Rio and Cabrera 1822; Navarrete 2000; Navarrete 1978)? The area around Palenque and Chinikihá was part of an active network of communities that moved and interacted, exchanged goods and ideas, integrating an economic system of exchange extending far and beyond the study area (Figure 5). A review and introduction to the archaeological research carried out in the region, well known for its epigraphic interpretations and archaeological wealth, will set the stage in this section.

The study is part of an ongoing project, and I am presenting results that will serve as the foundation for future research. The chapter will include a synthesis of previous and continuing projects in the area that have studied similar archaeological problems of regional settlement distribution and communication routes (Golden, et al. 2008; Liendo Stuardo and Teranishi Castillo 2011). The region is better known for major urban centers, architecture, and epigraphy of the elite and ruling groups. Places where the bigger nodes of population and urbanism left architecturally impressive material evidence of the state at centers like Palenque, Pomona, Tortuguero, or Yaxchilán (Martin and Grube 2000; Schele 1990; Schele 1986).

Many areas of the Americas have been part of large research projects concerned with the study of communities and settlements, focusing in the dichotomy between urban and rural communities (Jaeger (Liepens) 1991; Nichols 1996; Parsons 1972; Sanders 1979; Willey 1965b, 1978). This type of research has centered on recording the different types of settlements in a region, documenting location, type of archaeological remains (including the size, architecture,
ceramics, and lithics), and formal attributes (mapping, distribution) (Willey 1953; Willey and Phillips 1958; Willey 1965b, 1978). These kinds of studies have been fundamental in presenting regional perspectives and information about communities on the outskirts of urban centers, the so-called rural communities (Andrews 1984; Anschuetz 2001; Ashmore 2003; Gorenflo 1991; Jaeger (Liepens) 1991; Parsons 1971; Ringle 1985; Willey 1953; Willey 1965a).

The northwest Maya lowlands have seen a similar push toward regional studies recording and analyzing settlement distribution (Anaya Hernández 2001; Liendo Stuardo 2002; López Bravo 2013a; Ochoa Salas 1978; Rand and Rand 1957; Vargas Pacheco 1985). These large-scale studies have reconstructed and defined the overall types of sites, recording location, size, and even assigning hierarchy within the local universe of sites.

The information presented was gathered during field surveys, surface collection, and excavations at different sites located in an area of ±600 km² (Figure 3.1). That includes a sample of over 600 archaeological sites and the roads in between. The sites have been mapped and dated with a relative chronology beginning in the Preclassic (600 B.C. – 250 A.D.) through the Terminal Classic (700 – 900 A.D.). The Proyecto Integración Política en el Señorío de Palenque (PIPSP) collected most of the materials analyzed in the region. The second main body of data was accumulated through the Proyecto Arqueológico Chinikihá (PRACH). Both directed by Rodrigo Liendo Stuardo. The first analyzed the rural or surrounding areas in relationship to the biggest node of the population in the region, Palenque. The second explored the site of Chinikihá, and adjacent valleys of Lindavista and La Primavera, Chiapas. The Project has been sponsored by the Universidad Nacional Autónoma de México (UNAM) since 2004 and starting in 2009 a collaboration with Rosemary Joyce at UC Berkeley.

The PIPSP and PRACH have surveyed over 600 km² in the region believed to have been under the political and economic influence of Palenque (Liendo Stuardo 2005; Liendo Stuardo and Teranishi Castillo 2011). In the case of Palenque, epigraphic evidence has served as a point of reference for the city’s importance in regional interpretations of Classic Maya society and politics (Marcus 1976, 1993; Martin and Grube 2000; Schele 1990; 1991). The political history of Palenque has positioned it in the center of political models of Highland Chiapas due to its large body of texts and impressive architecture (Martin and Grube 2000; Schele 1999). These inscriptions have assisted researchers in delineating the possible limits of political control by Palenque, the ruling family genealogy, rituality in relationship to specific events and dates, but most importantly the official history. The richness of Palenque's architecture and its written history permits a reconstruction of the political territory centered around Palenque. With subsidiary sites like Xupa delimiting frontiers to the south, Chinikihá and Pomoná to the East, and El Retiro and Tortugero to the West (Bernal Romero 2011; Liendo Stuardo 2005). Other minor sites reveal important architecture and are located in specific areas within the general settlement area. The lack of epigraphic evidence at some of these smaller sites makes it difficult to reconstruct many other aspects of local histories outside of Palenque. At archaeological sites like Agua Clara, Boca Chinikihá/Lindavista, Chancalá, Cerro Limon, La Concepción, La Providencia, El Lacandón, La Ucrania, El Bari, El Aguacate, Ojo de Agua, Reforma, Santa Isabel, San Joaquín, and San Juan Chancalaito all in relative proximity from each other. Previous studies have increased understanding of the general disposition of the sites, formal attributes, types of archaeological remains and connections thought to be under the direct control of
Palenque's political and economic hegemony (Berlin 1958; Culbert 1991; Marcus 1973; Silva de la Mora 2011).

Such research has been vital in defining our present view of rural communities. Including the secondary sites and the interpretations of political and economic interactions during the Maya Classic Period (Liendo Stuardo 2002, 2005; 2011; López Bravo 2013b). These regional studies included the first settlement pattern research recording and mapping the archaeological variability of settlements. The variability and disposition of the archaeological sites which adapted to the diversity of the local topography, including morphogenic differences seen in the Pleistocene fluvial terraces, Intermediate Plains and Tertiary formations of the Sierra de Chiapas (Teranishi 2011; West 1969).

**Moving through the region: rivers, roads and houses**

There is material evidence of the political and economic implications of movement in the region between different settlements (Bernal Romero 2011; Liendo Stuardo 2002; Ochoa Salas 1978; Rands 1967, 1976). This region has unique topographic and geomorphic characteristics of karstic nature that permitted some of the patterns observed. The landscape also includes many rivers and estuaries. Some areas where those river routes are located can only be navigated on some stretches or tend to be constricted by the terrain. The study region is characterized for the most part as landlocked topography that was the perfect setting for porters or mecapaleros using local roads and paths for land transport (Hammond 1978; Lee Whiting 1978; Navarrete 1991).

Previous studies have characterized and theorized about different aspects of ancient causeways and communication routes in the Americas (Denevan 1991; Earle 1991; Hirth 1991; Hyslop 1991; Keller 2009; Normark 2008; Obenauf 1991; Romanov 1973; Snead, et al. 2009b; Trombold 1991). Just in the Maya area, the exceptional topographic diversity of terrain reflects different adaptations to topographic changes through the use of trodden paths and roads. The traces of social practices were also shared and can be seen in the techniques and adaptations to solve terrain or topographic differences. The shared customs such as the construction techniques are evident in the arrangement of roads and functions throughout the Maya Area (Folan 2001; Gonzales and Stanton 2013; Shaw 2001). Resulting in a great variety of communication routes, types, and technologies applied in the construction and maintenance of causeways. The study of roads and communication routes has also contributed in recording the connection of settlements, distances, and modification to the landscape (Anaya Hernández 2001; Folan 1995; Kurjack and Andrews V. 1976). P

In general terms, the expression for road or causeway in Maya archaeological research has been given the name of *sacbeob* or *zac beob*, meaning white road, an integral part of Classic Maya landscape (Folan 1991; Fowler 2001). The term alludes to causeways in reference to the color and physical characteristics of this type of feature on a karstic landscape (Bolles 2001; Fowler 2001; Keller 2009). When the local communities were asked what they called this land feature, a simple response was the “caminos de los antiguos” the causeways of the ancestors. The local Chol speaking communities would reference to them as *(Z)Sicix Bäbih*, meaning white road (Silva de la Mora 2008). There is one unique case reported in the archaeological literature of stone markers directly associated to a sacbeob at the Cobá - Yaxuná causeway (Stuart 2006; Villa Rojas 1934). Stone monuments placed at defined distances to guide and aid the traveler. The epigraphic cartouches are very eroded but represent a unique case where markers have been found associated with a road connecting two mayor population nodes. It also brings out the
question of why the need to have those markers? Was this derived from political or economic control? Each with their own set of repercussions. It also points to the possibility of porters or travelers using an unknown road, yet important enough to have this type of markers. The causeway between these two sites covers a distance of ±100 km, and the monuments were found spaced at regular intervals. Stuart has interpreted the glyphs as mentioning Sak b’i-hi in Ch’olan (Stuart 2006). Archaeological studies have shown that from at least the Late Preclassic raised causeways were constructed in the Maya lowlands to facilitate movement between and within sites (Andrews 1975; Fowler 2001; Gonzales and Stanton 2013).

The reference to a pathway or causeway can be an allusion to a trail, road, or even a path. The reference to a pathway or causeway can be an allusion to a trail, road, or even a path (Silva de la Mora 2008). Each term or category can be defined and differentiated according to the formal attributes of the travel route. Mesoamerican routes were built or made for porters (mecapaleros). From what is known there was no known beast of burden, diverging from the Andes in this sense (Hirth and Pillsbury 2013). Trails are natural passages or paths, which with the pass of time, regular use, and the tramp of travelers develop into formal routes. In the study area, the natural outcrop became the route of least effort and they can be defined in two general groups. The terms of an intersite and intrasite road have been used in the past to characterized, record, and study this type of cultural feature. Intersite roads are found within archaeological sites and link architectural groups, temples, neighborhoods, or natural features such as caves or sinkholes (Chase 1987; Cobos 2003; Shaw 1998, 2001). The intrasite roads allude build features that connect sites placed at great distances. These can be formal physical routes as the case with sacbeobs that are raised causeways, also interpreted to reflect possible political and economic relations between settlements (Benavides Castillo 1975; Bolles 2001; Golden, et al. 2004; Gonzales and Stanton 2013; Roys 1966; Villa Rojas 1934).

Some roads embody a greater amount of effort and planning in their construction or maintenance, while paths are simply made informally through the natural passages in topography, the tramping of passers and removing of stones that get on the way. This type of road usually has little or no maintenance and cost. Once a stone is removed from the road, the path starts forming and a walking surface is created (Snead, et al. 2009b). A road is also an artificially constructed surface, which reflects an investment of time and effort in its construction. It can be considered a major venture since it requires time to plan, build and maintain. Some raised causeways, or sacbeob, exhibit social organization that can be compared to the organization needed for the construction of a pyramid, a palace, or a temple. In relationship to the investment of labor and engineering capabilities required. Sacbeobs can also have more practical functions, The Cobá to Yaxuná sacbeob served as a marker for the city entrance and as a channeling causeway to collect and gather water for the city's use (Gonzales and Stanton 2013; Leyden 1998).

Settlement Pattern

The information gathered by the PIPSP and PRACH has produced a regional perspective on the material culture, settlements, and distribution of sites representing the rural areas or surrounding settlements. The relationship between the bigger nodes of population, like Palenque and Chinikihá, provide a vital perspective to understand the general structure and distribution of the settlements in the area thought to be under Palenque’s political control (Berlin 1958; Culbert 1991; Liendo Stuardo and Teranishi Castillo 2011; Marcus 1976).
The area surrounding the sites of Palenque and Chinikihá have recently seen a push toward regional studies. Aimed at studying the diversity of archaeological sites in the region (Balcells Gonzalez 2011a; Grave Tirado 1996; Liendo Stuardo 2002, 2004; Liendo Stuardo and Teranishi Castillo 2011; López Bravo 2013b; Ochoa Salas 1978; Rands and Bishop 1980). These studies include the first regional surveys of the surrounding area of Palenque that placed the region within a ceramic typology (Rands and Rands 1957). Succeeded by a perspective on the political and economic integration (Liendo Stuardo 2002). Palenque and the neighboring region has seen regional successive survey efforts starting in the 1960’s (Rands 1967) that have included a variety of archaeological research problems that have gone beyond the study area (Aliphat 1994; Anaya Hernández 2001; Golden, et al. 2004; Rands and Bishop 1980). The first study aim was to define the nature of local resource exploitation, manufacture and ultimately the consumption of ceramics (Rands and Rands 1957). The first ceramic sequence for the region and also the initial reconstruction of Palenque’s settlement pattern. Ceramic Compositional analyses have shown the role of Palenque in the regional exchange system opening the discussion of economy and trade (Rands and Bishop 1980). Following Robert Rands’ regional survey, other studies continued recording the settlement distribution and diversity of archaeological sites, including the material culture (Grave Tirado 1996; Liendo Stuardo 2002; Lorenzo 1978).

These surveys have considered functional variation in nonresidential structures, architectural characteristics, distribution and arrangement (Liendo 2005). That led to the differentiation of settlements based on physical characteristics of the major types of architecture. Including domestic groups, range structures (possibly palaces or administrative buildings), pyramids (likely mortuary shrines), plazas, and ball courts. Co-residential groups in the region have been found to be larger in comparison to those reported for other areas in the Maya area and Mesoamerica (Ashmore 1981; Evans, et al. 1988; Liendo Stuardo 2005). One type of building called a "range structure" in Maya archaeology due to its elongated design, shows a quality of construction and increased volume that has been interpreted as elite residences or for public-ceremonial purposes (Becker 1973). Something hard to prove with surface collections and no excavations. The major type of architectural variation and the easiest to detect has been the presence of pyramids, which are associated with other architectural components such as plazas, ball courts or platforms, and interpreted as having civic-public functions (Liendo Stuardo 2005). For Oliver De Montmollin (1988: 175) range buildings are defined as elite housing based on the formal attributes. Using examples in size and volume distribution of domestic settlements reported at places like Oaxaca. He also considers the difference in residential compounds between the Quiche Maya and surrounding groups (De Montmollin 1988: 177-178).

The differentiation of these larger architectural features has led to recognize clear distinctions supporting their use as civic-ceremonial centers, due to their quantitative and qualitative differences. A quantitative volumetric difference in the larger structures usually built with more carefully worked materials and reflecting a qualitative difference when compared to smaller structures outside the main architectural nodes. These sites present a structural complexity and stand out as being larger and internally diverse in comparison to the surrounding undifferentiated habitation sites. The larger sites also display evidence of elite residences and associated architecture that served political and ceremonial needs. The main examples are Palenque and Chinikihá, Agua Clara, Boca Chinikihá/Lindavista, Chancalá, Cerro Limón, La Concepción, La Providencia, El Lacandón, La Ucranía, El Bari, El Aguacate, Ojo de Agua, Reforma, Santa Isabel, San Joaquín, and San Juan Chancaita.
To understand better the complexity of the rural areas, the sites in these areas were classified following formal criteria established initially by the PIPSP. As single platforms, informal groups, patio-oriented group, and multi patios groups (Liendo Stuardo 2005; Liendo Stuardo and Teranishi Castillo 2011). This proposed classification of archaeological sites has allowed a ranking and ordering of the sites in the study region providing a context to discern political and economic integration within the universe of settlements. Combined with a statistical cluster analysis the settlement distribution has provided a view of the rural communities about other communities and the primary nodes of the population in the area (Figure 3.2).

![Figure 3.2](image_url)  
Figure 3.2: Highlights the settlement distribution and ranking of the sites in the study area.

All sites in the region have a classification and ranking, where the sites of Palenque and Chinikihá (Figure 3.3) are Class 1 sites. Characterized as capitals in the region that in both cases seem to have been the dynastic seat of a ruling family. Usually characterized by expressing the title of K’uhu’l Ajaw or sacred lord, associated to those families. Found starting at the Preclassic Period through the Terminal Classic Period in the region (Liendo Stuardo and Teranishi Castillo 2011; Martin and Grube 2000). They represent the bigger nodes of the population, reflected through the quantity and quality of architecture, and must have also been important centers of political and economic influence in the local region, with connections extending to the Usumacinta and the Petén (Campiani 2011, 2014).
Class 2 sites are represented by structures with significant architectonic volume and height, aligned to at least one plaza. Frequently they were occupied during the entire sequence of occupation, and possess public architecture, such as temples, elongated (range) structures, and in most cases ball courts. These sites also have accessible connectivity and proximity to the sicix bäbih, the formally constructed roads built in the region, discussed further below. The sites included in this Category are Belisario Dominguez, San Juan Chancalaito, La Cascada, La Providencia, Linda vista / Boca Chinikihá, Reforma de Ocampo, Santa Isabel, and Sulusúm (Figure 3.4).

Class 3 sites (n= 45) have many platforms that can be aligned to central patios. They can also, not be aligned but include the presence of complex architecture. Such as elongated tall or L shaped platforms without civic-ceremonial architecture. One possible interpretation of these sites is perhaps they are administrative or public in function. There is a clear pattern in the region of settlements distributed at specific distances connecting the region through the sicix bäbih or roads and located at specific intervals (Figure 3.5).
Class 4 sites (n= 221) constituted by low platforms, aligned to form patio groups or informal groups distributed without a clear pattern. The materials recovered at these locations are usually of domestic use. This type of groups sometimes would form small-dispersed communities. Many others were found in association with the sicix bäbih or sacbeob (Figure 3.6).

Class 5 (n= 191) is represented by single platforms, without any apparent architectural association, the only being to the roads (see Figure 3.7). These platforms appear to be isolated, but as it will be shown later, special stone tool production was also taking place in these isolated places. Finally, field surveys also encountered dispersion of material on the surface with no visible architecture associated.
The study of the rural communities around Palenque and Chinikihá point towards a complex system of settlements where the sites were linked through a Piedmont roads, evidence of movement of people and flow of goods. In modern times usually, ceramics and lithics are the most common form of material withstanding the pass of time. Roads also help understand The appropriation of the Piedmont path. A pathway creating a landscape connected by communities. Where roads, settlements, and Rivers were a fundamental part of daily life (Balcells Gonzalez 2011b; Canter 2015; Canter and Pentecost 2007; Liendo Stuardo 2002; Silva de la Mora 2008; Silva de la Mora and Mirón Marván 2009). The archaeology in the region has shown how the ancient communities shared many practices and technologies, including crafting traditions like stone tool production and use. Figure 3.8 below illustrate the topography part of the Sierra Madre where the local communities appropriated the landscape.

The evidence for domestic and daily life is evident throughout the region and at larger sites site of Palenque and Chinikihá, Places where most research has taken place. With material evidence noticeably related to domestic contexts. Noticeable through the recovery of manos (hand stones), metates (grinding platforms), blades, cutting and chopping tools, as well as weapons. Material evidence recovered during many field seasons that attest of the many practices and histories of
The materials recovered in the region can be seen as traces of everyday activities and social practices that took place in both urban and rural communities or homesteads (Joyce 2015). In the case of Palenque, an emphasis has been given to its importance as a ritual and economic node in regional politics and economy (Grube 1996; Liendo Stuardo 2001; Rands and Bishop 1980). The site is the biggest node of population and the biggest archaeological site in the study region. With barrio-like architectural groups that extended beyond the center of the city (Barnhart 2001; López Bravo 1995). Also positioned in a unique topographic location where temples and palaces were part of everyday life, Palenque's inscriptions name it the great city of Lakam-ha’, or Baakal (Bernal Romero 2011; De la Garza, et al. 2012).

The many temples must have been magnets for pilgrims and believers that fueled the multitudinous products, goods, offerings and material culture that came from many local and foreign communities. For them to walk to the city, whether it was to have access to goods not available otherwise. Or maybe to barter goods produced in the homestead for needed goods. Also, just like pilgrimages in the present, people moved through a landscape along a local Piedmont path following routes that connected the settlements. Many of those routes continue to be active in the present. If not necessarily attracted by the temples, there are many material indications of the importance of imported goods and the efficiency of a regional exchange system. There is a good indication of an active flow of goods, ideas, and technologies at all levels of society (Silva de la Mora 2008, 2011).

The architecture with great public central spaces has been interpreted to be a reflection of social practices common to the Maya and even Mesoamerica. Including the interpretation of large open plazas in the center of the site for markets, just like in the present where people acquired and exchanged stone tools (Barnhart 2003; Braswell 2010; Campiani 2014; De la Garza, et al. 2012; Hirth and Pillsbury 2013; Liendo Stuardo 2001; Mejía 2005; Stuart and Stuart 2008). The importance of the central area of Palenque has been interpreted in relationship to temples, where a recreation of the cosmos and the elite ruling class was part of the official discourse and lineage validation (Greene Robertson 1991; López Bravo 2005; Stuart 2000; Stuart and Stuart 2008). Apart from its cosmological importance, the city size is considered an indication of the need for local and foreign goods, as well as the local production of certain goods for both local use and exchange. Sites like Chinikihá and even smaller ones like Boca Chinikihá were also part of local and long distance exchange through the importation of goods, movement of people, shared technologies and social practices (Braswell 2010; Hirth and Pillsbury 2013).

The many years of research in the region have uncovered materials reflecting the entire spectrum of the population, from elite production and specialized crafting to debitage found during field surveys at Class 5 sites. These formed the materiality of community members that perhaps shared technological practices, like Flintknapping. A reflection of the value of stone tools used in daily life. In the following chapters the study will delve into lithic production at a workshop at Chinikihá, a case study focused on social aspects of crafting and technology in the region. Many questions are surrounding the crafting of stone tools in the region. Including how was it controlled? Were families involved in the production of goods for local or regional use? Was Chinikihá or the dwellers of Group G part of a larger market system? How was this technological knowledge passed from individual to individual? Did anyone control this knowledge? Were stone tools acquired through exchange? Were most stone tools consumed at the site made
locally? Were families controlling types of production? Was such exchange centralized? What about informal merchants and independent workers?

Archaeological inquiry in the region has recovered artifacts and tools that show a high level of skill, knowledge of the physical characteristics of the raw material and productive proficiency. The roads are evidence of the exchange of foreign and local goods and practices that can be recognized through studies in lithics.

**Site distribution and Geographical Information Systems**

The use of Geographical Information Systems (GIS), have been vital in allowing a representation of space, the location, and distribution of geographic information in a coherent form (Conolly and Lake 2006). The settlement distribution has recognized archaeological patterns that can be related to the social and political organization. GIS analysis can generate models of regions to represent and scrutinize the impact of human behavior and action (Carke 1977; Conolly and Lake 2006; Hodder and Orton 1976).

By defining the settlement distribution, the communication routes, the formal attributes of sites including the ceramic and lithic material are vital in making regional differentiations. Through the settlement distribution and the ceramic materials, buffer zones have been identified and proposed (Jimenez Alvarez 2015; Liendo Stuardo 2005, 2007; Miron Marvan 2014; Silva de la Mora 2008). A buffer zone is simply areas where no physical evidence of human occupation can be established, an empty space that separates physically two or more communities in a given space (DeBoer 1981). Sometimes the buffer zones reflect topographic barriers or politically based frontiers that are harder to identify and prove. The lack of materials on the buffer zones identified for the region can be attributed to multiple reasons. Perhaps simply because of a broken topography or physical environment which does not present the correct physical attributes for settlement. Perchance its nature is due to social differences between communities, where physical distance serves as a mechanism to reduce or avoid conflict. Also, it could be that there is an agreement between communities so that neither can use those spaces or that is used by both, a type of shared space (DeBoer 1981). I

GIS studies have been used to understand proximity through analysis and studies of buffer and tessellation between points or sites (Conolly and Lake 2006). That tends to be an analysis of the vicinity of specific points. The proximity is normally considered from the maximum and minimum distances between two points. The program also computes the presence or absence of locations, delimiting areas by considering the location, slope and the distances between sites (Figure 3.9). The buffers are represented as polygons in vector maps and are used to generate maps of distribution to understand regions. Tessellation is the process of dividing those areas into smaller tiles. In archaeology, a similar use of Thiessen polygons to define the influence of urban centers was developed long before the use of GIS (Clarke 1968).
Figure 3.9: GIS buffer zones of the study region.

For the region, the buffer zones are thought to respond to both physical and perhaps even social-political factors (Jimenez Alvarez 2015; Liendo Stuardo 2005, 2007; Miron Marvan 2014). The interpretation for the region has been reached by using ceramic and architectural data. With this investigation, lithic tools are adding another layer in the appreciation of communities of practice by considering stone tools within these buffer zones and the sites (Figure 3.9). The archaeological evidence points toward a move and increases in the population in the region for the Late Classic (Figure 3.10). The existence of these buffer zones might be the result of that expansion, where the empty spaces were being populated by the growing populations of the time.

Figure 3.10: Illustrates the settlement distribution and buffer zones or possible frontiers.

The evidence indicates an expansion of Palenque’s influence in the region during the Otulum-Murcielagos phases (around A.D. 550-750) (Liendo 2005). Even though there are diagnostic Late Formative (450 BC-A.D 250) and Early Classic (250-550 A.D) ceramics identified at sites
such as El Lacandón, Chinikihá, Chancalá and San Juan Chancalaito. It is during the Late Classic that there is a population expansion seen in the increase in settlements in the surrounding region when the influence of Palenque is felt regionally. During the last part of the Late Classic, throughout the horizon Balunte (750-850 AD), the region sees continuing settling in the vacant spaces between the minor nucleated centers (Liendo 2005), creating a landscape of sites distributed through the valleys and piedmont of the Sierra Madre (Liendo 2005).

As noted by Liendo (2005, 2007, 2011), the region has a distribution of settlements with public architecture that are evenly spaced out at precise distances. There is a regular pattern of allocation of administrative sites with public architecture (plazas, large mounds or elongated platforms) connected by the road every 4-6 km. Archaeological sites with public architecture are associated with a communication system and present the establishment of settlements evenly spaced out, which has been translated to a reflection of the possible political control in the region by Palenque (Liendo Stuardo 2007). The distances also represent an important line of evidence into a system of communities that interacted and were connected by a system of practices based on foot movement and long distance exchange (Hirth and Pillsbury 2013; Snead, et al. 2009a).

<table>
<thead>
<tr>
<th>Author</th>
<th>Distance</th>
<th>Time</th>
<th>Location</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morley (1938: Vol. 2, 235-236)</td>
<td>2-3 km</td>
<td>1 hr</td>
<td>Jungle</td>
<td>On foot</td>
</tr>
<tr>
<td>Morley</td>
<td>35 km</td>
<td>10 hr</td>
<td>Jungle</td>
<td>On foot</td>
</tr>
<tr>
<td>Morley</td>
<td>3-4 km</td>
<td>1 hr</td>
<td>River</td>
<td>Against the current</td>
</tr>
<tr>
<td>Morley</td>
<td>9-10 km</td>
<td>1 hr</td>
<td>River</td>
<td>With the current</td>
</tr>
<tr>
<td>Adams (1978: 30)</td>
<td>25-30 km</td>
<td>1 workday</td>
<td>Highlands</td>
<td>On foot</td>
</tr>
<tr>
<td>Adams (1978: 32)</td>
<td>31-36 km</td>
<td>1 workday</td>
<td>Lowlands</td>
<td>On foot</td>
</tr>
<tr>
<td>Scholes and Roys (1948: 422-423)</td>
<td>3.1-3.3 km</td>
<td>1 hr</td>
<td>River</td>
<td>Canoe</td>
</tr>
<tr>
<td>Hassing (1991: 55)</td>
<td>21-28 km</td>
<td>1 workday</td>
<td>Mexican Altiplano</td>
<td>On foot</td>
</tr>
</tbody>
</table>

Table 3.1: Summary of travel estimates for Mesoamerican porters and canoe.

The system provides a unique network of both river and terrestrial routes where people could have easily traveled throughout many of sites within a day (Table 3.1). The region’s unique terrain, with minor sloping, open roads, and accessibility between settlements created a complex system that was entirely connected. Many of the sites are linked in more than the direction described above since paths, trails, and roads all have different physical characteristics, and the site distribution is not only dependent on the Piedmont path or the road. There seems to be a direct correlation between the existence of settlements and the quality of the road. Sites like Palenque or San Juan Chancalaito have examples of roads leading straight into the settlement.

All the field surveys were vital in shaping a view of the region that encompasses both the rural and urban areas. The roads are not only physical constructions but also traces of daily social practice, community interaction, movement of goods and technologies. Having this information was vital and the interest to do spatial analysis and representations of the road recorded through field surveys. The use of GIS was also vital in providing an important tool through the
application of a study to understand spatial and human activity (Conolly and Lake 2006). Network analysis has given archaeological research a very powerful tool that allows for investigating different scales within territories. From the study of rooms within individual buildings to the analysis of networks, cost paths and hydrology in a region (Allen, et al. 1990; Mackie 2001). The application has been of value to the discipline and also to many modern uses in other disciplines. The use of a predictive model like GIS, with the Least Cost Path Analysis (LCPA), was used to observe how the road would be predicted, what are the areas of least effort and least cost.

The least cost analysis (LCA) predicts the possible least cost paths (LCP) within the region; ArcGIS 9.1 Esri version. The tool creates a series of possible networks using the actual connection of points. Using the observable physical links to connect a geographical reference in space. A different type of analysis would be of social network which does not need a physical geographic reference, but a social one (Fischer 2003). The maps were created through an initial set of data objects or entity types that will function as the foundation for all the maps. To create a data modeling at three different levels of abstraction: conceptual, logical and physical (Fischer 2003: 391). People organize their settlements throughout the landscape, and the archaeological record should reflect the ancient way of life (Anaya Hernández 2001; Llobera, et al. 2011; Ordóñez 2003; Taliaferro, et al. 2010).

Archaeologists argue that people tend to organize and locate themselves to ease, constrict, or restrict access (Giddens 1984; Richards-Rissetto and Landau 2014). Roads serve as visual evidence of such interaction. Traces of the places people used to move and the connection between those communities. The causeways in the region are located on a fracture with a porous karstic nature that kept it dry and evident on the surface. Serving as a highway that connected communities locally and abroad as in other regions (Ashmore and Knapp 1999; Doyle, et al. 2012; Llobera 2000; Rapoport 1990).

The mobility of past communities and interaction should become evident by the use of an LCA model to compute the cost of movement across the landscape. This model functions under the principle of least effort (Anaya Hernández 2001; Inomata 2004; Rapoport 1990), with the logic that, all else being equal, people will look for the most efficient and economic path in order to economize and use the least amount of energy (Zipf 1949). Using the spatial analyst extension, the GIS takes into consideration the distance, slope, and also friction of the surface. Calculated by using the angle of the slope, rivers and even the location of the roads in relation to the landscape.

Using the data points or locations, the program generates a data model, a simple representation of reality by a vector. The vector is a mathematical term that corresponds to one or more coordinates representing Cartesian space. The vector structure also represents the real world by using three geometrical primitives: points, lines or polygons(Conolly and Lake 2006: 25). These primitives are defined by coordinate pairs \((x, y)\), called vertices and are described as discrete objects using defined locations and boundaries in the space (Conolly and Lake 2006: 26). The nodes are the vertices located at the ends of discrete lines or intersections. This vector structure has a geometrical relationship between the vector objects, named a topology. The relationship between the topology connections is what generates the relationship between the vector objects and polygons, for example how polygons relate to each other in a given space, such as two adjacent polygons (Conolly and Lake 2006).
Next, a raster data structure is created through a matrix grid of equally sized cells or pixels to represent spatial information (Conolly and Lake 2006: 26). The cell size represents the spatial parameters of the objects and the area covered. They are used to create a digital elevation model (DEM), where each cell has a quantitative value that represents the average elevation across the defined space (Conolly and Lake 2006: 26). They are assigned specific attributes and value to represent and create the friction in the surface. Another important variable is the size of the cell, which defines the resolution of the map. The maps created have a definition of one pixel per m².

To represent and account for the difference in elevation and terrain, the study uses a spatial vector structure called triangulated irregular networks (TIN) which help solve the problem of a two-dimensional representation. The account for elevation by creating a three-dimensional model of elevation. This is also named a digital elevation model (DEM). The study relied on the TIN since it presents more options of analysis if compared to an altitude matrix. A DEM also presents the advantage of having accuracy considering terrain, slope, and surface (Fischer 2003). This creates a vector model to build a digital surface that works as a digital elevation model. The program uses this digital model to account for speed, friction, and minimum accumulated cost. For example, the difference in resistance walking in a flat area or a slope. The following formula to reclassify slopes in the terrain:

\[
\text{Sin (angle) (°slope X 100) = Seno (slope angle X 100)}
\]

This gives the opportunity to reclassify the slopes in 5° intervals:

\[
\text{interval} = (\text{radian (slope)} \times 100).
\]

![Figure 3.11: GIS and LCA in the region. The green lines are the LCA, the yellow lines and points are places were the road was identified.](image)

The maps generated through LCA were vital in reaffirming the importance of the topography in the regional settlement. The route of least effort coincides with the location of the physical roads and even settlements (Figure 3.11). The topography seems to have played an important role in
the process of decision making for the people living in the region. Also, it was valuable to observe the communication and shared practices seen throughout. The site distribution shares many components, as will be seen in the next chapter in the examination of a collection of obsidian analyzed from the region.

**Materiality of roads, Sicix Băbih**

![Regional map with site distribution, roads, rivers, and the GIS LCA.](image)

The many field surveys in the region have contributed to a global consideration of the archaeological materiality of the study area. The importance of recognizing the settlements within a community perspective permits an appreciation of the value of rivers and causeways in the study area (Figure 3.12). Reflected in the distribution of sites in association with a Piedmont path and the linear pattern of the settlement distribution (Liendo Stuardo 2005; Liendo Stuardo and Teranishi Castillo 2011). To the east at the junction of the River Tulijá and Michol, evidence of a site and port have been reported (Balcells Gonzalez 2011a; Canter 2015). At this position, a decision had to be made to get to Palenque, continue on foot or take a cayuco through the Michol River. The site of Palenque is located 32 km in straight path traveling East from the Tulijá. Figure 3.13 illustrates a close up of a Geographic Information System (GIS) map including all the sites and the least cost analysis (LCA) from the Tulijá river to the site of Palenque.
The site of San Miguel is a site that likely served as a port and point of entry towards the Palenque region. Perhaps diverting goods and even traffic of people from places like Toniná in the Highlands. The upstream navigation alternative would be to keep going on the Tulijá to the south into the highlands of Chiapas, which was not part of this study (Canter 2015). There was also a route downstream North toward the Usumacinta and the Gulf of Mexico. The Rio Michol has been reported to be navigable from the Tulijá junction at the San Miguel (Figure 3.14) toward the sites of Santa Rita, Cástulo, El Michol, Las Cúmbres, San Juan, Las Colmenas, El Retiro, Modesto Garcia, and Mira Flores (Balcells Gonzalez 2011b). The Piedmont path continued along connecting all the sites mentioned before and continued from Miraflores toward Santa Isabel. The path extends the Sierra Norte of Chiapas, or Montaña Don Juan through a Piedmont path for ± 32 km from the river Tulijá to the archaeological site of Palenque.

The combination of a river route and a Piedmont path could have been used depending on the type of load and the time of the year. Perhaps in consideration of the easiest route and the more efficient for the traveler. It is also possible that the two routes reflect a possible political control or social organization that dictated who could use which route. A similar possibility could apply to other sections where both routes are present.

At Santa Isabel the riverine option is non-existent, and the traveler had to use the Piedmont path starting in Miraflores. The path became a formal route in proximity to the archaeological sites,
which just like in the rest of the region tend to have a linear pattern of distribution and are associated with the Piedmont path and distributed in a linear pattern.

The sicix bäbih can be considered visually evident in the region, as it can be easily identified. Even running parallel to the modern dirt trail or cattle trail, in use by the local cattle ranchers. The route from Santa Isabel to Palenque was one of the best preserved. Including the clearing and maintenance of the road. Only parts of the Piedmont path present manipulation and investment of work. In a pattern observed in the entire region. Usually, the sections that are worked are in proximity to the sites or next to the sites. On other parts, the Piedmont fracture did not show evidence of manipulation or work. The fracture also has the topographic advantage of providing a naturally occurring flat surface that looks very much like a road, even though is all natural. On this route, the internal space on the road could be easily identified by the existence of walls, making the sicix bäbih very evident. With varying internal space variation measuring on the average between 2-3 meters wide. Furnishing a space in proximity to the settlements that permitted interaction between communities and movement (Figure 3.15).

The road splits about one kilometer before it enters the city of Palenque. One route continues through the north of the site. This route avoids going into the center of the city and would have given freedom of movement around the center. The other route followed straight to enter the west of the city, at the Picota Plaza. This part of the city is unique in many different aspects. It has a standing stela that could have been part of the road and a marker for the beginning or end of the city.

The architectural distribution mapped by Barnhart also presents the possibility of the existence of an intrasite road or sicix bäbih within the city of Palenque (Figure 3.16). The clear and consecutive space observed on the map starting at the Picota Group and leading straight into the center of the city, entering the main plaza where the modern parking lot of the site is located notable (Barnhart 2001). Alfonso Villarojas (1934: 191) reports having a conversation with Frans Blom, who mentioned finding a paved road while excavating within Palenque. Unfortunately, he does not go into detail on the location of the possible intrasite sac beob or sicix bäbih, but this proposal could represent one of those roads. Arianna Campiani (2014) has continued the analysis and has found more possible roads or causeways through an architectural analysis within the site of Palenque. There is a good indication that the city had many entrances and intrasite roads, probably from all directions of the site. Recently intrasite routes have been proposed for the city which awaits to be tested in the future (Campiani 2014; Silva de la Mora 2008).
The south region of Palenque also awaits field surveys, but there is a very good indication that roads could also connect the archaeological sites on that face of the valley and Carro San Juan. To the east from Palenque, the Piedmont path or sicix bābih reaches the site of Nututún located 8 km away. One of the earlier settlements in the region, where ceramics from the Late Formative have been recovered (Liendo Stuardo 2002). Nututún probably also served as a port of entry or exit into the Piedmont route which continues east to west following the Sierra Madre bridging all the sites in different valleys and the lowlands (Liendo Stuardo 2007). The Chacamax is one of the bigger rivers, and it could have been navigated for great distances. Also serving as evidence of another section of the route where both the river and the road were available. Access to both the river and Piedmont routes from this site (Figure 3.17). The route continues to the east, to the site of El Lacandón, located 12 km away. This site also had access to both the river and piedmont routes.
The site of Xupa is a unique site in the region, a rank 2 site with at least 14 structures registered and located near different routes. The site has a strong indication of having an affinity with Palenque through epigraphy, ceramics and architecture (Bernal Romero 2008; Blom 1926; Liendo Stuardo and Teranishi Castillo 2011). The site was initially visited and reported by Franz Blomm (1926), who also describes a stele with an elite female figure, now housed at the Fine Arts Museum in San Francisco. The site is located 8 km to the southeast of Nututún, next to a branch of the Chacamax River and also with access to the sicix bābih. The site of Xupa is an enclave on the valley of Chancalá and was followed by a buffer zone of about ±15 km, between the settlements on the Xupa zone and those close to La Cascada. The buffer zone was identified by the lack of settlements and surface materials, an empty space in an otherwise very populated territory.

The site of Nututún is important for various reasons. It is no coincidence that this site is located next to the river in the place where it is. Some of the oldest evidence in the region comes from that site. The location of the place happens to be next to the modern route or highway that connects the highlands with Palenque. Which also happens to be over parts if not all sections of the old and initial route. There is very good evidence that Xupa had an importance in the past since it functioned as a meeting point in the topography of the Sierra Madre and the valley behind South. The modern road to Ocosingo crosses the river next to the site of Nututún, more than likely over the same route where the ancient road used to be. The local topography functioned as the juncture of the river and the Piedmont path. From Nututún it would have been easy to access the flatlands to the North, Palenque to the west, the sites of San Marcos and the Valley of Lindavista to the east. Xupa and the Valley of Chancalá to the southeast, and the Highlands to the south.

From Nututún the traveler had access to move into two different Piedmont paths and regions. The field survey showed one route that continues east to the Valley of Lindavista until reaching the Usumacinta, and there is good indication that the pattern continues to the Petén and the lowlands in the North (Golden, et al. 2004; Silva de la Mora 2008) A second route was found at the Valley of Chancalá, which also led to the Usumacinta and continues south toward the Rio Pasion region (Bernal Romero 2008; Demarest 2013; Golden, et al. 2004; Silva de la Mora 2008).

Other researchers working in other areas in the region have noted similar patterns since the territory is connected through a series of roads. Built on the Piedmont path created by the folds in the Sierra Madre and Valleys. A pattern noticed by other researchers working similar problems in the larger region (Demarest 2013; Demarest, et al. 2008; Golden, et al. 2004; Johnson 1976a, b; Silva de la Mora 2008). The causeways in essentially moving in all directions connecting communities in all cardinal directions and following the local topography. Patterns of utilization of spaces in the region are common as both settlements and roads are reactivated and reused by modern communities. Some ancient causeways are still in use today.

In the region, there is an evident reuse of the ancient roads, either partially or completely. Different areas have been identified where there is good indication of the reuse of ancient causeways by modern roads. The site of Nututín and Xupa are located next to the modern highway, reusing the ancient roads and causeways. The roads were also used by the Spanish entradas (entries into the jungle) since the 1500s. More recent times, after the independence the exploitation of timber would continue until modern times and part of the history of the Selva Lacandona (De Vos 1994, 1996). The same roads that have been in use for longer than what we
probably imagine. The modern federal highway 199 is the same route that drives through Nututún and goes to the Highlands to the South, specifically Ocosingo, where the ancient city of Toniná is located. Also, not far from Nututún, about 6 km away, at the juncture of highway 199 (Ocosingo) and 307 (Frontera Corozal) the road to the National Park of Selva Lacandona is toward the east and archaeological sites can be seen from the road. About half a kilometer away from the juncture the site of Xupa is located, and can be seen from highway 307. This road is also reported as the old road by Blom when he visited the same sites and continued toward La Cascada and the Selva Lacandona (Blom and Duby 1955; Blom 1957; Blom 1926). Maler also mentions some of the routes reported in this study, as the logging roads that were probably prehispanic in nature (Maler 1896, 1908; Scherer and Golden 2012). There are many examples of this type of pattern, where the modern and ancient roads are the same route, like Santa Isabel, Nututún, Xupa, Chinikihá, and Boca Chinikihá on the town side (Silva de la Mora 2008; Silva de la Mora and Mirón Marván 2009). Another important route in this Valley is the Chancalá River, which runs parallel to the Piedmont path or sicix bäbih and also reaches the Usumacinta. People living in the region had access to both routes and probably used them depending on social factors, commodity, access and time of year.

Figure 3. 18: Detail of the sites, causeway and river on the Chancalá Valley; GIS including LCA, settlements and rivers.

Continuing to the east on the Chancalá Valley, the route of La Cascada - San Juan Chancalaito - Chancalá was identified through field survey (Figure 3.18). From Chancalá to San Juan Chancalaito the entire sicix bäbih was identified and survey in its totality by the author (Silva de la Mora 2008). From San Juan Chancalaito to La Cascada, the information used was from previous field surveys including the sicix bäbih and settlements identified in the past because of lack of permits to survey the land (Figure 3.19). The site of La Cascada was reported initially by Teobert Maler who names it La Cascada-Chancalá (Maler 1901: 14). The site of La Cascada is also one of the bigger sites in that region with public architecture, including a standing temple, a ball court, at least 21 structures. Is believed to have enjoyed a level of autonomy, since they used their own emblem glyph (Stuart and Stuart 2008: 235).
The entrance at San Juan Chancaía is one of the most impressive and better-worked sections of the roads surveyed. The site features at least 42 structures, many of great size distributed in eight different architectural groups. The road is an evident feature at the entrance to the site (Figure 3.20). That leads the traveler straight into the center of the settlement. Very similarly to Palenque, before it reached the central architectural node, the road was diverted to the south of the site and continued to the west towards La Cascada (Figure 3.20 and 3.21).

The sicix bäbih of San Juan Chancaía is also one of the best examples of this type of monumental endeavor in the area reported. No excavations were done at the site or road, but
because the entire route from Chancalá to San Juan Chancalaito was registered, the relationship between the sicix bäbih and the settlements in the region became clear. The site S4E8-257 is located next to the sicix bäbih and its function was probably associated with the road (Figure 3.22). The association with the causeway is unique and further research could delve into possible relationship of the architectural group to the road. The sites of San Juan Chancalaito and Chancalá have been dated using ceramics as having an occupation starting in the Late Formative Period through the Late Classic Period.

Figure 3. 22: Site S4E8-257 site located to the east of San Juan Chancalaito

The Valley of Chancalá and the Piedmont path was an alternative route from the highlands to the Pasion River and many of the sites close to the Usumacinta (Figure 3.23). The region must have had a great need of exchange goods. The causeways were an important factor in the exchange and movement of goods, like obsidian or pine from the highlands of Guatemala. Through different distribution channel that was also fueled by the Úsumacinta River route and also identified by other researchers (Demarest, et al. 2014; Hammond 1972, 1973). This route could also have been used by the site of Lah, identified in inscriptions from the jade offering in Palenque. The site is believed to have been located in this zone, perhaps further west. The epigraphic mention of the site comes with a reference to the payment of a tribute of jade to Palenque that was to be used in the funerary trousseau of Pakal (Bernal Romero 2008).

Figure 3. 23: Section of the Chancalá to San Juan Chancalaito sicix bäbih.

Incidentally, in modern times, the town of Rio Chancalá is one of the biggest nodes of population in the area today. Located at a unique position where terrestrial routes and the river provided a
unique topography and combination of both routes. The Chancalá river was used during the 1800s as the main route for logging out of the jungle. All the existing logging roads from that time would meet here. Most modern roads (carretera Federal 199 and 307), like the federal highway, was initially a logging dirt road. Old routes that were paved during the 1990s after the Zapatista revolt in Chiapas. The site of Chancalá is located under and around the modern town of Rio Chancalá, with at least 19 structures recorded. This site likely was much bigger from what can be observed today. Including its location and relationship to Rio Chancalá, a river route that can be navigated until the Usumacinta River.

During the late 1800’s and early 1900’s the Catalan family, Bulnes were the owners of this area and were logging and exploiting many hardwoods out the jungle. Precious hardwoods like Mahogany, Cedar, and extracting the natural latex for rubber production (caucho or hule – náhuatl olli- Castilla elastica) (De Vos 1994). The biggest montería (logging station) during the 1800d was precisely at Rio Chancalá; This was also the last settlement before heading into the Jungle until the late 1980s. The town of Rio Chancalá was also utilized as a port by shooting the logs on the Chancalá River as a causeway for their extraction. After drifting and floating to the Usumacinta and moving downstream, the logs were picked up again in Tenosique, Tabasco (De Vos 1994). There the logs would be collected, cut and shipped downstream on the Usumacinta River down to the Gulf of Mexico. Also, the easiest route to navigate out of the Selva Lacandona. The Valley of Chancalá continues, and even though the field survey stops at this point, there are good indications that the route continues southeast going through many archaeological sites distributed in the region.

 Returning to the Palenque to Nututún and El Lacandón route described before (Figure 3.24), field surveys were vital in perceiving differences in the terrain and existence of spaces clear of any material evidence I Like the one bordering the site of El Lacandón and the settlements around Flor de Chiapas. A buffer zone of 4 km was identified by the absence of both settlements and surface materials, yet the Piedmont path continues in a West – East direction. From both sites the Piedmont path or sicix băbih continues following the Sierra Madre in a linear pattern, connecting all the communities in that area. The settlements were associated with the Piedmont path or in some cases the Chacamax River, which could be navigated locally. This route continues to the Linda Vista Valley and also connects with La Primavera Valley where the site of Chinikihá is found. In a straight line, from Flor de Chiapas, there is a distance of 37 km to the
site of Boca Chinikihá / Lindavista at the Usumacinta River. The site of Chinikihá is also the second biggest node of population, with the greatest concentration of structures in the region after Palenque.

The sicix bäbih in this region was very easy to identify, and the sites are in close association. In many places, the modern road runs parallel to the ancient road or over it, following the topography and turns in the terrain. The road is an active route for the local communities, and until recently, about ten years ago when the Chancalá to Penjamo highway was constructed, this terraceria (dirt logger road) used to be a route to reach the modern town of Palenque from the towns of Tenosique and Penjamo in Tabasco. The distribution of sites in this region tended to be dispersed. Long platforms and monumental architecture continued to be identified associated to this route.

The River Chacamax was also an important factor in the preferred placement of settlements. Just like many other sites had access to the Piedmont path and the river. At Estación Chacamax evidence was observed of a possible port and a bridge, with platforms located nearby on both sides of the river (Figure 3.25). Incidentally, this was another monteria or logging station for the Bulnes family. Traveling east the route continues until the site Ejido Reforma. Ceramic evidence recovered on the route indicate a relative chronology starting in the Late Formative by the presence of Sierra Rojo. There is also strong evidence, just like in the rest of the area, of Late Classic settlements. From the Site of Ejido Reforma, the traveler could do one of two things, continue to the Usumacinta or diverge into the route to Chinikihá and the Miraflores Valley to the south.

![Figure 3.25: Sicix bäbih between Ejido Reforma and Est. Chacamax and a bridge and possible port recorded at the Est. Chacamax.](image)

The site of Chinikihá is located at a strategic point in the landscape. With access to the site of Ejido Reforma to the north and the Piedmont route towards Palenque to the west. Also, access to the Valley Lindavista to the East, a direct path to the Usumacinta River. Furthermore, the northern neighbor was Pomona, which can be seen from Chinikihá. To the East access to the Valley of La Primavera. To the south the valley of Chancalá and that route.

It is the natural passage from the Valley of Lindavista to the Valley of La Primavera, and it is here too that the modern road connects the modern towns of Penjamo with Rio Chancalá. The road used to be a logging trail, which I am very confident used to be an ancient road or route. This is the same Camino Real described by Spanish colonial sources (Caso Barrera 2002; De Vos 1996). Later the Bulnes logging company used this same route as a road to get to Rio Chancalá and from there into the Selva Lacandona (Ballinas 1951; Blom and Duby 1955; Blom 1957; Montañez 1961). Even when Mahler visited the region, he describes taking this road from
Tenosique to the montería at Penjamo, then to the montería at Reforma Agraria (where he visited Chinikihá). Then again toward Chancalá (La Cascada-Chancalá) using the same logging routes that compose the modern roads (Maler 1901). This road cuts through or passes straight through the middle of sites, specifically at sites like Arena Hidalgo, Chinikihá, and Chancalá. An evident pattern observed at the site of Chinikihá, where the modern road cuts through the middle of the site. Just like today, the entries to the site were influenced by the natural topography and modified by people (Figure 3.26).

Figure 3. 26: Topography at Chinikihá illustrating the main points of entry into the site

Unlike other sites, Chinikihá does not really have access to an on-site river route. Caves and natural pits on the southern portion of the site have been reported and probably used for water consumption. However, there is no navigable river in proximity to the site. The inhabitants of the site had access to clean undersurface water year round. The River Chinikihá, which meets the Usumacinta river at Lindavista or Boca Chinikihá, is located about two kilometers to the north of the site, where it emerges from under the surface. The sites in the Lindavista Valley had access to both routes, something that becomes very evident at the site of Boca Chinikihá / Santa Margarita (Johnson 1976b; Maestri 2012; Silva de la Mora and Mirón Marván 2009). With a small cayucos (canoe) the River Chinikihá could have been navigated for most of the year, especially during the rainy season (Figure 3.27).
Also, the site of Boca Chinikihá must have played an important role as a node of population, but also in the economy and movement in the region. The River Chinikihá cuts the site in two, on one side the archaeological site, where the ceremonial and public architecture are located, and most archaeological research has been done (Canter 2015; CFE 2002; Maestri 2012; Silva de la Mora and Mirón Marván 2009). The recent ejido of Lindavista is located over the archaeological site. Also, the settlement distribution increased as the field surveys got close to the Usumacinta, observed in a large number and distribution of settlements. This region had large administrative centers and a complex distribution of settlements closely located. Much of the visible architecture was monumental and evident. The site of Las Delicias was composed of large mounds and smaller structures over open plazas (Figure 3.28).

Another site located on this same stretch was Ojos de Agua, site with a complex arrangement of large structures, next to the dirt road, having its source of clean water and a cave (Figure 3.29). The cave included large amounts of broken ceramics with early ceramic sherds identified as Sierra Rojo, with waxy red surfaces and compact fine pastes.
The site of Boca Chinikihá seems to have played an important role in the local organization and economy. After Chinikihá, it seemed to be one of the biggest sites in the region and functioned as a river port of entry for goods from the Highlands in Chiapas and Guatemala via the Usumacinta River (Hammond 1972; Johnson 1976a, b; Maestri 2012; Silva de la Mora and Mirón Marván 2009). It is located at the junction of the Rivers Chinikihá and Usumacinta, and it is the last settlement before going through the rapids at Boca del Cerro, a region with rapids and not navigable. On the other side of Boca del Cerro, the site of Panhale is located, an enclave of Pomona (Anaya Hernández 2001, 2002, SF). A great wealth of sites has been reported to the southeast of Boca Chinikihá, and La Urania, Camino a las Delicias, Ojo de Agua, Las Delicias, San Jose de los Rieles, Sta. Margarita, Santo Tomas and Piedras Negras. All located within a reasonable distance. The Usumacinta continues its path from the Highlands, connecting sites in the Rio Pasión, Grijalva and the many sites close to the Usumacinta until reaching Boca Chinikihá. The site of Boca Chinikihá is the source of a large part of the obsidian material analyzed in this study, from excavations at the main population node (Maestri 2012).

The Materiality of Movement

The archaeological sites are distributed along the Piedmont following a natural breakage or outcrop of limestone, with a genesis dating back to the Tertiary (66-2.58 million years BP) that constitutes the Sierra of Chiapas (Mülleried 1957; Teranishi 2011; Waibel 1946). The region’s unique topography was appropriated by the ancient dwellers and became the preferred location for settlements. A pattern visible through the distribution of archaeological sites in a linear arrangement along the Piedmont. Following this natural breakage or outcrop of limestone where the archaeological sites are located. This natural break created a linear rift that resulted in a unique topographic feature that would become a road, path and connected the area. Their Karstic Genesis makes it very porous and visible to detect on the surface that was modified in some areas and was left as it was on others.

The outcrop was an important geologic feature in the landscape, which follows the base of the Sierra Norte the Chiapas, creating folds and breaks in the valleys and natural passages in the northwestern Maya lowlands. This natural feature became part of the communities and settlements in the region, creating a unique distribution of settlements that were connected through a Piedmont path (Figure 16). The natural feature was probably utilized first as a natural path into the area from places like the Petén, the Gulf of Mexico or the Highlands through the Usumacinta and the Tulijá (Hammond 1986; Matheny 1986a; Sabloff 1975; Vargas Pacheco 1985; Willey 1990).
This natural feature is associated with the archaeological sites in the region. The settlement distribution shows that the ancient dwellers preferred to settle close to this natural alignment, modifying it as time went on and it eventually became a formal causeway (Canter 2015; Canter and Pentecost 2007; Silva de la Mora 2008, 2011). The natural shape of the fracture and the modifications done by the ancient communities resulted in kilometers of roads and well-connected communities. River routes and access to them must also have been a deciding factor when choosing where to live and settle and must have had an impact on the overall functioning of the sites.

To understand the construction technique, excavations have been carried out at different locations of the road, and it became evident they showed a similar construction pattern as those reported in the Northern Lowlands (Folan 2001; Villa Rojas 1934). The sicix bābih were built up through layers placed over a natural base. The mother rock was leveled through a process of deposits of layers of gravel and rocks, which decreased in size as the road was flattened. Following that logic, layers of smaller gravels with soil and in some cases a light covering of limestone was found mixed in the top soil (Silva de la Mora 2008). The thickness of the deposits vary according to the topography, but in general, the excavations did not go deeper than one meter. The surfaces persisted to be flat and were easy to see, identify and walk through. The path tended to be two to three meters wide at the base. Many of the sections had walls on both sides of the road. The complexity of this Piedmont path must have been related to economic activity, and it could have been used as a cohesive political tool (Canter 2015; Silva de la Mora 2008).

The materiality of the causeway could serve as an indicator of the possible political control of ruling groups and lineages at large sites like Palenque or Chinikihá (Liendo Stuardo 2005; Liendo Stuardo and Teranishi Castillo 2011). It could also reflect the organization and social organization of the local communities. The causeway seems to have served to channel, perhaps even control traffic and movement through specific routes. The existence of roads can also be related to cohesion or binding of the communities, allowing for the movement of trade, flow of people and even the deployment of troops if needed (Canter 2015; Silva de la Mora 2008). Apart from the causeways, there are some parts of the Chacamax and Michol river that could have been navigated most time of the year if not all. Bridges and possible ports were also identified at different places.

The area has been extensively modified through a change in land tenure and land use, usually cleared for husbandry, mainly cattle raising and cultivation of corn (maize – *Zea mays*), squash (*Curcubita ayotl* or *pepo*), chile Serrano (*Serrano sinahusia*), tomatoes (*Solanum lycopersicum*), and yucca (*Yucca elata*) for family consumption (Trabanino Garcia 2014). As a result, the deforestation of the landscape has made the archaeological remains easily recognized and visualized during field surveys (Liendo Stuardo 2001, 2002, 2004, 2005).

Recent migrant settlers from different parts of Mexico constitute smaller settlements in the study region, with the exception of bigger towns like Palenque and Tenosique. A post-revolutionary government saw the solution to the agrarian reform and imagined long term benefits and possibilities for economic growth through the colonization of the Selva Lacandona (De Vos 2004; Lobato 2003). Many people migrated to the area for the possibility and promise of acquiring land, through a system of ejidos (common land assigned to a person or family), a process that extended in the 1950s and 1960’s to different sectors of the Selva Lacandona (De Vos 1994, 2004). The establishment of ejidos throughout the jungle created a long-term process of colonization, resulting in deforestation and changes in land tenure. The modern settlements...
also tend to follow the ancient land and distributional patterns. Commonly resettling over, next to, or in close proximity to the ancient houses and archaeological sites. Yet the deforestation and change in land tenure have been major contributors to the identification through field surveys of settlement distribution and piedmont path.
Ch. 4: Obsidian in the Northwestern Maya Lowlands: Technology and Source Provenance

In order to connect the regional settlements, reconstruct the movement of goods and local crafting technologies, the study has utilized lithic analysis and the use of archaeometric science to have a better consideration of the local communities of practice. The chapter will introduce the study of obsidian tools and their distribution. The use of stone tools in the Maya area can encompass many different aspects of everyday activities and social practices (Anderson and Hirth 2009; Clark 1997). It can also be seen as a reflection of past social practices and even how people viewed themselves as part of a community (Sassaman and Rudolphi 2001). The analysis of lithic technology provides a study of the sequence of production, the events which allows the reconstruction of the entire spectrum of activities from the recollection of the raw material to the disposal of a used broken blade at an archaeological site (Joyce 2011; Shackley 2011d). Also the reductive techniques used in the manufacture of flaked stone tools serve as evidence of production areas, procedures and techniques used in the past, clarifying the technological processes employed, detecting characteristics that allow for differentiation in both time and space (Hirth 2003a).

In Mayan archaeology there has been an effort, equitable to other cultural areas for the use or archaeological science to better understand different aspects of the past human experience (Glascock 2002; Johnson 1976a; Joyce 2011; Moholy-Nagy, et al. 2013; Shackley 1998a, 2011c). In specific, the use of Geoarchaeological techniques has been shown to be a reliable tool in the study of exchange and trade of certain archaeological materials like stone tools, specifically obsidian (Carter and Shackley 2007; Craig, et al. 2007; Davis, et al. 2011; Glascock 2011; Latham, et al. 1992; Negash, et al. 2006; Poupeau, et al. 2010; Shackley 2011d).

The Maya Area happens to be a society with a relationship with stones that left an abundance of materiality, opening the possibility for the implementation of elemental analysis to reconstruct the source of raw materials and recreate the exchange routes and movement of goods, people and social practices (Glascock 2011; Shackley 1998a, 2011d).

The study of obsidian has opened a venue to discern the total array of stages used in the acquisition of raw material, the possible lines of exchange, the techniques used in the production, the use and exchange of stone tools in a region (Hirth 2009; Sheets 2003). Also a technological analysis centers on understanding the techniques used on the manufacture of stone tools, grounded on the assumption that manufacturing behavior is reflected on the implements and the waste from production, which in turn allows to reconstruct the manufacturing procedures used to create specific morphological attributes (Sheets 1975). The chapter will introduce the collection analyzed to provide an overview of the technological analysis and the results from an archaeometric study using ED-XRF to assign provenance of sources for the region. It will also display the results from the study to provide a regional perspective of use and distribution of obsidian in relationship to the local communities. As it will be seen obsidian tools represent a unique trace of past social practices that were an integral part of the local communities of practice.

Technological considerations

The study utilizes a behavioral explanation of the materiality found in lithic tools and debitage by attempting to determine the procedures used during the manufacture (Sheets 1975). The
crafting of stone tools leaves traces from production behavior on the lithic implements and debitage, which can be studied and recorded to understand the different procedures and products represented on the collection (Sheets 1975). In this sense a technological typology must have a problem target to be addressed by the analysis. For Payson Sheets (1975, 1978), the typology relevant for blade-core reduction considers the specific behavior needed to produce prismatic blades. The proposed typology has been widely used in lithic analysis in the Maya area, and later John Clark and Douglas Bryant (1997) proposed a technological typology, to address their critique that the nomenclature did not consider specific mistakes. The typology included a sequence of core production (macrocore, polyhedral core, prismatic core) to describe the core morphology and stages of production. This is important since it also examines the variation in productive techniques, such as a polyhedral core can have similar characteristics as a percussion core (Hirth and Andrews 2002b). The modification of Sheets initial typology has influenced Mesoamerican lithic studies since its appearance, because of its rationale, simplicity, and coherence (Anderson and Hirth 2009; Andrews 2003; Carballo 2013; Healan 2009; Hirth 2003b, 2006, 2008). The methodology acknowledges and uses different attributes, like technological and morphological attributes to try to define specific industries. The methodology has also been used to study trade and exchange networks in the Maya area, including proposing different distribution models which might not have been controlled by political economy (Fowler 1991).

Other typologies have also considered other aspects for the study of microcrystalline-quartz tools, like separating and naming different morphological and technological aspects, since they were trying to assign type names to artifacts (Rovner 1975; Rovner and Lewenstein 1997). The study resulted in inconsistencies in nomenclature, due to an imposed function, which might have had different uses depending on the time period used.

Another important study and typology was created and implemented at Colhá in Belize (Shafer and Hester 1983). The methodology and typology was created to account and organize the large collections recovered at workshops. This resulted in a nominal system that was implemented to organize the industries at the site, but not necessarily to other sites and regions. Yet the unique nature of this site, being a productive center located over the raw material, resulted in terminology that was unique to the site (Hester and Shafer 1984, 1991, 1994).

Attribute Analysis

A behavioral approach to lithic technology in the analysis of flaked stone tools and debitage has been shown to benefit the appreciation of ancient manufacturing behaviors (Ahler 1989; Schiffer 1976; Sheets 1975). This methodology is based on the idea that technological choices are variable, depending on different social and environmental conditions that affect the production of stone tools. A lithic technology approach provides an analytical framework for the classification and examination of flaked stone remains based on the behavioral decisions of humans who created and used the stone tools (Clark 1997; Schiffer 1976; Sheets 2003). The analysis reconstructs the behavior behind the production by deducting the different stages of production, sequence of events (Schiffer 1975) the chaîne opératoire (Kardulias and Yerkes 2003; Sellet 1993). The study results in the definition of technological categories that reflect the sequential stages from the acquisition of the resource, the production, use, curation and eventual discard of stone tools (Flenniken and Raymond 1986). Examining technological style in order to establish communities of practice in production and thus comprehend the movement of goods and aspects of production and distribution is a prime focus of the analysis. A technological style can be visualized as a distinct method of creating goods through production steps replicated by social
practices shared by a group of craft workers (Edens 1999; Lechtman 1984, 1993). Those social practices are parts of communities that share crafting knowledge from one generation to the next by processes of peripheral learning and ways of doing (Hull 2002; Lave and Wenger 1991).

The production and social organization have been interpreted in the past as an essential component political economy; especially in relationship to the production, exchange, acquisition, and use of crafted goods by particular groups within a community (Costin 1993; D'Altroy and Earle 1985; Hendon 2006, 2007; Spielmann 2002). Technological style can be used in archaeology as a tool to discern the choices involved in doing things, resulting in definable characteristics of objects that archaeologists recognize as style (Edens 1999; Hegmon 1992). In this sense a social group will make choices according to their world of possibilities and in many situations for no functional reason, but due to shared learning and social practices (Lemonnier 1986). The craftsperson who uses a particular technological style and technique can be viewed as part of a community of practice, a group of people who share a way of doing or making things as a result of learning in a particular time and place (Lave and Wenger 1991). The technological style should reflect differences and distinctive methods utilized by communities that can be studied to understand exchange, production and even social complexity (Simon and Burton 1998).

The obsidian

The analyzed obsidian artifacts and debitage were recovered from 37 archaeological sites in the NWML (Table 1). The collection was directed toward recognizing the craft technology (what was being produced), the mechanisms of such production (were the artifacts produced locally or were they imported finished, or were they preformed elsewhere and the crafter was finishing the artifacts locally) and to understand daily local practices of use in the region during the Late Classic. Also it was important to see the physical characteristics to understand shared social practices and shared ways of doing. As mentioned in chapter two, many aspects of urban and rural economy are not fully understood for the Maya region, and the study aim is to understand some of this dynamics between the rural and urban communities at a regional level. Obsidian has been used in the past to consider the crafting technology, its economic and political implications like those reported for Teotihuacan’s regional political economy in relationship to obsidian tool crafting and exchange (Sanders 1979; Santley 1984); or in the Maya region the study at Kaminaljuyu in relationship to the economic and political distribution and control of obsidian (Aoyama 2001). From a political economy perspective, craft production can be seen as a pivotal factor in the control and redistribution of goods. While it doesn’t create elite power, craft production may augment it (Hendon 1991). Craft production may reflect economic changes unrelated to elites, but to the adaptations of the majority to changing circumstances within a community (Spielmann 2002). Obsidian happens to be considered a utilitarian good, and it is known of its importance throughout the Maya region and the greater Mesoamerican communities, but its wide distribution and consumption is not fully understood (Anderson and Hirth 2009; Aoyama 2001; Cobean 2002).

The collections were recovered from a greater area in the NWML, with obsidian artifacts from sites outside the study region like Yaxchilán and Moral Reforma, important urban centers for the Classic Maya. Also Tierra Blanca a settlement by the Usumacinta in the Lowlands of Tabasco and which actually presents the longest occupation record for this study (see Table 1). The material recovered from Moral Reforma and Yaxchilán were collected by the INAH from excavations in the main nodes of the sites, in the “plazas” and “central architecture” which is
something important to consider (Garcia Moll 1975, 1996; Juárez and Castillo 2004). The artifacts from Tierra Blanca were recovered from households, small settlements next to the Usumacinta that have the entire chronology of occupation and a variety of materiality seen in the ceramics and stone implements. The rest of the material was collected by the PIPSP (Proyecto Integración Política en el Señorío de Palenque- Political Integration in the Palenque Realm) and PRACH (Proyecto Arqueológico Chinikihá – Archaeological Project Chinikihá) from the UNAM. The obsidian artifacts were collected from field surveys and surface collections, as well as excavations at some of the sites, mainly Chinikihá and Boca Chinikihá, adding up to a total of N= 1338 artifacts.

Initially it was decided to work with this assemblage because it presented the opportunity to study and analyze a collection that could reflect a global perspective of the use of this volcanic glass in the region. The size of the collection was also a determinant since it allowed for an attribute analysis of artifacts regionally. Also, the attribute analysis was generated based on previous research of similar lithic studies (Clark 1989; Clark and Bryant 1997; Crabtree 1968; Shackley 1989; Sheets 1975). The materials collected represent the entire spectrum of sites encountered in the region. Characterized by sites like Yaxchilán, Moral Reforma or Chinikihá, examples of rank or class 1 sites, to the smallest types of settlements represented by isolated platforms and material dispersions in the rural areas of the NWML. A total of 37 sites were included in the study that allowed for a technological analysis, and also the deduction of some social practices observed in the artifacts and the regional use.

Most sites around the Maya Lowlands do exhibit a diversity of obsidian tools and local production (Brokmann 2000; Coe 1958; Hruby 2006; Kaneko 2003; Moholy-Nagy 1997, 1999; Ricketson 1937). The analysis has provided a unique view of the regional use of obsidian, where there is clear pattern of consumption for the region, in specific the use of prismatic blades; reaffirming some of the results and conclusions reached by Johnson (1976a). The sites are not only sharing roads, ways of making their homes, or ceramic wares, but also the stone tool technology, crafting techniques and even how to use the tools.

The obsidian analyzed depicts a wide distribution and similarities in the use and crafting technology of this material for the region. The most common type of artifact or tool recovered was prismatic blades (out of N= 1338 artifacts analyzed n= 1181 are prismatic blades – observe table 4.1 and Figure 4.1). The use of pressure blade technology, in specific prismatic blade technology is one of the most ancient technologies known in the Americas, reported in Paleoindian sites from the Valley of Mexico and Northern United States that date back between 14500 BP and 10900 BP (Eren, et al. 2008; Gonzalez, et al. 2015; Jennings, et al. 2010). This can be seen as, a reflection of the importance and preference for this type of tool for the ancient communities that continued to be produced in Mesoamerica (MacNeish, et al. 1967: 22). Also this continuity of one technology and type of tools should be recognized, since the same technology can be found throughout Mesoamerica and beyond to the North and South (Sidrys 1976).
<table>
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<th>Chronology (Relative time frame)</th>
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<td>Max, Puy, Ajin, Post-Ajin</td>
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<td>Field Survey, Excavations</td>
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</tr>
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<td>Modesto Garcia</td>
<td>4</td>
<td></td>
<td>600-850 A.C.</td>
<td>Field Survey, Excavations</td>
</tr>
<tr>
<td>Moral-Reforma</td>
<td>1</td>
<td></td>
<td>250 to 900 A.C.</td>
<td>Excavations INAH</td>
</tr>
<tr>
<td>PH 111 E2 S1E1-24</td>
<td>5</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>PH 112 E2 = S4E7-246</td>
<td>4</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>PH 113 E1 = S4E7-247</td>
<td>5</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>PH 119 E2 = S4E8-254</td>
<td>4</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>PH 122 E13 = S4E8-258</td>
<td>4</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>PH 122 E17 = S4E8-258</td>
<td>4</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>PH 125 - S4E8-260</td>
<td>5</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>PH 136 - N1E1-41</td>
<td>4</td>
<td>Puy, Ajin</td>
<td>250 to 850 A.C.</td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>Rancho Trinidad</td>
<td>2</td>
<td></td>
<td>600 B.C. to 1500 A.C.</td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>Reforma de Ocampo</td>
<td>2</td>
<td>Ajin</td>
<td>700 to 850 A.C.</td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S1E7-392</td>
<td>Surface Scatter</td>
<td>Max</td>
<td>600 B.C. to 850 A.C.</td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E10-474</td>
<td>3</td>
<td>Max, Puy, Ajin</td>
<td>600 B.C. to 850 A.C.</td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E11-463 = S2E9-463</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E11-553</td>
<td>4</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E11-544</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E12-490</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E12-511</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E12-512</td>
<td>4</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E12-536</td>
<td>5</td>
<td>Max, Post Ajin</td>
<td>600 B.C. to 850 A.C.</td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E9-463 = S2E11-463</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E9-469</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S2E9-520 = S2E12-520</td>
<td>4</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>S3E12-502</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>San Juan Chancalaito</td>
<td>Surface Scatter</td>
<td>Max, Puy, Ajin, Post-Ajin</td>
<td>600 B.C. to 900 A.C.</td>
<td>Field Survey, Excavations</td>
</tr>
<tr>
<td>301 PISP 2003 = S0E8-301</td>
<td>Surface Scatter</td>
<td>Unknown</td>
<td></td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>Tierra Blanca</td>
<td>1</td>
<td></td>
<td>600 B.C. to 1500 A.C.</td>
<td>Field Survey (Surface Material)</td>
</tr>
<tr>
<td>Yaxchilan</td>
<td>2</td>
<td></td>
<td>250 to 900 A.C.</td>
<td>Excavations INAH</td>
</tr>
</tbody>
</table>

Table 4.1: Sites in the study, rank/class of site, relative chronology and where the artifact was recovered.

The analysis has shown that polyhedral cores were arriving in the region and local crafters were producing the blades that were distributed. Researchers have noted the importance of specialization in prismatic blade production, since it is a skill that needs to be learned and maintained and is thought to have been performed by specialized crafters (Clark 2003a, 2007). The importance of polyhedral cores in the region reflects the social practices and perhaps even preference for this type of artifact and raw material. The volcanic glass was imported into the area through long distance channels of exchange, since the closest source used in the region is located in the Guatemala Highlands, 344 linear kilometers distant from Chinikihá (Arnauld 1990; Hammond 1972, 1973; Johnson 1976b). Table 4.2 depicts the different linear distances to and from the two mayor sites discussed in the study.
Table 4. 2: Illustrates the linear distances to the different sources from the sites mentioned in the study.

Also, the analysis has shown homogeneity in the production and consumption of prismatic blades. The techniques of preparation and production of blades is widespread, with very little variation (Figure 4.1 and Table 4.3). The crafters used the same techniques and even the artifacts reflect social patterns of use like breaking or snapping them into smaller fragments to be hafted, a similar pattern found in other regions (Hayden and Deal 1981; Hirth 2012; Hirth and Andrews 2002a; Hirth and Flenniken 2002; Lewenstein 1987). The production of polyhedral cores probably was a determinant in the type of tool produced and used, but also it could have influenced the local technologies of production and the shared knowledge by those crafters who produced the blades (Hirth and Flenniken 2002).

Figure 4. 1: Summary of artifacts analyzed.
<table>
<thead>
<tr>
<th>Artifact Type</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifacial Fragment</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Exhausted Cores</td>
<td>8</td>
<td>0.6</td>
</tr>
<tr>
<td>Flakes</td>
<td>147</td>
<td>11</td>
</tr>
<tr>
<td>Prismatic Blades</td>
<td>1181</td>
<td>88.2</td>
</tr>
<tr>
<td>Scraper Fragment Distal</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1338</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4. 3: Summary of artifacts analyzed.

**Prismatic Blades**

The prismatic blades account for 88.2\% (n=1181) of the obsidian artifacts analyzed in this study. Prismatic blades have exhibited a wide use and distribution in the region, as they have been found throughout the study area and can be considered a widely used and commonly recovered artifact. It also became evident how some sites or households had greater access to obsidian in comparison to others, and this could be related to where the collections come from. Most of the materials analyzed come from the bigger nodes of population like Chinikihá and Boca Chinikihá, where the consumption was more evident and concentrated. The bigger sites also tend to have the most source diversity (Table 4.4).

Prismatic blades are long and narrow artifacts with regular parallel edges and prepared platforms. Just as the name denotes, they tend to be trapezoidal in cross section with the majority of them having two parallel dorsal ridges (88\%). A small number in the sample had three ridges (4\%) and the remaining (8\%) only had one ridge.

<table>
<thead>
<tr>
<th>Prismatic blades statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Std. Error of Mean</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Mode</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>Range</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
</tbody>
</table>

Table 4. 4: Summary data for prismatic blades (mm).

Also the prismatic blades showed a pattern of use, broken into smaller blade sizes to later be hafted in a handle (Figure 4.2 and Table 4.5). Only a few prismatic blades were actually complete and a unique pattern was observed about those blades once seen in a regional perspective. In general the obsidian artifacts analyzed tended to be fragmented and had apparent use. Yet the prismatic blades from Moral Reforma tended to be complete and appeared to be unused blades. Signaling a different use and specialized primary production. The artifacts were recovered from the main plaza and were probably specifically made to be deposited there, perhaps part of specific social practices.
Table 4. 5: Prismatic blade proportions.

The most common fragment recovered were the central sections of the blades. Perhaps a result of the "snapping technique" and use of the tools by hafting, making the fragmented blade a modified artifact by snapping them and using them as tools (Figure 4.3 and Table 4.6).

Figure 4. 3: Illustrates the prismatic blade sections.
Another line of evidence points toward the hafting and use of this type of tools. The use of prismatic blades as part of hafted tools is evident and has been reported previously for the Maya (Hayden and Deal 1981). Out of the entire sample, n = 125 (10.6 %) presented side notched hafting in one side, n = 54 (4.6%) presented bilateral notched hafting, and n = 705 (59.6 %) presented evidence of possible hafting on the proximal or distal parts of the blade.

On the proximal fragments of the prismatic blades, it was noticed that the bulb is diffuse with no lipping on the proximal edge (Mean: 0.48 mm, Std Dev: 1.08) like the one reported by Johnson for Palenque (1976a: 34) It was also noticed that the platform surface preparation included two different types of techniques, grinding (n = 191, 16.2%) and pecked (n = 14, 1.2%), including the use of both techniques (n = 2, 0.2%). Figures 4.4 illustrate examples of prismatic blades analyzed.

<table>
<thead>
<tr>
<th>Prismatic blade sections</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>778</td>
<td>65.8</td>
<td>65.8</td>
</tr>
<tr>
<td>Complete</td>
<td>11</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Distal</td>
<td>62</td>
<td>5.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Proximal</td>
<td>331</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>1182</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4. 6: Blade sections proportions in sample.

Flakes

Most of the material collected, with the exception of two artifacts (a biface and scraper described below) was the result of prismatic blade production. Just like the prismatic blades, the waste debitage from production can result in a wealth of information regarding the local crafting technology, places of production, and reuse or recycle of pieces (Ahler 1989; Andrefsky 2001; Clark 1991; Clark and Bryant 1997; Moholy-Nagy 1997). The study of core rejuvenation debitage has been documented and reported for different research projects in the Maya area, and their consideration in archaeological research has been proven beneficial in the interpretation of rejuvenation techniques (Graham and Heizer 1968; Moholy-Nagy 1997; Rovner 1975). As noted previously for the NWML the flakes present rejuvenation of polyhedral core for prismatic blade production (Johnson 1976b). The analysis demonstrated the local production of prismatic blades at different types of sites, and even through much of the material was fragmented and only 17 flakes were recovered complete, the other 130 flakes have been vital in the regional perspective of prismatic blade production (Figure 4.5 and Table 4.7).

Figure 4. 4: Example of prismatic blades from the study; drawings by Keiko Teranishi.
The value of flakes on identifying locales of production has been reported previously, emphasizing the importance of rejuvenation flakes as an indicator of production (Anderson and Hirth 2009; Clark 1989, 1991; Hirth 2012; Hirth and Andrews 2002a). The analysis showed that all the flakes recovered and analyzed were part of polyhedral core rejuvenation and platform preparation (Figure 4.8).

The local production of prismatic blades was reflected through the platform rejuvenation flakes, a technique of core rejuvenation for production of prismatic blades once the polyhedral core has...
no functioning core platform. A total of 13 (8.8%) core rejuvenation flakes were identified in the collection. Very similar to the core rejuvenation flakes, the distal rejuvenation flake was removed from the distal end of the polyhedral core to give a straight axis to the core. They tend to be thicker and had the bulb of force. The analysis identified 2 (1.4%) of distal rejuvenation flake (Figure 4.6 and 4.9). The rest of the flakes (reduction flake) tended to be broken and thin, but they were the result of polyhedral core reduction for prismatic blade production.

Figure 4. 6: Proportions of flakes characteristics identified.

<table>
<thead>
<tr>
<th>Flake characteristics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core rejuvenation flake</td>
<td>13</td>
<td>8.8</td>
</tr>
<tr>
<td>Distal rejuvenation flake</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Reduction flake</td>
<td>132</td>
<td>89.8</td>
</tr>
<tr>
<td>Total</td>
<td>147</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4. 9: Flake characteristics in sample.

**Polyhedral exhausted cores**

Polyhedral exhausted cores are the only type of cores recovered in the region. In places like Yaxchilán or Cancuén, complete or semi complete polyhedral cores have been found and reported in the past (Brokmann 2000; Demarest, et al. 2014). Exhausted cores are identified by their small size, cylindrical in shape with many fluting or blade scars on all of its sides (Hirth and Andrews 2002a). The polyhedral cores recovered were exhausted and only two of them were actually complete. The majority of the cores were broken, probably used until the last blade was produced. Also, very small needle like bladelets have been recovered at the site of Chinikihá, which serve as evidence of the last stages of production and witnesses the importance of this imported good; those artifacts are not part of this study. A total of 8 polyhedral-exhausted cores were recovered in the region, 1 (12.5 %) was complete and 7 (87.5 %) were fragments (Table 4.10 and 4.11).
<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>2</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Complete</td>
<td>1</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Distal</td>
<td>2</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Proximal</td>
<td>3</td>
<td>37.5</td>
<td>37.5</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.10: Polyhedral core summary.

<table>
<thead>
<tr>
<th>N</th>
<th>Width (mm)</th>
<th>Thickness (mm)</th>
<th>Length (mm)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>14.78</td>
<td>10.03</td>
<td>29.46</td>
<td>5.76</td>
</tr>
<tr>
<td>Median</td>
<td>15.47</td>
<td>13.36</td>
<td>29.57</td>
<td>6.05</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>2.5</td>
<td>7.69</td>
<td>10.08</td>
<td>2.85</td>
</tr>
<tr>
<td>Variance</td>
<td>6.25</td>
<td>59.21</td>
<td>101.76</td>
<td>8.16</td>
</tr>
</tbody>
</table>

Table 4.11: Polyhedral cores basic statistics.

Also, all the exhausted cores were recovered at either Chinikihá or Boca Chinikihá, the two biggest nodes of population included in the site (Figure 4.7 and Table 4.12).

![Figure 4.7: Proportions of exhausted cores by site.](image)

<table>
<thead>
<tr>
<th>Site</th>
<th>Frequency</th>
<th>Percent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boca Chinikihá</td>
<td>3</td>
<td>37.5</td>
<td>37.50%</td>
</tr>
<tr>
<td>Chinikihá</td>
<td>5</td>
<td>62.5</td>
<td>65.50%</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>100</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4.12: Exhausted polyhedral cores by sites.

**Study on polyhedral cores and debitage**

The evidence collected through the debitage of production and polyhedral cores point toward regional production of prismatic blades. Evidence for local production and master crafters has become evident through the study. The relevance of finding both byproducts of production, but specially the presence of debitage (flakes) of blade production has been seen as evidence of production (Clark 1989, 1991; Clark and Bryant 1997; Costin 2001). From a universe of 37 sites,
12 of them had evidence of production, but most importantly, there is indication that crafters were ambulatory to different locales to produce and distribute obsidian blades. Statistically it would indicate that 32% of the sites have evidence of production of prismatic blades. The best samples are obviously from sites where more work has been done, but it opens the discussion for the local capacity of crafting and local production (Table 4.13).

<table>
<thead>
<tr>
<th>Site</th>
<th>Debitage Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boca Chinikihá</td>
<td>106</td>
</tr>
<tr>
<td>Chinikihá</td>
<td>26</td>
</tr>
<tr>
<td>Las Colmenas</td>
<td>1</td>
</tr>
<tr>
<td>Moral-Reforma</td>
<td>2</td>
</tr>
<tr>
<td>PH 111 E.2 S1E1-24</td>
<td>1</td>
</tr>
<tr>
<td>S4E8-258</td>
<td>1</td>
</tr>
<tr>
<td>S1E7-392</td>
<td>3</td>
</tr>
<tr>
<td>S2E9-469</td>
<td>1</td>
</tr>
<tr>
<td>S3E12-502</td>
<td>1</td>
</tr>
<tr>
<td>San Juan Chancalaito</td>
<td>1</td>
</tr>
<tr>
<td>S1E8-301</td>
<td>1</td>
</tr>
<tr>
<td>Yaxchilán</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 4.13: Evidence for local production was recovered from exhausted cores and flakes.

The production of stone tools in the past has been interpreted from a political economy perspective (Andrieu 2013; Dahlin, et al. 2007; Demarest, et al. 2014; Feinman 2004; Rice 2009; Smith 1991). Yet the rural or surrounding settlements can help understand how these communities acquired and produced the many tools that were needed for every day life. Some of the sites where this evidence was recovered happen to be isolated platforms and sites that don’t necessarily have public architecture or complex layouts (Figure 40). Many of which present material evidence of domestic dwellings.

Figure 4.8: Site S4E8-258 where evidence of obsidian prismatic blade production was recovered.

**Bifacial Fragment**

One bifacial fragment was analyzed in the study. It should be noted that this artifact was unique in its physical characteristics and the context where it was recovered, which relates to daily life and serves as trace of social practices and even daily life. The artifact was recovered at Moral-Reforma, a Class 1 site.
that had epigraphic and political presence regionally, as well as a unique political relationship with Calakmul history in the region and with Palenque specifically (Bernal Romero 2011; Grube 1996; Martin and Grube 2000; Schele 1999). It was recovered from excavations at Edificio - Building 2 and it was part of the materials deposited in the facade of one of the main temples. The biface presented two different knapping techniques, on one face it had long cross-section scars, known as outré passé or transverse flaking, while on the other face the scars were short and did not follow the same pattern. Also, the artifact had been recycled, since it seems to have been broken on the proximal end, and perhaps was passed down from person to person as an heirloom. It was probably used as a knife since it had a lateral notch on one of the proximal sides for hafting, and the piece was still sharp and usable. Also the sourcing analysis attributed provenance to the Zaragoza obsidian source. Width: 3.38 cm, Length: 3.16 cm, Thickness: 0.72 cm, Weight 0.89 gm.

**Distal Scraper Fragment**

This artifact was given the name of a scraper due to its shape, but it could have had another use. Just like the biface, it was allocated to Zaragoza and it was probably locally produced and used at Boca Chinikihá, where it was recovered. It was missing the proximal end, as it had broken and it appeared to be used. The scraper was made from a primary flake. The dorsal face had scars from prismatic blade production and the ventral side did not present any intentional retouch. It presented some use as well as possible hafting. Width: 4cm, Length: 5.94 cm, Thickness: 1.54 cm, Weight 2.68 gm.

As mentioned before, the behavioral analysis showed the homogeneity of obsidian artifacts, the production and distribution in the region. Part of the interest to understand the local dynamics of lithic production, crafting technology, distribution and movement it was decided to use archaeometric techniques to allocate possible provenance. The use of archaeological science as part of archaeological practice has shown to be very prolific and can serve material studies immensely by shedding nonvisual data that is scientifically testable and comparable (Shackley 1995, 1998b, 2011b; Shackley 2007).

**Archaeological Science – X-ray Fluorescence Spectrometry (XRF)**

Since the 1950’s and 1960’s the use of geoarchaeological techniques in archaeological research has been implemented on geologic materials to investigate problems of social relevance (Glascock 2011; Shackley 2011c). Archaeologists have looked at provenance, distribution routes, market, exchange, landscape and even identity utilizing archaeological science (Bamforth 1986; Binford 1973; Gould 1980; Shackley 2005; Weedman Arthur 2006). The use of geochemical techniques in lithic analysis is used to determine the elemental composition of stone artifacts to better understand the provenance as well as elemental composition. The elemental composition of artifacts can be matched or fingerprinted to pinpoint the location of its genesis and therefore reconstruct the unique history of the artifact (Malainey 2011; Shackley 1998a).

There are a number of geochemical techniques which can be utilized in archaeological research, some examine the whole artifact, while others only examine the outer surface of artifacts, some are destructive while others are not, some are more effective to gather information about certain elements, and some are more financially accessible (Glascock 2011; Shackley 2011d). Therefore a basic knowledge of their applicability is a must. All rocks are made of elements that fall into the following classification: major elements are those which make up at least 90% of the sample, minor elements make up from 2% to 1% of the sample, and trace elements make less than 0.1% of the sample (Malainey 2011). Geochemical techniques generally focus on trace elements in order to determine provenance by determining the relative percentages or quantity of elements.
Meaning that mineral constituents are identified through these techniques. It is also important to mention that other characteristics of rocks like texture, crystal inclusions, or fossils cannot be established using XRF or NAA techniques (Glascock 2011). For those cases XRD, microprobe, and ICP-MS can analyze small constituents in rocks and ceramics (Shackley 2008).

In order to understand other aspects, such as mineral content in a rock, the researcher should conduct petrographic analysis using thin section microscopy, which involves cutting a section of the sample with a rock saw, placing it to a glass slide, grinding the sample to approximately 1mm in depth to be scanned using a polarized microscope to specify the mineral content and texture (Malainey 2011). The difference with geochemical techniques, particularly XRF, is that they measure the radiation absorbed and released by the atoms as the electrons move between different energy levels. By analyzing such levels, the number and type of atoms can be determined to dictate the elements present in the stone (Malainey 2011; Parkes 1987; Shackley 2011a).

Lithic studies have utilized X-Ray fluorescence effectively to determine precise distances from the source of the raw material, the place of activity, or the home base. X-ray fluorescence spectrometry, also known as XRF, particularly here, Energy-Dispersive X-ray fluorescence (EDXRF) work by evaluating the composition of a specimen through the irradiation of X-rays (Malainey 2011; Shackley 2005). One of the major advantages of this technique is that it’s a non-destructive tool. In the great majority of cases samples are not destroyed or changed through the exposure to the X-rays (Shackley 2011c). In some cases the samples may be crushed into a fine powder in order to determine elemental data from more than the surface area as done with wavelength XRF or WXRF (Shackley 2011a). The technique has been utilized to determine the composition of obsidian for the most part, while others have tried the technique to determine chert composition, but its utility has been criticized (Church, et al. 1995; Latham, et al. 1992; Warashina 1992). The analysis is done through irradiation with a beam of X-rays, which accelerates electrons into higher energy levels (Parkes 1987; Shackley 2011a). When these electrons settle back into electron orbits they discharge secondary or fluorescent X-rays. The fluorescent X-rays emit wavelengths and energy, which are characteristic of the elements that were irradiated. By measuring the different wavelengths (WXRF) or energy (EDXRF) emitted by the X-rays it is possible to measure the concentrations of different elements in the sample, a type of fingerprint that is unique to each source of raw material. This technique has been proven to work extremely well with obsidian (Cobean 2002; Moholy-Nagy, et al. 2013; Shackley 1995, 2005).

Another technique involving X-rays is the particle or proton induced X-Ray emission analysis or PIXIE. It is actually very similar to XRF in the way it works, as it produces the kind of electron activity and emission. The main difference is that the particle beam can be centered in a desired area of a sample, compared to XRF where the whole surface of an artifact is analyzed. The advantage of this technique is that it permits the assessment of different areas in a sample (Annegarn and Bauman 1990; Shackley 2011b). Another difference is the cost, as PIXIE is relatively more expensive compared to XRF. The surface must be highly polished in order to be effective, which can result in permanent damage to the artifact (Parkes 1987).

Another elemental analysis commonly used is electron microprobe analysis or EMPA. It can provide quantitative analysis of single crystals through the scanning with a focused electron
beam, which causes the emission of secondary X-rays that are then separated and measured the same way as XRF.

An important technique in the study of ancient stones is neutron activation analysis (NAA). It can provide multi-element analysis of major, minor and trace elements with a high degree of instrumental precision. When NAA is performed directly on irradiated samples, the technique is termed Instrumental Neutron Activation Analysis (INAA) (Glascock 2011; Johnson 2011). NAA is based on the nuclear properties of the elements in the sample and it requires a nuclear reactor in order to analyze the artifact. Another difference between XRF and NAA is that it can be destructive, as part of the sample will be destroyed during the analysis and remains radioactive for many years (Glascock 2011; Glascock, et al. 1984). The advantage of NAA is its analytical properties, as it does a bulk analysis of elements with a sensitivity of parts per billion opposed to that of XRF that has a sensitivity of parts per million (Shackley 2011a). Another major difference is the price as NAA is more expensive in comparison to XRF.

An additional technique utilized in geoarchaeology is ICP or inductively coupled plasma emission spectroscopy (Parkes 1987). A sample is made into a solution by heating it to a temperature of 6000°C when it becomes vapor as a plasma, it is then injected to a stream of argon and heating it in order to obtain the emission of a spectrum of the elements present and their relative concentrations (Parkes 1987). It has been found to be very effective in determining the provenance of silicates (Jarvis 1988; Thompson, et al. 1986) and it is also effective for identifying most major, minor and trace elements (Kemple and Templeman 1983).

There is an array of geochemical analysis that can provide different type of information about the chemical signatures or fingerprint of rocks, these techniques should be applied according to research questions and the type of rock under analysis (Andrefsky 2005; Kooyman 2000; Odell 2004; Shackley 1998b). Geochemical sourcing studies provide the range of compositional elements in a given sample, in order to make associations with the source, the parent rock must also be geochemically analyzed, as there are some geochemical signatures that have not been assigned or match to a known source. Obsidian artifacts have been widely evaluated geochemically as well as obsidian sources (Bayman and Shackley 1999; Eerkens, et al. 2007; Eerkens and Glascock 2000; Ferguson and Skinner 2005; Glascock, et al. 1984; Hughes 1998; Negash, et al. 2007; Negash and Shackley 2006; Roth 2000; Shackley 1998a, 2005; Stoltman and Hughes 2004; Tykot 2002, 2003). Different geochemical compositional analysis have been successful for obsidian provenance studies, probably due to its genesis which gives a diagnostic array of minerals that results in diagnostic elemental signatures. Yet most stone tools in the study area are made from secondary siliceous sediments like chert and flint (Luedtke 1992), which unlike obsidian is a cryptocrystalline silicate sedimentary material that results in a non-diagnostic geographic geochemical signature, meaning that it is very hard to associate an artifact with one particular source (Hess 1996; Hoard, et al. 1992).

**Discussion**

The major trace elements in the obsidian (or any geological material) involves the reaction of the atoms when radiated with X-rays as discussed above (Shackley 2011a). When materials are disturbed by high-energy, short wavelength radiation becomes ionized. If enough radiation is emitted the tightly-held inner shell electron is dislodged and the atom becomes unstable as an outer shell electron replaces the missing inner electron (Shackley 2011a: 16). The emitted radiation, called fluorescence, has characteristic energy and the resulting fluorescent X-rays are...
used to distinguish the elements present in a given sample (Shackley 2011a: 16). The process of displacement of the electron is called excitation, a mechanism that when irradiated with high energy X-rays disturbs electrons from the atom to generate an ion (Jenkins 1999; Shackley 2011a). The generated orbits or shells are read through a detector, into a multi-channel analyzer and by the software as emission lines (K through O) and the transition of the lines are technically measurable by XRF. The X-rays of highest transitions are measured by the XRF, measured as peaks called alpha radiation (Kα/Kα2). This is also the most frequent and highest energy transition that serves as accurate measures of the elements.

Most volcanic rocks are formed as highly variable composition and structure. That variable composition affects the fluorescence radiation detected by the XRF spectrometer (Davis, et al. 2011; Shackley 2011a). Software used in EDXRF allows for the matrix effects of mass absorption and overlap effects to be eliminated by stripping routines in order to accurately determine the concentration of each element (Shackley 2011b: 21). Also, the use of standards (RGM1 used in this study, a USGS obsidian standard from Glass mountain obsidian flow at Medicine Lake Highlands in northern California) provides international controls and calibration to check machine calibration and inter-instrument issues (Shackley 1998a, b).

For the present study and after some consideration having to do with the collection and legislative issues from the INAH (Instituto Nacional de Antropologia e Historia) in Mexico, it was decided to utilize EDXRF a nondestructive technique. It has been used in the past in major archaeological sites in the Maya Area (Rice 1987; West 2002). The samples were analyzed using a Thermo Scientific EDXRF at the Archaeological Lab at UC Berkeley; details on the instrument methodology can be found at Shackley (1995; 2011). The technique analyzes trace elements in geological materials, for the obsidian. The following elements were identified: Ti, Mn, Fe, Co, Ni, Cu, Zn, Ga Rb, Sr, Y, Zr, Nb, Pb, The (Table 4.14 and Figure 4.9). Once the obsidian was analyzed, the data went through a process of qualitative analysis, to determine what elements are present and which elements can best discriminate obsidian source or sources within a geographical region (Shackley 2011a).

The study was vital in providing information regarding exchange in the region, illustrating the regional movement of obsidian. The study was also important in providing a picture of the movement of goods and address questions regarding local production and exchange. Obsidian has been widely used to understand production and exchange in the Maya region (Davis, et al. 2011; Glascock 2011; Moholy-Nagy, et al. 2013; Shackley 2007).

The sourcing analysis indicates that the dominant source in the region was El Chayal (96.86 %), followed by Ixtepeque (0.60 %), and Jilotepeque (1.20%), all located in the highlands of Guatemala (Table 4.14). The three sources are located within the Maya area and their distribution has been reported in most sites where obsidian has been analyzed (Cobean 2002; Cobean, et al. 1971; Hammond 1972; Johnson 1976a). The other sources come from the center and west of Mexico: Penjamo (0.07 %) in Guanajuato, Zaragoza-Oyameles (0.60 %) in Puebla, and Pachuca (0.37 %) in Hidalgo (Table 4.14). The sources were identified using controls from previously identified obsidian in the Americas (Glascock 2002; Glascoek, et al. 1990; Shackley 1995). As it can be seen in (Figure 4.9), the elements Rb (Rubidium) and Sr (Strontium) were most operative in the analysis. Table 4.15 summarizes the results by site and source.
Table 4. 14: Total number and frequencies of sources identified.

<table>
<thead>
<tr>
<th>Source</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Chayal</td>
<td>1296</td>
<td>96.86%</td>
</tr>
<tr>
<td>Ixtepeque</td>
<td>8</td>
<td>0.60%</td>
</tr>
<tr>
<td>Jilotepeque</td>
<td>16</td>
<td>1.20%</td>
</tr>
<tr>
<td>Penjamo</td>
<td>1</td>
<td>0.07%</td>
</tr>
<tr>
<td>Pachuca</td>
<td>5</td>
<td>0.37%</td>
</tr>
<tr>
<td>Zaragoza</td>
<td>8</td>
<td>0.60%</td>
</tr>
<tr>
<td>Unknown</td>
<td>4</td>
<td>0.30%</td>
</tr>
<tr>
<td>Total Identified</td>
<td>1334</td>
<td>99.70%</td>
</tr>
<tr>
<td>Total sample tested</td>
<td>1338</td>
<td>100</td>
</tr>
</tbody>
</table>

**EDXRF results**

**Rb and Sr**

Figure 4. 9: Illustrates the concentrations of elements using Rubidium and Strontium.
Table 4. 15: Sites included in the study with EDXRF results and attributed sources.

The study has also shown differences in the distributional patterns of obsidian, as some sites have greater diversity and access to certain sources in comparison to others. Looking at the material analyzed there is a dominance of the obsidian sources from the Maya Area (Figure 4.10), specifically from El Chayal, Ixtepeque, and Jilotepeque (Hruby 2006; Johnson 1976a; Moholy-Nagy 2003; Moholy-Nagy, et al. 2013). The study also echoed the relationship with exchange routes and goods that were being exchanged between the highlands and the lowlands in the region. The study also points to the importance of terrestrial and riverine routes to the local communities and the Maya region as a whole (Silva de la Mora 2008, 2011).

However, if the source of El Chayal is taken out of the sample, a more illustrative pattern is observed within the regional distribution of obsidian. This simple exercise serves to illustrate the circulation and distribution of obsidian within the local communities and the dominance of obsidian from El Chayal and the Guatemala highlands sources (Figure 4.12). Even though there is a clear dominance, other sources are well represented, as it can be observed that the same amount of obsidian was recovered from Ixtepeque and Zaragoza, perhaps pointing to similar exchange dynamics from the two sources even though the are in opposite directions (Figure 4.11). Also, this simple exercise showed how distance might be more elusive in communicating differences in patterns of distribution for obsidian in the region. The pattern of the same quantity of obsidian from these sources illustrates the problem of accounting for the movement and
exchange of the volcanic glass. Specifically in the case of the three sources in Guatemala, the El Chayal obsidian has been well recorded and identified within the Maya region, with a wide spread use and distribution both within the highlands and the lowlands (Chinchilla and Carpio Rezzio 2003; Clark 2003b; Coe and Flannery 1964; Demarest, et al. 2014; Hammond 1972; Mejía and Ley 2000; Michels 1975; Moholy-Nagy, et al. 2013).

Figure 4. 10: Illustrates the proportion of sources in the study by count.

Also the results from the EDXRF analysis entered into a GIS database allowed the creation of maps with all the sites in the study that were vital in contributing a graphic picture of the distance the obsidian had to travel in order to arrive in the region (Figure 4.12 and 4.13). The maps serve as evidence of the flow and richness in exchange and contact in prehispanic Mesoamerica.

Figure 4. 11: Frequency distribution of non-El Chayal sources in the overall assemblage.
The GIS information generated distribution maps that illustrate the differences in circulation and transport of obsidian in the region. Delineating the distribution of obsidian by source, and serving as evidence for the possible routes of exchange and movement of the volcanic glass. The maps of distribution were made to depict the movement, transport and dissemination of obsidian by source (Figure 4.13) and the distribution by sites (Figure 4.14). All the maps generated played a crucial part in understanding the regional distribution of obsidian and the different communities. The patterns are very similar to others found in the region and the study intends to serve as evidence of the value of archaeometric tools to reconstruct the movement of goods and people.

The obsidian tools analyzed were all used, and even though I didn’t carry out a use wear analysis, it was evident the wide and shared used of prismatic blades in the region. Also, I think it relates to how communities share practices and ways of doing things. Another valuable outcome of the study was the observation of the multiple locales of production of this specialized pressure technique. The summary for the EDXRF elemental analysis is displayed in Table 4.16 and for the control RGM-1 in Table 4.17.
Figure 4.12: The sources identified in the study in relationship to the major sites considered in the study.
Figure 4. 13: Distribution proportion of obsidian from El Chayal.

Figure 4. 14: Distribution by percentage of el Chayal obsidian.
### Table 4.16: Summary of concentrations of elements (ppm) from the entire sample.

<table>
<thead>
<tr>
<th>Element</th>
<th>N</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Error Statistic</th>
<th>Std. Deviation Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ti</td>
<td>1338</td>
<td>1004</td>
<td>77585</td>
<td>1437.81</td>
<td>62.94</td>
<td>2302.49</td>
</tr>
<tr>
<td>Mn</td>
<td>1338</td>
<td>266</td>
<td>1025</td>
<td>575.9</td>
<td>1.55</td>
<td>56.84</td>
</tr>
<tr>
<td>Fe</td>
<td>1338</td>
<td>8453</td>
<td>19607</td>
<td>10118.03</td>
<td>21.56</td>
<td>788.92</td>
</tr>
<tr>
<td>Co</td>
<td>1338</td>
<td>15</td>
<td>1560</td>
<td>17.54</td>
<td>1.15</td>
<td>42.21</td>
</tr>
<tr>
<td>Ni</td>
<td>1338</td>
<td>-0.31</td>
<td>22</td>
<td>3.08</td>
<td>0.06</td>
<td>2.518</td>
</tr>
<tr>
<td>Cu</td>
<td>1338</td>
<td>-3</td>
<td>20</td>
<td>3.54</td>
<td>0.06</td>
<td>2.52</td>
</tr>
<tr>
<td>Zn</td>
<td>1338</td>
<td>41</td>
<td>300</td>
<td>85.05</td>
<td>0.58</td>
<td>21.28</td>
</tr>
<tr>
<td>Ga</td>
<td>1338</td>
<td>8</td>
<td>32</td>
<td>15.38</td>
<td>0.06</td>
<td>2.31</td>
</tr>
<tr>
<td>Rb</td>
<td>1338</td>
<td>98</td>
<td>231</td>
<td>155.67</td>
<td>0.28</td>
<td>10.38</td>
</tr>
<tr>
<td>Sr</td>
<td>1338</td>
<td>1</td>
<td>208</td>
<td>151.54</td>
<td>0.45</td>
<td>16.75</td>
</tr>
<tr>
<td>Y</td>
<td>1338</td>
<td>13</td>
<td>120</td>
<td>21.02</td>
<td>0.17</td>
<td>6.57</td>
</tr>
<tr>
<td>Zr</td>
<td>1338</td>
<td>18</td>
<td>945</td>
<td>112.43</td>
<td>1.45</td>
<td>53.06</td>
</tr>
<tr>
<td>Nb</td>
<td>1338</td>
<td>3</td>
<td>94</td>
<td>10.42</td>
<td>0.15</td>
<td>5.57</td>
</tr>
<tr>
<td>Pb</td>
<td>1338</td>
<td>20</td>
<td>36</td>
<td>29.28</td>
<td>0.05</td>
<td>1.87</td>
</tr>
<tr>
<td>Th</td>
<td>1338</td>
<td>-0.13</td>
<td>31.207</td>
<td>12.23</td>
<td>0.1</td>
<td>3.87</td>
</tr>
</tbody>
</table>

### Table 4.17: Summary of concentrations of elements (ppm) from the control of RGM-1.

<table>
<thead>
<tr>
<th>Element</th>
<th>N</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Error Statistic</th>
<th>Std. Deviation Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ti</td>
<td>71</td>
<td>1435</td>
<td>1672</td>
<td>1551.73</td>
<td>6.57</td>
<td>55.37</td>
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<tr>
<td>Mn</td>
<td>71</td>
<td>263</td>
<td>310</td>
<td>287.69</td>
<td>1.32</td>
<td>11.12</td>
</tr>
<tr>
<td>Fe</td>
<td>71</td>
<td>13406</td>
<td>13687</td>
<td>13558.97</td>
<td>6.79</td>
<td>57.27</td>
</tr>
<tr>
<td>Co</td>
<td>71</td>
<td>15</td>
<td>24</td>
<td>17.97</td>
<td>0.23</td>
<td>1.98</td>
</tr>
<tr>
<td>Ni</td>
<td>71</td>
<td>-0.3</td>
<td>10</td>
<td>3.67</td>
<td>0.28</td>
<td>2.38</td>
</tr>
<tr>
<td>Cu</td>
<td>71</td>
<td>11</td>
<td>20</td>
<td>15.74</td>
<td>0.26</td>
<td>2.22</td>
</tr>
<tr>
<td>Zn</td>
<td>71</td>
<td>18</td>
<td>31</td>
<td>24.31</td>
<td>0.28</td>
<td>2.43</td>
</tr>
<tr>
<td>Ga</td>
<td>71</td>
<td>13</td>
<td>23</td>
<td>17.79</td>
<td>0.25</td>
<td>2.16</td>
</tr>
<tr>
<td>Rb</td>
<td>71</td>
<td>140</td>
<td>149</td>
<td>145.95</td>
<td>0.24</td>
<td>2.08</td>
</tr>
<tr>
<td>Sr</td>
<td>71</td>
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<td>105</td>
<td>100.91</td>
<td>0.22</td>
<td>1.9</td>
</tr>
<tr>
<td>Y</td>
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<td>28</td>
<td>24.64</td>
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<td>1.75</td>
</tr>
<tr>
<td>Zr</td>
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<td>215</td>
<td>209.86</td>
<td>0.28</td>
<td>2.42</td>
</tr>
<tr>
<td>Nb</td>
<td>71</td>
<td>4</td>
<td>14</td>
<td>8.78</td>
<td>0.26</td>
<td>2.27</td>
</tr>
<tr>
<td>Pb</td>
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<td>23</td>
<td>29</td>
<td>26</td>
<td>0.15</td>
<td>1.28</td>
</tr>
<tr>
<td>Th</td>
<td>71</td>
<td>3</td>
<td>22</td>
<td>14.39</td>
<td>0.49</td>
<td>4.17</td>
</tr>
</tbody>
</table>

Sample No 71
Chapter 5: Household Archaeology: Group G at Chinikihá

To grasp the meaning of a community of practice is necessary to look at the smallest unit of analysis the household and the activity areas as the representation of social practices (Wilk and Rathje 1982a; Wilk 1989; Wilk and Rathje 1982b; Yanagisako 1979). This chapter will delve into the study of crafting, technology, and communities of practice by exploring a household group at Chinikihá (Figure 5.1). The previous chapters 3 and 4 have shown a regional perspective of how the local communities were organized in the region. Using the ancient settlement distribution, the communication routes, and material culture. This chapter will introduce the site of Chinikihá and the excavations carried out at the site. To understand the local communities of practice, I believe is essential to study the homestead and working areas. The place where people lived, walked, and reproduced their way of life and unique histories. The aim is to study the intimate spaces of activity and daily life, places where lithic production occurred. Many authors have addressed the importance and value for the identification of workshops and activity areas, yet the identification of this type of context in the field seems to be missing from archaeological reported research (Andrieu 2013; Potter and King 1995; Rice 1987). Further, the lack of large amounts of visible debitage from the surface can add to the misidentification of this type of material context, essential to our understanding of production and distribution patterns (Aldenderfer, et al. 1989; Clark 2003b; Speal 2009). Likewise, the identification of workshops can help identify and study the traces of crafting, skill, learning and daily practice (Bartlett and McAnany 2000; Hendon 2015; Joyce 2012; Kovacevich 2007).

![Figure 5.1: Map of Chinikihá and the location of Group G –highlighted area; Map IIA-UNAM.](image)

The Maya were expert users and crafters of stones. Having previous knowledge that allowed them to differentiate between the many physical characteristics of various geologic materials and how they were acquired, produced, used, and eventually discarded as part of daily life and practice. The sophisticated use of different geologic materials employed in daily life and embedded in social practices testify of the collective knowledge and shared social practices (Hughes and Smith 1993; Luedtke 1992). The study region, located on the Yucatan Platform, which includes the Campeche and present day Chiapas-Tabasco range provided a range of
sedimentary rocks exploited by the local communities (Grajales-Nishimura, et al. 2005; Grajales-Nishimura, et al. 2009; West 1969, 1971). The area is part of a geological region where different lithification processes resulted in a wide variety and mix of lithic materials and fossils appropriated during the past. These mechanisms resulted in a landscape dominated by sedimentary cryptocrystalline and microcrystalline quartz, as well as different metamorphic rocks used throughout the region part of distinct social practices (Grajales-Nishimura, et al. 2009; Luedtke 1992).

In chapter 3 the regional settlement was introduced. A territory where the communities were intertwined throughout the landscape. Observed in the relationship of the settlements with the Piedmont and geologic fracture part of a Karstic landscape, a natural feature with a genesis dating back the Cretaceous-Tertiary (65 Ma) (Teranishi 2011; Waibel 1946). The local communities created a unique relationship with the geologic features. A Piedmont path that ultimately progressed into the veins through which people interacted sharing social practices, crafting technologies, knowledge and geologic materials. Stone was used as masonry to build the surrounding environment at the macro and micro level. From its use to build walls, floors, and even furniture like benches, to the construction of roads connecting communities daily (Carmean, et al. 2011). Furthermore, its use to build roads, terraces, bridges, canals or large plazas is similar to those reported before (Folan 1991, 2001; Normark 2006; Snead, et al. 2009; Trombold 1991).

The expertise of crafting stones encompasses many fields or bodies of knowledge, related to developing skill and replicating situated ways of doing. Including the fundamental social relationships to acquire and exchange stone tools or other types of goods vital to everyday activities. As time went on, there is a clear indication of the importance of lithic by-products that became part of the lives and daily practices of ancient dwellers of Chinikihá and the greater NWML. The application of similar technologies, specifically knapped technologies is something that should be noted, as I think this echoes both the old relationship with stones and long-standing tradition of crafters. Seen through the body of knowledge passed by individuals from one generation to the next, in which knowledge of how to craft stones is passed down in a continuum of crafters (Bleed 2008; Downey, et al. 2014; Eerkens 2000; Joyce 2012). The woman, men, and children who lived and shared their physical and social spaces through routine activities in situated practices involving stones and ways of doing (Lave 1993).

Ways of doing that reflect shared knapped technologies using cryptocrystalline materials and shared crafting technologies (Garcia Moll 1977; Guevara Sanchez 1981; Lorenzo and Mairambell 1986; Mastache, et al. 1990; Santamaria and Garcia-Barcena 1984). People have been creating stone tools for a long time, through processes of social learning grounded on active participation, which includes observing and learn by doing. The study region’s geology is very diverse, and even though there are vast deposits and good limestone available, there is considerable variation in the qualities of the raw materials available for the local communities. The people that lived and worked at Chinikihá needed to outsource the procurement of certain products like chert, obsidian or Pyrite. A reflection of the complex network of exchange and shared practices by the local communities. Observed initially in the imported obsidian flowing through different channels and sourced from distant places in the center of México and mainly from the highlands in Guatemala. For the dwellers at Group G, this probably meant having the contacts and the sufficient resources to acquire the right type of materials to produce stone tools.
Daily practice and life histories at Chinikihá

The case study pivots on the premise that people intertwined within communities linked through daily practice and peripheral participation. The ancient dwellers in the NWML are theorized from a perspective of communities of practice. Through the study of stone tool materiality, production, and crafting technologies as the traces through which people shared daily and social practices. In particular, regarding knapped production, waste or debitage of stone tool making, and masonry from the perspective of household societies developed recently within archaeology (Gillespie 2000; Hendon 1996a, 2010b; Hendon 1996b; Joyce 2000b; Tringham 1991, 1995, 2005).

The study of crafting considers the importance of situated learning, a perspective developed to dissect differences in skill and craftsmanship to understand the social and political organization, or meaning in relationship to communities (Clark 2003a; Costin 2001; Hendon 2006, 2015; Hirth 2003). The technology is theorized as the embodiment of social responses and solutions employed to grapple with the physical world (Clark 2003a; Hendon 2006). Social practices that manifest in many ways. Including how people cook their meals, how they eat, make their furniture, construct their houses, dress, or even how they write their history (Bartlett and McAnany 2000; Canuto and Yaeger 2000; Hendon 1989; Hester and Shafer 1994; Joyce 2012; Sassaman and Rudolph 2001; Wenger 1998). A perspective of community of practice is grounded in the value of common ways of learning that fits perfectly with the type of study explored and developed here.

The regional work and the site research serves as evidence of the overall lithic technological diversity, homogeneity in the region and many of the sites. Initially recognized in the study of the regional patterns of obsidian, where evidence for shared access and use of prismatic blades is clear. Furthermore, It seems that everyone had a basic knowledge of stone tool use, reduction, and maintenance techniques used in everyday life. However, there is a difference in the production level and crafting since not everyone was producing stone tools the same way and in the same proportion. Even thought lithic debitage is commonly found, there are visible differences in localities of production and the distribution between households. Authors have remarked previously the shortage of reports in areas of production and their distribution directly linked to the lack of research identifying workshops (Hirth 2008; Masson and Freidel 2013; Moholy-Nagy 1990, 1997). The implications in the identification of stone tool debitage, as an indicator of production, can be misleading and also point the activity at hand. The practice of stone tool production leaves all the traces of production. But how that wasted material is disposed of can have different implications and meaning. Since debitage of production can also have other social and cultural uses. Debitage can be left in situ after knapping, removed and deposited in safe areas, reused as architectural filling, or used in burials (Healan 1992; Hester and Shafer 1992; Mallory 1986; Moholy-Nagy 1990; Shafer and Hester 1983). Workshops are theorized as places where craft activity results in the production of goods in larger quantity than the producer’s consumption (Clark 1986, 1990). The workshops at Group G is the largest deposit of stone found at the site until now. Another context was found at the site that reflects the diversity of crafting and materiality. However, the Group G is truly a unique context concerning the concentration and amount of stone tool debitage.

The Group G was also one of the locales for the production of obsidian prismatic blades, observed in the recovery of exhausted prismatic blades cores and core rejuvenation flakes. The obsidian collection gave the opportunity to study how one industry (pressure technique) can shed
information on crafting techniques, movement of goods, and ways of using the tools. Including the diversity in the locations of production. The producers were also ambulatory and very likely local crafters who had to learn the techniques of pressure blade technology through grounded peripheral learning and referential participation through observation and practice (Lave and Wenger 1991). Additionally, there are many indications of people having access to different materials not necessarily found locally at the site, but acquired from the region. Access to different qualities and types of materials meant having the right channels to obtain the goods. Just as an example, the use of a dark black flint, of very high quality, can be detected throughout the study region. This material source has not been identified locally on surveys yet, but the material is of high quality and reflects an extensive local distribution. These blades point towards a possible production of flint blades using a pressure technique. The crafters created very thin blades that were hafted and used similarly to prismatic blades. Observe Figure 5.2 below for an example of this type of black chert core. Found on the surface next to a domestic context about 100 m to the East of the excavation area.

![Figure 5.2: Used core of the black flint, recovered from group H.](image)

The crafting of stone tools had many different components based on daily social practice. Including grounded referential participation in the development of skill and knowledge in crafting techniques of chipping stone, but also the necessary social interactions that gave access to many materials distributed locally (Bleed 2008; Carmean, et al. 2011; Eerkens 2000). In reference specifically to a skill more social in nature, the personal social relations needed to acquire the desired raw materials from both long distance exchange and regional sources or channels of distribution, something harder to observe archaeologically. However, the vast diversity of raw material, the physical quality of raw material, diversity in colors, textures, and quantity of stones point toward exchange access. Such diversity can be interpreted to a household with the ability to acquire all the materials and tools needed to work. The excavation at group G reflected the abundance of raw materials available to the crafters like chalcedony, limestone, fossilized chert, chert (flint), quartz, granite, obsidian, sandstone. The crafters at this architectural group had the knowledge and utilized different techniques, like pressure blade technology, direct and indirect force, grinding and polishing. The architectural complex excavated presented a unique type of context demonstrating the living and working spaces defined through both visual and nonvisual evidence.

The many uses of lithic tools can also be a reference to other types of activities that are much cleaner in nature and don't live much material evidence, like quartz polishers used for ceramic production or spindle whorls used in textile production. The production can utilize and recycle the clay not used. In the case of textile production, spindle whorls serve as the only evidence in cotton manufacture for weaving. In this sense Lithic production is reductive in nature, which leaves traces of the entire process of production, crafting techniques and behavioral choices of
production (Ahler 1989; Andrefsky 2001, 2007; Clark 1991). One of the results of this study was the identification of spaces through the use of visual evidence of lithics and ceramics distribution and the use of nonvisual evidence to contrast and compare the areas. Done through the initial survey of the architectural group through visual examination of the area. Followed by an initial shovel testing and small excavations that resulted in traces of the activities that led to the excavations of specific sectors of the homestead. To exemplify this point, all the grinding stones or manos were found near a kitchen, while all the hard hammers were found in association to the terraces, where the activity areas of knapped technology were found. The ceramic material was also associated in larger quantities and diversity of wares with the domestic spaces closer to the home and kitchen.

**Social organization: Gender and Labor**

Accounts from different parts of Mesoamerica illustrate some of the general tendencies for residence, craft organization, craft production and the relationship with age, gender and status (Carballo 2013; Clark 1997; Costin 2001; Hendon 2006, 2015; Hirth 2006b; Inomata 2001b; McAnany 2013; Reents-Budet 1998). There is a tendency to generalize certain genders, such as prehispanic women seen as subordinate to men. While there are many indicators that women might have enjoyed a greater level of equality between the sexes and power in comparison even to some modern societies (Burkhart 1997; Carballo and Pluckhahn 2007; Joyce 2000a, 2008; Kellogg 1986; McCaa 2003; Schroeder, et al. 1997). As they could own land, inherit their property to their descendants and initiate divorces from their spouse. Additionally, some production has been seen closely related to elite groups. For example pottery production, which could have taken place at both commoners and elite residences. But highly decorated pottery with painted scenes and hieroglyph writing is reported to have been produced by people with specialized training and specific knowledge base, the Classic Maya elites (Reents-Budet 1998). There is also evidence for specialized knowledge and skill that transmitted from elder individuals to the younger community members. For instance, there are accounts of the use of metates (metlatl or grinding stone) for food processing, and of spinning and weaving, as female-gendered activities that were transmitted from generation to generation.

Another important aspect of the practice of crafting was the age of the individual, as the person could gain proficiency in a craft as she or he approached adulthood, maintaining the skill through routinized practice (Andrews 2003; Bamforth and Finlay 2008; Bleed 2008; Downey, et al. 2014; Eerkens 2000). As mature adulthood approached so might the loss of competency as manual dexterity, eyesight and strength began to fade. A life cycle for the craftsperson can be seen as analogous to the notion of chaîne opératoire or operational sequence where the choices and steps transform the material from a natural condition to a fabricated item that has a life cycle of use (Lemonnier 1986: 149). That results in a habitus of crafting creating a culture of technology based on shared practice and knowledge that changes over the life course (Lemonnier 1986: 154).

Ancient Maya society, like other Mesoamerican societies, could have transmitted knowledge from generation to generation, replicating skill, expertise, and proficiency with precise repetition for countless generations. Archaeologically the allusion to use terminologies such as types or traditions used to assign chronologies and typologies, yet they speak to us of memory, social status, gender and traditions that are part of the cultural transmission of technology(Hendon 2006, 2010a).
But perhaps a reason why some crafting is associated with males or females has to do with the terminology and sources utilized to understand and explain craft production and social organization among the Maya. Unfortunately, many times assigning exclusivity of craft production and skill with genderized labor by interpreting the pronominal gender associated to crafting in Colonial Yucatec Maya dictionaries (Barrera Vasquez, et al. 1980; Ciudad Real 1984; Gates 1935). Assigning crafting activities during colonial Yucatan for women to be: spun thread, wove cloth, made nets, and probably also plaied mats and baskets. For men: pottery, worked wood, wax, stone, leather, and practiced many minor arts such as making flutes, shields, bows, and arrows, and probably gourd vessels. Based on ethnographic studies, pottery and gourd vessels are usually expected to have been female crafts, although not exclusive to women (McAnany 2010; Reina and Hill 1978). Ruben Reina and Robert Hill (1978) point out the explicit references in the Colonial Vienna and Motúl dictionaries to male potters and the lack of references of women producers. Perhaps the tribute load placed on Maya women during the colony made them specialize in cloth production and leave other types of crafting aside (McCafferty and McCafferty 1991).

An unanswered historical concern regarding daily practice and social identity of ancient Maya crafters. There were a number of crafts that might have been produced by both women and men in prehispanic times (i.e.: stone tools, lapidaries, masonry, mantles, paper, baskets, mats, sacks and nets, hunting traps, carved gourds, shell, bone, hide work, salt processing, cacao and tobacco cultivation, carpentry and specialized woodwork, rubber processing, glues or adhesives, beekeeping, etc). The same question stands for specialized craft knowledge that could have been restricted, or not, to family status or the group's activity (i.e.: architects, scribes, painters, hunters, midwives, healers, calendar keepers; stone workers, etc). Recent studies point out the importance of daily practice and multicrafting in archaeological contexts (Dobres 2000; Shimada 2007). In this sense household archaeology provides the opportunity to study human activity at a finer scale, allowing to reconstruct the depositional history and structured history of the site, providing an opportunity to create a dialogue, an archaeological chronotype with historical meaning (Joyce 2002: 52). What other authors have discussed about the creation of an archaeological interpretation and historical narrative discussion of the nature of archaeological explanation and discourse (Hodder 1999: 55-56).

**Group G**

The Group G is located on the northern section of the site, next to the main road and access to the central plaza (Figure 5.3). The area was identified as a unique context where production of stone tools was evidently visible. Its location and physical characteristics represented an ideal example of a commoner household, not located within the main node of the site, where the big houses and elite context are located, and therefore would allow a bottom-up perspective and study of living space. The survey and excavations were carried out through three different field seasons. The study serves as a case study of a commoner household social daily practices about the production and crafting of stone tools.

The Group G is an architectural complex with well-defined spaces and architectural layout in an excellent state of preservation (Fig 51). In this sense, looting has been a problem for many decades in that region. Even though there is a law against the practice since 1972, it continues to be part of the destruction of many sites. The biggest problem at Chinikihá has been associated with its location and proximity to the main road, with easy access to reuse the masonry at the site. Stone material looted for many decades for construction of local roads, bridges, houses, or
anything that needs precut masonry. It is common to find looting holes in the structures, even complete mounds destroyed with bulldozers sold by the recent and past owners of the land. The physical characteristics of Group G, specifically not being of monumental proportions and the interest by the new proprietor, this architectural complex was intact. All the deposits were in their original location, and only a small looting hole was identified on the southern section of G13.

The excavations were carried out using a single context recording system that considers human-made stratigraphy and reconstruct the depositional history (Brown and Harris 1993; Hammond 1993; Harris, et al. 1993; Joyce and Pollard 2010). The Harris matrix provides a methodological tool to reconstruct the depositional events and isolates specific activities and deposits in relationship to anthropogenic stratigraphy. The single context recording system was the means to document the different depositional events that might be otherwise not recognized (Harris, et al. 1993). This method also allows the archaeologist to understand the depositional processes and relationships that can help in the association with other time periods, and architectural remains, events and local histories (Brown and Harris 1993; Hammond 1993; Harris 1989).

There have been certain types of archaeological contexts located in the Maya area that has given archaeologists unique opportunities to study and view households at the time of abandonment. At sites such as El Cerén in El Salvador, archaeologists were able to locate houses, recording the cultural deposition, ecofacts used and storage loci from around 600 A.D. when people fled due to a volcanic eruption (Sheets 2002). Another example was found at Aguatecas’ elite residence presenting a similar event of abandonment around 800 A.D.(Inomata, et al. 2002). These samples are unique in the sense that they allowed the archaeologist to study architectural remains and the spatial distribution of artifacts at a given moment due to fast abandonment. Something observed in this study was the unique history of events at this part of the site, and some of the social implications part of the bigger community and the overall constellations of practices.

Different areas have been identified by now where significant traces of stonework were identified and documented at Chinikihá, such as the survey at Group B and Group G (Silva de la Mora 2012). As mentioned briefly before, the architectural complex at Group G had unique physical characteristics and a wealth of archaeological materiality that became evident after the initial field surveys (Campiani 2011, 2014). Including the topography and location, containing a water source and a spacious layout (Figure 5.3 and 5.4). The region is quite hot most of the year, and even though precipitation varies within yearly cycles, weather patterns affected in different

Figure 5.3: Illustrates excavated area and topographic model of Group G.
ways the many areas for water supply (Iannone 2014). As an example, the topography of the region allows for local access to water year long with proper draining during the wettest time of the year. During the mapping of the site, the topography team found water holes and some elevation difference seen in the water distribution within site. According to the location of the center was a determinant factor in the supply of water. For areas on the hilltops in the central node of the site, they had to walk down to a water source and fetch the water on a daily basis. Some “houses” had access to water all year long and are located near the River Chinikihá, but no water source of that type exists at the center of the site. I mention this in relationship to Palenque, where many rivers flow through the site, and the main node includes architectural modification that gave many families access to fresh water through aqueducts and drainage ducts. Including major architectural modifications in the topography through the construction of aqueducts, basements, and terraces to channel the water draining down the Sierra Madre folds (Houston 1996; Kirch, et al. 2012; Marken 2007).

![Figure 5.4: Illustrates topography and water dyke (water source for cattle known as “aguada”).](image)

An initial survey using shovel test and small excavations gave a clear pattern of use of space and differentiation in the deposits of the lower plazas or open spaces. The lower areas are flat, and the shovel test gave the opportunity to see how there was a mixture of natural deposits part of the topography and the filling of sectors with strata containing cultural material. These open plazas had been filled through anthropogenic processes, and the topography had been modified in the places that needed to be flat. Additionally, constructing terraces and building platforms to construct the house and activity areas. The terrain is very flat, and through the shovel testing, it was possible to observe the depth of the deposits (up to 50-60 cm below the surface). Including the different matrix of soil differentiating the deposits.

This initial survey was vital to understand the deposits and the distribution of the cultural material. The materiality recovered was weighed, and maps of distribution created that allowed a general perspective of the types of deposit and physical characteristics of the deposits. The ceramics and lithics from those shovel test were vital in providing a picture of the deposits and possible use of spaces. The Figure 5.5 below and Figure 5.6 display the results of the survey, highlighting the weights (in kilograms) of ceramics (blue color) and lithics (red color). The distribution of the debitage from stone tool production was concentrated between the terraces G22-G23-G12-G15. The ceramic material was more dominant and located on the lower parts of the complex near platform G13. Most of the ceramics collected came from the back sections excavated between G13 and the space located adjacent to G16. Later during the excavations, it was discovered that this space was alongside the kitchen of the house.
Figure 5.5: Group G and the areas initially surveyed during the first two field seasons. The map also shows distribution of ceramics and lithics from shovel test. The white color represents the survey in 2011 and the color black the 2012 field season.

Figure 5.6: Total weights in Kilograms from the shovel test; color red is for the lithics recovered and blue for the ceramic material. The accumulation of debitage had to be deposited during an extended period, and there is a good indication of generations of stone crafters or at very least a broad range of practitioners and crafters with different levels of skill that lived at Group G for many generations (Figure 5.7). The existence of lithic evidence of various levels of skill, proficiency, and knowledge was not expected. A very positive indication of a community that is transmitting the technological knowledge through grounded practices, peripheral observation, and experiential learning (Hendon 2004, 2015; Joyce and Hendon 2000; Lave and Wenger 1991). Similarly to researchers who have looked at the importance of communal practice and crafting of stones from the perspective of children practice and learning (Högberg 2008). The exposure of children and
novices to the crafting of stones and daily practices reflects the richness of stone tool studies and their possibility for interpretation.

![Debitage on the surface and the results from a shovel test.](image)

There are many parts of the site where extensive deposition of stonework activity or production of tools was detected. Including a visual difference in the craftsmanship of the artifacts in every group and even households. Tool production debitage and re-sharpening debitage in the region is an indicator of local knapping traditions, yet there are visual differences in the perceived technological style (Collins 1975; Lechtman 1977; Lemonnier 1992). The presence and ubiquity of stonework are also closely related to the identification of possible activity areas. The excavated areas for this study were able to define two clear areas of activity: a domestic and working space. The first one defined by the existence of the homestead, the kitchen, and possible family fields. The second area identified by the presence of large amounts of stonework debitage over the slope of the hill. This last one was the location where the production was taking place, including the different activities identified by the differentiation in the distribution of material traces through both visual and nonvisual evidence.

**Radiocarbon dates**

Apart from the charcoals recovered during flotation, samples were collected when identified during excavation and processed for carbon dating. The initial cleaning and separation of the charcoals was done at the Geology Department at UNAM (Rebollo Franco 2016). The screened samples were then sent to the University of Arizona Accelerator Mass Spectrometry (AMS) Laboratory in 2015. Calibrated with the OxCal v.4.2.4 Bronk Ramsey 92013; R 5 IntCal13 atmospheric curve (Reimer, et al. 2013). The samples with successful carbon dates were recovered in direct association with an altar from a substructure. The excavations were also important in allowing a view of the architectural sequence and construction technique at Group G. The continuity in the construction over the initial platforms could have been to the growth of the group or families living there. Perhaps the result in needs that led to spatial changes reflected in the architectural layout of the G13. The last construction epoch left out and did not make an obvious altar. However, the social use of the space in relationship to the altar seems to have continued. Since the beginning of the excavation, the area presented a complex overlapping of deposits of different texture and even burned soil (Figure 5.21 and 5.22).

From the samples collected for carbon dating only two of the charcoals resulted in relevant dates (Figure 5.8 and Table 5.1). The sample CH 42 came out of the last deposit before mother rock or bedrock, probably pointing to the initial occupation. The deposit was associated to ceramics and
lithics. The second sample CH 43 was found on the surface of a tamped floor from the substructure, and associated to the altar. Pointing to the expansion of the architectural complex and the construction of G13 as it looks today. The architectural complex continued occupied until the abandonment of the site in the Late Classic. The sample CH 43 was also associated to ceramics, lithic debitage, shell, a broken figurine and burned soil, which was part of the tamped floor part of the altar. The dates also serve as collaboration for the relative chronology provided by the ceramic analysis that will be discussed ahead.

Figure 5. 8: Calibrated carbon dates (Ca/AD).

<table>
<thead>
<tr>
<th>Lab Code</th>
<th>Context</th>
<th>Performance wt %</th>
<th>Radiocarbon Years (without calibration)</th>
<th>Cal AD (In)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 42</td>
<td>OP 311 Locus 15</td>
<td>45.40%</td>
<td>1514 ± 20</td>
<td>540-585</td>
</tr>
<tr>
<td>CH 43</td>
<td>OP 311-EXT Locus 10</td>
<td>20.90%</td>
<td>1447 ± 20</td>
<td>600-640</td>
</tr>
</tbody>
</table>

Table 5. 1: Illustrates the carbon dating results.

Household archaeology, activity areas and residue analyses

Archaeology has dedicated much work and effort to the study of formal aspects of architectural compounds, barrios, villages, homesteads, houses and the possible implications of their social organization. Initially from a formal archaeological perspective resulting in the comprehension of construction techniques, materials used, formal size, spatial disposition, possible use and chronology (Aldenderfer and Stanish 1993; Andrews 1984; Hohmann-Vogrin 2006; Marquina 1928, 1964; Shaw 1998). Household archaeology approaches living spaces from a theoretical and methodological perspective with the aim of elucidating ancient patterns of domestic life reflected in the archaeological record (Arnoud and Netting 1982; Ashmore and Wilk 1988a; Bawden 1982; Beaudry 1989). The use of different approaches and methods usually depends on the standpoint of the researcher. The nature of the material remains the region under study or the type of archaeological site.

The development of household archaeology coincided with a paradigm shift within Processual archaeology to a need for ways to bridge the gap between empirical data and generalized theorizing through middle range theory, voiced by Lewis Binford (1977) and Ruth Tringham (1978). This resulted in a shift in the interest to the conceptual development of household archaeology (Ashmore and Wilk 1988b; Wilk and Rathje 1982b). The study of households allows an analysis of social groups and their interactions with economic and ecological processes. Processual archaeologists brought a methodological framework of scientific logical positivism that combined objective observation and standardization of the data, to household archaeology (Hendon 1996b; Sheets 1994; Tringham 1991, 1995). Even though it was a relatively late development with Processual archaeology, archaeologists bridged household research with behavioral and ecological processes through the development of empirical theory-building known as middle-range research (Binford 1986; Binford, et al. 1983; Tringham 1978;
Wilk and Rathje 1982a). Particular attention was given to excavation methods and field recording techniques because excavation is a destructive activity. The household was examined and analyzed at a micro-scale to understand social and economic changes at broader scales (Tringham 2001). Activity areas were studied following a standardized methodology that could be reproduced at different excavations, allowing for the data to be analyzed in many ways. The archaeological record offered a window into the rich detail of everyday activities and lives. Attempting to understand daily practice by studying the spaces where people lived and worked. Households were seen as activity groups where past activities took could be explored and studied (Netting 1965; Netting, et al. 1984; Wilk and Rathje 1982b).

The development and use of activity area with residue analysis have seen a unique developed in Maya archaeology (Gillespie 2001; Hendon 1989; Joyce and Gillespie 2000; Rathje 1983; Wilk and Rathje 1982b). The emphasis and value given to understanding processes of deposition and the formation of archaeological contexts were a significant development in US archaeology (LaMotta and Schiffer 1999; Schiffer 1987). A similar advancement occurred in the UK that led to the development of recording techniques and interpretive archaeology that resulted in important changes in the methodology of recording data during excavations in both the Old and New World (Brown and Harris 1993; Harris 1989). It is not universally accepted, and it became a characteristic practice of Post-Processual excavations. Many archaeologists began utilizing a version of the single-context recording during excavation. Standardizing the information from each level of a unit excavated that allows for post-extraction analysis. The method consists in the production of ordered and complete site records during excavations that then become the structure and nomenclature for the archive report (Hammond 1993; Harris, et al. 1993).

Physically and spatially separated data sets that can then be utilized to interpret the excavation and material evidence. The change from arbitrary layers to single context allows the researcher to separate and follow depositional events that can only be detected by utilizing this method.

With the advancement in household archaeology, an intimate and personal perspective became visible (Ashmore and Wilk 1988b; Wilk and Rathje 1982b). The studies were able to detect finer and even nonvisual lines of evidence, through the use of residue analysis by testing floors and surfaces to comprehend daily practice and use of space (Barba, et al. 1996; Inomata and Stiver 1998; Manzanilla and Barba 1990). The interest in the study of activity areas has continued and developed into research addressing social organization or social structure.

Additionally, household studies in the Maya region have interpreted patio groups as part of domestic groups (Hendon 1989; Sheets 1991). While other interpretations have indicated, the individual range type structures were occupied by many households sharing central spaces like patios (Tourtellot 1983; Tourtellot and Sabloff 1989). Moreover, it has become evident that households are not homogeneous entities and can be studied from perspectives of agency (Gillespie 2001; Hendon 1997; Inomata 2001a; Joyce 2000a, 2007; Joyce 2000b) or practice theory (Bourdieu 1977) and structuration (Giddens 1984; Swell 1992). Research from the perspectives on gender has examined the roles of individual agents within a community, where every person has their identity and place within the social structure, including status (Hendon 1999; Joyce and Hendon 2000). Practice theory stressed how large social structures are embedded in daily practice, and emphasizes the study at the micro-scale to understand the macro-scale (Bourdieu 1977, 1990; Swell 1992; Tringham 1995).
Consequently, a focus on activity areas and its research possibilities have the ability to consider more intimate issues about its dwellers and daily practices (Costin 2001; Tringham 1996, 2005). The value of a perspective on social learning concerning craft production of stone tools can help elucidate and reconstruct the how people learned and became agents capable of making choices and safekeeping technological knowledge. The use of a perspective embedded in daily practice and situated learning must also include the use of other types of inquiry, what Ingold names “lines of evidence” (Ingold 2007). Aimed to study the archaeological materiality from multiple perspectives, using different methods or lines of inquiry to have a broader perspective and more interpretative tools.

Hence, activity areas are theorized as the locations of evidence where the traces of past activities define the practices and agents in the house (Triadan and Inomata 2004). For archaeologists, activity areas are the closest direct observation of past societies and precisely those activities (Joyce 2015; Triadan and Inomata 2004). The relevance of activity areas can elucidate a way to access interpretations of social practices and even individual agents. Activity areas reflect the spatial and functional organization within and around a dwelling (Triadan and Inomata 2004: 219). As mentioned briefly before, different lines of evidence have been used to define and delineate activity areas. From the architectural visual features and differences in the materiality recovered, including macroscopic and microscopic remains, as well as chemical residue analysis and botanical studies.

The initial identification of activity areas was done through the recognition of physical characteristics and the materiality associated with them. Specifically, lithics, ceramics and artifact assemblages in situ uncovered during excavations. In this sense, formation theory stresses the importance of artifact assemblages and how they are found. Though it also stresses they may not necessarily be likened with a function of a given area (Inomata and Sheets 2000; Schiffer 1987). Similarly, the consideration that in situ assemblages may reflect the last moment of occupation or the time before abandonment, and do not necessarily represent the use of space or the artifacts left there, as the case with storage spaces which are not activity areas (Deal 1998; Triadan and Inomata 2004).

The spatial analyses at Group G were able to provide crucial information for the interpretation of a commoner household and their daily practices. Also, the materiality recovered was a key element in the comprehension of the distribution and use of spaces. The excavations were vital in providing a general picture of the use of space and the formal differences of the possible uses, comprising the home and surrounding areas. Presenting a view of what a household looked like in the past, conceding a view of the home. The place where they live, constituted by formal architecture that included masonry construction of raised walls with a wattle and daub roof, even built in furniture (like benches or beds). In the house, the floors and walls were coated with a thick layer of stucco (Figure 5.9). The floor surfaces were well kept, and at least three thick layers or coating of stucco were identified. A common practice of up-keeping the floors and surfaces to protect them and ensure the long-life of the architectural features. Also, clay was utilized to enclose and protect parts of the walls and the connecting section of the inner roof frame. The roofs were made of a wattle and daub capped with a layer of clay. Fragments of this clay covering were recovered during the excavations on the house. These clay chunks also had the imprinted scars of the reeds used.

On the central patio of the platform, the excavations uncovered the frame of an altar from a substructure. This altar was located in the middle of the complex and reflected a unique context.
of activities represented on the materials recovered and the superposition of many deposits of different colors, texture, and materials associated. Including burned soil and figurine fragments located on top of the floor of the substructure. Also, the excavation of this part of the platform served as evidence of construction techniques and the construction system used. Another result was related to the precise recording of the architectural layout of the group. The use of photo scans in combination with the topographic mapping was used to create a record log that permits understand the entire process of excavation. The data has been used to generate maps on GIS and AutoCAD of the excavated areas and associated architecture.

![Figure 5. 9: Illustrates the excavated area in G13 where stucco floors and domestic spaces.](image)

On the northern part of the platform, a distinctive architectural feature was exposed. Just like the central patio, it had an earthen tamped floor, and the structure had the association of lithic tools not found on the terraces or the dwelling, grinding stones. Also, the ceramic analysis differentiated the type of ceramic wares, associated with food production. The architectural feature had unique formal characteristics like a hearth or fire pit.

The study of activity areas has been used in archaeology to understand past activities. Used as evidence to approach interpretations of the level of social practices and even individual agents. The study and description of activity areas can serve to understand the spatial and functional organization within and around residences. Different lines of evidence can be used to define activity areas, including the use of distributional analysis of artifact assemblages and the use of organic and inorganic residues in surfaces such as stucco floors and tamped floors.

The excavations at Group G do not reflect fast abandonment. The surfaces on the living and working spaces were clean, pointing toward an slow and timed abandonment of the complex. The spaces evidence seems to indicate that people had time to leave and take what they needed. Particularly in the case of the house, where stucco floors were cleaned, and very few artifacts were found in situ. In an attempt to understand the possible uses of space chemical and microscopic analysis of residues in soils were utilized to identify and differentiate between the activity areas.
The sampling strategy

The survey continued having a controlled and systematic sampling strategy to collect the different sets of data. Each sampling strategy was designed with the purpose of having comparable data that was systematically collected and recorded. That information resulted in evidence for the use of space within and surrounding architectural features. The initial shovel test (Figure 5.7) gave a general perspective of the topography and some general patterns at the architectural complex. The exterior spaces were also of interest, and the use of areas surrounding G13 was a vital part of daily life and the local social practices. The sampling strategy sought to study the surrounding areas of the main platform to try to interpret and explore the surrounding spaces and open spaces. Among the possible uses of the surrounding areas could have been for the cultivation and harvest of plants, breeding and safekeeping of domesticated animals like (turkey / *Meleagris ocellata*) or dogs (*Canis familiaris*), and the captivity of hunted animals for consumption like deer (*Mazama Americana, Odocoileus virginianus*) or tepezcuintle (*Lowland paca / Cuniculus paca*) (Montero Lopez 2008, 2012; Montero Lopez and Núñez 2011; Trabanino Garcia 2014b). Because of the physical characteristics of the surrounding space, the possibility of multi uses and functions of spaces and the use of areas surrounding the domestic architecture, patios, and gardens. Including keeping small orchids, with plants for medicinal or culinary daily consumption and subsistence (Marcus 2004; Melendez Guadarrama, et al. 2013; Obregón Cardona 2014; Parnell, et al. 2002b; Trabanino Garcia 2014a, b). Produce kept close to the house and used throughout the year.

The exploration for interpretation of different domestic spaces was also informed through the observation of local Chol communities of El Naranjo and Lopez Mateos. Two nearby communities in the neighboring region around the ruins of Palenque where direct observation of traditional, modern communities have been described (Trabanino Garcia 2014a, b). Modern Maya communities multiplicity of domestic activities extends within and surrounding the domestic architecture, patios, and gardens. Including keeping small orchids, with plants for medicinal or culinary daily consumption and subsistence (Marcus 2004; Melendez Guadarrama, et al. 2013; Obregón Cardona 2014; Parnell, et al. 2002b; Trabanino Garcia 2014a, b). Produce kept close to the house and used throughout the year.

The strategy included the gathering of soil samples from two types of surfaces, tamped earthen floors, and stucco floors. Three main areas were surveyed: a) the surrounding areas around G13, b) the internal spaces within the platform, and c) one of the workshops. Efforts were focused on the main platform (G13), where the earthen and stucco floors were analyzed. Well preserved stucco floors were localized in the primary household. Another sampling was done within architecture, like the stucco floors (G13a) and the tamped earth floors in the kitchen (G13b). The next section will exhibit the results of the chemical analysis of both the tamped earth floors and stucco floors.

In general two different samples were collected whenever possible, one on top of the other at controlled intervals following the excavation methodology of recording and understanding cultural deposition. The different maps are a representation of each surface identified and also as means of comparison resulting in various samples in a data groups to compare. Each surface or floor was called a Locus 1 (at ±3 cm below the surface) and a second Locus 2 (at ±5 cm from the surface). The samples represent the middle and inferior portion of the first horizon of the identified living surface. The logic is to collect samples that permit the evaluation of the vertical mobility of the chemical residues, considering the modern use of the land and avoid the contamination of the samples collected to understand the deposits and processes that occurred after the abandonment of the site (Obregón Cardona 2014). The two surfaces were not always
identified and not all the areas have results from those two possible surfaces. In the case of G13a, the homestead, the stucco floors were well preserved. On the front bench, three different stucco surfaces with reapplication of plasters for the maintenance of the house was distinguished. Additionally, the excellent preservation of the stucco floors meant a good sampling of the internal spaces of a home.

**Distribution of chemical residues**

The use of chemical and microscopic residue analysis in soils is a tool used in archaeology to identify and interpret activity areas. The relevance of residue analyses as a powerful tool to detect and understand the possible use of those spaces. The analyses were initially developed in the Maya area by Luis Barba and Linda Manzanilla (Barba 1994; Barba and Manzanilla 1987; Barba and Ortiz 1992; Manzanilla and Barba 1990), Nicholas P. Dunning (Dunning, et al. 1997; Dunning 1993; Dunning 1992) Richard E. Terry and his team (Parnell, et al. 2002a; Parnell, et al. 2002b; Terry, et al. 2000; Wells, et al. 2000), and Cynthia Robin (Robin 1999, 2002). This type of analysis used in combination with extensive excavations provides a general view of the distribution of chemical residues linked to daily activities and practices. Residue analyses provide general patterns that can be observed in floors and soils at archaeological sites. In this sense, organic and inorganic compounds are preserved in the archaeological record, such as phosphates or different types of heavy metals (Duning 1992; Manzanilla and Barba 1990; Triadan and Inomata 2004). High concentrations of phosphates in soils can indicate high organic content associated with food preparation, cooking or trash deposit through time (Ball and Kelsay 1992; Dunning, et al. 1997; Dunning 1992; Manzanilla and Barba 1990; Parnell, et al. 2002b). Also, high concentrations of heavy metals, like copper or iron have been interpreted in relationship to lapidary work, and ceramic or painter’s workshops (Parnell, et al. 2002a). The use of chemical residue analysis considers the nature of anthropic activities on the premise that chemical residues accumulate through long periods of time and are the results of many different activities that took place in an area (Bethell and Máté 1989; Heron 2001).

The Maya area has seen a development of residue and chemical analysis to study domestic living spaces like the case of Cobá and Playa del Carmen (Barba and Manzanilla 1987; Barba and Pérez Rivas 2002; Manzanilla and Barba 1990). Also, in conjunction with ethnography to understand domestic spaces as in Las Pozas, Guatemala (Fernández, et al. 2002) and Yucatan (Pierrebourg de, et al. 2000). These studies provide valuable information that bridges the distribution of chemical residues in floors and surfaces with human activity. Recognizing the chemical residues, distribution, and possible social practices with archaeological materials. Another line of evidence commonly used in household archaeology is the use of residue and chemical analysis on artifacts, such as lithics or ceramics, which was not applied in the present study. Residue analysis can be used to identify pigments on grinding stones and understand production techniques or even reconstruct exchange networks (Triadan and Inomata 2004). Furthermore, residue analyses of ceramics have been widely used in Maya archaeology to understand their use. Since ceramics have a porous surface that can absorb organic and inorganic residues deposited on the surface and can reveal the kind of food cooked or stored to understand use and function (Evershed, et al. 2001; Evershed, et al. 1992; Heron and Evershed 1993; Rottländer 1990).

The excavations included a systematic collection of samples at the places of habitation which combined with ethnographic data has provided an interpretative view of the living spaces (Obregón Cardona 2014). A methodology developed at the UNAM based on a semi-qualitative
analysis that identifies organic substances in floors and surfaces (Barba 1990a, b; Barba and Rodríguez 1991; Ortiz and Manzanilla 2003). Differentiating chemical residues on the living spaces that can be linked with human activities and daily life in the past. Through the pass of time and the daily activities, different organic and inorganic substances permeate the porous surfaces that serve as indicators in the use of space in archaeological contexts (Barba 1990b; Barba and Rodríguez 1991; Ortiz and Manzanilla 2003).

The methodology provides certain advantages and disadvantages in comparison to other methods. The benefits include a low cost, an analytical applicability to large spaces. The recollection of many samples that can provide broad tendencies of distribution of substances in large surfaces. The resulting concentrations of residues identified can reflect patterns or regularities that can hypothetically be linked to the use of spaces (Obregón Cardona 2014). The methodology is also nondestructive and the samples not used can be stored for further studies at a later time or for other types of chemical analyses that can be more precise or expensive. The results have a semi-quantitative character that does not reflect the precise quantity or absolute value, as part per million or percentage of the substances identified. The only exception is the pH. These semi-quantitative results can establish the relative quantities of residues and allows for comparison and basic statistic analysis (Barba and Manzanilla 1987; Barba and Rodríguez 1991).

A detailed report on the methodology and treatment of the samples can be found in the activity field report by Mauricio Obregón Cardona (2014) and by Eos López Pérez (2017). Their collaboration was vital in obtaining a general perspective of different locations of activity.

The samples were tested to determine the analytical presence and relative quantity of the following substances and residues: carbonates/CaCO3, phosphates/PO3, proteins, carbohydrates, fatty acids and pH (Barba and Rodríguez 1991: 20; Obregón Cardona 2014: 8). The traces identified have been linked to daily activities and social practices using the signatures of residues in floors with cultural activities. The sampling aim was to understand the use of spaces. As different chemical signatures point toward diverse activities that can be associated with specific actions. For example, food production (including consumption and disposal) is tested by carbohydrates. The chemical signatures can also be hinting at the use of fermented drinks (pozol or pox/posh) or the use of maize dough (masa). Fatty acids test for vegetable and animal fatty acids and oils. Protein residues are an indication of animal meat and blood. Feces and organic waste correlate to the presence of high concentrations of phosphates. Furthermore, high values of carbonate residues can be linked to the production and use of hominy (nixtamal). Additionally as an indicator of the presence of lime in stuccos, plasters, and mortar. It should be recognized that the region has a Karstic Genesis that can result in higher pH values. Consideration to have since the soils are more alkaline and can affect the results. Moreover, high values of pH in surfaces has been associated with long-term recurring and prolonged presence of ashes, an indication of fireplaces, hearths, or arson (Barba and Rodríguez 1991). Soil controls were collected for calibration from the different areas, including cowpats.

**The surrounding living spaces**

The surrounding periphery of G13 was surveyed through a controlled shovel test and soil analyses to visualize possible uses around and between architecture (Obregón Cardona 2014). A traced grid of 10 x 10 meters guided the location for the shovel test at every intersection (Figure 5.10 and Table 5.2). First soil samples were collected for the chemical analysis, followed by shovel test units of 20 (W) x 20 (L) cm excavated to a depth of ±20 cm. Samples for the soil analysis were collected from the identified surface with a small spoon. The ceramics, lithics, and
The charcoals recovered were used to create maps of distribution (Figure 5.17-5.19). The evidence can be analyzed and represented in maps, charts, graphs or through basic statistical analysis. Each provides unique visualization of the results about the particular use of spaces within architecture. Because many areas were surveyed, distributional maps were created to visualize architecture and the soil chemical analysis patterns. Basic statistics were also employed to analyze the data and see in some cases different patterns. The maps were generated using Surfer and AutoCAD to illustrate the results visually from the chemical analyses; Surfer V 8, Golden Software; Autodesk Autocad for Mac, Version M.48.M.622. The use of photoscans was also vital in allowing a precise recording of the excavations. The photoscans and distribution maps will serve as visual models and scaled records of the material evidence and space where daily life occurred. The photoscans were created used using Agrisoft PhotoScan Professional Edition; Version 1.0.4 build 1847 (64 bit). All the basic statistics were done using Exel 2011 and IBM SPSS Statistics version 24 both Mac version. The anthropological modification and construction of surfaces resulted in physical differences, as see with stucco and tampered floors. The tampered floors have a higher content of carbonates that results in a higher reading of the pH linked to higher level of alkaline compounds.

![Figure 5.10: Map of surveyed area surrounding the structures. Table 5.2: Basic average medians and standard deviation of the results.](image)

<table>
<thead>
<tr>
<th>Median +/- Standard Deviation</th>
<th>Locus 1</th>
<th>Locus 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Context</strong></td>
<td>Chinikihâ</td>
<td>Chinikihâ</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>G13</td>
<td>G13</td>
</tr>
<tr>
<td><strong>Locus</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>N Samples</strong></td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td><strong>Ceramic</strong></td>
<td>14.4 +/- 14.4</td>
<td></td>
</tr>
<tr>
<td><strong>Lithic</strong></td>
<td>5.8 +/- 26.2</td>
<td></td>
</tr>
<tr>
<td><strong>Carbon</strong></td>
<td>2.0 +/- 3.1</td>
<td></td>
</tr>
<tr>
<td><strong>CaCO3</strong></td>
<td>2.1 +/- 0.8</td>
<td></td>
</tr>
<tr>
<td><strong>PO4</strong></td>
<td>2.3 +/- 0.7</td>
<td></td>
</tr>
<tr>
<td><strong>Protein Residues</strong></td>
<td>9.0 +/- 0.3</td>
<td></td>
</tr>
<tr>
<td><strong>Fatty Acids</strong></td>
<td>0.3 +/- 0.7</td>
<td></td>
</tr>
<tr>
<td><strong>Carbohydrates</strong></td>
<td>4.0 +/- 0.1</td>
<td></td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>7.4 +/- 0.1</td>
<td></td>
</tr>
</tbody>
</table>

**Fatty Acids**

The fatty acids are easily lost or quickly absorbed by plants and animals as nutrients. Some residues can survive and withstand the passage of time. As mentioned earlier fatty acids and pH are related to organic residues, ashes, and fireplaces. Figure 5.11 illustrates the locations for the signatures of high fatty acid levels of two areas on Locus 1. The location of high values also coincides with possible areas of activities. One concentration found to the north on top of G16 that could be the traces of a hearth or fire. The second located to the west of the map, behind G13, close to the areas excavated. The high values were recovered from an associated trash midden partially excavated. The Locus 2 also resulted in high signatures to the south of the map, between G13 and G10.
Similarly, the pH residues exhibit two areas with a high concentration on both Loci, observe Figure 5.12. The Locus 1 has two regions with high readings of pH. One is located in the northeast section of the map and associated to G24. A low domestic platform, where previous shovels test found domestic materials in the same area where the high values were observed. The second concentration was found to the southwest of G13. This same area had previously shed domestic materials, which were collected during the initial shovel test and survey. Further, the medium to low values in the surrounding frontal spaces could be related to foot traffic and areas that were kept clean. A similar pattern observed in from of G16 and to the North of G13, with very low values. The Locus 2 displayed low values again in the frontal spaces of G13.

Phosphates

The signature of phosphates relates to the intensity and occupation of a settlement. Figure 5.13 illustrates the two Locus and concentration of high values of phosphates. The distribution is concentrated in the frontal and posterior areas of G13. A small area was excavated in the front of G13, where four sets of stairs were identified. The stairs are located in the frontal or Eastern side...
of G13, between G13a and G13b. The entire frontal area was the principal access, and as Figure 5.13 illustrates, the high values are located associated with the steps. The high values are precisely clear in this area between G13 and G10, where the traffic is more evident on the northern section. Even seen as a path of traffic between these two platforms. For the Locus 2, lots of activity was registered in the adjacent lower patio, space between G13, G16, and G24. The same path is seen with high values between G13 and G10. The space surrounding G10 also had high signatures and evidence for traffic. In general, both Locus reflect strong signatures of phosphates. The signatures were identified at entrances and in the open lower spaces of the open plazas. The signatures are also residues of daily foot traffic and activities in open patios, opening the interpretation to the possible use of large open spaces for daily activities.

![Figure 5.13: Phosphates / PO3 residues distribution for Locus 1 and Locus 2.](image)

**Carbohydrates**

The values for carbohydrates have a clear pattern of high signatures around the northern section of G13. There seem to be two different areas in Locus 1 and related to G13. The southern section and most of the immediate northern parts have high values. Also, for Locus 2, the high values are again surrounding G13, perhaps illustrating some of the traffic areas. The elevated signatures of carbohydrates around G13 could be related to the continual use of those spaces. Observe Figure 5.14 for the distribution maps. The presence of high values in the lower spaces of the open plaza could be indicating the presence of organic residues and organic matter.
Figure 5. 14: Carbohydrates distribution for Locus 1 and Locus 2.

**Carbonates**

The presence of high values of carbonates could be a result of the local geology and even land use. Below, Figure 5.15 exhibits the results and the strong signatures seen in the elevated areas in both Loci. The values in the lower areas were also less concentrated and much lower. The high values of carbonate residues reflect a similar pattern in both Locus in elevated areas. The high values could be related to the characteristics of local geology, the action of water, or human activity.

Figure 5. 15: Carbonates/CaCo3 distribution for Locus 1 and Locus 2.

**Protein Residues**

The enrichment of high values of protein residues signatures in Locus 1 is very evident. The low plaza between G13 and G16 have evidence of protein residue accumulation perhaps accounting for past daily activities or related to the kitchen found in G13b. Observe Locus 1 and the adjacent area to the north of the kitchen (G13b) with highest signatures y clearer evidence. That patio or open areas between G16, G13, G10, and G24 have four nodes with high values. One high value also is seen within G16 in association to the frontal patio and perhaps related to
the activity at this platform. Observe Figure 5.16 for Locus 1 and Locus 2. This second registry had its high values located in the most southern area in association to G13.

![Figure 5.16: Protein residues for Locus 1 and Locus 2.](image)

The enrichment and high values can be a result of natural processes independent for those registered by the phosphates, greases, ceramics, lithics, and botanical charcoals (Obregón Cardona 2014: 21). Also, the samples represent the tamped surface surrounding constructed platforms. Specifically, in the case of G10 and G13, the sampling was done on the plaza or lower area outside architecture. Only two shovel test were located over G16 and included the identification of lithic debitage.

**Charcoals**

The botanical charcoals were collected in an attempt to identify the spaces surrounding the architecture and the possible use. The charcoals high values were concentrated in the lower flat region and behind G13 as shown in Figure 5.17. Additionally, two concentrations of charcoals was associated to G10. With high values detected to the northeast and the west of the platform.

![Figure 5.17: Botanical charcoals from shovel test (by weights).](image)
**Lithics**

For the lithic material recovered, the same pattern of lithic debitage associated to the workshop area in G16 was observed. Not much debris was found in the lower open areas, as its distribution was associated with the higher elevated areas (Figure 5.18). Also, the same pattern of clean areas from much lithic debitage.

![Lithic distribution from shovel test (by weights).](image)

**Ceramics**

The ceramics also continued to reflect a similar pattern observed during the initial survey. Similarly and opposite to lithics, ceramic was abundant and dominant in the lower areas. Different deposits of ceramic material were identified, including known concentration, like the one behind or to the west of G13, or the material observed around G10. As it can be observed in Figure 5.19, the lower plaza between G13 and G16 was also kept clean and probably cleared for foot traffic. The concentration in front of G13 was part of the filling deposits in the front to flatten the main entrance. The ceramic concentration to the West of G13 was part of a ceramic deposit that was partially excavated.

![Concentrations of ceramics from shovel test (weights).](image)
The central patio

The next level of inquiry concentrated on the tamped earth floors located in the main architectural complex at G13 and the terrace G16. The central patio was covered by a well preserved flatten tamped floor. A grid was used to set up the different excavation areas and sampling strategy. Figure 5.20 illustrates the various areas where soil samples were collected. The central patio was sampled using a grid of 1 X 1 meter trying to survey the entire central spaces. A unit of excavation was placed in the middle of the patio of 2 X 4 meters, where a substructure surface was also sampled. The excavation permitted the collection of soil samples about the altar found there. A very rich context with many different soil deposits, botanical evidence, and included broken fragments of figurines in direct association to the floor and the altar (Op 311 and 311EXT).

The area was initially surveyed to understand the spaces and the best areas to excavate, but as the study progressed, it became evident of the importance to look at the living spaces and include other lines of evidence. Attempting to get close to the living spaces in relationship to the materiality of domestic social practices. The following section illustrates the results from the earthen floors soil chemical analysis surveyed at G13. Figure 5.20 depicts the location of the survey and Table 5.3 the average and standard deviation of the results of the residue analysis.

![Figure 5.20: Illustrates the location of the different areas surveyed and sampled for soil analysis.](image-url)
Table 5.3: Results from chemical residue analyses tamped earthen floors.

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>No. Samp</th>
<th>PO3 ±/− 0.5</th>
<th>CaCO3 ±/− 0.5</th>
<th>Prot Res ±/− 0.5</th>
<th>Fatty Acid ±/− 0.5</th>
<th>Carbohydrate ±/− 0.5</th>
<th>pH ±/− 0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chnikihá</td>
<td>G13 Patio L1</td>
<td>124</td>
<td>1.6 ±/− 0.6</td>
<td>2.4 ±/− 0.4</td>
<td>9.1 ±/− 0.4</td>
<td>0.6 ±/− 0.7</td>
<td>3.8 ±/− 0.3</td>
<td>7.5 ±/− 0.0</td>
</tr>
<tr>
<td>Chnikihá</td>
<td>G13 Patio L2</td>
<td>127</td>
<td>2.2 ±/− 0.5</td>
<td>2.3 ±/− 0.3</td>
<td>9.5 ±/− 0.5</td>
<td>0.2 ±/− 0.5</td>
<td>3.8 ±/− 0.3</td>
<td>7.4 ±/− 0.1</td>
</tr>
<tr>
<td>Chnikihá</td>
<td>Op 311 L2</td>
<td>6</td>
<td>3.8 ±/− 0.4</td>
<td>2.1 ±/− 0.2</td>
<td>8.2 ±/− 0.4</td>
<td>0</td>
<td>2.5 ±/− 0.4</td>
<td>7.7 ±/− 0.1</td>
</tr>
<tr>
<td>Chnikihá</td>
<td>G13 B L2</td>
<td>29</td>
<td>2.3 ±/− 0.5</td>
<td>2.6 ±/− 0.3</td>
<td>9.3 ±/− 0.4</td>
<td>0.1 ±/− 0.3</td>
<td>3.9 ±/− 0.2</td>
<td>7.4 ±/− 0.1</td>
</tr>
<tr>
<td>Chnikihá</td>
<td>G16 L1</td>
<td>18</td>
<td>2.4 ±/− 0.4</td>
<td>2.6 ±/− 0.2</td>
<td>9.4 ±/− 0.4</td>
<td>0</td>
<td>3.9 ±/− 0.2</td>
<td>7.5 ±/− 0.1</td>
</tr>
<tr>
<td>Total Samples</td>
<td></td>
<td>304</td>
<td>2.0 ±/− 0.7</td>
<td>2.4 ±/− 0.4</td>
<td>9.3 ±/− 0.5</td>
<td>0.4 ±/− 0.6</td>
<td>3.8 ±/− 0.3</td>
<td>7.5 ±/− 0.1</td>
</tr>
<tr>
<td>Control Samples</td>
<td></td>
<td>13</td>
<td>2.9 ±/− 0.8</td>
<td>2.8 ±/− 0.6</td>
<td>8.7 ±/− 0.4</td>
<td>0.2 ±/− 0.8</td>
<td>3.6 ±/− 0.4</td>
<td>7.8 ±/− 0.3</td>
</tr>
</tbody>
</table>

The results indicate general patterns found within earthen floors, which coincide with each other. Figure 5.20 illustrates the areas excavated and the location for the soil sample analysis. Except for the house in the southeast section of the map (G13b), all the surfaces were tamped earth floors, which initially made their identification somewhat tricky. The house (G13a) was the only location where thick stucco floors and walls were unearthed. In general, the tamped earthen floors resulted in enriched soils with high contents and similar values of phosphates, protein residues, carbohydrates, and pH. The central patio of G13 had high average signatures, specifically for greases and proteins as shown in Table 5.3.

Figure 5.21: Photoscan 1 of excavated area and the altar excavated.

The central excavation exposed another tampered floor surface part of a substructure. Observe Figure 5.21 for photoscan and Figure 5.22 for altar location and image of the excavation. The altar excavated was located in the middle section of the central patio and not initially visible. This altar was associated with botanical remains, charcoals vital in establishing the chronology of the group through C14 dating. The deposits in the floor associated to the altar had a complex superposition of many deposits correlated to the substructure. The two carbon dates discussed earlier were recovered from this substructure and excavated unit. Ceramic, lithic debitage, and broken figurines were found as part of the filling on the floor. The surface identified also had a small deposit with ceramic, lithic debitage, shell, and burned soil. It was also noticeable that the altar was completely covered up on the last platform. Initially, during excavation, it was thought that it was part or architectural retaining boxes, an architectural technique consisting of the interlocking walls that create boxes which are filled to create volume. Perhaps reflecting a change in the use of the internal patio space, for which it was decided to cover and protect the
altar instead of maintaining its place and building a new one. A space that could have continued
to be a place of offering and memory, but without a formal delimiting structure. Similar altars
have been uncovered at the site of Chinikihá.

![Image](image_url)

**Figure 5.22:** Altar and tampered floor of the substructure located in the
middle of the patio at G13; map exhibit the location of excavated units of
Op 311 and 311-EXT.

**Fatty Acids**

The central patio study also generated a series of maps that depict nonvisual evidence on the
possible use of space. The fatty acid signatures of high values were dispersed throughout the
surroundings of the patio. Perhaps reflecting the importance of open spaces in daily activities.
Note Figure 5.23 Locus 1 northeastern corner at the corner of the patio with G13b. The high-
value concentration of high signatures located in direct association with the platform, where the
kitchen was identified. For both Loci, the distribution of the levels seems to be related or
distributed around architecture. The concentration of fatty acids is visible throughout the
adjacent areas, including the middle section. Some of these signatures could be pointing towards
the existence of fireplaces or hearths.

![Image](image_url)

**Figure 5.23:** Distributions of fatty acids high values for Locus 1 and 2.

**pH**

The residues of pH are reported to be associated with fire practices, or the presence of large and
constant quantities of ashes that generate changes in the sediments pH. Many spaces can be
observed in the distribution maps with a presence of high values, yet three concentrations should
be noted (Figure 5.24). The concentration in the north again associated to G13b, the kitchen. The second is located next to G13a, with two concentrations. One associated facing a stucco bench and another concentration to the West linked areas that were not excavated.

![Figure 5.24: pH high values in Locus 1 and Locus 2.](image)

**Phosphates**

The distribution of signatures is very clear with the phosphates. Figure 5.25 illustrates how the highest values are located on the border of the patio and also could be representing traffic venues, how people move. With internal traffic routes and the possible indication of activities next to the architecture or about the platforms. Let us remember that the presence of phosphates is an indicator of long-term human habitation presence. The maps and reading also indicate an important activity area in relationship to the patio and the activities at the place. The low concentrations are located in the entry to G13 and the central areas. All of the adjacent zones next to the architectural platforms (G13 a and b) have high values associated with them. Also, the high concentrations seem to be associated with the entrance into G13a and b.

![Figure 5.25: Phosphates in Locus 1 and Locus 2.](image)

**Carbohydrates**

The carbohydrates indicate the presence of sugars, with an average of ± 3.5 as shown in Figure 5.26 for Locus 1 and Locus 2. Also, making it possible to identify the five areas with higher concentrations. In the northern section associated to G13b where the kitchen was is the place with the highest and most dominant concentration of high values. Another area is in the south, where again the highest residue values are directly associated to the bench in G13a. On the Locus 2 similar patterns are observed, including the area not excavated in G13c and which also
Presented a possible internal traffic zone. The other area is located to the east of the platform, precisely where the stairs are located. I was able to clean and recorded the existence of at least three sets of stars that ran NE to SW. This values and concentration correlate with foot traffic in the area.

![Image](image1.png)

**Figure 5. 26: Carbohydrate residues for Locus 1 and Locus 2.**

**Carbonates**

Like other residues observed before, the concentration tended to be on the sides of the patio and in close association to architecture (Figure 5.27). Also, high values were observed in the middle portion of the patio. Perhaps reflecting the materials utilized in the construction of the architecture, with stuccos and use of lime. The middle section of the patio had high contents of carbonates located where the altar was found. Perhaps this concentration is pointing to a specific activity not known by the author. The concentrations in the middle were observed in both Locus 1 and 2.

![Image](image2.png)

**Figure 5. 27: Carbonates for Locus 1 and Locus 2.**

**Protein Residues**

The distribution of protein residues throughout the central patio can be linked to the same areas associated before. On the northern section of the map, large concentrations are seen in proximity to G13b where the kitchen was identified (Figure 5.28). It should be noted that almost all the analysis has indicated large levels of phosphates, carbohydrates, carbonates, and proteins. On the southern section, the concentrations are also associated to G13a but seem more evenly spaced. For the Locus 2 the higher signatures were found closer to the kitchen as well. In general high
values were observed in association to architecture and in the middle section of the patio, where the altar was located.

Figure 5. 28: Proteins residues Locus 1 and Locus 2.

The kitchen.

The northern section of G13b (Op 312) had a different architectural layout and masonry volume in comparison to the southwest structure (G13a – Op 310), where the main extensive excavations were located (Figure 5.29). The second extensive excavation was precisely done at G13b, excavating a total of 28 m2. The kitchen area turned out to be the eastern architectural limit of the platform. The excavations uncovered an area believed to be a kitchen. Identified with a structural feature shaped in a half moon with ash and burnt soil recovered in the middle (Figure 5.30 and 5.31). The feature is of semicircular shape, very similar to a half moon located at the southeastern corner of the structure. The surrounding structure probably looked like a modern Maya kitchen with wattle walls and good ventilation. No indication or parts of the poles holes for the eastern corners were identified. A specialized area where cooks, probably women, crafted their meals. A kitchen is one of the most important places of daily activity and practices. Also indicating the possible interpretation of gender dominated spaces found in Group G.

Many Classic Maya sites have been interpreted on the notion of extravagant and complex shows of wealth in feasts by the ruling elites that included the consumption of meat, cacao, and maize prepared at local kitchens (Chase and Chase 2001; Gerry 1993). Similarly, other mechanisms that must have made those differences more evident between commoners and elites, yet the preparation of food within those social displays has been part of archaeological interpretation (LeCount 2010). The kitchens are also similar places to workshops, where different activities occur, many of which include specialized knowledge and membership. Something similar must have taken place with food production, where social practices go hand in hand with the mastership of food production. A craft that can also be theorized from a perspective of communities of practice, technology, knowledge, social practice and referential learning (Costin 1991; Hendon 1989, 1997; Lave and Wenger 1991). The kitchen was also characterized as having a tamped earth floor, with little ceramic and lithics. A couple of complete artifacts were recovered that serve as evidence to the interpretation of space in use and daily life. Next, to the half moon, three different manos or pestles were recovered. Also, another complete pestle was recovered in the southwestern corner and a complete biface. The area included a small step that served as the entrance to the central patio.
Surprising evidence observed during excavation was the clear defined use of spaces, including the cleanliness and neatness of those areas. The surfaces were cleaned and kept clear. Without much evidence of trash, places where people could move around efficiently and comfortably. Just like modern Mestizo and Maya communities that live on tamped floors, the surfaces are clean and kept clear from much clutter. Moreover, the kitchen was located in proximity to midden deposits, the location from where most of the ceramics came from. The modest architectural technology of G13b was very evident. In comparison to G13a where the physical characteristics of the structures could not be any more different to one another.

<table>
<thead>
<tr>
<th>Site</th>
<th>Architectural Subunit</th>
<th>N of samples</th>
<th>PO₄</th>
<th>CaCO₃</th>
<th>Proteins</th>
<th>Fatty Residues</th>
<th>Carbohydrates</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td></td>
<td>352</td>
<td>1.9</td>
<td>2.2</td>
<td>9.2</td>
<td>0.3</td>
<td>3.8</td>
<td>7.5</td>
</tr>
<tr>
<td>Chinikhá</td>
<td>Kitchen</td>
<td>29</td>
<td>2.3</td>
<td>2.6</td>
<td>9.3</td>
<td>0.1</td>
<td>3.9</td>
<td>7.4</td>
</tr>
</tbody>
</table>

Table 5.4: Summary of results from chemical residue analyses tamped earthen floors.

Similarly to crafting, the art of cooking is a specialized activity that was probably vital not only for elite groups but by creating meals for daily consumption and social events. I will come back to this point during the ceramic analysis ahead, to discuss certain patterns visualized with the ceramic analysis. The chemical analysis was collected using a 1 m grid to locate the samples.
However, move samples were collected on the southeastern quadrant, where the hearth was located.

![Figure 5. 31: The south facade of Op 312, the east to west profile.](image)

The SE step was well defined and well constructed with big boulders (Figure 5.32). The results indicated high values in the carbohydrates and carbonates that are somewhat similar to the results observed in the central patio. The residues also included high values in phosphates and protein residue. The chemical analysis showed high values of carbohydrates and carbonates. Also, the phosphate and protein residues resulted in high values. The distribution maps are shown next with discussion.

**Fatty Acids**

The excavation of the kitchen area generated a series of maps, which reiterate the existence of possible patterns, many of which were also considered in relation to the half-moon in the center (Figure 5.33). The existence of fatty acids can be related to natural processes. When observed with other results, like phosphates it could be pointing toward the domestic nature and long occupation at G13b. It was also positive to see how the largest concentrations are located on the outside or surrounding the half moon or possible fireplace.
pH

As expected, the high concentration of pH was localized in a similar pattern as those with the fat residues. The concentrations are located in proximity to the half moon, surrounding that area. Observe in Figure 5.34 the high concentration on the northern section and to the southeastern, encompassing the hearth. They could also be the reflection of the removal of ashes and present a path of disposal to the north of the platform. An area where a trash midden was localized and partially excavated. The northern values are also the highest values dominating a large area. Figure 82 illustrates the three different concentrations and their locations.

Phosphates

The phosphates residues resulted in high values located in the outer areas, perhaps illustrating where people sat. Observe how the middle area around the hearth is empty. These residues have been used to understand long-term occupation and the places where people walked or sat (Figure 5.35).
Figure 5.35: Phosphate residue distribution for Locus 1.

**Carbohydrates**
The soil residues for sugars indicated the high values in the surrounding areas of the kitchen. Figure 5.36 again illustrates the locations for high values with a central area with low or no values.

Figure 5.36 CaCo3 residues for Locus 1.

**Carbonates**
The high values and concentrations of carbonates could be related to the uses of lime. The northern section of the map had the highest concentration of carbonates. In a tamped earthen floor this could indicate the location of lime for household consumption (Figure 5.37).
Protein Residues

The identification of protein residues on the northern section of the map could also reflect the use of the space perhaps for the storage of goods. The high concentration was detected in the northeastern corner of the kitchen. An area where the carbohydrates and carbonates also had high values. The residues are also located in an area that could have been the back or side of the kitchen and possible place for storing organic and inorganic goods (Figure 5.38).
The terrace G16 and a view of the workshops

Figure 5.39: Illustrate terrace G16 with location of units and samples collected.

The last samples were collected from the earthen floors at G16, believed to be one of the workshops. It was also done to have a different area to compare with the work done at G13. Large deposits of lithic debitage are located behind G16 or to the western section. The operations were located on the frontal space after the first earthen floor was unearthed. Two small units of 2 x 2 m each were placed at this terrace, with the specific intention of sampling the surface for chemical and residue analysis (Figure 5.39). The samples were collected using a grid of 1 m (n=18). The results were reassuring the differentiation in the evidence of residues and the possible interpretation for the use of those spaces.

**Fatty residues**

The sampling and evidence of fatty acids was observed with a set of high values on the southern sampling quadrant at G16. A total of 18 samples were taken from this area and the location and intensity of the signature points toward the existence of a hearth or fire. Figure 5.40 illustrates the high values of fatty residues in the southern unit.

Figure 5.40: Fatty acids residues high values Locus 1.
**pH**

The pH has also been linked to the presence of ashes or fire pits. The high values might be hinting at the location of a fireplace (Figure 5.41). A plausible situation at this location, since is very plausible that they had a fireplace at the site. From its use for cooking, warming up water, for stone tool production, or for the production of smoke to keep insects away.

![Figure 5.41: pH residues high values Locus 1.](image)

**Phosphates**

Similarly to the other residues, the phosphates values were in general low (Figure 5.42). With High values circumscribing the units. Perhaps illustrating foot traffic areas.

![Figure 5.42: phosphates residues high values Locus 1.](image)

**Carbohydrates**

The indication of carbohydrate residues is high values. Both sample areas had high concentrations of residues, indicating high levels of sugars. Illustrated in Figure 5.43.
Carbonates

The carbonate residues in this area resulted in a low concentration. The low values also coincide with those found in other residues like fatty residues, pH or protein signatures (Figure 5.44).

Protein Residues

In a similar pattern, the protein residues presented low values or low concentrations. The southern unit had higher values of residues, but the pattern tended to be low (Figure 5.45).
The dwelling an stucco floors

The platform G13 was extensively excavated and chemically analyzed, providing a unique perspective of the dwelling of a commoner household during the Late Classic (Figure 5.46). The excavations were vital in providing an image of a household and its internal layout. (Figure 5.49 and 5.50) Large portions of the stucco floors were unearthed in situ. The construction method included the construction and maintenance of thick stucco walls and thick plastered stucco floors, covering all internal the internal surfaces (walls and floors). This was vital in understanding the process of abandonment and collapse of the walls. Yet large sections of the stucco floors were preserved and analyzed through a sampling of the internal rooms and the frontal step of the house (n=73). The frontal step probably functioned as a bench, which included high residue values. Also, at least three of the internal rooms had benches in situ, which allowed to observe possible architectural furnishings too. Because of the type of walls and the way the house collapsed, it was easy to identify most internal surfaces with stucco, as the faces of the collapsed wall was in contact with face of the floor. Most of the ceramic and lithic material recovered was part of the wall filling, and only a couple of bifaces and a large ceramic fragment were found in situ. The ceramic fragment was the lower half of a ceramic pot (olla) located next to the bench in the back southeastern room of the house. Further, two balls or spheres of lime were found next to the frontal access.

In comparison to the other samples analyzed, the stucco floors resulted in high contents of carbonates, protein residues, phosphates, and pH (Table 5.5). The high values of carbonates (med: 3.1 ± 0.3) can be seen as a reflection or result of the limestone materials utilized during its manufacture. The high pH values are also related to the alkaline nature of the construction materials, from a calcareous genesis (med: 9.0 ± 0.1). What the results showed were high values of phosphate (med: 2.7 ± 0.9) and protein (med: 9.2 ± 0.6) residues. This could be a result of the processes in the preparation and production of the stucco floors.
Table 5. 5: Summary of basic statistics (average and standard deviation) from stucco floor chemical analysis in G13a.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>G13a</td>
<td>73</td>
<td>2.7 +/- 0.9</td>
<td>3.1 +/- 0.3</td>
<td>9.2 +/- 0.6</td>
<td>0.1 +/- 0.2</td>
<td>2.2 +/- 0.4</td>
<td>9.0 +/- 0.1</td>
</tr>
<tr>
<td>Floor Bench Locus 1</td>
<td>16</td>
<td>2.3 +/- 0.8</td>
<td>3.2 +/- 0.4</td>
<td>9.2 +/- 0.6</td>
<td>0.2 +/- 0.3</td>
<td>2.2 +/- 0.4</td>
<td>8.9 +/- 0.1</td>
</tr>
<tr>
<td>Floor Bench Locus 2</td>
<td>9</td>
<td>2.4 +/- 0.3</td>
<td>3.1 +/- 0.2</td>
<td>9.3 +/- 0.7</td>
<td>0.0 +/- 0.0</td>
<td>2.3 +/- 0.3</td>
<td>9.0 +/- 0.1</td>
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<tr>
<td>Floor Bench NE</td>
<td>3</td>
<td>2.5 +/- 0.5</td>
<td>3.2 +/- 0.3</td>
<td>9.7 +/- 0.6</td>
<td>0.0 +/- 0.0</td>
<td>2.5 +/- 0.0</td>
<td>8.9 +/- 0.3</td>
</tr>
<tr>
<td>Floor Bench E</td>
<td>12</td>
<td>3.0 +/- 1.0</td>
<td>3.2 +/- 0.6</td>
<td>9.4 +/- 0.7</td>
<td>0.1 +/- 0.3</td>
<td>2.0 +/- 0.4</td>
<td>8.9 +/- 0.1</td>
</tr>
<tr>
<td>Interior Floor</td>
<td>17</td>
<td>2.9 +/- 0.5</td>
<td>3.1 +/- 0.2</td>
<td>9.2 +/- 0.4</td>
<td>0.1 +/- 0.3</td>
<td>2.1 +/- 0.4</td>
<td>8.9 +/- 0.0</td>
</tr>
<tr>
<td>Floor Room South</td>
<td>11</td>
<td>3.0 +/- 1.3</td>
<td>3.0 +/- 0.2</td>
<td>8.9 +/- 0.4</td>
<td>0.0 +/- 0.0</td>
<td>2.2 +/- 0.3</td>
<td>8.9 +/- 0.1</td>
</tr>
<tr>
<td>Floor Fourth Bench/Bed</td>
<td>5</td>
<td>2.8 +/- 0.8</td>
<td>3.0 +/- 0.0</td>
<td>8.7 +/- 0.4</td>
<td>0.1 +/- 0.2</td>
<td>2.1 +/- 0.5</td>
<td>9</td>
</tr>
</tbody>
</table>

The chemical analysis was essential in broadening the interpretation of the spaces. Let's take the step or the stucco bench localized on the front part of the house. The area is facing the central patio, which was protected by the rubble from a collapsed wall. By collapsing to the front and falling on top, it preserved that stucco surface (Figure 5.47). The bench was also a section of the frontal step of the house (Figure 5.48). The section of stucco bench was one of the best preserved, and the results from the chemical analysis showed a higher enrichment of residues if compared to the rest of the house. The bench, in general, presented high values of chemical residues, including carbonates, carbohydrates, phosphates, and protein residues. On this sense, the high values seen in the phosphates, carbonates and protein residues can be an indication of intense activity about the handling of foodstuff (cooking or consumption).
The interior spaces had low median averages of chemical residues, special in the central room (interior floor). Which also happened to be the main access to the house. The inner spaces, in general, had low-medium averages. Despite the high average values recovered in some residues. Like the phosphate residues in the southeastern room (floor room south) and the southwestern room (floor fourth bench/bed), places where benches (likely beds) were uncovered. This architectural space was probably added to the main household at some time in its history. The architectural addition became visible through in the corners of the house and the physical characteristics of the back wall. The difference between the architectural techniques, the masonry used to construct the wall, and just the overall construction crafting was not the same as the one observed in the rest of the house. The stucco floors for the back room were also of a much lower quality compared to the stucco floors uncovered on the rest of the house. Even though this could have been for preservation reasons. Additionally, the architectural internal spaces of the architectural extension were not very big. The spaces created were very constricted and probably dark. Also, the chemical results point to the possible use of the back living spaces as a storage space of organic materials, observed in the high values of phosphates believed to have accumulated over a long period of use (storage in the area). The back stucco floors had high values and were enriched with phosphate residues. Another room with a bench-bed was found in the eastern room of the house (floor bench E). The stucco floors there were also enriched with phosphates emphasizing the long contact of organic materials. Following are the distribution maps, images, and drawings of the house.

Figure 5. 48: Op 310 - G13a architectural profile, North to South; field drawing Keiko Terinishi, digitizing and autocad: author, A Campiani, E. Miron.

Figure 5. 49: Op 310 - G13a architectural profile E to W, façade; field drawing Keiko Terinishi, digitizing and Autocad: author, A Campiani, E. Miron.
Fatty Acids

The floors in this part of the house provided clear evidence of the stucco surfaces and domestic spaces. Even though the floors were cleaned up on abandonment, much of the stucco floor contained much information about the possible use of those spaces. Observe Figure 5.51, representing Locus 1 for fatty residues. Because of the location and the sampling strategy, three areas with evidence of high signatures of residues could have been fireplaces. One located on the outside of the house, at the northeastern corner of the house. The second located on the inside of the house, next to the access into one of the small private rooms. This one corner light could have provided much lighting to a good part of the house. Notice the concentration or high value on the bench almost at the corner of the house on the NE side.

pH

The pH reflected a similar pattern from what was observed with the fatty acids. The largest signature was found on the stucco bench mentioned before. Also, the internal spaces had medium to high values. The results from the patio analysis also confirmed the unique signatures of soils in relationship to the bench. Also, within the house, both Locus had similar results associated to that bench. The internal spaces also had high signatures, noted in the high values in the entrance.
to the back rooms, close to benches. In this case, it is very plausible that this were places were a fire was kept.

Figure 5. 52: pH high values in Locus 1 and Locus 2.

**Phosphates**

The phosphate residues are used to understand long-term occupation and even use of internal spaces in relationship to foot traffic. The internal spaces in Figure 99 for Locus 1 illustrate the contrast signatures and possible use of spaces. Where the high values were located in the back room. The front and access have an even distribution of phosphates, while the back and sections of one room have some of the highest values.

Figure 5. 53: Phosphate residues high values in Locus 1 and Locus 2.

**Carbohydrates**

The values of carbohydrates residues are very even, as observed in Figure 5.54. The values are directly related to the nature of the stucco floors, and their location directly correlates with the places where the stucco floor was preserved.
Figure 5. 54: Carbohydrate residues high values for Locus 1 and Locus 2.

**Carbonates**

Similarly the carbonate signatures were somewhat evenly distributed due to the nature of the stucco floors analyzed.

Figure 5. 55: CaCo3 residues high values for Locus 1 and Locus 2.

**Protein residues**

The protein residues observed in the floors was precise and reiterated the importance of some spaces in daily life. The high values associated and localized on the bench in the front of the house only serves as proof of its use. The high values of protein residues found in the internal spaces of the house attest to their continual occupation and use (Figure 5.56).
All the floors analyzed, tamped and earthen floors as well as stucco floors, have signs of chemical enrichment traces of human activity and daily practices as well as natural processes. The enrichment of floors and surfaces has been a unique line of evidence to collaborate information about human settlement over a long period. The study was also vital in providing a different line of evidence to understand the architectural distribution and layout of spaces. This information has open lines of interpretation to hypothesize about the use of spaces and location of features, such as food preparation, rituality, dwelling, and even possible location of fires. Besides, the analysis has provided evidence of the use of spaces including access to architecture, possible kitchen or house gardens. Hypothetically the study was vital in providing venues of
interpretation for the use of daily spaces and social practices by pointing to areas dedicated to ritual and use of spaces.

**Paleoethnobotany**

The research strategy at Group G included the collection of soil samples from every excavation unit for later flotation and analysis (observe map 40 for location of excavation units). Ancient Maya communities had a wealth of knowledge and applied technologies that included the manipulation and safekeeping of plants for human use and consumption. The management of the forest-included agroforestry socially constructed practices that lead to the manipulation of plants and spaces where people lived in the past (Ford 1979; Trabanino Garcia 2014b).

The methodology applied identifies the use through the distribution of charcoals and macro-remains or macro-botanical remains (carpological and anthracological) to understand human activities in the domestic space (Trabanino Garcia 2014a, b). The soil samples were collected from each locus excavated and has also served as indicators of human occupation and abandonment. Part of the objectives of the analysis included the identification and localization of the climbing vine *cundeamor* (*Momordica charantia*) and the *luluy* (*Spondias mombin*), which have been identified as indicators of post-contact introduction, serving as a chronological indicator during excavation. The evidence of charcoals and seeds in archaeological context has been used as indicator of cultural settlement. The use of charcoals have also made possible the identification of conceivable locations for trash midden and fire places within and around domestic context, by the analysis of the distribution of macroremains of charcoals and seeds in all contexts. Fire has long been also used as a tool in trash management, which can leave more charcoals that are left in situ and were a vital part for the study.

Likewise the excavation locations resulted in the deification of possible areas of fireplaces in G13 and its surroundings through the distribution of the charcoal study or the results of the pH, which also serve as evidence of prolonged presence of ashes. Another important result was the identification of charcoals from *ocote* pine (*Pinus* spp.) corn kernels or carbonized cobs as evidence for activities in food production or part of waste deposits. This is important to mention, because the spaces located between G13 and G16 were places of large amounts of debitage. The op. 313 was a trash midden, where a complex overlaying of deposits were excavated and resulted in an important source of information for this analysis. The information was also used in conjunction with the chemical analysis to understand the possible use of spaces and the uses of plants in daily life. The results for all the samples are included in the annex at the end.
Method.

The acquisition of soil samples for flotation was the main methodology for the recovery of botanical remains like charcoals and seeds. The separation was initially done in the field in conjunction with excavations. The sample collected 1 liter for every m² of every Locus or deposit excavated, for every 2 X 2 m unit excavated 4 L were collected. Around 492 liters of sediments were processed between the excavation at Chinikihá and Santa Isabel to the West of Palenque; about two-thirds of the total soil floated came from the excavations illustrated in Figure 5.58 (Op 310, 311 & EXT, 312, 313, 314-1, 315-1). The initial flotation resulted in 38491 grams of botanical material that was analyzed and separated at UNAM. The methodology is further explained in the field report by Felipe Trabanino (2014a).

The results included the identification of cultural and biotic indicators of cultural occupation and abandonment. The presence of cundeamor (*Momordica charantia*) is an indicator of human perturbation, and its presence is identified in contamination of the initial surface deposit (or locus). Found to be in contact in contact with the archeological deposits. It was usually encountered up to locus 5 in most units. The *Momordica charantia L.* was introduced into the Indo-Maya region from the old world after contact (Bharathi and John 2013; Lira and Caballero 2002; Trabanino Garcia 2014b). The plant is part of many modern uses and practices, including the adaptation by local American communities. Some of its uses included medical and consumption practices in both Africa and Asia going back in time. Its specific location of origin has not been determined but believed to be between the south of India and China (Bharathi and John 2013). To the Americas it could have also been introduced into Brazil from Africa through the slave routes. The plant is widely used and known in places of Guatemala and Mexico, including Tabasco, Chiapas, Veracruz, Oaxaca, and Sinaloa (Trabanino Garcia 2014b). The adoption and local appropriation of the plant seen in the attribution of local names, including local names in Maya Yucatec like *ak yakunax, xiw yakunaj, yakunah-ax, yakunaja ak’, xkool mool* and in the Petén as *ix ʰ’amor* and *u-chʰupa* (Atran, et al. 2004; Trabanino Garcia 2012). The plant has seen an adaptation and use in the local family.
orchids and managed forest used by the local families (Ford 2008; Trabanino Garcia 2014a, b).
Therefore the Momordica can be used as an archaeological indicator of abandonment and post-
European contact.

The charcoals and the seeds became the evidence to reconstruct the use of spaces, some social
practices, and even the construction techniques in architecture. For example in the Op 310
fragments of imprinted wattle shapes on daub of clay were recovered during excavation. Also, in
Op 310 D3 locus 5, burned clay and Guadua (Guadua angustifolia) were recovered and
identified (Figure 5.59 and Table 5.6). As mentioned earlier, the fragments recovered were
probably from this type of bamboo, and those fragments were collected at both G13a and G13b,
where the walls appear to have been made of wattle and daub.

![Charcoal micrographs section of Guadua](image)

**Figure 5.59:** Charcoal micrographs section of Guadua; image Trabanino 2014.

<table>
<thead>
<tr>
<th>Op / quadrant</th>
<th>Locus</th>
<th>Probable identification</th>
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<tbody>
<tr>
<td>310 D3</td>
<td>L5-3</td>
<td>GUADUA</td>
</tr>
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Table 5.6: Summary of results for Guadua charcoals.

Another important identification was the identification of maize and ocote (or pine). Both were
recovered in association to the altar in the middle of Group G and the trash midden associated
with the back of G13. The presence of Maize (Zea mays) was identified in association to the
substructure and altar in the Op 311 (Figure 5.60). Also, pine was identified within four different
deposits associated to this altar. As described briefly above, the altar had a complex stratigraphy
recognized during the excavation (Table 5.7).
Another burned kernel and a fragment of a corncob were recovered from Op 313, a trash midden with deposits from the kitchen on G13b (Figure 5.61). This unit also had a complex overlaying of deposits and many pine charcoals.

The pine charcoals collected denoted the importance of fires at both the kitchen and central altar (Figure 5.62, 5.63, and Table 5.8). The presence of pine sparked the discussion about the movement, exchange, and use of this wood. Found to be widely distributed within Chinikihá and considered to come from higher lands where pines grow. Like the Altos in Chiapas. There is a lowland pine reported in low altitude areas of the Yucatan peninsula, but none have been identified within the study region (Trabanino Garcia 2014b). A common practice that coincides with the use by local communities of fast burning pine to start fires for cooking or light. Fire keeping is one of the most important daily practices. Including the up keeping and cleaning of ashes from the fireplace that can be deposited in trash middens in the back of the house. In areas with little or no traffic where much of the trash from daily activities is deposited. Daily cleaning of the kitchen and the altar must have been a regular repetitive activity. The charcoal evidence corresponds to the use of ocote (*Pinus montezumae* / *Ocote / Ocōtl*), A fast burning wood used for starting and maintain fireplaces. The presence of pine only raises questions regarding its distribution and consumption in relationship to exchange and access.

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**Table 5.7: Summary of identified seeds**

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<td>L7-0</td>
<td><em>Zea mays</em></td>
</tr>
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<td>312 A1</td>
<td>L2-1</td>
<td>Type Poaceae caña/cane of maize <em>Zea mays</em></td>
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<tr>
<td>313 L7</td>
<td>seed</td>
<td><em>Zea mays</em></td>
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Figure 5. 62: Charcoal micrographs section of pine from Op 313 L7; image Trabanino 2014.

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<thead>
<tr>
<th>Op / quadrant</th>
<th>Locus</th>
<th>Probable identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>311-ext</td>
<td>L7-1</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L7-3</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L9-1</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L9-5</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L10-4</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L11-1</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L11-2</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L12-5</td>
<td>Pine tree</td>
</tr>
<tr>
<td>311-ext</td>
<td>L14-1</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L7</td>
<td>L7-1</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L8</td>
<td>L8-4</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L8</td>
<td>L8-5</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L9</td>
<td>L9-6</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L10</td>
<td>L10-1</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L10</td>
<td>L10-4</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L10</td>
<td>L10-5</td>
<td>Pine tree</td>
</tr>
<tr>
<td>313 L12</td>
<td>L12-1</td>
<td>Pine tree</td>
</tr>
</tbody>
</table>

Table 5. 8: Detail of Operations and Locus where charcoals were identified.
Pottery consumption and practices

Pottery is a ubiquitous material that is easily found archaeologically and commonly used to understand possible use of space, social practices or get relative chronological data. Ceramics were fundamental in the interpretation and study of social practices, including their use as possible chronological indicators. Additionally, they provide a dataset that can be compared to other collections excavated and previously analyzed at Chinikihá in controlled context (Jimenez Alvarez 2009, 2015; Jiménez Alvarez 2009; Liendo Stuardo 2012; Miron Marvan 2014). The analysis also provided a line of evidence into culinary social practices and daily life during the Classic and Late Classic. The ceramic collection has rendered a line of evidence to understand local practices of consumption about the site of Chinikihá and the greater study region (Bishop, et al. 1982; Rands 1967a, b, 1973, 1976; Rands and Bishop 1980, 2002; Rands and Rands 1957). Illustrating a regional perspective of the ceramic wares that have been placed within two main regions of traditions of consumption (Miron Marvan 2014), perhaps pointing to specific types of constellations of practice of ceramic consumption and practice (Joyce 2012; Lave and Wenger 1991; Roddick and Stahl 2016).

Ceramic analysis has been part of an ongoing effort of research to understand production, consumption, distribution and chronology for the region (Bishop, et al. 1982; Jimenez Alvarez 2015; Liendo Stuardo 2001, 2002, 2005; Miron Marvan 2014; Rands 1967a, b, 1973; Rands and Bishop 1980, 2002; Rands and Rands 1957). This study has benefited from that research, which has been influential in understanding differences between Palenque, the sites distributed in the Sierra Madre and the lower Usumacinta region, which seems to have local production techniques and developed local styles influenced from areas in the Gulf of Mexico from non-Maya groups (Culbert and Rands 2007). The studies have focus in the relationship of production technology, form, and style of ceramic wares (Rands 1967a, b, 1976; Rands and Bishop 1980). Others studies have built ceramic chronologies in the region by examining local technologies and focusing on local temporal patterns. Including styles of production like those reported at Piedras Negras (Holley 1986, 1987), Pomona (López Varela 1994), el Lacandón (López Bravo 2005, 2013), Uaxactun (Smith 1955), Chinikihá (Jimenez Alvarez 2009, 2015; Liendo Stuardo 2012; Miron Marvan 2014), Palenque and surrounding region (Bishop, et al. 1982; Liendo Stuardo 2001; Rands 1967b, 1976, 1987). The differentiation of ceramic distribution in the region began in the Preclassic (Holley 1986; Jiménez Alvarez 2009; López Bravo 2005; López Varela 1994; Mirón Marván 2010). Including a decreased occupation of the rural or neighboring areas during the
Early Classic. A pattern observed in the evidence from Palenque, where the ceramic indicates the city as the main node of population and consumption for the region (López Bravo, et al. 2004; San Roman Martin 2009). On this note regional ceramic analysis has shown that all sites rank 1 and 2 have evidence beginning with the complex Max representing the Preclassic. Even though its presence is not great in quantity or amount, its presence is consistent in the region and at Chinikihá.

As mentioned local traditions of productions have been recorded for the region, especially about the consumption of Palenque (Rands 1967a, b, 2007b). The development of regional constellations of practice that was part of an active network of production, consumption, and distribution including local preferences of ceramic surfaces, forms, and shapes (Jiménez Alvarez 2015; Miron Marvan 2014). Pottery making is an additive technology where the production, modeling, and firing of clay is a transformative action and unlike stone-tool making provides more freedom to the crafter to mold ceramics. However, the production leaves no archaeological evidence as obvious as stonework. Similar to stone tool production, the many steps of pottery making can be examined through a representation of chaîne opératoire that allows for human variety and creativity (Lemonnier 1986: 149). From the perspective of memory, pottery represents the long-term stability of many pottery traditions. Ruben Reina and Robert Hill (1978: 163) indicate for certain ceramic types that almost went into extinction during the 1940’s at San Luis Jilotepeque in Guatemala and yet made a strong comeback during the 1970’s. Some ceramic wares found archaeologically and dating back their use to Mesoamerican times can still be found at mercados (market) in parts of Mexico and Guatemala (McAnany 2010). Further, reflecting the cohesion of communal uses and preference for certain types of vessels. In this sense some ceramic types go without or very little change, while others can have a short life, disappear, or come back. In this same note, Reina and Hill (1978) argue for the importance too of entrepreneurs and the introduction of styles by local preferences in the production of ceramics. Similar dynamics have been described in archaeological contexts, like ceramic wares found at the site of K’axob in Guatemala. The similar technology of production, shape, and slips in ceramic wares that can be compared to deposits dating back a couple of thousand years earlier (Lopez Varela 1996). When people were using the same wares as those produced and used in modern time. A hint of the importance and power of tradition, including the shared technologies, uses and social practices around ceramic wares. The materialization and embodiment of technology through the crafting and use of specific ceramic wares (Bartlett and McAnany 2000).

Archaeological literature makes reference to different contexts of pottery production during the Late Classic, as Joseph Ball (1993) points to “palace schools” and “village traditions”. Clemency Coggins (1975: 32) introduced the idea of site-specific local traditions of polychrome painting for the ancient city of Tikal. An idea that continues to echo within Maya studies is that of political economy control by the elite. Rice Prudence (1987: 21) makes reference to the elite control of highly skilled and production of fine wares. Knowledge in techniques of production, technical skill and intensity of production assumed to be controlled by elite groups. The difference between or establishments of these two types of schools of production has been suggested to have taken place at the beginning of the Late Classic around 600 C.E. when skills of literacy and figural painting became more common (Reents-Budet 1998: 71). Others have noted that even these innovations in Late Classic pictorial polychrome were produced according to established standards and traditions (Loughmiller-Newman 2008). The other “tradition” of production can be traced back to the earliest pottery production during the Preclassic in lowland villages (Ball 1993: 259). These community traditions, the counterpart to the palace schools of
production, can be compared to contemporary community potters reported at Ticul in Yucatan (Arnold 1971). Opening up the possibility of local production of ceramic for self-consumption within the household that would also mean a distributed local knowledge of ceramic production and firing techniques. At Group G all the chronological indicators were identified, with the last occupation during the late Classic represented by the complex Ajín. Observe Table 5.9 below. The sample analyzed included seven Operations totaling 14884 sherds adding up to 1610 registries, which were used for the statistical analysis. Summaries illustrated bellow in Table 5.10 and 5.11.

Table 5.9: Ceramic chronologies and recorded registries used for the study.

<table>
<thead>
<tr>
<th>Chronology</th>
<th>Total Analyzed</th>
<th>Relative Chronology</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>2</td>
<td>400 B.C.E. - 250 A.C.</td>
<td>0.12%</td>
</tr>
<tr>
<td>Puy / Sip</td>
<td>172</td>
<td>250 - 700 A.C.</td>
<td>10.68%</td>
</tr>
<tr>
<td>Ajín</td>
<td>995</td>
<td>700 - 850 A.C.</td>
<td>61.80%</td>
</tr>
<tr>
<td>Post Ajín</td>
<td>1</td>
<td>850 - 950 A.C.</td>
<td>0.06%</td>
</tr>
<tr>
<td>Not Identified</td>
<td>440</td>
<td></td>
<td>27.33%</td>
</tr>
</tbody>
</table>

Table 5.10: Operations analyzed, frequency, registry, and total weights.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Total sherds</th>
<th>Total registers</th>
<th>Total weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>165</td>
<td>396</td>
<td>57</td>
<td>295</td>
</tr>
<tr>
<td>176</td>
<td>1434</td>
<td>209</td>
<td>6.2</td>
</tr>
<tr>
<td>200W</td>
<td>5670</td>
<td>485</td>
<td>16.91</td>
</tr>
<tr>
<td>310</td>
<td>1335</td>
<td>225</td>
<td>5.7</td>
</tr>
<tr>
<td>311</td>
<td>1198</td>
<td>150</td>
<td>3.96</td>
</tr>
<tr>
<td>312</td>
<td>680</td>
<td>94</td>
<td>2.5</td>
</tr>
<tr>
<td>313</td>
<td>4171</td>
<td>390</td>
<td>16.64</td>
</tr>
<tr>
<td>Totals</td>
<td>14884</td>
<td>1610</td>
<td>54.86</td>
</tr>
</tbody>
</table>

Table 5.11: Summary of results from ceramic analysis.

The region, in general, saw its greatest social complexity and larger occupation during the Late Classic, mirrored in the dominance and ubiquity of ceramic wares at sites like Palenque, Chinkihá, Piedras Negras, Pomoná, Yaxchilán, Toniná, Chanchalá and Tortuguero and the surrounding communities (Golden, et al. 2008; Holley 1987; Jimenez Alvarez 2015; López Varela 1994; Miron Marvan 2014; Nelson 2003). The particularities of the local shapes, styles, and production technology have kickstarted a discussion about the import and embrace of foreign shapes and styles observed and recovered locally, such as the Mamom, the Chicanel, and the Tzakol ceramic complexes, initially reported to have a Petén origin (Smith 1955). Table 5.12 presents the local typologies identified at Chinkihá and their position within ceramic typologies and chronologies from comparable Mayan centers. It should be noted that the divisions within the Chinkihá chronology represent the diffuse nature of the ceramic material and the difficulty to accurately define possible time periods. The chronology at Chinkihá ceramic complexes was developed initially by Robert Rands (2007a, b), Socorro Jimenez (2009) and more recently by Steban Mirón (2014).
The methodology of analysis is based on delimiting the temporal complexes, emphasizing the morphological evolution and change on the containers through time, production technology, surface treatment and decoration (Jimenez Alvarez 2009; Miron Marvan 2014). The seriation is done through multiple lines of evidence in a non-hierarchical system of attributes based on surface treatment and production technology. This multimodal methodology includes the mineralogical categories established initially by Patrick Culbert and Robert Rands (2007) for the region and Socorro Jimenez (2015) for Chinikihá. These studies looked at production techniques in relationship to raw material and mineralogy. The analysis includes the study of the ceramic paste, form, and surface attributes through macroscopic analysis to organize ceramic groups into complexes. At Chinikihá the ceramic complex Max, Puy, Sip, and Ajín were used to identify and differentiate the ceramic materials recovered during the field seasons (Table 5.13).
Max

The presence of Max ceramics at Chinikihá has been interpreted as an indicator of the initial settlement at the site, following a pattern seen in the region. This ceramic presents technological styles associated with Preclassic patterns, like waxy slip in red tones and found throughout the region, including all the sites rank 1 and 2 (Miron Marvan 2014). Even though the ceramic sample from this complex might seem small at 0.12% of the total analyzed at Group G, a similar pattern was detected for Palenque and Chinikihá, with a reported 0.77% of the material analyzed.

Max ceramics are not the least commonly found, represented and recorded at most sites in the region. On the contrary, all major sites have the presence of this ceramic type. Its identification has been associated with Preclassic settlements in the region and the greater Maya area, what Rands called an axiomatic presence of waxy slips, especially in reddish colors throughout the region (Culbert and Rands 2007). Similar ceramic types include the wares Flores Cerosa and Paso Caballo Ceroza identified in Uaxactun (Smith 1955), but their presence in the study region have not been fully defined. This ceramic ware tended to have fine finishes and reflected a careful treatment and polishing during the production (Miron Marvan 2014). The complex included a wide range of formal classes that would have been associated with food service and production. Like medium size cooking pots (olla) with thick walls and curved extending lip (Figure 5.64). The most common serving ware were medium and small bowls (cajete) without supports and a flat base (Figure 5.65). They usually have straight walls with a very slight everted lip. They could have also been used for storage of smaller quantities or volume.
The Puy-Sip ceramic complex represents ceramics from the Early Classic through the transition to the Late Classic. The difficulty in defining the transition between Early and Late Classic has been discussed in many of the analysis in the region by many (Jimenez Alvarez 2015; Jiménez Alvarez 2009; Rands 2007b; Rands and Bishop 2002). The ceramics were locally produced with clays rich in CaCO3 (carbonates) making a coarse paste that was fire resistant and could be exposed to high temperatures. Similar examples reported are Triunfo from the Uaxactun typology and Motiepa for Palenque (Rands 2007a, b; Rands and Bishop 2002; Smith 1955). The cooking casseroles (cazuelas) and cooking pots (ollas) in this phase were made with a coarse paste and locally produced (Miron Marvan 2014). This complex was also associated to the complex Sip (600-700 C.A. calibrated), a context behind the palace was fundamental in defining this complex for Chinikihá (Jimenez Alvarez 2009; Jiménez Alvarez 2009; Liendo Stuardo 2012; Miron Marvan 2014). The use of some of the casseroles (Figure 112) and cooking pots could have been used for storage or cooking, since they were resistant to fire.
The ceramic ware also included containers used for food service that had visible differences with the collections from the Preclassic. Among these changes, are differences in the ceramic composition observed in the production of paste with a sandy texture and mixed refined carbonates. Very similar to the macroscopic characteristics of the Ajín complex with similar local and regional production (Miron Marván 2014). The ceramic ware included types used in food consumption and service like platter (platónes), plates (platos) and cajetes (bowls) (Figure 5.67). Morphologically the plates have physical characteristics that make them especially apt for serving large amounts of solid foods, like tamales. A typical scene in Maya Palace art scenery like the bases K6418, K5492, K8743 where food is located on similar plates. On this sense, one of the largest platters found in the study came from the upper workshop (G 22), possibly illustrating food delivery and consumption. During the Sip complex thin wall cooking pots (olla) started being produced and seemed to be a replacement or the equivalent for the same type of ware found in the Ajín complex (Mirón Marván 2014). The sample included 448 ceramic sherds, 172 registries and added up to 10.68% of the material analyzed.
Ajín

The Ajín complex represents the largest sample of the collection with 995 registries, 4605 sherds, and adding up to 61% of the material analyzed. This complex is comparable to the Murciélagos–Balunte complex for Palenque, the best-known period and the largest occupation in the entire region. Also, this is the body of the analysis that was used for a comparison with other areas within Chinikihá. An analysis that looks into the access and economic power of the dwellers at Group G through the materiality of ceramics. As other authors have pointed out, there are broad compatibility and morphofunctional similarities between the inventories from Palenque, sites in the Usumacinta, the Petén regions, and the rest of the Maya area (Culbert and Rands 2007; Jimenez Alvarez 2015; Miron Marvan 2014; Rands 2007b). The ceramic ware is composed of containers of open and restricted openings for use to store or process food, like cooking pots and casseroles. Also, a wide range of types of ceramic wares used for food consumption like bowls and plates (cajetes and platos), believed to be connected to socially stratified interpretations for the Classic Maya (Miron Marvan 2014).

Post-Ajín

The Post-Ajín complex is the least represented, with only 1 registry and totaling to a 0.06 % of the sample. The same pattern detected in the region, where the presence of this complex only accumulated to 1% of the sample analyzed (Miron Marvan 2014). At Chinikihá known examples tend to belong to service ware, like bowls for the service of liquids. The ceramic complex is associated to the Terminal Classic and no known context have been excavated yet at Chinikihá.
Using the data recovered from the Ajín complex, a basic statistical analysis was done to observe the ceramic distribution at Group G. Another layer of analysis also considered and compared the different ceramic wares with other architectural complexes within Chinikihá. Figure 5.68 illustrates all the Operation and architectural groups considered in the analysis. Previously, a ceramic analysis was applied at Chinikihá and the region that was utilized during this study (Miron Marvan 2014). A collection and database used to contrast and compare the ceramic wares from Group G.

Basic statistics and distribution bullet graphs were generated to organize and visualize the data about each other and divided by architectural complexes. This study was vital in allowing the visualization of the possible relationship between the different architectural groups and their access to ceramics. Data utilized in the interpretation of social and culinary practices. The collections were all excavated at Chinikihá and included: (A) CHK/D82 at n=325 registries, (B) Est. A-7 at n=1227 registries, (C) CHK/109 with n=323 registries, (D) CHK/D87 at n= 2070 registries, (E) CHK/F150 with 1287 registries, (F) CHK/Palace with 6869 registries, (G) CHK/Group G with n=1152 registries (Figure 5.68). These contexts were used because the collections included enough registries to make a meaningful comparison that was statistical sound and had statistical significance (Drennan 1996).

<table>
<thead>
<tr>
<th>Shape</th>
<th>Frec</th>
<th>Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cajete/bowl</td>
<td>2818</td>
<td>6616.4</td>
</tr>
<tr>
<td>Cazuela/casserole</td>
<td>443</td>
<td>5011</td>
</tr>
<tr>
<td>Olla/cooking pot</td>
<td>1837</td>
<td>11766</td>
</tr>
<tr>
<td>Plato/plate</td>
<td>443</td>
<td>4044</td>
</tr>
<tr>
<td>Platón/plate</td>
<td>11</td>
<td>126</td>
</tr>
<tr>
<td>Incensario/censer</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Sahumadorcenser</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Tambor/drum</td>
<td>30</td>
<td>152</td>
</tr>
<tr>
<td>Tapa/lid</td>
<td>9</td>
<td>49</td>
</tr>
<tr>
<td>Vaso/cup</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td>Not ident</td>
<td>9283</td>
<td>27193</td>
</tr>
<tr>
<td>Total analyzed</td>
<td>14883</td>
<td>55037.4</td>
</tr>
</tbody>
</table>

Table 5. 13: Illustrates results by shapes frequency and weight (grams).

Ceramics at Group G and Chinikihá

Using the data recovered from the Ajín complex, a basic statistical analysis was done to observe the ceramic distribution at Group G. Another layer of analysis also considered and compared the different ceramic wares with other architectural complexes within Chinikihá. Figure 5.68 illustrates all the Operation and architectural groups considered in the analysis. Previously, a ceramic analysis was applied at Chinikihá and the region that was utilized during this study (Miron Marvan 2014). A collection and database used to contrast and compare the ceramic wares from Group G.

Basic statistics and distribution bullet graphs were generated to organize and visualize the data about each other and divided by architectural complexes. This study was vital in allowing the visualization of the possible relationship between the different architectural groups and their access to ceramics. Data utilized in the interpretation of social and culinary practices. The collections were all excavated at Chinikihá and included: (A) CHK/D82 at n=325 registries, (B) Est. A-7 at n=1227 registries, (C) CHK/109 with n=323 registries, (D) CHK/D87 at n= 2070 registries, (E) CHK/F150 with 1287 registries, (F) CHK/Palace with 6869 registries, (G) CHK/Group G with n=1152 registries (Figure 5.68). These contexts were used because the collections included enough registries to make a meaningful comparison that was statistical sound and had statistical significance (Drennan 1996).
The different excavations at Chinikihá have given a general perspective on the diversity and economic value of ceramic wares. The ceramic analysis has also been vital in observing the differences and similarities between the collections identified previously (Jimenez Alvarez 2015; Miron Marvan 2014). Below Figure 5.69 and table 5.14 illustrate the results from the ceramic analysis by comparing the percentages of every shape (forma) with the total registries for each rank and complex. The different types and complexes have been theorized to relate directly to the economy and social practices of a household. Even though the analysis was based on the grouping of ceramic types that fall under a category. Subcategories conform those groups, which represent many different possible functions under one category (Miron Marvan 2014). Within each shape, there is a variation and differentiation in uses of the ceramic wares, which should be considered within the possibilities of daily life. The physical characteristics like size and shape could have also related to the uses and social practices.
The ceramic at Group G was compared in three broad categories: a) food sorting, processing, and transport, b) food service, and c) non-culinary practices. The first category includes cooking pots (ollas), for b are plates, platters, bowls, and (c) includes censers, drums, or anything that is not part of ceramic ware. The ceramics from Group G are the second most extensive complex. Only second after the ceramic diversity found at the palace. Meaning that after the palace, the dwellers of F150 and Group G had the most cooking pots and wares used in the production and processing of food and the transport of liquids (Figure 5.69 and Table 5.14). Including the most wares for food service. For non-culinary practices, both architectural groups also exhibit an almost identical percentage of ceramic wares. The two architectural complexes seem to have a similar economic power of acquisition and overall wealth. With the non-culinary ranges, it was also evident the differentiation within this category. Where most architectural groups seem to have a somewhat similar middle percentage, the palace had a much higher percentage within this category.
Discussion

Because of the large amounts of stone found at the site of Chinikihá, modern populations see as a repository of high-quality limestone used to build and transform the landscape. The site is a source of good quality stone (limestone) used in the past for masonry and some tools types like bifaces or axes used for agriculture or clearing vegetation. Some of the hills were also used as quarries for the extraction of masonry to be used in temples, terraces, plazas, and houses at the site. A pattern observed throughout the region, where settlements are placed using the topographic elevation for the edification of houses, temples, and terraces. Figure 5.70 illustrates the topography and placement of Group G within the site of Chinikihá.

![Figure 5.70: Topographic model of Chinikihá showing location of Group G (highlighted) and the topography of the site; Map IIA-UNAM, generated with Surfer 9.](image)

Archaeological sites like Palenque, Yaxchilán, and Plan de Ayutla are very similar to Chinikihá, in the modification of vast areas creating a cultural topography through long-term settlement and urbanism. A product that took multiple generations to construct and which serves as a reflection of similar social practices and technological adaptation (Acosta 1974; Barnhart 2003; Blom 1923; Haviland 1970; Ricketson 1937). The hills were carved into striking architectural complexes. The use of terraces on the elevated areas provided flat spaces, where stone architecture could be constructed and used for many production activities. Also, the slopes were utilized as quarries for raw material for construction of architecture (Figure 5.71 and 5.72). Fundamentally the community of Chinikihá can be thought of as located and distributed on top of outcrops of high-quality limestone. In large nodes of population like Chinikihá, Yaxchilán or...
Palenque is common to find fractured blocks and debitage of stonework in proximity to architecture (Figure 5.71). Evidence of the exploitation of good available stone. At Chinikihá the site is one of the bigger nodes of architectural volume in the region, with many locations now identified where lithic production took place. These areas are located in different parts of the site and have not been excavated.

The existing hills of the Sierra Madre provide high areas protected from common rains in the region (Campiani 2014; West 1971). There is a direct relationship between the geology and topography in the selection of where people decide to settle. Both the region and Chinikihá show a pattern of preference for places with a high geographic elevation with access to valleys and good drainage. The importance of the location of Chinikiha was vital to the network of exchange. The site today continues to be part of the movement of people, and the modern road from Tabasco to Chiapas cuts through the middle of the archaeological site.

![Figure 5. 71: Outcrop and worked stone in Group B; image by author 2011.](image)

![Figure 5. 72: Example of masonry found on surface and produced locally, image Group Mahler; image by author.](image)

The outcrops in some areas have a relatively thin surface organic deposit of no more than 10 cm thick, usually followed by the outcrop. In many locations at the site, the outcrops have no protecting layer of soil and exposing places quarried. These types of stone quarries are places located near large architectural volume and in elevated areas. One such area located to the NE of the Group Mahler had evidence of such pattern. A close-by quarry was used to construct the
temple, terraces, and houses around the elevation. An example of this practice can also be observed on the slopes of the South Acropolis at Yaxchilán, or at the side of the hills at Plan de Ayutla, Chiapas. Another example is the quarry found about five hundred meters in a straight line to the South of the Palace going up the Sierra San Juan. They all have the entire chain of production, from the existence of big boulders to small flakes and debris for architectural masonry.

Palenque is another place that had access to good quality local limestone for masonry. Researchers in the past have observed the differences in quality of the stone used in architecture when compared to the raw material found at sites in the Yucatan Peninsula, like the Puuc Region (Acosta 1973; Greene Robertson 1991; Riqueime, et al. 2012; Ruz Lhuillier 1952). The fracture is not as uniform, and the limestone tends to have more impurities due to its genesis (Mülleried 1957; Riqueime, et al. 2012; Salas and Lopez Ramos 1951; Waters 1996). There are many deposits of sascab or breccia distributed throughout Chinikihá, a limestone very brittle and in the process of dissolution that makes it ideal for the production of lime (Lola 1991). Locations of high-quality limestone can be found locally in the NWML, and its exploitation is extensive and widespread. At the site of Palenque modern artisans or craftsperson working at the entrance of the site make replicas using two main techniques. One technique is the use of molds and pastes to create replicas of the carvings of the Classic Maya that are sold to the tourist. The second is the work of artisans that are more similar to those done by the elite crafters in the past. With the use of modern tools, they carve replicas on the same limestone found regionally around Palenque and work by the crafters in the past.

The local communities knew of the many uses and applications of the most dominant raw material in the Maya region, limestone. Also, the local production or crafting of different stones was part of daily practice, including the technology for the use and production of lime (Lola 1991; Russell and DaWin 2007; Wernecke 2008). Commonly found protecting buildings and floors as thick plaster layers attest the widespread use of lime. Some of which is still visible on the bigger buildings and also encountered during excavations in domestic context (Liendo Stuardo 2009; Silva de la Mora 2014). Domestic excavations at Chinikihá serve as evidence of household production and use of lime (Liendo Stuardo 2010). Reflecting similar traces of lime production as those recorded and reported archaeologically throughout the Maya region (Lola 1991; Russell and DaWin 2007; Wernecke 2008). During the excavation at Group G, balls of lime were recovered from the surface level close to the entrance of the house (G13a). Also, stucco floors were uncovered where at least two-three layers of replastering and maintenance.

Not all the material is of excellent quality, and just like in other parts of the Maya area, there is evidence of the use of particular types of stones for specific purposes and tools, usually determined by the raw material. Local knowledge of good quality sources must have been an important part of daily life in the past. Still, not all the commodities were available locally, and long distance exchange was needed. Previous research in the Americas has found clear evidence of the diversity and significant movement during prehispanic times of goods and people (Hirth and Pillsbury 2013; Lee Whiting and Navarrete 1978; Santley 1991; Trombold 1991).

Material culture reflects the technological choices and behavioral patterns of a society unique relationship with tools and technologies out of stones. The diversity of not only raw materials but also social practices rooted in daily practice is the embodiment of personal choices. In this sense, habits can be thought of as grounded practice, as people learn by observation of daily activities, rooted in locality, like a workshop or a kitchen and share ways of doing, ways of learning and
crafting (Lave and Wenger 1991; Lemonnier 1992; McAnany 2010). The local traditions in which people made things, comparable to contemporary Maya and non-Maya communities in the region and the importance of customs or “costumbres” (De Vos 1994, 1996, 2004; Mauss 1973; Pinkus Rendon 2010; Salazar Ledesma 2010). Habitual traditions embedded in daily practice that include simple tasks or ways of doing, up to specific technologies necessary for the production of certain kinds of artifacts, that reflect physical practices and behavioral choices (Vogt 1973, 1992; Watanabe 1997). Daily practices embedded in ordinary activities the habitus and hexis developed by Bourdieu (Bourdieu 1977, 1990). Simple general rules that help people navigate and belong to a community of practitioners.

**Summary**

The domestic information recovered at Group G in Chinikihá was presented in this section. Delving into the macro level by introducing the archaeological site, the architectural complex, the different excavations and research carried out. The information gathered was vital to understand various aspects of daily life and social practices of a commoner domestic complex. The importance of the context lays precisely in the many different spaces incorporated by the household. The lithic evidence also provided a unique opportunity to study the activity areas and spaces of a group that spends a large amount of time and energy crafting stones. The use of many lines of inquiry is an attempt to present a wider spectrum evidence to understand and recreate the local histories from a perspective of communities of practice. The importance of lithic practice serves as an indication of the importance of shared knowledge, grounded ways of doing and the reflection of social structures shared from generation to generation.

The excavations were vital in exposing the home, space where people worked, lived, and slept. Allowing the recognition of physical differences in spaces within a commoner domestic group. Also, the excavation of a kitchen presented the opportunity to examine another activity area. The only known excavated example of this type of structure in the NWML. The internal patio and surrounding area offered a wealth of information on the history of the site and opened the discussion of different activities and the use of space. The soil chemical analysis was vital in the appreciation of nonvisual evidence and its importance to the interpretation of the context. Allowing a fuller perspective on the possible use of spaces, like the traffic areas and movement within and around architecture. The macrobotanical information was also another line of evidence that vital in the appreciation of social practices, preferences, and uses of plants. Also, helping the reconstruction of exchange routes and the move of non-lithic products; like pine. The carbon dating in association to specific architectural features were vital in dating the architectural group, allowing the recognition of the many generations living at Group G. The ceramic data was also critical in contributing a relative chronology of the architectural group. Also, the results from the ceramic analysis gave an image of the access to ceramic wares and the placement of Group G in comparison to other architectural groups. The next chapter complements the results in relationship to lithic production and consumption.
Chapter 6 Stone crafters and stone tools at Chinikihá.

The architectural complex excavated at Chinikihá provided a unique opportunity to delve into the daily life of the ancient dwellers and the community they created through the use of stones in daily practice. As mentioned above (see Chapters 2 and 5), the lack of research on production contexts, like workshops, has left many questions related to the social status and level of commoditization of stone tools (Andrieu 2013; Clark 2007; Feinman and Garraty 2010; Flad and Hruby 2007; Smith 2004; Wells 2006). Furthermore, assumptions about how the production of stone tool was organized in the past have a reduced scope of interpretation. Past discussions have included interpretative models based on the restriction of some stone tools and other goods as means of economic control. Models are also fitted to account for the production and distribution of stone tools, which many times forgets to consider social diversity and the multiplicity of economic relations. The interpretation includes larger aspects of the social organization concerning the exchange and distribution systems from a top to bottom perspective (Clark 2007; Feinman and Garraty 2010).

The study aims to understand and analyze some of the differences between the rural and urban communities by contrasting the lithic evidence from the site of Chinikihá with information from the region. Also, to delve at the level of local organization from the perspective of stone tool production that includes the social and economic value of the crafters (Hendon 2015; Hirth 2003, 2009a). The chapter illustrates the results of the research into the production areas or workshops adjacent to the domestic group described in chapter 5. It also serves as evidence of stonework activity recovered in a workshop. The section will introduce theoretical and archaeological terminology used in this lithic study to better understand the local communities of practice.

The use of stones can be theorized as a reflection of the technological knowledge influenced by ways of doing grounded in daily practice (Lave and Wenger 1991). Practices embedded in communal activities created over generations of crafters that continue the knowledge by replicating techniques of production in a group of a family or lineage (Joyce and Gillespie 2000). The routinely daily activities including the production and use of stone tools were part of many, if not most of the daily activities. Memory and knowledge are also powerful tools socially learned by doing and replicating behavior, including specific ways of doing. Knowledge is shared by members of a community and can even reinforce group identity and overall communal life (Edens 1999). The material remains of production and activity areas serve as the windows to the study of a household. In this case the study of activity areas of a lineage at Chinikihá with evidence of long-term production of stones. This study doesn’t come without a questioning of the methods and models used. The aim is to examine activity areas about identifying the locations and the place where people lived, worked and played. A problem studied before by researchers working similar problems that question production from a perspective of household archaeology. Specifically in the relationship of the materiality of workshops, as means to grasp the relationship of production and social learning within specific physical spaces (Andrieu 2013; Hester and Shafer 1992; Lemonnier 1992, 1993; Moholy-Nagy 1990; Shafer and Hester 1983).

Studies have attempted to address general questions concerning the recognition of workshops and the relationship to the produced debitage or production waste. A problem to consider due to the nature of lithic waste material with an output of large quantities of debris from production and its ubiquity in the archaeological context (Moholy-Nagy 1997; Shafer and Hester 1983). A problem related to the correct identification of the production activity area and not just a deposit
or midden. Lithic debris can be used as filling in Patios to even surfaces, or architectural filling, to its use in tombs, or being in left in situ after production. Likewise, the nature of stone tool production leaves the traces of production through debitage. Further, those same lithic deposits can be a reflection of different activities, not necessarily related to the manufacture of stone tools. For example, the leftover debitage used and re-deposited in architectural or burial fill, as reported in Maya cities like Palenque and Tikal seems to have been an important factor in social practices (Blom 1923; Moholy-Nagy 1997; Ruz Lhuillier 1952, 1958a, b; Saenz 1954). This cultural re-deposition is also the reflection of behavioral choices since the debitage was extracted from its original place or context to be deposited in a particularly social activity and moment (Anderson and Hirth 2009; Dobres 2000; Hammond and Sidrys 1981; Shafer and Hester 1991; Spielmann 2002). Apart from the lack of information on workshops for the Maya region, another question stands regarding the craft of stone workers during the Late Classic or pre-contact time.

Crafting of Stones

The study of production integrates a focus on the materiality of lithics, as a reflection of the crafting techniques and daily socially learned practices that were past from generation to generation (Hendon 2015; Hendon, et al. 2014). The appraisal of Maya crafting through a perspective of communities of practice (Lave and Wenger 1991) considers the individuals doing the crafting, the crafted objects and the community of practice where people interacted, engaged, and learned how objects were to be crafted (Hendon 2015; Joyce 2015; Shackley 2000, 2005). Valuing the crafters, their skill and ability to adjust and make decision vital during the creation process (Keller 2001). The communal use of stone tools can be perceived as embedded in daily practice and daily use. Practice is grounded through daily life activities, the mundane ordinary actions where communal ways of doing are always being recreated and become the means of knowledge transmission by shared spaces and means of using stone tools (Hutchins 1993; Lave and Wenger 1991; Wenger 1998).

Daily practice and participation can be seen as a traditional transmission of techniques and knowledge through a process of appropriation that includes styles and techniques fundamental to craft production (Hendon 2015). There is regional evidence of a constellation of crafts persons that shared practices and were also able to reproduce the embodiment of local techniques and styles through lithic production. This can be seen in how they worked masonry and built their houses, or how they produced and used their tools in daily life. The many years working at Chinikihá has provided an opportunity to observe different lithic materials from the different units excavated and the variation in the archaeological context. The artifacts found complete reflect a level of skill in each household. Finding similar tools in all contexts but also observing a difference in the spectrum of skill level and crafting; this was observed in the production of tools like bifaces, where some present a high level of skill and others seem the work of someone learning. Also, related to the differences and similarity of tools and crafting styles within the site of Chinikihá. There are visible differences in finished tools observed in the shape, axis and levels of knapping skill and was of working stones. As the various operations are analyzed, many more intimate aspects will be known and perhaps begin to understand the production and crafting of different groups within the site.

Production and Distribution

For the Late Classic economic organization, there has been a tendency to be interpreted around a feudal model of organization, which asserts the vertical obligations of the producing sector of
society to an elite class in the form of taxation but does not consider the diversity of social organization around production and exchange (Adams and Smith 1981). An alternative model proposed highlights specialized production and marketing mechanisms for distribution of stone tools (Rice 1987). Both models have been utilized to elucidate the possible channels and processes of exchange, for example of obsidian throughout Mesoamerica and beyond (Clark 2003b; Cobeán 2002; Sidrys 1977; Woodfill and Andrieu 2012). Obsidian happens to be a great material to exemplify and illustrate the wide distribution of this volcanic glass through some of the patterns identified from the source to the final place of deposition (Joyce 2011; Shackley 2007). Also, differences can be observed on the sources of obsidian and the quantity or levels of prevalence of the sources in a region (Shackley 1998, 2008). The identification of sources throughout the Maya area and Mesoamerica have helped in our understanding of the movement and exchange of this good (Arnauld 1990; Clark 2003b; Demarest, et al. 2014; Glascock 2002; Moholy-Nagy, et al. 2013). Perhaps a manifestation of different economic and social means of procurement, exchange, and eventual distribution through local systems of exchange like gifting, markets, and barter.

**Workshops and Production of Stone Tools**

![Figure 6.1: Map and image of workshop terraces and location of surveyed shovel testing and excavation units. The image captures the slope between terraces G22 and GG16, picture taken from G23 viewing SW towards G12.](image)

The study of workshops at Chinikihá serves as the case study of production areas in association to a domestic context. The study attempts to understand technological aspects of stone tool production and the crafting of stones part of the domestic and daily life at Group G. The focus on stone tools and its relationship to daily living can broaden our knowledge of Maya commoners during the Late Classic from a perspective of lithic communities of practice (Canuto and Yaeger 2000; Joyce 2012; Potter and Yoder 2008; Shackley 2005; Wenger 1998). A model that recognizes the importance of peripheral participation and situated learning in traditional societies. The continual grounded transmission and sharing of technological knowledge through daily practice and shared ways of doing. The architectural complex offered an opportunity to study areas where people worked, produced and used stone tools in their everyday lives. Allowing an examination of different areas of daily activity, like the house, kitchen, and workshops. The physical spaces where the transfer of knowledge of production of stone artifacts
happened. Also, the evidence of production of stone tools indicates a set of knowledge that was a fundamental component of the productive processes of the residents at Group G. A set of knowledge that was shared between members and included the traditional ways and rules of how to produce stone tools. The many structures needed in crafting, and socially grounded spaces where members could develop their skill. The value in identifying the areas where the daily activity occurred serves as a case study to examine social processes of production and sharing of knowledge. The physical spaces where crafters became active agents of their community and practices, first by observing and beginning a process of learning, followed by doing. A continuing progress that would culminate in a skill set of a craft master capable of replicating the structured knowledge embedded in daily practice (Lave and Wenger 1991; Wenger 1998).

The workshops are located in the posterior section of Group G, in the highest and somewhat most isolated part of the compound (Figure 6.1). It should be noted that there are more settlements to the West on the upper section of the continuing the Sierra Madre, but the mapping of that section hasn’t been done. The architecture surrounding Group G seems to be domestic and distributed in the flat terraces, with basements or small mounds enclosing interior patios (Campiani 2014). This is somewhat a regular pattern found at Chinikihá, and just like other architectural sites, the importance of large open spaces or patios is common, where a lot of the daily activity took place (Bawden 1982; Browser and Patton 2004; Linehan and McCarthy 2000). The use of terraces generated large flat spaces where evidence of production was recovered and around which the long-term deposition of waste resulted in a concentration of production lithic debris. The structures G-22-23-12-16 mainly bounded the lithic debitage creating a large space where the archaeological material was scattered; observe Figure 6.1. The terraces were constructed on the slope, perhaps trying to have the working area in a place that was not to have much traffic or also for safety reasons for children or older family members. A good portion of the slope was covered in chip stone debitage of cryptocrystalline materials (Luedtke 1992), mainly chert, a term used as a synonym of each other. The technologies used and the shapes or forms of the tools are very similar to those found in surrounding areas, with techniques of direct and indirect percussion, grinding, polishing and pressure techniques (Coe 1958; Hruby 2006; Johnson 1976; Ricketson 1937).

The debitage deposits at Chinikihá were located scatted on a large surface, perhaps reflecting the long-term process of deposition. Also, the study concentrates on one architectural complex at Group G and will serve as the starting point for future workshop studies. The study is at no point ready to source local production at different areas within the site or the study region. Including the location of sources for chert, since no chert middens have been identified. Other studies in the Maya area have been able to that that, like the bifacial artifacts from the workshops at Colhá, Belize. Local production of Colhá has been reported in places as distant as Chiapa de Corzo in Chiapas, located about 500 kilometers to the southwest in Mexico (Hester and Shafer 1991). The long-term evidence of stone tool production and distribution makes the Colhá archaeological study unique in the Maya region since it has been able to attribute long distance source of production to chert materials. It also points to the importance of looking at the materiality as a communal reflection of shared daily practices and its value both locally and for the Maya region. Where the same types of tools and shared practices have been reported at many sites (Lohse and Valdez 2004).

The site of Colhá is also fundamental in the recognition and proposal of the producer-consumer model for lithic production. A model that explores the importance of stone tools in long distance
exchange and distribution within the Maya lowlands. The workshops at Chinikihá will examine
the possible social implications of stone tool technology and how the knowledge of production
was shared from one generation to the next, including the techniques and local ways of crafting
utilitarian artifacts (Dockall and Shafer 1993). The study at Group G attempts to provide crucial
information to understand the importance of collective knowledge in the craft (or technology) of
crafting stone tools. The diversity of stone tools identified in the study included household uses
and trade goods used in daily life. Just like reported in other areas, the workshops at Chinikihá
were producing a wide range of artifacts, from agricultural tools to elaborately crafted prestige
items like pyrite mirrors (Gibson 1989; McAnany 1993; Santone 1997). In this sense, there is
evidence of production of specialized goods like pyrite mirrors (Figure 6.2) or jewelry. The
pyrite mosaic included evidence of grinding and polishing techniques.

Figure 6. 2: Drawing and image of a pyrite mosaic recovered at the
workshop in Group G.

Other possible workshops have been reported from other parts of the Maya lowlands, where
debitage piles are indications of the intensive crafting of stone tools beyond levels required for
household consumption (Andrieu 2013; Shafer and Hester 1983; Whittaker, et al. 2009). These
studies have described and documented the duration and intensity of production (Lewis 1996) or
the locality of the workshop (Barnhart 2003) usually using the attached specialist paradigm. At
Tikal, attention in the deposition processes originating from the production of stone tools
resulted in a redeposition of debris by removal and transport to other places. Large quantities of
refuse from stone tool production was utilized for filling in burials and even reported as
“identical to that of special-purpose lithic dumps. It differs markedly from household midden by
virtual absence of finished artifacts and a scarcity of (pottery) sherds” (Moholy-Nagy 1997: 307).

The study of the material evidence of stone tool production has been vital in unveiling the local
crafting embedded in daily practices and local ways of making stone tools. The
unique characteristics and large amounts of debitage attest the local chipped stone technology,
preferences of raw material, and different techniques applied in the production of stone tools and
goods. The stone tools and debitage serve as the physical evidence of the spectrum of skill levels
and perhaps even the reflection of traditional forms of learning. Where apprentices, including
children, learn by what they perceive from their surrounding and community, a daily grounded
socially base process of learning by doing (Högberg 2008; Hutchins 1993; Kamp 2001; Lave
2008; Mauss 1973; Morehart 2008). The differentiation found in some of the crafted goods or in
usable flakes that reflect non-specialized knapping or someone learning. A clear behavioral
pattern observed through experimentation of stone tools, where the process of learning is related
to the ability of production. The evident skillful crafting seen in some bifaces. Bifacial
with skillful proportion and straight axis of the blades. Pieces crafted by careful skillful knapping that produce unique artifacts. A reflection of a high degree of control and mastership in the craft.

The area was surveyed using excavations and shovel tests to discern the location of middens, materiality associated, construction methods, stratigraphy, construction technique and relative chronology (through ceramics). The shovel testing resulted in a clear general perspective of the deposits localized at Group G, specifically in providing a perspective of the possible use of spaces (Figure 6.3). The material evidence identified was also vital in defining the use of spaces and choose areas to excavate. As seen in chapter 5, the lower area was easily defined through the increased presence of ceramics and used tools like grinding stones. Just like ceramics, stone tools can also point to the use of space and daily activities. In the excavations at G13b, in the kitchen area, grinding stones were identified next to the half moon, believed to be where the hearth was located. Located near the fireplace and probably the primary location of use. The location of this type of tool indicates the possible purpose of the space. Grinding stones have been found in association or close to domestic context and areas of food production. No grinding stones were collected from the workshop areas.

The debitage covered an extensive area, and the architecture of the terraces was not very evident on the surface, due to the incline on the terrain and the modern land use for cattle grazing (Figure 6.1). The areas with the most concentration of lithic debitage were defined through the implementation of a shovel test. The results were a visual perspective of the concentration of lithics and visualization of the total differences in proportions of lithics to ceramics. The shovel test were post holes of 25 x 25 cm and excavated until bedrock was reached or unless it was too deep to continue. For the most part, the bedrock was encountered within the first 25 cm or less from the surface. On the incline where the workshops were found, the maximum depth encountered was of 40-60 cm from the surface. A similar pattern was seen in the lower flat section to the East and South East of G13 and G16, with thicker layers of strata and depths of over 80 cm from the surface in few places. The plaza in the front of G13 and G16 was modified to have a flat surface. Observed in the difference in the location of the bedrock from the surface and the types of deposits. The larger plaza contained mainly ceramics and lithics mixed, but not all shovel test the same amount of debris. Also, some shovel test, not many, had no archaeological material, or almost none. Not all the area had cultural deposits, but deposits with cultural material were used and placed throughout the space to fill empty or uneven spaces and create a flat surface to be used for other activities. The inhabitants made sure the areas around the Group G were flat and clean, as all the surfaces in the lower areas (what seemed to be the frontal spaces) tended to be very clean and with little trash on the surface. By trash, I am making reference to ceramics and lithic deposits.

These characteristics generated spaces that could be easily communicated with facility and ease of movement. The architectural distribution is open, and even though many sections of the group have not been surveyed, the inhabitants lived in well-made and defined domestic context that included dwelling and working spaces. The architectural layout at Group G was different to the pattern observed in the elite architectural groups that lived in the central sections of the site. The elite domestic context is located on the top or high places of the main topographic elevation. With the use of elaborate architecture that included reduced spaces in multi-room complexes and differentiated space layout. The Group G is positioned in a low area, with easy access to the architectural complex and the main road. The area presents a multi-platform distribution, the opposite to the architecture in the central areas. The intermediate structural compound around the
Group B has a multi-floor complex named the Palace (El Palacio) of its architectural volume, painted stucco walls that had multiple layers of cobblestone rooms and surrounding temples.

The shovel test provided a pattern of distribution where the debitage was associated to the terraces and did not extend away from that area. The empty spaces between the terraces could have also easily been used to harvest plants for family consumption, providing spaces for a family garden. The ceramic also directly associated with the residential lower areas in G13, discussed in the previous chapter 5. In contrast, ceramic evidence was almost nonexistent on the slope between the terraces where the lithic debitage was located and dominant (Figure 6.4 and Table 6.1). Also, the ceramic wares identified have been connected with the presentation or service of food and not the preparation. Possibly reflecting the use of spaces in the past and how the terraces G16, G22 and G23 were spaces dedicated to at least the production of stone tools and byproducts. Also, the amount of debitage collected demonstrated the complexity of the context and the possibilities for studying stone tool production, crafting, and activity spaces defined by the particular material attributes observed in the area.

Figure 6. 3: Illustrates the shovel test and concentration of lithic debitage by weight; map generated with Surfer and AutoCAD.
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<th>Weight Kg</th>
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Table 6.1: Displays results of the shovel test lithic weights in kg from the debitage collected from shovel test by field season 2011 (blue) and 2012 (green).

Figure 6.4: Illustrates the shovel test weights of lithic debitage in kg recovered during season 2011 between terraces, and 2012 in the frontal patio and lower areas.
The Stone Tool Debitage

As mentioned in chapter 4, two types of data collection strategies were applied, a modified Attribute Analysis applied to the obsidian collection and also a small of microcrystalline chipped artifacts from Group G. The methodology was used for complete or semi-complete artifacts. The second type of analysis and the one introduced in this section was chosen because of the kind of context and materiality recovered, the application of a modified Mass Debitage Analysis based on the work of Stanley Ahler (1975, 1989b). The methodology also considers other author’s contribution and critiques, like those from William Andrefsky (2007a, 2008, 2009), George Odell (2004), Steven Shackley (1989) and Payson Sheets (1975). Also, as mentioned in chapter 4, the use of a behavioral approach was vital part of the design of the lithic analysis (Odell 1980; Schiffer 1975a; Schiffer 1975b, 1976; Sheets 1975) and provided the opportunity to theorize about technology (Lechtman 1977; Lemonnier 1983, 1992; Pelegrin 1990; Schiffer 2001; Shackley 1989; Sheets 1978), crafting of stone tools (Clark 2003a; Hendon 2015; Hirth 2009a, b; Yerkes 2003) and communal daily life (Joyce 2012; Lave 1990; Lave and Wenger 1991).

Tools used during the production of stone tools, i.e. hard hammers (Figure 6.5) and polishers (Figure 6.6), were also recovered and attest to the activities carried in the past. It should be noted that polishers of different shapes, forms, and from different raw materials were recovered at both areas. Archaeologically complete or semi-complete artifacts are not easy to find, yet it’s far easier to recover the debitage of production, (re) sharpening, reuse or discarded tools once hey have concluded their life cycle, which might mean only having a fragment of the original tool (Wynn 1993). Many tools were hafted to different types of handles creating tools not visible in modern times. Other tools like hard hammers or grinding stones (manos) do not need a handle. The complete and semi-complete artifacts were analyzed with the attribute analysis that has more variables and records more information on a single artifact or tool. The artifacts recovered intact also serve as evidence of crafting techniques and skill from the crafters at Group G. As future research progress and more collections are analyzed from different context at the site of Chinikihá, questions regarding distribution of finished artefacts and perhaps even skill levels, local differences and the constellations of practice will become evident.

The use of a debitage analysis has only been used in this context and to the material recovered from Group G, where a production context was recognized, and the amount of debitage recovered made it impossible to analyze by attribute. The debitage can be seen as the most common archaeological evidence, especially when considering the Maya unique relationship as a community of stone practitioners. As mentioned in chapter two and four the social practice of stone tools can take many directions through the use of different techniques or methods of production. Also, because of its nature, the entire chain of production can be studied and understand the activities taking place at the workshop.
The workshop was the initial section surveyed at Group G, and there was a clear pattern of production of stone tools, not only about other materials, like ceramics but also from its formal characteristics and amount of debitage recovered in a large space. An ideal context to study aspects of social learning related to transfer of knowledge and daily practice. The material remains used to theorize about crafting, and the relationship of stonework and the possible links to the social placement of the lineage from Group G. It should also be noted that different technologies have been identified concerning many techniques of stone tool production. The crafters had knowledge of other techniques like grinding, polishing, pressure techniques and evidence for other types of production. Part of the research carried out included different aspects or experimentation including replication and possible use of the stone tool to observe fracture patterns. This study did not get to analyze or do microanalysis and macroscopic study of use wear. Also, flint knapping has been an integral part of the study, adding layers of personal experience in the experimental production of stone tools and the possibilities for identification during the analysis of specific attributes like scars, flakes and shatter debris from the many stages of production. It has also been very relevant to understand processes of production related to the acquisition of skill and knowledge. The study looks at debitage as the result of different stages of production of various individuals.
The Mass Debitage Analysis

The Mass Debitage Analysis (MDA) was initially developed by Stan Ahler (1975, 1989b) as a multivariate approach for a technological classification of large samples of debitage. A methodology develops to be in a context where very large samples of debitage are available, like workshops and give a set of specific variables on its ideal applicability (Ahler 1989a, b). Figure 6.7 and 6.8 show the type of debitage collected at Group G. It should also be mentioned that the method recently has received a fair share of critiques considered for this study (Andrefsky 2007a, 2009; Bradbury and Carr 2009; Larson 2004; Railey and Gonzales 2014; Root 2004). Including the critique that MDA has no utility in defining technological aspects in archaeological flake debitage collections (Andrefsky 2007a; 2009: 82). I will first go into detail about some general aspects of the methodology and do a revision of the critiques before presenting the results.

Figure 6.8: Example of the lithic debitage recovered at the workshops.

The original Mass Analysis was developed as an unbiased method applicable to large collections belonging to context with very large samples ideally from areas of extraction like quarries and production areas like workshops, where hundreds of thousand debitage flakes are part of large deposits (Ahler 1975, 1989b). The use of the method for small samples or collections is not
recommended and becomes very questionable because of the nature of the type of debris analysis it produces (Ahler 1975, 1989a, b). The procedure does attempt to solve the problem of large samples of material evidence. Considered one option to do an analysis of large collections. But it should be noted that other researchers have used other similar methodologies, like the simple flake aggregate analysis (Bradbury and Carr 2009; Hall and Larson 2004). MA is based on extensive experimentation on quarries where the original material used in the past is also available for replication and testing. Included in the methodology are specific data collection methods that are finally used for comparison through basic statistic interpretation (Andrefsky 2001; Larson 2004). MDA can be seen as an approach with multiple variable consideration and analysis (Ahler 1989b). The analysis is structured around the familiarity of the knapper with stone tool experimentation and reproduction.

The MA methodology includes having to be faced with other issues like the learning curve of knapping and the mechanics of working stones. Learning the many aspects to acquire the skill and experience in the stonework. Even though the knapping is a modern reflection through the experimental replication, the value is meant to aid in the comprehension and execution of the analysis itself (Ahler 1975, 1989b). I also think that Mass Debitage Analysis has some advantages and can result in very positive results with high levels of confidence by including multiple variables of evidence and testing that can be used to compare the results. The type of context encountered at Group G was a good place to apply and learn from this method due to its physical characteristics and amount of lithic debris collected. I also think as a result of the methodology, which includes the experimental reproduction of tools, has been an active ingredient in my research providing the opportunity to see first hand the applicability and importance of the learning process and building of a community of stone tool practitioners through repetition and daily practice. Other methods have been proposed to understand large samples of lithic debitage and possible interpretation, such as the Interpretation Free Method IFM. Others have also included the use of experimentation as a methodology for flake debitage analysis (Andrefsky 2001; Johnson 2001; Magne 2001). Some critiques disclosed by the archaeologist working similar issues were quite constructive and vital to the development of the analysis.

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Sieve Opening</th>
<th>nominal wire diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aperture in (Tyler #)</td>
<td>Aperture mm</td>
</tr>
<tr>
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<td>$1\frac{3}{4}^\prime$</td>
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</tr>
<tr>
<td>G2</td>
<td>$1^\prime$</td>
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</tr>
<tr>
<td>G5</td>
<td>$\frac{1}{8}^\prime$</td>
<td>6.3</td>
</tr>
<tr>
<td>G6</td>
<td>Brass Pan</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. 2: Illustrating the sieve nomenclature and sizes.

Size-graded groups design the Mass Debitage Analysis around the separation of flake debris, where specific attributes are used for organizing and giving an overall view. Standard geologic sieves of varying mesh size were used to separate and group the material recovered. Done through the use of 8” (brass 7) Stainless Steel Sieves (Tyler brand). Each size of the sieve is given a name, i.e. Gauge 1 or G1, Gauge 2 or G2, etc., (observe Table 6.2). The present study used five different mesh sizes to have a precise control of the debitage. Various researchers use a combination of various sieves (Ahler recommends four sizes) and have experimented with varying size grades to refine the method (Baumler and Downum 1989; Carr and Bradbury 2004).
The method should include distinctive conventions to label and separate the size grades (Andrefsky 2007a: 397; Morrow 1997: 56). Regarding the process of size grading, Ahler (1989b: 100) favors and recommends the hand-manipulating of flakes through the largest two screen sizes in sorted to avoid flake damage. I fund this recommendation to be useful, yet not sufficient to only do in the first two grades sieves. The procedure was implemented throughout the separation of all sieves. What I found to be very efficient was actually to run the debitage through the screen at least twice, classifying and grouping as the sieving occurred. After this initial separation, all the flakes were divided and grouped by physical characteristics. The debris was separated by raw material, color, texture, and type of flakes (e.g. cortical flakes, primary flakes, etc.). The specific physical characteristics of the artifacts were also recorded (complete, incomplete, fragment), color (using a Munsell Rock Color Chart) and texture. Once the classification was done, the assemblages were registered and bagged after being counted, weighed, and measured. During the study, one flake was used as a representation of the group, and basic measurements recorded. The same methodology was applied for the analysis of the experimentation and reproduction to have a point of comparison and observe how crafting occurs. The inquiry also considered the possible techniques of production, such as direct or indirect percussion, bipolar, or pressure technique.

Another factor to consider in this type of analysis is the possibility of debitage mixing, a result from the flake debitage off many different stages of reduction or production and many crafters working and contributing to the same debris deposit. A similar critique has been argued about the aggregate approach used for MDA and some of its shortfalls (Andrefsky 2007a). An issue part of a larger analytical discussion, where researchers have pointed out precisely that lithic samples are usually a reflection of mixed contexts and the value of attribute analysis on debitage materials (Andrefsky 2007a: 396; Bradbury and Carr 2009: 2791). This has been identified as a major problem with Mass Attribute studies and relates to the methodology of separation by size. The idea is that debitage from one stage of production gets mixed with different types of attributes, skewing the results by mixing different diagnostic attributes and creating the problems of debitage mixing in the interpretation (Andrefsky 2007a: 396). Options have been explored to account for the extent of mixing or when it has occurred (Ahler 1989a; Bradbury and Carr 2004; Root 1997). Researchers recommend different statistical analysis to account for this problem such least squares analysis (Stahle and Dunn 1982, 1984) or partitioned discriminant analysis (Ahler 1989b), which looks at the different size fractions of the total debris sample by technology, followed by conjoined, graphic interpretations. Larson (2004: 17) recommends a different approach regarding debitage mixing, to “subdivide debitage assemblages and more clearly understand the context of those subdivisions in the archaeological record.” A behavioral differentiation by subdividing the assemblage into meaningful technological groups that would provide contributing practices in crafting of stones.

Part of the study also required the use of multivariate analysis to try to interpret the many measurements and possibilities of interpretation. The use of this type of analysis provides certain advantages but also raises some issues. A general critique is a question of allocating the correct attributes to the proper technological process of production reflected by the debitage grouping. Taking into account the volume of analyzed materials and making sure that all the debitage in that group belongs to the same size, form, and shape as the analytical categories. The use of a measured sieve to gather precise information regarding formal metric attributes does not control the debitage size and even form or the flake or debris (Andrefsky 2009: 89). Here can result in allocating different stages into the same grade, grouping everything into one and mixing
attributes that shouldn’t be together. During the study, the flakes were separated manually as much as possible, both through the sieve and then once the group was divided to better separate and classify these many categories. Trying to allocate the different types of flakes to the many possible types of flakes. I am aware that there is a level of error in my interpretations and some attributes to me might be different to another researcher. Therefore I used as many variables into my analysis like flake size, shape, form, physical attributes and Munsell geologic chart.

There can be a lot of variation in the weight, and the count by sieve size. The bigger and thicker flakes will tend to be less compared to the smaller flakes, but they will also weight more. A variation of the physical attributes related to the reduction stages, technique sand even crafting abilities of the crafter. All the results include the total numbers and weight of flakes at all the size grades. As Odell (2004: 133) argued: “mass analysis is not necessarily the answer to a lithic analyst’s dreams, but it can be a useful complement to a battery of analytical techniques that together, provide a wide range of data from which to render informed interpretations”. At Chinikihá where this type of analysis is beginning to be applied, I believe MDA provides some general patterns and information that can help unveil local technologies, crafting techniques and ways of doing of a lineage part of a community of practice during the Late Classic.

This separation and identification of the many variables and physical characteristics are aids in the classification to understand stone tool technology and production (Bradbury and Carr 2009). During the debitage experiments Ahler (1989a: 99) determined to take out the “usable” flakes before collecting the data. On the one hand, I think choosing the usable flakes can mean different things to different crafters, much depending on the needed tool. The idea is that in the past, usable flakes were separated and used, which is also probably true. While other archaeologists have determined to leave the assemblage as they are produced since this allows for a view of the entire sequence of events and resulting debris (Bradbury and Carr 1995). In a way I followed the second example, choosing to reproduce and leave the entire assemblage as proof of the different steps and also the tools attempted to produce. I do have to admit that in some occasions the usable flakes were taken out to use them for the production of other tools. The Mass Debitage Analysis includes statistical methods used to separate the experimental material and used as a key to classify and separate the archaeological material (Ahler 1989b; Andrefsky 2007a; Mallory 1986).

here was one important difference between the archaeological collections and the experimental raw material. The obsidian and chert used do not come from the original regions, or locations found archaeologically, with the exception some of the obsidian used in experimentation. The obsidian and chert used for experimentation come from the center of Mexico or the US, and none from sources in the Maya region. I collected obsidian from the Tequila Mountain (Volcán de Tequila) near the Teuchitlán area in Jalisco (a very small sample of red and black obsidian) and a large sample from Hidalgo around Pachuca. This last one was the one utilized the most because it was easy to access and good knapping quality. The source was the only raw material that I had access to which was also represented in the study. Also, a sample of obsidian from Glass Mountain in California was used during experimentation at UC Berkeley. The GM obsidian was also of good quality and smooth knapping. Large samples of chert were collected from the Valley of Meztitlán in Hidalgo, Mexico. The chert, unfortunately, was of very bad quality, tended to be very brittle and only small sections were of good quality to do flint knapping. To have an option of good knapping quality and which might have been more similar to those found in the sample, I ended up getting heat-treated chert from the US (Keokuk chert). The chert was
used to try to replicate the debitage and stone tool production that presented in the experimentation analysis.

I mention this because of concerns found about ideally using material from the same source for the excavated or studied site (Andrefsky 2007b: 397). Urging that for experimentation to be reliable there needs to be a use of the same raw material as the one excavated. Sometimes getting those materials might not be such an easy task, especially when no known sources for chert have been identified for the study region. The cryptocrystalline materials seem to come from the surrounding regions, unlike obsidian that was imported mostly from the Guatemalan Highlands. chert use has been reported throughout the Maya region and believed to be of local deposits and part of regional distributional systems (Rovner and Lewenstein 1997). The case of Colhá in Belize represents a unique example where the source for chert is positioned near the workshops and domestic groups. Unlike volcanic materials, which can be attributed source through archaeometric elemental analysis, chert sources remain to be a question for the region.

**Considerations on MDA**

MDA proved to be very efficient in the relationship of time used in the laboratory and the overall results. The methodology became extremely useful since it has led to general patterns of information regarding stone tool production and practice in a relatively short span of time. Including in the analysis was the realization of the need for databases that could be used easily by the author and collaborators to standardize the collected information. Also, many routinely step part of the analysis can make it easy for mistakes to be made, including forgetting to fill out data fields. To address this issue databases were generated initially on Excel, and finally through File Maker database used during the analysis. Originally, one database was created for the attribute analysis of the obsidian, described in chapter 4. Including in the database was the modification and integration of specific fields for microcrystalline chipped technology and used in the analysis of complete and semi-complete artifacts recovered during the excavation. A second database was created for the MDA and presented below.

The analysis included experimental knapping using different techniques to observe and better attempt to understand the many possible fracture patterns, possible techniques, and how knapping materials behave. In general different of cryptocrystalline materials were knapped, specifically different quality of obsidian and chert. The study used two different types of toolkits for the experimentation: a modern and a traditional toolkit. When the material was collected for the recording used in the study, the traditional toolkit was employed. The recorded analysis presented here results from direct percussion techniques using billets, antlers, hammer stones of different sizes, and polishers. The traditional toolkit includes hard hammers, usually made out cobblestones or even good quality quartz, antler tines and a moose billets. The attempt was to reflect the pattern observed at Chinikihá. The modern toolkit included copper tools used as hard hammers, billets, and punchers. Both used for specific reasons related to learning the different techniques and ways of replicating using different tools. Also, the experimentation allowed for the direct observation of the differences in the materials utilized in the past and analyzed by the study. To recreate the smaller production of debitage antler tines of different size were used, and a billet was implemented as a hammer. Even though no pressure flakers (antlers) have been recovered or identified archaeologically, they could be identified in the future. It should be stated that ethnographic work completed in the Lacandón mention or make reference to the possibility and use of antler tines by modern groups that could reflect social patterns and local exploitation.
similar to those in the past (Bruce 1976; Clark 1989a, 1991; Nations 1989; Nations and Clark 1983).

The experimentation also provided evidence related to the specific characteristics of the materials and how this might relate to the types of tools being produced and used. Additionally, the experimentation provided first-hand experience and evidence on fracture types and contributed a framework to interpret the material evidence. The fractures patterns are different depending on the characteristics of the raw material. The experimentation also encourages to reflect on the unique mechanics of how tools work during production and the skill levels of the crafter. It also provides a unique perspective of materiality as an extension of behaviors, uses, and practice. The obsidian analysis serves as regional evidence of preference on a type of tool and how the production is widespread. Almost all the materials were a direct result of prismatic blade technology for the production of blades for hafting. A shared material evidence of traditional practice that included a similar pattern of fragmentation and snapping of blades to be hafted tools. A shared and widely distributed type of material evidence shared throughout the region. A known highly efficient technique of production of blades, considering that a polyhedral core no larger than 10-15 cm thick, under the right crafting hands, can produce over two hundred prismatic blades (Clark 1989b; Clark and Bryant 1997).

Also, the materials were worked or manufactured locally, following behavioral practices and choices that followed styles, techniques, and ways of doing that must have been learned through shared situated social participation. The relationship between material culture and daily practice can elucidate into the intimate daily mundane activities of Maya commoner intergenerational relations and even how knowledge was transmitted in daily social life (Hutchins 1993; Joyce 2012; Lave 2011; Roddick 2009).

I have also used modern knapping tools like copper billets, copper pressure flakers, and hard hammers, which I found easier to control and therefore learn how to flintknap. The modern tools presented the advantage of producing tools with a higher degree of accuracy, and efficiency. The traditional toolkit was used in the experiments of direct freehand percussion, indirect free hand percussion, pressure flaking, polishing, grinding, and pecking. The experiments included replication of different chipped tools, trying to mimic some of the artifacts recovered in the NWML. Different types of tools have been uncovered at Chinikihá, which include and in no way are limited to usable flakes. Many used as scrapers or cutting tools and a great range of bifacial tools like blades, axes, points, choppers, punchers and knives.

Source of Cryptocrystalline Stones

Two possible chert sources have been proposed, but not tested, for sources of collection of cryptocrystalline raw material (chert). One possible source might be Jolpabuchil formation near Teapa, in Tabasco (Grajales-Nishimura, et al. 2005; Peterson 1983; Salas and Lopez Ramos 1951). A personal communication in the summer of 2013 with Miguel Varela Santamaria. A PEMEX regional geologist who has worked in that area since the 1980s. Another possible channel to acquire good quality material was through collection in local rivers of good quality nodules. Following this line of thought, a unique mention of possible source comes from an ethnographic study of modern Lacandón community of Naja, in Chiapas. There Roberto Bruce's (1976: 62) ethnographic study describes a source where modern Lacandones acquire chert:

“Flint nodules appropriate for cores are selected from among river gravels. Raw flint is rather scarce in the territory occupied by the northern group Lacandones,
and the best known traditional place to look for nodules is in the Arroyo Santa Margarita near Tenosique, Tabasco. Using any convenient stone as a hammer, one or several large crude flakes are removed from the nodules where they are found so as to expose the unweathered interiors. Those showing a smooth, glossy and fine—grained surface are selected for cores, and the duller-surface stones are rejected. (It is necessary to break off the weathered outer surface or cortex of the nodules in order to appreciate the quality of the flint).

The process to acquire good local available material is also a common practice for modern artisans in the Palenque region. Due to tourism, there is a market for souvenirs which local crafters or artisans have assimilated quite well. Also known as artesanos, they sell different types of polished stones used to make jewelry, ashtrays, small objects like animals, pipes, and spheres made out of local Fossilized chert. These figurines don't have much to do with prehispanic designs but follow modern patterns of souvenirs sold in major tourist cities in Mexico. When asked where they get the chert, they all tend to have the same answer. They mention that they look in rivers and drainage areas for nodules of good quality. They also mention braking the nodules in situ to test the quality of the material. For the Lacandón study mentioned above, it included descriptions of where to get the raw material, how to choose the stone, and even aspects of the social organization surrounding the production of stone tools. Through the song mentioned in chapter two and also reproduced in the annex section. The song explains different aspects of the production of bows and arrows (usually for sale to tourist). The chant includes the importance of the location for napping within Lacandon basic set of knowledge. It even mentions the and implementation of the song in the process of teaching children how to knap, including the special treatment given to the chert (Bruce 1976). The embodiment of social learning through the use of a song. Communicating and transmitting knowledge to new members of a community of practice. Also providing a unique example of the materialization and embodiment of socially constructed ways of working stones. Later on, James Nations and David Clark would also do an ethnographic study on the production of stone tools by modern Lacandón communities, giving an ethno-archaeological description of stone tool technology and modern use (Clark 1991; Nations 1989; Nations and Clark 1983). Another important example of a study on production and use of stone tools was the research at the Belizean Maya habitation site of Cerros (Lewenstein 1987, 1991). The study evaluated hypotheses on ware and use of stone tools by carrying out experimentation that included the reproduction of stone tool and use in daily life. Susan Lewenstein study is of relevance because of her work on replication of tools and uses in everyday activities. She found a correlation between fracture patterns and activities in relation to specific types of tools. The relationship of specific tools which were used only in specific activities like agriculture or the crafting of wood.

Used and chunks of nodules have been registered, but they have all been archaeological and cannot be used for experimentation. Good quality nodules have been recovered on occasion, like the example on Figure 6.9 below. They have mostly been found in association to domestic context and always present evidence of knapping. Some concerns have been reported on the possible effects of the raw material variation on the replication and testing of stone tool debitage (Ahler 1989a, b; Amick and Mauldin 1997; Bradbury and Franklin 2000; Magne 1985). I have found this point a major issue and initial concern in my research since I had to use different raw materials that might not necessarily come from the same source as the archaeological sample. An issue related mostly to the chert. It was very hard to acquire raw material from the same sources as the archaeological sample since we don't know where they are. Even with the obsidian, which
was easier to obtain, I was not able to get any raw material for knapping from sources in Guatemala, the dominant sources. However, I did manage to work with material from one source found in the sample. The obsidian collection had a clear pattern dominated by the volcanic glass from el Chayal. The obsidian from the Group G a total of n= 19 prismatic blades and debitage was analyzed, identifying 18 to have come from the El Chayal source and one from an unknown source. There were a total of four samples not identified in the complete study, one of those came from Group G. Also, fragments and flakes from core rejuvenation and an exhausted polyhedral core were later recovered at Group. Alluding to local production of prismatic blades. The production was deduced through the recovery of core rejuvenation byproducts like core-platform flakes, bidirectional cores, core-platform flakes and distal ends of blades from bidirectional cores. Only the samples collected from the first field season were sourced with ED-XRF due to legal permits of exportation from Mexico.

Unless the excavations are taking place at the source or quarry and the associated workshop, is very hard to get the same material as the one used archaeologically, such as this case study. In this sense, Ahler (1989b: 113) points out that “even if controlled experiments have not been conducted for the particular raw materials and archaeological samples in question...provide useful model for interpretation of archaeological samples”. Likewise, the sample from Group G mirror the diversity of materials knapped, and techniques applied, reflecting the technological application to a wide range of techniques, which should also be reproduced during experimentation (Ahler 1989b: 113). Adding to this, Ahler mentions the importance of pooling data from different sources to add another layer of variability increasing and complementing the database. For Bradbury and Franklin (2000) data set produced from various raw materials have been used to classify other datasets. Using experiments and classification of various raw materials, they found that initial package size of the nodules could be the determinant factor in the resulting production, and therefore experimental reproduction of debitage. They detected that the shape and size of the core were much more determinant on the amount and production of stone flakes and tools in comparison to raw material (Bradbury and Franklin 2000: 50-51).

Stones Materiality and Daily Life at Group G

As mentioned earlier, the study separated the debitage from the workshops using five different sizes of sieve (G1-G5); illustrated in Table 6.3. The separation resulted in an overall view of the debitage by analyzing 14.88 kg of debitage lithic material, identifying 22263 flakes of debitage and recorded 508 registries (each representing one artifact and one assemblage of debris with shared characteristics). The material evidence of past production and socially shared knowledge transmitted through daily social practices. As mention in chapter 2, the study of materiality provides an opportunity to theorize the materiality as a reflection of past histories, knowledge, choices, and past lives. The analysis resulted in two different sets of data used conjunctively during the data interpretation. One data set recorded the physical attributes of one artifact, while a second registered all the similarities and difference within a flake group. Also, including the total number analyzed and the weight for each set of data. Therefore, each registry represents two sets of data, a single fake and the total flakes in a grouping. The attempt was to have two sets of that data which could allow statistical analysis of a single artifact or the group of debitage.
### Summary Sieve size

<table>
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<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
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</tr>
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<td>18.9</td>
</tr>
<tr>
<td>G4</td>
<td>152</td>
<td>29.9</td>
<td>29.9</td>
</tr>
<tr>
<td>G5</td>
<td>114</td>
<td>22.4</td>
<td>22.4</td>
</tr>
<tr>
<td>Total</td>
<td>508</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 6.3: Summary of the total numbers of registries by Sieve size and proportion within the overall analysis.

The MDA was pivotal in recognizing the different uses of raw material and how some geologic materials were manipulated in the past. That led to noticing that certain tools were exclusively found associated with specific locations. Or how certain types and shapes of tools were made using locally available limestone. The analysis allows for the recognition of the wide perspective of the materiality recovered, including the evidence for different types of crafting in relationship to the raw material. Just like in chapter 5, the encompassing methodology attempts to capture a perspective of the materiality concerning the use of space and activities. Ground stones or mortars are the perfect examples of tools not found in the workshops. But they can be found associated with domestic contexts in general. On the other hand, some tools could be found throughout both areas. Polishes of different sizes, which presented scars from abrasion, rubbing, percussion, and pecking were recovered represented throughout the architectural group. Their ubiquity may be indicative of the multiple uses and the possible similarities of some activities in both areas. The analysis also recognized the use of different geologic materials, dominated by chert (total count 15754 = 70.73%) and limestone (by total count 6483 = 29.12%). By far chert was the most abundant and commonly used material at Group G. Tables 6.3 through 6.6 exhibit the total percentages of materials analyzed by MDA. Including the total in the sample and by the registry, as well as weight by each category.

### Raw Material

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalcedony</td>
<td>1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Chert</td>
<td>389</td>
<td>76.6</td>
<td>76.6</td>
<td>76.8</td>
</tr>
<tr>
<td>Fossilized Chert</td>
<td>2</td>
<td>0.4</td>
<td>0.4</td>
<td>77.2</td>
</tr>
<tr>
<td>Granite</td>
<td>1</td>
<td>0.2</td>
<td>0.2</td>
<td>77.4</td>
</tr>
<tr>
<td>Limestone</td>
<td>112</td>
<td>22</td>
<td>22</td>
<td>99.4</td>
</tr>
<tr>
<td>Microcrystalline Quartz</td>
<td>1</td>
<td>0.2</td>
<td>0.2</td>
<td>99.6</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
<td>0.2</td>
<td>0.2</td>
<td>99.8</td>
</tr>
<tr>
<td>Pumice Stone</td>
<td>1</td>
<td>0.2</td>
<td>0.2</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>508</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.4: Summary of raw material by registry.

Diverse types of geologic materials were recovered at Group G, as shown above in Table 6.4. Reflecting a use of local and foreign stones in the production and materiality. A reflection of socially preferred geologic material used for stone tool production at the workshops. The analysis showed the use of chert as preferable in the manufacture of tools. While locally acquired limestone was used as masonry and used in the production of bifacially worked celts. Even the analysis showed the communal preference or use of an almond shaped bifacially worked celts produce with local limestone. The tools were probably used to create hoes for agricultural work, and examples are illustrated in Figure 6.35. Delineating at least two different means of
acquisition of raw material for stone tool production. Locally available sedimentary stones and a wider range of materials from sources in further distances.

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Total number in sample</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalcedony</td>
<td>1</td>
<td>0.0045</td>
</tr>
<tr>
<td>Chert</td>
<td>15754</td>
<td>70.73</td>
</tr>
<tr>
<td>Fossilized Chert</td>
<td>2</td>
<td>0.009</td>
</tr>
<tr>
<td>Granite</td>
<td>1</td>
<td>0.0045</td>
</tr>
<tr>
<td>Limestone</td>
<td>6483</td>
<td>29.12</td>
</tr>
<tr>
<td>Mycrocrystalline Quartz</td>
<td>1</td>
<td>0.0045</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
<td>0.0045</td>
</tr>
<tr>
<td>Pumice Stone</td>
<td>20</td>
<td>0.089</td>
</tr>
<tr>
<td>Total</td>
<td>22263</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 6.5: Summary of all the raw materials identified.

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Total number in sample</th>
<th>Weight all samples (g)</th>
<th>N of registries (1 artifact)</th>
<th>Weight one sample (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalcedony</td>
<td>1</td>
<td>3.1</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Chert</td>
<td>15754</td>
<td>9176.27</td>
<td>389</td>
<td>974.801</td>
</tr>
<tr>
<td>Fossilized Chert</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Granite</td>
<td>1</td>
<td>0.6</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Limestone</td>
<td>6483</td>
<td>5795.33</td>
<td>112</td>
<td>795.37</td>
</tr>
<tr>
<td>Mycrocrystalline Quartz</td>
<td>1</td>
<td>1.7</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
<td>1.5</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Pumice Stone</td>
<td>20</td>
<td>19.6</td>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Table 6.6: Summary of raw materials by the total number in the sample, total registries, and weights.

Five indicators were used to separate the materials initially and make groups that would allow differentiating between the levels of the technological sequence of production. The methodology attempted to record the metric and technological traits to understand the techniques of production and crafting. The distribution resulted in a perspective of the different levels of production at the workshops. The complete sequence of events or chain of production was identified through the materials, which permitted an initial understanding of the workshop and artifact histories. In relationship to the local acquisition and production of stone tools. The analysis was able to recover chert nodules in association to different levels of waste flakes. Including hard hammers and polishers associated to production areas. The Figure 6.9 below illustrates a chert core recovered in a midden between the domestic platform (G13) and the terrace (G16) attest to the local stone tool production. The location illustrates the many places where production occurred and the production of flakes used as blades, scrapers, or to make other bifacial tools.

Figure 6.9: Images of chert nodule.
The evidence the application of different techniques, like direct and indirect percussion, or prismatic blade pressure techniques became evident by the types of flakes and produced tools. The materiality of choices and ways of creating bifaces, blades, scrapers, and masonry for use at the site. The employment of these tools seems to vary depending on the need and chore at hand. Like cutting, chopping, abrading, or piercing to name some. One of the most common tools recovered were large bifaces or axes and unifacial tools. Similar bifacial tools recovered have been reported for use in agricultural and domestic activities, usually made from locally available limestone (Lewenstein 1987). Also, large flakes or blanks were modified to create unifacial tools. Some of these same tools could later become bifacial tools with sharpening or further reduction depending on the activity. Many types of tool fragments were also recovered that can be related to two types of production. Tools that were being made and fracture during the manufacturing process with no evidence of use. Including in this category would be tool fragments and mistakes. The second type of production evidence was recovered from used bifacial broken artifact. They tended to be the proximal ends of bifacial or unifacial tools that did present use wear and could have been broken during use. They were probably brought in hafted and replaced for a new one in situ. Below Figure 6.10 are examples of production of complete new tools recovered in situ and never used.

![Figure 6.10: Example of tools made from blanks and large primary flakes.](image)

The study initially attempted to understand and get a general perspective of the types of tools and materiality found at the architectural complex. This allowed for a general viewpoint of the debitage collected, formal characteristics and the local production. The Table 6.7 and Figure 6.11 below shows the general results of the MDA analysis by Sieve size (G1-G5), using the total number of registries (by a group and by individual) as well as by weight (by a group and individual). It can be claimed that all levels of production were found at the site, discussed below by going over some of the results from each sieve size in relationship to the location of recovery. It should also be asserted of the importance of considering all the different metric measurements resulting from MDA and the type of information that each data set can relate to.
Table 6.7: MDA summary of results: divided by sieve size and raw material.

<table>
<thead>
<tr>
<th>Gage sieve</th>
<th>Raw material</th>
<th>Total number in sample</th>
<th>Weight all samples (g)</th>
<th>Weight one sample (g)</th>
<th>Registries</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Chert</td>
<td>508</td>
<td>3116.64</td>
<td>549.3</td>
<td>49</td>
</tr>
<tr>
<td>G1</td>
<td>Limestone</td>
<td>372</td>
<td>1771.1</td>
<td>622.1</td>
<td>18</td>
</tr>
<tr>
<td>G2</td>
<td>Chalcedony</td>
<td>1</td>
<td>3.1</td>
<td>3.1</td>
<td>1</td>
</tr>
<tr>
<td>G2</td>
<td>Chert</td>
<td>957</td>
<td>2067.36</td>
<td>215.38</td>
<td>56</td>
</tr>
<tr>
<td>G2</td>
<td>Fossilized Chert</td>
<td>2</td>
<td>7</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>G2</td>
<td>Limestone</td>
<td>628</td>
<td>1613.25</td>
<td>66.68</td>
<td>19</td>
</tr>
<tr>
<td>G2</td>
<td>Obsidian</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
<td>1</td>
</tr>
<tr>
<td>G3</td>
<td>Chert</td>
<td>1857</td>
<td>1789.68</td>
<td>130.53</td>
<td>74</td>
</tr>
<tr>
<td>G3</td>
<td>Limestone</td>
<td>979</td>
<td>1094.41</td>
<td>70.27</td>
<td>21</td>
</tr>
<tr>
<td>G4</td>
<td>Chert</td>
<td>4915</td>
<td>1463.43</td>
<td>66.87</td>
<td>118</td>
</tr>
<tr>
<td>G4</td>
<td>Myocrystalline Quartz</td>
<td>1</td>
<td>1.7</td>
<td>1.7</td>
<td>1</td>
</tr>
<tr>
<td>G4</td>
<td>Granite</td>
<td>1</td>
<td>0.6</td>
<td>0.6</td>
<td>1</td>
</tr>
<tr>
<td>G4</td>
<td>Limestone</td>
<td>2205</td>
<td>788.77</td>
<td>32.72</td>
<td>32</td>
</tr>
<tr>
<td>G4</td>
<td>Pumice Stone</td>
<td>20</td>
<td>19.6</td>
<td>0.8</td>
<td>1</td>
</tr>
<tr>
<td>G5</td>
<td>Chert</td>
<td>7517</td>
<td>739.16</td>
<td>12.821</td>
<td>92</td>
</tr>
<tr>
<td>G5</td>
<td>Limestone</td>
<td>2299</td>
<td>527.8</td>
<td>3.6</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>22263</td>
<td>15005.1</td>
<td>1784.871</td>
<td>508</td>
</tr>
</tbody>
</table>

Figure 6.11: MDA results by sieve size and raw material.

The difference and similarities in the physical characteristics of the geologic materials became evident and observed during my replication of stone tools. The preference for the local good
quality limestone in the production of certain stone tools was also evident. Some of the debitage of production and broken or used tools were used as part of the architectural filling, midden deposits or deposits to level surfaces. Even with modern communities surrounding the site, the recycle and reuse of some masonry and lithic materials is visible in the construction of modern architecture, local roads, and bridges. At the site of Chinikihá, certain patterns of recent local exploitation been recognized, such as the use of limestone masonry in the production of houses and even the church. Local limestone was exploited in the past by the ancient community of Chinikiha. Through the production of tools and houses. In limestone, silica can precipitate in place making the limestone knappable or workable, which seems to be the pattern at the site and the region (Luedtke 1992). Also, this makes a lot of sense, considering the whole site does contain good quality limestone that was precisely used to modify and construct their dwellings. Therefore the limestone did not have to be imported and was exploited in situ. The exploitation seems to be associated mostly with masonry and some types of bifacial tools. Areas of limestone quarries have also been proposed for Chinikihá, but they need to be excavated and studied to truly understand the nature of the local use at the site. Behind and around the Mahler complex there is an area that seems to be a quarry, but the only further survey would affirm or refute this claim.

The production of bifacial tools seems to have been dominated primarily with cryptocrystalline quartz like chert. The limestone is the parent material and is the preferred masonry material at the site. The analysis has also provided some information on the chert used in the region since it accounts for the majority of the debitage and production evidence (n= 70.73% of the total sample analyzed). The chert was imported in nodules since cortex was easily identified in the flakes recovered. Some of the chert also presents vugs encrusted in different sections of the material; “a small cavity in a vein or rock, usually lined with crystals of a different mineral composition from the enclosing rock” (Bates and Jackson 1984: 557). Next, I will review some of the outcomes from the MDA and debitage information.
Figure 6. 12: Images of flakes separated with G1, notice an example of a vug and cortex.

The first material sieved and grouped by raw material were the largest flakes or chunks of rocks recovered. The sorting and separation of the material resulted in an overall view of techniques and raw materials used in the past to craft their tools (Figure 6.12). The sieving of G1 culminated in the largest flakes and fragmented material made from by chert and limestone debitage. Also, the biggest usable flakes tended to be removed and not necessarily found in the debris analyzed. Very few large usable chert flakes were recovered. It seems very logical that they were taking those flakes to be used. The presence of chunks or fragments of used and exhausted cores of chert were separated (n= 9). Also, the evidence of cortex on flakes was found in chert and limestone through all the different sieves. A larger number and quantity of chert was evident. For G1, the percentage of dorsal cortex varied from covering 100% of the surface to 5-≤10%. The total of flakes registered were chert n= 133 or 75.4% and limestone n= 60 or 24.6%; observe Figure 6.13 above. Displaying great variation of cortex scars, but most importantly regarding early stages of production or processes of reduction of stone tools and implements (Andrefsky 2005: 115). Also, the amount of cortex did vary within the flakes, and it was estimated in the following categories: primary flakes (up to 100%), the percentage decreased for secondary flakes (≤ 60-50%) and even less for tertiary flakes (≤ 30-20%). The cortex might be present in all the stages of reduction, including in finished artifacts like bifaces and unifacial tools.

Figure 6. 13: Results from G1 shown by raw materials and totals.
Figure 6. 14: Comparative details of medians, quartiles and extreme values of flake cortex percentage, separated by sieve size and contrasted with the experimentation data.

Figure 6. 15: Comparative details of medians, quartiles and extreme values of total proportion of flakes with cortex, separated by sieve size and contrasted with the experimentation data.

The Figure 6.14 and 6.15 above illustrate the presence of cortex through all the sieved samples and how similar patterns were detected during the control experimentation. Figure 6.14 compares the largest percentage of the cortex by the sample (percentage of cortex on dorsal surface). The larger the sieve also had the larger amount of flakes with cortex. The boxplots will compare the similarities and differences within each sive. Providing both specific and general patterns for the lithics analyzed. Descriptive statistics use numbers and data to standardize and display the distribution of numbers. The boxplots provide five number summaries displayed in one graph: median, minimum, first quartile, third quartile, and maximum (Drennan 1996). The Figure 6.15
emphasizes the number of flakes with cortex and compares both data sets by sieve. Again, the presence of cortex in the larger flakes was also identified through the plots. The analysis separated a large number of early stage pressure flakes and seems to have been the result of the early reduction process of bifacial and unifacial tools made from primary flakes. These results are illustrated in Table 6.8 and 6.9 below. Furthermore, the primary and secondary flakes were the result of early and middle stages of reduction (Andrefsky 1994, 2005; Goodyear 1979). Late stage biface reduction flakes tend to be thinner and tend to look more refined. Even though the different stages of production were mixed, different stages of production became visible through the sieving.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>238</td>
<td>148</td>
<td>90</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>505</td>
<td>252</td>
<td>253</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>161</td>
<td>77</td>
<td>84</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>23</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>255</td>
<td>131</td>
<td>124</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>420</td>
<td>202</td>
<td>218</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>377</td>
<td>247</td>
<td>130</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>96</td>
<td>102</td>
<td>82</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>407</td>
<td>246</td>
<td>161</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>241</td>
<td>125</td>
<td>115</td>
</tr>
<tr>
<td>Pressure flaking</td>
<td>32</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>668</td>
<td>373</td>
<td>295</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>9</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tool fragment</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>193</td>
<td>133</td>
<td>60</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>4872.54</td>
<td>3616.74</td>
<td>1755.9</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>65</td>
<td>49</td>
<td>16</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>880</td>
<td>508</td>
<td>372</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>11</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>not treated</td>
<td>834</td>
<td>467</td>
<td>357</td>
</tr>
</tbody>
</table>

Table 6.8: Summary the total material analyzed found from G1.

Many of the primary and some secondary flakes had few flake scars or facets on the dorsal face of the flakes (usually not more than three or four), rendered as early stages of production. Also, the platforms on flakes had preparation scars visible, reflected a technique of grinding and pecking for core preparation in flake reduction. The early stages of production included different types of percussion, mainly had hammer percussion. Observed in the presence of conchoidal and bending flakes, with very little, if any bipolar flakes (Cotterell and Kamminga 1987; Cotterell, et al. 1985). In general, the sample was largely dominated by evidence of hard hammer percussion (n= 407 flakes), followed by soft hammer (n= 41 flakes).
Table 6.9: Summary of basic statistics by raw material from G1.

The separation also made it possible to identify fragments of tools (n= 2). Failures or accidents result of mistakes discarded in situ. Part of the evidence of the production stages or sequence of events considered diagnostic of production loci (Callahan and Dragoo 1979; Whittaker 1994). As mentioned briefly before, a unique type of broken tool recovered at Group G were the broken sections of bifaces in association to the workshops (Figure 6.16 and 6.17). Including many of the proximal fragments recovered presented use and hafting scars. Making it possible that they were brought to the workshop to get replaced by new ones.

![Figure 6.16: Examples of distal ends of broken chert bifaces recovered associated to the workshops.](image)

![Figure 6.17: Examples of proximal broken bifaces recovered in association to the workshops, notice side notching for hafting.](image)

**Controlled Experimentation G1EXP**

The experimentation and replication data was part of the process of learning knapping techniques. Aid to recognize fracture patterns and physical characteristics of lithic technology first hand to understand better and interpret the materials. The data has served to compare the results from the archaeological material with the experimental data from replication of tools and the debitage created. The resulting lithic material was sorted and studied using the same methodology of MDA. The next Tables 6.10 and 6.11 summarize the results of the analysis,
which represents the same data for each sieve size. The chert used during the experimentation did have cortex, and the limestone did not, since it was collected from veins. This data was also utilized as a control to contrast the results. The data is used and presented throughout this chapter and in relationship to the size of the sieve.

<table>
<thead>
<tr>
<th>Geologic Material</th>
<th>Weight (g) total</th>
<th>N sample Total</th>
<th>Weight (g) by registry</th>
<th>N of registries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>286</td>
<td>31</td>
<td>91.2</td>
<td>4</td>
</tr>
<tr>
<td>Limestone</td>
<td>17.9</td>
<td>104</td>
<td>534.6</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>303.9</td>
<td>135</td>
<td>625.8</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 6. 10: Totals from experimentation data by sieve size and raw material.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>69</td>
<td>14</td>
<td>55</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>63</td>
<td>26</td>
<td>47</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>39</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>95</td>
<td>30</td>
<td>65</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>39</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>54</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>47</td>
<td>0</td>
<td>47</td>
</tr>
<tr>
<td>Pressure flakes</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>135</td>
<td>31</td>
<td>104</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tool fragment</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>64</td>
<td>10</td>
<td>54</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>303.9</td>
<td>286</td>
<td>17.9</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>8</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>135</td>
<td>31</td>
<td>104</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>31</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>not treated</td>
<td>104</td>
<td>0</td>
<td>104</td>
</tr>
</tbody>
</table>

Table 6. 11: Summary of totals from experimentation data analyzed.
The sieve size G2 reflected a wider diversity of geologic materials available to the crafters (Figure 6.18). Which includes chalcedony, chert, fossilized chert, limestone, and obsidian. The variety in the geologic inventory also reflects the use and appropriation of many types of geologic material, including some with very similar fracture patterns like Chalcedony and Fossilized chert (Figure 6.19). Both cryptocrystalline rocks are ideal raw material for producing stone tools. These materials are locally available and used by local populations. Similarly to G1, the groups remained dominated by the presence of primary flakes (n= 798). Followed by secondary flakes (n= 526) and finally tertiary flakes (n= 111). The comparison of the types of flakes is illustrated below in Figures 6.20, 6.21, and 6.22. Contrasting the means by flake types. Table 6.12 and 6.13 below record the results and basic statistics. The sample was dominated by direct percussion techniques resulting in conchoidal flakes and bending flakes. In a similar pattern as seen in G1, the flakes were the result of hard hammer (n= 555) percussion and soft hammer (n= 470) percussion and less indication of pressure flakes (n= 61). A similar pattern of flakes with cortex was also observed, with signs of nodule reduction. The flakes confirmed early or initial stages of production of tools of bifacial work. The following boxplot 3-5 compare flake
types recovered in the analysis. The primary flakes, shown in Figure 6.20 below, were somewhat evenly represented throughout the archaeological sample. But clear differences were observed in the representation of the experimental data. Where the larger primary flakes were mostly identified in the larger sieves and tended to weight more. This specific comparison brought up to my attention the problem of fragmentation within collected collections as well as the physical qualities and size of the raw material. This made me consider some possible mechanical consequences of transportation and the process of curation, something mention in lihic studies in general (Odell 2004).

Figure 6. 20: Comparing details of medians, quartiles and values of primary flakes percentage, separated by sieve size and contrasted with the experimentation data.

Figure 6. 21: Comparing details of medians, quartiles and extreme values of secondary flake percentage, separated by sieve size and contrasted with the experimentation data.

The archaeological sample also illustrated a pattern of secondary flakes identified throughout the sieves (Figure 6.21). The experimental data illustrated a similar pattern, with minor differences in the last two sieves G4-5.
The tertiary flakes had the same pattern in both collections. Illustrated in Figure 6.22 below. These flakes monopolized most the last two sieves. The archaeological collection had tertiary flakes in all the sieves, while the experimental data did not have any in the first sieve. This last point could be related to the skill and the raw materials used during the experimentation.

![Figure 6.22: Comparative details of medians, quartiles and values of tertiary flakes percentage, separated by sieve size and contrasted with the experimentation data.](image)

Also, the evidence for other techniques of production became visible by recovering obsidian a core rejuvenation flake in the MDA and others during excavations that were separated initially. Also, part of the collection was analyzed by the elemental analysis. Evidence of pressure blade techniques and rejuvenation work on polyhedral cores by local crafters was collected at both terraces and workshops. Locates that also included all the different stages of production of pressure blade technology. From the initial importation of obsidian polyhedral cores from el Chayal, including at least one unknown source was known from the XRF study. Another indications were the flakes and exhausted cores collected at Group G. It should also be noted that all the prismatic blades recovered at the site presented visible scars of use and were fragmented. That was a normal denominator for the obsidian recovered in the region, it all seems to have been broken into smaller fragments and heavily used. Minor differences in the flakes started to become evident too. Evident difference in the skill level and ability of the crafters. Perhaps related to the geologic material and fragmentation patterns, but differences in the spectrum in skill level started to be visualized. There was a difference in the types of flakes and others were also worked. Many flakes were recovered that presented very unskillful knapping, while other flakes were straight and controlled. Other were thick and uneven, while some were thin and straight. Following the will of an experience Knapper that knew the desired outcome.
<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Mean Width (mm)</th>
<th>Length (mm)</th>
<th>Diameter (mm)</th>
<th>Thickness (mm)</th>
<th>Weigh One Sample (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalcedony</td>
<td>15.77</td>
<td>24.18</td>
<td>28.33</td>
<td>7.06</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>1.1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Std. Error of Mean</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>Range</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Variance</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>% of Total Sum</td>
<td>0.00%</td>
<td>1.00%</td>
<td>1.10%</td>
<td>1.60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.16%</td>
</tr>
<tr>
<td>Chert</td>
<td>24.04</td>
<td>28.09</td>
<td>31.03</td>
<td>5.65</td>
<td>3.77</td>
</tr>
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<td>Std. Deviation</td>
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<td>6.01</td>
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<td>34.17</td>
<td>31.23</td>
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<tr>
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<td>% of Total Sum</td>
<td>22.56</td>
<td>37.65</td>
<td>36.15</td>
<td>7.04</td>
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<td></td>
<td></td>
<td>8.59</td>
</tr>
<tr>
<td>Limestone</td>
<td>22.38</td>
<td>26.71</td>
<td>31.03</td>
<td>5.62</td>
<td>3.5</td>
</tr>
<tr>
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<td>0.36</td>
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<td>Std. Error of Mean</td>
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<td>0.81</td>
<td>0.255</td>
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<td>3.15</td>
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<td>0.51</td>
</tr>
<tr>
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<td>Variance</td>
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<td>4.96</td>
<td>1.31</td>
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<td>2.50%</td>
<td>2.50%</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>2.40%</td>
</tr>
<tr>
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<td>32.52</td>
<td>5.5</td>
<td>3.52</td>
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</tr>
<tr>
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<td>1.09</td>
<td>1.46</td>
<td>0.28</td>
</tr>
<tr>
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<td>17.44</td>
<td>20.22</td>
<td>4.84</td>
</tr>
<tr>
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<td>1.63</td>
</tr>
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<td></td>
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<td>23.14</td>
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<tr>
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<td>1.62</td>
<td>0.51</td>
</tr>
<tr>
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<td>Variance</td>
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<td>4.96</td>
<td>1.31</td>
<td>0.13</td>
</tr>
<tr>
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<td>% of Total Sum</td>
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<td>2.30%</td>
<td>2.50%</td>
<td>2.50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.40%</td>
</tr>
<tr>
<td>Limestone</td>
<td>23.16</td>
<td>29.57</td>
<td>32.52</td>
<td>5.5</td>
<td>3.52</td>
</tr>
<tr>
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<td>20</td>
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<td>4.78</td>
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<td>1.09</td>
<td>1.46</td>
<td>0.28</td>
</tr>
<tr>
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<td>Variance</td>
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<td>17.44</td>
<td>20.22</td>
<td>4.84</td>
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<tr>
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<td>% of Total Sum</td>
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<td>24.19</td>
<td>22.86</td>
<td>1.63</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>0.98</td>
</tr>
</tbody>
</table>

Table 6.12: Summary of basic measurements of flakes by raw material.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chalcedony</th>
<th>Chert</th>
<th>Fossilized Chert</th>
<th>Limestone</th>
<th>Obsidian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>526</td>
<td>0</td>
<td>300</td>
<td>2</td>
<td>224</td>
<td>0</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>798</td>
<td>1</td>
<td>519</td>
<td>0</td>
<td>277</td>
<td>1</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>111</td>
<td>0</td>
<td>58</td>
<td>0</td>
<td>53</td>
<td>0</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>114</td>
<td>0</td>
<td>36</td>
<td>2</td>
<td>146</td>
<td>0</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>486</td>
<td>1</td>
<td>284</td>
<td>1</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>587</td>
<td>1</td>
<td>264</td>
<td>0</td>
<td>321</td>
<td>1</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>971</td>
<td>0</td>
<td>671</td>
<td>2</td>
<td>298</td>
<td>0</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>273</td>
<td>0</td>
<td>207</td>
<td>0</td>
<td>66</td>
<td>0</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>555</td>
<td>1</td>
<td>384</td>
<td>2</td>
<td>168</td>
<td>0</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>470</td>
<td>0</td>
<td>355</td>
<td>0</td>
<td>384</td>
<td>1</td>
</tr>
<tr>
<td>Pressure flaking</td>
<td>61</td>
<td>0</td>
<td>19</td>
<td>0</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>1283</td>
<td>1</td>
<td>749</td>
<td>2</td>
<td>530</td>
<td>1</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>tool fragment</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>265</td>
<td>1</td>
<td>153</td>
<td>0</td>
<td>111</td>
<td>0</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>3790.61</td>
<td>3.1</td>
<td>2165.76</td>
<td>7</td>
<td>1613.25</td>
<td>1.5</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>80</td>
<td>1</td>
<td>57</td>
<td>1</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>1589</td>
<td>1</td>
<td>957</td>
<td>2</td>
<td>628</td>
<td>1</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>26</td>
<td>1</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>not treated</td>
<td>1546</td>
<td>0</td>
<td>919</td>
<td>2</td>
<td>624</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 6.13: Summary results from G2 MDA.
Controlled Experimentation G2EXP

As mentioned above, the information from the different stages of replication served as control of the analysis. The following Tables 6.14 and 6.15 summarize the result from experimentation. The data illustrate the means used for primary, secondary and tertiary flake analysis in Figure 6.20 to 6.22).

<table>
<thead>
<tr>
<th>Geologic Material</th>
<th>Weight (g) total</th>
<th>N sample Total</th>
<th>Weight (g) by regist</th>
<th>N of registries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>160.16</td>
<td>50</td>
<td>32.98</td>
<td>9</td>
</tr>
<tr>
<td>Limestone</td>
<td>1048.7</td>
<td>435</td>
<td>18.7</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 6.14: Totals from experimentation data by sieve size and raw material.

<table>
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<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>205</td>
<td>17</td>
<td>171</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>231</td>
<td>29</td>
<td>173</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>44</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>103</td>
<td>12</td>
<td>79</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>179</td>
<td>14</td>
<td>151</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>306</td>
<td>36</td>
<td>234</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>138</td>
<td>12</td>
<td>114</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>50</td>
<td>14</td>
<td>151</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>86</td>
<td>19</td>
<td>48</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>328</td>
<td>24</td>
<td>280</td>
</tr>
<tr>
<td>Pressure flakes</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>412</td>
<td>42</td>
<td>328</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
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<td>0</td>
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</tr>
<tr>
<td>tool fragment</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>135</td>
<td>13</td>
<td>109</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>1369.02</td>
<td>106.16</td>
<td>1048.7</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>15</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>535</td>
<td>50</td>
<td>435</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>98</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>not treated</td>
<td>435</td>
<td>0</td>
<td>435</td>
</tr>
</tbody>
</table>

Table 6.15: Totals from experimentation data analyzed.
The next sieve was dominated by chert and limestone, with a higher representation of the first by the number of samples, weight, and registries (Figures 6.23 and 6.24). Again the analysis represented the existence of different techniques of production. For both raw materials, the secondary flakes were the most commonly identified, beginning to see an evident decrease in primary flakes: primary flakes (n= 530), secondary flakes ( n= 1257), tertiary flakes (407). The dominance of secondary flakes might be attributed to the types of nodules worked and the techniques of percussion used in the past. Also, there was an evident increase in the use of soft hammer techniques: hard hammer (n=  723), soft hammer  n= 1236, pressure flaking (n= 339). Pressure flakes tend to be smaller, thinner and weight less than percussion flakes and started to appear and could be identified (Ahler 1989b: 91; Andrefsky 2005: 118; Root 1997: 87). Part of the differentiation for identifying the type of hammer was based on experimentation, and the recognition of pronounced bulbs of force, with no lipping, and the scars from crushed platform areas were the main attributes used to differentiate between techniques (Crabtree 1970: 44). An
interpretation based on the recognition of percussion bulbs result of direct percussion that creates a diagnostic conchoidal fracture believed to be the result of hard hammer from the direct force (Cotterell and Kamminga 1987: 686). Figure 6.25 below represents the average median thickness size of the pressure flakes throughout all the sieves and comparison to the experimental data. Even though some flakes seemed to be pressure flakes in all the sieve sizes, it is in this sieve where it became very evident and where I feel more comfortable with calling them that. The outliers reflect the diversity of flake size and thickness related to the sieving of the material and resulting debitage diversity.

Figure 6.25: Comparative details of medians, quartiles and extreme values of pressure flake flakes percentages, separated by sieve size and contrasted with the experimentation data.

Another important evidence identified was the existence of different levels of crafting and skill ability. The difference in the types of flakes, where somewhere fragile and reflected the ability of the craftsperson to control and peel the stone in the right places, with the right amount of force and controlling the fracture. Moreover, the evident presence of tool fragments recovered from mistakes or accidents during the production of the tools. A total n= 83 tool fragments were recorded for this sieve. The tools were also finished at the site, but some evidence of blanks was recovered for the limestone almond shaped bifaces described more in detail below in the chipped stone artifact section. Perhaps linked to either storing of blanks or pieces that were to be transported and finished later at a different place. Overall the materials indicate that the stone tools were produced there until finished. Tables 6.16 and 6.17 below summarize all the results from the analysis. It should also be mentioned that one complete tool was found, a unifacially worked scraper. This type of tool is more evident and common in the region and further studies in the future will look into these tools. Made from many materials and observed in many shapes, like oval, triangular, straight or any shape possible. They are also easy to make since all one needs is a big enough flake.
### Table 6.16: Summary of totals from data analyzed.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>530</td>
<td>283</td>
<td>247</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>1257</td>
<td>837</td>
<td>420</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>407</td>
<td>350</td>
<td>57</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>201</td>
<td>77</td>
<td>124</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>1206</td>
<td>798</td>
<td>408</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>924</td>
<td>469</td>
<td>455</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>1641</td>
<td>1118</td>
<td>524</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>931</td>
<td>698</td>
<td>233</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>723</td>
<td>337</td>
<td>386</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>1236</td>
<td>851</td>
<td>385</td>
</tr>
<tr>
<td>Pressure flaking</td>
<td>339</td>
<td>300</td>
<td>39</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>1788</td>
<td>1050</td>
<td>738</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>tool fragment</td>
<td>83</td>
<td>29</td>
<td>54</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>369</td>
<td>226</td>
<td>143</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>2884.19</td>
<td>1789.78</td>
<td>1094.41</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>96</td>
<td>74</td>
<td>22</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>2836</td>
<td>1857</td>
<td>979</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>87</td>
<td>86</td>
<td>1</td>
</tr>
<tr>
<td>not treated</td>
<td>2506</td>
<td>1555</td>
<td>955</td>
</tr>
</tbody>
</table>

### Table 6.17: Summary of basic measurements of flakes by raw material.

#### G3 Basic Statistics for flakes (Means for one artifact)

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Width (mm)</th>
<th>Length (mm)</th>
<th>Diameter (mm)</th>
<th>Thickness (mm)</th>
<th>Weight One Sample (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>Mean</td>
<td>17.69</td>
<td>20.47</td>
<td>22.7</td>
<td>4.21</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>74</td>
<td>74</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>4.97</td>
<td>4.88</td>
<td>4.57</td>
<td>2.37</td>
</tr>
<tr>
<td></td>
<td>Std. Error of Mean</td>
<td>0.475</td>
<td>0.56</td>
<td>0.53</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>25.82</td>
<td>28.04</td>
<td>18.97</td>
<td>18.68</td>
</tr>
<tr>
<td></td>
<td>Variance</td>
<td>16.57</td>
<td>23.83</td>
<td>20.92</td>
<td>5.627</td>
</tr>
<tr>
<td></td>
<td>% of Total Sum</td>
<td>76.60%</td>
<td>74.30%</td>
<td>75.10%</td>
<td>76.20%</td>
</tr>
<tr>
<td>Limestone</td>
<td>Mean</td>
<td>18.21</td>
<td>23.82</td>
<td>25.37</td>
<td>4.41</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation</td>
<td>3.69</td>
<td>4.778</td>
<td>4.55</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>Std. Error of Mean</td>
<td>0.78</td>
<td>1.01</td>
<td>0.97</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>16.08</td>
<td>19.34</td>
<td>19.12</td>
<td>3.47</td>
</tr>
<tr>
<td></td>
<td>Variance</td>
<td>13.68</td>
<td>22.75</td>
<td>20.7</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>% of Total Sum</td>
<td>23.40%</td>
<td>25.70%</td>
<td>24.90%</td>
<td>23.80%</td>
</tr>
</tbody>
</table>

### Controlled Experimentation G3EXP

The controlled experimentation was vital in contributing a counterpart to identify and differentiate the different processes of production and reduction of flintknapping. Also, the overwhelming evidence for the use of knapping techniques and how stone tools can accurately reflect the skill and crafting signatures of different individuals (Tables 6.18 and 6.19). Knapping Sessions with colleagues and students with varying levels of experience and practice were a great place to observe this. Also, the mechanical, physical dexterity of each becomes evident as the flakes become smaller and more precision and practice is needed.
<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>127</td>
<td>43</td>
<td>84</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>242</td>
<td>134</td>
<td>108</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>46</td>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>92</td>
<td>32</td>
<td>60</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>211</td>
<td>43</td>
<td>168</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>316</td>
<td>147</td>
<td>169</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>204</td>
<td>54</td>
<td>150</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>211</td>
<td>43</td>
<td>168</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>172</td>
<td>28</td>
<td>144</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>335</td>
<td>147</td>
<td>188</td>
</tr>
<tr>
<td>Pressure flakes</td>
<td>63</td>
<td>24</td>
<td>39</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>441</td>
<td>171</td>
<td>270</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tool fragment</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>103</td>
<td>33</td>
<td>100</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>508.68</td>
<td>245.18</td>
<td>263.5</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>18</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>542</td>
<td>203</td>
<td>339</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>200</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>not treated</td>
<td>339</td>
<td>0</td>
<td>339</td>
</tr>
</tbody>
</table>

Table 6. 18: Summary from experimental analysis.

<table>
<thead>
<tr>
<th>Geologic Material</th>
<th>Weight (g) total</th>
<th>N sample Total</th>
<th>Weight (g) by registry</th>
<th>N of registries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>245.18</td>
<td>203</td>
<td>18.76</td>
<td>14</td>
</tr>
<tr>
<td>Limestone</td>
<td>263.5</td>
<td>339</td>
<td>4.1</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 6. 19: Summary from experimentation data by sieve size and raw material.
In a similar manner to G2, this sieve size resulted in a vast diversity of cryptocrystalline materials. Including one more that was found in both the workshop area and the domestic spaces, pumice stone (Figures 6.26 and 6.27). The pumice stones have been found at other domestic context in Chinikihá as well, and present scars derived from process of abrasion, characterized by the flattening of one or both sides of the stone. The small fragments recovered could have been used as abraders. The utilization of local stones can be observed in the dominance of chert and limestone, but also the use of granite and microcrystalline quartz in chipped technology is also necessary. Also, the analysis showed the many stages of production represented, including primary flakes (n=1107), secondary flakes (n=2902), and tertiary flakes (n=1393). Evidence for soft hammer (n=3622) and pressure flaking (n=1407) were the dominant types of debris, with an evident decrease of hard hammer (n=82) percussion. Tool fragments (n=4) were also
recovered. A continuing evidence of possible mistakes and learning processes or mistakes of the craft. Tables 6.20 and 6.21 for summaries of the results.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Granite</th>
<th>Limestone</th>
<th>Microcrystalline Quartz</th>
<th>Pumice Stone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>1107</td>
<td>747</td>
<td>0</td>
<td>360</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>2902</td>
<td>1906</td>
<td>1</td>
<td>986</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>1393</td>
<td>929</td>
<td>0</td>
<td>452</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>1925</td>
<td>1302</td>
<td>0</td>
<td>594</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>3506</td>
<td>2386</td>
<td>0</td>
<td>1103</td>
<td>0</td>
<td>46</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>2286</td>
<td>1633</td>
<td>0</td>
<td>622</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>4278</td>
<td>2686</td>
<td>0</td>
<td>1576</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>2957</td>
<td>2072</td>
<td>1</td>
<td>884</td>
<td>1</td>
<td>46</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>82</td>
<td>16</td>
<td>0</td>
<td>66</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>3622</td>
<td>2349</td>
<td>0</td>
<td>1227</td>
<td>1</td>
<td>46</td>
</tr>
<tr>
<td>Pressure flaking</td>
<td>1407</td>
<td>938</td>
<td>0</td>
<td>457</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>4261</td>
<td>2843</td>
<td>0</td>
<td>1372</td>
<td>1</td>
<td>46</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>12</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tool fragment</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>529</td>
<td>443</td>
<td>1</td>
<td>85</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>2277.2</td>
<td>1465.63</td>
<td>0.6</td>
<td>790.17</td>
<td>1.7</td>
<td>19.6</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>7168</td>
<td>4919</td>
<td>1</td>
<td>2205</td>
<td>1</td>
<td>46</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>391</td>
<td>347</td>
<td>0</td>
<td>44</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>not treated</td>
<td>6573</td>
<td>4515</td>
<td>1</td>
<td>2010</td>
<td>1</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 6. 20: Summary of results by material.

The boxplot 7 below illustrates flakes by total number, contrasting the archaeological data with the experimentation information. The boxplot serves to illustrate the pattern observed at the workshops of lithic debris and how the experimentation data was able to reflect a similar pattern. Figure 6.28 below illustrates flakes by total number, contrasting the archaeological data with the experimentation information.

Figure 6. 28: Comparative details of medians, quartiles and extreme values of total flake percentage, separated by sieve size and contrasted with the experimentation data.
<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Mean Width</th>
<th>Mean Length</th>
<th>Mean Diameter</th>
<th>Mean Thickness</th>
<th>Weigth one Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>12.84</td>
<td>29.83</td>
<td>32.66</td>
<td>2.97</td>
<td>0.58</td>
</tr>
<tr>
<td>N</td>
<td>117.00</td>
<td>117.00</td>
<td>117.00</td>
<td>117.00</td>
<td>117.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>3.44</td>
<td>170.51</td>
<td>179.30</td>
<td>2.80</td>
<td>0.89</td>
</tr>
<tr>
<td>Std. Error of Mean</td>
<td>0.32</td>
<td>15.76</td>
<td>16.58</td>
<td>0.26</td>
<td>0.08</td>
</tr>
<tr>
<td>Range</td>
<td>21.92</td>
<td>1851.41</td>
<td>1951.75</td>
<td>29.34</td>
<td>9.30</td>
</tr>
<tr>
<td>Variance</td>
<td>11.83</td>
<td>29073.96</td>
<td>32148.20</td>
<td>7.83</td>
<td>0.79</td>
</tr>
<tr>
<td>% of Total Sum</td>
<td>0.76</td>
<td>0.87</td>
<td>0.87</td>
<td>0.73</td>
<td>0.65</td>
</tr>
<tr>
<td>Granite</td>
<td>9.53</td>
<td>9.80</td>
<td>12.59</td>
<td>5.73</td>
<td>0.60</td>
</tr>
<tr>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Limestone</td>
<td>32.00</td>
<td>32.00</td>
<td>32.00</td>
<td>32.00</td>
<td>32.00</td>
</tr>
<tr>
<td>Microcrystalline Quartz</td>
<td>3.09</td>
<td>3.76</td>
<td>3.62</td>
<td>1.13</td>
<td>2.20</td>
</tr>
<tr>
<td>N</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>Std. Deviation</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Error of Mean</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>16.33</td>
<td>15.94</td>
<td>14.03</td>
<td>5.41</td>
<td>12.90</td>
</tr>
<tr>
<td>Variance</td>
<td>9.56</td>
<td>14.13</td>
<td>13.13</td>
<td>1.27</td>
<td>4.85</td>
</tr>
<tr>
<td>% of Total Sum</td>
<td>0.22</td>
<td>0.12</td>
<td>0.12</td>
<td>0.24</td>
<td>0.32</td>
</tr>
<tr>
<td>N</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Pumice Stone</td>
<td>16.64</td>
<td>16.80</td>
<td>20.33</td>
<td>5.46</td>
<td>1.70</td>
</tr>
<tr>
<td>N</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Error of Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Variance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of Total Sum</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>N</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Error of Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Variance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of Total Sum</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 6. 21: Summary of basic measurements of flakes by raw material.

**Controlled Experimentation G4EXP**

The experimentation data illustrated the importance of good quality stone about the lithic debitage generated. The chert and limestone used during the experimentation had very clear differences in the quality and conchoidal fracture properties. I was able to obtain good knapping material, specifically heat-treated chert, which generated a very different type of debris when compared to the limestone. This second one did not have a good fracture pattern and ended up creating more lithic debitage than actual tools. The chert, on the other hand, was easy to work with and had a clean fracture pattern.
### Table 6.22: Totals from experimentation data by sieve size and raw material.

<table>
<thead>
<tr>
<th>Geologic Material</th>
<th>Weight (g) total</th>
<th>N sample</th>
<th>Total</th>
<th>Weight (g) by registry</th>
<th>N of registries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>97.84</td>
<td>209</td>
<td>9.97</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>161</td>
<td>348</td>
<td>5.8</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.23: Totals from experimentation data analyzed.
The last sieve size was again dominated by chert and limestone, with a clear dominance from the first (Figures 6.29 and 6.30). The sieve G5 separated what seems to be the most common or numerous type of production evidence. Scars of the detailed work and crafting, like pressure flaking and small detailed work. Table 6.24 and 6.25 below for the summary of results. This last sieve also was critical evidence of the sequence of events and production of bifacial work, where a high number of marginal flakes (n= 2666) and non-marginal flakes (n= 5413) were recognized. Further, the presence of soft hammer (n= 4500) evidence and pressure flaking (n= 2495) are both congruent with the evidence of chipped technology and bifacial knapping. No hard hammer evidence was identified for this sieve size. Again, the presence of tool fragments was also identified (n= 192). Throughout all the sieves, the evidence for mistakes and broken
artifacts serve as an indication of not only the error of crafters, or the local fixing of tools at the workshop, but also processes of learning and continuing a craft. The different levels of proficiency and skill observed in the analysis attest to varying range of crafters with varying levels of ability. A reference to the socially localized transfer of information from crafters of different skills levels with other individuals taking part of the production and socially transmitted knowledge of flintknapping.

Figure 6.31: Comparative details of medians, quartiles and extreme values of marginal flake percentage, separated by sieve size and contrasted with the experimentation data

Figures 6.31 and 6.32 illustrate the pattern observed with the presence of marginal and non-marginal flakes in both collections. These type of flakes have been associated with bifacial production (Andrefsky 2001). Note the apparent increased pattern with the archaeological collection, illustrating the detailed bifacial work done at the site.
Figure 6. 32: Comparative details of medians, quartiles and extreme values of non-marginal flake percentage, separated by sieve size and contrasted with the experimentation data.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>459</td>
<td>311</td>
<td>148</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>2189</td>
<td>1386</td>
<td>803</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>2284</td>
<td>2638</td>
<td>246</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>3189</td>
<td>2532</td>
<td>657</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>6321</td>
<td>4793</td>
<td>1528</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>2666</td>
<td>1916</td>
<td>750</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>5413</td>
<td>1569</td>
<td>3844</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>5440</td>
<td>4114</td>
<td>1326</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>4500</td>
<td>3067</td>
<td>1433</td>
</tr>
<tr>
<td>Pressure flaking</td>
<td>2495</td>
<td>2046</td>
<td>449</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>4389</td>
<td>3311</td>
<td>1078</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tool fragment</td>
<td>192</td>
<td>142</td>
<td>50</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>227</td>
<td>186</td>
<td>41</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>1279.56</td>
<td>751.76</td>
<td>527.8</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>114</td>
<td>92</td>
<td>22</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>9816</td>
<td>7517</td>
<td>2299</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>208</td>
<td>208</td>
<td>0</td>
</tr>
<tr>
<td>not treated</td>
<td>9152</td>
<td>6973</td>
<td>2179</td>
</tr>
</tbody>
</table>

Table 6. 24: Summary of totals by raw material.

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Width (mm)</th>
<th>Length (mm)</th>
<th>Diameter (mm)</th>
<th>Thickness (mm)</th>
<th>Weight One Sample (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>Mean</td>
<td>25.23</td>
<td>32.52</td>
<td>33.88</td>
<td>12.14</td>
</tr>
<tr>
<td>N</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>138.13</td>
<td>185.29</td>
<td>187.45</td>
<td>19.5</td>
<td>96.34</td>
</tr>
<tr>
<td>Std. Error of Mean</td>
<td>144.4</td>
<td>19.1</td>
<td>19.53</td>
<td>1.91</td>
<td>0.06</td>
</tr>
<tr>
<td>Range</td>
<td>1201.87</td>
<td>1731.43</td>
<td>1758.18</td>
<td>911.27</td>
<td>0.299</td>
</tr>
<tr>
<td>Variance</td>
<td>15962.18</td>
<td>23054.54</td>
<td>25125.54</td>
<td>9091.27</td>
<td>0.004</td>
</tr>
<tr>
<td>% of Total Sum</td>
<td>63.26%</td>
<td>59.00%</td>
<td>59.00%</td>
<td>51.50%</td>
<td>76.60%</td>
</tr>
<tr>
<td>Mean</td>
<td>64.56</td>
<td>94.46</td>
<td>95.32</td>
<td>47.91</td>
<td>0.16</td>
</tr>
<tr>
<td>N</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>252.93</td>
<td>460.14</td>
<td>399.95</td>
<td>135.48</td>
<td>0.04</td>
</tr>
<tr>
<td>Std. Error of Mean</td>
<td>55.52</td>
<td>48.31</td>
<td>48.21</td>
<td>56.98</td>
<td>0.81</td>
</tr>
<tr>
<td>Range</td>
<td>1188.83</td>
<td>1879.16</td>
<td>1878.38</td>
<td>704.85</td>
<td>0.1</td>
</tr>
<tr>
<td>Variance</td>
<td>83778.11</td>
<td>168119.23</td>
<td>159985.03</td>
<td>380958.8</td>
<td>0.002</td>
</tr>
<tr>
<td>% of Total Sum</td>
<td>36.80%</td>
<td>41.00%</td>
<td>40.20%</td>
<td>48.50%</td>
<td>21.40%</td>
</tr>
</tbody>
</table>

G5 Basic Statistics for flakes (Mean for one artifact)
Table 6.25: Summary of basic measurements of flakes by raw material.

**Controlled Experimentation G5EXP**

<table>
<thead>
<tr>
<th>Geologic Material</th>
<th>Weight (g) total</th>
<th>N sample Total</th>
<th>Weight (g) by registry</th>
<th>N of registries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
<td>124.2</td>
<td>1369</td>
<td>3.2</td>
<td>24</td>
</tr>
<tr>
<td>Limestone</td>
<td>424.8</td>
<td>994</td>
<td>1.2</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 6.26: Totals from experimentation data by sieve size and raw material.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total N</th>
<th>Chert</th>
<th>Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flakes</td>
<td>142</td>
<td>76</td>
<td>66</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>573</td>
<td>376</td>
<td>197</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>901</td>
<td>166</td>
<td>125</td>
</tr>
<tr>
<td>Bifacial thinning</td>
<td>553</td>
<td>105</td>
<td>448</td>
</tr>
<tr>
<td>non intentional debitage</td>
<td>1322</td>
<td>832</td>
<td>671</td>
</tr>
<tr>
<td>Marginal flakes</td>
<td>984</td>
<td>862</td>
<td>346</td>
</tr>
<tr>
<td>Non-marginal flakes</td>
<td>483</td>
<td>344</td>
<td>139</td>
</tr>
<tr>
<td>Fracture from percussion</td>
<td>1240</td>
<td>770</td>
<td>470</td>
</tr>
<tr>
<td>Hard Hammer</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soft hammer</td>
<td>828</td>
<td>267</td>
<td>561</td>
</tr>
<tr>
<td>Pressure flakes</td>
<td>1123</td>
<td>829</td>
<td>294</td>
</tr>
<tr>
<td>Direct percussion (evidence)</td>
<td>823</td>
<td>267</td>
<td>556</td>
</tr>
<tr>
<td>Core (fragment/chunk)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complete tool</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tool fragment</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flakes with Cortex</td>
<td>68</td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td>Weight (g) (all samples)</td>
<td>549</td>
<td>124.2</td>
<td>424.8</td>
</tr>
<tr>
<td>Total number of registries</td>
<td>30</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>Total number flakes in sample</td>
<td>2363</td>
<td>1369</td>
<td>994</td>
</tr>
<tr>
<td>Possible Thermal Treatment</td>
<td>1101</td>
<td>1325</td>
<td>0</td>
</tr>
<tr>
<td>not treated</td>
<td>992</td>
<td>0</td>
<td>992</td>
</tr>
</tbody>
</table>

Table 6.27: Totals from experimentation data analyzed.

This last sieve confirmed many of the patterns observed throughout the analysis. The size and the type of flake illustrated the type of context encountered. A materialization of the hours and time spent at the workshops working and doing detailed bifacial work. As a stone worker, I can only imagine the amount of time the crafters at Group G dedicated to the craft of stone tool production. But as it was observed in chapter 5, the material evidence reflects an image of a Maya commoner that had access to goods and enjoyed the technological knowledge that permitted them to specialize and spend large lapses of time working stones (Table 6.26 and 6.27).

**Brass Pan - G6**

Lastly whenever possible all the left over lithic shatter was collected and weighted. It should be noted that all the material was washed before analysis (Figure 6.33). Unfortunately, some fracturing does occur during the movement and transportation of the archaeological material from the field to the lab. The screening of the material in the field and the results from the all the sieves attest to different stages manipulation of the material that could have created some of this shatter (Table 6.28).
Figure 6. 33: Image example of shatter.

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Weight (g)</th>
<th>Sieve</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G6</td>
<td>616.5</td>
<td>G6EXP</td>
<td>218.2</td>
</tr>
</tbody>
</table>

Table 6. 28: Total shatter collected from analysis and experimentation.

Figure 6. 34: Comparative details of medians, quartiles and extreme values of flake diameter and thickness total, separated by sieve size and contrasted with the experimentation data.

The MDA results were vital in our understanding, and the experimentation data served as a control. Not only was the data used in statistical analysis, but also to generate a series of graphs (bar graph, boxplot, pies, etc.), which contributed different layers to understand and attempt to interpret the material evidence. The following Figures 6.34 a and b and 6.35 a and b illustrate this important part of the methodology. In a similar form as having a control when running another test, the experimental data provided layers of verification. Representing the results from the MDA with results from the test; diameter, length, thickness, and weight.
Figure 6. 35: Comparative details of medians, quartiles and extreme values of flake thickness and weight totals, separated by sieve size and contrasted with the experimentation data.

**Chipped Stone Artifacts**

The analysis resulted in an overall view of different data sets and social practices in connection with the production of stones at Group G. From evidence collected at the workshops like hammer stones or the grinding stones collected in association to the kitchen in the domestic mound. Also, complete or semi-complete artifacts were recovered providing a unique vision of the styles and complete types of tools. Artifacts that will assist in the understanding of the material characteristic of locally produced stone tools. To know which production was for self-consumption and what was for exchange is up for debate. Many of the complete pieces were collected from the workshops or closely associated. Also, they do not seem to be used and were left in situ maybe by accident. The tools associated to the mound G16 tended to be broken and others with the possible use or re-sharpening scars. In general, the cryptocrystalline chipped stone artifacts can be divided into two technological groups: a cobble reduction tools and core-flake tools. As mentioned briefly before, the complete pieces are harder to find, but a few complete tools with biface and uniface retouch were recovered and analyzed. The complete artifacts had the advantage of serving as evidence of both the crafting techniques and also serve as evidence for their physical characteristics. Unfortunately, no evidence was collected for another type of known crafting material like shells or bone. The diversity of styles provides a perspective of the technology and technique used to produce stone tools during the Late Classic. Like at other Maya sites, the bifacial celts or oval bifaces are one of the most commonly found and recovered general utility bifaces (Aoyama 2009). I should make a clarification here regarding the differentiation between chert and limestone. The difference in uses at Chinikihá can be observed and seem to be related to the use of the two stones. Locally acquired and produced limestone tools tend to be represented precisely in utilitarian tools intended for daily local consumption and for building living spaces. Local consumption of limestone for the production of masonry for building and household needs became apparent. Moreover, the examples below illustrate the almond shaped limestone bifaces (I will also refer to them as oval shaped bifaces) that are commonly found at Chinikihá and reported throughout the region. Figure 6.36 and 6.37 are examples of tools made from local limestone. Figure 6.38 has been the only example found this shape made out of limestone. It was found in association to G13b, the kitchen.
In general, the most dominant material for the production of stone tools was chert, also known as flint (Luedtke 1992). Almost all core reduction tools and core-flake reduction tools, including bifacial and unifacial retouched, as well as un-retouched artifacts, were made out of chert. Unlike obsidian polyhedral cores, chert nodules were not specially prepared, and blades could be obtained through core reduction (Clark 1988: 51). Similarly reported for other areas, evidence for production of blades using a pressure technique was also observed in a small number of high-quality blades (Johnson, et al. 2015). In general, a pattern of use of chert for the production of tools was identified through the MDA and attribute analysis. Table 6.29 summarizes the main type of artifacts identified.
Table 6.29: Summary of complete and semi complete stone tools from Group G.

In general, oval shaped bifaces were one of the most commonly found types of artifact. A unique artifact recovered in the workshop was an oval shaped biface shown in Figure 15.5. Because of its size and shape, it stands alone in the collection, as it could have been used as a scraper, a palette or small plate. The ventral surface was coarse and rough. A similar artifact is reported at the site of Aguateca identified as a small palette (Aoyama 2009: 78).

The second most common type of artifact is the leaf or laurel shaped bifaces. They could have been used as knives, spear points or weapons. They were hafted into handles and present similar pattern as those reported by other researchers (Lewenstein 1987). Most of the semicomplete samples identified are the proximal ends and present hafting in one or both sides. Figure 6.39 illustrates a complete laurel shaped chert oval biface found in the workshop at G22.
Another commonly recovered type of tools is scrapper, made from flakes. The production for this scrapers does not seem to be constrained, where some are worked unifacially others had evidence of bifacial work. Observe Figure 6.40 for tow different examples of scrapers. The preference for the use of good quality chert was evident in the diversity of colors and cryptocrystalline stones, yet all were made with good quality chert. Most of the scrapers also showed consideration for the hafting of the tool in a handle. As it can be observed in Figure 6.40 below, some had a stem while others had a negative scar for hafting.

Evidence at Group G also included the production of personal ornamentation like jewelry and even the evidence of the production of pyrite mirrors. Below Figure 6.41 depicts the production of chert beads, a broken piece found at G22. Perhaps initially result of chipped technology, this bead was abraded and polished before it broke and was left in situ. The interior section was socked to create a conical aperture shape. The artifact also serves to exhibit the utilization of chert to many types of goods, to include personal adornments like jewelry that require a different level of skill and attention to detail.
Another unique artifact recovered in direct association to the floor surface of the workshop was an iron pyrite mosaic shown in Figure 6.42 below: measured 2.1 X 1.9 X 0.27 cm. The mosaic probably lost by accident, since it was finished and complete. This type of artifacts has been reported in association to elite domestic craft production (Inomata 2007; Kovacevich 2007). The mosaic was polished in its frontal face, with all the sides and back face grounded to a smooth surface. A good indication of access to iron pyrite by the local crafters and also a signal to the necessary knowledge in pyrite mirror production. As far as the possible source and provenance for pyrite would be known deposits located in the Grijalba region of Tabasco (Ortiz-Zamora, et al. 2002). Again, this was not tested, and no known sources are assigned for the pyrite.

Evidence for other craft production

Other types of production identified reflect the diverse technological knowledge and crafting diversity within one household group. In a trash midden excavated between G13 and G16 two unique artifacts were also identified which also indicate other crafting activities that could have occurred at Group G. A small fragment of a limestone malacate or spindle whorl was recovered, indicating the importance of textile production and the possible activity of women. Casually the deposit was located near the kitchen area and a section of the group not excavated. Textile production was an important part of everyday life, and there is ethnohistorical, historical and archaeological information to help us understand its production and uses in ancient times. Cloth production is also important to mention because it has been considered, just as opposite to lithics, a female gender craft (Burkhart 1997; Hendon 1997, 2006; Joyce and Gillespie 2000).

The crafts of weaving and spinning were part of a woman’s daily routines and economic production to meet household as well as ritual and tribute needs and responsibilities (Burkhart 1997; Hendon 2006; Joyce and Gillespie 2000).

The economic and political importance of female labor and cloth production has been noted in different parts of Mesoamerica (Brumfiel 1991; Hendon 1997; Joyce and Gillespie 2000; Little 2008) and even other parts of the world (Gero and Conkey 1991; Weiner 1992).
Mesoamerican women place them at the center of the production and artistry of the high demand of cotton mantas needed for tribute by the Postclassic Mexica and later exploited during the Colonial period by the Spaniards (Garza, et al. 1983; Sahagun 2006; Tozzer 1941). There are many images from Late Classic Maya royal iconography where tribute of mantas is depicted. Reflecting the importance to local lords as in the case of the murals of Bonampak or painted vases (Kerr; Miller and Martin 2004).

Archaeologically, the evidence of cloth production comes to us in the form of implements and tools such as spindles whorls made of stone, coral, wood, seeds and even ceramic sherd (Ardren, et al. 2010; Hernandez and Peniche 2007) including needles made out of bone and wood (Ardren, et al. 2010; Hendon 1992). Fragments of intricately brocaded cloth have been recovered during excavations the Cenote at Chichén Itza (Coggings and Shane 1984: 143-145). These fragments serve as samples of ancient techniques and styles of mantas (cloth).

Ethnohistoric and ethnographic studies describe weaving as an important female activity with no mention or differentiation to status. However, archaeologically there seems to be a differentiation, as elite and royal women left behind more tools associated with weaving or textile production compared to those of lower status females (Chase, et al. 2008; Halperin 2008; Hendon 1997; Inomata and Stiver 1998). At the site of Copan, Hendon (1997: 44) found evidence of a correlation between the size of the household and the presence or absence of textile production tools in three different architectural residential compounds. A similar pattern was reported at Aguateca (Inomata and Stiver 1998), a site rapidly abandoned where elite architecture was excavated, and the presence and frequency of bone needles and spindle whorls have been interpreted in relationship to cloth production.

In the case of the Highland Mexica, fray Sahagun left descriptions of commoner women creating clothing spun from maguey fibers, while cotton spinning and its production was more likely done by noblewomen who were expected to excel at weaving and brocading (Sullivan 1982: 13-14). The direct association between the female gender and textile production for Maya and central Mexican is also part of iconography, where females are actively engaged in textile production (Sahagun 2006; Thompson 1972). Images and verbal associations between female deities and textile production also serve as indicators of female identity through the production of textiles (Hendon 2006).

Another unique material reflection of past activity was a small fragment of a bark beater recovered in the same trash midden as the spindle whorl. Its presence also indicates the knowledge of how to manufacture other goods and also can only make one wonder the diversity of tools and production of commoner households during the Late Classic.

Finally, ongoing lithic studies from the surrounding territories of Palenque and Chinikihá serve to complement the perspective of the uses of stones in the region and the geologic materials used. I only use this data as reference to point out some differences, similarities and possible implications for the research presented here. The excavations at Group G have given a unique intimate perspective of a domestic compound during the Late Classic. Including the many technologies, practices, and goods available to the local communities. As it can be seen in Table 6.30 below, the study also allowed broadening the comprehension of the types of stones used and exploited in the past. When compared to available information from the region exploitation of geologic materials, a larger diversity was observed at Chinikihá. There is a pattern of
appropriation and utilization of locally accessible cryptocrystalline stones as well as a large web of distribution of geologic materials.

<table>
<thead>
<tr>
<th>Region</th>
<th>Geologic Materials</th>
<th>artefacts</th>
<th>weight (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone</td>
<td>57</td>
<td>1697.2</td>
<td></td>
</tr>
<tr>
<td>Quartzine</td>
<td>10</td>
<td>345.6</td>
<td></td>
</tr>
<tr>
<td>Quartz</td>
<td>49</td>
<td>550.8</td>
<td></td>
</tr>
<tr>
<td>Chert</td>
<td>579</td>
<td>10528.13</td>
<td></td>
</tr>
<tr>
<td>Not Id</td>
<td>70</td>
<td>2472.12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>765</td>
<td>15593.85</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group G</th>
<th>Raw Mat</th>
<th>Total artifacts</th>
<th>Total weight gm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chaledony</td>
<td>1</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>6483</td>
<td>5780.13</td>
<td></td>
</tr>
<tr>
<td>Fosilized Chert</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Microcrystalline Quartz</td>
<td>1</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Granite</td>
<td>1</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Iron Pyrite</td>
<td>1</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Chert</td>
<td>15754</td>
<td>9206.37</td>
<td></td>
</tr>
<tr>
<td>Sandstone</td>
<td>46</td>
<td>19.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22290</td>
<td>15023.7</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.30: Raw materials from attribute analysis in the study region (Ana data).

The archaeological context in the NWML indicates that different types of knapping techniques occurred at many places, including houses of both elite and non-elite groups. The manufacture of utilitarian tools (e.g. prismatic blades, knives, scrapers) and specialized tools (e.g. eccentrics - chipped stone artifacts that represent images or have non-functional yet intricate and highly skilled elaboration) including the recycle or reuse of exhausted stone tools and debitage (Masson 2000; Moholy-Nagy 1999; Pendergast 1990). During the Classic period, large quantities of lithic debitage (from chert and obsidian crafting) were used as the architectural filling or used in burial deposits in ceremonial and elite structures at Tikal (Moholy-Nagy 1976, 1989). In commoner households, lithic debitage and materials reflect various stages of the production of stone tools reported in midden context (Moholy-Nagy 1976). Moreover, an interpretation for the presence of lithic debitage has been described as a possible indicator of differentiation of status (West 2002).

In the case of Palenque, the city is reported to have functioned as an important center of distribution and consumption for exchanged goods. In the case of consumed ceramic wares, Palenque imported and used local production for local consumption (Bishop, et al. 1982; Rands 1967; Rands and Bishop 1980). Also, the site is considered not to have the local ability to self-produce the necessary goods, like ceramic wares by local crafters. In this sense, Palenque functions as the center and economic node. The regional studies show that the provincial consumption of those ceramic wares followed that pattern of regionally produced wares consumed within the larger cities like Palenque. In other regions arguments have been made that people in the larger nodes of the population could have had better access to ceramic wares and stone tools in comparison to the rural peripheral settlements (Aoyama 2001; Fedick 1991; Fry 2003).
The NWML rural communities saw their biggest growth episode during Late Classic and whether there is a similar pattern of stone tool consumption as ceramics is up for debate. There is evidence for the regional stone tool production at the domestic context in the Palenque region (Johnson 1976) including smaller rural sites (Herckis 2015; Liendo Stuardo 2002) and major secondary centers like El Lacandón (López Bravo 2013), with lithic evidence starting in the Late Formative and part of Palenque political influence. These studies have reported similar patterns for technologies and local production of chipped technology and pressure technique. Recently a study in two domestic groups in the region of Palenque was excavated and report evidence of late stage reduction flakes, indication of local production of prismatic blade technology in domestic rural contexts (Herckis 2015). Earlier the study by Johnson (1976) also reports obsidian prismatic core rejuvenation flakes and local production of prismatic blades from the local collection and the lithics analyzed from excavations at Palenque. At the site of Lacandón, evidence for lithic production, and specifically prismatic blade production was also recovered from domestic contexts of commoner populations (López Bravo 2013). Also, at Piedras Negras prismatic blade technology has been reported and the production of pressure blades from microcrystalline stones. Even though the approach and methodology for analysis was different, Hruby (2006) reports similar patterns of production as those found by this study. Another important place of production of prismatic blades and other obsidian tools was Yaxchilán, site that seems to have had direct access to obsidian from the Highlands in Guatemala (Brokmann 2000; Kaneko 2003; Silva de la Mora 2012).

The regional material indication of prismatic blade technology production seems not to have been restricted by the location of producers, but perhaps responded to local consumption needs and even social dynamics. The obsidian production and its distribution reflects local social patterns not necessarily restricted to elite groups. This doesn’t mean the elite groups or site leaders were not involved in the importation or distribution of prismatic blades. The distribution of obsidian polyhedral cores, or the local production of blades could have been an important part of the elite groups. As there is evidence on the direct procurement of polyhedral cores reported at sites like Palenque, Cancuen, Piedras Negras and Yaxchilán (Brokmann 2000; Demarest, et al. 2014; Hruby 2006; Johnson 1976)). That could also have extended to the production and local distribution of some lithic tools or the polyhedral cores. However, the production of utilitarian stone tools seems to be much more widespread or democratic with different locations and levels of production in the region and Group G. Furthermore, the discussion should also consider the social status of the artifacts. In relationship to whether the site of production and distribution or even who made the artifact and how this affected its value. The relationship between the produced artifacts and the place where they were acquired could have had some added value that reflected in the value of an object (Joyce 2015). Perhaps in relation to the commoditization of those tools within a system that included whether or not the importation of goods was also an added social value (Clark 2007; Feinman and Garraty 2010; Hruby 2006).

Early studies suggested that obsidian was at least exchanged as a prestige good controlled and distributed by the elites to re-enforce and re-validate their political, economic and social control or power (Sidrys 1976). Others argued their distribution as a commodity and not a luxury product which enjoyed a greater distribution and use (Aoyama 2001; Tourtellot and Sabloff 1972). In this sense, as illustrated in chapter 4, and with the information gathered in this chapter, tools were widely distributed in the region and its production localized at different places within the NWML, in specific at the domestic context (Herckis 2015; Hruby 2006; Johnson 1976; López Bravo 2013). It should also be noted the real value of stone tool production for the local
communities, as its production seems to be wide and evenly distributed through the different groups of society. At all levels and all sites, have access to the different technologies and the production is taking place at many places.
Chapter 7: Summarizing comments

The dissertation used a perspective of learning as the means through which communities’ structure can allow us to see more evidence of everyday life for people and agency. Applying a suite of methods in the small scale of a housework and workshop I have been able to prove how the use of spatial analysis and study of material culture can be used for interpretation. I have also shown the importance of combining the small and large scale within a regional perspective to better understand the materiality. The investigation centered on understanding the local and regional communities of practice through the crafting of stone tools.

The scale of the study was also an attempt to theorize about the dichotomy between the rural spaces and the main urban centers. A dichotomy that continues to puzzle archaeological research and current social theory. The complex puzzle of power structures within society. The study attempted to reconstruct a small portion of the economic relations in the NWML by examining the daily life materiality centered around stone tools traditions, technology, and styles. Including the use and exploration of different models of interpretation from a perspective of political economy. The results of this dissertation suggest a complex arrangement of shared practices and economic relations. The local communities had access to long distance imported goods that reflect shared preferences for certain products and technologies creating a constellation of practices in the NWML. The study illuminates an interpretation that considers Mayan commoners daily activity and shared knowledge of lithics technologies. Placing them at the center of Maya society, as agents that were part and owners of technological knowledge with access to many goods of local and foreign origin. As it was shown through the presence of imported obsidian and other imported products like pine (ocote) for fire starting.

The study also explored the regional settlement distribution using the local routes of communication, where goods moved throughout the settlements and communities. To reconstruct and study the local exchange an EDXRF sourcing analysis assigned the best possible sources. The analysis was used to reconstruct different aspects of exchange and recreate the exchange routes, location for ports of entry, distribution of production and even explored the crafting traditions of everyday life. Furthermore, reconstructing the regional consumption preferences of lithic materials, as observed with the obsidian source and preferred technologies. Also, it was revealed how the regional production and crafting of stone was an egalitarian and widely used craft. The archaeological evidence points to how all levels of society had access to different stone materials and had a core set of skill and knowledge of production and manipulation of stone tools and related goods. Just production for prismatic blade was identified and represented in the entire typology spectrum of settlements. Furthermore, to add another level of analysis and evidence, a residential complex was excavated where an adjacent lithic production area was recognized. Providing the opportunity to study stone tool production and crafting from a perspective of social learning and referential practice. The results and interpretations provide a bottom-up perspective of stone tool technology and daily practices that will encourage a reevaluation of our interpretations of Classic Maya society, economy, including the value of shared social knowledge.

Because of the unique nature of lithic technology and production, it was theorized as an egalitarian craft. Its efficiency and simplicity serves as evidence of its wide distribution and use. Stone tool technology was part of the shared collective knowledge and a vital part of daily practices by the local communities. The archaeological evidence has illustrated the wide
distribution and ubiquity of stone tool production and use. Evidence for a landscape of practitioners and communities linked, creating a constellation of communities that shared the production of many crafts and the way to use them. The study was aimed to identify socially based practices through the study of stone technologies and daily consumption. The skill of flint knapping is not dependent on the access to specialized training like calligraphy, scribal artistry or other types of specialized knowledge. Commonly assumed to be based on social status and restricted to particular groups of society. However, lithic technology included a set of specialized and highly skilled techniques that people had access to. All archaeological sites have evidence of some stone debitage or debris result of lithic production. I am not referring to lithic production as a minor or even a less sophisticated technology, but quite the contrary. It’s simplicity and efficiency has ensured its existence and development throughout thousands of years. What I want to stress is the ubiquity of the technology and the subtle technological traditions hidden within lithics. The knowledge that was based on shared social knowledge and shared through referential learning. Many crafts are assumed to even have social restrictions. Theorized on the base of controlled access to their instruction based on social status. However, I am not sure if the same can be assumed about all crafts, like chipped technology. I know the complexity of lithic technology, the amount of work and time that it takes to master the craft. But I am also not sure if such assumption would apply to all of the lithic production and techniques.

In general, there is ample indication that everyone had a core set of practical and technical knowledge on the use of a repertoire of practices part of daily life that included how to Knapp or chip stone. Even though there seem to be some techniques that require a higher level of training, skill, and mastership such as the pressure techniques for the production of prismatic blades, the local production of prismatic blade was recovered in one third of the sites. However, prismatic blades can be fond at all households. The production of prismatic blades was represented at all levels or ranks of the archaeological site. Not all the sites have evidence of production of prismatic blades, but all the levels of sites were represented in the sampling to have production and access to prismatic blades. Traces were found of a wide distribution of crafters working at all site levels. Perhaps a reflection of the access of the local communities to many products and crafters. Something crucial to this study, which considered the crafting level of mastership acquired by learning the techniques through daily practice and peripheral participation in an active, productive environment. To be a skillful flint knapper or stone worker, time and practice have to be spent producing stone tools to develop and master the craft. Everyday practice and socially learned techniques that were based on traditional ways of doing. Shared through a process of learning based on social interaction part of a group identity.

In the Maya region, good quality Chert is ubiquitous and was easy to access. Obsidian was introduced through long-distance exchange and locally distributed through a network of well-defined routes. It is precisely this access to different goods that more likely allowed the introduction of other techniques and different types of knowledge into the local communities. The settlements had access to many types of stones and other goods that were a direct result of the wider exchange network. Archaeologically both flint and obsidian are commonly found everywhere in the study region, represented by all the different types and levels of sites. From the main nodes of population like Chinikihá, to the small isolated platforms in the rural areas. Evidence for production of stone tools was identified within the entire spectrum of settlements that reflect the use of different techniques such as knapping, pressure, chopping, pecking, abrading, grinding, and polishing. All the sites have evidence of some level of stone tool production, which can be theorized as the reflection of ancient local knowledge and crafting
ability to produce goods. The ubiquity of stone tool debitage also reflects regional diversity of techniques and how stone tool technologies were socially shared and learned. A great diversity and wide range of skill were also identified through the MDA and attribute analysis, translated as traces of the many crafters that learned and developed their knapping skills at Group G. Identified through the presence of well-crafted tools and controlled flakes that were most likely being produced by master crafters. To the presence of many blanks or flakes with extra flaking, unfinished, or broken unskilled bifaces that are more likely the result of a novice or someone learning. The scars of an apprentice going through the process of traditional forms of learning, to learn the craft by doing. Many of the blanks identified seemed to be the result of unskilled hands, reflecting the different processes of production. Also, the type of material evidence analyzed at Group G indicates that at least during the Late Classic the domestic group was actively involved in the production of stone goods. The architectural complex represents the lives of 8-12 generations of a community of practice at Chinikihá. Also observed in the architectural history, where a substructure was identified during excavations.

The materiality also illustrates the regional patterns of similar uses of stone technology and stone tool use. Observed clearly with the obsidian collection, where almost all the material is associated with prismatic blade production and use. Hafted fragments of prismatic blades seem to be one of the preferred tools found in every household. A common characteristic found throughout the entire analysis and for most of the materials. A preference for hafted tools. The polyhedral cores were imported from different places, used in the local production of prismatic blades, and widely distributed. Prismatic blades were a shared crafting tradition that produced a constellation of practice. A pattern that extends beyond the study area and is part of Mesoamerican socially based technology and structured socially base practices. Also, the distribution of obsidian had a clear pattern of dominance of obsidian from El Chayal for the Late Classic.

All the sites have stone tool implements made out of different rocks like chert or limestone. However, not all the sites were producing the same tools or using the same techniques. Some households seem to be more engaged in the production of certain goods. Other authors have pointed out the presence of indicators of multicrafting within households in prehispanic times, and Chinikihá or the region is not the exception. Quite the contrary, evidence for other types of production was identified at Group G. The fragment of a spindle whorl found next to the domestic area is evidence of cloth production. A small fragment of a bark beater was recovered, denoting other techniques and craft production activity and knowledge by the group. Also, within lithic production different techniques and technologies were used in the crafting of stone tools.

Lithics were also vital in allowing the identification and use of spaces, which were also collaborated using different lines of evidence. The domestic complex excavated provided a visual and quantitative view of the activity areas. Valuable information used to grasp the multiplicity and specificity of the use of space and crafting traditions. As there was a clear differentiation in the type of materiality found at different spaces within Group G. Grinding stones were only recovered associated to the domestic space, specifically the kitchen area. The grinding stones were limited to the areas surrounding G13b, providing a substantial evidence of the use of space through the lithic materials. Hammerstones were associated with the terraces or workshop areas. The areas were also examined in conjunction with the chemical residue analysis, ceramic analysis, and Paleoethnobotany results. The different lines of evidence were
vital in the interpretation of the domestic and working spaces. Allowing a fine grain analysis that considers the various crafting activities part of daily life. In this sense, the domestic space was recreated rendering an opportunity to observe the use of different spaces where people lived, walked, slept, ate, and worked.

One of the contributions of the study was to illustrate and emphasize the importance of the investigation of debitage or debris to examine socially constructed knowledge and think of the materials as physical evidence of communities that shared technologies and social practices. A landscape where Maya commoners were active agents in the use, production, and ensured the continual passage of effective techniques from one generation to the next. Communities of practices linked through roads that acted as material evidence of the interlocked connection between the communities and their daily social practices. A landscape where commoners had not only the control to crafting knowledge but the expertise and skill to produce many of the goods consumed by different strata of Maya society.

Social practices grounded in daily life where individuals and future crafters learned by participating and observing the many daily group activities. Creating socially constructed spaces of activities through regular social interaction that resulted in shared knowledge and practices. As it was pointed out in chapter 2 with the Lacandon Flint song recorded by Bruce (1976) in Naja, Chiapas. The value of the songs in demonstrating the importance of traditional knowledge, the information and communal practices shared through a song. The song exhibits many stages of stone tool production and social organization: where to find flint, how to find it, how to Knapp, the different tools used and where to Knapp. Also, his description of the social space created by knapping, where people sat together and worked next to each other. Even mentioning the importance of teaching the song and flintknapping to children within the community, singing and reaping the song. A reference to the routinely daily participation of many family members in flintknapping, like children, women, and men. Providing a perfect space where shared practices are transmitted through grounded referential practice, learning by doing. Even illustrating the importance and relationship of cognitive factors related to the art of crafting stones like practice, development of skill, and dexterity.

The situated and grounded daily interaction became a way of learning, following a traditional transfer of knowledge, the lithic productive activities that were consistently and continually generated through daily repetition and social interaction. This constant recreation of social practices is a central component of social constructs in all cultures. A fundamental part of the communal essence and the local traditional ways of doing things. Social constructed daily practices shared by the NWML communities. The production and crafting of lithic goods at Group G were also vital to the appreciation of the household economy. An architectural compound which had a unique layout, with evidence of well-made spaces and access to many local and imported products. As it was observed in Group G, the ceramic analysis provided the placement or position within Chinikihá. The architectural group was only surpassed by the ceramic collection recovered from the palace. Evidence of the possible economic well-being and importance of the family and the group craft. It should be noticed that no elite paraphernalia was recovered at Group G (epigraphy, ritualized objects like incense burners, music instruments, etc.). The location of the Group G also attests to its importance in the local distribution of goods and possible connection to other settlements within the region. The evidence of obsidian and pine are evidence of the broad movement of goods from the Highlands of Chiapas and Guatemala. A route of exchange seems to have been very active and through which many goods
were distributed to the local communities, like obsidian and pine. A similar pattern of lowland objects was more than likely making it way up and out to other regions.

The study has used many lines of evidence in an attempt to consider sectors of society that were not part of the elite groups depicted and studied at larger sites like Palenque, Yaxchilán, or Moral-Reforma. By concentrating in the rural areas of the NWML, the study attempted to explore the importance of the local communities within the regional economy. The study illustrated how those rural and commoner communities had a significant degree of specialization and ownership of knowledge that allowed them actively participate in the exchange of goods and use of stone tool techniques. The results have important implications for the interpretations of Maya commoners during the Late Classic.

The dissertation focused on multiple levels of study attempted to use multiple layers of evidence to understand the many local histories. An endeavor to give an overview of the meta-narrative of the macro and micro level, the region, and Group G. An effort to reconstruct and recreate the social complexity of many overlapping factors, including a view of the longue durée of the local communities of practice. The different cycles and events that were part of daily practices which transformed the physical characteristics of the space through generations of dwellers. Communities whose social practices adapted the landscape and surrounding geologic materials to the needs of the group. Additionally, providing a new type of interpretation where lithic technology can be theorized as a more egalitarian and widely distributed technology and knowledge.

The regional study used Geographical Information System to better understand the overall connections and constellations of practices in the NWML. The result was a view of the roads, the regional settlement, and lithic distribution. Mapping the flow of goods by reconstructing the Least Cost Path Analysis and comparing the results with the materiality of roads and settlements associated. Studying the region from a bottom-up perspective, where the rural communities and all the different groups of society were at the center of the research. Not differentiating by type of evidence or location, but trying to encompass and consider as many different aspects or archaeological research. Including the use of archaeological science and material studies. The tools used should represent a methodology that can be replicated and even tested within the study region or applied in similar contexts. At all the various levels of analysis controls and calibration techniques were used as filters and checks.
Bibliography

Abrams, Elliot M
1994 How the Maya built their world: energetics and ancient architecture: University of Texas Press.

Acosta, Jorge R.

Acosta, Joseph de

Adams, Richard E. W., and Woodruff D. Smith

Adler, Michael A

Ahler, Stanley A.
1975 Pattern and Variety in Extended Coalescent Lithic Technology, University of Missouri-Columbia.

Aldenderfer, Mark S., Larry R. Kimball, and April Sievert

Aldenderfer, Mark S., and Charles Stanish

Aliphat, Mario
1994 Classic Maya Landscape in the Upper Usumacinta Valley, Department of Archaeology, Calgary.

Allen, Kathleen M., Stanton W. Green, and Ezra B. W. Zubrow, eds.

Alvarado, Pedro
Amick, Daniel S, and Raymond P Mauldin

Anaya Hernández, Armando

— 2002 The Pomoná Kingdom and its hinterland. FAMSI.

— n.d. Frail alliances, shifting boundaries: the growth and wane of the Usumacinta region Kingdoms. The XXXI Maya Meetings at Texas, SF.

Anderson, Heath J., and Kenneth G. Hirth

Andrefsky, William Jr


— 2001 Lithic Debitage: Context, Form, Meaning. Salt Lake City, Utah: University of Utah Press.


Andrews, Anthony P.

Andrews, Bradford
[References]

Andrews, George

__


Andrieu, C.

Annegarn, H J, and S Bauman

Anschuetz, Kurt F., Richard H. Wilshusen, Cherie L. Scheick

Aoyama, Kazuo

__


__


Ardren, Traci, et al.

Arnauld, Charlotte M.

Arnold, Dean E.

Arnold, Eric J., and Robert McC. Netting

Ashmore, Wendy
Barba, Luis A.  

—  
1990b Radiografía de un sitio arqueológico. Mexico D.F.: UNAM.  

—  

Barba, Luis A., and Linda Manzanilla  


Barba, Luis A., and Agustín Ortiz  

Barba, Luis A., and Manuel E. Pérez Rivas  

Barba, Luis A., and Roberto Rodríguez  
1991 Manual de técnicas microquímicas de campo para la arqueología: Instituto de Investigaciones Antropológicas, UNAM.  

Barnhart, Edwin L.  

—  
2001 The Palenque Mapping Project: Settlement and urbanism at an ancient Maya city, Faculty of the Graduate School of the University of Texas at Austin, University of Texas at Austin.  

Barrera Vasquez, Alfredo, Juan Ramon Bastarrachea Manzano, and William Brito Sansores  
Bartlett, Mary Lee, and Patricia A. McAnany

Bates, Robert Latimer, and Julia A Jackson

Baumler, Mark F, and Christian E Downum

Bawden, Garth

Bayman, James M., and M. Steven Shackley

Beaudry, Mary C.

Becker, Marshall Joseph

Benavides Castillo, Antonio

Bennet, Jane


Berlin, Heinrich

Bernal Romero, Guillermo

2011 El señorío de Palenque durante la Era de K’inich Janaahb’ Pakal y K’inich Kan B’ahlam (615-702 d.C.) PDF, Facultad de Estudios Mesoamericanos, UNAM.

Bethell, Philip, and Ian Máté

Bharathi, Latchumi Kanthan, and K Joseph John
2013 Momordica genus in Asia: an overview: Springer.
Binford, Lewis R.


—


—


Binford, Lewis R., John F. Cherry, and Robin Torrence

1983  In pursuit of the past : decoding the archaeological record. New York: Thames and Hudson.

Binford, Lewis R., ed.


Bishop, Ronald L., Robert L. Rands, and Garman Harbottle


Blanton, Richard E., and Lane Fargher


Bleed, Peter


—


Blom, Franz

1923  Las Ruinas de Palenque. Mexico: INAH.

Blom, Franz, and Gertrude Duby


Blom, Franz, and Oliver LaFarge

1926  Tribes and Temples: A Record of the Expedition to Middle America, Conducted by the Tulane University of Louisiana in 1925. New Orleans: Tulane University.

Bolles, David, William J. Folan


Bourdieu, Pierre


—

Bradbury, Andrew P., and Phillip J. Carr

__


__


__

Brabury, Andrew P., and Jay D. Franklin
Bradley, Richard
Brantingham, Jeffrey, and Steven L. Kuhn
Braswell, Geoffrey E.
Braudel, Fernand
Brokman, Carlos H.
Brown, Marley R., and Edward C. Harris
Browser, Brenda J., and John Q. Patton
Bruce, Robert
1976  Textos y dibujos Lacandones de Naja / Lacandon Texts and drawings from Nahá. Volume 45. Mexico D.F.: INAH, SEP.
Burkhart, Louise M.

Callahan, Errett, and Christine W. Dragoo

Campiani, Arianna
2011 Análisis urbano y arquitectónico de Chinikihá, Chiapas: informe final. UNAM-INAH.

—— 2014 Arquitectura de la Arqueología: analisis de la estructura urbana de Chinikih y Palenque entre los siglos VII y VIII, Facultad de Arquitectura, Universidad Autónoma de Mexico.

Cancian, Frank

Canter, Ronald L.

Canter, Ronald L., and Dave Pentecost

Canuto, Marcello, and Jason Yaeger, eds.

Carballo, David M.

Carballo, David M., and Thomas Pluckhahn

Carke, David

Carman, Kelli, Patricia A. McAnany, and Jeremy A Sabloff

Carpenter, Lacey B., Gary M. Feinman, and Linda M. Nicholas

Carr, Philip J, and Andrew P Bradbury

Carrasco, Pedro

—

Carter, T., and M. Steven Shackley

Caso Barrera, Laura

CFE
2002 Subdirección de Construcción Coordinación de Proyectos Hidroeléctricos Informe del salvamento del proyecto hidroeléctrico en la zona de Boca del Cerro, P.H. Boca del Cerro, Tabasco, Arqueologia.

Chambers, Erve J., and Philip D. Young

Chang, Kwang-Chih

Chase, Arlen E., and Diane Z. Chase

Chase, Arlen F., et al.

Chase, Arlen F., Diane Z. Chase

Chase, Diane Z., and Arlen F. Chase

—

Chinchilla, Oswaldo, and Edgar Carpio Rezzo
2003 EL TALLER DE OBSIDIANA DE EL BAÚL, ZONA NUCLEAR DE
COTZUMALGUAPA: INFORME PRELIMINAR. In XVI Simposio de Investigaciones
Arqueológicas en Guatemala, 2002. J.P. Laporte, B. Arroyo, H. Escobedo, and H. Mejia,
Church, Tim, Julie Francis, and Cherie Haury
1995 Lithic resource studies: a sourcebook for archaeologists. Volume 3. Tulsa, Okla:
University of Tulsa, Department of Anthropology.
Ciudad Real, Antonio de
1984 Calepino Maya de MotúlMexico DF: Universidad Autonoma de Mexico.
Clark, Desmond
1997 Prismatic Blade -Making, Craftsmanship, and Production: An Analysis of
Obsidian Refuse from Ojo de Agua, CHiapas, Mexico. Ancient Mesoamerica 8:137-159.
Clark, John E.
1986 From mountains to molehills: a critical review of Teotihuacan's obsidian industry.
Greenwich: JAI press.
—
1989a La Tecnica de Talla de los Lacandones de Chiapas. In La Obsidiana en
Nacional de Antropologia e Historia.
—
1989b Obsidian Tool Manufacture. In Ancient Trade and Tribute: Economies of teh the
Soconusco Region of Mesoamerica. B. Voorhies, ed. Pp. 215-228. Salt Lake CIty, Utah:
University of Utah Press.
—
1990 Enfoque Experimental en el Análisis de Talleres de Obsidiana Mesoamericanos:
un Ejemplo de Ojo de Agua,. In Nuevos Enfoques en el Estudio de la Lítica M. Doto de
—
1991 Flintknapping and Debitage Disposal among the Lacandon Maya of Chiapas,
63-78. Arizona State University Anthropological Research papers 42. Tempe: Arizona
State University
—
1995 Craft Specialization as an Archaeological Category. In Research in Economic
—
2003a Craftsmanship and Craft Specialization. In Mesoamerican Lithic Technology:
Experimentation and Interpretation. K.G. Hirth, ed. Pp. 220-233. Salt Lake City, Utah:
University of Utah Press.
—
2003b Review of Twentieth-Century Mesoamerican Obsidian Studies. In Mesoamerican
Lake City: University of Utah Press.


Clark, John E., and Douglas Bryant  

Clark, John E., and Stephen D. Houston  

Clark, John E., and Thomas A. Lee  

Clark, John E., Michael Blake  

Clarke, David L.  

Cobean, Robert H.  

Cobean, Robert H., et al.  

Cobos, Rafael  
2003  The Settlement Patterns of Chichen Itza, Yucatan, Mexico, Department of Anthropology, Tulane University.

Cochrane, Grant W.G.  

Cockrell, Bryan R.  
2014  The Metals from the Cenote Sagrado, Chichén Itzá as Windows on Technological and Depositional Communities, Anthropology, University of California Berkeley.

Coe, Michael D., and Kent V Flannery  

Coe, William R.  
1958  Piedras Negras archaeology: artifacts, caches, and burials, Anthropology, University of Pennsylvania.

Coggins, Clemency
1975  Painting and drawing styles at Tikal: An historical and Iconographic Reconstruction, Department of Fine Arts, Harvard University.

Collins, Michael B.

Conkey, Margaret W., and Christine Hastorf, eds.
1990  The uses of Style in Archaeology. Cambridge: Cambridge University Press.

Conolly, James, and Mark Lake

Conrad, Geoffrey W., and Arthur A. Demarest
1984  Religion and Empire: The Dynamics of Aztec and Inca Expansionism. Cambridge: Cambridge University Press.

Cook, Scott

Coole, Diana, and Samantha Frost

Corona Núñez, José , and Francisco del Paso y Troncoso

Cortés, Hernán

Costin, Cathy Lynne

—

—

Cotterell, Brian, and Johan Kamminga

Cotterell, Brian, Johan Kamminga, and Frank P Dickson

Cowgill, George L.

—

Crabtree, Don E.


Cunow, Heinrich 1929 El Sistema de parentesco peruano y las comunidades gentilicias de los Incas. Paris: Imprenta "le Livre libre".


De Montmollin, Oliver


De Vos, Jan
1994 Oro Verde: la Conquista de la Selva Lacondona por los Madereros Tabasqueños 1822-1949 Mexico: FCE.


Deal, Michael

DeBoer, Warren

Del Rio, Antonio, and Pablo Felix Cabrera

Delvendahl, Kai
2005 Las Sedes del Poder: Arquitectura, Espacio, Funcion y Sociedad de los Conjuntos Palaciegos del Clasico Tardio en el Area Maya Evaluados desde la Arqueologia y la Iconografia, Facultad de Filosofia y Letras, Instituto de Investigaciones Antropologicas, Posgrado en Antropologia, UNAM.

Demarest, Arthur


Demarest, Arthur, et al.

Denevan, William M.


Dillian, Carolyn D, and Carolyn L. White

Dobres, Marcia-Anne


Dobres, Marcia-Anne, and John Robb

Dockall, John E., and Harry J. Shafer

Downey, Greg, Monica Dalidowicz, and Paul H. Mason

Doyle, James A., Thomas G. Garrison, and Stephen D. Houston

Drennan, Robert D.

Drewitt, Bruce

Duning, Nicholas P.

Dunning, Nicholas, Timothy Beach, and David Rue

Dunning, Nicholas P., ed.

Durkheim, Émile

Earle, Timothy

Earle, Timothy, and Jonathan Erickson, eds.

Early, John

Edens, Christopher

Eerkens, Jelmer W

Eerkens, Jelmer W, et al.

Eerkens, Jelmer W, and Michael D. Glascock

Eren, Metin I, Aaron Greenspan, and C Garth Sampson

Evans, Susan Toby, Elliot Marc Abrams, and Bruce Gregory McCoy
Evershed, R.P., S.N. Dudd, and M.J. Lockheart  
Evershed, R.P., et al.  
Farnell, Brenda  
Fedick, Scott L.  
Feinman, Gary M.  

Feinman, Gary M., and Christopher P. Garraty  
Ferguson, Jeffrey R., and Craig E. Skinner  
Fernández, Fabián, et al.  
Fischer, Manfred M.  
Flad, Rowan K., and Zachary Xavier Hruby  
Flannery, Kent V., ed.  
Flenniken, Jeffrey J., and Anan W. Raymond  
Folan, William J.  
Folan, William J., et al.
Folan, William J., Joyce Marcus y W. Frank Miller

Ford, Anabel

Ford, Richard

Fowler, William R.

Fox, John W.

Fox, John W., et al.

Freidel, David A.

Freidel, David A., Kathryn Reese-Taylor, and David Mora-Marín

Fry, Robert E.

Gage, Tomas
García Moll, Roberto
1975  Primera temporada arqueológica en Yaxchilán, Chiapas. INAH Boletín 12:3-12.

—  

—  

Garraty, Christopher P.

Garza, Mercedes de la , et al., eds.
1983  RELACIONES HISTORICO-GEOGRAFICAS DE LA GOBERNACIÓN DE YUCATÁN (Merida, Valladolid y Tabasco) II  Mexico D.F.: Instituto de Investigaciones Filológicas, Centro de Estudios Mayas, Fuentes Para el Estudio de la Cultura Maya I, UNAM

Gates, William

Gero, Joan M.

Gerry, John P.
1993  Diet and Status among the Classic Maya: An Isotopic Perspective, Department of Anthropology, Harvard University.

Gibson, Charles

—  

Gibson, Eric C.

Gibson, Kathleen R., and Tim Ingold, eds.

Giddens, Anthony

—  

Gillespie, Susan D.


Ginzburg, Carlo

Ginzburg, Carlo, John Tedeschi, and Anne C. Tedeschi

Glascock, Michael D., ed.


Glascock, Michael D., Michael Elam, and Kazuo Aoyama

Glascock, Michael D., et al.

Golden, Charles W., et al.
2004 Reconocimiento y Patrones de Asentamiento en la Sierra del Lacandon, Peten.


Gonzáles Cruz, Arnoldo
1991 Proyecto Especial Palenque, Tercera temporada de Campo. INAH.

_—_ 1993 Excavaciones arqueológicas en Palenque, Chiapas 11a parte: Excavaciones arqueologicales en el Grupo XVI de Palenque, Chiapas. INAH.

Gonzales, Tatiana Loya, and Travis W. Stanton

Gonzalez, Silvia, et al.

Goody, Jack
Goodyear, Albert C.
1979 A hypothesis for the use of cryptocrystalline raw materials among Paleo-Indian groups of North America.

Gorenflo, Larry J., Thomas L. Bell

Gosden, Chris

Gould, Richard A

Graham, Elizabeth

Graham, John A., and Robert F Heizer


Gramly, Richard Michael

Grave Tirado, Luis Alfonso
1996 Patron de asentamiento en la region de Palenque, Chiapas, Arqueologia, Escuenal Nacional de Antropologia e Historia.

Greene Robertson, Merie

Grube, Nikolai

Grube, Nikolai y Simon Martin
1996b Notebook for the XXIInd Hieroglyphic Forum at Texas: Deciphering Maya Politics. Maya Workshop Foundation.

Guevara Sanchez, Arturo
1981 Los talleres líticos de Aguacatenango, Chis. Volume 95. Mexico DF: SEP, INAH.

Hall, Christopher T., and Mary Lou Larson, eds.
Halperin, Cristina T.
Halperin, Cristina T., et al.
Halperin, Rhoda H.
Hammel, E. A., and Peter Laslett
Hammond, Norman
Hammond, Norman, and Raymond Sidrys
Hanks, William F.
Hardy, Quentin
Harris, Edward
Harris, Edward C, Marley R. Brown, and Gregory J Brown
Harrison, Rodney
2010   Stone Tools. In The Oxford Handbook of Material Culture Studies. D. Hicks and
Haviland, William A.
1970   Tikal, Guatemala and Mesoamerican Urbanism. World Archaeology 2(2):186-
        198.
Hayden, Brian
Hayden, Brian, and Michael Deal
1981   Vitreous Materials Used by the Contemporary Maya. In Paper presented at the
        symposium Perspectivas en el Estudio de la Lítica, Universidad Nacional Autónoma de
        México.
Healan, Dan M.
1992   A Comment on Moholy-Nagy's" The Misidentification of Lithic Workshops".
1993   Local versus Non-Local Obsidian Exchange at Tula and Its Implications for Post-
        Formative Mesoamerica. World Archaeology 24(3).
1993   Ground Platform Preparation and the "Banalizaiton" of the Prismatic Blade in
Hegmon, Michelle
        536.
2008   Structure and Agency in Southwest Archaeology. In The Social Construction of
        Communities: Agency, Structure, and Identity in the Prehispanic Southwest. M.D.
Hendon, Julia A.
1989   Elite Household Organization at Copan, Honduras: Analysis of Activity
        Distribution in the Sepulturas Zone. In Households and communities : proceedings of the
        Twenty-first Annual Conference of the Archaeological Association of the University of
        Alta, Canada: University of Calgary, Archaeology Association.
        Anthropologist 93(4):894-918.


Hendon, Julia A., Rosemary A. Joyce, and Jeanne Lopiparo


Herckis, Lauren R.

2015  Cultural variation in the Maya City of Palenque, Dietrich School of Arts and Sciences University of Pittsburgh.

Heron, Carl
Heron, Carl, and R.P. Evershed

Hess, Sean C.

Hester, Thomas R.

Hester, Thomas R., and Norman Hammond, eds.
1976 Maya Lithic Studies: papers from the 1976 Belize field symposium: Center for Archaeological Research, The University of Texas at San Antonio.

Hester, Thomas R., and Harry J Shafer
1984 Exploitation of chert resources by the ancient Maya of northern Belize, Central America. World Archaeology 16(2):157-173.

Hirth, Kenneth G.

Hill, Warren D., and John E. Clark

Hirth, Kenneth G.


2006b Obsidian Craft Production in Ancient Central Mexico. Salt Lake City: The University of Utah Press.


Hirth, Kenneth G., and Bradford Andrews, eds.


Hirth, Kenneth G., and Jeffrey J. Flenniken


Hirth, Kenneth G., Geoffrey G. McCafferty, and William R. Fowler

Hirth, Kenneth G., and Joanne Pillsbury

Hiscock, Peter, and Val Attenbrow

Hoard, Robert J., et al.

Hodder, Ian

—

Hodder, Ian, and Clive Orton

Högberg, Anders

Hohmann-Vogrin, Annegrete

Holley, George
1986  The ceramic sequence at Piedras Negras Guatemala. Ceramica de la Cultura Maya 14.

—

Holmes, William Henry
1894a  An Ancient quarry in Indian territory. Washington: G.P.O.

—

—

Hruby, Zachary Xavier
2006  The organization of chipped-stone economies at Piedras Negras, Guatemala, Antropology, University of California, Riverside.

Hughes, Richard E.

Hughes, Richard E., and Robert L. Smith

Hull, Kathleen Louann
2002  Culture contact in context: a multiscale view of catastrophic depopulation and culture change in Yosemite Valley, California, Anthropology, University of California, Berkeley.

Hutchins, Edwin

Hyslop, John

Iannone, Gyles, ed.

Ingold, Tim


Inizan, Marie-Louise  

Inomata, Takeshi  

—  

—  

Inomata, Takeshi, D. Triadan, E. Poncoano, R. Terry, y H.F. Beaubien  

Inomata, Takeshi, and Stephen D. Houston, eds.  

Inomata, Takeshi, and Pason Sheets  

Inomata, Takeshi, and Laura Stiver  

Isbell, William H.  

Jaeger (Liepens), Susan Elizabeth  
1991 Settlement Pattern Research at Caracol, Belize: The Social Organization in a Classic Period Maya Site, Department of Anthropology, Southern Methodist University.

Jarvis, Kym E.  

Jenkins, Ron  

Jennings, Thomas A, Charlotte D Pevny, and William A Dickens  

Jeske, Robert  

Jimenez Alvarez, Socorro del Pilar

2009  Catalogo de la Ceramica de Chinikihá. UADY, UNAM.

2015  Consumo, Produccion y distribuicion especializada de los bienes ceramicos durante el clasico tardio de Chinikiha, Chiapas, Mexico, Departamento de Anthroponlogia Universidad Nacional Autonoma de Mexico

Johnson, Jay K.
1976a  Chipped Stone Artifacts from the Western Maya Periphery, Department of Anthropology, Souther Illinois University.


Johnson, Phillip R.

Joyce, Rosemary A.


McDonald Institute of Archaeological Research, University of Cambridge: Dist. Oxbow Books.

—


—


—


—


Joyce, Rosemary A., and Susan D. Gillespie

Joyce, Rosemary A., and Julia A. Hendon

Joyce, Rosemary A., and Jeanne Lopiparo

Joyce, Rosemary, and Joshua Pollard

Juárez, Daniel, and Stephen Castillo

Kamp, Kathryn A.

Kaneko, Akira

Kardulias, Nick P., and Richard W. Yerkes, eds.

Keller, Angela H.
2009 A Road by Any other Name: Trails, Paths, and Roads in Maya Language and Thought. In Landscapes of Movement: Trails, Paths, and Roads in Anthropological
Keller, Charles M.

Kellogg, Susan Melinda

Kelly, Raymond Case

Kemple, D. R. C., and J. A. Templeman

Kent, Susan

Kirch, French D, Christopher J Duffy, and Gopal Bhatt

Knight, Charles L. F.
2016 Variation in Residential Prismatic Blade Production and Status during the early Classic at Palo Errado, Veracruz. Ancient Mesoamerica 27(01):71-90

Kooyman, Brian P.

Kovacevich, Brigitte

Kuhn, Steven L.

Kurjack, Edward B. , and E. Wyllys Andrews V.

LaMotta, Vincent M., and Michael B. Schiffer

Larson, Mary Lou

Laslett, Peter, and Richard Wall, eds.

Latour, Bruno
2005 Reassembling the Social. Oxford: Oxford University

Lave, Jean
——
——
——

Lave, Jean, and Etienne Wenger

Le Guin, Ursula
2004 A Rant About "Technology".

Lechtman, Heather
——
——

LeCount, Lisa J.
——

Lee Whiting, Thomas A.
1978 The Historical Routes of Tabasco and Northern Chiapas and their Relationship to Early Cultural Developments in Central Chiapas. In Mesoamerica Communication


Lewenstein, Suzanne M. 1987 Stone tool use at Cerros: the ethnoarchaeological and use-wear evidence Austin, TX: University of Texas Press.


Leyden, Barbara, Mark Brenner, y Bruce Dahlin 1998 Cultural and Climatic History of Cobá, a Lowland Maya City in Quintana Roo, Mexico. Quaternary Research (49):111-122.

Liendo Stuardo, Rodrigo

_—_

2002  La Organizacion de la Produccion Agricola en un Centro Maya del Clasico: Patron de Asentamiento en la Region de Palenque, Chiapas, Mexico = The organization of agricultural production at a classic Maya center: settlement patterns in the Palenque region, Chiapas, Mexico. C.O. Rodriguez, transl. Mexico D.F. : INAH.

_—_


_—_


_—_


_—_

2009  Segundo Informe Parcial Proyecto Arqueologico Chinikiha, Temporada 2008. IIA-UNAM.

_—_

2010  Proyecto Arqueologico Chinikiha: Tercer Informe Parcial Temporada 2010. IIA, UNAM.

_—_


Liendo Stuardo, Rodrigo, and Keiko Teranishi Castillo, eds.


Linehan, C., and J. McCarthy


Lira, Rafael, and Javier Caballero


Llobera, Marcos


Llobera, Marcos, P. Fábrega-Álvarez, and C. Parcero-Oubiña


Lobato, Rodolfo

2003  "Por las veredas de los antiguos". Las nuevas comunidades Mayas en de la Selva Lacandona y el control del espacio. . In Espacios Mayas, usos, representaciones y

Lockhart, James

Lohse, Jon C., and Fred Jr Valdez, eds.
2004 Ancient Maya commoners. Austin, TX: University of Texas Press.

Lola, Carlos R.

Lopez Austin, Alfredo

Lopez Bravo, Roberto


— 2013a State Interventionism in the Late Classic Maya Palenque Polity: Household and Community archaeology at the El Lacandón Anthropology, University of Pittsburg.

— 2013b State Interventionism in the Late Classic Maya Palenque Polity: Household and Community Archaeology at El Lacandón, Graduate Faculty of Kenneth P. Dietrich School of Arts and Sciences, University of Pittsburgh.

López Bravo, Roberto, Javier López Mejía, and Benito Venegas Durán

López Pérez, Eos
2017 Residuos químicos en apisonados de tierra de dos unidades habitacionales Mayas del periodo Clásico en la región de Palenque, Chiapas, Arqueología, ENAH.

López Varela, Sandra L.
1994 Pomona, Tabasco: una ciudad puerta de entrada durante el Clásico. Tierra y Agua, La antropología de Tabasco:33-42.

— 1996 The K'axob Formative Ceramics: The Search for Regional Integration through a Reappraisal of Ceramic Analysis and Classification in Northern Belize, University of London.

Lorenzo, Jose Luis, and Lorena Mairambell, eds.

Loughmiller-Newman, Jennifer A.

Luedtke, Barbara E.

Mackie, Quentin
2001  Settlement archaeology in a Fjordland archipelago: network analysis, social practice, and the built environment of Western Vancouver Island, British Columbia, Canada since 2,000 BP. London: Archaeopress.

MacNeish, Richard, Antoinette Nlken-Terner, and Irmgard Johnson

Maestri, Nicoletta

Magne, Martin Paul Robert

—

Malainey, Mary E.

Maler, Teobert

—

—

Mallory, John K.

Manzanilla, Linda, ed.
1987  Coba, Quintana Roo Analisis de dos unidades habitacionales Mayas del horizonte Clasico. Mexico DF: Universidad Nacional Autonoma de Mexico.

—

Manzanilla, Linda, and Luis Barba
1990  The study of activities in Classic Households: Two case studies from Coba and Teotihuacan. Ancient Mesoamerica 1:41-49.
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Title</th>
<th>Location/Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marion Singer, Marie-Odile</td>
<td>1991</td>
<td>Los hombres de la selva : un estudio de tecnología cultural en medio selvático: INAH, SEP.</td>
<td></td>
</tr>
<tr>
<td>Marken, Damien B, ed.</td>
<td>2007</td>
<td>Palenque : recent investigations at the classic Maya center. Lanham, MD: Altamira Press.</td>
<td></td>
</tr>
<tr>
<td>Martin, Simon, and Nikolai Grube</td>
<td>2000</td>
<td>Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya. London: Thames and Hudson.</td>
<td></td>
</tr>
<tr>
<td>Martinez Muriel, Alejandro</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Masson, Marilyn A.


Masson, Marilyn A., and David A. Freidel, eds.


Mastache, Alba Guadalupe, et al., eds.

Matheny, Ray T.

Mathews, Peter

Matusov, Eugene, Nancy Bell, and Barbara Rogoff

Mauss, Marcel

McAnany, Patricia A.


— 1992  Agricultural tasks and tools: Patterns of stone tool discard near prehistoric Maya residences bordering Pulltrouser Swamp, Belize. In Gardens of prehistory: the


1995  Living with the Ancestors: Kinship and Kingship in Ancient Maya Society. Austin, TX: University of Texas Press.


McCaa, Robert  

McCafferty, Sharisse D., and Geoffrey G. McCafferty  

McKillop, Heather Irene  

McSwain, Rebecca  

Meanwell, Jennifer L, et al.  

Mejía, Héctor E., and Edgar Oswaldo Suyuc Ley  

Mejía, Javier López  
2005  Los Grupos Arquitectónicos de Palenque: Una Propuesta de Análisis, Departamento de Arqueología, Escuela Nacional de Antropología e Historia.

Melendez Guadarrama, Lucero, Felipe Trabanino Garcia, and Adriana Caballero Roque  
2013  Tres Perspectivas en torno al uso comestible de las inflorescencias de las palmas pacay(a) y chapay(a) en Chiapas, Mexico: enfoques paleoetbotanico, nutricional y lingüístico. Estudios de la Cultura Maya XLI:175-199.

Michels, Joseph W.  

Miles, Suzanne W.

Míron Marván, Esteban


— 2014  Las prácticas culinarias y sus recipientes cerámicos en la región de Palenque y Chinikihá durante el Clásico Tardío, Arqueologia, Escuela Nacional de Antropología e Historia.

Moholy-Nagy, Hattula


— et al.


Montañez, Pablo


Montero Lopez, Coral

2008  Infiriendo el contexto de los restos faunísticos a través de la tafonomía: el análisis de un basurero doméstico asociado al palacio de Chinikihá, Chiapas, Facultad e filosofía y Letras / Instituto de Investigaciones Antropológicas, Universidad Nacional Autónoma de Mexico.
2012 From Ritual to Refuse: Faunal exploitation by the elite of Chinikihá, Chiapas, during the Late Classic Period, School of Historical and European Studies, Faculty of Humanities and Social Sciences, La Trobe University.

Montero Lopez, Coral, and Luis Núñez

Montgomery, John

Morehart, Christopher T.

Morgan, L. Holmes

Morrow, Toby A.

Mülleried, Federico K.G.
1957 Geologia de Chiapas: Edit Cultura T.G.S.A.

Murata, Satoru
2011 Maya salters, Maya potters: The archaeology of multicrafting on non-residential mounds at Wits Cah Ak' Al, Belize, Graduate School of Arts and Sciences, Boston University.

Nations, James D.

Nations, James D., and John E. Clark

Navarrete, Carlos

Navarrete, Carlos C.


Negash, A., et al.
Negash, A., and M. S. Shackley

Negash, A., M. S. Shackley, and M. Alene

Nelson, Fred W., and John E. Clark

Nelson, Margaret C.

Nelson, Zachary

Netting, Robert McC.

Netting, Robert McC, Richar R. Wilk, and Erick J. Arnould, eds.

Nichols, Deborah L.

Nir, Dov

Normark, Johan
2006 The Roads In-Between: Causeways and Polyagentive Networks at Ichmul and Yo'okop, Cochuah Region, Mexico GOTARC, Serie B Gothenburg Archaeological Theses no 45, Department of Archaeology and Ancient History, Göteborg University.


Obenauf, Margaret S.

Obregón Cardona, Mauricio
2014 Distribución de vestigios, usos de espacio y prácticas domésticas en unidades habitacionales Mayas de la región de Palenque. UNAM, IIA.

Ochoa Salas, Lorenzo
1978 Estudios Preliminares sobre los Mayas de las TIerras Bjas Noroccidentales Mexico DF: Universidad Nacional Autonoma de Mexico.

Odell, George H.

—

—

Odland, Portisch Anna

Ordóñez, Galán Celestino y Roberto Martínez-Alegría López

Ortiz, Agustín, and Linda Manzanilla

Paris, Elizabeth H., and Carlos P. Peraza Lope

Parkes, Penelope A.

Parnell, J, Jacob, Richard E Terry, and Zachary Nelson

Parnell, J. Jacob, Richard E. Terry, and Payson Sheets

Parsons, Jeffrey R.

—
1972 Archaeological Settlement Patterns Annual Reviews of Anthropology 1:127-147.

Pauketat, Timothy R.

Pecora, Albert M.

Pelcin, Andrew

Pelegrin, Jacques

Pelegrin, Jacques, Claudine Karlin, and Pierre Bodu, eds.

Pendergast, David M.

Peterson, James A.
1983 Petroleum Geology and Resources of Southeastern Mexico, Northern Guatemala, and Belize. Department of the Interior.

Pierrebourg de, Fabienne, Luis Barba, and Claudia Trejo

Pina Chan, Roman

Pinkus Rendon, Manuel Jesus
2010 Los pueblos mayas y mestizos de Boca del Cerro, Tenosique, y sus alternativas turísticas. Mexico D.F.: IIF-UNAM, Centro Penninsular en Humanidades y Cinecias Sociales, Consejo de Ciencia y Tecnología, Estado de Tabasco.

Polanyi, Karl

Ponce, Fray Alonso
1875 Relación Breve y verdadera de algunas cosas de las muchas que sucedieron al Padre Fray Alonso Ponce en las Provincias dela Nueva España, siendo Comisario General de aquellas partes. 2 vols. Madrid, España.

Potter, Daniel R., and Eleanor M. King

Potter, James M., and Thomas D. Yoder

Poupeau, G., et al.

Preucel, Robert W.

Railey, Jim., and Eric J. Gonzales

Rands, Robert L.


Rands, Robert L., and Ronald L. Bishop


Ringle, William 1985 The Settlement Patterns of Komchen, Yucatan, Mexico, Tulan University, University Microfilms International, Ann Arbor.


Robin, Cynthia 1999 Towards an archaeology of everyday life: Maya farmers of Chan Noohol and Dos Chombitos Cik'in, Belize, Department of Anthropology, University of Pennsylvania.


Roddick, Andrew P. 2009 Communities of Pottery Production and Consumption on the Taraco Peninsula, Bolivia, 200 BC-300 AD, Anthropology University of California, Berkeley.


Rottländer, R.C.A.

Rovner, Irwin
1975 Lithic Sequences from the Maya Lowlands, Anthropology, University of Wisconsin.

Rovner, Irwin, and Suzanne M. Lewenstein

Roys, Lawrence y Edwin M. Shook, ed.

Russell, Bradley W., and Bruce H. DaWin

Ruz Lhuillier, Alberto

Sabloff, Jeremy A.

Saenz, Cesar A.
1954 Informe de los trabajos arqueologicos llevados a cabo en Palenque, Chiapas en 1954. INAH, SEP.

Sahagun, de Bernardino de (FRAY)

Sahlins, Marshall

Salas, Guillermo P., and E. Lopez Ramos

Salazar Ledesma, Flora L. I.
2010 Los pueblos del rio, perfiles urbanos de una unidad territorial. In Paisajes del Rio, Rios de Paisaje: Navegaciones por el Usumacinta. M.H. Ruz, ed. Mexico D.F.: Universidad Nacional Autonoma de Mexico, Instituto de Investigaciones Filologicas,
Centro Penninsular en Humanidades y Cinecas Sociales, Consejo de Ciencia y 
Tecnoogia, Estado de Tabasco.

San Roman Martin, Maria Elena  
2009   Palenque's ceramics: searching for a methodology for their study and 
classification.

Sanders, William T., Jedffrey R. Parsons, Roberts S. Santley  

Sanders, William T., and Barbara Price  

—  

Santamaria, Diana, and Joaquín García-Bárcena  
1984   Raspadores verticales de la cueva de Los Grifos. Volume 22. Mexico DF: SEP, 
INAH.

Santley, Robert S.  
1984   Obsidian Exchange, Economic Stratification, and the Evolution of Complex 
Society in the Basin of Mexico. In Trade and Exchange in Early Mesoamerica. K.G. 

—  
1991   The Structure of the Aztec transport network. In Ancient Road Networks and 
Cambridge University Press.

Santone, Lenore  
1997   Transport, Costs, Consumer Demnd, and Patterns of Intra-Regional Exchange: A 
Perspective on Commodity Production and Distribution from Northern Belize. Latin 

Sassaman, Kenneth E.  

—  
2000   A Southeastern Perspective on Soapstone Vessel Technology in the Northeast. In 
The Archaeological Northeast. M.A. Levine, K.E. Sassaman, and M.S. Nassaney, eds. 
Pp. 75-96. Native Peoples of the Americas Westport, Conn: Bergin & Garvey.

Sassaman, Kenneth E., and Victoria Rudolphi  
2001   Communities of Practice in the Early Pottery Traditions of the American 

Scarborough, Vernon L., and Fred Jr Valdez  
2009   An Alternative Order: The Dualistic Economies of the Ancient Maya. Latin 

Schele, Linda y David Freidel  
Morrow.

Schele, Linda y Mary Miller

Schele, Linda y Peter Mathews


Scherer, Andrew K., and Charles Golden

Schiffer, Michael B.


Schlanger, Nathan

Schroeder, Susan, Stephanie Gail Wood, and Robert Stephen Haskett Haskett

Sellet, Frédéric

Service, Elman

Shackley, M. Steven


X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology. New York: Springer

Shafer, Harry J., and Thomas R. Hester


Sharer, Robert y Loa Traxler
Shaw, Justine M.
1998 The Community Settlement Patterns and Residential Architecture of Yaxuná, Yucatan, Mexico, from A.D. 600-1400, Southern Methodist University, University Microfilms International, Ann Arbor.

Shaw, Leslie C.
Sheets, Payson D.
1974 Differential change among the Precolumbian Artifacts of Chalchuapa, El Salvador., Anthropology, University of Pennsylvania
Sheets, Payson, Thomas L. Server
Shimada, Izumi, ed.
Shott, Michael J.

Sidrys, Raymond


Sidrys, Raymond V.


Silva de la Mora, Flavio G.

2008  Sicix Bābih, caminos en las Tierras Bajas Noroccidentales. Una propuesta de rutas de comunicación., Departamento de Arqueología, ENAH.


— 2012a  Informe preliminar y avance de resultados: estudio de la lítica; Proyecto Arqueológico Chinikihá. Instituto de Investigaciones Antropológicas, UNAM.


— 2013  Informe de Actividades Temporada 2012 (Mayo-Julio): Proyecto Arqueológico Chinikihá Prospección Arqueológica en el Grupo G (2do Informe Preliminar). IIA- UNAM, INAH.

— 2014  Prospeccion Arqueologica en el Grupo G. IIA-UNAM.

Silva de la Mora, Flavio G., and Esteban Mirón Marván


Simek, Jan F.


Simon, Arleyn W., and James H. Burton


Smith, Carol A.

Smith, Michael E.


Smith, Michael E., and Katharina J. Schreiber

Smith, Robert E.

Snead, James E., Clark L. Erickson, and Andrew Darling, eds.


Speal, Scott


Spielmann, Katherie A.

Stahle, David W, and James E Dunn

— 1984 Experimental Analysis of the Size Distribution of Waste Flakes from Biface Reduction.

Stark, Barbara L., and Christopher P. Garraty

Stoltman, James, and Richard E. Hughes

Stout, Dietrich


Stout, Dietrich, and Nada Khreisheh


Stuart, David


— 2006 The Inscribed Markers of the Coba-Yaxuna Causeway and the Glyph for Sakbih.

Stuart, David, and George Stuart


Sullivan, Thelma D.


Swell, William H. Jr.


Taliaferro, Mathews S., Bernard A. Schriever, and Steven M. Shackley


Teranishi, Keiko


Terry, Richard E, et al.


Thomas, Julian


Thompson, Edward Herbert, and John Eric Sidney Thompson

1938 The high priets grave: Chichen Itza, Yucatan, Mexico; a manuscript. 1 vols. Volume 27: Kraus Reprint.

Thompson, J. Eric


Tostevin, Gilbert B. 2011 Special Issue: Reduction Sequence, Chaîne Opératoire, and Other Methods: The Epistemologies of Different Approaches to Lithic Analysis. Paleoanthropology:293-296.


—

2014b  El uso de las plantas y el manejo de la selva por los antiguos mayas de Chinikihá. Interacciones sociedad y medio ambiente a traves de la paleoetbotanica y de la atracologia, Facultad de Filosofia y Letras / Instituto de Investigaciones Antropologicas, Universidad Nacional Autonoma de Mexico.

Triadan, Daniela, and Takeshi Inomata


Tringham, Ruth E.


—


—


—


—


—


—


—

Trombold, Charles D.
Trombold, Charles D., ed.
1991b Ancient Road Networks and Settlement Hierarchies in the New World. Cambridge Cambridge University Press.

Tudella, José
1956 Relacion de las ceremonias y ritos y poblacion y gobierno de los indios de la provincia de Michoacan (1541). Madrid: Aguilar.

Tykot, Robert H.

Vaesen, Krist

Vargas Pacheco, Ernesto

Varien, Mark D, and James M. Potter

Villa Rojas, Alfonso

Vogt, Evon Z.
1973 Los Zinacantecos: un grupo maya en el siglo XX. Mexico D. F.: SEP/SETENTAS.
—, ed.

Waibel, Leo
Warashina, Tetsuo

Warfield, James P.

Watanabe, John M.

Waters, Michael R., David D. Kuehn

Weedman, Arthur, Kathryn

Wells, E. Christian, et al.

Wells, E. Christian

Wells, E. Christian, and Karla L. Davis-Salazar, eds.

Wells, E. Christian, and Patricia A. Mcanany, eds.

Wenger, Etienne

Wernecke, D. Clark

West, Georgia

West, Robert C.
1969 The Tabasco Lowlands of Southern Mexico. Louisiana State University
—, ed.

Whittaker, J. C., et al.

Wilk, Richard

Wille, Gordon R.

1965a  Prehistoric Maya settlements in the Belize Valley. Cambridge: Peabody Museum

Willey, Gordon R., W. R. Bullard Jr., J. B. Glass y J. C. Gifford
Willey, Gordon R., y Richard M. Leventhal
Willey, Gordon, and Philip Phillips
1958  Method and Theory in American Archaeology. Chicago, IL: University of Chicago.
Wobst, Martin H.
Wolf, Eric R.
Woodfill, Brent K.S., and Chloé Andrieu
Wylie, Allison
Wynn, Thomas
Yanagisako, Sylvia Junko
Yerkes, Richard W.
Zipf, George Kingsley
Appendix: Lacandon Song (Bruce 1975: 24-25)

**U K’AYIL TOK’**

La u nachuybān,  
ni bako’,  
chāk p’okil!  
la in nach ‘ininobel,  
lā kulen  
in tsaste in to’ok’.  
La u na ch ‘ibil in tok’,  
āh ch ‘ibix!  
La u na ch ‘ich’il  
in tok’,  
kotmax!  
La u na ch ‘ibil in tok’,  
lā in na ch ‘imi’,  
lā in na bak.  
P’ok’uk’un!  
La u na ch ‘ich’il  
in tok’.  
La u na ch ‘ibil in tok’  
lā in ch ‘imi’,  
lā in na bak.  
Witso, eh!  
La u na ch ‘ibil in tok’,  
lā in ch ‘imi’,  
lā in bak.  
Balun hunk ‘uk’!  
La u ch ‘ibil in tok’,  
lā in ch ‘imi’,  
lā in bak.  
La kulen in tsaste in tok’.

**CHANT TO THE FLINT**

There are the good flint-flakers  
my antler punches  
!red headed woodpecker!  
there is my good quartz hammer stone,  
all sitting there  
where I flame my flint

There is the good grain of my flint,  
āh ch’ibix palm!  
There is the good flething  
for my arrowheads,

harpie eagle!  
There is the good grain of my flint,  
there is my good quartz,  
there is my good antler punch.

Cresta eagle, p’ok’uk’un!  
There is the good flething  
for my arrowheads.

There is the good grain of my flint,  
there is my quartz  
there is my good antler punch.  
Oh bald eagle!  
There is the good grain of my flint,  
there is my quartz,  
there is my antler punch.

Golden eagle!  
There is the grain of my flint,  
there is my quartz,  
there my punch.

Seated there, I flame my flint.

**CANTO AL PÉDERNAL**

Allá están las cosas buenas para lasquear pedernal  
mis cuernos de venado,  
!pájaro carpintero!  
allí está mi piedra Buena de cuarzo,  
todo en espera  
de que trabaja mi pedernal.  
Allí está la veta buena de mi pedernal,  
!palmera āh ch’ibix!  
Allí están las plumas buenas  
para mis pedernales  
!gran águila!  
Allí está la veta buena de mi pedernal,  
allí mi piedra Buena de cuarzo  
allí mi buen cuerno de venado  
!Águila de cresta, p’ok’uk’un!  
Allí están las buenas plumas  
para mis pedernales.  
Allí está la veta buena de mi pedernal,  
allí mi piedra de cuarzo,  
allí mi cuerno de venado.  
!Oh, águila de cabeza blanca witso’!  
Allí está la veta buena de mi pedernal,  
allí mi piedra de cuarzo,  
allí mi cuerno de venado.  
!Águila rapaz!  
Allí está la veta de mi pedernal,  
allí mi piedra de cuarzo,  
allí mi cuerno de venado.  
Allí sentado, escamo mi pedernal.

There are the good flint-flakers  
my antler punches  
!red headed woodpecker!  
there is my good quartz hammer stone,  
all sitting there  
where I flame my flint

There is the good grain of my flint,  
āh ch’ibix palm!  
There is the good flething  
for my arrowheads,

harpie eagle!  
There is the good grain of my flint,  
there is my good quartz,  
there is my good antler punch.

Cresta eagle, p’ok’uk’un!  
There is the good flething  
for my arrowheads.

There is the good grain of my flint,  
there is my quartz  
there is my good antler punch.  
Oh bald eagle!  
There is the good grain of my flint,  
there is my quartz,  
there is my antler punch.

Golden eagle!  
There is the grain of my flint,  
there is my quartz,  
there my punch.

Seated there, I flame my flint.
La kulen in huxtēh.
La u na ch‘ībil in tok’,
boyō’ beh.
La u na ch‘ībil in tok’
La u na ch‘ībil in tok’
āh komo’,
lə u na ch‘ībil in tok’.
Mehen ch‘īch’!
La u na ch‘ībil in tok’.
Sūk bok!
La u na ch‘ībil in tok’.
La u na ch‘ībil in tok’,
ṣuk,
lə in na bak ko’.
La kulen,
in kiki huxtēh in tok’.

Alli sentado lo pulo.
Alli está la veta buena de mi pedernal,
sombras en el camino.
Alli está la veta buena de mi pedernal
Alli está la veta buena de mi pedernal
platanillo,
allī está la buena veta de mi pedernal.
!Pajarito!
Alli está la veta buena de mi pedernal.
!Garza Blanca!
Alli está la veta buena de mi pedernal.
Alli está la veta buena de mi pedernal, yerba,
y allī mis Buenos cuernos de venado.
Alli sentado,
pulo muy bien mi pedernal.

Seated there, I dress its edge.
There is the good grain of my flint,
shadows on the road.
There is the good grain of my flint.
āh komo’ palm leaves,
there is the good grain of my flint.
Little Bird!
There is the good grain of my flint.
White heron!
There is the good grain of my flint.
There is the good grain of my flint,
grass,
there are my good antler punches.
Seated there,
I dress very well the edge of my flint.