CIRCLES OF GLASS AND GRAIN:

ECONOMIC DIFFERENCES BETWEEN CORE AND SEMI-PERIPHERAL ZONES, A STUDY OF PUBLIC CENTER LITHICS FROM THE TEQUILA VALLEYS OF WEST MEXICO.

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Circles of Glass and Grain: Economic Differences Between Core and Semi-Peripheral Zones, a Study of Public Center Lithics from the Tequila Valleys of West Mexico

Thesis directed by Associate Professor Christopher Beekman

ABSTRACT

The dynamics of expanding polities and relationships between cultural core groups, peripheral populations and sites in semi-peripheral areas between the two groups are important topics in studies of complex societies. One area where these distinctions are clearly identified within the settlement pattern formed by the relationship between the cultural and the natural landscape is the Tequila Valleys of Western Mexico. The Teuchitlán culture of the Late Formative and Early Classic periods formed distinctive settlements around the edges of the valleys, which were also marginally bound to most complex social developments within the cultural core region near the center of the valleys. Semi-peripheral sites between cultural traditions are of particular interest as focal points for economic, political, and social relationships. This thesis focuses on two sites which occupied very different environments, namely Llano Grande and Las Navajas. I ask whether these sites show different degrees of emphasis on two basic economic strategies in ways which capitalized on the advantages of each site's respective environment. Specifically, did Llano Grande's relative physical isolation from the cultural core area, more distant location and differences in available resources reflect a greater reliance on trade via exported obsidian? Alternatively, did Navajas' closer relation to the core allow a continuance of the core's degree of emphasis on the staple-oriented economy, with less emphasis on obsidian production and trade than Llano Grande? This thesis draws upon the work of Earle (1991) to structure the analysis, particularly his

contrast between wealth and staple finance. Past research is reviewed to develop expectations for each model, which are tested using the analysis of obsidian debitage and products within the ritual centers of each site.

The form and content of this abstract are approved. I recommend its publication.

Approved: Christopher Beekman

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CHAPTER I

INTRODUCTION

The Tequila Valleys and the Teuchitlán Culture

The Tequila Valleys area of West Mexico is a portion of a chain of lake basins at the base of the Tequila Volcano, which form an open area within the forested hills of the Sierra Madre Occidental mountain range that runs parallel to the Pacific Coast (Beekman 2010:43-44, 63; Fig. 1.1). During the Mesoamerican Late Formative and Early Classic periods (ca. 300 B.C. - 500 A.D), the Magdalena Basin on west side of the valleys contained a large lake, and the remaining basins were marshlands. The areas immediately surrounding the lake were interspersed with steep hills and valleys of marshes and fertile alluvial soils, which formed a secluded setting for the development of a complex culture known as Teuchitlán.

Aside from a general attraction to clay figurines and dioramas that have been quite popular with collectors since the turn of the 20th century (Townsend 1998a:17-22; Weigand 1975:186, 223, 1985:47-54; cf. Breton 1903, 1905; Hrdlička 1903:393; Lumholtz 1903), the region has generally been marginalized by earlier archaeologists and explorers as an area populated only with nomadic groups and simple chiefdoms (Beekman 1996b:136; cf. Fernandez and Deraga 1988; Schöndube 1998). However, more recent investigations have better recognized the area's true cultural significance. Around 1970, investigators began to recognize a pattern of ceremonial architecture that points to

a much larger and more complex society than previously assumed (Kelley 1974; Ohnersorgen and Varien 1996:103; Weigand and Beekman 1998). Today, the culture is

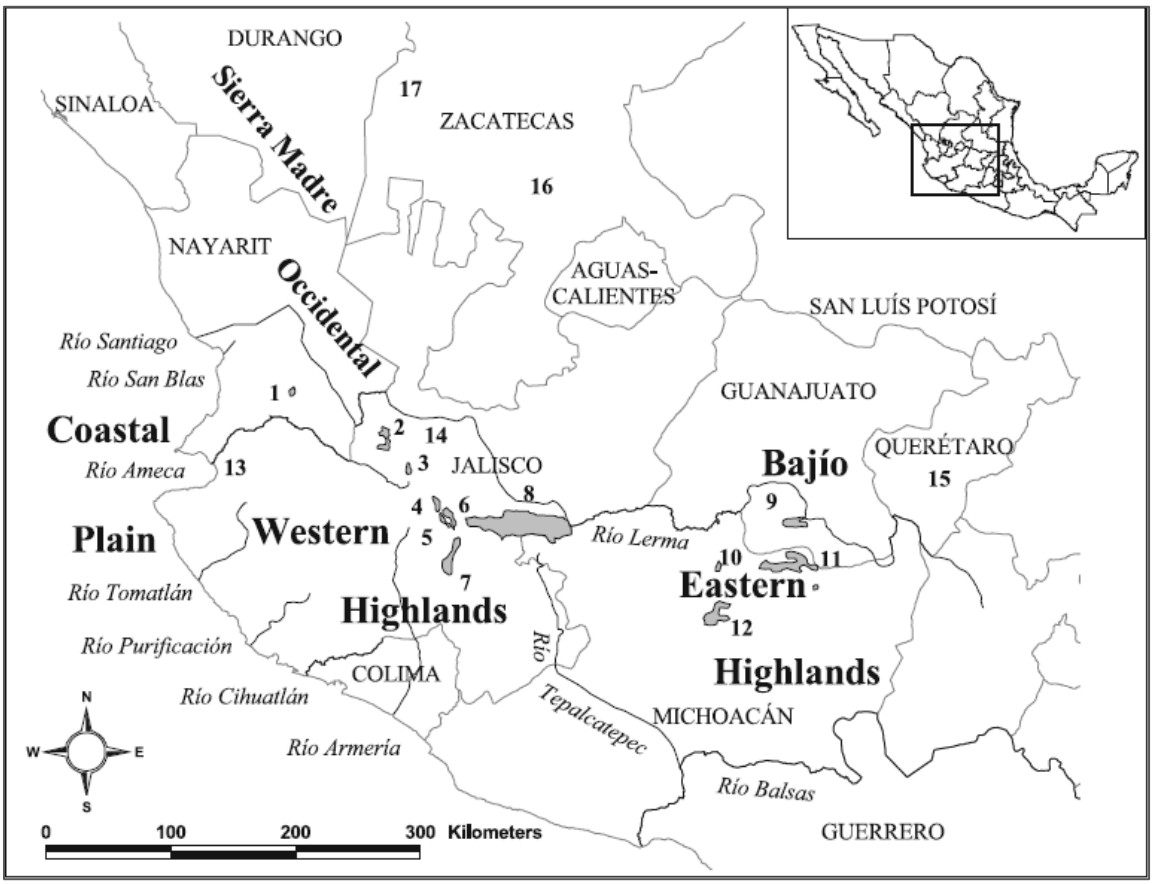

Figure 1.1: Map of West Mexico. Numbers indicate lake basins. Of particular interest to this thesis are the two main basins within the Tequila Valleys: Magdalena (2), and La Vega (3). Also of interest are more distantly associated sites in Sayula (7). (Beekman 2010:42).

known to a small but growing number of investigators as one unique to Mesoamerica with a social structure that has been described as something akin to either a complex chiefdom, or an early state (Beekman 1996a,b; Schöndube 1998; Weigand and Beekman 1998). One area for potential research is site specialization. Although the majority of sites associated with the Teuchitlán culture are found in a *core* population zone south of the

Tequila Volcano (figure 1.2), others are scattered throughout the rest of the Tequila Valleys. Six of the sites outside the core zone, namely Estolanos Mesa, Mesa El

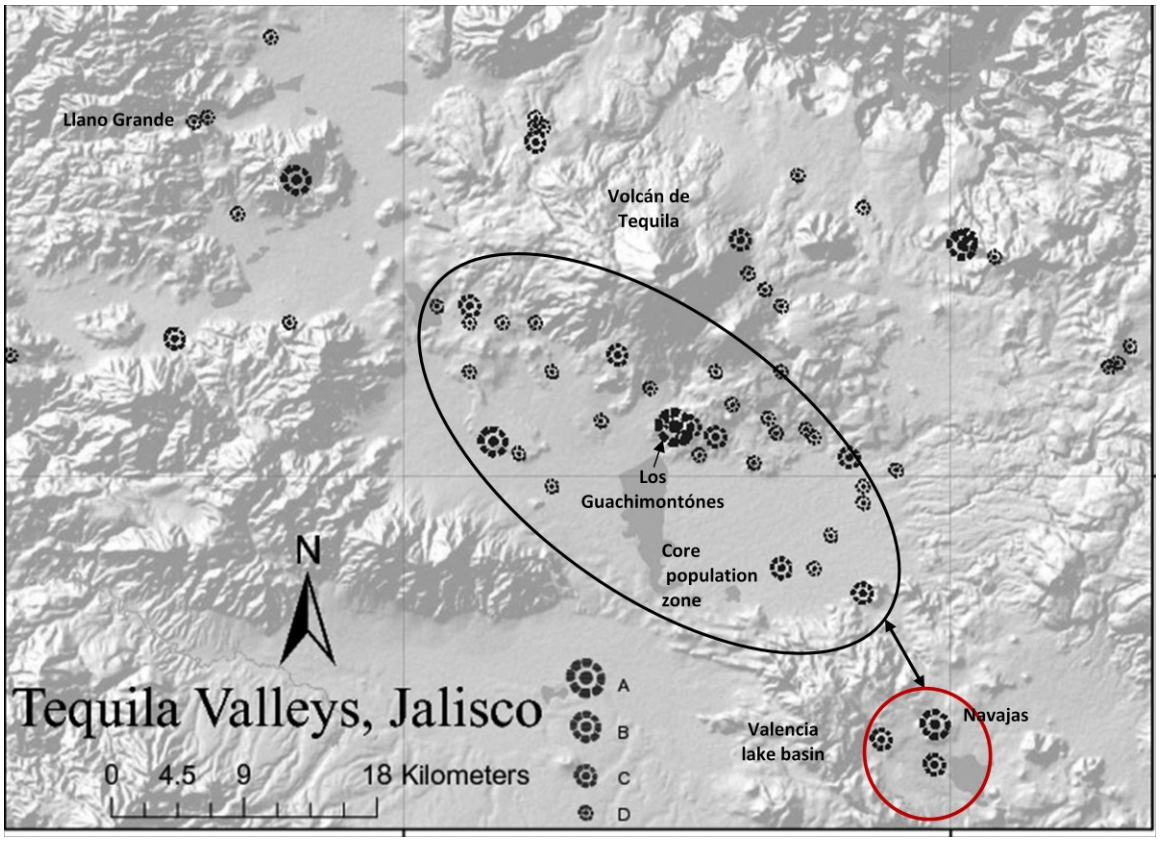

Figure 1.2: Map of the Tequila Valleys showing core and semi-periphery. Circled sites are within the core, and all sites outside the core population zone are considered semi-peripheral. Labeled sites are those under study. Navajas' location in a small exterior basin associates it more closely with the core zone. Adapted from Beekman in press a:Fig. 3.2.

Zacate, Cerro Tepopote, Peñol Tepopote, Cerro Pipiole and Llano Grande, were built within or near passes in the surrounding hills. The exact purpose and nature of these surrounding sites has been a major focus of study (Beekman 1996a,b; Weigand and Beekman 1998). Within this paper, all sites within the Tequila Valleys but outside of the core zone are referred to as *semi-peripheral* sites because of their location between the

densely populated core habitation zones and populations outside the Tequila Valleys. *Peripheral* sites are outside the Tequila Valleys, yet within West Mexico (Figure 1.3).

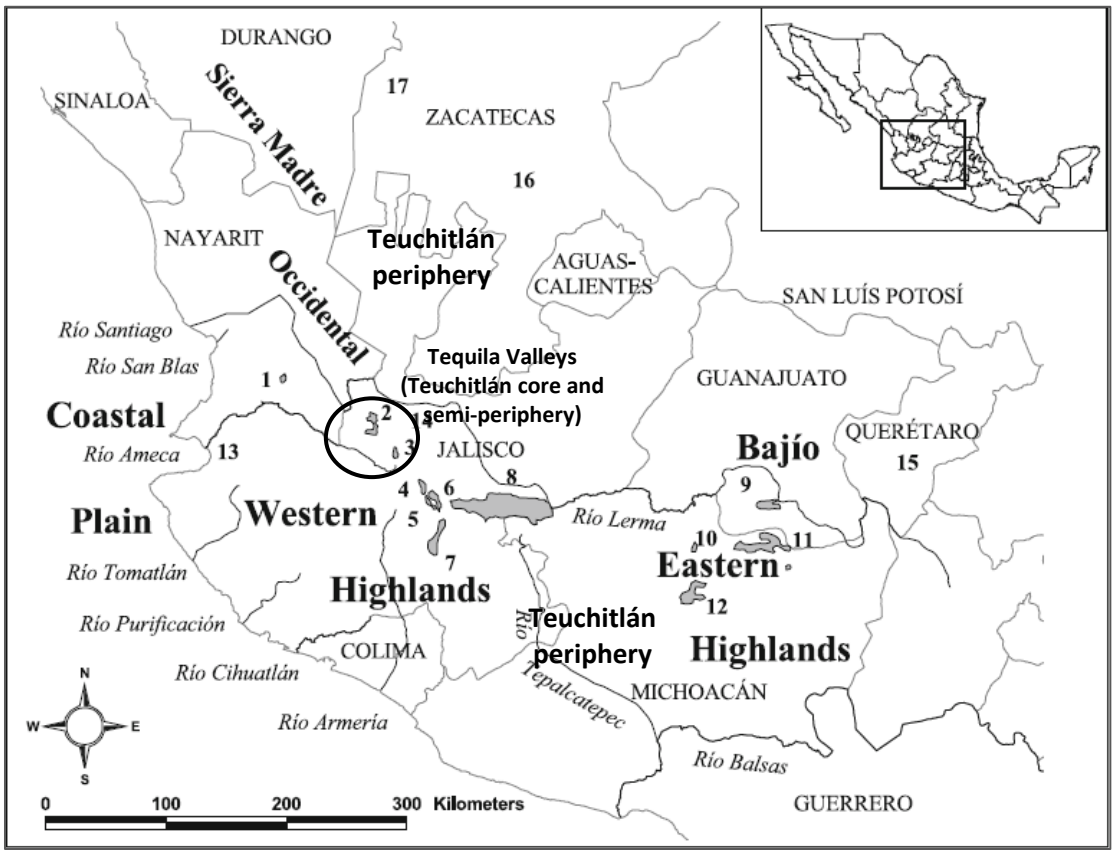

Figure 1.3: The Teuchitlán periphery (West Mexico) relative to the core and semi-periphery.

The line of questioning pursued for this thesis is a continuation and extension of these core-periphery discussions, and utilizes evidence found in local obsidian production for additional interpretation of their economic dimensions. Substantial evidence from archaeological, ethnographic and ethno-historic sources shows that elites of West Mexico relied heavily on agricultural production to finance their positions in the social structure (Beekman 2003a; Butterwick 1998; Lopez and Ramos 2006a; Lumholtz 1903; Schöndube 1998; among several others). Contrastingly, the position of Las Navajas, a

southeastern semi-peripheral site on a high plateau with an expanse of fertile farmland, provided ample opportunity to continue the agricultural tradition of excess production needed for staple finance (Beekman 2007a; Appendix A:Figures 4-6). In contrast, the micro-environment of Llano Grande 's chosen location, in a northwestern pass overlooking the Magdalena lake basin, was not conducive to agricultural production of any sort (Beekman 2001; Appendix A:Figures 1-3). It did, however, provide immediate access to an adjacent high quality obsidian source[1] and much greater potential exposure to external groups. Did Llano Grande operate under a different economic strategy relative to the core population zones of the Teuchitlán culture? And, given the presence of obsidian, did Llano Grande represent a relative shift within the Teuchitlán culture from a surplus producing, internally competitive agrarian economy to one based on trade?

Studies and discussions of semi-peripheral site functions in the Tequila Valleys have thus far concentrated primarily on architecture and area wide surface surveys with minimal excavation (cf. Beekman 1996 a,b; Weigand and Beekman 1998), and therefore could not yet address some of the economic dimensions of site function. However, more recently a large sample area has been excavated in the Llano Grande ceremonial space in the hills just outside the valleys to the northwest, as well as the entirety of one other example of public architecture at the site of Navajas to the southeast. Ceramic and obsidian artifacts recovered from both sites have been the subjects of study over the last few years (Hoedl 2013; Johns 2014).

For the current study, the above questions are addressed through a comparative analysis of the lithic assemblages recovered from the excavated ritual centers within

[1] The Llano Grande and Navajas obsidian sources mentioned in this thesis refer to those near the sites within the Tequila Valleys by the same name, and should not be confused with the more northern Llano Grande and Cerro de las Navajas lithic sources in Durango (cf. Darling 1993).

Llano Grande and Navajas. Wealth and staple based economic patterns discussed by Timothy Earle (1991) and related political strategies proposed by Richard Blanton and colleagues (1996) are used to frame the geographic and environmental implications of each site's economic potential in order to determine general economic expectations for the sites under test. Previously published lithic distribution analyses both within the valleys and in additional areas within Mesoamerica are used here to determine common lithic distribution patterns which relate to normative distribution strategies, and further refine specific expectations for each site's lithic industry, in relation to Earle's economic categories. Site contexts are discussed by local area, and include the primary core area near Los Guachimontones (Esparza 2003; Soto 1982, 1990) as well as three semi-peripheral and peripheral areas. The latter areas include the La Venta Corridor (Beekman 1996a, 1996b), the Magdalena Basin (Spence et al. 2002) and the Sayula Basin (Reveles 2005). Because of the high volume and spatial breadth of comparative data, distribution patterns of outside groups necessarily include a limited number of studies that have the best potential to identify common patterns which may have influenced semi-peripheral groups. External groups discussed include Teotihuacan (Spence 1981, 1987), the Maya (focusing primarily on Nohmul and Colha, as discussed by Johnson [1996]), and earlier groups in the Valley of Oaxaca (De León et al. 2009).

The specific research questions addressed in this thesis are as follows:

1. Do the lithic assemblages at Llano Grande show a greater emphasis on production over use contexts than the assemblages at Navajas and other sites more closely affiliated with the core population zone?

2. Does Llano Grande show evidence for a greater emphasis on the production of potential trade than Navajas, including commonly exported forms, known elite items, and/or items which require specialized production techniques?

A positive answer to the first question supports the notion of a specialized area of production that may be defined as a workshop (Clark 1981; Spence 1981) at Llano Grande, either within or nearby the public architecture, which also suggests a possibility of systematic overproduction for some form of exchange. However, production could still be used for the general trade of common goods, or of minimally prepared raw materials.

The second question deals strictly with the forms of items produced, and a positive answer to the question may show increased production of potential ritual or trade items at Llano Grande. However, based on the second question alone, the use of these items is ambiguous in that they may be intended for elite trade, or strictly for internal use. Positive answers to both questions would support an increased emphasis on both overproduction for trade and the development of wealth items in the same context, and therefore also an increase in the likelihood of a greater emphasis on the wealth trade economy.

The null hypothesis for this study is a lack of support for an increase in wealth trade at Llano Grande over Navajas. Therefore both questions must be positively answered for the null hypothesis to be rejected.

Lithicist George O'Dell's lament about his own specialty eighteen years ago is still essentially true today: "Although advances in lithic studies have been made in both the theoretical and methodological realms, yawning gaps exist in their articulation" (1996:4). This thesis is theory driven by design, and will serve as an attempt to bridge the "yawning gap" between the theoretical approach and methods through an explicit description of the relevant theory, the middle-range interpretive rules and assumptions, and the implications of the results on the theoretical foundation.

Overview of Chapters

Chapter II is devoted to describing the social theory which addresses and guides the questions under study. The chapter first covers theoretical discussions on the nature of core-periphery relations, and then turns to economic dichotomies that may explain how core areas may differ from peripheral or isolated semi-peripheral areas in economic strategies: Earle's wealth vs. staple elite financing (1991), and related networking/exclusion vs. corporate/inclusion power strategies (Blanton et al. 1996). The internal dynamics of these strategies as they are pursued in the same cultural groups and engage each other within designated community spaces, or *arenas* (Turner 1974) is also discussed. The chapter then discusses the reciprocal relationship between culture and environment, and how environmental factors may play a major role in elite decisions to emphasize certain economic strategies over others.

Chapter III covers Tequila Valleys background information. The chapter begins with the history of archaeology in the area and then turns to details of the area's prehistory,

which begins with past and current understanding of the timeline focusing on the transition from the Late Formative to the Early Classic periods. The prehistory section first briefly describes the distinctive elements of the culture (guachimontones, shaft tombs, ceramic dioramas/figurines, and unique forms of obsidian), then describes the demographics and other physical properties of core, semi-peripheral and peripheral sites. General descriptions and interpretations of apparent cultural uses of the shaft tombs and the guachimontones are then described in separate sub-sections. The chapter then discusses the current evidence for staple and wealth finance strategies. Feature details of the primary sites under study, Llano Grande and Navajas, are then discussed and compared to the primary core site, Los Guachimontones. The chapter then turns to environmental data, including resource and climate details. General area-wide details are presented before concentrating specifically on geography and climate differences between Llano Grande, Navajas and Los Guachimontones.

Chapter IV discusses the area lithic data, starting with an overview of Mesoamerican lithic forms, including details of West Mexican forms and discussions of proposed production methods which may offer ways to identify the manufacture of items which have been exported off-site from the remaining debitage. Since semi-peripheral area strategies may be as much or more influenced by external groups as they are by the core, lithic distribution strategies, including both products and debitage, three other Mesoamerican groups (Teotihuacán, Oaxaca and the Maya) are addressed before discussing the literature on lithic distribution patterns within the Tequila Valleys. Other relevant lithic attributes at the site and area level are then discussed and compared between Los Guachimontones, the La Venta Corridor and unaffiliated sites within the

neighboring Sayula Basin to find any detectible patterns of similarities and differences between core, semi-peripheral and peripheral sites.

Chapter V discusses the methods used to test the hypotheses outlined in this chapter. The chapter begins with a description of the datasets at both Navajas and Llano Grande, including the prior excavation process and associated issues encountered during excavation and artifact retrieval, the method of storage, and later retrieval and recording of the data. Expectations from the data for a wealth trade or an internal use (staple) strategy are then listed and described with the implications of all potential outcomes, and a series of tests used to determine whether these expectations are met are described.

Chapter VI reports on the outcomes of the tests outlined in Chapter V. The implications of each test's outcome on the research questions are also discussed, in relation to the site expectations.

Chapter VII concludes the thesis with a synthesis and summary of all outcomes and provides an overall interpretation of the sites under test in relation to the original questions and the implications that the results have to the theoretical foundations of the tests. A section on future work in pursuit of the same or related questions is also provided.

This project is not designed or intended to completely resolve the economic nature of all semi-peripheral sites associated with the Teuchitlán culture, or even completely resolve the issue specifically for Llano Grande and Navajas, as it is more of a theoretically guided probing study involving only two sites in detail, and general information from a few others. It is anticipated that, when employed on a much larger

scale, this form of theoretically informed technical analysis will bring West Mexico lithic research much closer to resolving these kinds of questions.

CHAPTER II

THEORETICAL DIRECTION

At the most fundamental level, this thesis seeks to determine whether economic differences can be seen in the material culture between sites associated with the same polity, but at different locations and positions relative to the core area, particularly when the chosen locations are within very different environments; and whether these economic differences represent differing emphases on wealth and staple economies (Earle 1991). Following Hirth (1996), economic differences between sites are seen here as relative differences in emphasis on multiple specific economies that may cross-cut staple and wealth categories, rather than a predictable dominance of one economic category over the other at the site level as originally proposed by Earle, and also Blanton et al. (1996). This study further tests whether observable elite choices in emphasis on different economies are influenced by the immediate area's economic resource options, as well as the distance and access to other internal and external groups.

Core-Periphery Relations

Differences in resource availability within different areas relate to patterns of settlement and social relationships originally described by Wallerstein's (1974) world-systems theory. Wallerstein describes a *core* group which is comprised of concentrated areas of consumption, and a *periphery* which contains the resources necessary for maintenance of the core's economy. In-between the core and periphery are *semi-*

periphery groups, which interact with both the core and periphery and create relations of exchange between the two areas (Wallerstein 1974:401-405). Wallerstein applied his theory exclusively to industrial capitalist societies with the technological capability to extend their reach globally and create dependent and unequal exchange relationships with less powerful groups, for the acquisition of agricultural and industrial bulk goods (1974:398-399). These relationships create a single system of labor division which cuts across cultural groups and polities (1974:390). The primary feature of Wallerstein's theory is the formation of a dependent and dominated periphery in an asymmetrical exchange relationship.

Schneider has suggested that Wallerstein's world system "suffers from too narrow an application of its own theory" in its strict application to capitalist systems (1977:47), and relies too heavily on bulk goods while dismissing luxury items as non-systematic trade items that had little effect on the overall economy (1977:52). Schneider (1977:52-53) contends that several luxuries, such as sugar, wine and precious metals, were also used quite effectively to manipulate peripheral groups before the world system began to form in the mid-seventeenth century. Schneider also referenced archaeologist Robert Adams' discussion of inter-polity social influence of long-distance luxury trade as far back as the earliest complex polities within Mesopotamia. Adams suggested that luxury trade was a "formidable socioeconomic force" (1974:247) which was often tumultuous, and used by the more powerful polities to coerce and dominate less powerful groups within Mesopotamia, given the presence of slave labor and very dynamic changes in exchange relationships revealed by the cuneiform records for luxury item trade (Adams 1974:247-249).

Blanton and Feinman (1984:674) suggested that the world system theory may be a more productive framework for the study of polity interaction within Mesoamerica, rather than the common approach to the region at the time, which treats the entire subcontinent as one massive culture area, which is yet multicultural, but held together by common ideologies and technologies that spread through various interpolity relations. These relations were identified through inter-polity commonality of some aspects of material culture, but essentially left unstudied regarding the nature of how and why they form and change over time. Blanton and Feinman do not advocate the application of all details of the theory to prehistoric Mesoamerica, and point out that no polity within Mesoamerican prehistory has ever extended its reach throughout the subcontinent, and some institutions associated with the capitalist system do not appear in prehistoric context. Blanton and Feinman's idea of a Mesoamerican "world system" utilizes Wallerstein's basic framework of cross-cultural labor division in a single multi-polity, cross-cultural system within the Mesoamerican context (Blanton and Feinman 1984:674; Hirth 1996:19). However, Blanton and Feinman assign a role for luxury goods which is as important as the role Wallerstein assigns to bulk goods (1984:675- 676), "through the calculated distribution of symbols of status that the elite controlled" (Blanton and Feinman 1984:676). They also suggested that multiple cores likely existed beyond their example of the Postclassic Central Highlands (areas exploited by the Aztecs), including Late Formative and Classic Period Teotihuacán, but "at present, we know less about them" (1984:679).

The principles of world-systems theory have since been utilized and modified by archaeologists to describe the economics of early prehistoric states, and theorists developed varying adaptations which included different dynamics between the core and

periphery. Algaze (1993) closely follows Wallerstein's definition for modern capitalist societies. Algaze interprets peripheral sites as "outposts" intentionally established within areas controlled by external groups with a very singular, intentional purpose of bringing foreign resources into an expanding core area, as the core's resource requirements increase due to its own growth. He further states that "by definition, marked developmental asymmetries always exist between pristine states and communities in the periphery." Informal trade relationships would then be established with a high probability of success, since peripheral groups would, at least initially, perceive some benefit from political relationship with the a more powerful core. However, Algaze describes outposts as "dendritic" entities entirely controlled by delegates of the core, therefore the trade-off to local elites is the cost of any real political control over the relationship. These outposts would then serve as remote collection points of goods from their respective locales (Algaze 1993:304).

Algaze further suggests that these outposts are, by nature, exploitive , as he states that "early outposts reflect a system of economic hegemony whereby early emergent states attempted to exploit less complex polities located well beyond the boundaries of their direct political control and this system may be construed as imperialistic in both its extent and nature" (1993:305) .

Gil Stein (1999:36; 2014:55-56, among others) has criticized the view of a strong, dominant core exploiting a week, subaltern periphery in world system theory as over-simplified and monolithic. Stein views the nature of the relationships between groups as quite variable according to individual political, economic, ideological, and logistical factors (such as distance and transportation economics) within each group. In many

cases, according to Stein, peripheral groups are active agents in the direction of trade relationships, and in some cases managed fully interdependent relationships, rather than asymmetrical ones.

Chase-Dunn and Hall (1991:19) also see a wider range of relationships involved in core and periphery relations, and offer a more inclusive definition in their model which distinguishes between core-periphery *differentiation,* or groups of different sizes and social structures interacting within the same system, and core-periphery *hierarchy*, the domination of one society over one or more others by means of political, economic and/or ideological control; differentiation does not assume dominance, and can involve favorable exchange for both sides. "Equality" of exchange is also difficult to measure, largely because different groups value the same objects of exchange differently within their own cultural contexts, especially if they utilize exchange items for different purposes (Chase-Dunn and Hall 1991:31). For the purpose of the current study, no initial assumption is made about the specific nature of the relationships between core and peripheral groups, and therefore Chase-Dunn and Hall's more flexible definition of core and peripheral sites are used.

Outposts and Remote Groups

Outpost settlements often occur at or beyond the farthest reaches of direct control, and are often strategically placed on natural transportation routes between the polity and external groups to facilitate both control and efficient transportation, collection and redistribution of traded goods, especially where transport is particularly difficult (Algaze

1993:321). Prehistoric Mesoamerica provides an excellent example of a region where transportation would have been especially problematic in many areas, due to a lack of pack animals and very rugged, hilly terrain in many places, especially along the Sierra Madre Occidental and Trans-Continental mountain ranges (Schöndube 1998:206).

According to Algaze, collection and redistribution operate most efficiently when handled in outposts somewhere near the outer edge of a group's area of political control, in corridors which provide limited access. Outposts are also frequently placed very close to a desired resource in a remote area. Outposts vary greatly in size from small apparent way stations positioned along long distance trade routes, to large remote city settlements set up on the way to other major polities that provide high volume trade (1993:310-311).

The establishment of peripheral outpost trade is not generally considered an end-point to core expansion. European colonial trade enclaves could be initially benign and even welcome by peripheral groups, but they often became entry points for later expansion of core powers throughout the area. Expanding trade eventually radically transformed cultural landscapes around the world, including the American continent (Curtin 2000:4-5). Although the arrival of the Spanish empire was a chief concern for the natives in Central Mexico, the Spanish trade economy was likely not initially considered a threat compared to other colonial ventures in agriculture, ranching and the mining of gold and copper. However, eventually "trade empires" became the single most important factor driving European expansion as they successfully out-competed all ventures. Enclaves in the centers of the native populations ultimately became the Spanish political centers for the area (Curtin 2000:79).

Alternative models of economic redistribution have been proposed which do not emphasize Wallerstein's principle of core dominance. Stein's (2014:59) concept of a *trade diaspora* is quite similar to descriptions of outposts and enclaves, except that they may experience a wide range of power relationships with local polities. Diasporas can be very dominant as in World Systems models, but may also be marginalized by remote groups, or experience neutral positions of protected autonomy among their hosts if the local elites find them useful. Also, the distribution of goods may be relatively uncontrolled, or only distantly managed within open market systems. Kenneth Hirth's (1998:453) proposed approach to identifying centralized market activity notes several consistent spatial patterns used by some archaeologists as clues for identification, derived from Spanish contact period observations. Large markets were often set up in Mesoamerica along major trade routes and either near or adjacent to "administrative centers," and served as points of collection and redistribution of goods. These observations closely match many aspects of Algaze's definition of large trade-route outposts, and some areas interpreted as "outposts" may have actually operated as centralized marketplaces. Hirth describes a *centralized* marketplace as one strategically placed for access by multiple groups, which features unrestricted exchange (although likely sponsored and managed by elites), with equal access of all goods to all consumers regardless of social status. Centralized markets tend to be quite large and typically operate on a regional scale (1998:454-455). In contrast, Algaze's interpretation of peripheral exchange is a hegemonic one highly favoring the core polity. The observed ethnohistoric markets were typically regional exchanges set up in distinctive forms of permanent architecture surrounded by walls which also surround buildings directly associated with market administration, but as

Hirth (1998:455) cautioned, prehistoric exchanges may have ranged widely in scale from central exchanges much like those in historic accounts, to locations designated for occasional isolated partner trades which do not involve direct architectural evidence of the point of exchange. A few forms of trade also occur in venues in-between these two extremes in scale, including trade activity conducted directly at workshops locations (Figure 2.1). Smaller scaled exchanges tend to be less centralized, and unequally accessed by certain segments of the population with access to trade networks of specific groups and an unequally high or even exclusive distribution of specific products and resources among network affiliates (Hirth 1998:455).

One likely example of a large outpost marketplace exchange area may be within the 6 km^2 core city area of Matacapan, perhaps at or near the central plaza. Matacapan is situated about half way between Teotihuacan and Mayan territory, yet shows very strong material cultural continuity with Teotihuacán, including Teotihuacán's trademark apartment building-like residential structures (Algaze 1993:304, 310-312).

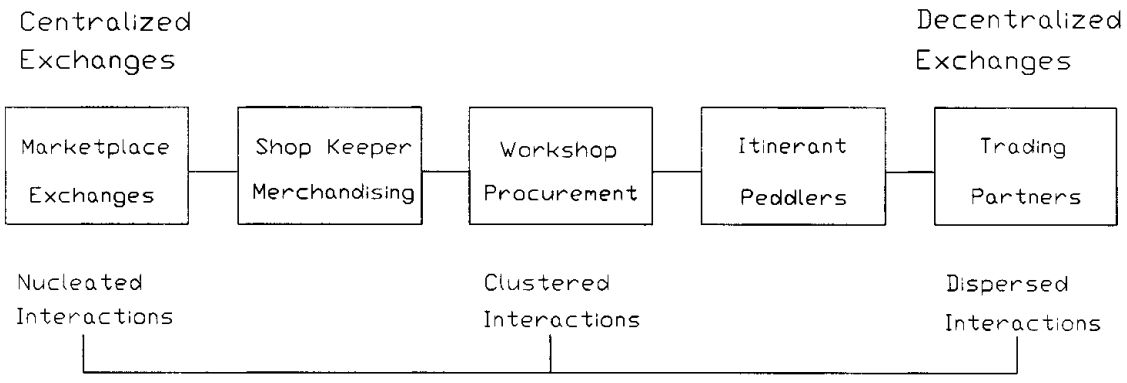

Figure 2.1: A scaled representation of different forms of exchange. (Hirth 1998:455)

Although Algaze asserted that especially remote and/or isolated outposts must maintain a fragile connection to the core due to transportation and communication limitations (1993:325), Phil Weigand has argued that direct control of outposts is not necessary, since their function and reason for existence is defined by economics and dedication to external trade and interaction with outside economies, rather than political relations (Weigand 2000:52; Weigand and Beekman 1998:44,45). However, Algaze refers to more distant outposts than Weigand, and the form of core control to which he refers is not political, but rather hegemonic and economic. Elite groups maintain their dominance through economic influence rather than institutionalized positions of power and authority.

Chase-Dunn and Hall have also argued for the use of world system theory on smaller scales in prehistoric contexts, on the basis that the range of interaction is actually part of the whole world of influence known to the system's participants, and is larger than any individual polity within the system. In prehistoric contexts, the authors also hold, along with Schneider (1977) and Blanton and Feinman (1984), that the prehistoric core/periphery connections tend to emphasize prestige goods; bulk exchanges in staple goods generally range over much smaller areas than exchanges in prestige items (Chase-Dunn and Hall 1991:12; Blanton and Feinman 1984:677).

Chase-Dunn and Hall also make use of Wallerstein's *semiperiphery* category of economic divisions in-between core and periphery sites. The semiperiphery is an economic and cultural intermediate point between the core and periphery, and is considered "both exploited and exploiter" in the economic process. The semi-periphery thus acts as a political buffer zone (and in this case, according to Wallerstein, the function

is indeed mainly political rather than economic) between core and peripheral areas, to avoid direct confrontation between starkly polarized regions, and thus promotes system stability (Wallerstein 1974:405). Semiperiphery sites may have hybridized core and peripheral organization strategies, and institutional features may show intermediate forms between those in the core and peripheral locations (Chase-Dunn and Hall 1991:21). Sites in these areas of transition are especially suited to social innovations since they can combine core and peripheral elements to create new cultural elements, and are less bound to the core due to their physical distance (Chase-Dunn and Hall:1991:31). Blanton, et al. (1996:7) also note that such areas are among the most likely areas to establish trade networks, and also often occur in areas of low agricultural potential.

The Aztecs were well aware of the advantages of semi-peripheries, and chose to transform the Postclassic Central Highlands city of Tepeaca into a properly functioning semi-peripheral group. Tepeaca was a city on an Aztec trade route which at one time discouraged trade by killing and robbing merchants passing through the area. Upon assimilating the city, the Aztecs insisted that Tepeacans cease their usual practice with outsiders and welcome merchants from all areas. They were also instructed to increase their number of *tlamemes* (burden carriers), and the Aztecs established a marketplace for luxury goods within the city (Blanton and Feinman 1984:678).

Boundaries

Semi-peripheral sites can be difficult to identify in the archaeological record, and we must rely on multiple lines of evidence beyond spatial organization to do so. Core,

peripheral and semi-peripheral zones are defined by the division of labor across polities, which are independent of political territories. However, elites utilize inter-polity trade flows for their own political gain through the accumulation of goods for the building of socio-political hierarchy, and through the economic manipulation of groups beyond their direct political control (Hirth 1996:219). The functions of physical boundaries may therefore include attempts to control economic activity in semi-peripheral areas. Of course, boundaries may also represent a number of other functions, including physical defense, service as an observation post, message relay point, symbolic representation or embodiment of the state, administrative center, strategic activity center, and diplomatic center (Southall 1988:56). Also, boundaries are often invisible in archaeological data, although heavily controlled sections of a boundary are sometimes revealed by walls (Chase-Dunn and Hall 1991:18).

Cultural borders are also often ill-defined, and even when they are made explicit, lines drawn on a map in ink as "borders" as though indelible are actually quite transient, elusive entities which may move back and forth frequently with contention over territory. The existence of boundaries also belies the great deal of interaction that tends to occur across them; no society can be assumed to be completely isolated, regardless of the level of complexity (Schortman and Urban 1987:81; Wolf 1982). A boundary's functions can also vary both spatially and over time (Wolf 1982). A boundary may be very porous to economic goods, while the movement of people is closely monitored and heavily guarded (cf. Beekman 1996a:742). Yet at another time, or even concurrently at a different location along the boundary, it may be completely open and any physical manifestation may serve only as a historic symbol of the state. For these reasons, other lines of evidence should be

used to confirm the existence of a boundary. Ultimately, although boundaries can be complex, heterogeneous and therefore challenging to interpret, understanding the nature of a boundary means understanding something of the internal structure and strategy of the polity which created it (Southall 1988:56).

Unitary States and Segmentary States

Some early states may not even conceptualize a physical boundary as part of their self-identity. Southall has noted an organizational difference based on the degree of intentional definition of a polity's boundaries, between what he calls *unitary* and *segmentary* states. Unitary states are much more formally defined, centralized and territorial by nature, and therefore strive towards "stable and controlled boundaries" as a management tool. Segmentary states maintain their power structures through hegemonic control based on economic power and prestige, rather than formalized institutions of authority (1988:55). Segmentary states may be identified in material culture through secondary site emulation of primary site architecture and symbolism, as an indicator of hegemony. The developmental trajectory of a segmentary state may eventually transform it to a unitary one as control of more remote locations is consolidated under a centralized government, where previously only a hegemonic form of control had existed. Such a transition may not often be easily accomplished, since direct administration of remote sites in territorial polities is much more costly, and has only been completely demonstrated by very powerful, well centralized polities such as the Roman Empire (Beekman 1996b:136). The limitations of transportation only by foot, hilly terrain, and a

very localized economy may make unitary state formation practically impossible in some areas, and control strategies may also vary within the same polity (Southall 1988:63,72).

Mesoamerican polities include a range of forms between unitary and segmentary states. A few of the most notable examples include the Aztecs along the Aztec-Tarascan border, the remainder of the Aztec empire, and the Classic Maya. The Aztecs near the border with their most powerful adversary were highly territorial and centrally controlled, with several fortresses along the border (Beekman 1996b:136; Beekman and Houston 1993: 3). Yet, throughout the rest of their area of control, the Aztecs paid no attention to territories and only imposed hegemonic control with only a return of tribute from subordinate groups (Smith 1997:76). The Aztecs at the Tarascan border may have been heavily influenced by the Tarascans themselves, since the Tarascan empire appears to have been very highly centralized and organized as territories managed by a hierarchical administration (Pollard 2003:80-82). The Maya gained power through ceremonial and symbolic hegemony to form various city-states spread out through a large portion of the Yucatan Peninsula. Several especially powerful cities such as Tikal did reach some level of centralization as they subordinated several smaller groups under the rulership of "overkings", but there was no overall centralization, spatial organization, or territorial boundary that would ultimately unify the Maya, and although some walls do appear, territories still do not appear to be a defining element of affiliation with the Maya as a whole (Martin and Grube 2000:18-21).

Political Strategies

Wealth vs. Staple Economies

The same division between luxury and bulk goods discussed above for the economic bases of world systems also has been described by Timothy Earle as a fundamental separation of economies utilized by elites in different groups to finance the maintenance of their social positions (1991). Earle uses this division to characterize economies of entire polities, although he does acknowledge that economies may occur "as admixtures in individual cases" (Earle 1991:3), which suggests that his economic division may occur at some component level within at least some polities. Although more complex views of how different economic bases and their related strategies are utilized have been adopted more recently (e.g. Blanton, et al. 1996; Hirth 1996), the basic definitions of wealth and staple economies remain important elements of more recent views.

Wealth economies involve long distance exchange and/or specialized craft production for symbols of status which elites use to legitimize their social positions, whereas staple economies include mainly food related resources utilized by elites as leverage for power. Staple economies include the hosting of feasts to attract followers and create a level of obligation to the hosts, and possibly other forms of food related payment (Earle 1991:3).

In wealth economies, elites incorporate exotic items from remote areas into group ideology as a means of creating exclusive control over objects that symbolically convey legitimacy of authority. These prestige items are either made from locally rare or unavailable materials, or they are difficult or expensive to produce, which makes them

more difficult to access and therefore easier for elites to control and monopolize their distribution (Beekman 2000:386, Earle 1991:7). Such objects are often utilized in ritual contexts to reinforce the elite ideology and validate elite authority (Reilly 1996:30). A common example of a wealth economy is the Classic Maya, who extensively traded and utilized eccentrics, ritual items and rare, distantly acquired commodities (e.g. Martin and Grube 2000:16; Johnson 1996). Mayan rulers legitimize their positions by "impersonating" (or perhaps, transform into, or join with, in their interpretation) the gods they represent using masks, ornaments and jewelry (Houston and Stuart 1996:291), and used very fine, specialized bloodletters in other ritual contexts (e.g. Carballo 2009:494; Johnson 1996:172; Joyce 2004:195).

In staple economies, feasting activity is used as a competitive display of power through abundance in order to gain political standing and an upper hand in economic and political negotiation. It is also very expensive as expectations of diverse and plentiful provision run high. Feasting is therefore also an indication of political competition among groups within a cultural tradition (Butterwick 1998:89-90,104-105). The extent of the sudden drain on staple resources required for feasting activity requires staple economies to rely heavily on a land and climate capable of consistent agricultural surplus (Hayden 1995: 62,63). Numerous ethnographic and archaeological accounts of feasting cultures have been identified through evidence of regular feasting behavior. Many favor livestock or wild mammals as the more prized fare over agricultural products, although a wide array of agricultural products are still included, and some extensive land resources and human labor are still necessary to support horticulture for highly populated areas. Some of the most common and elaborate feasts occur at funerals, which provide opportunities

for interaction when a void has been created in a social position, possibly requiring a shift in the social structure (Hayden 2009). Among the best documented staple groups are those within the Tana Toraja regency of Sulawesi, Indonesia, who are very highly stratified and hold six levels of funeral feasts, each with socially understood degrees of elaboration, based on the social status of the deceased. Expected expenditures (which hosts will go beyond if possible) range from 1-2 nights with a single pig and possibly a water buffalo for poor people, slaves and infants; to at least 27 nights, over 36 pigs and 16 water buffalos for only the very wealthiest individuals. Although the latter case may only occur once or twice in a lifetime, the former tends to occur approximately 20 times per year, leading to a consistently high expense in livestock (Adams 2004:64-65).

According to Kristiansen (1991:22), wealth economies tend to be individual oriented and horizontally structured since they involve individual peer level contacts and networks for exchange, whereas staple economies are more collective and vertically structured (such as the above example of Tana Toraja), as agricultural production involves the coordination of large numbers of laborers. Kristiansen and Earle both propose that although the two strategies differ by nature and thrive within different social structures, they can exist within the same polity. One economy will become dominant, and the "alternate" economy will become a dependent variable subordinate to the other (Kristiansen 1991:22; Earle 1991:8). In Kristiansen's view, overall trends in culture trajectories follow a usual progression towards increased complexity from wealth finance towards staple finance, but each of the two economies can follow its own trajectory into different patterns of increased complexity (Kristiansen 1991: fig. 2.2). However, individual trajectories have proven quite difficult to predict with any certainty. Past

attempts at creating any universal rules applicable to cultural trajectories have been thwarted by differences in environments, related technological developments and individual culture histories. For example, some groups considered to be members of larger state-like organizations may exhibit greater autonomy because they are cut off in some way from their parent culture. Earle treats these situations as exceptional cases, and termed such groups *devolved societies* (Earle 1991:14-15,25). A trajectory may also be altered by political reorganization, which may increase the demand for rare and exotic items and/or create a period of resource intensification as factions vie for control in a power vacuum (Beekman 2010:71, c.f. Beekman and Christensen 2003:145-149, Pollard and Cahue 1999). Therefore, the particular history and environment of a group must be considered before attempting to interpret their economic base.

Despite Earle's and Kristiansen's separation of the two economies, actual examples consistently show a trend towards a strong presence of both wealth and staple economies within the same social contexts. The Mayan elites are well known for their use and trade of a broad array of eccentrics, ritual items and luxury goods, as shown in grave goods public ceremonial spaces and other ritual and elite contexts (Johnson 1996; Martin and Grube 2000:16; Moholy-Nagy 1999:310; Spence 1996; and several others). Known wealth items for the Maya include jade jewelry, elaborately decorated ceramics jaguar pelts, cacao, shells and other marine items from the coasts, exotic feathers from other regions, clay and carved wood figures of gods (Barrett 2004:60; Martin and Grube 2000:16) as well as chipped stone eccentrics and ritual items. Elite Mayan stone items are typically made from both local chert, and rare obsidian from the Guatemalan Highlands and areas as far as Teotihuacan (1200 km), which controlled the nearby Pachuca source

of an unusually pure green obsidian (Johnson 1996; Moholy-Nagy 1999:300-303; Spence 1981, 1996).

But the Classic Maya also heavily emphasized maize and fertility, and elite connections to elements related to the staple yield, including a maize god which actually represented all life cycles, including those of people. To the Classic Maya, maize was a central component of life, and therefore all life cycles are related to the pattern represented in the life, death and regeneration of maize (Martin and Grube 2000:16). The Maya also emphasized regularly scheduled feasts. The Mesoamerican calendar's 18 month cycle recognizes monthly feasts (Townsend 1992:212 - 215). Also, in the ancient Mayan language, the phrase for an esteemed lineage leader translates literally as “head of the banquet” (McAnany 1995:31).

Across polities, it does not appear that an increase in staple reliance necessarily relates to a decrease in emphasis on wealth goods, or vice-versa. In fact, quite the opposite appears to be the case for Blue Creek in the Early Classic to Middle Classic periods, which exhibits an unusually high quantity of various luxury goods (Guderjan 2007:91), and especially of jade (Barrett 2004:109,155), considered one of the most valued luxury items based on its rarity and consistency of association with elite contexts (Barrett 2004:23-24). Yet Blue Creek's main economy appears to be based on the overproduction and trade of various agricultural items, including staples such as corn, beans, squash and other foods evident in phytolith evidence examined from the very fertile *bajos* and highland fields in the area; and an elaborate system of canals and ditches which would have served to regulate the flow of water between the rainy and dry seasons (Guderjan 2007:91-101). This dual economy coincides with Blue Creek's fortunate combination of a

strategic position at the end of a long trade route to encourage its wealth economy, as well as a location among pockets of very fertile land to feed its staple production (Barrett 2004:155). A group's location along the cultural and physical landscapes, as well as the natural resources which surround it, may therefore have more to do with a group's chosen economic emphasis than its current organizational state within a structural trajectory.

Wealth Relations and Boundary Permeability

Kowalewski et al. (1983:39) have proposed that decreased centralization of a social structure and increasing group population size are both directly proportional to a boundary's *permeability*, where permeability is the relative amount of energy flow across the boundary. In more concrete terms, permeability can be viewed as the amount of cross-boundary interaction, which is most visible archaeologically as economic flow of goods evident in the quantity of similar materials and artifacts deposited on either side of the boundary. *Centralization* is defined as the amount of interaction between the most active *node* or settlement group and other internal social groups, relative to the overall amount of interaction within the internal social system; and *size* is defined as the number of interacting social groups (Kowalewski, et al. 1983:35). Since Kowalewski, et al.'s measure of size does not include group populations or areas, but only a group count, it may be best viewed as more of a measure of population dispersion, rather than overall population count or density. Group identity, according to Kowalewski and colleagues, is based on the degree of *integration* between component groups, where their most

actionable definition of integration is "the total amount of flow of matter, energy, or information between system components" (Kowalewski, et al. 1983:35).

As noted by Beekman (1996a:8), Kowalewski et al.'s theory is a proposed abstract relationship between social parameters and is not tied to any particular social model. However, the connection to semi-peripheral area economics, especially where a clear boundary is present, does find some relevance here because it points to factors that may influence the degree to which economics of semi-peripheral sites may be directed to external groups; greater boundary permeability means that semi-peripheral sites are more heavily engaged in externally directed interaction. Increased interaction also increases the potential for trade relationships which would most likely include remote items involved in wealth trade.

Elites may attempt to increase their power by artificially increasing the size of the system (i.e., adding to the number of social groups), and thus the required level of integration between groups. This strategy, however, may not succeed every time simply because the available resources are not enough to increase the system size and maintain an adequate level of interaction to avoid fragmentation (Kowalewski, et al. 1983:37). Since elite-sponsored attempts at expansion often take the form of outposts and semi-peripheral area sites (Algaze 1993, Chase-Dunn and Hall 1991), expansion also may maximize exposure to outside groups, which in turn increases elite opportunity for acquiring prestige goods.

Kowalewski, et al. tested their hypothesis on count and location data for both sites and artifacts from the valley of Oaxaca, from the Middle Formative Period to the Contact Period, which include the temporally sequential groups of San Jose Mogote and Monte

Alban. The study confirmed that although the trajectory of the three variables within the region is inconsistent in the short term, the long-term trend is towards decentralization of the polity. The correspondence between size, centralization and permeability only aligns with the Kowalewski hypothesis for 5 of 11 organizational phases. A positive correspondence between size and permeability, however, is indicated for 9 phases. Therefore, the level of centralization does not appear to be a strong indicator of boundary permeability at Oaxaca, but the relation between permeability and the number of internal groups is consistent for over 80 percent of Kowalski et al.'s cases.

Exceptional cases noted by Kowalewski occur at two extremes, which reveal patterns as notable as the overall results. In one case, the system size shrinks to a point where the distance between groups is too great and the amount of inter-group interaction drops too low due to declining populations. As a result, so the price of integration can no longer be met. The polity then becomes fragmented and really no longer exists as a unified system. The remaining, newly-independent groups seek additional resources across what has essentially become a defunct boundary (Kowalewski et al. 1983:49). The situation also allows for the possibility of a redefinition of boundaries around multiple smaller polities, which may then also begin to interact. The second situation occurs when the increase in size is so great that it requires a complete reorganization, and elites once again turn inward to re-establish groups via staple resources until a new system is well established (Kowalewski et al. 1983:49).

Although the Valley of Oaxaca case reveals local trends that may be important to future studies, the authors stress that the patterns found in Oaxaca have not been demonstrated elsewhere. They suggest expanding investigation along the same lines to

other areas to determine how far beyond Oaxaca similar results might continue to hold (Kowalewski et al. 1983:49).

Network and Corporate Strategies

Differences in economic bases between different groups within a culture may lead to differences in the underlying power strategies employed by elites to build and maintain power. Richard Blanton and colleagues (1996) have recognized a distinction between basic strategic directions which he terms *networking/exclusionary* and *corporate* strategies. Elites engaged in a networking/exclusionary strategy establish relationships with specific contacts within a network of other elites, with whom they share and exchange resources which differentiate them from non-elite groups. Network affiliates may be formed along pre-determined parameters, such as kin or ethnic group, or purposely selected based on some criteria, such as access to specific resources. The network strategy involves a large degree of control of access to specific prestige goods requiring skill specialization, especially in peripheral areas, which may see a large jump in specialized production.

Network strategies also tend to foster innovation of product types, although an element of secrecy may slow the spread of some innovations. Production techniques which allow for less specialized skillsets to produce prestige items are not commonly spread, as the effect would be to "banalize" the product by making it common and universally available, and therefore lose all value as a prestige item. Given enough time, however, production innovations, "secrets" and/or source connections may slip to the

common public. This occurred with the Early Postclassic spread of prismatic blade-core platform grinding, which made the production of prismatic blades easy enough for non-specialists to regularly engage in the practice for their own uses (Healan 2009). In such situations, elites may need to define new forms of prestige items to symbolize their status.

The strategy is also labeled "exclusionary" because the act of selecting specific contacts for the exchange of goods also channels wealth and power away from other groups by taking advantage of resource monopolies. As a result, the practice limits the number of people which have access to certain products (Blanton, et al. 1996:5).

Groups engaged in a corporate strategy form a group identity through multiple peer institutions. The corporate group is unified through an ideology that is communicated and reinforced by ceremonial and ritual activity. Corporate power strategies limit or prevent domination of one group through a corporate code of behavior. Teotihuacán may be the largest and best known Mesoamerican example of a corporate strategy. Blanton, et al. (1996) suggest that the material culture close to the city center reflects a pattern of collective identity and action rather than sovereign rulership of a particular lineage (see also DeLucia 2008, DeMarrais et al. 1996). This is not to say that hierarchy is replaced by egalitarianism within each component institution, but rather that elite power images are suppressed in corporate level contexts such as ceremonies, collaborations on labor projects, and defense, in favor of symbols and images which support corporate group identity (Beekman 2008:414-415). Since corporate strategies are inclusive, they require large public spaces, whereas space requirements for networking strategies are very small and private due to the need for exclusion (Beekman in press a:57-60).

Connecting Economy and Strategy

Blanton, et al (1996, Table 3) specifically associate their networking/exclusionary strategy with Earle's wealth finance, and also associate their corporate/inclusion strategy with Earle's staple finance. According to Blanton, et al., wealth economies are controlled via trade relationships which form networks to obtain, transport and exchange prestige goods so that their distribution can be tightly controlled. Prestige goods can then be used to legitimize the networked group's position of authority. Conversely, intensive agriculture practices required to maintain a staple economy (see also Hayden 1995: 62,63) require vast territorial assets and very large labor pools. Elites may form inter-group alliances to better manage and coordinate agricultural efforts, and the cooperative arrangements between several groups create a competitive advantage over any remaining smaller groups, as well as collective control over a much larger population. Such arrangements may also reduce or eliminate conflict over resources between groups within the alliance. Cooperative arrangements may then be solidified over time as long term corporate entities through an ideology that promotes the corporate bond.

Institutional Competition

Blanton, et al. present the two strategies as incompatible, even though they are commonly both used, at least to some extent, within the same groups (Beekman in press a; Blanton, et al. 1996:2), but usually among separate institutions (Beekman in press a:57). Blanton and colleagues further state that concurrent use of both inclusive and

exclusive strategies may lead to conflict, and suggest that they may need to be separated at different sites with very different functions for stability within the polity (Blanton, et al. 1996:7).

Although these strategies may well co-exist with some tension and conflict in their competition for site dominance, they do not tend to contend for the same resources. As a result, their co-location is possible and appears likely in areas where both staple and wealth trade resources are abundant, such as the above example for the Maya at Blue Creek. At present, we don't know the details of how institutions utilizing each of these strategies were coordinated within Blue Creek's political and economic systems.

Bourdieu views institutions as groups which occupy certain positions in *social space*, which is "a space of differences, in which classes exist in some sense in a state of virtuality, not as something given but as *something to be done* " (Bourdieu 2002:275, emphasis Bourdieu's). Institutional actions cross multiple social contexts that Bourdieu refers to as *fields* (Wacquant 1989:38-40) as they vie for dominance in the power structure. Social actions also are played out in physical space, and are reflected in the patterns of spatial distribution of material culture in the archaeological record. Bourdieu's fields are not directly tied to physical space, but different architectural contexts are designed around different performative strategies that may include ritual, ceremony and other forms of social interaction (Beekman in press a), and therefore a designated physical space becomes an aspect of one or more fields.

A multi-purpose community space may also become a manifestation of Turner's *arena,* a built space where competing institutions engage. An arena can be as obvious as a literal battlefield, or as subtle as a discussion between members of opposed institutions

(1974:133). Community spaces are often regularly used for open festivals and other public rituals, and bring multiple institutions together to interact in one place. These spaces may regularly become ad hoc arenas for various combinations of institutions and fields. Arenas also are expected to eventually produce some ultimate decision over power, "even if it is the decision to leave things temporarily undecided" (Turner 1974:135). Despite what expectations may be present, the shifting balance of power may become an ongoing struggle, as has been the case with most Mesoamerican cultures between the Middle Formative and Postclassic periods which, according to Blanton et al. (1996:8-12) have oscillated between corporate and network strategies over time. Since institutions which employ different power strategies tend to utilize different kinds of assets, political competition becomes, in effect, a struggle over which form of capital dominates the society's economy (Beekman in press a 57-60).

The Náyari of West Mexico have demonstrated co-location of networking institutions in the form of descent groups and a community administration, both of which have their own spatially separated ritual expressions of ideals intended to instill loyalty to the institution. The relationship has been far from stable, however, as the lineages and the community administration have been in constant conflict, and emphasis has shifted back and forth between the two strategies throughout their history, much like the situation described by Blanton et al. (1996) for much of Mesoamerican prehistory. Instability in the Náyari case, however, is mired in direct interference from the Spanish during the colonial period, and the dominant American governments through much of the 20th century, which overturned and altered much of what may have been a pre-existing institutional balance. Beekman (in press b:7,8) has suggested that two factors may need

to be in place for both institutions to coexist in a stable relationship: Explicit benefits of belonging to each institution need to be understood by its members, and some form of cross-legitimization of institutions pursuing both strategies may need to be embedded in the group's ideology. Such cross-legitimization, which may perhaps bind networking institutions, rather than individuals, more directly to the community institution may have been lost after Spanish contact.

Another problem in the Náyari case is that the traditional community ritual does not show any associated resources or capital which may benefit participants. The only potential economic benefit is the elder responsibility of insuring the rainy season cycle, but land and agriculture appear to be the sole property of the lineages (Beekman in press b:5, 7).

Combining Economies: Context and Matrix Control

Earle and Blanton each proposed a form of social separation between economies. Earle proposed a separation of wealth and staple economies by polity, and Blanton, et al. suggested the coexistence of the two economies within the same polity, but within separate institutions and probably also separate sites. Kenneth Hirth (1996) has criticized this tendency towards compartmentalization of prehistoric economies:

> "The dichotomization between food and nonperishable commodities obscures the fact that (1) both food and luxury items play complementary roles in the development of political economies, and (2) elites may

> reorganize agricultural production to generate surpluses to trade for luxury items or control the production of craft goods or luxury items to procure food." [Hirth 1996:208]

Hirth developed a model which allows for the control and activities involved in both wealth and staple economies to co-exist at the same site. Hirth's *matrix control principle* suggests that elites may actively accumulate and diversify economies which they control even across wealth and staple boundaries as a risk management strategy. Elites accomplish this by including diverse strategies as separate lower-level institutions within the social structure. Production and accumulation of resources can then be managed under separate provisioning networks (Hirth 1996:224-225). However, the potentially conflicting ideology associated with a corporate institution must also be limited to that institution, and made to work in the context of an over-arching authority.

While the matrix control principle allows for coordination of different economies under the same social structure, Hirth's *context principle* addresses the need for spatial separation of economic bases by suggesting elite supervised spatial contexts for the production and storage of wealth. The principle does not require same-site economic activity, since mobilization networks are likely also included in the system for accumulation, but co-location of activities would be advantageous to supervision and management (Hirth 1996:223-224). Similarly, ritual activities for incompatible networking and corporate ideologies may utilize separate built space contexts, as suggested by Beekman (in press a).

Under Hearth's model, relative emphases on each economy under elite control largely depend on elite choices, although other factors, such as fluctuating availability of staples and changing demand for wealth items, remain important considerations. This changes the view of the economic balance that we may expect to be represented within the material culture of a site, relative to expectations of the models of Earle and Blanton, et al. Rather than a categorical view of wealth or staple dominance, the data may reflect more subtle differences of material culture represented by each economy. Hirth also identified several other economic categories that elites may attempt to control, although most (such as service economies) would not be represented in the material culture, especially when confined to lithic data, so Earle's wealth and staple categories will suffice as the more manageable division.

Structure, Economy and the Natural Environment

With all of the discussion on economic and related social dynamics in the literature, it often appears as if the natural environments of each respective social group are little more than backdrops in which these dynamics are played out. Environmental factors actually appear to have substantial effects on economic and strategic aspects of cultures (Blanton, et al. 1996:7, Earle 1991:13-15). However, opinions about the environment's specific role in shaping cultures have historically varied quite widely on a continuum of cultural vs. environmental dominance. Classic processual environmental determinists have commonly viewed cultures as "spatially delimited bodies of individuals living within and adapting to a specific physical environment" (Schortman and Urban 1987:63). On the

opposite end of the continuum, social theorists often see cultures as primarily driven by internally generated constructs of meaning which often actually instigate environmental change (Hodder 1982). Schortman and Urban have argued that the old processualist view ignores cultures which live and interact throughout areas of highly variable environments (1987:63), and Chase-Dunn and Hall have also suggested that a purely environmental distinction may work for some groups, but not others (1991:15-16). Others argue that the opposing concept of cultures as strictly innate, internally generated phenomena ignores evidence that environmental features combined with major climatic changes appear to have taken a large role, if not an exclusive one, in the formation and reconstruction of social structures (e.g. Chatters and Prentiss 2005; Shaw 2003). These few arguments are just a small sample of a very large debate which extends well beyond the intended scope of this paper.

Many archaeologists have chosen to either seek a middle ground or bypass arguments related to the primacy of nature vs. culture, and instead concentrate on the nature of the interplay between culture and environment. Maya lithicist Jason Barrett asserts that "neither natural nor anthropogenic inputs into the system necessarily take precedence in the metamorphic processes that affected realized landscapes. There is instead a perpetual balance of actions and reactions that inhibit stasis in either nature or culture" (2004:53), and Townsend states that the need to acquire resources required for survival is completely interrelated with the need for explanation and meaning (1998a:23).

Others still place culture and environment on somewhat less equal grounds: Otto Schöndube has conceded to at least some internally generated cultural influence in stating that geography is very highly influential, although not entirely deterministic (1998:205),

and John Jackson (1984) assigns a very fundamental role to the natural landscape in determining the degree of social organization. Some researchers state that corporate strategies tend to be pursued in environments where the most potential exists for agriculture (Blanton, et al. 1996:7; Hayden 1995: 62,63), and Blanton, et al. (1996:7) have also claimed that network strategies tend to occur where environments are marginal for staple goods, and also geographically in semi-peripheral or peripheral areas. However, they also state that political reorganization may create networking opportunities in the core as well. Here again, the authors take a view where the environment plays a dominant role in determining the economic base, which in turn determines the strategic direction of elites, but with some exception made for political upheaval in creating economic change.

Jackson (1984:150-151) makes a distinction which may also parallel core and periphery zones, between fragmented and irregular physical landscapes which he terms *vernacular landscapes*; and orderly, well connected areas which he calls *political landscapes.* Vernacular landscapes are also reflected in a social and political absence of structure, and are "usually small, irregular in shape, subject to rapid change in use, in ownership and in dimensions". Political landscapes offer a sense of centrality and structure, which is reflected in a structured landscape that includes "such things as walls and boundaries and highways and monuments and public places" (Jackson 1984:12).

Although the direction of this thesis does not directly address views regarding cultural or environmental primacy, it recognizes the interplay between culture and environment as highly influential in the formation of a culture's organization and economic base, and utilizes environmental data alongside material cultural data to determine initial

expectations for the questions being addressed. The supply potential is certainly a limiting factor in making decisions on an economic base in prehistoric contexts, but given multiple choices for viable economic pursuits (which may or may not be the case), elites will select and emphasize certain economic bases, based on multiple factors, including the demand for certain goods and in certain forms both within the core of a polity and among potential trading partners.

Examining Semi-periphery Economies

The theoretical question addressed in this thesis is whether prehistoric sites in economic semi-peripheral zones would have operated under a different emphases on economic bases, when the semi-peripheral zones differ in the availability of natural resources and access to internal groups. More specifically, it asks whether the semi-peripheral area site that diverges the most from the core given the immediate presence of obsidian, lower access to arable land, and internal group access, emphasizes an economy based on wealth trade over one based on staple production.

According to Blanton, et al., "to understand social change of this type in marginal environmental cases the analyst must take a 'top- down' view, placing the local system within its larger macroregional context to examine its role in the control and manipulation of intergroup exchanges" (1996:7). Studies of peripheral and semi-peripheral area relations in general should also begin with detailed information on social and economical organization at all scales before we can interpret comparative patterns between sites (Schortman and Urban 1987:80). Therefore, the remaining chapters serve

to tie background patterns discussed at the regional level, both inside and outside of the polity, to competing local strategies reflected in the material culture evidence of the social arenas formed within public spaces. It is hoped that this approach proves more useful than the usual research strategy of picking a scale of operation to work from, with no implications drawn from above or below that scale (Beekman 2000:386).

CHAPTER III

REGIONAL BACKGROUND

This chapter discusses environmental and cultural factors which may have influenced a semi-periphery site's degree of interaction with, or independence from, the core culture; and whether different availability of certain resources may have led one site to de-emphasize the core's staple economy and pursue wealth trade to a larger extent than a site associated with the core.

This chapter begins with a description of the natural environment within the Tequila Valleys, including the distribution of resources that would have influenced the economic and cultural trajectories of peripheral, semi-peripheral and core areas. The public architecture of the area (guachimontones and shaft tombs) is then described in relation to associated material culture evidence of economic strategies that appear to be employed within the region. The three political-economic zones outlined in Chapter II are then described for the region occupied by the Teuchitlán, and finally the sites under study (Llano Grande and Navajas) as well as the primary site of Los Guachimontones and the peripheral area of the Sayula Basin, are described in greater detail to determine more specific cultural and environmental characteristics related to each site's economic base.

The Natural Environment and Subsistence

Geology and Climate

West Mexico's Highlands region is situated at the intersection of two ranges: The Trans-Mexican Neovolcanic Belt that runs east-west across the continent from the Pacific to the Atlantic at the Gulf of Mexico, and the Sierra Madre Occidental which follows the Pacific Coast (Beekman 2010:44; Darling 1993:figure 1). The area is characterized by topographic complexity, extreme changes in altitude, a wide variety and abundance of inland fresh water sources and very fertile agricultural land that together produce a wide range of available resources (Beekman 2010:44; Schöndube 1998:205; Stuart 2003:3; Weigand 1985:55; Weigand and Beekman 1998:37). Land and climate reliably capable of producing a substantial agricultural surplus is necessary for systems which rely on competitive displays of abundance for social positioning and political control (Hayden 1995: 62-63). The geography of the Tequila Valleys provides numerous pockets of arable land fully capable of overproducing staple crops. The lake basins of the Late Formative and Early Classic periods primarily consisted of large connected marshlands in the valleys surrounding the Tequila volcano (Weigand and Beekman 1998:37). One exception existed within the Magdalena Basin on the west side of the Tequila Valleys, where recent geomorphological surveys show that the majority of the area within the Magdalena basin was still a lake rather than marshland (Anderson et al. 2013:25). Still, large enough tracts of land were made available for agriculture in the area as the lake waters receded, and the surrounding mountains offered ecological diversity (Weigand

and Beekman 1998:37). However, rainfall is extremely seasonal in the area. 85 - 90 percent of annual rainfall occurs during the 5 month rainy season from June through October. The season produces very heavy rains, with rainfall accumulations of 900 - 1600 mm per year.

The seasonality of the rain was likely not as much of an issue within the valleys in areas near the lake basins. The marshy nature of these areas and surrounding Lake Magdalena was likely similar to that around the remnants of the lakes that exist in the area today. Some items retrieved during Adela Breton's 1895 visit reflect the prehistoric landscape of their day as well: bracelets acquired from a purported grave context were decorated with carved frogs (Townsend 1998a:15-16). Such images reflect the importance of marshland to the Teuchitlán culture. The marshes acted as a stabilizing factor between the extreme wet and dry seasons by storing moisture for agriculture, which likely greatly extended the crop season.

Geographic Area Relations to Political-Economic Zones

Schöndube has stated that the microclimates formed across the extremely varied landscape of Jalisco made for close access to a large variety of available resources, but there was not enough resource capacity within each microclimate to support large settlements beyond chiefdoms (1998 207,215; see also Fernandez and Deraga 1988), thus the West Mexico Highland area was more suited to small, scattered settlements. However, Schöndube's assessment covers a very broad region, and the area of the Tequila

Valleys presents one exception as a relatively large, continuous ecosystem connected by the long series of lakes with abundant agricultural soils and other resources.

Economic Zones of the Teuchitlán Culture

Socio-economic roles do not automatically coincide with geographic areas, but the distribution of Teuchitlan architecture suggests a social pattern which closely relates to the geography of the Tequila Valleys. Weigand (1985) defined a cultural core zone which covers the entire Tequila Valleys region, with a periphery that describes any Teuchitlán culture outside of that region. Weigand also described an especially large and dense "habitation zone" within his core, to the south of the Tequila Volcano which in practice has been considered a sort of "core of the core". Following Beekman (in press a), the core zone within the Tequila Valleys is defined by a marked increase in architectural density across the landscape where distances between building and patio groups average about 100 m, and rarely exceed 250 m (Weigand 1985:82). The zone forms an arc of settlement that covers an area of 240 - 250 km^2 (Weigand and Beekman 1998:39, Beekman 1996b:136). This is a smaller area than defined by Weigand and corresponds to his "southern habitation zone" (Weigand 1985).

Also following Beekman (in press a), The semi-periphery corresponds to the remainder of Weigand's core, which include the areas to the north of the volcano, the Magdalena basin to the west, and the area within the Valencia Lake Basin to the Southeast. Semi-peripheral sites form a roughly defined outer core ring, still encompassed by the Tequila Valleys but much closer to the surrounding hills which mark the outer edge of the valleys (figure 1.2).

The peripheral zone matches both Beekman's and Weigand's definitions, and includes all Teuchitlán culture sites outside of the Tequila Valleys. Peripheral sites are spread over a wide range within West Mexico, including the states of Jalisco, Colima and Guanajuato (figure 1.1).

The natural landscape of the Tequila Valleys provides the first clue that semi-periphery areas may have varied from the core in political and economic organization. It is perhaps easiest to visualize the Tequila Valleys landscape starting from the prominent central cinder cone known as the Tequila Volcano, and moving outward through what are now very dry lake basins which, at the time of Teuchitlán occupation, were still mottled with receding lakes (Anderson et al. 2013:25). Across these basins from the volcano in all directions is the irregular "ring" of hills and valleys, which contain several passes with limited access to the basins from the periphery.

The more level and expansive area of the core allowed for easier travel between sites. This facilitated regionalized polities to mobilize people from larger areas, and allowed for greater corporate management of the labor-intensive staple economy, whereas the fragmented hills and gorges of the semi-periphery areas were more conducive to one-on-one or small group elite networking for wealth trade.

Weigand and Beekman (1998:47) have suggested that the Tequila Valleys' topographical features tend to foster a form of Jackson's political landscape (1984) with a strong tendency towards central control. The core landscape sharply contrasts that of the semi-periphery sites in the surrounding hills, which describe a more disorganized and fragmented vernacular landscape also defined by Jackson. Even though the architectural landscape within the valleys has been viewed as multinuclear, with several relatively

independent city centers controlling or vying for separate areas within the territory (Weigand and Beekman 1998:51; cf. Martin and Grube 2000:18-21), areas within the core were likely more centralized than the populations within the topographically fragmented semi-periphery areas.

Subsistence Resources

Maize was an important crop throughout the area, but nearly all subsistence studies for West Mexico within the last 20 years contain a recurring theme of variety in food sources rather than extreme reliance on domesticated maize. Pre-Spanish contact flora resources were extremely varied and most are still found there today. At the time of Teuchitlán occupation, the area likely saw an abundance of yams, avocados, soursops, tomatoes, chiles, beans, various squashes, maize, amaranth, chia (sage seeds), papayas, Maguey (agave), nopal cactus (tunas and paddles), cacao and several other crops. Fauna, however, were limited to dogs, turkeys and very localized groups of bees and ducks. The native animal species did not include the now-familiar work and pack animals of the area, and no animals capable of functioning in such a capacity are known to have existed in West Mexican prehistory. People therefore primarily travelled and transported resources on foot, over and around very steep and difficult terrain (Schöndube 1998: 205- 206). Even place names in the area reflect the abundance of resources: Mazatlán, the place of deer; Michoacán, the place of fish; Zapotlán, the place of zapotes. Archaeological evidence for the utilization of Maize, beans, chiles and squash goes back thousands of years and

midden evidence has been located for apparent food use of over a 16 faunal species, including deer, small game, crustaceans and birds (Schöndube 1998:208).

The diversity of food resources within the Tequila Valleys was well exploited during the Teuchitlán occupation of the area, but maize remained the most common crop. One environmental impact study of ancient maize fields in the area has estimated the degree of reliance on the common Mesoamerican staple relative to other crops at around 50 percent, although somewhat lower near the lakes and wetlands where resources more directly associated with the lake ecosystem were plentiful (Beekman and Baden 2011:359). Agave (maguey) flourishes in the high country within and around the semi-peripheral zones where it is generally grown commercially in modern times (Chadwick 2011; Heredia 2008), and was likely heavily utilized in that area during the Teuchitlán occupation as well.

Within the Sayula basin, prehistoric oven shapes and sizes most resemble those described in ethnographic data for the roasting of maguey *piñas* (hearts), a practice which today is most closely associated with Tequila production from the blue agave variety most abundant within the Tequila Valleys. (cf. Francisco Valdez 1998). Vessel forms often depict various food sources, sometimes prepared for meal service, such as roasted maguey leaf sections, squash, *pitayas* and organ cacti (Schöndube:209-210, figures 13, 14, 18-20, 22-24).

Minerals

Abundant mineral resources in West Mexico include obsidian, various forms of greenstone, various crystals, copper, silver, quartz, opal and salt (Weigand 1985:56, Weigand and Beekman 1998:37). Obsidian was one of the most utilized minerals throughout Mesoamerica during the time of the Teuchitlán, and Jalisco has the largest number of obsidian sources in Mesoamerica (Clark and Weigand 2009:79). The Tequila Valleys are especially rich in obsidian deposits (Beekman 2010; Esparza 2003:74,86; Stuart 2003:3), and contains over 30 obsidian outcrops, at least 12 of which appear to have been exploited before European contact (Spence et al. 2002:65).

The Economic Impact of a Changing Climate

Despite the apparent climate stability expressed by Schöndube (1998:205-206), relatively slow and subtle climate changes over time may have profoundly affected cultural dynamics within the area. One question of interest is the cause of the expansion of the Teuchitlán culture from the core areas to the hills and beyond, and what part a changing climate may have played in the decision to expand and establish peripheral and remote sites. Understanding the reason for the move may determine something about the purpose of the remote sites. Were people forced to seek alternate resources, or was the expansion an enterprising "power move" on the part of Teuchitlán elites to gain better access to remote resources?

Overall, the Late Holocene has been quite variable in climate in the Highland Lakes area, with multiple wet and dry periods (Schöndube 1998:205). The drying trend which began after the Late Formative Period may have profoundly impacted people living in the region from the Early Classic to the end of the Teuchitlan culture at the beginning of the Middle Classic (Anderson, et al. 2013; Beekman 2010:61).

Whether or not drought was motivating factor for culture change is unclear. However, Early Classic settlements in the hills of the semi-peripheral zone would have required different subsistence strategies than settlements in the valleys, although hills would not have been entirely agriculturally impoverished. Maguey thrives in hot, sunny and arid climates and is quite tolerant of poor soils and drought (Chadwick 2011; Knox 2013). The succulent also tolerates occasional moderate frosts down to about -3˚C (25˚ F) (Chadwick 2011). The Jalisco high country, and in particular, the hills north of the Tequila Valleys, are considered an ideal climate for maguey, and are currently one of the main regions for growing the blue agave variety commercially (Chadwick 2011; Heredia 2008). The agricultural fields in the valleys south of the volcano (including the former Teuchitlán core), in contrast, are primarily populated with maize and sugarcane.

Economic Strategies Within the Teuchitlán Culture

The two prominent forms of ritual spaces among the Teuchitlán, shaft tombs and guachimontones, appear to support the two economic strategies outlined by Blanton, et al. (1996). The shaft tombs reflected a network or exclusionary strategy manifest by descent groups which is associated with a wealth finance economy. In contrast, the

guachimontones were the setting for more group-oriented activities associated with staple finance (Beekman 2000:403-404; in press a:57-60). These economic bases and their relationships with the ritual architecture are described below.

Staple Finance

Guachimontones: Corporate Management of a Staple Economy.

The ritual architecture of the Teuchitlán culture, the guachimontón, is composed of a circular patio with rectangular buildings arranged around the circle's circumference, and usually a circular stepped pyramid altar in the center (Beekman 2008:419, 2010:62; Weigand 1985:66-69; Witmore 1998:138; figures 3.1, 3.2). Ceramic dioramas depicting Guachimontones, as well as wall remains on the actual patios, show the presence of buildings surrounding the patio. Dimple-shaped holes were discovered on the top surfaces of the altars within Los Guachimontones (Townsend 1998b:110) and in the center of the patio at Llano Grande, and some clay dioramas show the presence of a vertical pole in the same positions. The pattern has been the subject of much discussion on the rituals it hosted (e.g. Beekman 2000, 2008; Weigand and Beekman 1998; Whitmore 1998).

The earliest evidence of occupation at guachimontón sites is from around 300 B.C., and construction of guachimontones started some time later, by 100 B.C. (Beekman 2010:63). The level of effort required for these circular constructions is substantial. Even the moderately sized 8-building circles would have involved labor efforts in the range of hundreds of thousands of person-hours. Construction of the circles at the site of Los

Guachimontones is estimated to have required about 1.25 million person-hours of labor (Beekman 2000:395, 397). Despite the variation in architectural details, guachimontones follow several patterns relatively consistently across the landscape throughout the region. The number of buildings around the patio varies, but most have 8 satellite platforms and other variations are limited to 4, 10,12 or 16 platforms, all arranged in opposing pairs (Beekman 2008:419). Different construction techniques were used for each building in

Figure 3.1: Circle 2 guachimontón from the Los Guachimontones site.

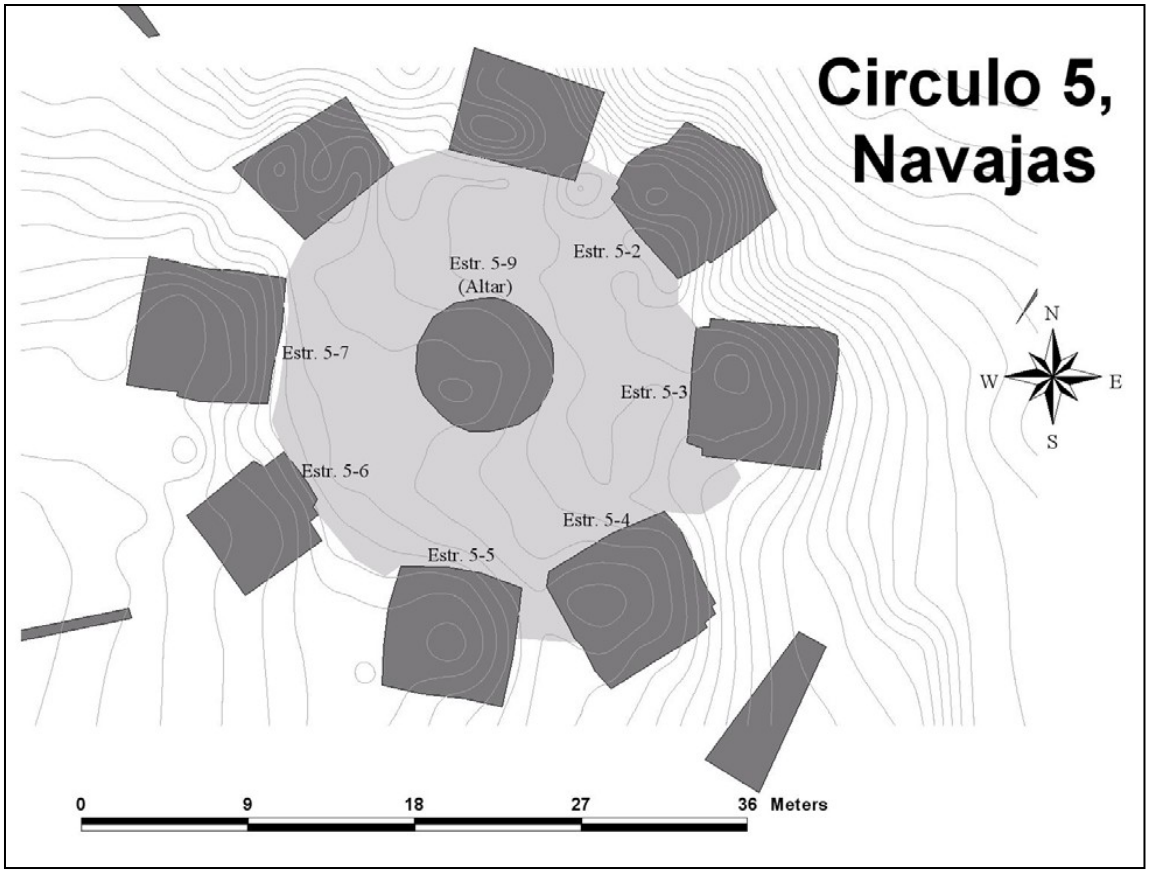

Figure 3.2: Navajas Circle 5 guachimontón plan view.

several documented cases, so the buildings were most likely constructed by different groups, with different learned techniques (Beekman 2008). Beekman has suggested that the groups representing each building on the circle were likely competing lineages (2000:414, 415).

Material culture within the guachimontones tends to be less ornate compared to artifacts within the shaft tombs described below, possibly due to suppression of aggrandizing behavior in a space dedicated to cross-institutional unity (Beekman in press a:63). For example, Catherine Johns' ceramic ware study (2014) from one core guachimontón complex revealed that the majority of the sherds by weight were of a plain utilitarian ware related to cooking and storage (*Colorines*), or a very uniformly painted

ware associated with communal feasting (*Arroyo Seco*). Relatively few of the sherds in each building were determined to be from more elaborately decorated forms (*Tabachines* and *Estolanos)* typically associated with aggrandizing ritual behavior (Johns 2014:figures V-12, V-13).

The social use of guachimontones appears quite varied from ceramic dioramas found within tomb contexts, which depict different scenes of dancing, drinking, playing music, apparent marriage ceremonies and rituals (Beekman 2003b:12, in press a:63,64). dioramas also depict apparent funerary processions crossing a guachimontón (Beekman 1996b:136, in press a:62). Clay dioramas found in some tombs depict scenes of dancers around the pole (Townsend 1998b:111).

Several archaeologists have proposed that the guachimontón architectural form symbolizes agriculture or fertility (Beekman 2003b, in press b), and that elites were involved in the staple economy through frequent agriculture related rituals held within and around the guachimontones (Beekman 2000; Butterwick 1998; Lopez and Ramos 2006a,b; Schöndube 1998). These proposals suggest symbolism of economic aspects that extend beyond the guachimontones themselves, and are described in the following sections.

Concentrations of obsidian often appear in ceremonial centers, and visual sourcing most often points to nearby area mines as the sources for collections within the centers. Therefore, any elite control of obsidian was likely not centralized. Spence, et al. (2002:68) have suggested that elites controlled obsidian on a per-area basis from secondary guachimontón sites that oversee each area. Control of obsidian may have been an important component in the political dynamics of the area (Spence et al. 2002:68), and

Weigand (1985:89; 1996:96; and others) has stated that guachimontones are also often associated with obsidian workshops, although Weigand's evidence is very preliminary since it is based on surface survey reports. If further excavation verifies Weigand's observation, the association reflects elite interest and likely control of the obsidian production industry.

Agriculture Production

Beekman (2003b:14,17) has suggested that the guachimontón architectural form may symbolize maize, since the pattern is quite similar to a cross sectional view of an ear of corn. In this view, the circular patio represents the cob and the surrounding buildings represent kernels. For the *Harinoso de Ocho* variety of maize, a likely common variety for the Teuchitlán culture, ears most commonly carried eight rows of kernels but ten and twelve kernels are also found on occasion. Likewise, most guachimontones in the core and semi-peripheral areas have eight surrounding buildings, although ten and twelve building guachimontones are occasionally found. Maize is a very high yield crop on which Mesoamerican people heavily depended, but also highly vulnerable to climate and soil conditions. It is therefore considered a high-risk crop. Attempts to mitigate the risk to the amount of surplus required for elites to maintain their political status probably relied heavily on cosmological solutions (Beekman 2003b:18).

Others have suggested that agricultural fields themselves show evidence of production intensification. Weigand (1993:228) has interpreted cross-hatch patterns in the Tequila Valley basins as artificially raised agricultural fields called *chinampas*. Conversely, Stuart (2003) has suggested that the pattern is actually a series of water management

channels, based on a lack of sufficient sediment for chinampas. Stuart also warns that his uncertain dating of the fields to the Terminal Classic period should be treated "with extreme caution" (Stuart 2003:241), and a geomorphological study of the lake basins in 2013 demonstrated that Stuart's canal system would have dried up long before his proposed termination dates (Anderson et al. 2013). Stuart's uncertainty of the dates, however, opens up a possibility that agricultural channels could have been utilized much earlier.

Beekman (2010:61) also suggests that The Early Classic Period expansion of the Teuchitlán culture spread ideas of agriculture based ritual and social heterarchy into the semi-peripheral and peripheral areas, which might have fundamentally transformed economies throughout West Mexican into a regional agrarian system if the gradual drying trend leading to Epiclassic drought had not already begun to affect the local environment. The drying trend also may have influenced the semi-peripheral zone sites to at least partially replace or augment their staple finance with a greater emphasis on the wealth economy.

Feasting

Butterwick has proposed that ritual feasting, an integral part of a staple economy, was pervasive throughout the Teuchitlán culture. The archaeological evidence suggests that the practice goes back at least as far as 100 B.C. (Butterwick 1998:99). Numerous depictions of food in ceramic art suggest that feasting was a deeply ingrained aspect of the West Mexican way of life since the Late Formative period, and some figurines suggest the ritual consumption of *aguamiel* (*maguey* nectar) or it's fermented form *pulque*

out of a container (Butterwick 1998). The contents of shaft tombs, particularly at the semi-peripheral site of Huitzilapa (Lopez and Ramos 2006a,b), have also suggest a related component of large food offerings for the dead, likely related to food for the deceased and funerary displays (Beekman 2000:393).

Wealth Finance

Shaft Tombs: Networking and Wealth Trade

Shaft tombs are often associated with Guachimontones, but are more frequently distributed outside the Tequila Valleys than Guachimontones (Weigand and Beekman 1998). They are nevertheless unique to West Mexico within Mesoamerican contexts, although tombs of similar construction also appear in South America (Anawalt:1998:238). The tombs are composed of a vertical shaft which leads down several meters to one or more chambers (figure 3.3). These chambers house multiple burials and may include numerous grave goods. Shaft tombs have been of interest to both archaeologists and collectors for much of the 20th century, but until the last four decades, the interest has only been due to the fact that they are the most productive caches of figurines, ceramic vessels, obsidian objects and other artifacts for modern-day collection, trade and sale (Beekman 2000, 2008; Weigand 1985). Still, much of what we have learned thus far about the culture and economic relationships within West Mexico have been derived from the contents of shaft tombs. Shaft tombs have offered some of the best preserved contexts due to their locations several feet underground, and in relatively stable soils that avoid early collapse. But looted shaft tombs still far outnumber

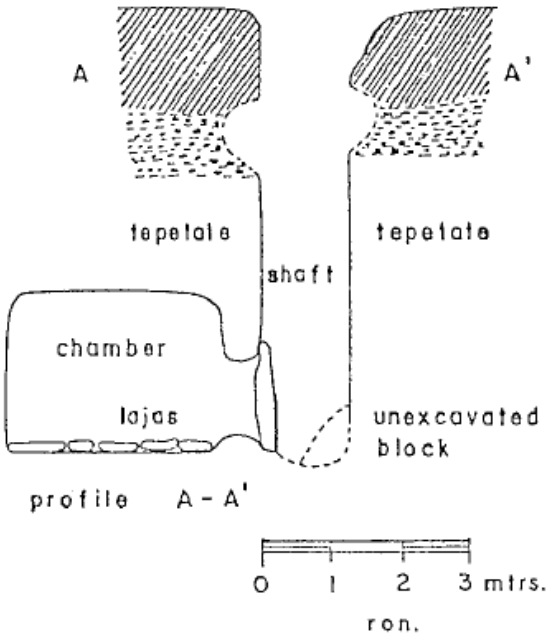

Figure 3.3: Profile of a shaft tomb from the Atitlan Las Cuevas site.
From Beekman 2000:391 figure 4.

those excavated by professional archaeologists, and Guachimontones have suffered the same fate. Published artifact data from actual tomb contexts is therefore very thin (Beekman 2000:386). But when found in context, some details of grave goods can be used as clues regarding ideologies and social relationships, and a differential distribution of goods between interments can provide clues about the organization and degree of social stratification.

Shaft tombs appear to have been used only for a certain portion of the elite population; overall, only about 10 percent of the population appear to have been buried in the tombs, with the rest interred in much simpler pit graves (Beekman 2000:391). Lineage appears to

have been emphasized over individuality in shaft tomb interments. Multiple individuals are sometimes buried within the same tomb, and genetic testing on human skeletons interred within tomb chambers has shown that individuals within each chamber are biologically related (Beekman 2008:418).

Middle- to Late-Formative shaft tombs are quite variable in construction with three ranks defined by Weigand according to size, elaboration and depth, which varies from 4 to 17 meters. Shaft tombs are often found closely associated with Guachimontones and in some cases underneath guachimontón buildings. They are also often interspersed among common pit graves (Weigand 1985: 64,66,128). Shaft tombs become smaller and contain less wealth in offerings in the Early Classic (Galván 1991 as found in Beekman 2000:396).

Funerary processions are depicted by some ceramic dioramas found within the tombs. Processions appear to function as displays of the wealth offered to the interred, which provides a way to advertise power as elites negotiate their position in the social structure (Beekman 1996b:136; Beekman in press:62). Shaft tombs instilled Chase-Dunn and Hall's idea of "differentiation" (1991:19), a social difference of prestige, the ability to mobilize people, and economy rather than one of overt territorial control. The presence of prestige goods within the tombs also illustrates Blanton, et al.'s (1996) networking/exclusionary strategy operating through a network of kin relations.

Obsidian eccentrics and other status items within the Teuchitlán culture are much more concentrated in elite locations, such as shaft tombs and guachimontones, in Late Formative and Classic period contexts than in earlier contexts; elites appear to have exercised a much greater degree of control over objects of authority during these periods

(Beekman 2010:63). During the later periods, elite grave offerings included imported goods from areas across the Mesoamerican continent, and include seashells from both coasts, jade beads and cotton (Beekman 2000:394, 2010:63, López and Ramos 1998:61).

Differential access to wealth goods is evident in the different distributions of goods between tombs, and even chambers within the same tomb, which shows clear evidence of a fully established social stratification (López and Ramos 2006b), and an exclusionary strategy. Obsidian artifacts in shaft tomb contexts include cruciforms, lunates, thin circles, pendants, large double pointed knives, mirror backs, beads and ear spools (Weigand 2000:49).

Ceremonial ceramics and other wealth goods are also extremely variable in style within each chamber collection, and Butterwick has suggested that the diffused ceramic distribution pattern is likely due to frequent trade and/or gift giving, possibly during funerary and mortuary events (1998:104-105). The practice of staple-financed feasting may therefore have actually encouraged internal wealth trade by simply providing a social context for the interaction of elites between groups, even if the corporate ideal officially discouraged networking practice.

Long-distance Trade

Evidence of foreign goods within shaft tombs indicates that long distance trade intensified through time to support the rise of an elite class. Some have suggested specific long distance trade contacts from South America based on material culture similarities and travel feasibility studies (Anawalt 1998; Callaghan 2003), and Weigand (2000, 2008) has proposed trade with the American Southwest based on artifact similarities and the

presence of high quality turquoise. However, the Southwest connection has been considered doubtful, since the Southwest had closer access to obsidian and the cultural similarities to West Mexico do not extend as far as the Tequila Valleys. Also, Weigand's turquoise was judged on visual aspects. Since existing compositional sourcing techniques for turquoise have not been successful, Weigand's assertion cannot yet be confirmed.

Obsidian's Relation to the Teuchitlán Wealth Economy

Jay Johnson (1996:171) has suggested that obsidian in general may occupy an intermediate status between a staple good and an elite item throughout Mesoamerica, since obsidian objects have been consistently found in highest concentrations within elite household and ritual contexts, yet are also present in commoner households. Obsidian is also made into both utilitarian and ritual or eccentric objects. Within the Tequila Valleys, utilitarian forms of obsidian as well as raw or prepared cores can be considered staple goods because of the material's ubiquitous presence throughout the area. More finely worked eccentric or ritual forms, however, were more likely produced by specialists and therefore easier to control by elites. We must also distinguish between obsidian designated for internal use, and that which is prepared for export to areas for which the material is in much greater demand. The production of finished goods from fine quality obsidian within consumer areas in other parts of Mesoamerica appears to most frequently occur within elite contexts (Johnson 1996; Spence 1981). Traders seeking the material would need to be connected with remote elite groups. Obsidian bound for export may then be considered a wealth good, since it can be used to obtain elite imports. Therefore,

obsidian items considered wealth economy goods are restricted to external trade items, and all eccentric items whether internally or externally circulated.

Economies and Ritual Space

The material culture evidence demonstrates that Teuchitlán elites relied heavily on both staple and wealth economies to maintain their power. The evidence for corporate crop related ritual and feasting is abundant, as is the evidence for the exchange of wealth goods throughout, and possibly even beyond, the Mesoamerican subcontinent.

Considering the distribution of wealth and staple related material culture as it relates to the shaft tombs and the Guachimontones, it appears that the *primary* purpose of the Guachimontones is for corporate festivities and rituals mainly related to the staple economy, and the primary purpose of the shaft tombs is the display of wealth in the context of the social network. However, unlike the degree of spatial separation predicted by Earle (1991) and Blanton, et al. (1996), both wealth and staple economies appear to not only coexist within the same sites, but in some ways can even complement each other, even within the same ritual spaces. The configuration of the Guachimontones reflects the formation of corporate groups depicted by the central patio and altar, out of the institutions that form the wealth economy; the kin groups which build and occupy the surrounding buildings. As Butterwick (1998:104-105) has noted, corporate rituals and festivals in the spatial contexts of the Guachimontones provide a potential catalyst for intergroup wealth trade among elites of different subgroups. The result is an internal site network formed from the elites of each kin group which resulted in the wide dispersal of

different forms of wealth items, but still only among elite members of each group. Guachimontón patios may then act as arenas for trade and other interactions, such as inter-group marriage relations and political maneuvering. Also, the use of ritual items in the corporate ritual contexts, including elite attire, jewelry and symbols of power, is demonstrated in some of the clay dioramas (Anawalt 1998:figure 1;Weigand 1996:figure 9). Conversely, shaft tombs display large quantities of food items alongside the various wealth goods, as the perceived need for staple supplies (and the elites' perceived ability to provide them) extends well beyond the earthly plane (Lopez and Ramos 1998, 2006a,b).

Timeline

Carbon dating combined with ceramic seriation has determined that the guachimontones were first constructed as large centers in and near the core during the Late Formative period, starting around 100 BC. Much smaller guachimontón construction later spread into the surrounding hills and more distant outlying areas, as far as Colima near the Pacific Coast and into all neighboring states, around AD 200. Around the same time, new construction within the core ceased, and only evidence of structure modifications appears for the core area during the Early Classic period. Based on a lack of evidence for any later maintenance of the structures, the culture is currently believed to have collapsed around AD 500. (Beekman 2010:64; Beekman and Weigand 2008:315). The shaft tomb culture also saw its peak in the scale and elaboration of construction, as well as the quantity of wealth offerings, roughly at the time of the earlier

guachimontones. Much like the guachimontones, the size of shaft tombs decreased in the Early Classic period, as did the quantity, size and wealth of tomb offerings.

Several timelines with different phase definitions have been created for different areas within the Tequila Valleys. Recent phase definitions for the sites and periods of interest is included here for general reference (Table 3.1). The periods of interest here are Tequila III (100 BC - AD 200) and Tequila IV (AD 200 - 500). Although timelines between different sites are not well synchronized over long time periods, an AD 200 transition is common to several locations and aligns well with the transition from the Late Formative Period to the Early Classic used throughout most of Mesoamerica. This thesis most often references the most universally understood Late Formative and Early Classic Mesoamerican periods, following Beekman (2010).

Distribution of Architecture

Even though the main features of guachimontones and shaft tombs are evident throughout the Tequila Valleys, more specific architectural differences exist between the core, semi-peripheral and peripheral areas. These differences may show different relative emphases on different economies by reflecting differing ideologies promoted by aggrandizing wealth-oriented political organizations rather than corporate ones. Ideologies which stress community are directly tied to Blanton, et al.'s (1996) corporate/inclusion economic strategy and therefore more likely target a staple economy. Aggrandizing systems which elevate one group above others at the highest structural level may be more likely to pursue a network/wealth trade economy. Although both

Table 3.1: Site occupation spans and related periods relevant to the current study

<table>
<tr><th>Date</th><th>Mesoamerica (Beekman 1996b:figure 3)</th><th>Tequila Valleys (Beekman 1996b:figure 3)</th><th>Los Guachimontones (Beekman and Weigand 2008:figure 9)</th><th>Sites Under Study (Beekman and Weigand 2008:figure 9)</th></tr>
<tr><td>400 - 500 A.D.</td><td>Middle Classic</td><td rowspan="3">Tequila IV</td><td rowspan="3">Ahualulco</td><td rowspan="2"></td></tr>
<tr><td>300-400 A.D.</td><td rowspan="2">Early Classic</td></tr>
<tr><td>200 - 300 A.D.</td><td>Llano Grande</td></tr>
<tr><td>100 - 200 A.D.</td><td rowspan="6">Late Formative</td><td rowspan="3">Tequila III</td><td rowspan="5">El Arenal</td><td rowspan="2">Navajas Circle 5</td></tr>
<tr><td>0 - 100 A.D.</td><td rowspan="5"></td></tr>
<tr><td>100 B.C. - 0</td></tr>
<tr><td>200 - 100 B.C.</td><td rowspan="2">Tequila II</td></tr>
<tr><td>300 - 200 B.C.</td></tr>
<tr><td>400 - 300 B.C.</td><td>Late Tequila I</td><td>San Felipe</td></tr>
</table>

economies are evident in the architecture of all three zones, sites appear to become relatively less corporate and more wealth oriented with increasing distance from the core.

Core Sites

The Teuchitlán culture's peak population period within the core settlement zone has been very tentatively, although conservatively, estimated at approximately 40,000 people (Beekman 2008:416). The overall settled area covers 24 km^2 with 30 km^2 of proposed

Chinampas (or canals, according to Stuart [2003]) and 300 km^2 of terraced fields (Beekman and Weigand 2008). Many of these claims and figures have not been substantiated by excavation and proper dating, so these data must be viewed with caution. At the latest published count, 38 ceremonial centers have been verified in the core population zone (Beekman in press a:69).

The forms and sizes of buildings surrounding the guachimontones in the core are quite uniform. No buildings stand out as being larger or more elaborate around or near the circle (Beekman 2008), which points to the representation of a likely corporate power sharing system between groups represented by each building (Beekman 2008). Shaft tombs within core and semi-periphery areas can be much more elaborate and labor-intensive, contain more grave goods than those on the periphery, and vary more in elaboration and wealth than more distant tombs (Beekman 2000:389-390).

Semi-peripheral Sites

Beekman notes that the more distant sites within the semi-periphery include a few guachimontones with unusually large residential buildings or a single disproportionately large building on the edge of a guachimontón. Semi-peripheral sites also more frequently include shaft tombs underneath guachimontón buildings, all of which reflect self aggrandizing behavior and an increase in emphasis on descent groups (Beekman in press a:70,71).

Six especially distinctive sites in passes overlooking the valleys have the greatest exposure to outside groups (Beekman 1996a,b ; Weigand and Beekman 1998). Four of

these sites are concentrated in the La Venta corridor to the east, and include Estolanos Mesa, Mesa El Zacate, Cerro Tepopote and Peñol Tepopote. The remaining two sites, Cerro Pipiole and Llano Grande, are in Magdalena basin valley passes to the west (Beekman 1996a:984-985, 1996b). Beekman suggests that all of these sites were established to monitor their corridors as trade and communication routes. Based on the scale, substantial nature of the architecture and amount of artifacts and debris at each location, the sites appear to be full-time settlements which range in size from just 5-6 architectural features at Estolanos Mesa, to 120 features for the largest site, Peñol Tepopote. All four of the La Venta sites contain wall features that either cross the pass or surround the site (Beekman 1996b:139-140), as does Llano Grande (Beekman 2001:4-5). No wall structures are mentioned for Cerro Pipiole, but the site has yet to be examined in detail.

The appearance of walls in semi-peripheral areas is one of a few archaeological clues that can be found of a group's attempt at defining social boundaries (Chase-Dunn and Hall 1991:18), and Beekman asserts that these semi-peripheral sites form a controlled boundary surrounding the core area (Beekman 2000:404).

Beekman has also noted that the architectural and functional redundancy of guachimontones throughout the Teuchitlan culture suggests more of a segmentary state than a unitary one, as each site shows emulation of the largest core sites and functional independence, rather than a functional specialization that requires centralized control expected from a unitary state (Beekman 1996b:136). Yet, if the walled semi-peripheral sites do indeed represent boundaries, then core elites may have attempted to increase their power by encompassing and managing the semi-peripheral areas as part of a conversion

of the political system to a more unitary state. If the area had become more centralized, then economic activity in semi-peripheral areas would have been directed towards the core, rather than external groups. As Kowalewski, et al. have pointed out, such transformations may not always be completely successful due to the required resources involved in controlling remote areas (1983:37), especially for remote locations which are less accessible across steep hills, marsh-ringed lakes and arroyos.

A few semi-peripheral sites also show differences relative the core in the proportions of guachimontones themselves. These circles include a single enlarged building which may reflect one descent group becoming dominant and gaining control over the ritual aspects of the entire group (Beekman in press a:64). This also reflects a move towards a vertical structure that favors aggrandizing elites, and likely accompanies an increase in wealth/trade aspects of the local economy. Weigand (1985:66) has stated that the most elaborate shaft tombs were located in the peripheral area of the Atemajac Valley east of the Tequila Valleys, and that the remaining tombs he had discovered by 1985 were "3rd rank", meaning less than 4 m deep and only one chamber Four of five sites known to contain shaft tombs beneath guachimontón buildings are in semi-peripheral areas (Beekman in press a:70). The guachimontón tombs are larger and more elaborate than those found in cemeteries. They also contain more variable and numerous grave offerings, and are more often reused for multiple interment. (Beekman in press a:62). Among the more elaborate semi-peripheral area examples is the tomb at Huitzilapa with an 8 m shaft, and a total of approximately 60,000 artifacts (Weigand and Beekman 1998:39). Beekman (in press a:62) suggests that kin relations were more emphasized at these sites, along with descent related claims to ceremonial positions related to the public

architecture, whereas cemetery tombs more consistently found in the core related elites to corporate control of labor and land capital.

Peripheral Sites

Peripheral guachimontones are underreported due to a lack of comprehensive, formal surveys in West Mexico, but so far two to three dozen sites have been found in Bolaños Canyon, several have been discovered in southern Jalisco and Colima, and one has been located in Puerto Vallarta (Beekman 1996a:88,89). These sites range from approximately 50 km to at least 200 km from the core. Guachimontón circles have also been found in the state of Guanajuato (Beekman 2000:figure 10, 2003b:5).

Peripheral sites tend to be located at strategic positions along transportation routes on the way to desired resources (Beekman 2003b:5). Peripheral and semi-peripheral areas were very sparsely populated, and Beekman has suggested that they likely emphasized exclusionary/networking strategies due to a lack of a labor pool to effectively implement a corporate strategy (in press a:73). Variation from the core architecture is most evident in peripheral sites. They have a much more narrow guachimontón size range, are not as well constructed and are the only Teuchitlán sites with ballcourts. The Tequila Valleys are also more agriculturally rich than any of the peripheral areas, and is the only area that shows evidence of intensive agriculture practices (Beekman 1996b:143). Peripheral sites in Bolaños Canyon appear to have incorporated local architectural styles into the standard concentric circle pattern well established in the Teuchitlán core. Beekman interprets these remote sites as local elites who have incorporated the guachimontón architecture through

the regional trade system in order to create an alliance with the Teuchitlán core, and likely adopted some elements of the Teuchitlán culture (1996b:143, 2000:400-401, 2010:64).

The remote sites to the northwest in Bolaños Canyon show the most variation from the core guachimontones. Hrdlička described and illustrated the site of Totoate and other, similar sites as a circular layout with four square mounds surrounding a square central mound. Three of the four satellite mounds appear quite uniform, but one mound to the northwest is of an unusually oblong shape with a much smaller mound directly in front of it (1903:392-393,figure 9).

A few peripheral excavated guachimontón circles contained burials under the central altar (Cabrero 1989:149-161, 187-195; Hrdlička 1903:392-395; Kelley 1971: 770-771), which strongly suggests that a single aggrandizing descent group may have claimed ritual authority over its entire community. Figurines from Ixtlán del Río of the Nayarit highlands show apparent elite rulers and/or religious leaders, one male and one female, holding scepter-like objects which were probable symbols of authority. The top of the male figure's object depicts an apparent abstract model guachimontón that includes the center pyramid, circular patio and four surrounding temples (Anawalt 1998:Fig. 1; Beekman 2003a:313).

Although the various guachimontón activities would have been a binding force of the corporate system, they may simultaneously have also contributed to its undoing. The interactions take place in the context designed to bring separate and normally competing institutions together. Therefore, all corporate gatherings designed for unity likely included a layer of negotiation and political positioning as a manifestation of Turner's

arena (1974:133). Social manipulations may involve subtle, seemingly casual strategies within festive settings, or more formal means, such as the funeral processions which involve parading grave goods of a particular lineage in sight of all participants, as a display of the lineage's wealth and potential influence (Beekman in press:62). Over time, certain groups may have become more prominent, at least in part by utilizing better access to wealth economies to out-compete other groups, especially in areas with less potential for staple finance.

Jackson's (1984) description of vernacular architecture as "usually small" and "irregular in shape" certainly matches the observed pattern in semi-peripheral and peripheral sites of the Teuchitlán culture, especially when compared to those of the Teuchitlán core, and Jackson suggests that such sites are "subject to rapid change in use, in ownership and in dimensions" (1984:150-151). We do not know what changes may have occurred within the semi-peripheral sites following their establishment, but they were likely dynamic entities which underwent continual change in their political and economic identities from both core and external influences. Thus far, interpretations of the difference in use, ownership and dimensions of semi-peripheral and peripheral sites from those within the core have favored a greater emphasis on networked wealth economy of emerging dominant descent groups. The difference can still be seen as one of degree rather than type, since the relative influence of more powerful elites within a site may vary, along with the degree of emphasis on alternate economies to which they may be linked. Some semi-peripheral and peripheral guachimontones vary from those in the core, they are still very much recognizable as guachimontones and thus still represent some degree of adherence to a corporate ideal, where a slight modification to Orwell's

adage that "all descent groups are equal, but some are more equal than others" may well apply.

Beekman has recommended that "further research, utilizing extensive excavations, should focus on this variation [in core and periphery political strategies], as well as on the multiple roles of boundary settlements" (1996a:998), and the present research can be viewed as a step towards the goal of understanding the role and nature of the Teuchitlán semi-peripheral sites.

Descriptions of Compared Sites

West Mexican archaeologists have very generally described the region as rich in certain agricultural and mineral resources. Yet, very little specific data on geology, soils and land use have been published for West Mexican archaeological contexts. The availability and quality of natural resources can change drastically between distant sites within an area as complex as the Tequila Valleys, so economic opportunities at the site level need to be assessed with consideration of very localized natural resource details. Environment details were therefore examined for the primary core site (Los Guachimontones) and the sites under test (Llano Grande and Navajas), and the pertinent data are summarized below. Land resource descriptions are taken from official Carta maps of the specific areas in question with some observations made at each site (excluding any at the Sayula Basin) during the 2011 summer lab season.

Elevations are also compared between sites to determine whether differences are large enough to effect available resources. Since elevation can profoundly affect available

resources, both topographical maps and an interactive tool (http://www.altitude-maps.com/) were used to find elevations and sloping trends where they are not specified in the literature. The altitude-maps tool finds elevations at more precise points than topographical maps can provide, but uses low resolution SRTM data which can show error rates of up to ±23m on steep slopes (Thomas, et al. in press; Tighe and Chamberlain 2009). The resolution is not as high as desired, but suffices for the current purpose.

Feature and layout details of the central site (Los Guachimontones), and also sites under test (Llano Grande and Navajas) are given here to better characterize the sites within the context of the Teuchitlán culture, and also to provide some context for the excavated features (Llano Grande Feature 14, and Navajas Circle 5) and the analysis of the lithic artifacts recovered from those features. The lithic analysis can then be used to further describe the economy of each site relative to the ecological and cultural conditions that the site represents.

Los Guachimontones

If some level of centralized control over semi-periphery sites such as Llano Grande did exist, it would likely have come from the primary site of Los Guachimontones just south of the Tequila Volcano, and near the center of the core (figure 1.2). The site likely influenced the entire core area at least culturally if not politically, and therefore is described in some detail here.

Site Environment

Los Guachimontones is on a hillside near the edge of marshland within the La Vega lake basin. Currently, Los Guachimontones contains mainly seasonal farmland to the immediate south, and mainly brush land to the north and west. During the Late Formative and Early Classic periods, much of the land immediaely below the Los Guachimontones settlement area to the south was marshland (Beekman personal communication, September 2013). Most of the soil in the area is of mixed quality for farming, except for an area about 1 km to the southwest, off the northwest shore of the lake, with deep, humus rich soil. On the opposite side of the public ritual center from the lake is a bank which runs southwest to northeast, directly behind the largest circle. Behind the bank is another area of very good soil, which may have been partly used by another Teuchitlán site on the opposite side of the field (figure A.7).

The elevation of the ritual center is 1,374 m, taken at the center of Circle 1. Over the bank above the large circle to the northeast, the field slopes downward away from the bank from southeast to northwest, and from an elevation of approximately 1,460m to 1,370m.

Description

The site's ceremonial center consists of ten circles and two ballcourts, with what has been described as a "miniature shaft and chamber tomb" in one of the older and more moderately sized circles (Beekman 2008:426-428). Los Guachimontones is by far the largest site in the region(Beekman 2008:427). Construction details are described as being similar to Navajas, although the difference in construction actually appears more similar

to what is found in Navajas Circle 5 with differences in construction material and method details for each building.

The public architecture is quite large in proportion to the size of the residential area, suggesting that it was a more central administrative center, possibly controlling a second tier of smaller major centers within the valleys (Ohnersorgen and Varien 1996:fig. 9), and the core population density also suggests that Los Guachimontones was part of a larger system, which Weigand suggests controlled six habitation zones via their respective administrative centers in the core area (Ohnersorgen and Varien 1996:103). Weigand's assertion again brings up the question as to how far Los Guachimontone's control actually extended beyond the south central core area.

Ohnersorgan and Varien (1996) borrowed a model successfully used by geographers to determine virtual "boundaries" for segmentary groups, and also tested by Alden (1979) on Aztec group data, to determine the potential political reach of Los Guachimontones. The model depends largely on the distance between sites, and the size of each site. Llano Grande wasn't included in Ohnersorgen and Varien's study, but closer and larger groups were determined to be "isolated clusters" in scenarios where the culture's willingness to travel long distances was similar to Alden's Aztec case. Therefore, Llano Grande would likely not have been included as a centrally controlled site according to the model. Navajas is half the distance to the cultural core area and on an easily accessed plateau so it is more likely to interact with, and therefore conform to, the core area.

Even though the concept has been used successfully to determine spatial limits of segmentary groups in geographic contexts, the model has not been subject to repeated testing for an archaeological context, the results should be treated with some caution.

Also, Ohnersorgen and Varien recognize the lack of any interpretation of the nature of the interaction between sites, and suggest that clarifying craft production/distribution systems, perhaps particularly in the especially prominent obsidian industry, can go beyond descriptions of the structure of the interactions to determine more detailed information about their nature (1996:119).

Navajas

Site Environment

Navajas is located in center of current farmland on a gently sloping, round, nearly circular plateau of bedrock about 1 km^2 in size, surrounded by a high-altitude plain. The site is also just outside of the semi-peripheral area hills but with very close access to the core near a pass (Figure 1.2). The Navajas guachimontones are on shallow bedrock, but agriculturally rich fields of marginal to ample depth form an expanse similar in area to the arable fields around Los Guachimontones. Arable land extends north from the ceremonial center, and also exists west of the site. Some poorer, loose and granular soil is intermixed in the northern half of the field. The rough circle of bedrock is mainly andesite, an extrusive igneous volcanic rock. The elevation at Navajas' Circle 5 guachimontón is 1,538 m, with a gradual slope from 1,592 m down to 1,458 m across the 2 km bedrock circle diameter (approximately 1˚), from the southwest to the northeast.

Description

The site of Navajas was excavated during the 2003 field season. The site is located in an area just outside the Tequila Valleys (Beekman 2008:424), on a plateau in the small basin surrounding Lake Valencia.

The site complex contains at least 10 guachimontón circles, one ball court 85m in length, scattered apparent residence buildings arranged in clusters of three to five structures, terraces, cemeteries, and satellite sites with their own guachimontones. All of these features are within 2 km. of the main center at Circle 1.

The guachimontón used for this thesis, Circle 5, was built just after the estimated time of occupation for Circle 1 (ca. 50 B.C. to A.D.50 for Circle 1, and ca. A.D. 50 - 200 for Circle 5) (Beekman 2007, 2008:424; Beekman and Weigand 2008:308,310), (figure 3.4). Circle 5 can also be seen as an early contributor to the Early Classic trend of downscaled guachimontón architecture, whereas the scale of Circle 1 is typical of its time within the Late Formative. Circle 5 contains eight perimeter platforms, and shows uniform size and shape except for one smaller building. The buildings are also positioned somewhat irregularly around the circle forming a lack of exact symmetry, with distances between buildings that vary from about 1 to 4.5 m, and each building shows different construction design and materials (Beekman 2008:423-425). The Circle 5 patio also forms a somewhat irregular circle (Beekman 2008:424). The total diameter of the guachimontón circle measured to the back walls of each opposing building is 36.0 - 37.9 m (Beekman 2008:424), and the diameter of the altar is 7.35 - 7.55 m. Using median diameter values as an approximation, the total activity area (the total area excluding the area of the altar) is about 1031 m^2.

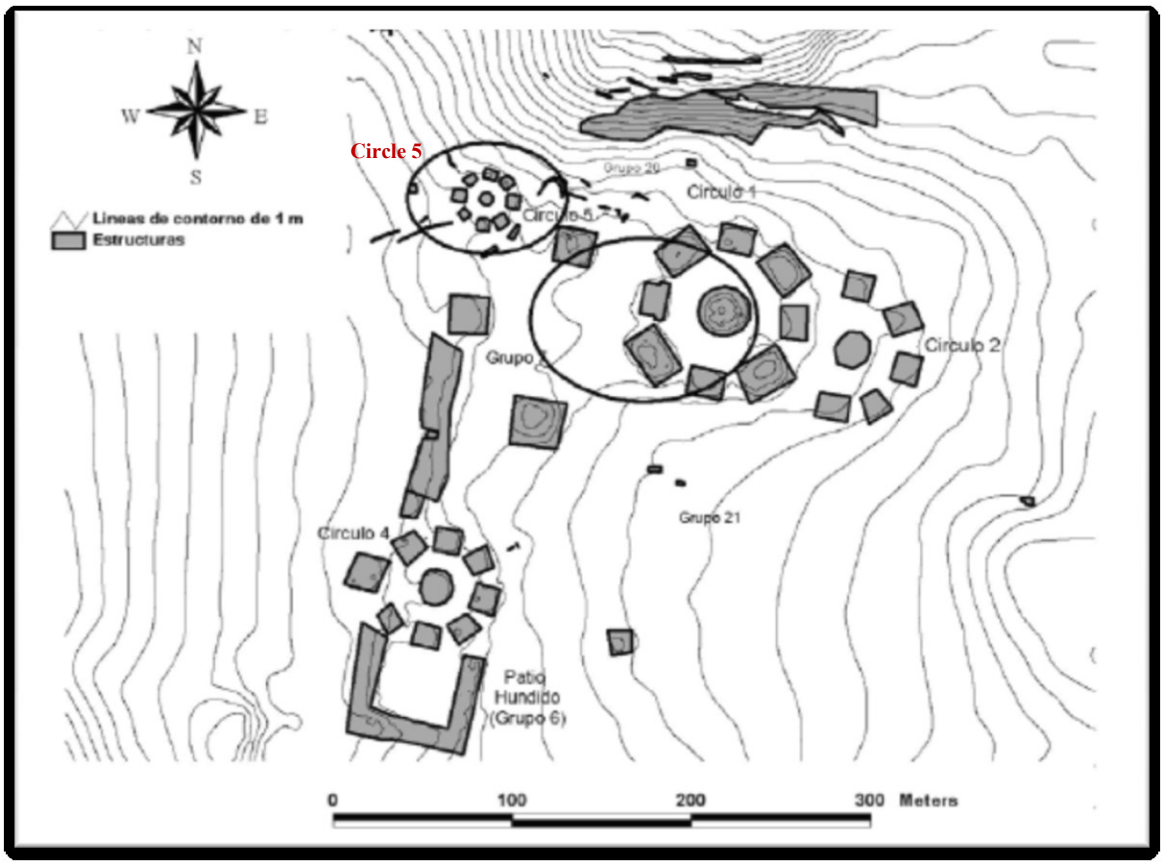

Figure 3.4: Navajas central group with areas of excavation circled. The guachimontón used in this thesis, Circle 5, is the northern-most circle.

Both Johns (2014) and Tyndall and Beekman (2007) conducted distributional studies of ceramic artifacts from Circle 5 to determine the nature of activities related to ceramics. Both studies found that relative proportions of the different types of vessels were essentially similar throughout the circle, suggesting a communal, corporate structure based form of ritual. However, both studies also note that overall counts of sherds varied considerably between buildings, suggesting unequal participation between groups. Ceramics recovered from Circle 5 include a total sherd count of 9,475 (Johns 2014:83),

which "far surpassed original expectations in terms of quantity and quality" (Tyndall and Beekman 2007:154), along with several complete and partial vessels and bowls. Based on the previous evidence for feasting depicted in ceremonial ceramic forms throughout the Teuchitlán culture (Butterwick 1998) as well as an abundance of storing and serving vessel forms at the circle (Johns 2014: figures V-12, V-13; Tyndall and Beekman 2007:174), the ceramic containers are interpreted as implements for corporate feasting. Although feasting was apparently still practiced during the Circle 5 occupation, at least two groups may have begun to dominate the rest in the corporate power field, utilizing the guachimontón ritual setting as an arena for political maneuvering. The outcome may have ultimately led to increased power of aggrandizers within the dominant groups, and a related expansion of economic control to include areas beyond staple goods.

Circle 1 also possesses 8 perimeter platforms, and Circle 1 buildings also vary in size, but in a consistent alternating pattern between large and small buildings. Within each respective size group, the large and small buildings also approximately equal each other in size, and the buildings are also much more regularly spaced around the platform. The perimeter buildings are constructed using similar materials and methods, with only a noticeable difference in the shapes of each building.

Again following the theory that the spatial relationships between buildings reflect the social relationships between lineages that built and operated within them, Beekman suggests that Navajas Circle 1 may represent a time of well-defined group relationships with major and minor groups uniformly and distinctly represented, whereas Circle 5 represents shifting relationships between groups. Just as variation in the Circle 5 architecture is limited to the basic guachimontón pattern, however, changing lineage

relationships are also seen as constrained within certain limits by the corporate code (Beekman 2008:426). The more uniform structures at Navajas are also very similar to those within the nearby internal core zone, and Navajas therefore appears to be both culturally and socially associated with the core.

Within the Navajas guachimontón, two plant species suspected to represent contemporaneous sources of subsistence were located in soil samples from activity floor surfaces, maize and *huauzontle.* The latter is a plant often cultivated for the use of its seeds and leaves in Mesoamerican cooking and medicine (Benz 2007:248). The huauzontle seeds are of some interest because they are confirmed to be of a domesticated variety, and the only other Classic Period incidence of domesticated huauzontle known to Benz is in Teotihuacán, the closest major Mesoamerican polity to the Tequila Valleys. It is not clear whether the huauzontle represents any sort of link with Teotihuacán, but it could be related to trade or some other social tie with the polity. Four obsidian tools registered positive tests for the presence of proteins which may have been food related. Three scrapers were positive for small animal proteins (species related to rabbits and guinea pigs), and one projectile point registered a grass protein which may have been maize, although no particular species were resolved from the tests (Parr 2007:225).

Llano Grande

Site Environment

Llano Grande's location is currently in a narrow tract of semi-open pastureland sparsely populated by wild Holm oak groves, surrounded by more dense Holm oak forest

land. Holm oak is an especially hardy tree variety which consists of several species of the genus *quercus*, which tolerate sandy soils and semi-arid environments (Botanicals Online 2014). The pass opens up approximately 1 km to the east into a narrow valley. The east end of the valley connects with the Magdalena Basin. The west end of the valley, closest to the site, is sloped pastureland highly subject to erosion which continues for about 200m as one travels east from the pass. Beyond this area in the valley below the pass is primarily part-time or seasonal farmland. The site is thus less than 1 1/4 km from arable land, although the pass drops down a hill into the valley. The closest water source in the valley may be 3/4 km from the west end, where a spring extends further east into the remnant Lake Magdalena. Several other springs provide water to the valley, mainly near the east end of the pass. A recent area geological study has determined that the northeast end of the valley would have been a marsh sourced by the current spring (Beekman personal communication August 2013). Thus, during the rainy season, Llano Grande would have had a 1.2 km distance to cropland. If the land was farmed during the dry season, water from the spring marsh would need to be utilized about 2 km from the site.

Land differences between the valley and the pass at Llano Grande are quite pronounced, and even assuming an adequate water source would have been available, there would have been no chance of growing any type of crop in the immediate vicinity of the pass. Although the valley contains entirely alluvial soil, the canyon is composed entirely of acidic (high-silicon) extrusive igneous rock. The canyon's soil type is considered *Regosol*, a sparsely distributed, residual soil which does not completely cover bedrock, and therefore has no appreciable depth. The valley soil type is a humus-rich, highly arable *pheozim* soil, in all areas except the southwest section which contains a

high clay soil type considered quite difficult to farm. Throughout the valley, the soil is more than adequately deep for agricultural purposes, although the soil in the sloping and eroding west end is much more shallow than the lower areas of the valley, at around 10-50 cm. The slope and degree of apparent erosion may have precluded farming in that section of the valley. The rest of the valley gradually slopes from 1,370 to 1,420 m from the Magdalena basin to the western end of the alluvial soil area. The Llano Grande guachimontón sits at 1,487 m in the center of the pass, which is essentially flat and the areas towards the margins only vary in elevation from 1,480 to 1,500m.

Botanical remains were located within the Llano Grande guachimontón, which indicate agriculture. These include charred cobs and pollen from maize, starchy seeds which could have been corn or beans, along with bottle gourd, cotton, and possibly tomato plant pollen (Schoenwetter 2004:4). Phytoliths analyzed from food residues of ceramics (four ollas and one bowl) primarily indicate maize, and also fruit from the genera *Prunus* and *Celtis* (Schoenwetter 2004:4,5). Schoenwetter states that these results indicate agricultural production at Llano Grande, even though the site "was not embedded in an agricultural landscape" (Schoenwetter 2004:1).

What Llano Grande lacked in agricultural potential, however, may have been well compensated for by the site's mineral rich environment. The site overlapped a large obsidian quarry (Beekman 2001:3; Spence et al. 2002) with a wide variety of color patterns (Spence, et al. 2002). Obsidian is ubiquitous throughout the site (Beekman 2001). The most abundant variety at the site is a dark green obsidian with very few inclusions and excellent flaking characteristics for the manufacture of stone products. Llano Grande's mineral resources also include red ochre and opals (Weigand 1985: 90),

although there is no definitive evidence that the latter two minerals were exploited by the Teuchitlán culture.

Like Navajas, Llano Grande has a direct route to the core directly across the valley floor, but Llano Grande is on the other side of the Lake Magdalena basin and is twice as far from the core than Navajas, at 20 km (figure 1.2). To a large extent, the lake and marsh levels would have further buffered the already geographically secluded Llano Grande against direct interaction with the core, and therefore also against centralized control. Although average lake levels during the Late Formative and through Epiclassic periods were steadily receding, The shoreline of Lake Magdalena reached the eastern mouth of the valley, which would have required either a longer route on foot or travel via watercraft to access the core (cf. Anderson et al. 2013:25). Thus far, no evidence of watercraft has been located within the valleys. If canoes were used the situation would have been alleviated to a large extent. However, ethnohistoric data regarding contact period canoe travel suggest that prehistoric transportation over water was 33 percent slower than land travel, and therefore increased the required travel time by an additional half of the time to travel the equivalent distance by land (Alden 1979:175). Also, the presence of a spring-fed marsh at the northeast end of the valley would have hampered travel between Llano Grande and all sites north of the core (Beekman personal communication 2013). Llano Grande was not completely cut off from the core, but a much longer route including travel through the hills would have been required. The increased travel difficulty would also increase the resources required to maintain regular interaction between the core and Llano Grande. The core may therefore have been unable

or unwilling to fully assimilate Llano Grande into the Teuchitlán social system (cf. Kowalewski et al. 1983:37).

Given Llano Grande's location in a mountain pass, one may expect a higher elevation than Navajas' location in a lake basin outside the semi-peripheral hill area, but the plateau on which Navajas sits is actually 51 m higher in elevation than Llano Grande. Los Guachimontones, however, sits 113 m below Llano Grande. Elevation is therefore considered negligible as an environment factor that could affect natural resource limitations between the two sites. Both areas also have access to good soils. However, Navajas has more expansive land resources, but with somewhat lower quality soil about 2.5 km away from the site. The topography and geology surrounding each site are categorically different, as is each site's specific location relative to staple resources. Navajas Circle 5 is adjacent to its highest quality farmland, whereas Llano Grande's guachimontón is approximately 2 km from any viable cropland.

Los Guachimontones' and Navajas' positions in open areas and adjacent to fertile soil may have been related to similar staple oriented economies, whereas Llano Grande's contrasting distance from agricultural resources suggests that the site may have diverged economically from the two core sites. However, both Llano Grande and Navajas show evidence of some degree of staple economy within their guachimontones, in the form of macrobotanical remains and residue analyses which reveal staple processing or storage.

Description

Llano Grande is situated in the center of a pass which opens into a valley off the Magdalena lake basin, northwest of the core (figure 1.2). Initial architecture surveys

which included Llano Grande recognized 43 structures and 3 walls to accompany the sole 8-building guachimontón (Beekman 2001:4-6), and the site only received passing mention in a couple of peer review articles, since it was only one of many included in early surface survey studies (Weigand 1985, 2000). Closer observations during the 2000 excavation brought the total number of recognized structures to 75, with 6 apparent walls totaling approximately 1000 meters in length. One is actually a double wall, composed of parallel walls approximately 3 meters apart, and is bounded at either end by steep arroyos (Figure 3.5). The wall system, and particularly the double wall, appear quite defensive in nature, but the walls are positioned to direct people travelling into the area through the site, and thus the walls appear to serve a dual purpose of defense and access control. Further, although the labor investment has not yet been quantified, it appears quite substantial compared to the moderate size of the site, and may well have been commissioned and coordinated by a central authority (Beekman 2001:4-6).

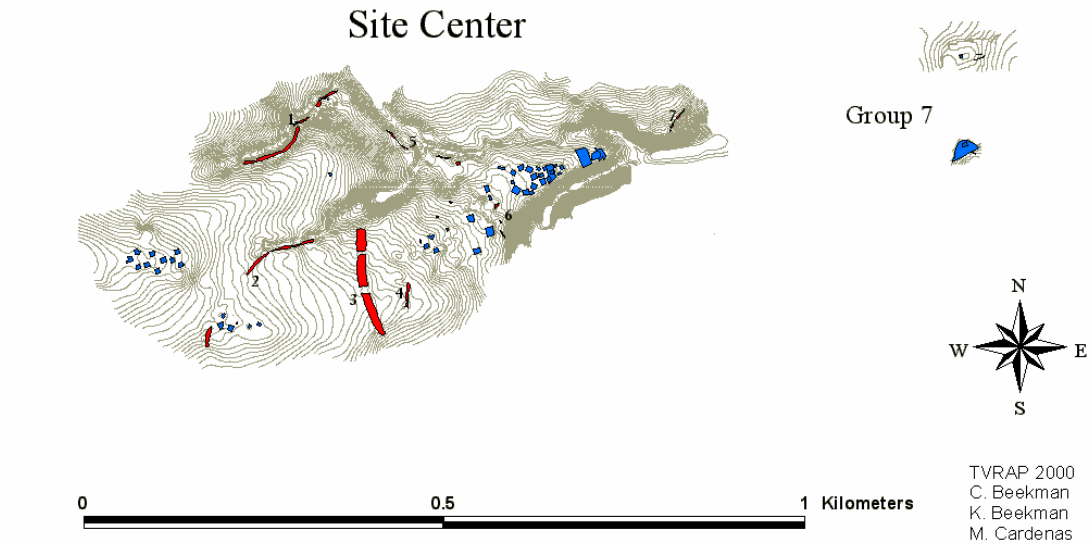

Figure 3.5: Site layout of Llano Grande. The largest wall in the foreground (Wall 3) is the double wall mentioned in the text.

The site is much smaller and less complex than Navajas, and the sole Llano Grande guachimontón, Feature Group 14, is dwarfed by Navajas' largest guachimontón. However, the Llano Grande circle is approximately the same size as the Navajas guachimontón used in the current analysis, Circle 5.

Field work on the Feature Group 14 guachimontón, which also consists of 8 perimeter buildings around the central patio, was done in the year 2000 (Beekman 2008:419). Like Navajas Circle 5, the Llano Grande circle architecture is irregular, with different building materials and methods for each building. The outer diameter of the circle ranges from 36.9 to 41.1m. Using 40m as a rounded average figure, the area calculates to approximately 1257 m^2, and the patio's area is approximately 527m^2. An old consolidated ash flow creates a slight rise in the center of the patio. A shallow hole was cut into the rise exactly in the center of the circle, approximately 25 cm in diameter and 20 cm deep. The ash rise appears to have replaced the center altar (Beekman 2003a:302, 2008:421-423). Based on these differences and irregular sizes and shapes of the Llano Grande guachimontón buildings (figure 3.6), the Llano Grande circle has the least uniform overall geometry when compared to both of the Navajas circles (Beekman 2008:424). A patio group of several structures is established unusually close to the guachimontón and directly behind perimeter building 14-6 (figure 3.6). The patio group may represent residences of more powerful elites associated with the lineage. An additional 50 structures grouped into 12 compounds, over an area estimated at about 20 ha, are interpreted as residences (Beekman 2003a:301).

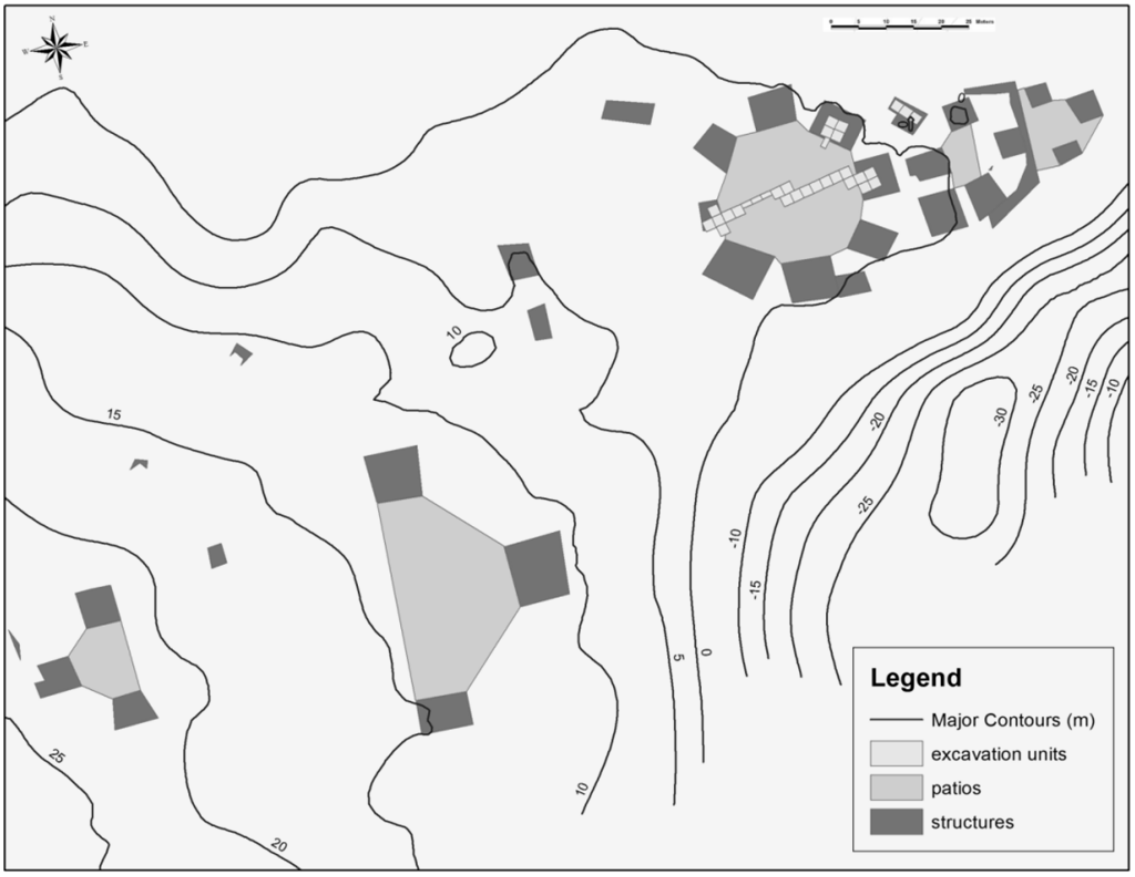

Figure 3.6: Llano Grande central group, with 5 meter increment contours.

Ceramics in the guachimontón are quite low in number, with notable artifacts located only in one building, 14-5, which included two jars and five or six bowls. Together, the collection appears to function for serving liquid within the guachimontones (Beekman 2001:7,11). The sherd count is also sparse, at 1,525 (Tyndall and Beekman 2007:155). However, these quantities must take into account that only a small proportion of the circle has been excavated so far, including only three of the eight buildings directly on the circle perimeter, and a trench across the diameter of the patio (figure 3.7). Beekman has noted that the distribution of ceramics appears unequal, in that most sherds were found within the buildings, rather than on the patio (Tyndall and Beekman 2007:170).

The lack of patio artifacts may simply point to sweeping of the public space, or as Beekman suggests, a non-communal form of feasting where each lineage group holds feasting rituals independent of the others.

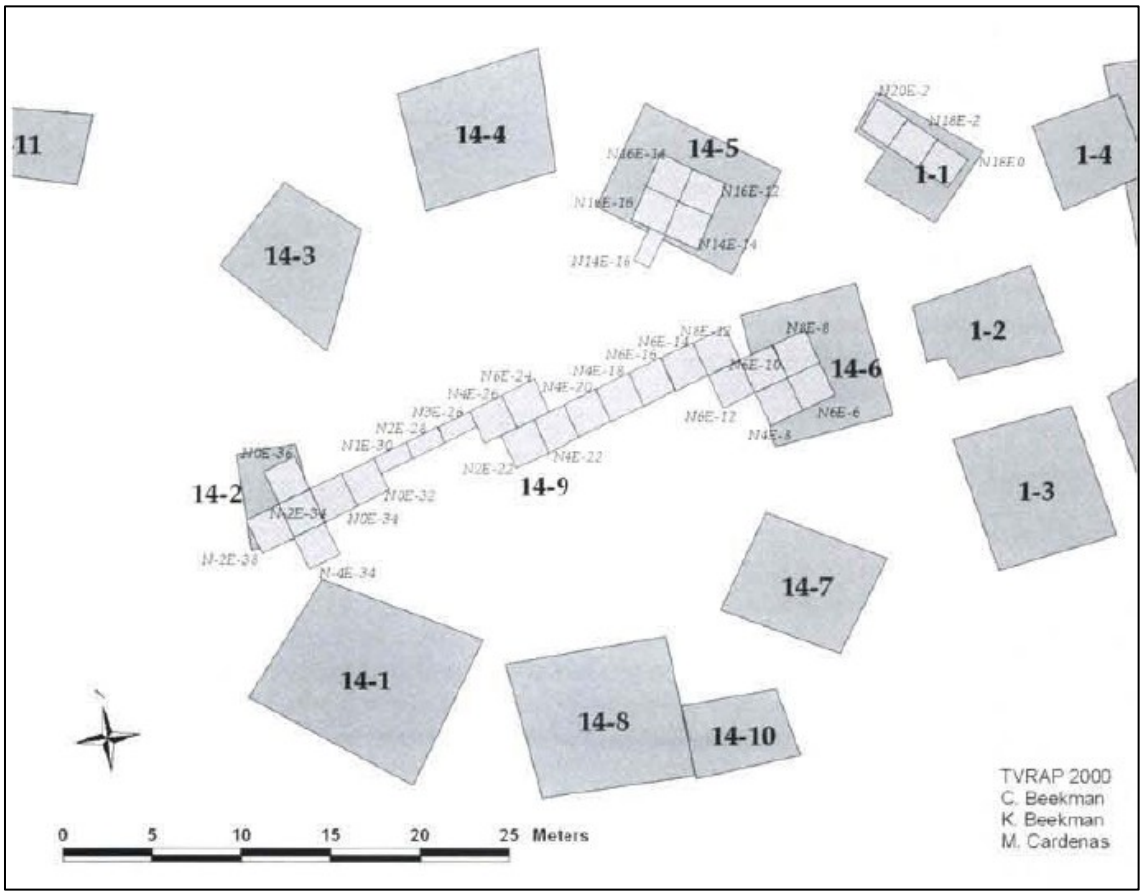

Figure 3.7: Plan of the Llano Grande guachimontón (with excavation units). From Beekman 2008, figure 4.

No shaft tombs have been published in relation to Llano Grande, but a cemetery has been located in the valley to the east (Beekman 2001:6-7), and shaft tombs were reportedly just discovered in that area during a 2013 survey, although they were thoroughly looted (Tony DeLuca, personal communication April 2014).

Llano Grande has been viewed as "a modest, specialized boundary fortification *tied to an overarching political authority*" (Beekman 2008:20, emphasis added), and indeed, the effort that was likely put forth for the substantial wall construction may represent resources beyond those available at Llano Grande, suggesting a cooperative effort involving core elite interests (Beekman 2001:5). However, the construction investment in the Llano Grande guachimontón appears relatively low, and its non-standard, irregular style suggest a local effort with little to no involvement from the core elite. Either the core elite were unsuccessful in fully conforming and controlling Llano Grande, or they never intended to, and kept a distant relationship with the remote site with an understanding of allegiance (however loosely defined) with the Teuchitlán sociopolitical structure.

Sayula Basin

The Sayula Basin lies well outside the Tequila Valleys to the Southeast, but still within the same chain of lake basins at the junction of the transcontinental volcanic range and the Sierra Madre Occidental. The basin settlement area contains no guachimontones or iconographic similarities to the Teuchitlán culture (Valdez 1998:230-231) and is therefore considered unaffiliated with the Teuchitlán. The area is given a special mention here as a neighboring area within the same geological and environmental region that shared other West Mexican cultural aspects, such as the shaft tomb tradition, and likely had a trade relationship with Teuchitlán. The Sayula Basin and surrounding area appears to have been a hub for trade and interaction between several groups in Nayarit, the Jalisco

highlands, Colima and Michoacán (Valdez 1998:224). The Sayula Basin has no obsidian of its own, but imported large amounts of it: 582 lithic items from excavated contexts were dated to the Middle to Late Formative periods, the majority of which were obsidian (Reveles 2006:387).

A marked increase in foreign items at the Sayula sites of Cerro del Agua Escondida and Caseta, including "all types related to jewelry and fine objects of obsidian and calcite (necklaces, anthropomorphic earrings, nose rings, tubular beads, circular finger scrapers)" for the Late Usmajac phase (200 B.C. to 200 A.D.) corresponds to the appearance of shaft tombs in the later sites and reflects an increase in the size and complexity of the exchange network (Liot, *et al*. 2006:414-416). The Sayula Basin experienced a parallel decline of shaft tombs with those of the Teuchitlán culture during Sayula's Verdia Phase, ca. 180 A.D. - 320 A.D. (Valdez 1998:224).

The decline of the shaft tombs in both Teuchitlán and Sayula basin contexts may have resulted from a decline in the related wealth economy, and its associated networking/exclusion strategy for the acquisition of wealth items. However, the decline may not have occurred equally through all semi-peripheral and peripheral areas. Also, the shaft tombs' roles in wealth trade, as determined thus far, is one of a bonding of members to the lineage network, reaffirmation of its legitimacy and a final ritual display and cache of wealth. None of these functions were necessarily exclusive to the tombs. Rituals and symbols which served to reinforce the lineage may have transferred to other ritual spaces, or other, non-lineage related networks may have formed for wealth acquisition. The increased presence of foreign goods in other contexts was likely at least partially due to the fact that wealth items which were previously destined for elite graves were still

widely circulated, but deposited elsewhere. Ultimately, the decline of shaft tombs is connected to changes in the trade economy, but not necessarily the trade economy's decline.

Conclusion

The variability evident in the organization of the Teuchitlán culture holds a potential to teach us a great deal about the dynamics of changing economies and power financing strategies in very different ecological situations within a variable natural landscape. Excavation and detailed site studies are still few in number, but exhaustive survey of the Tequila Valleys continues. Surveys and excavations published thus far suggest that material culture differences between core and semi-peripheral sites demonstrate deviation from the core corporate ideal which increases with distance from the core, and therefore distant sites show a weakened association with the core. Large walls at sites within passes between the Tequila Valleys and the outside world suggest an attempt at creating a territorial identity which encompasses the semi-periphery sites, but semi-periphery sites still varied substantially from the uniform, corporate symbolism demonstrated by the core. this indicates that core affiliation likely remained at arm's length. The walls at Llano Grande and other sites within passes may only demonstrate the risk involved in attempted polity expansion with inadequate resources to maintain the necessary relationships for full assimilation of a remote site into the culture (Kowalewski, et al. 1983). Ohnersorgen and Varien's (1996) measure of social interaction via the gravity model also supports the

notion of a very week relationship between the core and at least some of the more distant and geographically isolated sites such as Llano Grande.

At the site level, this chapter has described the emphasis on wealth economy primarily associated with the shaft tombs, concurrent with an emphasis on staple economy mainly associated with the guachimontones. The data further demonstrates how the Teuchitlán wealth and staple economies, which are viewed elsewhere as conflicting, articulate within the same socioeconomic system to support the social structure. Points of articulation between financial bases are reflected in the utilization of ritual artifacts in some corporate guachimontón rituals, and the reflection of staple finance in the presence of many shaft tomb food offerings along with prestige gifts. However, this relationship apparently did not exist without tension, since the corporate institutions still served to restrain and limit the power of individual lineages. Since more distant sites were also more culturally distant from the corporate ideal, the corporate system appears to have been manipulated by the stronger lineages, reflected in asymmetrical emphasis on specific buildings placed around the guachimontón circles.

The weakening of the corporate structure in at least some parts of the semi-peripheral zone would have opened the door for elites to expand their power laterally by capitalizing on additional abundant resources in each area, a pattern outlined in Hirth's matrix control strategy (1996). Accumulating controlled resources would have served to lower the risk of failure for any one resource by creating an option to lean on the successes of others (much like stock portfolio diversification in modern times), which may have been especially important as in periods of drought or other unforeseen environmental change that may cause general crop failure. Elites would also have viewed each resource as an

opportunity for increased political power, as additional elements of the society come under their control. A staple oriented economy would have remained where agriculture was viable, while those in power likely sought to extend their reach by acquiring control of additional economies and their associated networks. At Llano Grande, the primary "alternate" economy would have been obsidian. Llano Grande was certainly close enough to some of the richest land in the valleys to capitalize on staple resources, yet the ceremonial center and a substantial number of buildings were instead placed beside and partially on top of the nearby obsidian mine situated at the top of the pass. Conversely, Navajas Circle 5 and the Los Guachimontones ritual center were both built adjacent to farmland, where access to obsidian sources appeared to be a secondary consideration. A large obsidian mine existed near Navajas, about 2-3 km away from the ceremonial center (Hoedl 2013:6,110,figure 4.14), and the Los Guachimontones center was also only 3 km from its nearest source, La Mora Teuchitlán (Spence et al. 1980:358-359, 2002 67-68; Weigand 1985:88-89). Navajas' remote, yet exposed high plain environment is also in a good position for exchange and the group almost certainly did engage in such activity. Unlike Llano Grande, however, travelers are not restricted to passing through Navajas on their way in and out of the Teuchitlán semi-periphery. Llano Grande's chosen position where an obsidian source and restricted access happen to coincide is ideally situated for regular exchange with outside groups on a moderate scale, as a workshop-based exchange center (Hirth 1998:453; figure 2.1). For these reasons, it is hypothesized that Llano Grande embraced both staple finance and wealth finance, but emphasized obsidian over agriculture more than Navajas. Navajas is expected to have followed the tradition of

nearby core more closely, and continued the core's emphasis on agriculture, while also trading with nearby areas for luxury goods.

CHAPTER IV

LITHICS BACKGROUND

This chapter discusses lithic forms and relevant lithic studies within West Mexico, and primarily within the Tequila Valleys. Lithics in other selected parts of Mesoamerica are also discussed, and are utilized along with the West Mexico data to form the basis for expectations regarding wealth and staple industry related products further described in Chapter V. As Jay Johnson asserted in his study of the Mayan obsidian economy, "a clear understanding of what actually is being made is necessary before hypotheses about state level economics can be tested" (1996:171). In order to determine whether, and to what extent, lithic assemblages within semi-peripheral sites were likely a result of wealth trade with external groups rather than agricultural, food preparation and/or other common functional activities, it is necessary to determine which forms tend to be utilized for each of these purposes. Some quantities of prestige forms produced locally were also likely used for ritual purposes, so context becomes especially critical to interpretation. Distribution studies can then describe not only what was made, but what portion of the process may have been included in source, production and use contexts.

This chapter is divided into two main sections: Descriptions of lithic forms related to both elite prestige and general purpose utilization; and distributions of various forms related to local, regional and long distance trade. The primary site under test is in a semi-peripheral zone which may have maintained economic relations with core populations, external groups or both. Therefore, these two sections are further divided into sub-sections on internal Teuchitlán data, and external group data. Some external groups might

not have traded directly with the Teuchitlán groups, but probably heavily influenced other groups with which the Teuchitlán people did interact.

Overview of Mesoamerican Forms

Chipped stone items throughout Mesoamerica were made from both chert and obsidian. Chert is a cryptocrystalline quartz formed as a sedimentary deposit in lakes and streams. It is very durable, forms sharp edges and often very workable for most knapped stonework, although heat and pressure from volcanic activity may reform it into a more macrocrystalline structure to a point where it may become unusable for tool manufacture (Phillips 2011:46). Obsidian, however, is a direct product of volcanic activity. It is a natural glass produced when rhyolitic or silicic magma is extruded to the surface. Material just under the surface of the magma cools too quickly to crystallize, and forms a glass layer. The magma surface forms into a layer of porous glass from the release of gases into the atmosphere, which results in a very rough and visually distinctive cortex layer. For the most part, obsidian remains just below the surface except for a few places where it breaks through and forms an obsidian spine (figure 4.1). Obsidian spines then become access points for mining operations. As a natural form of glass, obsidian contains no crystal structure, which makes it extremely workable for knapping (Phillips 2011:115-116). Knapped obsidian edges are also unparalleled in their degree of sharpness (Clark 1988:11), with an edge width of only $3x10^{-6}$ mm (Phillips 2011:116), which is sharper than surgical steel, and obsidian blades have been tested as scalpels on both animal and

human tissue with very positive results (Buck 1982). These properties have made obsidian a most desired material for knapped stone objects (Phillips 2011:116).

Each group utilized both chert and obsidian somewhat differently, at least partially due to the population's degree of access to these materials. Prismatic blades were generally only made from obsidian since it is the only material with fracturing properties that work sufficiently well for the required manufacturing technique. Teotihuacán used obsidian for both prismatic blades and more common items such as bifaces (Spence 1981:774,776) whereas the lowland Maya, who had much less access to

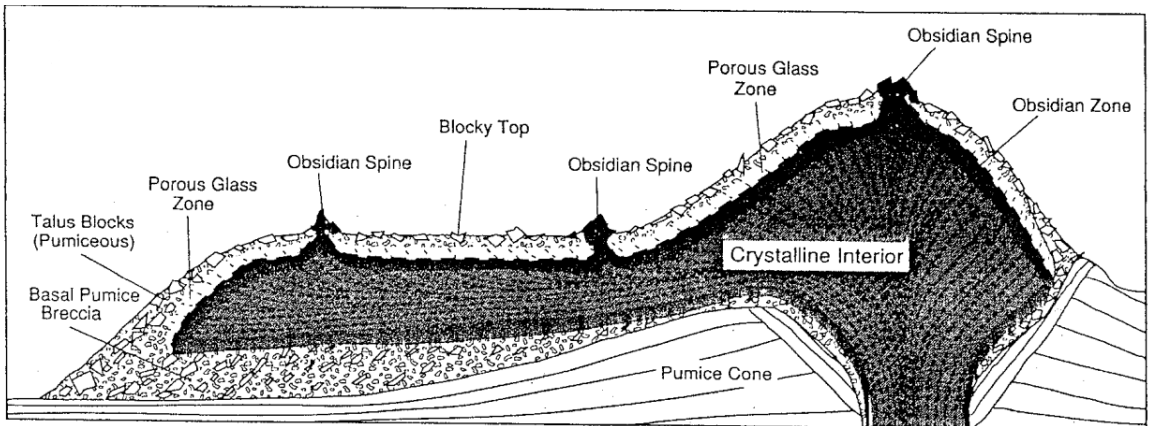

Figure 4.1: Profile of a rhyolite dome from a lava flow, showing the obsidian layer and spines. (From Hughes and Smith 1993, as found in Phillips 2011:116).

obsidian and for whom the material was a rare commodity, typically reserved their obsidian exclusively for prismatic blades (Johnson 1996:168).

Mesoamerican lithic studies tend to concentrate on formal objects, and often on prismatic blades in particular. Yet much of the Mesoamerican flake industry is actually very expedient and typically contains many multidirectional (often termed *casual*) cores and only a one to two step tool production technique. Due to this level of expedience,

informal tools may be indistinguishable from what may be categorized as debitage, which has prompted Clark (1988:15) to suggest that the very distinction between lithic products and waste may be considered meaningless; any struck edge, even as a byproduct, is a candidate for use. Flake tools in this region involved perhaps one or two stages of operation to obtain a quick edge and a roughly workable shape (Clark 1988:27). The same is true for Mayan contexts, where such "ad-hoc" flake tools are common throughout the region although generally treated as "background noise" in the study of formal tools, although they do often show signs of use. One of the few analyzed examples is the dataset from the Mayan site of Cerros, where expedient flakes were shown to make up 65 percent of the tools bearing use wear (Johnson 1996:161,162). Spence et al. (2002) conducted a surface survey throughout the Tequila Valleys to determine the distribution of lithic material, including production debitage and product forms. The team also noted that expedient flake retouch was common in the area, and combined the informal tools with their waste category (2002:63). Others (e.g. Beekman 1996a; Esparza 2003; Soto 1982, 1990) have separate categories for informal flakes and blades, where their status as debitage, secondary use or expedient tools is unspecified.

Aside from some eccentric forms, Mesoamerican lithics include typical forms found throughout the world, including knapped items such as bifaces, points, unifaces, expedient flakes and blades; and ground stone tools such as *manos , metate*s, mortars and pestles. The Mesoamerican polyhedral core-blade industry became common at some point between the Early and Middle Formative periods (Darras 2012:418; Hirth and Andrews 2002:123), and eccentric production and trade became popular among elites

during the Early Classic period (Moholy-Nagy 1999:306; Moholy-Nagy and Nelson 1990:77-78; Spence 1981:780, 1996).

Polyhedral Core Blades

John Clark describes polyhedral core blades more by the technique of manufacture than by morphology, even though morphological characteristics must be used to identify the use of the technique in the field. They are created by orienting a pre-shaped, roughly cylindrical core vertically along the major axis so that one of the two flat ends is at the top. Blades are then removed from the side of the core by repeatedly striking the top near the edge and working in succession around the perimeter of the platform. Working around the core multiple times produces successively thinner, more narrow and more uniform shapes with little waste of the original material and a high number of products for a given volume of source material. The initial *macroblades* and the next few successive stages are easily accomplished with hard hammer percussion (figure 4.2), but the smallest and finest blades that can be produced with the technique require the precision of a pressure flaking technique. It is usually assumed that the final desired products are very thin and narrow *prismatic* blades (Figure 4.3). Prismatics have very straight and parallel lateral edges, and one or two very straight and vertical dorsal scars which also parallel the edges (Clark 1988, 1997; Clark and Bryant 1997; Hirth and Andrews 2002:2-4). However, previous stages including macroblades have also been found with utilized edges, and as the basis for more formal tools (Dockall and Shafer 1993; McAnany1989:335,342; Parry 1987:37). In areas of West Mexico, larger blades

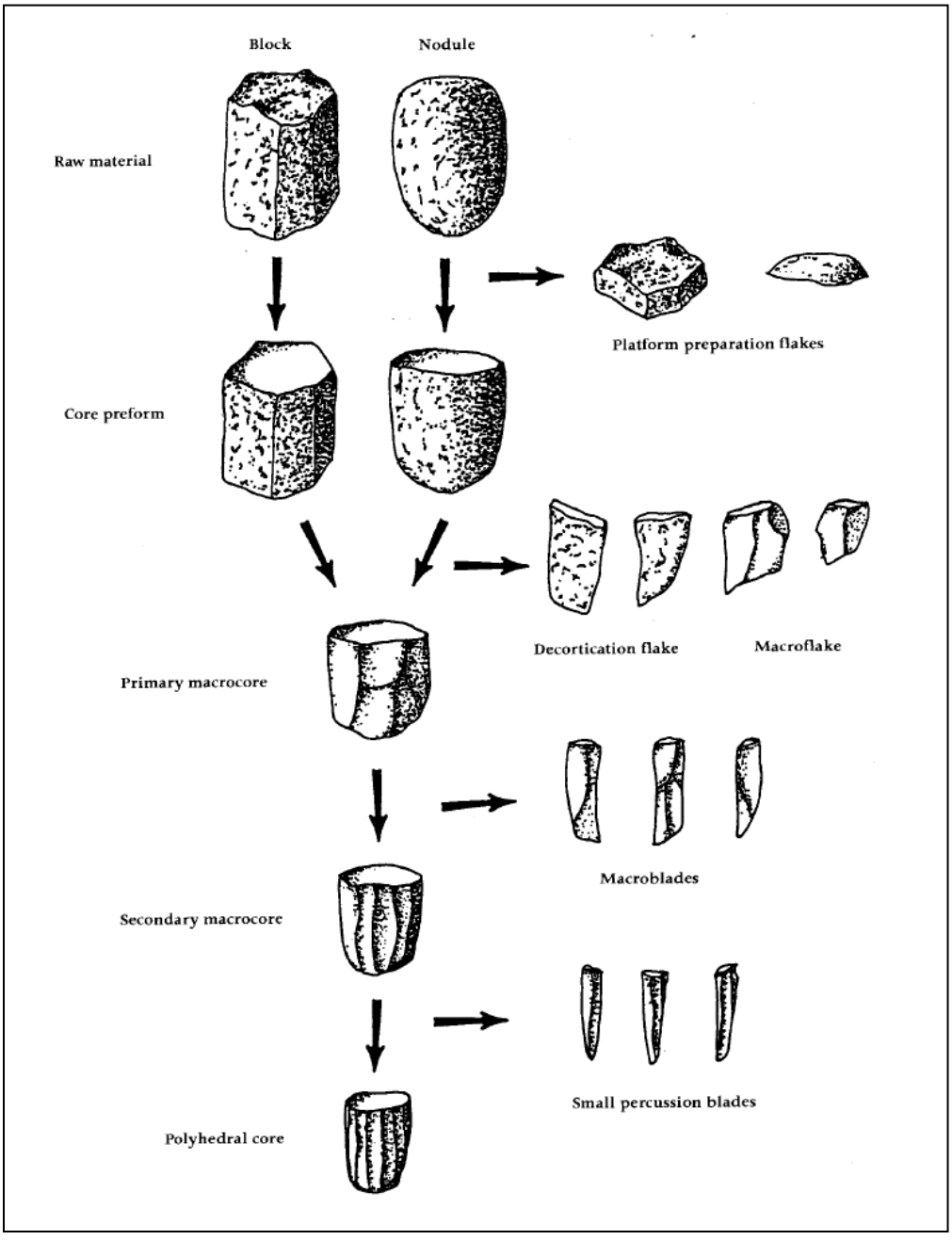

Figure 4.2: Polyhedral blade production sequence defined by John Clark, illustrated by Bradford Andrews. From Hirth and Andrews (2002:3).

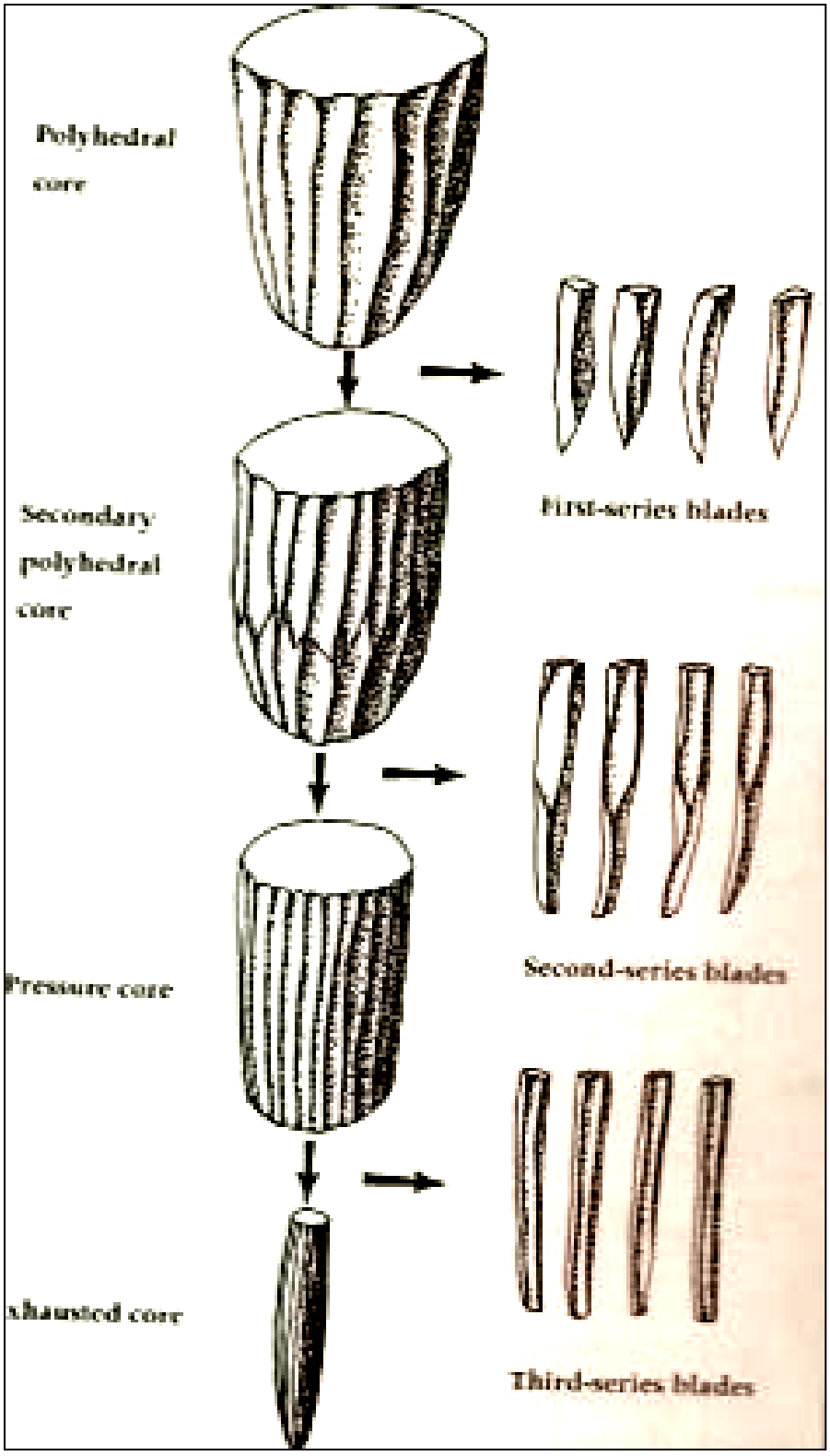

Figure 4.3: Prismatic blade production sequence defined by John Clark, illustrated by Bradford Andrews. From Hirth and Andrews (2002:4).

are produced, with no evidence of continuing the process as far as prismatic blade production (Darras 2012:420-421). Even though the process creates very little unusable material following core preparation, polyhedral blade production does create distinctive debitage and unused byproducts that can confirm the use of the technique (Clark 1997; Clark and Bryant 1997). These forms are further detailed in the Chapter V.

Eccentrics

Eccentrics are lithic artifacts which include features that have no known practical function other than ritual or a mark of elite status (Whittaker 1994:177). Some eccentric shapes suggest some implied function, such as knives with intricately carved ornate handles found in ritual contexts (cf. Moholy-Nagy 1999:figure 3a,h; Whittaker 1994:figure 8.2), and some items defy any functional category (Moholy-Nagy and Nelson 1990:77-78; cf. Moholy-Nagy 1999:figure 3b-g,i-k; Whittaker 1994:figure 3.20;).

Overview of West Mexican Forms

Most Mesoamerican chipped stone items were made from both chert and obsidian, but knapped Teuchitlán items were almost exclusively obsidian. Brief informal surveys of Navajas and Llano Grande have not revealed any chert or other alternate raw material sources suitable for knapping. Llano Grande is located on an obsidian source and Navajas has several abundant sources nearby. Some basalt appears to have been worked, but in a

very expedient fashion and surveyors have discounted all but a few potential artifacts from the material (Christopher Beekman, personal communication, 2014). The area's abundance of obsidian is due to the volcanic nature of its location, and the superior workability of obsidian has allowed the Teuchitlán culture to manufacture any knapped items common to Mesoamerica, though prismatic blades are absent. Macroblades are quite common, and some fine blades with irregular dorsal scars, called "first series blades" in Clark's sequence (figure 4.3) also are found. Although large numbers of prismatic blades are found in West Mexican surface assemblages, there has been almost no sign of the prismatic form near activity floors in excavated West Mexican contexts. The prismatics on the surface therefore appear to be Postclassic (Darras 2012:420-421).

The Teuchitlán culture produced four forms of eccentrics, most of the which are have not been found in other Mesoamerican cultures. These include pointed dowel shaped objects known as *pikes*(cf. Beekman 1996a:figure 6.18), small *rod ornaments*, thin and flat jewelry items of various shapes referred to here as *laminar flake jewelry*, and small cruciform shapes. Aside from some additional use contexts for pikes elsewhere in West Mexico (Reveles 2005), the only eccentric items the Teuchitlán people are known to have had in common with other groups is the cruciform. Some have suggested that pikes are equivalent to Mayan bloodletters found in Belize (Beekman, personal communication 2014). However, no publications found to date suggest any form similar to pikes outside of West Mexico. Additionally, the literature generally suggests that the Maya used prismatic blades for bloodletters, which have no resemblance to pikes (cf. Clark and Bryant 1997:131-132; Haines et al. 2008; Stemp 2014). The lack of production or use

context in other areas for these items creates extra interpretational challenges to lithicists, regarding both manufacturing techniques and functional purposes.

Pikes and Rod Ornaments

Pikes may be the least understood lithic items in West Mexico. Production techniques and use contexts for the pikes are both very much unknown, and there has been very little study regarding them. Pikes are long and roughly dowel-shaped objects about a centimeter in diameter, with two bluntly pointed ends or a "knob" shaped protrusion that extends from one end (figure 4.4). There may also be a short protrusion that extends

Figure 4.4: Pike collection, photo courtesy of
Jose Guadalupe Romero, director,
Casa de Cultura Museum, Tala, Jalisco, MX

perpendicularly from the center of the pike, which may have been used for hafting (Beekman (1996:802). Beekman has observed that pikes are "more or less triangular in cross-section" (1996:802), although at least one segment with four sides has been located at Navajas. The sides are also somewhat convex on cross-sectional edges, giving an overall impression of a roughly rounded shape.

There also appear to be at least two varieties of objects usually labeled as pikes. The variety which is termed a *rough pike* in this thesis has large, deep and irregular flake scars of varying lengths. Some scars are quite large, occasionally exceeding 2 cm in length, and are mainly oriented with scars' major axes aligned vertically, along the major axis of the piece. (figure 4.5). Rough pikes may simply reflect early shaping activity for the production of the more formal *refined pikes* (figure 4.6), which exhibit much more consistent, uniform dimensions and small finishing flake scars. Closer observation of two pike fragments at Navajas shows that these scars are often oriented along the minor axis, around the circumference of the piece. Finishing scars are often aligned in parallel rows that run the length of the pike, and the pattern creates a more clear definition of the object's side edges than rough pikes. Although the flake pattern differences are clear in the artifacts recovered from Navajas and the one rough pike from Llano Grande, only a few items have been recovered from both sites so it is not known how consistent these patterns may have been, or how widespread they may be among pikes throughout the region. Two personally examined rough pikes from the sites under study closely resemble modified *crested blades* from the polyhedral core blade industry. In polyhedral blade manufacture, either at the start of macroblade production, or if the core face has

Figure 4.5: Rough pike from Navajas Circle 5, lateral and cross-sectional views. Photos by Kathy Beekman.

Figure 4.6: Refined pike fragment from Navajas Circle 5, lateral and cross-sectional views. Photos by Kathy Beekman.

undergone reshaping activity after a failure, the face is chipped along two parallel lines from the platform to the distal end to create the dorsal side and lateral edges of a first blade. The initial blade is struck from the core before continuing on with the usual macroblade knapping procedure. This distinctive first blade is called "crested" because of its protruding dorsal edge with wide and deeply set flake scars (Clark and Bryant 1997:125,figure 5; Soto 1990:240).

The resulting rough but distinctive scar pattern of a crested blade very closely resembles that of a rough pike. Elsewhere, Reveles describes rough pikes in the Sayula Basin as having "a series of bi-marginal adjustments ranging from abrupt to flake-like" (2005:352), which closely describes the scar pattern of a crested blade. The transformation from blade to pike would then only require a rounding off of the lateral edges to form a nearly even width to depth ratio. Since crested blades are generally thicker than macroblades, they are likely the most ideal starting point for a rounded object. However, crested blades do not appear in very large numbers since only one would be produced to create a starting point for each core. A tentative production sequence for pikes may begin with roughly shaping a crested blade, if available, or macroblade with strikes along the edges of the blade, and then using perpendicular rows of finishing flakes to complete the product. However, the fact that rough pikes have appeared in the nearby Sayula Basin without any complimentary presence of refined varieties (Reveles 2005:352, Fig. 1c), suggests that the rough forms may also have been utilized directly.

Regardless of the exact method of production, unless the Belize "bloodletter" claim is verified, the process appears to have been unique within Mesoamerica. The distinctive finishing scar patterns on pikes reveal a fine, curved flaking from an unknown pressure technique. Even if pikes internally served some very practical purpose, their unusual shape would make them very collectible prestige items to external groups whether or not their intended function was understood or practiced by outsiders.

Rod ornaments have similar dimensions to pikes but only two convex sides, and no obvious flake scars. These items appear to be produced by polishing a piece of obsidian down to the form of a narrow rod shaped object (Beekman 1996a:802 Figure 6.18d). No rod ornaments were located at Navajas or Llano Grande, and they might be limited to the La Venta corridor. Based on the contexts of two discovered rod items, they may date to the Postclassic period (Beekman personal communication 2014).

Laminar Flake Jewelry

Laminar flake jewelry is made from thin obsidian flake blanks, referred to in this thesis as *laminar flakes* (termed "cylindrical core flakes" by Beekman [1996:797-799, figure 6.16] after one potential method of manufacture, and also called "obsidian mirrors" by Long [1966:228-230]). They are extremely thin (less than 2.5 mm maximum thickness) and flat obsidian pieces with little to no detectable bulb of percussion and little to no rippling on either side (Figure 4.7). They are very smooth and reflective, and are usually found retouched into various shapes with small drill holes in ideal locations for suspension as pendants. Shaped laminar flakes are therefore invariably interpreted as

jewelry or adornments for ritual purposes (Beekman 1996a:790; Clark and Weigand 2009; Reveles 2005).

Figure 4.7: Anthropomorphic laminar jewelry from Navajas.

Three proposals for manufacturing methods of laminar flakes have been offered. Stanley Long's initial proposal is based on analysis of two round items interpreted as mirrors at San Sebastian, another site on the west side of the Magdalena Basin near the base of the surrounding hills (southeast of Llano Grande). Long suggested the use of a polyhedral blade core worked to a point where a near-cylindrical shape is achieved. The core is laid on its side and thin, disc shaped sections of the platform are removed, in much the same way as one would slice a sausage. The technique has thus been dubbed the "sausage technique" by Schöndube (Beekman 1996a:795). The core is rotated a

quarter turn between each strike to create a more even surface with a different orientation of the bulb of percussion on each side, which is removed along with the rippling through polishing to form a smooth, lustrous surface (Long 1966:228-230, Fig. 129). The proposed method could produce very uniform, repeatable results, and has thus been suggested as a means of production for an extensive exchange network (Long 1966:40). However, prepared fine blade cores, much less those worked down to a uniformly cylindrical shape, have thus far proved to be rare in Teuchitlán contexts (Esparza 2003; Soto 1982, 1990). Also, Clark and Weigand (2009:79) have argued that Long's suggestion of polishing to achieve the finished surface is unfeasible. Since obsidian is essentially glass, its highest possible luster is achieved when it is fractured and the interior is initially exposed; the finest polishing material available in the area could only serve to dull the surface. Long's basic technique remains a viable potential method with perhaps some modification; the bulb of percussion and rippling would need to be controlled through the knapping technique, rather than subsequent polishing.

Clark and Weigand succeeded in replicating laminar flakes by making successive strikes on a core, such that each flake centers the previous flake scar. (Usually, a knapper will strike over a dorsal ridge from the edge of a scar for easier flake removal.) Each removal then creates a larger flake as reduction progresses towards the center of the core. The process results in laminar flakes which are quite variable in size. Rippling and the prominence of the bulb of percussion are controlled through slowly delivered blows via a soft hammer, such as an antler or a wooden billet (Clark and Weigand 2009**:**5**,** Fig. 3).

Yet a third potential method was proposed by Clark after close examination of one museum item of laminar jewelry, which revealed a *plano-convex* shape (slightly rounded

on one side, and essentially flat on the other). The shape appears to be the result of removing a bulb of percussion from a flake with a pressure technique, and then utilizing only the detached bulb for production (Clark and Weigand 2009:7,8). Some of the flakes from Llano Grande and Navajas do appear to have had their bulbs of percussion removed, as noted in the field before any awareness of the proposed technique. Several flakes exhibit some very small scars and some crushing left behind in position where the bulb is expected. Later observations by Camilo Mireles and Rodrigo Esparza have confirmed a *convex-convex* shape on some flakes from within and near the core zone, which resembles two ventral surfaces, and is suspected to be the result of Clark's bulb removal method (Camilo Mireles, personal communication, 2014). However, although laminar forms are very much restricted to the region, they can be fairly numerous in West Mexican collections. A usefully reliably rate of production for these pieces based solely on this extremely fragile method appears unlikely, especially considering that very large bulbs of percussion of up to at least 15 cm in width with no eraillure scars or noticeable rippling or fissuring would be required to match the sizes and features of some laminar artifacts. Mireles also has confirmed that the bulb of percussion method could not have produced the largest laminar items. Clark had nearly dismissed his previous experiment based on the one plano-convex sample. However, although it is unconfirmed by detailed comparisons to field data, Clark's original method demonstrates that an alternative which has a potential for high rates of production can successfully produce laminar flakes.

Technology often allows for multiple, diverse variations on basic production techniques that can result in essentially the same final form (cf. Hiscock 2004), and Clark's experimental method certainly allows for a great deal of flexibility in technique as

well. For example, we do not know the degree of core preparation before the first laminar flake is created. It could be a matter of simply lopping several of the more protruding angles off the core and then using an opportune flake scar as a starting point. Or, towards another extreme, the core could be worked down to an ideal size and shape with arrises aligned for easy successive laminar flake removals. Clark's seminal publications on prismatic blade reproduction (Clark 1982, 1997; Clark and Bryant 1997) deal with a technology designed for maximum material use efficiency (Sheets and Muto 1972), and Clark's proposed laminar flake production method provides the same advantage. In an area such as the Tequila Valleys where obsidian is readily available throughout the territory, material use efficiency is not a major concern, and thus less efficient and usually more expedient production methods tend to be employed (Beekman 1996a:750, 817; Darras 2012; Hirth and Andrews 2002:9; Magne 1989:22). Potential technique variations can therefore allow for some less efficient means to create a laminar flake of the desired size. It is certainly possible and perhaps likely that techniques varied between sites, and to some degree even between artisans at the same site.

However, allowing for multiple technique variations does not negate the specialized nature of the products themselves. The jewelry disappeared from Tabachines shaft tombs in the periphery at the end of the Late Formative period, but continued to be made in sites closer to the core, including Navajas, Llano Grande, and Los Guachimontones. This pattern paralleled other items interpreted as elite markers, such as hollow figurines, which suggests that elites had brought the technique under a more centralized control (Beekman and Weigand 2008:309). Concentrated production debitage for likely flat obsidian jewelry was found in only one isolated area in the La Venta corridor which is considered

a probable workshop. It also appears to be the result of one or more specialized techniques, and is therefore considered a prestige item (Beekman 1996a:805,815).

Distribution

In order to understand how lithic technology fits into the overall economy of a culture, it is necessary to understand as much as possible about the full spectrum of what several French lithicists have termed the *chaîne opératoire*, or sequence of operation. Although the chaîne opératoire does include the production sequence of a particular technology, as illustrated above in figures 4.2 and 4.3 for Clark's prismatic blade sequence, it encompasses human activities beyond the production sequence to include the entire industrial cycle, beginning with procurement and continuing through production, use, storage, maintenance and discard. These actions can then provide information about the concepts, technology strategies and roles of the people who carried them out (Bleed 2001:105; Boëda 1995:43; Julien and Julien 1994:15; Lemonnier 1986). Thus, "the *chaîne opératoire* aims to describe and understand all cultural transformations that a specific raw material had to go through" (Sellet 1993:106). The concept has been criticized as inflexible in its attempt to identify specific technology strategies with specific cultures (Shott 2003). However, the Mesoamerican literature reviewed below suggests that exchange relationships cause some transformations to cross cultural boundaries. Operational sequences are often expressed as workflows and can form branching paths, often from items considered production byproducts to create additional

products from the same material (e.g. Bleed 2001:figure 4; Sheets 1975), as described above for Mesoamerican macrobades and expedient flakes.

Therefore gaining understanding of an economic strategy must go beyond familiarity with lithic forms. Where and how both prestige and utilitarian products and related materials typically travel in various stages of their lifecycles must be determined, as well as the types of locations at which they are found. Such locations may include ceremonial centers, administrative centers, workshops, and neighborhoods within identifiable social strata. Since partially worked materials can be transported and further refined at either intermediate or destination locations, part of this process is to determine what stages of the production process were likely transported over local, interregional and interpolity scales of trade. Transported forms may include raw material, finished products, or some intermediate stage such as prepared cores or bifacial blanks. With this background, differences in physical characteristics of artifacts at the examined sites (such as specific tool forms, debitage forms, and expedient tools) resulting from production and distribution activity for various artifacts can then be used to determine relative quantities of lithic items which were likely the result of production for trade. Forms and production stages of traded prestige items as well as those of staple related items for local and area-wide use, can be used to interpret the economic nature of the lithic collections and give us insight into staple and wealth finance mechanisms of the regional political system. Items considered "elite" or "prestige" goods and related distribution strategies may differ between polities. Therefore, a survey of product distribution pattern studies in surrounding areas will be utilized in this section to determine what categories of lithic

products were consistently valued as prestige items across different groups, and how these products and related byproducts/debitage were distributed.

Workshops and Points of Exchange

Most studies of trade and other distribution patterns focus on workshops as indicators of nearby distribution points of exported items. Such locations are often identified and referenced with assumed definitions of exactly what is meant by the term "workshop". However, discussions regarding definition of a workshop, and relatedly, how one may be recognized in the field, show some diverse opinions and explanations. According to Michael Spence, a workshop can be identified as a site with unusual lithic deposition, which may include an especially dense area of obsidian, a high debitage to product ratio, or the presence of unfinished products (1981:771). Moholy-Nagy has used a more functional definition to differentiate workshops from other deposit contexts, such as middens and collections of offerings. She describes workshops as places "where the principal activity is the manufacture of stone artifacts" (1990:269). Clark's definition is more specific to trade contexts: "A designated space where artisans or specialists create products for sale or exchange," and Clark further specifies that production must exceed the consumption needs of the specialist (1981, as found in Soto 1990:216). Johnson (1996) has noted that Clark's requirement for evidence of overproduction ignores remote deposition, especially in relatively confined areas such as small buildings where large accumulations must be periodically removed. Enclosed spaces used as workshops will still contain an unusually large concentration of debitage, due to its usefulness as a cache

of potential expedient tools, which creates some degree of reluctance to move debitage to its final contexts (Whittaker and Kaldahl 2001). When the span of time for workshop activity at a site is unknown, however, Clark's overproduction stipulation becomes impossible to measure because the rate of production cannot be derived. This thesis will follow Clark's definition as the most useful to its purpose, but with special attention to the nature of objects produced rather than relying on quantity to determine whether production may have been done for the purpose of exchange.

Challenges to Interpreting Inter-polity Exchange

Differences in products and manufacturing techniques between polities may complicate any interpretation based on data from multiple groups, but different forms can be generalized into broader categories. For example, the most obvious difference between West Mexico and other Mesoamerican regions is the apparent lack of any prismatic blade industry. Polyhedral cores worked down to a point where prismatic blades can be produced have been found in a Los Guachimontones area workshop (Soto 1990) and the few published excavation contexts from the area show heavy emphasis on polyhedral core macroblades (Darras 2012:420-421). However, excavated contexts in the area have not revealed a substantial number of prismatic blades or exhausted prismatic cores (Darras 2012:417-418, 420). Yet elsewhere in Mesoamerica, prismatic blades were ubiquitous since at least 700 B.C. (Hirth and Flenniken 2002:123). Despite these differences, distribution patterns can still be validly generalized and compared along lines other than specific forms, such as production stages (finished formal products, raw

material, and items from intermediate production stages such as "blank" forms and prepared cores), items deemed "elite" or "wealth" items, and common or pragmatic staple goods.

Exchange in Mesoamerican contexts

The following discussion provides some background in lithic production and distribution patterns among Mesoamerican groups, and note common approaches to trade which can be considered normative for inter-polity interaction. Some trade norms of external groups were also likely followed by Teuchitlán semi-peripheral groups involved in economic interaction, which may be reflected in the material culture. The topic of Mesoamerican lithic distribution patterns, even when limited to specific periods and to a few major groups, is far too broad to tackle comprehensibly for the purpose of this thesis, so just a few summary reports and case studies considered representative of general patterns for Middle Formative Central and South Mexico (De León et al. 2009), Classic Period Maya (Johnson 1996), and Teotihuacán (Spence 1981)

A consensus regarding lithic distribution during the Late Formative and Early Classic periods throughout Mesoamerica held that, in nearly all cases, prepared cores were exchanged and transported rather than finished products (Clark 1987; De León and Carballo 2003; De León et al. 2009; Jackson and Love 1991; Parry 1987). Core preparation removes most of the external cortex material and shapes the core for easier manufacture. The strategy would expose the severity of inclusions in the underlying stone and also reduce unnecessary mass for ease of transport (Spence 1981:776, 777).

Consumer sites then had the responsibility to manufacture their own finished goods. The pattern is seen as a stark and abrupt change from the Middle Formative practice of trading mainly finished products. However, this consensus was based on studies which considered only the presence or absence of cores and products near source and consumer areas. Later, more detailed analysis determined that although the pattern appears true in a general sense and is useful as a framework for comparison of more detailed studies, specific sub-regional contexts appear to have varied in the rate and timing of the transition to core trade and local production (De León et al. 2009).

Finished Product Distribution: Early to Middle Formative

Early to Middle Formative data predate the time-frame for any known presence of Teuchitlán culture. The early data are presented here to provide a background for trends leading up to the Late Formative to Early Classic distribution pattern, and to illustrate an alternative to the expected pattern.

De León et al. (2009) examined changes to lithic distribution strategies throughout South and Central Mexico over time using lithic data sets previously collected in Formative Tlaxcala, the Basin of Mexico, and Oaxaca. The De León and company approach used comparisons of formal attributes associated with both ceramic and lithic artifacts between periods at multiple sites to identify distribution differences, following Hirth (1998). De León et al. interpret the presence of *primary debitage* (cores and debitage distinctive to polyhedral core-blade production , such as facial correction flakes, platform correction flakes, crested blades and cortical flakes) within a consumer context as evidence of imported raw material and local production, whether or not cores have

actually been found on-site. A presence of actual cores, of course serves to strengthen the argument but since they are few in number and may have been deposited in different contexts, their presence in a manufacturing debitage context is not necessary (De León et al. 2009). An absence of both cores and core formation debitage along with a large quantity of flakes that appear to be from middle to later stages of the production process (such as various forms of failed blades or small biface flakes) suggest the use of itinerant craftsmen who travel with the core material and knap products to order at various consumer locations. However, one potential problem with the approach noted by De León et al. is that an absence of core material may just as well result from a partial excavation of the site that missed the evidence because it was spatially displaced, possibly because of culture norms that dictate different handling of exhausted cores (De León et al. 2009:114).

The presence of larger quantities of cross-sectionally broken blades in use contexts suggest that fine blades within Middle Formative Mesoamerica were often intentionally broken into multiple segments, and the straight, uniform medial sections were favored for use. An unequal distribution of proximal, medial and distal blade segments at a site was also used by De León et al. as a clue to determine whether blades were segmented, and therefore also knapped, at a different location. Conversely, a preponderance of medial sections suggests a consumer site where blades were externally knapped and segmented. A nearly even count of all segments suggests local segmentation of whole blades, although the determination of local or remote blade production then requires additional evidence (De León et al. 2009:115-118). The medial blade distinction can therefore be used with the identification of primary core debitage to identify mixed contexts which

reflect a combination of both final product imports and local production (i.e., both a predominance of medial segments and the presence of cores, rejuvenation flakes, and other identifiable blade industry debitage.)

De León examined blade and debitage data retrieved from the site of San Jose Mogote and the Early to Middle Formative Loma de Atoto site in the Basin of Mexico, and concluded that most of the blades at both sites were imported. The sites of Amomoloc, Tetel and Las Mesitas of Formative Tlaxcala show a more complex scenario. Amomoloc is the earliest site, and contained a high degree of prismatic medial segment import along with some secondary (non-core) debitage distribution. Tetel, which spans most of the Middle Formative period and ends just before the start of the Late Formative (700 - 400 B.C.), shows an apparent gradual transition from imported pre-segmented blades in the earlier contexts, to local household production in more recent layers. Las Mesitas, which was occupied only during the later part of the middle formative (500 - 400 B.C.) shows evidence of both pre-segmented blades and core debitage, indicating a mixed model of product and raw material import (De León et al. 2009:124).

For the most part, De León et al.'s analysis confirmed the accepted view of changes in Formative Period trade and production patterns. However, it did identify some details about a more gradual and earlier than expected transition from the import of blades to the import of cores and local production in Tlaxcalla. The later Las Mesitas data is also from a time period too early to suggest that it negates the expected change in traded forms for the Late Formative period, but illustrates a need to consider the possibility of multiple distribution strategies for any specific region or time period.

Raw Material Trade: The Late Formative and Classic Maya

De León et al. also noted a lack of status differentiation based on elite and commoner access to obsidian during the Middle Formative, which only began to emerge in South and Central Mexico during the Late Formative period (2009:119-121). The Maya began to more clearly display elite/commoner differentiation via imported goods throughout the Mayan Lowlands during the Late Formative period as well, and the trend appears to have peaked during the Early Classic (Barrett 2004:43, 281). The Lowland Classic Maya mainly imported obsidian as a relatively scarce, exotic material from distant lands (Johnson 1996), which included areas in the Guatemalan Highlands and Central Mexico (Moholy-Nagy and Nelson 1990; Moholy-Nagy et al. 2013). Although obsidian blades do appear in earlier contexts, evidence of local manufacture does not appear until the start of the Late Classic period (Moholy-Nagy et al. 2013:78). Debitage distribution analyses in the area show that obsidian was brought into major settlements mainly in the form of cores, and nearly all major Mayan centers followed a pattern of spatially and politically centralized obsidian import and production, but likely only partial control of the distribution for ceremonial purposes. Obsidian cores, rejuvenation flakes and other core related flake types have been found mainly at city center workshops, including the public center of Nohmul in Northern Belize (Johnson 1996).

Nohmul is viewed by Johnson as a good representative case study of Mayan obsidian distribution strategies, since the center's lithic distribution data have been thoroughly studied throughout the area, and they appear to exemplify the most common distribution strategies found throughout the Maya region during the Classic Period (Johnson 1996:170). Obsidian tools used in common household contexts at Nohmul show a similar

pattern to that of the Late Formative households, in that obsidian appears to have been utilized to a greater extent by elites than by commoners. Material utilization intensity studies using multiple, disparate methods including measures of density in counts per unit, ratios of obsidian to chert, and cutting edge to mass ratios, have all demonstrated that aside from the relative rarity of obsidian in all contexts, elite household contexts consistently show greater utilization of obsidian over that of commoner households (Johnson 1996:166). Johnson also utilized pottery sherd density as an indicator of the intensity of non-lithic related activity in different locations, and compared sherd to flake ratios to determine where work with obsidian was emphasized over other activities.

Johnson concluded that within the Nohmul city center and periphery, the emphasis on obsidian working appears to have been about 30 percent greater in the city center area (excluding the apparent workshop area) than in the commoner households, relative to ceramic usage. The proposed workshop location shows a much higher concentration of flakes relative to sherds than other city center areas, with an increase in relative flake density ranging from 85-98 percent, which further confirms its use as a specialized lithic related workshop.

The study's use of ceramic quantities as a normalizing factor does not appear to differentiate between expected amounts of ceramics in ceremonial contexts relative to that of households (and indeed, Johnson does warn that sampling within Mayan city centers is problematic, due to their "large, complex and heterogeneous" nature [1996:168]), but Johnson's data show a consistent reduction in obsidian density as one moves farther away from the center. Based on the workshop's location quite close to public spaces (and actually directly under a later Classic Period ballcourt), obsidian

appears to have been brought directly into the city center and worked by attached artisans, primarily for public ritual purposes. Surplus goods (primarily prismatic blades) may have been released to the surrounding elite residences for more common uses, and eventually dissipated outward to the peripheral commoner communities through a relatively uncontrolled form of trade (Johnson 1996:170-172).

Once released to the general public, in both elite and commoner residential contexts, blade use appears to be quite utilitarian and diverse in form. Within the private sector, therefore, obsidian was likely primarily used for a wide array of common household tasks (1996:166). More recently, residue analysis from the lowland Maya site of Los Naranjos and nearby communities in Honduras confirmed this notion. Prismatic blades have produced residues of soft botanicals such as grasses, palms, maize and other starches likely utilized for culinary purposes, as well as woody plants more likely exploited for industrial uses, such as building construction and hafted tool components. The residue data reveals a more strikingly varied use of even the relatively small and fragile prismatic blades than previously surmised through contextual data (Morell-Hart, et al. 2014). Non-utilitarian uses are also considered quite likely. Mayanists and other pre-Columbian Mesoamerica scholars have noted that especially small, narrow blades within both ritual center and elite household contexts appear ideally suited for blood rituals, and commonly refer to these items as "bloodletters" or "lancets" (e.g. Carballo 2009:494; Johnson 1996:172; Joyce 2004:195).

Another apparent consequence of the short supply of obsidian at Nohmul is a more extreme conservation of core material, and a desire to maximize material use efficiency by utilizing nearly every possible cutting edge. Dorsal flake scar patterns show reuse of

shattered polyhedral cores as flake cores, with use wear patterns on flakes as short as 10-15 mm. There also is evidence of attempts to create new platforms at the distal ends of prismatic cores so they can be worked from the other side to extend the life of the core.

Yet, three relatively under-utilized polyhedral cores and one macrocore were discovered in a Late Classic Nohmul tomb, along with several high-status items which include 14 whole obsidian blades, jade, and chert eccentrics (Hammond et al. 1987:265, fig's 8 and 9). The inclusion of largely unused obsidian cores in a Mayan tomb would have been considered a major sacrifice of a highly sought resource considering the apparent level of demand for useable obsidian edges. Fine imported obsidian has also been located in Mayan tombs at several other sites, including Kaminaljuyú, Tikal, Altun Ha and Copan in several forms, including blades, bifaces, points and eccentrics (Becker 1992; Hendon 1991; Sheehy 1991; Spence 1996). Hendon (1991:910) has stated that blades were actually quite common in both elite and commoner graves at Copan, but Copan is considered an atypical site regarding overall obsidian distribution in that it is near an obsidian source, and production appears decentralized in household contexts (Johnson 1996:170). A few exhausted cores also have been located in tombs at Tikal (Moholy-Nagy et al. 2013), but the use of cores as grave goods does not appear to be a common pattern among the Maya.

Although the cores in the grave context do provide further evidence of emphasis on local manufacture from imported cores, perhaps more importantly, they also show the importance of obsidian to elites even as a lightly worked raw material prior to product manufacture. Obsidian was highly sought by elites even though high-quality chert which could be made into very refined objects was more readily available from sources within

Northern Belize (Shafer and Hester 1986). Elite affinity to obsidian, therefore, does not appear to be entirely related to its superior workability and performance as a tool, but to a large extent, also to status and symbolic power.

Despite the evidence for local production in general, the chert eccentrics within the Nohmul tomb may well have been produced elsewhere. The small Northern Belize site of Colha appears to have specialized in the production of eccentrics and highly specialized tool forms distributed within the Northern Belize area. The sheer volume of debitage at the site (over 100 piles averaging 30 meters in diameter and 1 m deep) suggests tool production rates well beyond local needs. The site is estimated to have produced about 4.5 million pieces through the Late Formative period, and given site population estimates, this translates to 150 tools per worker per year (Shafer and Hester 1986:162). Colha has been an area of contention with some archaeologists who have viewed the site as more of a common debitage dumping ground for multiple sites, rather than a major workshop area (Mallory 1986; Moholy-Nagy 1990). Moholy-Nagy (1990) has pointed out that ethno-archaeological evidence consistently demonstrates cores prepared at the source, worked into final form at workshops removed completely from the source area very near artisan residences, then dumped at a remote location to free up space for other domestic purposes. However, consumer site debitage studies within the area surrounding Colha do suggest the presence of a nearby centralized production site from which finished tools were exported. Colha chert tools were found at Pulltrouser Swamp approximately 35 km from Colha, and no production debitage other than small resharpening/recycling flakes have been located at the site. "Colha chert" tools have been discovered in similar contexts at several other sites as well, within a radius of approximately 40 km from Colha.

Distinctive eccentrics from Colha also appear at several of the largest Mayan sites up to 100 km away (McAnany 1989). Colha appears to be one of several specialty workshop areas discovered within the Southern Lowlands at smaller sites near major polities (Shafer and Hester 1986:163). Apparently, one exception to the Mayan pattern of local production was the import of uncommon items that require rare skill sets or lesser-known techniques.

Some of the data presented by Johnson appears to parallel De León's proposed evidence for mixed-model distribution (imported products combined with local production) for core blades, in that the number of medial blade segments (N=1002) in an apparent workshop context far exceeds the number of proximal and distal segments (N=367 and 191, respectively) (Johnson 1996:Table 1). Additional pre-segmented blades may have been brought in from elsewhere within or near the city center, especially if the site served a dual production purpose where blades were both manufactured and utilized for some other purpose at the workshop. The possibility of a dual production workshop in Mayan territory is not without precedent; such utilization has been determined at Kaminaljuyú via apparent use wear on expedient "waste" flakes among other evidence for core-blade manufacture (Anderson and Hirth 2009), and some workshops in Teotihuacán previously thought to be producing lithic items for exchange were also found to contain a high percentage of use wear, and re-interpreted as craft production areas (Spence 1987:430-432).

Of course, any set of generalizations that attempts to cover an expansive segmentary group such as the Maya may be especially subject to De León's caveat about the likely presence of local variability in distribution strategies, and such exceptions may especially

apply to economies within areas that feature unusual ecological profiles. Both the highland sites of Copan and Kaminaljuyu show some variation from the pattern of centralized production and initial control of distribution. Production at these sites appears to have been done primarily in household contexts, rather than elite workshops within city centers. A difference in material access may be a primary cause for the difference in control in both cases, since both sites are also near obsidian sources (Johnson 1996:170). The Blue Creek area, within the alternating hills and fertile valleys just west of the alluvial plain of coastal Belize, provides an example on the other end of the resource availability spectrum. The Blue Creek territory contains very few sources of workable stone of any sort. Spatial correlations between concentrations of known elite goods (e.g. jade, cacao and *spondylus* shells) and concentrations of stone tools and debitage from local outcroppings show that elites likely controlled areas of common lithic sources (primarily chert) as well as obsidian (Barrett 2004).

This variability, however, offers an opportunity to observe at least one factor affecting the dynamic aspects of distribution, rather than making static predictions which assume uniform circumstances between groups. In all of the above cases within Mayan territory, the degree of centralized, elite control of obsidian appears to inversely relate to the degree of availability of the material. Since rarity is one important aspect of a designated prestige item, the control pattern matches the expectations of Earle's (1994) concept of a wealth financed economy, controlled through Blanton, et al.'s (1996) concept of networking/exclusion power strategy.

Teotihuacán

Teotihuacan was one of the primary Mesoamerican centers in central Mexico from the latter part of the Late Formative period through the Middle Classic (ca. 0 - 750 A.D.). The city is the closest major contemporaneous Mesoamerican center to the Tequila Valleys, and even though no trade relationship has been found between the two areas (Beekman 1996a:997; Weigand 1993:231), some aspects of Teotihuacan economy likely influenced patterns of production and trade in all surrounding Mesoamerican groups in some way, either directly or indirectly, including the Teuchitlán. Common obsidian tools created in and around Teotihuacán were distributed primarily locally and regionally, with a small amount of long distance trade that reached as far as Mayan territory (Spence 1981). Also, the city was largely formed by emigrants from various surrounding communities, one of which was near the Tequila Valleys, within Michoacán. Ceramics and obsidian from grave goods found in the Michoacán barrio were sourced via INAA and XRF analysis, and found to be of Michoacán origin. Yet, items in living floor contexts were local, and completely in the Teotihuacán style. If ties to Michoacán were maintained, some ideas related to Teotihuacán culture, including lithic production and distribution strategies, probably also made their way back to Michoacán (Begun 2013). Some pressure blades of a high quality, distinctive green obsidian from the Cerro de las Navajas source have also been found in the Sayula Basin in what appears to be a Late to Terminal Classic Period context (Reveles 2005:368). The source (also commonly called the *Pachuca* source [Stemp et al. 2012]), is within the Central Mexican Highlands about 50 km from Teotihuacán and more than 500 km from the Tequila Valleys. Phil Weigand has determined a single green blade within the Teuchitlán core area to be from the

Pachuca source as well, which indicates a possibility of at least some rare interaction between Teotihuacán and Teuchitlán (Spence et al. 2002:71). The Sayula and Teuchitlán items, however, were recovered from surface surveys, and therefore the chronological data are unconfirmed (Darras 2012).

Green obsidian at various Teotihuacán workshops has been identified as material from the Cerro de las Navajas source via neutron activation analysis. Obsidian from this source (often referred to as simply "green obsidian" by Spence since the color was commonly associated with Cerro de las Navajas) was the primary material for core-blade production as well as all known exported eccentrics. Green obsidian was brought into the site in core form and utilized in workshops within or near the city center (Spence 1981). Cores were located in all workshops engaged in core-blade production. During the Tlamimilolpa phase (A.D. 200-450)**,** 90 percent of the core and blade material in workshops within the city have been found to originate from Cerro de las Navajas. Another source of lower quality grey obsidian from the Otumba region 16 km from the city was utilized for bifaces and scrapers. Otumba obsidian was also apparently imported in core form, evident from a very common presence of cortex at each workshop, despite the fact that most of the cortex was most likely removed from these cores by field preparation at the source location (Spence 1981:776, 777).

Some well shaped but unfinished bifaces have also appeared at some workshops, and are interpreted as probable blanks which were left unfinished to retain a shape more resistant to breakage during transport, and finished by the recipient upon arrival at their destinations. Blanks were rarely found locally outside of the workshop contexts, and according to Spence's analysis, local finished points appear to not have been

manufactured from blanks, which indicates that the blanks were likely made strictly for export purposes (Spence 1981:771). Bifacial blanks are emphasized in the first known workshop set up for regional distribution during the Tzacualli phase, ca. A.D. 1-150, and their production grew with the expansion of the regional distribution system, ca. A.D. 200-450 (Spence 1981:781).

Spence suggests that Teotihuacán may have held direct state control over workshops closest to the city center, while those in more semi-peripheral areas were encouraged and fostered by the state but essentially self-directed. Spence's conclusion is based on communication and transportation issues related to the physical distance of the workshops from state resources and the workshops' strategic positions, which were more directly exposed to both local and remote consumers (1981:770). The distributions of product forms in regional and local consumer sites were compared to those within semi-peripheral and centralized area workshops, and Spence concluded from the distribution data that internal city workshops produced mainly locally utilized goods, and semi-peripheral area workshops produced items for external trade (mainly, the aforementioned biface blanks) as well as local and regional distribution. However, later use-wear analysis has concluded that some of the workshops actually manufactured obsidian tools primarily for internal work on other crafts, such as woodworking or textiles, with little or no redistribution of the obsidian itself. But internal use of obsidian tools was only indicated at a minority of workshops; the amount of estimated production for export remains substantial, involving at least 44 regional workshops (Spence 1987:430-432, tables 2,3), and Spence's reduced estimation of the magnitude of Teotihuacan's obsidian export

industry did not change the overall view of the role of Teotihuacan obsidian within Mesoamerica as the central region's primary exported commodity (cf. Algaze 1993:312).

Teotihuacán also shows some evidence of a difference in control over each of the two sources. Spence suggests that the acquisition and dispersal of the green core-blade obsidian to final destinations was controlled by the state, whereas the collection and transport of grey obsidian was an independent effort from each respective workshop. The green obsidian is not found in workshops elsewhere in central Mesoamerica, which suggests Teotihuacán control of the source, and it shows up in core-blade contexts in nearly the same source material proportions at each workshop, which indicates a central, coordinated effort for dispersal. The grey obsidian source includes one color variant which shows up in different proportions at each site. The variant differences likely resulted from different workshops working independently to access different areas of the same source. One apparent state-associated workshop at the Ciudadela, a large public open space near the city center which produced large bifaces and could take most advantage of the larger block cores from the grey source, but does not have a proportionally higher supply of grey cores within external biface production areas than what has been located in semi-peripheral workshops (Spence 1981:777-779). Spence has suggested that Teotihuacan fully controlled the green source during its Tlamimilolpa phase, during the Early Classic period (A.D. 200 - 450) (Spence 1981:782,783).

As with the Maya, Teotihuacán elite graves include obsidian in forms of blades, points, tools and eccentrics (DeLucia 2008; Sempowski 1992; Sempowski and Spence 1994). Obsidian is found much more frequently in Teotihuacán interments than in the Mayan tombs, at an approximate proportion of 25 percent over all excavated graves. It is

still found disproportionately among graves of relatively high status, identified by the abundance of other elite offerings (Sempowski 1992:33,36). In Teotihuacán, obsidian was not an exotic item, and therefore not high on the list of internally wealth-related goods unless elaborately worked (1992:34). Although its internal use is relatively common, it is also commonly used for wealth *export,* so its use as a grave good underscores some level of identity of Teotihuacán elites with a wealth industry.

Inter-polity Distribution

Some Teotihuacán manufactured ritual ceramics and obsidian eccentrics have been found dispersed through Mayan territory. These elite trade items, and the nature of the inter-polity relationship that their presence represents have been a topic of study spanning several decades (e.g. Kidder et al. 1945; Moholy-Nagy 1999; Moholy-Nagy and Nelson 1990:72-73; Pendergast 1971; Spence 1981:780, 1996; Stemp et al. 2012). Sourcing via x-ray fluorescence and neutron activation analysis has confirmed that Central Mexican obsidian from six sources of varying quality were exported as far as the Mayan city of Tikal in Guatemala, at a distance of over 1,200 km, from the Middle Formative to the Early Postclassic periods (C.A. 800 B.C. - 900 A.D.). Some of the material is from the aforementioned Cerro de las Navajas, which is found in ritual contexts at multiple Mayan polities (Moholy-Nagy 1999:300-303, Table 1; Spence 1981). These items have occasionally been found in elite tombs at several sites, including La Lagunita, Yaxha, Kaminaljuyú, Tikal, Rio Azul, and Altun Ha in the forms of blades, bifaces, points and eccentrics (Spence 1996), although a larger portion from the green source has been found in utilitarian forms within household contexts, and use wear on some of these items also

indicates common utilitarian use (Stemp 2014). Relatively little debitage from the Mexican obsidian, however, appears in Mayan contexts. Product frequencies even outnumber frequencies of debitage pieces, so debitage appears limited to edge retouch and occasional tool modification/restoration. Obsidian was therefore likely exported over the longest distances of inter-polity trade primarily as finished products for bifaces and eccentrics, as well as prepared prismatic blade cores for the widest uses (Moholy-Nagy 1999:310, Table 2).

Spence's view of the role of luxury items in Mesoamerica echoes that of Wallerstein for the European world system (1974), in that such trades are infrequent and very small in scale, and thus considered relatively inconsequential to the overall economy (Spence 1981:781). However, Schneider's response to Wallerstein (1979:52) also applies to Classic Period Mesoamerica: These occasional items likely represent diplomatic ties that are key factors in maintaining relationships between polities, and thus also forms of inter-polity exchange.

The regional expansion and partial control of Teotihuacán's obsidian trade during the Tlamimilolpa phase corresponds with the likely beginning of the expansion of the polity into the nearby highland valleys surrounding the Valley of Mexico between 200 and 300 A.D. (Algaze 1993:310; Cowgill 2000:277-280). The expansion also coincides with the expansion or dispersal of the Teuchitlan culture, including the occupation of Llano Grande over the same time frame. However, given the lack of any evidence of material exchange between the two polities, any relationship between Teotihuacán and the Teuchitlán culture would have been an indirect one through common trading partners or perhaps a more general influence on trade interactions throughout the area.

Common Mesoamerican Patterns

Several common lithic distribution patterns emerge from the literature among the two most prominent and influential groups for the Late Formative and Classic periods, Teotihuacán and the Lowland Maya. Remote transportation of obsidian after the Middle Formative is generally in the form of prepared cores, and most products, especially those of lower quality material most suited to common tools, are distributed locally. Lower quality material, whether low-grade obsidian or locally sourced chert, does not appear to be subject to elite control, but is handled by a relatively uncontrolled direct market system. Despite elite control of production, social stratification was only moderately reflected in the Late Formative lithic data in both areas. Although more obsidian consistently appears in elite rather than commoner households, there is no readily apparent difference in the *forms* of obsidian used in locations that reflect social position. The same pattern of mixed elite and commoner household use was also noted by De León et al. for Late Formative contexts in Central Mexico (2009:119-121), and therefore appears quite consistent throughout Mesoamerica. Both Johnson and Spence interpret the distribution pattern as an initial elite control of the supply with the surplus of higher quality obsidian redistributed for common use contexts among elites households, whether to non-centralized workshops as raw material in the case of Teotihuacán, or along family lines to households as finished products, as is suspected with the Maya. From there, according to Johnson and Spence, a relatively small amount of obsidian flows downward through the social hierarchy to commoner households, although the mechanism for continued redistribution is not apparent in either case.

Both Teotihuacán and the Maya also utilized specialized workshop areas in outlying areas for specific products destined for wider distribution, but still within each city's sphere of control. Area exports from these two polities differ in that Teotihuacan's exports from regional workshops are primarily intermediate forms (bifacial blanks), whereas Mayan area exports are often complete, specialized tools. Also, some of Teotihuacan's regional trade workshops appear within the core city area, as well as the outer edge of the city.

Finally, both areas produce eccentrics and apparent ritual items from high quality material (although among the Maya, some of these items are from a high quality local chert rather than obsidian) which have been located in centralized ceremonial contexts within a much larger, region-wide area of distribution. These items appear targeted for ceremonial purposes among rulers of remote polities.

Teuchitlán: Internal Distribution

> "...this [excavated] mound is near the great obsidian workings of Teuchitlan, where miles of hillside are strewn with refuse cuttings." [Breton 1903:133]

It has been clear even from the first casual observations made by Adela Breton that obsidian production was a major industry for the Teuchitlán culture. The initial impression of lithics within the Tequila Valleys from early surface surveys was that a high degree of site specialization occurred throughout the region. Breton (1905) also

noted differences between waste areas, where polyhedral cores appear quite frequently in some areas, but not at all in others. Different sites vary greatly in product types, debitage to product ratios and manufacturing technique (Spence, Weigand and Soto 1980, 2002). A high degree of variability also appears at quarries. Core-blade technology, flake cores, and laminar jewelry all appear to be emphasized differently at different sites. Bifaces appear in a number of places, but never as the sole type of product (Clark and Weigand 2009:79-80).

Debitage distribution observations from the Tequila Valleys thus far suggest the same pattern of core transport from the source and production at the local destination seen throughout the rest of Mesoamerica. The pattern has been observed through all published study areas within the Tequila Valleys (figure 4.8), including the core center of Los Guachimontones (Esparza 2003:77; Soto 1990; Weigand 1985), the La Venta Corridor to the east (Beekman 1996a:753), and around the Magdalena Basin to the northwest (Spence 1980; Spence et al. 2002).

One exceptional case is the material from the La Joya source on the eastern side of the Magdalena Basin (figure 4.9). Obsidian from the La Joya source appears to have been distributed through the Magdalena Basin area since the Middle Formative period. Most of the La Joya material was found in the form of unmodified material, although it appears also to have circulated in the form of complete blades among several sites (Spence et al. 2002:65,66,70). The La Joya source is best known for its association with the nearby Las Cuevas workshop, which was very heavily utilized during the Postclassic period (Spence et al. 2002:71-72). However, utilization of La Joya during the Teuchitlán occupation span appears very light.

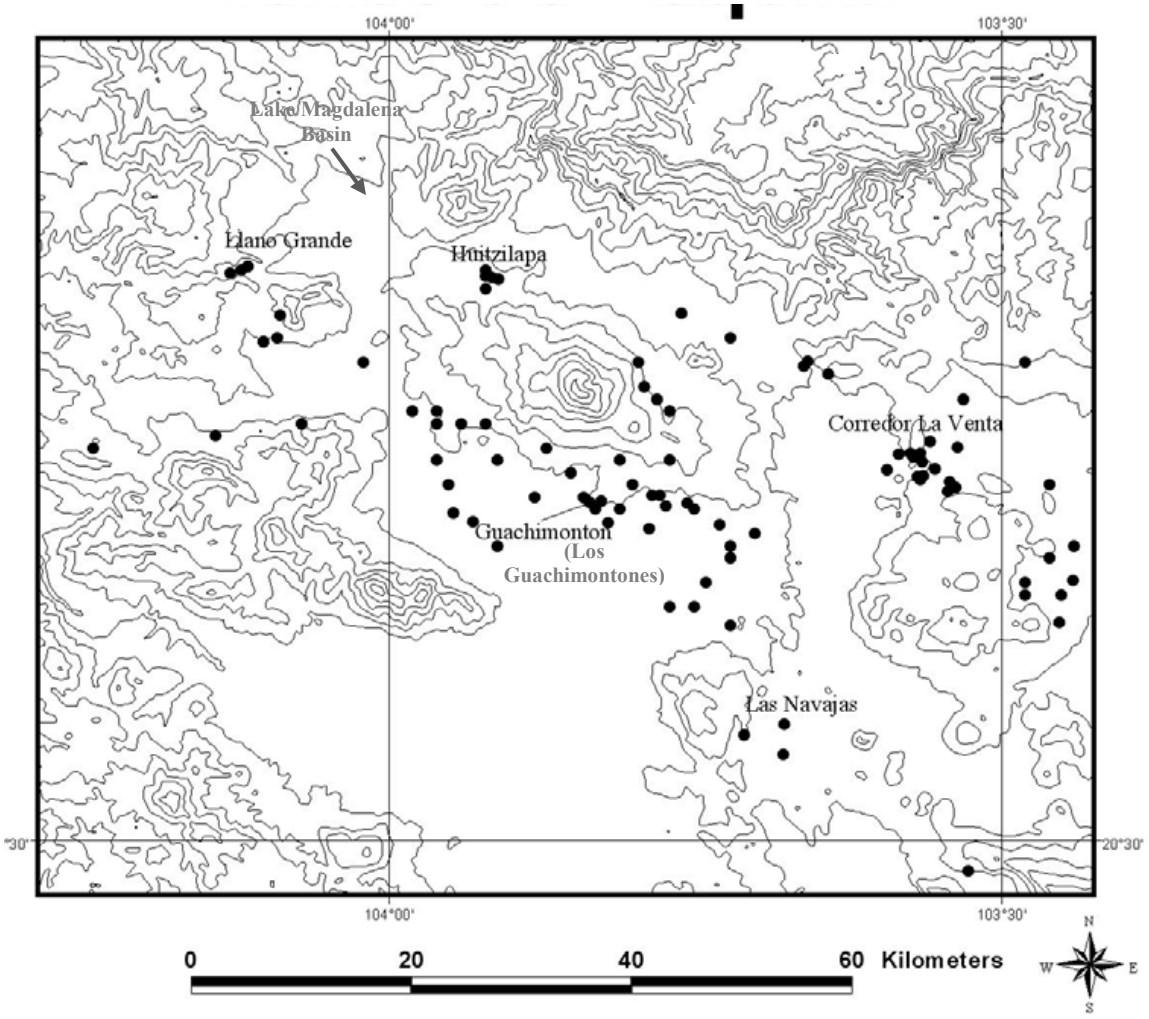

Figure 4.8: Major areas and sites studied within the Tequila Valleys. Adapted from Beekman 2007:figure 1.01.

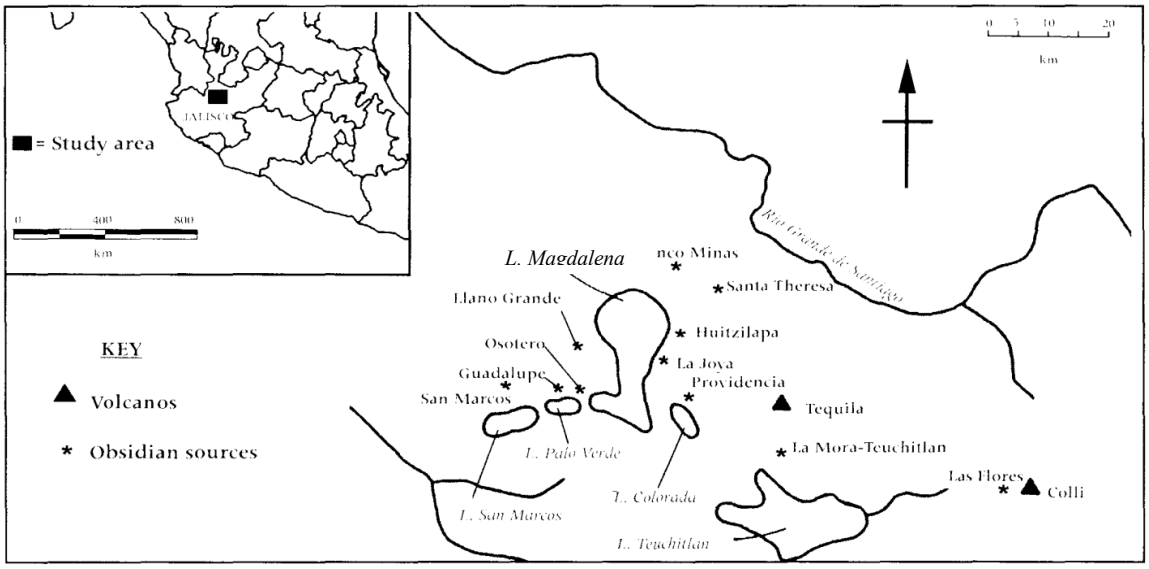

Figure 4.9: Tequila Valley obsidian source locations mentioned by Spence, et al. Adapted from Spence, et al. 2002:figure 6.2.

Late Formative and Early Classic obsidian distribution appears to have been limited to local areas surrounding each source location. Surveys and a few excavations show that guachimontones are quite often associated with obsidian workshops (Beekman 1996a; Esparza 2003; Soto 1990; Spence, et al. 1980), and they appear to be involved in some way with obsidian distribution (Beekman 1996a:976). Based on regional differences in platform preparation and the sizes of most workshops throughout the area, lithic production and distribution appears to have involved independent networks surrounding secondary guachimontón centers, rather than central control from the Los Guachimontones site, despite the presence of a very large obsidian production area near Los Guachimontones (Beekman 1996a: 748-749; Soto 1982, 1990; Spence et al. 1980) which is by far the largest and most artifact dense workshop in the Tequila Valleys (Spence et al. 1980:358), and spans about 1.5 acres (Soto 1990:217).

Judging from the lack of overall frequency or grouping of flakes with cortex, the workshop appears to have taken in obsidian in the form of prepared cores. Most, and possibly all, of these cores are from the nearby La Mora Teuchitlan source, which contains an estimated 1000 - 1200 tons of debris and "millions" of decortication flakes (Weigand 1985:88-89). Spence (1980:357-358) has suggested that much of the lithic mass in the workshop can be attributed to items used for woodworking, rather than lithic products destined for direct distribution. However Soto's (1990) interpretation has been directed mainly toward lithic export, and her dataset does not show a presence of more than a few actual tools and tool fragments. A craft workshop context should show a high number of worn tools as they are used up and discarded.

Source quality differences could have potentially drawn people towards more distant sources, based on Clark and Weigand's (2009:79,80) remark that differences in product types appear to be based on the quality and limitations of available materials. However, the evidence in at least one area suggests that raw material differences may not have been a major consideration for the culture. The more moderate quality local sources in the La Venta corridor appear adequate for most Teuchitlán lithic production, and even laminar jewelry, which appears to be the primary elite item of the Teuchitlán occupation period, could still be made from the local obsidian. Lithic sources used in the eastern part of the region were found to be predominantly from the most convenient eastern volcanic formations of the Sierra de la Primavera, despite the relatively mediocre quality (Beekman 1996a:833, 846). No patterns that suggest centralized obsidian control were seen in the La Venta corridor, except for the laminar jewelry products which were distributed only among elite sites (Beekman 1996a:986).

With adjustments for the later corrections to the architecture timeline (Beekman 2010:64; Beekman and Weigand 2008:315), the La Joya quarry appears to have dominated the Magdalena area during the peak public architecture period of the Late Formative (Spence et al. 1980:358, 359; 2002:65-66), although some obsidian circulated from an area that includes several sources in the surrounding hills, including Llano Grande, about 25 km northwest of the La Joya source. Approximately 38 percent of the obsidian found in the core occupation area surrounding Los Guachimontones is visually similar to that of the hill sources near Lake Magdalena, but most or all of it is likely from the much closer source near San Juan de los Arcos, approximately 18 km to the southeast (in the opposite direction from the Magdalena hills). The San Juan de los Arcos obsidian falls under the same visual type description in Spence's typology as the Magdalena Hills sources (Spence et al. 2002:68).

The primary site of Los Guachimontones appears to have mainly utilize the nearby La Mora Teuchitlan source, just three km northwest of the ceremonial complex (Spence et al. 1980:358-359, 2002 67-68; Weigand 1985:88,89). Some Llano Grande obsidian as well as a minority of remote materials from Nayarit and Michoacán appear to have made their way to Los Guachimontones ceremonial center (Esparza 2003:75,88; Spence et al. 2002:68). But for the most part, material from sources in the west and northwest, including Llano Grande, were limited in internal distribution to the Magdalena basin. Also, no obsidian identified as La Mora Teuchitlán material has been located in the Magdalena area (Spence et al. 1980:359).

Obsidian export outside of the Tequila Valleys has been mentioned on a few occasions, but thus far the evidence is scant. Some obsidian artifacts from the Navajas

source as well as San Juan de los Arcos have been located in the Sayula Basin at the site of La Peña. Recovery contexts of the artifacts were determined to be either Middle or Late Formative layers. Most were in the form of debitage, and one included a knife which appears to have been manufactured locally at La Peña, based on dimensional characteristics (Reveles 2006:388).

Of 27 successfully sourced northern Mexico INAA tested samples, four prismatic blades from sites in southern Zacatecas and northern Jalisco were traced to obsidian sources within the Tequila Valleys, but dates for those deposits are uncertain (Darling 1995, as found in Beekman 1996a:823-824), and as discussed below, were likely from the Postclassic period. Esparza (2003:90) has also determined that obsidian from the La Mora Teuchitlán source was traded to areas well beyond the Tierra Caliente region of Michoacán, approximately 320 km from the Tequila Valleys, and elemental analysis of a single blade segment found in an Epiclassic context at a Mayan site on Ambergris Cay off the coast of Belize most closely matches sources from the Tequila Valleys, but an exact match could not be confirmed. Although the context of its deposition is very late, blades likely began to circulate outside of the Tequila Valleys some time before the end of the tradition, around 500 A.D. (Braswell et al. 2011:143). Finally, although not a definitive match, burials within the Feathered Serpent pyramid in Teotihuacán contain items very similar in form to the laminar jewelry of the Tequila Valleys (although not in technique - the Teotihuacán items are bifacially knapped), which are dated to 150 - 250 B.C.

One issue with Spence's collections is that they are all from surface surveys. Spence himself has stated that although surface densities of artifacts are important evidence, by

themselves they are "not always reliable" (1987:30). Both Spence and Esparza mention the appearance of "fine" pressure blades or prismatic blades, and these items were almost ubiquitous around West Mexican surface ruins, yet too few are associated with excavated contexts to suggest any prismatic blade industry for the area during the span of occupation for the Teuchitlán culture (Darras 2012). Large quantities of prismatic blades within the area rather suggest Postclassic activity in the region. Also, due to funding and time limitations, obsidian sourcing in the area has historically relied on visual properties such as colors, patterns, translucence and tactile characteristics rather than geochemical analysis. Beekman initially utilized visual identification for his La Venta corridor survey, but later submitted samples for INAA analysis and found that most samples were from the Primavera source, including three samples originally suspected to be from Llano Grande (1996a:833).

The practice of visual sourcing has been common for some time, but it has been tested against laboratory analysis using XRF with materials from known sources, and was deemed unreliable by Moholy-Nagy and Nelson (1990). Following the publication of these tests, analysts have shown an ability to learn from previous test results, and have improved their success rates from roughly 50 percent to 95 percent (Braswell, et al. 1994; Clark personal communication to Beekman, as found in Beekman 1996a:819-821). But in practice, visual sourcing attempts are invariably done by analysts who are not intimately familiar with the sources associated with the collections under study. However, visual sourcing may still have valid applications in the right circumstances. Moholy-Nagy and Nelson's test was primarily run on the least distinguishable gray varieties of obsidian in all but three cases, and more recent pXRF sourcing has confirmed that previous visual

identifications of Teotihuacán's Pachuca green obsidian were correct in 16 of 19 tested samples (Moholy-Nagy 2013:75). It must be noted that pXRF is relatively new and its reliability is less certain than conventional XRF or INAA, but the base XRF technology on which it relies does have a proven track record. These later results suggests that more visually distinctive sources might be reliably identified through visual observation. Beekman and Spence have determined that the lithic sources in the Tequila Valleys are quite visually distinctive, but some visual types, particularly Spence's "Group G," are observed in several sources across most of the area. Nevertheless, results from additional elemental analysis comparisons to visual sourcing, such as one currently pending for the Tequila Valleys (Hoedl 2013), should be used to further test the validity of the approach in the area under study.

One item not included in Spence's survey analysis is the most abundant material at the Llano Grande source location, a fine dark green-black obsidian. Based on the visual description, it may be the missing source of the fine "group B" obsidian mentioned by Spence, which he speculates to be from a source external to the Tequila Valleys, and only occurs in very small quantities within the Valleys. Obsidian originating from the hills surrounding the Tequila valley basins is described as visually atypical in color and tone, relatively poor quality and likely not practically useful for pressure blades (Spence et al. 2002). My limited casual test knapping experimentation with a variety of visually distinctive sources at Llano Grande suggests that the dark green-black variety at that location is quite workable, especially relative to other visually distinct types found near the Llano Grande quarry site which do fit Spence's characterization of the area's obsidian. The source database recently produced by Glascock, et al. (2010:204, Table 12.1) does

recognize several additional visual variations including the dark green material, and rates the overall obsidian quality at both Llano Grande and Navajas as "excellent". The finer quality material at Llano Grande may have been more rarely distributed within the basin because it was more useful as an external trade item, given the site's difficult access to the interior, and relatively easy access to the periphery discussed in Chapter III.

Area and Site Studies

The few published lithic studies from the Tequila Valleys and surrounding areas to date are primarily based on surface surveys limited to specific areas, and most West Mexican studies are still almost completely descriptive in the nature of the culture-history approach (Beekman 2010:45). Although they do offer valuable data from excavation results for future analyses, publications resulting from these studies are very general; no truly detailed studies of ceremonial circles have been published (Beekman 2007:20). As a result, with the exception of Soto's work (1982, 1990) detailed technological lithic production studies in the area have also been lacking despite the abundance and perceived importance of obsidian to the area.

Most publications on lithic studies in West Mexico offer only descriptions and interpretations of processed data, and little access to the data itself, other than glimpses of certain attributes regarding specific points. Also, as purposes for these datasets differ, collected attributes and database designs also vary. As a result, none of the literature on areas compared in this chapter show perfectly congruent datasets for a comparison of all attributes and calculated results. However, much overlap in methodologies and data

definitions does occur, so the data which are publicly available and useful for comparison are utilized where possible. Some types within the more detailed typologies are collapsed here into more general "least common denominator" categories. Collapsing accomplishes two goals: It creates an additional degree of compatibility between data sets for comparison, and focuses the data on details which are most pertinent to the economic questions and related attribute categories addressed by this thesis.

Typologies in West Mexico are usually a mix of Clark's technological types for prismatic blades, various flake technologies (1997; Hirth and Andrews 2002) with some generalizations and modifications, and functionally oriented descriptions of various retouched tools. Most of the literature reviewed here relies heavily on functional interpretation, as does this thesis. The use of subjective morphological characteristics to interpret tool function has been criticized by some lithicists because perceived functions are often assumed *a priori* and unverified. (Hirth and Andrews 2002:1; Whittaker 1994:27). Many functional tool types, such as projectile points, manos and metates, have been verified many times ethnographically and ethnohistorically, and also via contextual and residue analyses. Certain functional types have been long accepted by nearly all researchers (but see Aoyama [2005] for a study on alternate use of projectile weapons among the Maya), and some degree of functional interpretation is necessary to arrive at any meaningful conclusions. However, unverified interpretations of less understood forms should be viewed with caution, but still considered along with contextual data, as future opportunity to test these interpretations may become available.

Four areas and sites are examined in this section: First is the core site of the ceremonial center and second the Feature 83 workshop at Los Guachimontones. Third,

the semi-peripheral area of the La Venta corridor, and fourth the peripheral La Peña site within the neighboring unaffiliated area of the Sayula Basin.

Los Guachimontones

The primary site of Los Guachimontones is chosen as a centralized representation of Teuchitlán core culture. In Chapter III, environmental and architectural aspects of the Navajas site were suggested to be more representative of core culture than Llano Grande. To the extent that the datasets are comparable, a review of lithics in Los Guachimontones should be useful for comparison to lithic data in Llano Grande and Navajas as further described in Chapter V, to determine whether the proposed relative degrees of adherence to the core between the sites is also borne out in the lithic data. Specific aspects of the lithic collections provide additional details about the nature of similarities in what was produced and/or used at each site. Lithics at both the ceremonial complex and the obsidian workshop are described here.

Ceremonial Complex

The ritual complex of Los Guachimontones is composed of nine guachimontón circles and two ballcourts. 16,000 lithic artifacts have been extracted from the complex. A lithic spatial distribution study was conducted by Rodrigo Esparza (2003) for the largest features of the ceremonial center. Units of analysis previously defined and mapped by Weigand were used to record the spatial distribution, but for the purpose of the current analysis, only site totals for various artifact types are considered. Artifacts were mainly

recovered from the surface, along with some from several sample pits in building platforms around the two largest circles (I and II), and in the largest ballcourt situated between the two circles. Where possible, distinctive tools were functionally defined, but described by technological form where functionality could not be discerned. Esparza followed Clark's technical typology for both blade and flake industries (1997; Clark and Bryant 1997), although some of Clark's types were generalized into "macro" and "smaller" or unqualified flakes and blades. Some attention also was given to retouch subtypes that have been tied to functional purposes (e.g. denticulation, concave and convex edging, and notching). Esparza's typology was designed to determine the degree of spatially differentiated labor between circle buildings, and thus group specialization.

Esparza's Circle II contained the highest number of obsidian pieces, at 5,020. Most pieces in Circle II were flakes, and more than half showed use wear (Esparza 2003:81). Esparza found that decortication flakes in the site were minimal, and therefore core preparation likely took place prior to the material's arrival at the complex. Most cores within the complex were casual/multidirectional; very few polyhedral cores were located. Many expedient flakes or flake byproducts of other production activity, including macro-flakes, were retouched and utilized as tools (Esparza 2003:76-78).

Esparza also suggests a similarity of guachimontón production strategies to that of the major nearby workshop excavated by Soto (1982,1990), and cites the proportions of blade striking platform types as evidence. The platform preparation techniques utilized at both locations are indeed similar (Table 4.1), although Soto found a more even distribution with the greatest proportion (47%) pecked, whereas the ceremonial center contained a majority (70%) of multifaceted platforms. The platform preparation

technique was therefore more standardized at the ceremonial center. This may only be due to a much lower number of people involved in the production process at the ceremonial center, since more individuals introduce more of their own variations. Another possibility is less variability in the types of items being made at the ceremonial center. The most expedient type, the single facet or smooth platform, is a minority in

Table 4.1: Platform preparation percentages, center vs. workshop. From Esparza (2003:78).

Platform type	Ceremonial Center Esparza/Ponce (1999-2000)	Workshop Soto (1982)
Single facet	11%	17%
Multi-faceted	70%	36%
Pecked	18%	47%

both contexts, indicating both sites may have emphasized formal production techniques.

Some macroblades and over 20 first and second series core blades were found in Circles I and II, and the ballcourts. Some of these were refitted to cores, demonstrating that blade knapping took place on-location (Esparza 2003:79).

Very few bifacial products and biface blanks were found. Most retouched tools were flake based, and functional interpretations include potential staple processing items such as choppers, knives, "mashers" (perhaps pestles), as well as awls, polishers, scrapers and scratchers (Table 4.2). There were not enough bifacial products to define a detailed formal typology (Esparza 2003:80). Items translated as "razorblades" are not described, so are assumed to be a relatively fine, 1st or 2nd series blades (figure 4.3), and blade

segments are likely horizontally broken pieces. The only item that can be considered a luxury or ritual artifact is an impact fractured Clovis point tip (verified as a true Clovis

Table 4.2: Lithics from the Los Guachimontones public center, adapted from Esparza 2003:Table 3

Type	N	%
Blades	1,644	9.9%
Fine blades ("razorblades")	1,116	6.7%
Flakes	12,072	72.8%
Blade segments	332	2.0%
Points	44	0.3%
Preforms	58	0.3%
Cores	167	1.0%
Specialized tools (awl, chopper, knife, masher, polisher, scraper, scratcher, unknown use)	1,142	6.9%
Staple tools (Masher - pestle?)	5	0.0%
Total	16,580	100%

from independent sources) in a ball court offering context, which may have been an ancestral offering (Esparza 2003:80,81).

Esparza found that different tool types were emphasized within different buildings, suggesting specialization on certain tasks between groups. But despite the workshop-like organization, he concluded that the center did not include a workshop, primarily based on the predominance of internally worn tools which indicates manufacture for local use (2003:90). Esparza does not mention any prestige or ritual items other than the Clovis point and other archaic period points previously extracted from a ritual deposit in one of the smaller circles within the complex. None of the distinctively Teuchitlán prestige forms (pikes, rods or laminar flake items) are specifically mentioned, although a category for items of "unknown use" included 21 artifacts (0.1 percent of the total count).

The Los Guachimontones study does suffer from the same problem encountered by Spence et al. (2002) in his regional distribution study, in that most of his data are from surface collections. However, Esparza's data appear contemporaneous with excavated contexts produced thus far for the period. Only a very small percentage of first and second series blades were located compared to the number of blades from earlier stages (1.2 percent of the total number of blades), and 3rd series (prismatic) blades were not present.

Feature 83 Workshop

The primary Los Guachimontones workshop area designated Feature 83 was thoroughly analyzed by Maria Soto (1982, 1990). It is in an entirely different context from the ceremonial centers under study, but with the contextual difference in mind, provides additional clues about the nature of lithic production and use in the central core area in general, and also the nature of lithic workshops in the region. The workshop area is quite expansive compared to any other lithic concentration in the region; Soto defined a 75m x 78m grid for the area which covers approximately 0.6 hectares, or 1.4 acres (1990:217).

Like Esparza's ceremonial center study, Soto examined the differential distribution of lithics within the site, but concentrated more on the distribution of technological forms in the far more abundant debitage to determine labor divisions and degrees of specialization for different production stages as well as tool forms. Soto very closely followed all of Clark's polyhedral blade forms (Clark 1997; Clark and Bryant 1997; Hirth and Andrews 2002) and other commonly recognized attributes such as core platform preparation types

and platform angles, to determine the clustering of attributes within distinctive concentrations of debitage. Again, at the scale of the current study, only the emphases on specific technologies and forms from the site as a whole are reviewed for comparison.

As with most other Teuchitlán contexts (excluding only Spence, et al's [2002] identified use of the La Joya source within the Magdalena basin), the lack of any appreciable quantity, size or clustering of decortication flakes indicates that obsidian arrived at the workshop already prepared as macrocores (Soto 1990:225). Soto located an abundance of virtually every type of polyhedral product, byproduct and debitage specified by Clark, down to but not including final-stage prismatic blade manufacture (Table 4.3). She also noted use wear on some items which indicated some utilization for other activities within the workshop area, but only occurring on 1 to 4 percent of items for each typological category, with an overall percentage of 2.16. Nearly all of the use wear (98.4%) was within a single cluster which was also the only concentration out of 11 clusters that contained no microdebitage indicative of a lithic production area

Table 4.3: Lithics from the Feature 83 workshop, with used item percentages. From Soto (1990:238, 240).

Type	N	% of Total	Used	% of type used
Crested macroblades	269	0.3	6	2.23
Macroblades	20,179	20.2	226	1.12
Macroflakes	10,000	10.0	95	0.95
Blades	28,578	28.6	1246	4.36
Flakes	23,364	23.4	250	1.07
Cores	45	0.0	1	2.22
Ground stone (manos, metates)	11	0.0	n/a	n/a
Debitage (platform preparation, error correction flakes, flake and blade fragments)	17,390	17.4	91	0.5
Total:	99,836	100	1915	n/a

(Soto 1990:238). The same cluster was also the only one which contained evidence of ground stone products, specifically four metate fragments and seven manos, as well as the majority of ceramics in the area. The cluster was therefore interpreted by Soto as a living quarters, and the rest of the workshop was determined to be designated solely for the manufacture and redistribution of lithic products within the area. The majority of forms were related to polyhedral blades, with a parallel industry for the generation of large flakes for flake-based blanks. Soto suggests that most blanks were likely designated for exchange as preforms (1990:241), as also suggested by Spence for similar items found in Teotihuacán (1981:771). Soto does not detail exact quantities of retouched blanks or tools remaining in the shop in her synopsis of the workshop data. She does, however, report that all of the retouched pieces are either broken or show signs of production failure, which indicates that all viable finished products had been exported. Also, none of the retouched pieces outside of the living quarters assemblage show signs of use (1990:241). No pikes, laminar flakes, flake jewelry, or debitage related to either eccentric industry are mentioned by Soto in relation to the workshop.

The La Venta Corridor

Beekman's (1996a:123-124) study of the semi-peripheral La Venta Corridor area also primarily relied on a surface survey, with sampled areas which show unusually high artifact density more systematically and comprehensively covered. Sample excavations at targeted sites followed the survey (1996a:144). Beekman also notes that the majority of

fine blades recovered from the area are first or second series items, rather than third series (prismatic) blades (1996a:756), and fine blades are also very low in number (Table 4.4). Therefore, like the Esparza collection, the blade types present suggest that the majority of items in the area are contemporaneous with the Late Formative and Early Classic sites. Various functionally specialized tools are defined for the area, as well as rough bifaces and point preforms (Beekman 1996a:763,768,figures 6.3-6.5). The latter two items may have been utilized as bifacial blanks for trade purposes, as described by Spence (1981:771,781).

Beekman's (1996a:756) lithic analysis for the area also used much of Clark's typology, but eliminated Clark's distinction between macroblades and blades, and also between macroflakes and flakes because the "macro" distinction is typically defined by size rather than morphology, which is also dependant on the initial core size. The study also included some common morphological distinctions of debitage not present in other studies of the area, including some types specific to core-blade debitage. More specific types are collapsed into more basic categories here, as noted at the beginning of this section.

Laminar flake based items appeared in the area, and include various geometric shapes such as anthropomorphic figures, lunates, discs, crosses and axe-shaped items. Whole flakes are noted to consistently possess a bulb of percussion and some rippling on both sides, and the markings are oriented in different directions on either side. The

Table 4.4: Lithics from the La Venta Corridor (nodules excluded).
Adapted from Beekman 1996a:Table 6.1.

Type	n	% of total
Debitage (shatter, blade-core fragments and	2,196	45.2

flakes, cylindrical core)		
Flake	2,061	42.4
Finishing Flake	53	1.1
Macrocore	22	0.5
Casual core	1	0.0
Percussion blade	312	6.4
Fine blade	6	0.1
Scraper	25	0.5
Stripper	12	0.2
Multi-functional (awl/knife, awl/scraper)	15	0.3
Knife	15	0.3
Rough biface (blank/preform)	7	0.1
Chopper (Reworked core fragment)	1	0.0
Chisel	1	0.0
Ground stone, staple processing (manos, metates, molcajetes)	10	0.2
Unknown (too fragmentary or no known use)	10	0.2
Points	74	1.5
Cylindrical core flake	17	0.4
Cylindrical core jewelry	15	0.3
Pikes and rods	10	0.2
Total	4,863	100

evidence supports Long's (1966:228-230) proposed "sausage" manufacturing technique for these items, since turning the core between blows as Long described would produce this pattern. Many laminar pieces which may have been broken during manufacture were found within the site, and Beekman suggests that the site was a workshop dedicated to laminar jewelry (1996a:790, 795-799, figure 6.16). Several pikes and rod ornament fragments were also located throughout the area (Beekman 1996a:802).

Artifact counts from the surface collection were compared to those recovered from excavated contexts. Laminar jewelry was found to be very much underrepresented by survey data, and all other types decreased in number below the surface. There is little evidence of differences in both production and distribution of various product types

between sites, except for the sites at Cerro Tepopote, which shows a much lower than average count of core/blade debitage (Beekman 1996a:805).

Beekman (1996a:742) notes that the political boundaries of the La Venta corridor defined by the walled semi-peripheral sites did not affect the distribution of artifacts, which showed no change in density on either side of divisional walls; the local economy therefore appears to have followed an independent course from any attempted political control. Artifact types collected from the area include very small quantities of prismatic blades, some discoidal scrapers, jewelry, long narrow points and long handled scrapers. Beekman also notes some difficulty among less experienced staff in determining natural obsidian cobbles from artifacts, due to the abundance of naturally occurring obsidian throughout the area. The problem is compounded by the prevalence of more expedient and therefore less obviously human altered tools (Beekman 1996a:750). Very little cortex in the La Venta corridor sites once again indicates that cores were prepared before distribution to consumer sites (Beekman 1996a:753).

The Sayula Basin

The Sayula Basin is the only site in the periphery which contains verified obsidian from the Tequila Valleys. Excavation in the Sayula site of La Peña in 2000 and 2002 yielded 4,301 lithic artifacts, of which 3,203 (74.5%) were interpreted as imports, and 3,180 of the imports (99.3%) are obsidian. Most of the remaining imports were of elite materials which included greenstones of unspecified mineral type, pyrite, chalcedony and specular hematite (Reveles 2006:373).

Some obsidian from the site has been sourced to the Tequila Valleys mining sites of Navajas and La Joya via neutron activation analysis (NAA). One obsidian knife is also sourced to Navajas. Based on dimensional characteristics, the knife is of local manufacture (Reveles 2006:388). Other items were visually sourced to the Teuchitlán sites of San Juan de los Arcos and La Mora Teuchitlán; as well as the Teotihuacán controlled Pachuca (Cerro de las Navajas) source in Hidalgo. Of the visually identified sources, all except one (Ixtan del Rio) have previously been confirmed within other parts of the Sayula Basin via NAA. The use of these distant sources was necessary for the area, which has no obsidian of its own (Reveles 2006:373), and obsidian was utilized in the Sayula Basin more than any other lithic material (Reveles2005:350). The proximity and abundance of obsidian in the Tequila Valleys made the Teuchitlán culture a highly desirable primary trade partner.

However, only 582 lithic pieces were attributed to contexts which were contemporaneous with the Teuchitlán culture. These were discovered in Atotonilco and Usmajac phase contexts (Middle Formative into the Early Classic.). The two phases needed to be combined because they could not be accurately differentiated at the site for knapped tools (Reveles 2006:374), although Reveles also notes that this is partly because there appears to be considerable technological and morphological continuity between these phases (2006:387). 574 of these items were knapped, and they include 556 debitage pieces. The majority of the obsidian debitage is from polyhedral cores. Artifacts include nine obsidian projectile points, one obsidian biface (an elongated item suggested to be a knife), one andesite scraper likely made from local material, four polished items (two pebbles, a piece of partially polished slate and a mano) and four jewelry pieces. Two of

the jewelry pieces are specular hematite flakes, one of which was perforated; the remaining two are earrings, one of chalcedony and the other of a "fine volcanic rock" (2006:374). Some of the more distinctive points are very wide triangular items with nearly equilateral dimensions and wide, short rectangular stems (Reveles 2006:387), and resemble some of those found in Teuchitlán contexts (e.g. Beekman 1996a:figure 6.14f).

Reveles' description of the Sayula Basin's material culture through most of the Formative and Early Classic periods reflects a group primarily engaged in a wealth trade economy. Types and styles of artifacts in the area were diverse, and most often included similarities in styles to several surrounding groups. Foreign artifacts increased in number during the basin's Usmajac phase (200 B.C. - 300 A.D.)(Liot et al. 2006:415-416). Most of the lithics were also retrieved from contexts dated to the Usmajac period, described by Reveles as "pre agricultural" (Reveles2005:351) which, from Earle's perspective, would likely indicate investment in a wealth economy. Some ground and pecked tools also were located. Artifacts are described as diverse, and include more categories of items and diversity of forms than reported in any Teuchitlán context. Artifacts from the area include anthropomorphic items, necklaces, lip plugs, eccentrics, drills, end scrapers, racloirs, points and knives with only a small presence of blades and prismatic blades. Direct percussion appears to have been used until the very last finishing step in the production process for most tools, including blades. No exhausted cores were found, and Reveles suggests that finished blades were imported. Oval, semi-circular and circular scrapers are common. Some necklace pendants and beads made of obsidian were located in a Sayula shaft tomb (Valdez 1998), and some rough pikes and laminar anthropomorphic figures have also been recovered from the area (Reveles2005:351-352).

If blades were imported, the Sayula Basin is the one area that essentially breaks the post- Middle Formative pattern of local blades manufacture. As discussed earlier, however, additional evidence of core-blade industry byproducts may be necessary to determine the presence of a local core-blade industry. The focus on lithic imports and prestige items, coupled with a paucity of items suitable for food processing are clues to a heavily wealth-oriented economy a short distance from the Teuchitlán semi-peripheral zone.

Inter-Area Comparisons

One additional caveat must be noted for any comparison of literature on previous lithic studies in the area: The few datasets available with comparable type and frequency data are from different scales of research. The La Venta Corridor dataset is an area-wide collection, which may include a wide range in types of assemblage contexts, whereas the two Los Guachimontones studies are at the site level. Fortunately, source sites at La Venta were avoided (Beekman 1996a:751), as were shaft tombs during the excavation phase (Beekman 1996a:144) but assemblages frequently included midden deposits (1996a:156), and likely household deposits along with the production and public centers which better correspond to the contexts of the locations at Los Guachimontones. The Feature 83 workshop area did include a likely dwelling unit, and the public center only shows clear evidence of the use of utilitarian objects, but such use is likely to have differed to some degree from that of households. Beekman's observation of the nearly exclusive presence of laminar jewelry in the few excavations done in the La Venta

Corridor (1996a:805) require some consideration that such items were very much underreported in the surface survey data. A concentration on only excavated contexts would drastically reduce the sample size, Nevertheless, these datasets are what we have available, so comparisons must be made with these noted differences in mind.

As shown in Table 4.5, the La Venta Corridor dataset is dominated by debitage and flakes. Flakes are also prevalent in the Los Guachimontones sites, but La Venta's proportion of debitage differs from both Los Guachimontones contexts by the widest margin of any category, at a difference of 27.8 percent from the Feature 83 workshop. Approximately 98 percent of the debitage category from La Venta is classified as shatter, or broken and unidentifiable worked pieces. A consumer context such as the Los

Table 4.5: Percentages of each lithic type per location.

Location	La Venta Corridor	Los Guachimontones Ceremonial Center	Los Guachimontones Feature 83 Workshop
Blades	6.5	16.6	49.1
Flakes	43.5	72.8	33.4
Points	1.5	0.3	n/a*
Blanks/Preforms	0.1	0.3	n/a*
Cores	0.5	1.0	0.0
Staple tools	0.2	0.0	0.0
Other tools	1.3	6.9	n/a*
Eccentrics	0.9	0.0	0.0
Debitage	45.2	2.0	17.4
Unknown	0.2	0.0	0.0
Total	100	100	100

*Unspecified by Soto (1990); the only remaining retouched artifacts are production failures.

Guachimontones ceremonial center would not be expected to contain a large quantity of shatter, and a polyhedral core workshop starting from prepared cores may contain mostly

readily identifiable pieces since the distinctive products and byproducts of the industry are easily recognized, even in a broken state. The prevalence of shatter at La Venta is likely due to an emphasis on other industries, such as expedient knapped items, bifaces or eccentrics. Midden contexts might also show a much higher concentration of shatter, since shattered cores and macroblades/flakes often have no reuse potential. La Venta's blade industry is quite low, and contains a 10.1 percent lower proportion of blades than even the flake-dominated ceremonial center. The ceremonial center shows a preference for flake tools over blades by a wide margin, even though the workshop emphasized more blades than flakes, which suggests a wider area of distribution than the ceremonial complex for the workshop. It also suggests that the balance of the distribution outside of the ceremonial complex, which would have been primarily household contexts, mainly included blades and blade products. As discussed above, other Mesoamerican contexts which include Teotihuacán, the Maya and Oaxaca, primarily used polyhedral blades in household contexts for a wide variety of utilitarian purposes.

The comparison also suggests that the lithic industry within the La Venta Corridor is only partially similar to Teotihuacán's regional workshop industry. Unlike the more distant Teotihuacán workshops, bifacial blanks do not appear in greater numbers in La Venta. Rather blanks appear to be more popular for the creation of tools within the central ceremonial center, most of which were likely provided by the parallel flake industry of the workshop. However, like Teotihuacán's workshops, La Venta contained eccentrics (laminar jewelry, pikes and rod ornaments) in small quantities which were likely used, at least in part, for elite trade with nearby external groups. These items are not seen in the public areas within the core. This does not suggest that such items were

rare or absent in the core. Rather, the lack of evidence for production or use of these items in the primary workshop or the larger components of the ceremonial center at Los Guachimontones indicates that eccentrics were likely not particularly emphasized for either trade or corporate ritual. As network acquired prestige items, they may only appear in smaller kin-oriented production contexts and shaft tombs within the core, where the networked wealth trade institutions could (quite literally) maintain a low profile in an area which emphasizes corporate ties over networked ones. Again, the data likely reflect a difference in relative degree of utilization, rather than a categorical difference.

Stone tools specific to the processing of staples are quite few in number for a comparison of relative percentages of entire datasets, and these are invariably ground stone items, which may arguably fall into a different category from knapped tools. The La Venta corridor does marginally contain the highest relative proportion of these items, which is likely due to a frequent occurrence in household assemblages. Three of the ten items (a mano and two metates), however, were found in a La Venta burial chamber (Beekman 1996a:317). The ceremonial center contained five pieces that Esparza termed "mashers" (2003:Table 3), which may have been pestles or items of a similar function. The items was therefore tentatively placed in the staple category. Oddly, the Feature 83 workshop contained the highest number of staple-specific items (N=11), namely the seven manos and four metate fragments in the living area noted above. However, other retouched tools were given somewhat more generic functional categories such as choppers and knives, which have a number of applications but are also common for staple processing. These utilities appear in a higher concentration in the ceremonial center than in La Venta. Soto mentions the presence of retouched tools in one group at

the workshop (1990:241), but her synopsis of the investigation does not include specific numbers for them.

None of the retouched products were very frequent in any context compared to flakes, blades and debitage. However, the percentage of projectile points in the La Venta corridor, at only 1.5 percent, was still five times that of the ceremonial center at 0.3 percent. Some increase in points may be expected for defense in a semi-peripheral zone which pursues an exclusionary economic strategy, or which functions as a border monitoring area. Points may also find increased utilization for hunting game (Beekman 1996a:52) to supplement staple crops in agriculturally poor semi-peripheral zones. The difference between the point percentages at La Venta and the ceremonial center, however, is minimal at 0.2 percent. Teuchitlán material and eccentrics which include some similar forms appear in at least one known peripheral area known for its trade economy, along with eccentric items of other styles which may be locally produced, or from other trade partners.

Conclusion

Several patterns are shown in the external and internal lithic data comparisons which can be used to inform expectations specified in Chapter V. Two of these are counter-intuitive. First, unlike Teotihuacán, the percentage of bifacial blanks produced at the semi-peripheral zone of La Venta for possible trade opportunities is quite low, and does not surpass those utilized in core. Also, staple processing tools are more frequent in the semi-peripheral zone, which is suspected to be less agrarian than the core. As stated

above, the latter result is likely due at least in part to a mismatch in types of sites. The La Venta survey includes a combination of public and private contexts that includes households, and the Los Guachimontones sites are public contexts, each with a very specific purpose. The lack of bifacial blanks appears to simply reflect a lack of preform exchange in the corridor. Since groups in different semi-peripheral areas within the same culture can engage external groups in different ways, forms of exchange not seen in the La Venta corridor may still occur elsewhere, but the likelihood of the practice is diminished because the corridor does not provide a precedent for it.

The rest of the comparisons support the notion of a semi-peripheral area which is more involved in wealth trade and less involved in staple finance than the core area. These include a decreased proportion of blades and other utilitarian tools commonly used for staple processing, and increased proportions of points and eccentrics.

Even though the peripheral Sayula Basin data do not include comparable statistics, they do provide ample evidence for an active exchange relationship with other groups in the area, as well as evidence of a strong wealth trade economy. Tequila Valleys obsidian has also been traced to the Sayula Basin, and a diverse array of eccentrics including some forms strongly associated with the Teuchitlán culture, have also been found in the area

This review has shown some patterns in the lithic data between the central core area, one semi-peripheral area and one peripheral area, but has also revealed a need for isolated ceremonial center and workshop lithic studies from both semi-peripheral and peripheral areas. We can now compare and address expectations for the ceremonial center within the semi-peripheral site of Llano Grande, and the distant but strongly core-affiliated site of Navajas. The case of Navajas becomes especially interesting in light of a known possible

trade partner in Sayula, and a more balanced combination of trade and staple emphases may be demonstrated at the site, which would show an exceptional case to Blanton et al.'s (1996) and Earle's (1991) expected spatial separation between staple and wealth economies.

CHAPTER V

METHODS

This chapter introduces the lithic assemblages recovered from the guachimontón public architecture at Llano Grande and Navajas. Methods of recovery and data collection are then discussed, followed by methods of comparison.

The Llano Grande and Navajas Datasets

All lithic artifacts under study were previously retrieved from Llano Grande Group 14 and Navajas Circle 5 guachimontones. In the case of Llano Grande, one building very near the guachimontón circle and apparently associated with it was also excavated, but contained only a few pieces.

At both sites, artifact locations were tracked with 2x2 meter excavation units used in conjunction with a numbered lot system. Lots define site features delimited by vertical soil and architectural layers as well as horizontal architectural areas, such as buildings, patios and altars. Some lots also define features which cut through layers and disturbances such as postholes, tree roots and looters' pits. Following the collection of artifacts in each unit and lot, all remaining soil was run through 1/4" mesh screens to capture remaining fragments (Beekman 2001:6, 2007:20).

One major difference between locations which affects the analysis is that only a small proportion of the Llano Grande guachimontón was excavated, namely three buildings adjacent to the circle, the one off-circle building noted above, and a trench across the

diameter of the circle (figure 5.1). At Navajas, six of the eight buildings were excavated, along with the majority of the patio and the central altar (figure 5.2). Therefore, between-site comparisons are restricted to relative proportions and artifact densities.

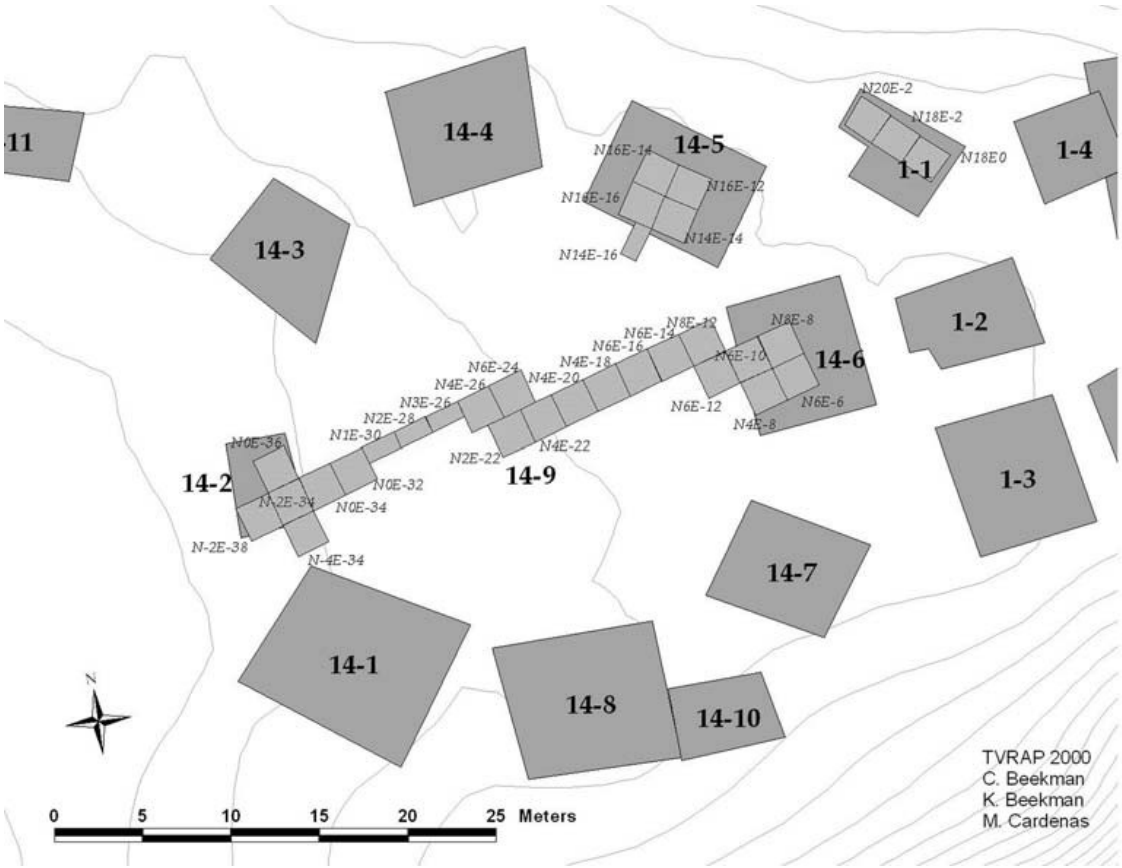

Figure 5.1: Llano Grande plan, with excavation units. From Beekman 2008:figure 4

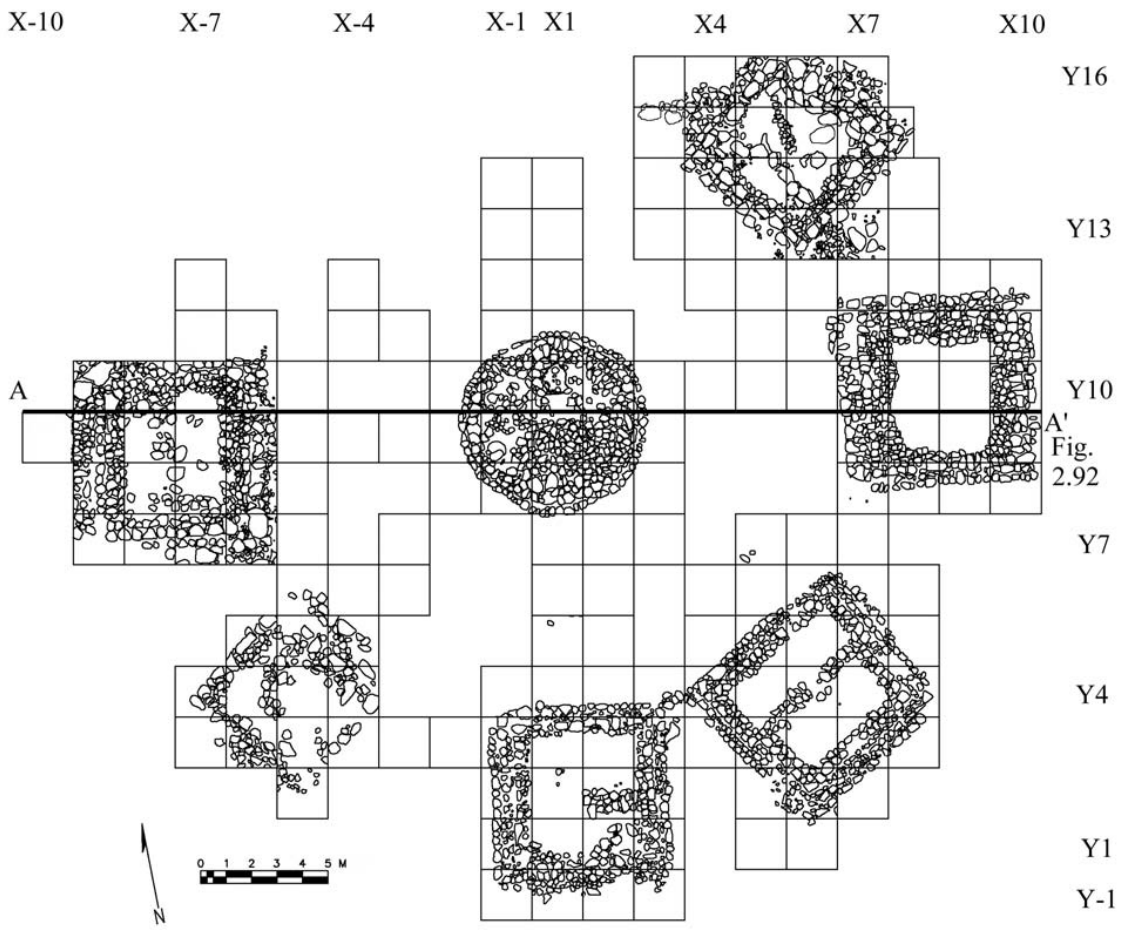

Figure 5.2: Navajas plan, with excavation units. From Beekman 2007:figure 2.91.

One environmental difference between sites which affected the collection of artifacts was the ubiquitous presence of naturally occurring obsidian cobbles, gravel and fragmented spalls at Llano Grande, which presented the same problem as La Venta in the identification of human altered items among the natural ones (Beekman 2001:4). As a result, many natural pieces were retrieved, stored and reported among the artifacts. Since Navajas was 2-3 km removed from its obsidian source, such natural cobble "noise" was not an issue, and recorded artifacts were primarily isolated to one or two layers immediately above the activity floors.

Preliminary analyses were performed by Dr. Christopher Beekman for the lithic artifacts at Llano Grande, and by Bruno Calgaro for the lithics at Navajas. For Llano Grande, context information was recorded by unit and lot, along with typological classifications, weights, visual material properties and cortex presence. These data were recorded and entered into electronic spreadsheets. Many items were grouped by type and entered as individual records, with a count entered for the number of pieces in each record. The general data format was not usable for the current project , but most of the typology was used as a starting point for the data definitions. The Navajas data included more detail on individual pieces and the data definition was quite similar to the one I had extended from the Beekman data, but was handwritten in paper tables and only photocopies were available to the lab, which were largely unreadable. Therefore, artifacts needed to be re-examined and recorded for the current project, from both sites.

Artifacts were stored in a back room at the Tala Museum according to their site contexts by lot and excavation unit identifications. The time window for access to these artifacts was limited and the required time to record the necessary data was uncertain, so debitage artifacts were sampled and transported according to prioritized lots. Priority and thus lot order for analysis was based on likelihood of contemporaneity with the architecture and the degree of protection from post-occupational disturbance. Lots directly above and below the latest activity floors in each excavated building received the highest priority and were therefore the first prioritized for examination, with lots immediately below each activity floor receiving secondary priority. In most cases, activity floors were described in the excavation project documentation as well-defined clay layers atop gravel subfloor, although in some areas the clay was not preserved,

which at times posed challenges to floor and activity lot identification at Llano Grande (Beekman 2001:appendix). Activity areas above previous floor layers were targeted next, and finally central patio artifacts were examined. All debitage pieces within each targeted lot and unit were examined. Due to laboratory space and transportation limitations between storage and our hotel room lab areas, artifacts were transported and examined for one site at a time. Navajas was examined first, and all of the priority areas were covered for that site. However, the higher volume within the Llano Grande guachimontón did not allow time for examination of debitage within its central patio.

Due to the very small sample of obsidian products (including decorative and ritual items as well as tools) at both centers relative to the amount of debitage, product analysis received secondary priority. All products were examined, but only for a very limited number of attributes.

Observations and measurements for each item were recorded in Microsoft Excel© spreadsheets according to lot and unit location data, and all items within each unit and lot combination were given unique sequential IDs. The spreadsheet data was also imported into IBM's SPSS© statistics program for statistical comparisons between sites.

Attributes

Debitage

For debitage, recorded physical attributes pertinent to the current project are morphological type, cortex coverage, length, width, and flake scar count. Physical attributes were recorded as follows:

- Morphological type

General shape characteristics were used to determine a basic category for each piece. The type characterization was then used to determine which of the following attributes applied to the piece. Defined types relied on previous work in the area and leaned towards an expectation of a dominant percussion blade industry for the region (Calgaro 2003; Darras 2012; Soto 1990; Spence et al. 2002). Types are grouped into two broad categories: General types, which may be either part of a casual flake or biface industry, or byproducts of any more formal industry; and polyhedral industry types that are specific to percussion blades and polyhedral macro-cores, following Clark's observed reduction sequence (1988, 1997).

Basic categories such as "debitage" and "tools" were pre-defined for the purpose of organization and storage of artifacts by these categories, so they were kept as-is. Debitage categories generally follow Spence's scheme, where flakes, blades and any expediently retouched items which do not form recognizable formal tools were included as debitage (2002:63). Retouch is recorded as a separate attribute for these items.

Debitage and expedient tool types are defined as follows:

casual core: A core with unpatterned, multidirectional flake scars.

Chunk: Follows Beekman's (1996:754) definition of the term (not to be confused with Clark's definition [1988:16, 1997:125], which defines a "chunk" as synonymous with this project's definition of shatter). A chunk is an angular piece of workable

material without any specific indications of human alteration, even though it may be within a debitage context. It may well have been a byproduct of stone manufacture, but no reliable evidence is present.

Shatter: A piece defined as shatter may resemble a chunk, but contains at least one distinctive indicator of knapping, such as one or more positive and/or negative bulbs of percussion, or concentric rippling. However, the piece also bears an ambiguous form that cannot be oriented in such a way that it defines a core, flake or blade.

Macroflake: Macroflakes are generally created early in the reduction process, primarily to reduce the size of the core while working towards a general core shape. They usually hold at least some cortex, and are relatively thick, irregular, and often much larger than later stage flakes. Macroflakes are invariably hard hammer pieces with prominent bulbs of percussion.

Shaping/finishing flake: Shaping and finishing flakes are relatively flat, uniform and thin (Spence et al. 2002:63,64), with little to no cortex, and are usually moderate to small in size (Clark 1988:17), with a major axis typically under 4 cm.

Types specific macro/polyhedral blade production are defined as follows:

Macrocore: An early stage polyhedral blade core, as defined by Clark and Bryant (1997:fig. 3), that contains primarily vertical but irregular dorsal scars.

blade-core fragment: A fractured macrocore or blade core.

Macroblade: A large, irregular blade generally wider than 2.5 cm (Clark 1997:113).

1st series blade: A uniformly shaped blade generally smaller than 2.5 cm, but with irregular flake scars.

2nd series blade: A uniformly shaped blade much like a 1st series blade, but with only one or two vertical dorsal arrises extending from the proximal end towards the center, and irregular flake scars from the same point near the center to the distal end.

Platform correction flake: A round, polyhedral or semi- round/polyhedral flake with an

inclined edge thickness that creates a wedge-shaped profile. Created from a horizontal removal of the striking platform for the purpose of leveling the platform.

Core correction flake: A flake with a series of straight and parallel dorsal scars, either horizontal or vertical, resulting from removal of an error on a polyhedral core .

Natural object : A stone object of either rare or visually striking material, or with a simple geometry that suggests a human crafted product, but shows no reliable signs of manufacture such as a bulb of percussion or impact rippling. The object may even be nearly or completely covered with a finely textured cortex. Its presence within a ritual space is suspected to be intentional.

As stated in the type descriptions, the distinction between *reduction* and *shaping/finishing* flakes is according to size, morphology and/or the presence and amount of cortex (figures 5.3 through 5.5). The size distinctions parallel Clark's typological distinctions between *macroflakes* and *flakes* (Clark 1988; see also figures 4.1 and 4.2 of this thesis). In the current typology, the "shaping/finishing" prefix is added to the smaller flake category in this project, in order to avoid confusion with the more common use of “flake” as a general term covering all measurably large pieces intentionally removed

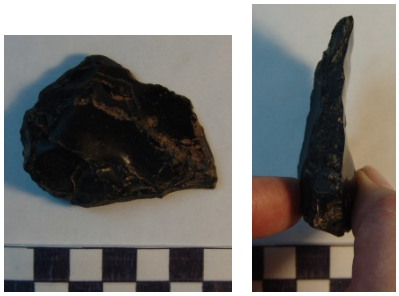

Figure 5.3: Reduction flake

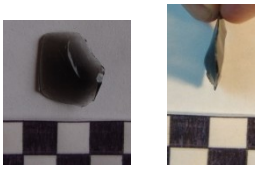

Figure 5.4: Small shaping/finishing flake

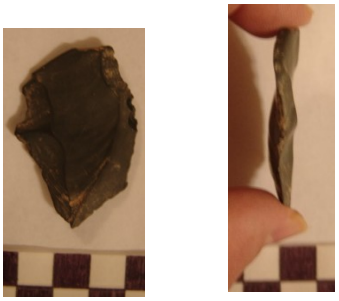

Figure 5.5: Large shaping/finishing flake

from a lithic core. The use of morphological characteristics as added criteria for identification borrows from Spence et al.'s blade typology, which distinguishes between rough and irregularly shaped *flake blades,* and uniform *fine blades* with parallel edges (Spence et al. 2002:63-64). Spence et al. note that their fine blades closely match Clark's 2nd and 3rd series blades. However, shape uniformity is used in a somewhat different context within this thesis, to distinguish the two defined flake types as well as earlier blade sequence distinctions between macroblades and 1st series blades.

Clark's typological distinctions are based on experimental observations. However, as Clark himself has stated, his method of identifying flakes of various types is essentially subjective (Clark 1988, Clark and Bryant 1997). A width division of 2.5 cm has been suggested as a more concrete means of distinguishing between blade types (Clark and Bryant 1997:113), but the figure is based on past experience in certain areas, and subject to localized variations. Beekman based much of his own West Mexican lithic typology on Clark's work, but chose not to utilize the macroflake category in his typology because flake size is also largely dependent on the size of the original core as well as the stage or degree of reduction (1996a:755-756). Spence, et al.'s definitions also move away from Clark's size dependence to some degree by including morphological characteristics which can be associated with each type (specifically, relatively parallel lateral edges and a more regular overall shape without angular protrusions associated with shaping flakes). However, Spence does not indicate any measure of the degree of uniformity required to distinguish between types. The use of subjective morphological characteristics has been criticized in the past by lithicists, as they have lead to assumed designated tool functions based solely on perceived morphology that may be incorrect (Hirth and Andrews 2002:1;

Whittaker 1994:27), and are prone to inconsistent interpretations and labeling between analysts (Whittaker et al. 1998).

The macroflake/flake distinction does, however, represent a distinctive step in a known formalized production process, based on ethnohistoric data (Clark 1982). The problem is in verifying the correct identification of each step's products in the field. Therefore, a measurable and objective statistical test for distinctiveness between items labeled as reduction and shaping flakes is provided for the Teuchitlán data from both Llano Grande and Navajas, in the form of Kolmogorov-Smirnov tests. In the current context, the Kolmogorov-Smirnov tests indicate whether the two groups represent genuine differences in frequency distributions by size. The results of the tests consistently show that the size distribution curves are significantly different at the $p<.05$ level.

Since any one or more size measures may show a significant distribution difference between the two types, three size attributes were evaluated: length, width and the product of length and width (labeled "lxw"), where lxw is considered a rough approximation of the ventral surface area. As shown in Tables 5.1 and 5.2, significantly different size distributions were found for all tested size variables ($p<.001$ for all dimension variables at both sites, except for length in the Llano Grande data, where $p=.001$). Note that there are no positive *extreme differences* (a Kolmogorov-Smirnov term for maximum points of difference between data relationship curves) for any size category, although each size parameter shows a negative extreme difference. Clark's reduction flake type was used as the initial or "control" group for all cases, so the lack of positive differences simply shows that those items labeled as reduction flakes are consistently larger in each

dimension. Since Clark's primary criterion for separating these types is size, these results support his observations.

Sample sizes in these tables are different for length, width, and lxw because dimensions truncated by breaks were not recorded. This was done to insure that recorded samples reflect original knapped dimensions, rather than post-production fragmentation from trampling and post-occupational formation processes.

Table 5.1: Llano Grande size frequency distribution comparison for different flake types [a]

		length (n=280)	width (n=297)	lxw (n=231)
Extreme Differences	Positive	.000	.000	.000
	Negative	-.243	-.358	-.336
Asymp. Sig. (2-tailed)		.001	.000	.000

a. Grouping Variable is Type ("reduction" and "shaping" types only)

Table 5.2: Navajas size frequency distribution comparison for different flake types [a]

		length (n=146)	width (n=132)	lxw (n=123)
Extreme Differences	Positive	.000	.000	.000
	Negative	-.485	-.504	-.582
Asymp. Sig. (2-tailed)		.000	.000	.000

a. Grouping Variable is Type ("reduction" and "shaping" types only)

- Cortex coverage

Rather than utilize a typical binary "presence/absence" criteria for cortex, following Mauldin and Amick (1989:68,70,Table 1), cortex coverage quartiles were recorded to

expediently obtain a finer distinction between cobbles and cortical flakes that had very few flakes struck from them, and those which may have been worked to a point just short of a finishing phase with a very small amount of cortex. The cortex coding scheme is defined as follows: 0 = no cortex present, 1=1-25 percent cortex coverage, 2=26-50 percent coverage, 3=51-75 percent, 4=76-99 percent, and 5=full coverage (a natural cobble). For the needs of the current project, this scale is coarse enough to allow an accurate visual estimate, and fine enough to avoid the aforementioned overgeneralizations. Also in keeping with the Mauldin and Amick method, on flakes and blades, the ventral surface is not counted as part of the total area for the estimate, since by definition it cannot hold cortex (1989:68).

- Metrics

Due to a high degree of fragmentation at both sites, only complete edges were measured for length and width. Length and width measurements were done with standard lab calipers to a 1 mm resolution.

Following Odell (1989:168), length was measured as the maximum distance from the platform to the distal edge, perpendicular to the striking platform. As Odell also notes, and especially with a preponderance of irregular flakes that are often struck at a lateral angle that is not perpendicular to the platform, this is not always the major axis, or the maximum length when following the direction of the strike. This method was chosen for its repeatability in the field with irregular flake morphologies, and to allow for comparability with other datasets.

Width is defined as the maximum distance between lateral edges, as measured perpendicular to the length measurement (and thus parallel with the striking platform). Due to the same flake irregularity problem described for length, the width measurement defined here is not necessarily the geometric minor axis of the piece.

Products

The term "product" is preferred here over "tool" in contexts which may include items that are ornamental or ritual in nature. Products are divided by type as points, blades, bifaces, scrapers, and miscellaneous tools and eccentrics. The latter category includes apparent ritual and jewelry items, as well as apparent specialized tools that do not fit any common lithic categorization.

Three basic attributes are used in the same manner with all product categories as they are with debitage. These attributes are length, width and cortex. Descriptive names are used in place of type codes because product forms are very diverse, yet sample sizes are quite small, and therefore groupings of common formal attributes beyond the most basic types could not be determined. Descriptions included form attributes commonly referenced in lithic studies, such as stem, notch and blade forms, so that examples from similar sites in the region can later be incorporated to determine groupings of common morphological attributes that can define a useful typology. Other tool/product attributes were recorded beyond basic categorization and description, however that level of detail is not required for the current project.

General Approach for Analysis

Analysis proceeded in three phases: First, percentages of generalized formal types from both sites were compared to those from the previously discussed datasets between the site of Los Guachimontones and the La Venta corridor to determine whether similarities and differences in the lithic industries follow the general material culture patterns seen in core and peripheral areas, as described in Chapter III. The analysis then moves to comparisons between the sites of Llano Grande and Navajas. Since Navajas contains the only excavated guachimontón circle of a comparable size to Llano Grande, and both sites have comparable recorded lithic attributes, additional comparisons are made between the two sites.

Second, each site's debitage collection was then tested for primary or secondary archaeological context and the collection's degree of completeness. The criteria for completeness is based on the shapes of size distribution curves as outlined below in the *Nature of the Deposits* section.

Third, once the collections were deemed adequately complete for the subsequent tests, direct comparisons of percentages of assemblage properties that suggest either a trade industry, or internal use for staple processing, were made. Most of the focus of these comparisons is placed on the difference in emphasis on trade rather than attempting to find direct evidence of agriculture practices via lithics. Typical markers of agriculture found in the old world, such as sickle sheen on stone blades from wheat harvest, do not appear or suggest any analogs in Mesoamerican contexts. Also, most Mesoamerican cultivation tools, if similar to manual tools used in the area historically, were likely made

primarily from wood and were therefore perishable (Stuart 2003:1). Differences in tools utilized for domestic processing of food items may well increase in number and/or in size for feast related activity over regular household production (Adams 1999), although there are still only a few stone tools, such as *manos* and *metates,* that tend to be exclusive to food processing tasks in the area.

A distinction must also be made between prestige items useful for trade, and common tools that may be intended for either trade or local utilization. As described in Chapter IV, obsidian within Mesoamerican sites is invariably found to be more concentrated in elite household and ritual contexts, but is also found among commoner households, and is often in the form of common tools in residences of all classes. Johnson therefore suggests that unfinished obsidian and utility items held a status midway between staple and prestige goods (1996:171). However, since the importation and initial distribution of obsidian was under direct elite control and prioritized for the local production of prestige goods (Johnson 1996; Spence 1981), evidence of obsidian export from Teuchitlán sites in the form of prepared cores, utility products, bifacial blanks and debitage resulting from these forms also are considered evidence of a wealth trade economy.

Criteria for Comparing Staple and Wealth Lithic Economies

The Nature of the Deposits

As a first step towards the economic analysis and interpretation of the site, the nature of how debitage came to be deposited within the ritual centers must be addressed. Understanding the nature of the debitage can resolve how completely the debitage/flakes

represent a complete manufacturing assemblage, and whether it is reasonable to pursue certain forms of analysis that require the full complement of debitage from the production process for accurate results.

The usefulness of "waste" flakes as expedient tools tends to work strongly against any tendency towards frequent offsite dumping, even within enclosed areas (Whittaker and Kaldahl 2001), and the common use of expedient and/or byproduct flakes within Mesoamerica is well documented. As discussed in Chapter IV, expedient flakes and blades often considered as only cast-offs from formal tool production can also be viewed as products which follow a different branch in the *chaîne opératoire* (Julien and Julien 1994:15; Lemonnier 1986; Sellet 1993), which stems from more formal tool production (Bleed 2001:figure 4; Sheets 1975). Therefore, it is not surprising that flakes are found stashed within public architecture, although the consistent presence of common flakes within guachimontón ritual architecture is somewhat curious.

Logistically, at least three possibilities exist: 1.) Lithic artifact production took place directly within the guachimontón circles, 2.) production took place somewhere nearby, but the remaining flakes were gathered and moved into the ritual centers, or 3.) specific flakes were selected from the original location and brought into the site as tools. These possibilities are, of course, not mutually exclusive. If the first or second possibility is true, more detailed statistical analysis can be done to determine more about what was produced, although the second scenario invalidates any analysis that specifically targets the smallest flakes for comparison. If only the third scenario is true, all further analysis must proceed by treating most flakes as individual expedient tools rather than debitage.

The three scenarios show differences in frequency distributions of various flake size range categories. Complete primary deposits contain exponentially greater counts as size range categories decrease in value, and form a reverse J-curve trajectory when size and count are graphed. When lithics are swept and moved together, perhaps from a workshop to a midden or a secondary cache for expedient flakes, the J-curve should still hold true for all but the smallest items, which are usually left behind from the cleanup operation and thus the resulting curve peak is truncated for those smaller pieces (Root 2004). One recommendation states that the ratio of flake lengths ranging from 1/8" to 1/4" to those ranging from 1/4" to 1/2" should be greater than 1.48:1 in order to consider the assemblage a primary deposit (Behm 1983:14, as found in Baumler and Davis 2004). A more recent recommendation is that flakes smaller than 5.66 mm in length should outnumber those greater in size by a ratio of 4:1 (Root 2004:86,87).

The third possibility of "picking and choosing" only those pieces desired as tools and transferring them to the guachimontón will likely show an entirely different distribution trajectory. Such an operation would involve transporting flakes a few at a time, at most, to the guachimontón and selected flakes would comprise a narrow range of sizes and shapes that fit most usefully and comfortably in the hand (or perhaps with a makeshift haft such as wrapped maguey fibers) as tools, and also provide a useful blade length, position and shape for the task at hand. Such an assemblage would likely not show the expected J-curve pattern, and might better resemble a bell curve pattern which peaks towards the larger end of the size scale, around the most frequently useful tool sizes.

The most likely of the three possibilities was thus determined through size category distribution plots. One centimeter incremental ranges were defined and unfragmented

piece lengths were tallied within each range. Size ranges were then plotted against counts for each range to determine a distribution pattern, and also determine a "best fit" from each of the three scenarios, while watching for potential crossing of patterns or "hybrid" plots to reveal any multi-modal transport considerations.

The implications of the overall volume of lithics at each site are then discussed, given unequal amounts of excavation and estimated projections based on artifact densities of data excavated thus far, before moving on to more specific tests based mainly on percentages and ratios of artifact types discussed below.

Expectations and Tests for Economic Distinctions

A greater economic reliance on obsidian trade at Llano Grande than at Navajas would result in one or more of the following eight differences in the lithic data. Each expectation corresponds to a specific test, with different implications in support or rejection of its null hypothesis. The total combination of all outcomes, however, involves an exponential increase in possible scenarios regarding the nature of lithic trade at both sites. Therefore, implications of each test are limited in scope to the test in isolation here, and only the actual results are synthesized. Tests 1 and 2 determine the relative degree of specialized obsidian producer or consumer roles for each site. Tests 3 and 4 pertain to relative emphases on prepared obsidian cores, tests 5 and 6 pertain to utilitarian items, and tests 7 and 8 pertain to relative emphases on trade oriented products. Navajas is considered the core control site, therefore each of the following tests describe outcomes specifically for Llano Grande, and relative to Navajas.

1. **A lower number of products relative to the amount of debitage:** If Llano Grande is more involved in production for export than Navajas, then a much lower proportion of artifacts at Llano Grande should be in the form of formal products, relative to the amount of debitage (Magne 1989:20; Morrow 1996:357-358; Spence 1987:431). Heavy specialization in export should result in a large amount of "ghost" debitage that has no corresponding tools present at the site. Conversely, a lithic import site should have more "orphan" tools that have no corresponding debitage present (Morrow 1996:357-358).

   Test Procedure: Product counts were tallied and compared to the total number of examined artifacts (products and debitage) at each site. Retouched byproduct flakes and blades, in this case, were also counted as debitage. Since items categorized as chunks are indistinguishable from natural stone fragments that are abundant at Llano Grande (Beekman 2001:4,12), they were not included in the total artifact counts for either site. Results are presented as product to total artifact count ratios, and as product percentages of the total number of artifacts. The null hypothesis is supported by an equivalent or higher percentage of products to debitage at Llano Grande. Support for the null hypothesis of this test could result from manufacture of lithic items for both internal use and trade at a location away from the circles, underutilization of Llano Grande's lithic source, and/or thriving lithic production within or near Navajas' circles

2. **A higher ratio of obsidian flakes and debitage to ceramic sherds:** If Llano Grande site did specialize in lithic production, evidence of other activity is expected to diminish, which tends to be best represented by ceramic waste (Johnson 1996:170-172; Spence 1987:430). In the context of a guachimontón, ceramic vessels and bowls are especially indicative of staple ritual activity (feasting) (Johns 2014; Tyndall and Beekman 2007:174).

   Test Procedure: Ceramic sherd totals for Llano Grande were taken from Tyndall and Beekman (2007:154,155), and totals for Navajas were taken from Johns (2014:83). The ratio of lithic debitage pieces to ceramic sherd totals was then calculated for each site, compared, and presented as both ratios and equivalent indices found by dividing lithic totals by ceramic totals. Support of the null hypothesis is indicated by an equivalent or lower debitage to sherd index at Llano Grande, in which case Llano Grande may have continued the core-based staple rituals, possibly in conjunction with increased trade.

3. **A lower percentage of prepared cores:** If Llano Grande functioned as a quarry site for trade, it would most likely have continued the Mesoamerican Late Formative and Early Classic pattern of emphasis on export of prepared polyhedral macrocores. Most distributed cores, whether internal (Beekman 1996a; Esparza 2003; Soto 1982, 1990; Spence et al. 2002) or external (De León 2003; Johnson 1996; Parry 1987; Spence 1981; among others) to the area inhabited by the Teuchitlán culture, were decorticated to a large extent. Therefore, exported Teuchitlán cores from sites near

sources were uniformly prepared near the source in some way. Llano Grande is an obvious candidate for showing evidence of source preparation, but Navajas may also have served in the same capacity, to a large extent, with easy access to a nearby mine. Therefore, both sites may have engaged in wealth finance to different degrees.

Morrow's concept of "ghost" debitage may also be applied to cores. The presence of a relatively small number of polyhedral macrocores or cores lacking cortex relative to the amount of debitage indicates a preparation site for a core export economy. A large percentage of prepared cores would be more indicative of local utilization of lithic resources. There is little precedent for the distribution of unprepared cores within Mesoamerica in the periods under study, and are more likely used for expedient internal tools. The majority of recognizable cores will be at least partially worked (as indicated by negative bulbs of percussion and impact rippling), although completely unworked obsidian pieces of adequate size to form products may also be interpreted as unprepared cores, if found in isolated contexts.

Test Procedure: Relative proportions of cores were compared and presented as a percentage of total artifact counts within each site. Both the total amount of cores and categories of prepared and partially decorticated casual cores were compared. Unworked obsidian was not considered, since it is ubiquitous at Llano Grande and therefore any intent for use could not be confidently determined.

Support of the null hypothesis in this case is indicated by an equal or higher proportion of prepared cores at Llano Grande, which would indicate preparation primarily for internal use. A presence of casual cores with partial cortex does not

affect indications of trade, but does affect the interpretation of cortical flakes, as described below.

4. **An increase in the amount of cortex on flakes**: This expectation is the complementary evidence for prepared core export. Lithic manufacture removes the vast majority of cortex very early in the reduction process (Clarkson 2008:288; Magne 1989:17; Mauldin and Amick 1989:70-71). Debitage from core preparation would primarily involve cortex removal, and should result in higher proportions of flakes with high percentages of cortex coverage, than debitage from later stages of production.

   Test Procedure: Since cortex percentages were recorded as quartile codes, a measure of association for ordinal data was chosen for this test. Cortex proportion frequency distributions of flakes and blades were compared through a Pearson Chi-Square test. Upon discovery of a significant association at the $p < .05$ level, Kendall's tau- c was used to determine the strength and direction of the association. Additionally, the mean difference in cortex coverage between sites was determined for all items with partial cortex (i.e., excluding those coded as "no cortex" and "full cortex") to show the overall difference between sites.

   The null hypothesis is supported if either a lack of significant association, or a significant positive association, is found between sites and amounts of cortex. The null hypothesis is also supported if an equal or lesser mean percentage of cortex coverage per piece is found for Llano Grande. Conversely, the null hypothesis is

rejected if a significant negative association is discovered between sites and amounts of cortex, and a greater mean percentage of cortex per piece is discovered at Llano Grande. Failure to reject the null hypothesis here would indicate that unaltered cores were prepared within or near the Navajas guachimontón at least as frequently as Llano Grande.

Bar charts of the cortex distributions are then compared to help determine any differences in the nature of production between the two sites. The differences in "full cortex" and "no cortex" codes are also compared to more clearly show the magnitude of differences in decortication between sites.

5. **A lower percentage of specialized tools for staple processing** (e.g. *manos, metates*, *molcajetes*[2]*,* mortars and pestles). Following the logic behind previous ceramic studies in Navajas (Johns 2014; Tyndall and Beekman 2007), the consistent inclusion of staple tools in ritual contexts such as guachimontones links staple processing to public ritual activity, and therefore provides an additional form of evidence for feasting rituals related to a staple economy. A lower percentage of staple tools may therefore indicate reduced emphasis on staple related ritual in a consumer context.

Test Procedure: Percentages of staple processing forms relative to the total number of recovered products at each site were compared and presented. The null hypothesis is supported by an equal or greater percentage of specialized staple tools at Llano

[2] a *molcajete* is a tripod supported grater bowl used for grinding spices.

Grande, which would indicate that staple related rituals were likely continued and emphasized to an equal or greater degree than at Navajas.

6. **A lower percentage of debitage associated with to polyhedral blades and blade-based products:** Even early-stage polyhedral macroblades are produced by a very distinctive, methodical and formal process that creates very identifiable morphologies in several flake forms (Clark and Bryant 1987; Hirth and Andrews 2002:2-3). Yet, as Johnson observed, blade production is "an apparent enigma, the specialized production of a generalized tool" (1996:167). Fine polyhedral blades and macroblades are forms of very flexible utility by nature. Site contexts and use wear evidence have shown that blades were used for a wide variety of common tasks, such as shaving and food preparation, and mainly within domestic areas of Mesoamerican core population centers (Johnson 1996:166, Spence 1981:780).

   Blades and blade byproducts are therefore likely common at both Llano Grande and Navajas for internal utilization. For trade purposes, much more refined core blade manufacture was commonly known and practiced through all other areas of Mesoamerica, so there would not have been any demand for West Mexican macroblade production. Also, if the above expectations regarding the trade of cores for later production by the consumer holds true, material for blades was probably not traded in its final form, but rather as prepared macrocores.

Test Procedure: Debitage pieces which are primarily associated with the polyhedral blade industry (blade-core fragments, core flakes, macroblades, 1st and 2nd series

blades, platform correction flakes and core correction flakes) were tallied, and type counts were aggregated to determine percentages of blade-specific items relative to the total count of debitage pieces at each site.

The null hypothesis is supported by an equal or greater percentage of blade-based types at Llano Grande, indicating greater emphasis on a polyhedral blade industry than Navajas. An increased polyhedral industry at Llano Grande may mean production of blades for internal use as utilitarian or staple processing items, and also possibly a return to (or continuation of) the Middle Formative practice of direct trade of blades and blade products.

7. **A higher percentage of bifaces**: Despite a lack of evidence for the production of bifacial blanks in the La Venta Corridor described in Chapter IV, remote areas may differ in their exact function, depending on internal cultural and environmental differences between them, and the political and economic differences between the peripheral groups with which each semi-peripheral group interacts (Stein 1996:36, 2014:57-58). Therefore, given the popularity of bifaces as a regional export items for Teotihuacán, Llano Grande and/or Navajas may still have produced them for trade. Blanks would be particularly advantageous to traders in the hills around the Tequila Valleys, since they are more robust for transport compared to finished products (Spence 1981:771), much lighter than prepared cores, and require less production labor than cores at the destination.

   Theoretically, the relative percentage of bifaces and other specific types could be derived from debitage attribute statistics in much the same manner as the procedure

followed here for the blade industry, but debitage from bifacial blanks is much more difficult to distinguish from expedient flake production or early stage production from other industries. This is especially true when multiple technologies are known or suspected to be present within a single assemblage, which is most often the case in the field (Ahler 1989:206; Carr and Bradbury 2001; Tomka 1989:137). Carr and Bradbury (2001) and Ahler (1989) have developed debitage attribute based formulas from their own experimental data to address the mixed technology type identification issue. However, like most experimental debitage studies, reliable use of these formulas across different datasets or in the field is still untested. Therefore, only counts of identifiable products which remain from the production process can be used as indicators of the emphasis on each type produced at both sites.

Using the Feature 83 workshop as a general pattern for production deposit expectations (Soto 1990), it also appears that even the largest Teuchitlán workshop did not stockpile products for later distribution on-site, which left only broken and unfinished products. Therefore, incomplete and flawed items may be the only clues to indicate each site's relative degree of biface production .

Test Procedure: Unrefined and failed bifaces were tallied for each site, and percentages relative to the total number of tools at each site were compared. Support of the null hypothesis is determined by a lower relative percentage of bifaces at Llano Grande than at Navajas, which would indicate that bifacial blanks were less utilized as a form for trade than at Navajas.

8. **An increase in emphasis on production related to esoteric items (eccentrics) unique to the Teuchitlán culture (i.e. laminar jewelry, pikes and rods)**:

Trade in items considered unique and rare to remote locations is an exception to the usual core trade pattern. Such items are especially useful to outsiders as status markers and also easier for external elites to control when the method of manufacture is not widely known or easily duplicated (Beekman 2000:386; Earle 1991:7). External refined pike distribution is unknown, but rough pikes have been located in the Sayula Basin, and laminar items are found throughout West Mexico (Reveles 2005:352). Production debitage for laminar jewelry has previously only been found at one site within the La Venta corridor (Beekman 1996a:816,846) and possibly at the San Juan de los Arcos quarry south of the core population zone (Clark and Weigand 2009). It is considered a probable prestige item (Beekman 1996a:816,846), and also appears to be the result of one or more unusual and spatially limited techniques (Clark and Weigand 2009; Long 1966).

Since the discovery of laminar items has been limited to West Mexico, and thus far the evidence for the production of these items has been further limited to the Tequila Valleys, laminar production and use is less understood than other items previously discussed. Because of this lack of understanding, and because these items are also especially pertinent to questions of wealth and staple finance, the bulk of effort in the analysis is spent on identifying markers of manufacture for laminar technology.

Refined pikes fall into the same category. However, much of refined pike production would be revealed in the retouch pattern, and flakes of the required size are missing from the field data.

One basic method of determining relative degrees of laminar production is the presence of final stage laminar debitage itself, which may be identified as flakes and blades with only one dorsal scar, and with very low (0-25%) cortex. (Thickness would be a better identifier, but unfortunately thickness data were not recorded.) These items can be differentiated from late and final stage biface debitage since even small biface flakes usually have multiple dorsal flake scars. Most or all of the larger laminar pieces were likely utilized, but fragments and pieces of unwanted size or shape would have been left behind, which may be numerous in the case of a specialty workshop for such items as discovered by Beekman in the La Venta corridor (1996a:790, 795-799). However, such items may be sparse in secondary contexts where laminar production was done in much lower volumes. Due to their fragile nature, many remaining pieces may be quite small due to fragmentation, and may not have been transferred to their final locations.

Although multiple methods have been proposed for the production of laminar blanks and more than one method may well have been practiced throughout the valleys, the main distinction between laminar jewelry and most other product types is that the jewelry has no dorsal flake scars, so reduction must work towards that end. The usual expectation is that the number of dorsal scars per flake, and therefore also the density of scars, *increases* as reduction progresses (Andrefsky 2005:106; Magne 2001; Phillips 2011:71-72; Shott 1994:80). Logically, flakes must also progressively

decrease in size through the reduction process. Magne has concluded that dorsal scar counts, along with counts of platform scars, statistically appear to be the best predictors of the degree of reduction (2001:23). However, the scar-eliminating goal of laminar jewelry is at odds with this process. Even in mixed typological and technological contexts the presence of laminar obsidian manufacture should at least weaken the negative correspondence between size and flake or blade scar density. In some cases with relatively high percentage of laminar jewelry, a scar density/size correlation might become insignificant or even change to a positive correlation.

Just one other, far better known technology in the area may create a positive scar density to size correlation, namely the polyhedral core-blade technique. However, core-blade debitage also leaves more recognizable morphological patterns (e.g. failed blades, core correction and facial correction flakes) in the debitage to reveal its presence.

Using either Long's or Clark's proposed methods (aside from Clark's observed bulb of percussion removal method), isolated laminar production may only leave behind some core preparation, failed laminar flakes, and partial "scrap" flakes from forming specific shapes. Failures from both techniques may be indistinguishable from thin platform preparation flakes, in that they can be uneven in thickness, even but thicker than desired, a wedge shape formed by failure to pass completely through the core, or fractured upon removal. Long's "sausage" technique also would show forms of debitage diagnostic of core-blade production activity and possibly one or more cylindrical cores of variable lengths. In either case, if laminar production was an exclusive or overwhelmingly dominant form of production, the presence of small

fragmented and whole thin flakes along with broken retouched pieces should be readily apparent, as discovered by Beekman in the La Venta corridor (1996a:795). But for the large majority of lithic collections, the likelihood of mixed production technologies within the same assemblage is quite high (Carr and Bradbury 2004; Larson 2004; Root 2004; Tomka 1989), and despite some earlier experimental progress with multivariable regression and discriminant analysis techniques using a limited number of product forms (Ahler 1989; Bradbury and Carr 2001) there is currently no verified method to determine the proportions of each industry (blade, laminar jewelry, bifacial core, etc.) within a debitage collection. However, the strengths and directions of any correlations between scar counts and flake sizes should directly relate to relative proportions of laminar vs. conventional flake production within each site.

The strength and slope of negative correlations is also affected by other factors, such as the combination of types of other products being made, the material being worked, and the combined techniques of individual knappers (Andrefsky 2005:107). The correlation between size and scar density should not, however, become insignificant or turn to a positive sloping trend with any commonly known product or method.

Test Procedure: The term "flake" is used here in a generic sense to mean any pieces with flake or blade dimensions and characteristics. Both flakes and blades are tested in this procedure since laminar flake dimensions can't be assumed.

Scatter plots were produced of dorsal scar density to size relations as a preliminary visual check, in order to determine sloping trends and possible grouping patterns in the relationship between the two variables. One chart per size variable (length, width and the product of length and width as a rough approximation of area) was created for each site. Since grouping patterns may either be isolated to one flake type or occur across the entire dataset, shaping/finishing flakes and reduction flakes are included as separate groups within each chart. The same scar density and size parameter relationships were then checked for statistically significant correlations by running Pearson's r tests for each size variable against dorsal scar density figures at both Navajas and Llano Grande. Pearson's r figures were also calculated for the experimental data to verify a significantly negative correlation in conventional products. Evidence for laminar production at either site is manifested in a lack of significant correlation between size and scar density, or a reversal to a positive correlation. If both sites were strongly engaged in laminar production then a relatively greater emphasis on laminar production at one site will produce a statistically stronger positive correlation at that site. Conversely, the null hypothesis is supported by a statistically significant negative size to scar density correlation for all size parameters at both sites, more strongly positive correlations at Navajas, or a lack of a statistically significant correlation at Navajas if Llano Grande shows any result other than a significant positive correlation. Support of the null hypothesis in this case would indicate ritual items were not shown to be a greater part of the trade system at Llano Grande than at Navajas, and therefore Navajas shows a likely greater emphasis on wealth economy represented by these items and their exchange with the Sayula Basin

sites, and possibly others. The null hypothesis is also supported if results are mixed between different size variables.

Counts of laminar waste flakes are also used as supplementary evidence to assist in determining the relative proportions of laminar debitage. Laminar waste flakes at each site were counted and compared as relative percentages. The null hypothesis is rejected if a higher percentage of laminar items is observed for Llano Grande relative to Navajas.

Import Considerations

One obvious additional criterion was considered, but had to be eliminated due to a lack of data from the excavations at either guachimontón site: the presence of incoming "exotic" elite items from outside areas would show evidence of reciprocity in a trade relation. However, obvious imports were not present in either site, and may never be found because they are often very perishable. Perishable trade goods are often staple items, but many are usually considered wealth items. Examples of perishable wealth goods may include salt, feathers or certain animal hides (Nassaney 1996). Absence of evidence of foreign goods, therefore, is not considered a strong argument against the existence of a wealth trade economy. Some less perishable items, such as foreign minerals or seashells, may later be discovered within other guachimontón satellite buildings at Llano Grande or in other contexts, such as nearby shaft tombs or elite occupational units with additional excavation.

Outcome Analysis

Navajas has thus far shown a greater degree of affiliation to the core through its architectural configuration and staple related artifacts. Therefore, it is expected that Navajas may show a greater relative degree of similarity to the more utilitarian and staple oriented lithic industries discovered in Los Guachimontones' Circle II (Esparza 2003) and the Feature 83 Workshop (Soto de Arechavaleta 1982, 2000), whereas Llano Grande may show relatively greater emphasis on one or more trade economies identified in Chapter IV, namely, eccentric, bifacial blank and/or prepared raw material trade. The null hypothesis, therefore, is supported if no differences in trade or staple economies are seen between the sites, if only Navajas shows greater emphasis on one or more of the three trade economies, or if the results are mixed (i.e., Llano Grande and Navajas both show greater emphasis on different trade economies). Otherwise, if the analysis indicates a higher relative emphasis on obsidian trade only at Llano Grande , or of a wealth economy at Navajas, the null hypothesis will be rejected.

It is tempting to speculate on a particular role or status of each site within the social structure, based on the outcome of these tests. However, given that these tests involve only relative differences between sites, we can currently only determine the state of the economy of each site relative to the other. Llano Grande and Navajas may well both have "primarily" operated under the same economic base; Llano Grande still had fertile land available nearby, and Navajas had a large, high quality source of obsidian in close proximity, as well as possible trading partners in the Sayula Basin. However, there is no criteria established for the amount of staple or wealth production that warrants either

categorical distinction. These data are also currently limited to two specific sites, which happen to be in certain positions within the social structure. Additional sites will need to be included for testing in the future in order to generalize whether the same relative differences may apply more generally to populations within the core and semi-peripheral zones.

Conclusion

Since this is an initial probing study for the data at both sites, aside from a couple of more involved statistical comparisons, most of the above tests involve only descriptive statistics. The descriptive information may, however, actually be the most useful choice for an initial interpretation of the sites under test. Multiple lines of evidence are, of course, always recommended for verification of overall results, which is certainly no less true in lithic studies (Magne 2001:23-24). But when also considered as separate clues about different aspects of the theoretically informed questions, unanticipated details about the nature of the sites beyond the basic statistics can emerge, which provide the best chance for generating additional questions as a basis for moving forward. Therefore, although the obvious goal of Chapter VI is to seek answers to the overarching theoretical questions through these tests, the more important goal in this first detailed look at the data may be to discover better questions.

CHAPTER VI

RESULTS

This chapter provides results of the tests defined in Chapter V along with discussion of the significance of each result. Implications of these results are summarized and synthesized in Chapter VII.

Organization and Review of the Test Criteria

The results discussion begins with an overview and comparison of morphological type proportions in the lithic collections from Navajas and Llano Grande, with those published from other sites reviewed in Chapter IV. The background comparison is intended to provide an indication of relative adherence of each site under test to economic patterns of other core and semi-peripheral sites. The nature of origin (primary or secondary context) and the degree to which each debitage collection from the sites of Llano Grande and Navajas may represent complete production activity, as determined through piece length sample distributions, is then discussed. Following confirmation of adequately complete assemblages for an analysis of production related aspects of the data, all of the following tests are run to determine the relative emphases on the economic bases in question at each site:

1. *The number of formal products relative to the number of informal flakes, blades and debitage*, to determine whether either site represents a consumer or producer context.
2. *The ratio of obsidian flakes, blades and debitage to ceramic sherds*, to indicate the degree of specialization in lithics relative to other activities at each site.
3. *The percentage of prepared cores relative to debitage*, to determine the relative likely degree of prepared core export if accompanied by a larger quantity of debitage, or internal utilization if accompanied by a lesser degree of debitage.
4. *The amount of dorsal and platform cortex on flakes*, as an additional indicator of internal core preparation.
5. *The percentage of specialized lithic tools for staple processing* relative to the total number of samples at each site, to indicate the degree to which each site utilized lithics for feasting rituals.
6. *The percentage of debitage associated with polyhedral blade manufacture and blade-based products* relative to the total number of samples at each site, to indicate the degree of emphasis on utility items most often produced for internal use.
7. *The percentage of bifaces* relative to the total number of samples at each site, to indicate the degree of emphasis on items commonly prepared for trade.
8. *The relative emphasis on production related to eccentrics unique to the Teuchitlán culture.* The only testable item in this case is laminar flake production, which is examined through relative degrees of disruption of the normal flake scar density size distribution pattern.

Lithic Type Proportion Comparison to Background Contexts

The lithic background contexts discussed in Chapter IV are reviewed in Table 6.1 below, and Table 6.2 shows relative percentages of lithic types for sites compared in Chapter IV, along with the same categories from the sites under study. The table includes the data from table 4.5, with the addition of data from the sites of Navajas and Llano Grande.

Table 6.1: Summary of compared background locations.

Site	Descriptions
La Venta Corridor	A semi-peripheral zone east of the core, The collection is from combined area-wide survey and multiple site excavations. Lithics from the entire zone are compared from all periods. Surface lithics appear contemporaneous with Teuchitlán occupation, but surface eccentrics are underrepresented compared to excavated contexts. Staple tools and debitage may be elevated by the excavation of household and midden contexts, respectively.
Los Guachimontones - Ceremonial Center	A surface survey of the entire center, with sample pit data from the two largest circles and the ballcourt between them.
Los Guachimontones - Feature 83 Workshop	A comprehensive excavation of the primary core workshop, which spans 0.6 hectare.

Table 6.2: Inter-site comparison of lithic proportions by percentage relative to total item counts, including sites under study.

Location	Llano Grande (n=962)*	Navajas (n=356)*	La Venta Corridor (n=4,863)	Los Guach. Public Cntr (n=16,580)	Los Guach. Workshop (n=99,863)
Blades	3.8	7.6	6.5	16.6	49.1
Flakes	65.3	61.1	43.5	72.8	33.4
Points	0.3	2.6	1.5	0.3	n/a
Blanks/Preforms	0.3	0.7	0.1	0.3	n/a
Cores	3.9	0.7	0.5	1.0	0.0
Staple tools	0.0	0.2	0.2	0.0	0.0

Other tools	1.4	11.2	1.3	6.9	n/a
Eccentrics	0.1	1.9	0.9	0.0	0.0
Debitage	24.8	13.8	45.2	2.0	17.4
Unknown	0.0	0.0	0.2	0.0	0.0
Total	100	100	100	100	100

*The samples used in this comparison for Llano Grande and Navajas include only the verified artifacts (all types excluding *chunks*) analyzed for this thesis, not excavated sample totals.

Again, the aim of this section is to determine similarities between areas, with Navajas proposed to align with Los Guachimontones as a core affiliated site, and Llano Grande proposed to align with the La Venta Corridor as a semi-peripheral site. However, several of the differences in percentages do not align as expected. Navajas is closer to the semi-peripheral La Venta Corridor in the percentage of polyhedral blades. Los Guachimontones does, expectedly, show a relatively high percentage of blades, and Llano Grande shows even fewer blades than La Venta.

Points are much lower in proportion at Los Guachimontones relative to the La Venta Corridor. An increase in points for military purposes may be expected within a semi-peripheral zone with exposure to external groups. However, the heavily fortified site of Llano Grande contains a site-relative proportion of points as low as Los Guachimontones. If the walls did involve a centrally directed construction effort, then perhaps any anticipated threat from external groups at the time of construction either did not materialize or greatly diminished before the site was abandoned. Points may also be concentrated elsewhere on-site at Llano Grande. In any case, the reason for Llano Grande's low point percentage also requires further investigation. Points do not appear to have been primarily made from source or workshop blanks in any area, since relatively few blanks are reported for any site. However, blanks are most concentrated at Navajas

where the highest percentage of points is also located. Those blanks may, however, only be early stages of production or failures since they are still only a fraction of the number of points found on-site.

The percentage of eccentrics is also higher at Navajas than at any other site, even though they are apparently non-existent at the Los Guachimontones ritual center. Small percentages exist at Llano Grande and the La Venta Corridor. Much like other product types discussed so far, however, a more important factor in determining the relative amount of export of such items is the evidence for manufacture relative to the number of items which are present.

Flakes are the most frequent items and also show differences in percentages between study areas, but knapping produces very large quantities of flakes and the percentage of secondary flakes which were actually utilized at each site is unknown without use wear and/or residue studies, and therefore cannot yet be compared. Also, relevant data regarding cores cannot be discussed without knowing specific types (casual, decorticated casual, polyhedral, etc.) which were often not provided in the literature.

The majority of types, including blades, points, cores, staples and eccentrics all show closer percentages between Navajas and the La Venta Corridor than between any other two locations. some of these similarities may be due to greater regional affinity between the two eastern areas, than between core and semi-peripheral zones. For example, the increased presence of points in both areas may be due to increased hostilities from external groups to the east. Other similarities, however, appear coincidental. The presence of staple processing items, for example, would be common in household areas within the La Venta corridor, and may have no association with ritual areas.

The results of this comparison suggest that some social factors other than core and semi-peripheral area relations may, in certain circumstances, have greater impact on economic similarities and differences. However, although it is an important consideration, this is a different question which runs tangential to the present purpose of this thesis. In the current comparison such factors may only serve to mask the impact which core to semi-periphery area relations may actually have on the economy. To observe differences specific to the relations under test, it may prove more beneficial to look at specific sites from different areas in relative isolation.

General observations on the Collections Under Test

Overall, each collection at Llano Grande and Navajas gives the initial impression of an expedient flake industry. Flakes at both sites are very wide, and in some areas they average wider than they are long. Unusually wide dimensions may be due to expedient flaking, or possibly a technique which intentionally favors more rounded dimensions. But the majority of obsidian pieces lack any defining features or patterns, even after setting aside the over 40 percent of the data in Llano Grande which are classified as chunks. Relatively low proportions of polyhedral blade related debitage exists at either site; blade industries were present, but do not appear to have been emphasized. The few cores remaining at each site are nearly all casual; no polyhedral cores and only one very small macrocore were located. Edge retouch also appears on 2.8 percent of flakes and blades at Llano Grande, and 6.2 percent of the same categories at Navajas. If left to casual observation, one may conclude that nearly all lithic activity associated with the

guachimontones is highly informal, and therefore used primarily for internal purposes. Internal use could include craft work for ritual items such as clothing, decoration, or food processing. However, what appears to be strictly expedient in nature can easily represent secondary byproduct utilization from a more formal industry, such as bifacial or unifacial tool production. A closer look is therefore required to determine the nature of each site's lithic industry.

Much like the neighboring Sayula Basin (Reveles 2005:351), bulbs of percussion are obvious through all recovered size grades at both sites, indicating that percussion was used until the final stages of production. Some blades and flakes do appear to have been produced by pressure flaking, with very shallow and sometimes nearly undetectable bulbs of percussion. The most obvious of these are the laminar jewelry flakes. However, even when including the jewelry flakes, pressure flakes are relatively uncommon. This created an additional challenge in the determination of Clark's division for "series" blades as well as the corresponding flake categories. The switch to pressure flaking techniques is a usual hallmark of Clark's series blade production (Hirth and Andrews 2002:2). It also illustrates the earlier point that local variations often occur within what otherwise appear to be equivalent lithic industries.

Overall Quantities and Site Coverage Differences

Of the 1,636 examined pieces from Llano Grande, 674 items (41%) were determined to be of questionable artifact status and are thus categorized as chunks. The Navajas guachimontón contained substantially less natural stone; 128 out of 484 analyzed

obsidian items (26%) from Navajas are chunks. Yet even with chunks excluded, the Llano Grande debitage sample is approximately 2.7 times larger than that of Navajas.

But the overall count differences discussed thus far only involve the samples examined for this study. As discussed in Chapter V, although excavation at Navajas Circle 5 was nearly complete, the Llano Grande guachimontón was only partly excavated. Site totals can be estimated, however, based on average artifact densities to achieve some idea of the magnitude of artifact counts within each guachimontón.

In most excavated applications of artifact density, volumetric densities are used in contexts which span time periods long enough to use layer depth as a proxy for time. In the current context, however, we have single occupations over 100 to 150 year periods. The guachimontón contexts also contain artificial "strata" composed of compacted earth floors over artificial subfloor material (Beekman 2001, 2007). Further, collapse and post-occupation layers have shown no evidence of post-period occupation at either site, so items in the more recent layers were either items stored higher up in each building, or the product of post-depositional formation processes which vertically displaced the artifacts. Excavated volumes in this case has little to do with occupation periods, and will therefore produce misleading differences between sites. Therefore, area rather than volume densities are used for the estimated site totals.

The total excavation area at Navajas is 706 m^2, and Llano Grande's excavation covered a total area of just 104 m^2, or approximately 15 percent of Navajas' coverage. Based on preliminary analysis data recorded by Beekman on entire recovered datasets from each site, the total number of verified lithic artifacts is 1,747 for Navajas and 2,980 for Llano Grande. The average artifact density at Llano Grande is therefore 28.6

pieces/m^2 , compared to just 2.47 pieces/m^2 at Navajas. When Llano Grande's density average is projected over the entire guachimontón, it provides a comparable estimate of approximately 34,165 pieces.

Since lithic counts in different areas of the Llano Grande guachimontón vary considerably, ranging from just over 100 to over 1200 pieces near the activity floors of each building, continued excavation at Llano Grande will most likely yield counts that vary considerably from this projection. But even in the very unlikely scenario where further excavation fails to yield any additional lithic artifacts at the Llano Grande circle, at minimum Llano Grande's total artifact count remains nearly twice that of Navajas, which still suggests greater emphasis on lithic activity in or near the Llano Grande circle. Even if none of the production happened directly on the circle, the volume of production within the vicinity of the guachimontón may well be definable as a workshop, although Clark's workshop criterion of overproduction beyond the needs of the site population cannot be resolved within the scope of this thesis.

The Nature of the Deposits

The count distribution patterns for piece lengths are shown in figures 6.1 and 6.2. Both Llano Grande and Navajas show a size distribution pattern of a negative exponential curve that would be produced by a full complement of lithic production debitage, minus the smallest pieces. The sites show very similar patterns of divergence from a complete debitage distribution in that in both cases, smaller items begin to diverge from what would be expected if all pieces were present, and sample counts of the smallest items

drop off quite drastically. The only differences in patterns between sites are the size thresholds where both of these changes occur. At Navajas, the curve begins to attenuate at around 3 cm, whereas Llano Grande begins to diverge near the 2 cm mark. Likewise, the Navajas curve drops steeply at 2 cm and the Llano Grande curve drops at around 1 cm. Additionally, there are only 15 flakes reported to be smaller than 1 cm at Llano Grande, but none at Navajas. As discussed in Chapter V, both curves are likely a result of

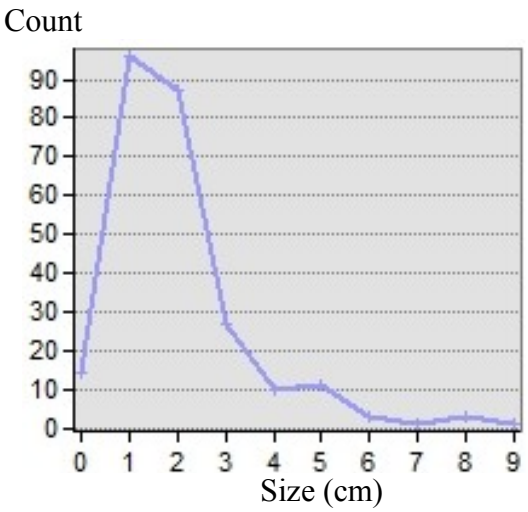

Figure 6.1 - Llano Grande flake length distribution

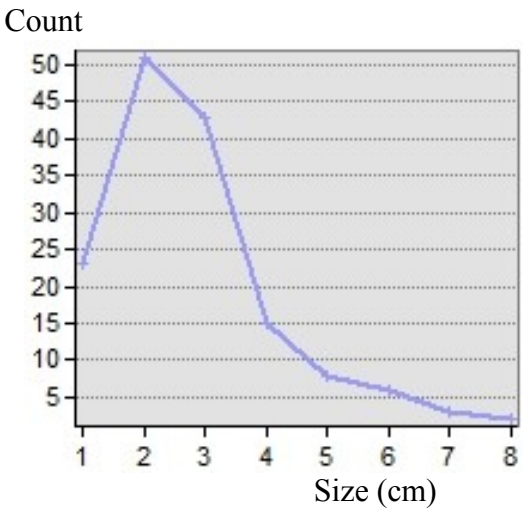

Figure 6.2 - Navajas flake length distribution

secondary depositions, since primary depositions of even early percussion stages of a lithic production process consistently include a majority of flakes under 1 cm, and moving debitage typically results in most or all of the very smallest pieces left behind at the original location. This is primarily due to sweeping tool inefficiency and the embedding of smaller items in dirt or grass floors (Root 2004).

However, retention of the reverse J-curve pattern in the larger pieces is likely the result of transfers of entire debitage piles into the guachimontones, perhaps as an

expedient way to gain convenient access to an assortment of edges, rather than picking and choosing large numbers of flakes for secondary use. In both sites, it appears that the actual production had likely occurred in some nearby location, and the resulting flakes were gathered together and moved into the guachimontón buildings. Although the loss of the smallest flakes and primary context is not the most ideal situation for a production study, the fact that flakes appear to have been moved together does allow for closer examination and interpretation of all aspects of the nature of the debitage relevant to the study, therefore all eight tests can validly proceed.

Lithic Industry Tests

Test 1: Formal Products vs. Debitage and Expedient Tools

Product counts are very low in the sample data from both sites, with the exception of scrapers at Navajas, and polyhedral blades at both sites. Only one item in the ground stone category appears in the Llano Grande collection, which is a large symmetrical oval rock approximately 20 cm in length, that shows evidence of grinding activity in the form of a groove carved around its circumference, perpendicular to the major axis near one end. The groove resembles those used on axe heads for hafting, but the stone is very round and blunt on the opposite end, and does not readily suggest any known function.

Despite their low numbers, there is a disparity in relative percentages of products between sites (Table 6.3), which crosses all product types except laminar flakes.

Table 6.3: Percentages of formal product counts relative to total analyzed sample (products and debitage).

	n	Bifaces - Points	Bifaces - Other	Scrapers	Blades	Ground stone	Pikes	Laminar Jewelry	Total
Navajas	356	2.6%	1.4%	10.0%	7.6%	0.2%	1.2%	0.7%	23.7%
Llano Grande	962	0.3%	0.3%	0.4%	3.8%	0.0%	0.1%	0.0%	4.9%

The consistently greater product percentages at Navajas combined with the comparatively sparse quantity of debitage at the site further suggests a greater emphasis on product consumer activity, and conversely, more of a lithic producer role for Llano Grande. The null hypothesis is therefore rejected for this test.

Test 2: Debitage to Ceramic Sherd Ratios

Debitage (including expedient and secondary flakes and blades) and sherd quantity comparisons also utilize Beekman's verified site totals, as well as Tyndall and Beekman's (2007:164) sherd counts for Llano Grande and Johns' (2014:83) counts for Navajas. Again, differences in excavation coverage do not permit a direct comparison of counts across sites, but only within each site. Therefore, only the site ratios between artifact types will be directly compared.

Table 6.4: Debitage and sherd total comparison.

	Llano Grande	Navajas
Debitage	2,980	1,747
Sherds	1,525	9,475
Ratio (debitage:sherds)	2.0:1	1:5.4

It appears that Llano Grande emphasized lithics to a much greater extent than ceramic related activity as compared to Navajas, but this does not mean that ceramic related activity by itself was actually lower at Llano Grande. The ratio between sherds and lithics is only a relative comparison between two independent industries. The average artifact density for sherds (1525 sherds over 104 m^2, or 14.66 sherds/m^2) can also provide an estimated count for an equivalent excavated area to Navajas, and calculates to an estimated 10,325 pieces, or actually a 9 percent *increase* over the count at Navajas.

As with the debitage, sherd counts vary considerably from building to building (Tyndall and Beekman 2007:Table 4.2; Johns 2014:91). Also, as with the debitage, the degree of artifact fragmentation and the specific forms of ceramic utilization may have varied between sites. Therefore this estimate is quite tentative. However, given the information we have to date, it appears that although lithic related activity was more prominent in and around the ritual structure at Llano Grande than Navajas, ceramic related activity was at least as intensively pursued, and may have involved the same feasting rituals (or some modified versions adapted to the area) as Navajas. Therefore, lithic processing could not have been the sole industry at Llano Grande, but it did rise to a relative prominence as other activities continued apparently undaunted within the circle. Therefore, the null hypothesis in this case is only partly rejected. Lithic activity did increase relative to other activities, but there is no evidence that other activities diminished.

Test 3: Core Totals

Only two polyhedral cores were found between the two sites, one at each site. All other cores at both sites are casual items with substantial amounts of cortex (mostly ranging from 25 to 75 percent). Navajas contained only three casual cores, or 0.8 percent of the frequency of all debitage pieces, and Llano Grande contained thirty-seven (3.8 percent of its debitage count). Chi-square and T-test statistics could not be run on core quartile values, due to the extremely low core count, but it is nevertheless clear that these cores do not show an obvious indication of trade.

Table 6.5 Core quantities as a percentage of debitage at each site.

Type/Site	n	polyhedral blade-core	casual core
Navajas	356	0.3%	0.8%
Llano Grande	962	0.1%	3.8%

Llano Grande's core collection demonstrates some lithic production from the initial part of the reduction sequence within or near a guachimontón, which has not been seen elsewhere in the Tequila Valleys. However, the presence and expedient nature of the cores within the circle shows a likelihood of production for local use and possibly some form of product trade, rather than trade in the form of prepared cores. The null hypothesis is therefore supported for this test.

Test 4: Amounts of Dorsal and Platform Cortex on Flakes and Blades

As mentioned in Chapter V, proportions of cortex coverage were recorded by quartile, but two categories define extreme states of no detected dorsal or platform cortex, and full cortex over these areas. Since these properties are absolute states and do not scale with the quartile ranges, they are included here as separate comparisons relative to their respective site's totals in Table 6.6.

Table 6.6: Site percentages of flakes and blades which possess full or no cortex

	Llano Grande (n=649)	Navajas (n=262)
No cortex	50.2%	68.3%
Full Cortex	11.2%	2.3%

A decided majority of Navajas' flake and blade debitage bears no cortex, and very little of it (2.3%) bears full cortex. These figures show further affinity of Navajas with previously discussed areas within the Tequila valleys which reflect the prepared core import model, in that relatively little cortex is seen in those sites. In contrast, roughly half of Llano Grande's debitage is cortex-free. Although Llano Grande's proportion of full cortex pieces is not exceptionally high, it is nearly five times that of Navajas. Llano Grande appears to reflect a greater degree of decortication and early stage production, although not such a substantial number of cortical pieces to suggest that Llano Grande was solely engaged in core preparation for trade.

Quartile Distribution Differences

The Pearson Chi-Square result for frequencies of each cortex quartile value, combining both flake and blade types between Navajas and Llano Grande (n=649 for Llano Grande, n=262 for Navajas), shows a significant association between sites related to the cortex distribution ($p<.001$). The tau-c value shows a negative association, although a week one at -.191 ($p<.001$). These results indicate definite, but relatively subtle differences in lithic processing between sites.

Overall mean cortex quartile values between sites for flakes and blades with partial cortex are compared in Table 6.7. The mean difference is small, at 0.39, which translates to an actual difference in percentage of 9.75%. This value is very approximate, given the low resolution of quartile values, but nonetheless reveals a small difference in lithic processing behavior.

Table 6.7: Means and standard deviations for flakes and blades with partial cortex

	Site Code	n	Mean*	Standard Deviation*
cortex	Llano Grande	250	2.19	1.110
	Navajas	75	1.80	.959

*Calculated from the ordinal code values from 1 to 4 which represent successive quartile ranges.

This result aligns well with the complete and absent cortex percentages as well as the chi-square result. None of these results present such a wide difference between sites as to suggest a difference between a quarry which is solely invested in core preparation for trade, and a remote consumer site. Core preparation consists primarily of the removal of

cortex along with some rudimentary shaping, therefore most of the resulting debitage from that process alone should contain high proportions of cortex. However, the results do suggest that a somewhat lesser degree of later stage production was also done at Llano Grande. Since the differences are statistically significant, the null hypothesis is rejected, but with the observation that some combination of core preparation and later stage production likely occurred in or near the Llano Grande guachimontón.

Cortex Distribution Details

Bar charts more clearly show the potential mixed economy in the data distribution pattern as a bimodal distribution (Figure 6.3): At Navajas, flakes and blades with no cortex expectedly dominate, and flake counts are sharply reduced as cortex proportions increase. The same pattern is shown to a lesser extent for Llano Grande, except that there is a small but noticeable increase in proportion for flakes and blades with over 75 percent coverage. This increase may indicate some presence of increased decortication for the purpose of core preparation for export, although in small proportions compared to the amount of further lithic processing for local use or trade.

Cores at Llano Grande show a cortex distribution that is nearly complementary to the flake cortex distribution, with a peak in the 51-75 percent range (Figure 6.4), whereas cortex on the three Navajas cores are all in the 25-50 percent coverage range. These differences may only reflect the relative proximity of sources, as closer sources tend to be utilized for more expedient and less material efficient knapping (Newman 1994:499). With virtually no travel required to obtain material, Llano Grande knappers could pick and choose from multiple cobbles and spalls that suit their needs with no concern about

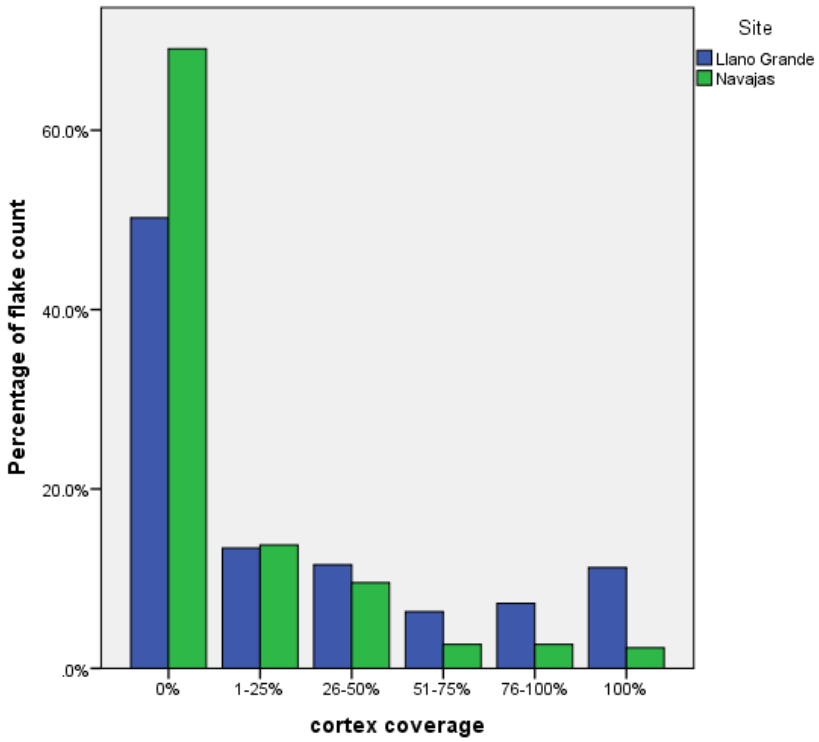

Figure 6.3: Flake and blade comparisons of cortex coverage distributions per site

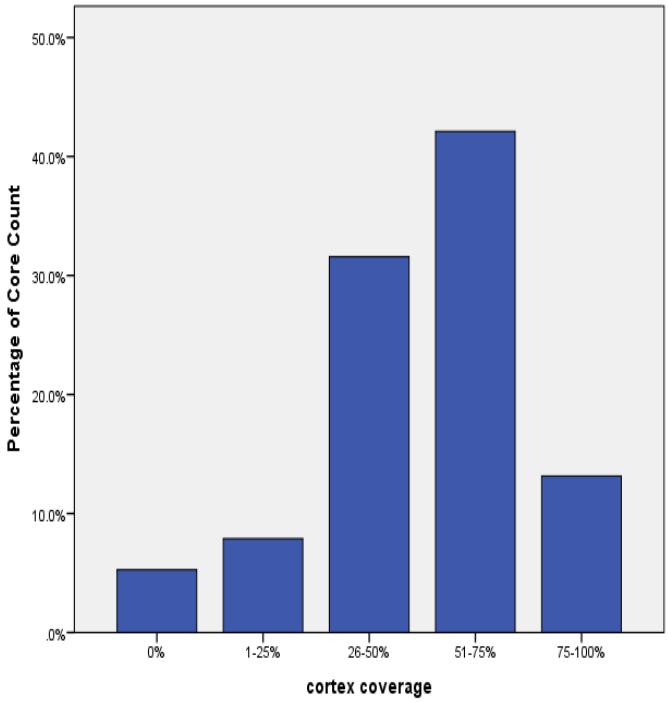

Figure 6.4: Core comparisons of cortex coverage distributions at Llano Grande.

efficient utilization of material, whereas Navajas knappers would tend to utilize the material more intensively before retrieving more of it. A more relevant observation is that most of these cores in both cases are in the middle quartile ranges, where they are obviously not either pre-prepared, or new cobbles cached for later processing. Instead, their intermediate state suggests their use on an as-need basis. As noted above, the larger proportion of these casual cores are at Llano Grande, which suggests a greater expedient industry at the site .

Test 5: The Percentage of Specialized Tools for Staple Processing

Items in this category are especially sparse. A single metate was found at Navajas within the excavated contexts, on the activity floor of one of the satellite buildings. Two additional metates and three manos were discovered among post-occupation debris at Navajas, as well as several unidentifiable ground stone fragments in unspecified contexts (Beekman 2007:253, figure 12.1), but only the activity floor metate is included in this analysis, as well as Table 6.3. The lone metate is also a very small, "single handed" item that may have been used for a number of purposes beside staple processing, such as pigment mixing, and by itself is scant evidence. However, in the context of the previously discussed ceramic vessel and diorama evidence for feasting rituals associated with the guachimontones, its utilization in some capacity for staple processing appears likely.

No ground stone implements known or suspected to be associated with food processing were discovered at Llano Grande (Beekman 2001:11). However, the complete

lack of staple related items at Llano Grande may well be due to the very low coverage of the circles, which did not reach a majority of the buildings. The null hypothesis is quite tentatively rejected for this test, and the results should be considered with a high degree of caution due to the inadequate sample for such a low frequency item. Confirmation is therefore pending further excavation and analysis.

Test 6: The Percentage of Debitage Associated with Polyhedral Blades

All forms of debitage related to polyhedral blades (Table 6.8) are also quite sparse, but frequent enough to suggest with some confidence that some polyhedral blade industry did exist at both sites. Navajas contains the largest internal proportion of debitage pieces related to polyhedral blade production overall, and also consistently for each subcategory of debitage. Polyhedral blade technology is considered primarily a utilitarian form of production and was more prominent at Navajas, where it was most likely employed for local use rather than trade. Therefore, the null hypothesis is rejected for this test.

Table 6.8: Percentage Comparisons of Blade Types by Count.

Site/ percent	n	polyhedral blade-core	Macro-blade	1st series blade	2nd series blade	Platform correction flake	Facial correction flake	Total Blade Artifacts
Navajas	356	0.3%	2.5%	5.9%	0.6%	0.3%	.8%	10.1%
Llano Grande	962	0.0%	1.0%	2.7%	0.1%	0.0%	0.3%	4.2%

Test 7: The Percentage of Unfinished or Failed Bifaces

This test specifically addresses bifaces prepared for export as blanks, either in an early stage of processing or finely shaped but not completely thinned and without defining features. Some of the bifaces represented above in Table 6.2 appear to be finished products and are therefore not appropriate for inclusion here. At Navajas, two bifaces are finely finished non-standard shapes: an elongated ovoid and a circular item. Also, a third biface contains very steep edges and is therefore interpreted as a bifacial scraper. All three items appear to be finished utilitarian pieces which were likely used locally. From Llano Grande, one biface had a broken base and corner retouched into edges, and was therefore a secondary use item. The remaining items, however, were rough bifaces, one of which had a prominent plateau on one face, an early production failure caused by too many step fractures surrounding material intended to be removed.

Table 6.9: Bifacial Blank Percentages by Count

	n	bifacial blanks
Navajas	356	0.6%
Llano Grande	962	0.2%

Although counts at both sites are again very small, even after ruling out apparent finished items, it appears that Navajas bifacial blanks take up a larger percentage of their respective assemblage than do those at Llano Grande, and the null hypothesis is supported for this test. Apparently, much like the La Venta Corridor, Llano Grande did not engage in frequent trade of blanks. Navajas' proportion of bifaces was larger, but still

quite infrequent. Therefore, neither site is likely to have developed a noticeable industry for bifacial blank trade.

Test 8: Emphasis on Production Related to Laminar Flakes and Blades

For the sake of simplicity in the text, the term "flake" in this test refers to any informal flake or blade shaped item. The only blades excluded from this test are 1st and 2nd series items, which show vertically oriented flake scar patterns indicative of formal polyhedral core processing.

Since thickness was not a recorded dimension, laminar flakes are identified as single faceted shaping flakes with less than 25 percent cortex. Although the lack of a thickness parameter is not ideal, the current method of identification may also catch some failed laminar flakes struck at an angle such that thicknesses were uneven. The method could also misidentify some platform correction flakes, but correction flakes were initially recorded as a separate type from shaping flakes.

The percentage of debitage identified as laminar flakes is virtually equal between sites: 1.0 percent of flakes and blades were identified as laminar for Navajas (n=262), and 0.9 percent were identified for Llano Grande (n=649). These data suggest that laminar production was a minor industry pursued equally at both sites, and may have been intended mainly for internal use in both cases. However, as previously discussed, some of the smaller members of this infrequent and especially fragile category may not have survived intact, or may not have been transported to the guachimontones in equal

proportions between sites. Therefore, possible evidence earlier in the laminar production process may be a deciding factor.

Tables 6.9 through 6.11 show Pearson's r correlation results between flake scar density and each size parameter (length, width, and length-width product). Correlation results are shown for all flakes, and also separately for each flake type. There is no pre-supposition of a positive or negative correlation so p-values are calculated as two-tailed. Sample sizes differ for different test cases, since certain dimensions on some flakes were not included due to fragmentation, and outliers were also removed. The null hypothesis is supported by a significantly negative r-value, which corresponds to the usual reduction progression towards increased dorsal flake scars, rather than a single scar. The null hypothesis is rejected in cases where a positive correlation or no significant correlation is discovered.

An initial evaluation of all flake types as a single category tests for a flake scar density to size trend without regard to a "reduction" and "shaping" type distinction, and may show a more positive trend for laminar flake production whether or not the type distinction truly reflects a distinctive stage boundary on the part of the artisan. The Pearson's correlation results for combined types shown in Table 6.10 indicate that the correlations of all dimensions at each site are significantly negative. The strength of the correlation is weak for length and width, but moderate for length x width. Since strong negative correlations would not be expected in assemblages with mixed production methods, this is an expected pattern. The Navajas trend is also slightly less negative than that of Llano Grande. However, the negative correlation in each case is still statistically significant at the $p<.05$ level. With such a subtle difference between sites, it is unclear

whether the difference is more strongly influenced by factors other than the degree of laminar flake production.

Table 6.10: Correlations of flake scar density with dimension/size variables for all flake types

Site		length	width	lxw
Navajas	n	124	125	125
	p	.002	<.001	<.001
	r	-.280	-.376	-.487
Llano Grande	n	136	138	128
	p	.001	<.001	<.001
	r	-.285	-.296	-.480

As shown in Table 6.11, when isolating reduction flakes, both sites still show a weak to moderate trend of flake scar densities increasing relative to a decrease in size in all cases, and all correlations are again significant at the $p<.05$ level. No differences which can be attributed to laminar jewelry production are evident in reduction flakes. Such differences are not particularly expected in this flake type, since the laminar flakes themselves can only meet the definition of shaping or finishing flakes.

Table 6.11: Reduction flake correlations of flake scar density with dimension / size variables

Site		length	width	lxw
Navajas	n	71	73	72
	p	.027	.002	<.001
	r	-.262	-.362	-.521
Llano Grande	n	65	67	63
	p	.008	.002	<.001
	r	-.326	-.372	-.504

However, when shaping/finishing flakes are isolated, the pattern changes. As seen in Table 6.12, the significantly negative correlation between flake scar density and all size parameters still holds for Navajas, but the scar density correlation between length and width dimensions at Llano Grande is not statistically significant, and is only weakly negative. The scar density correlation to the length x width area approximation remains statistically significant.

Table 6.12: Shaping/finishing flake correlations of flake scar density with dimension / size variables

Site		length	width	lxw
Navajas	n	51	50	49
	p	.022	.010	.001
	r	-.320	-.363	-.478
Llano Grande	n	68	69	65
	p	.116*	.083*	.001
	r	-.192	-.210	-.417

* The correlation is *not* significant at the $p<.05$ level.

Within our current understanding of West Mexican lithic technology, the only known technique that may cause an abrupt difference in scar density distribution only within the shaping flake category could be due solely to the presence of final stage laminar flakes. However, as shown above, surviving laminar flakes are essentially equal in proportion between the two sites. Polyhedral core-blade technology logically must also produce a reduction in scar density with decreased size down to the prismatic blade stage, since the final products only result in two or three vertically oriented dorsal scars, but this is only necessarily true if cores are worked down to the 2nd or 3rd series in Clark's sequence. 2nd series blades were excluded from this test, and no 3rd series blades were found. Also,

Navajas contains twice the proportion of blades compared to Llano Grande (9.0%, n=356 for Navajas vs. 3.8%, n=962 for Llano Grande). Some additional method of setting up the core for faster and/or easier removal of laminar flakes of the desired shape and size may have been responsible for the observed pattern change at Llano Grande.

In any case, since only Llano Grande shows some disruption in the scar density to size correlation, the site may be a more likely candidate for larger scale laminar flake production. However, the requirements defined in Chapter V for the test states that *all* size parameters must show a lack of significance at Llano Grande to reject the null hypothesis. Since the length and width product (lxw) still shows a significantly negative correlation, the null hypothesis is supported for this test. Also, some caution should be exercised because this test relies on logic rather than archaeological or experimental debitage data from actual laminar production. Two of the three parameters, length and width, did behave as suggested for an increase in laminar production at Llano Grande. Therefore, known laminar debitage should be observed to confirm the interpretation of this test.

Of the three techniques considered by analysts thus far for laminar flake production (Beekman 1996a:797-799; Clark and Weigand 2009; Long 1966:228-230), all suggest that either the core material was prepared by some form of conventional reduction, or no preparation may have been necessary, prior to creating flakes with single dorsal scars. Since any disruption of the flake scar to size trend does not appear in reduction flakes, but only shaping/finishing flakes, the results of this test lend some further strength to the idea that only conventional early preparation, if any, preceded finer work. However,

removals done later in the sequence may have involved more than a single-step production of laminar flakes.

Flake Size/Cortex Distribution Grouping Patterns

Scatter plots of the relationships between dimensions and scar densities are shown in Appendix B. Reduction and shaping flakes are marked differently within the same plots for easy comparison. All charts show essentially the same general negative sloping (though non-linear) trend determined through statistical analysis, although it is less obvious in the shaping flake category of most of the charts, mainly due to their more limited size range. For Llano Grande, slopes are especially difficult to detect because of their very weak correlations.

CHAPTER VII

DISCUSSION AND CONCLUSION

This chapter begins with a summary of the results of each test, as each relates to the original research questions, followed by a discussion of the nature of the lithics within the contexts of the guachimontones, and the significance of the results to differences in economies at Llano Grande and Navajas in general. Project limitations and issues are then discussed, along with future work that may stem from this project and the questions it has addressed.

Question 1:

> Do the lithic assemblages at Llano Grande show a greater emphasis on production over use contexts than the assemblages at Navajas and other sites more closely affiliated with the core population zone?

A greater emphasis on production in general at Llano Grande is well supported from the available assemblages. The average lithic density at Llano Grande is more than ten times that of Navajas, and projecting the average density over the entire guachimontón suggests that the ritual center may contain over 30,000 pieces. The assemblages at hand are specialized contexts within public centers, and therefore show a specific view of the political-economic emphasis of the site on obsidian production. The guachimontones are likely secondary contexts, so it is also likely that neither guachimontón represents the total sum of flakes produced at its respective site. Therefore, it is not suggested that one site has a greater throughput of obsidian production over the other, but only that the

specific public context reflects a political economy at Llano Grande which emphasized the production of obsidian as an important commodity to a greater degree than at Navajas. However, based on the current evidence, only the amount of obsidian at Llano Grande might be deemed large enough to suggest the presence of a workshop on-site. Additional deposits, such as middens and actual workshop locations, may show evidence of production on an even larger scale.

The Navajas guachimontón, which covers nearly the same area as the Llano Grande ritual center and was much more thoroughly excavated, contains less than 3,000 pieces. It also contains proportionally more formal products by count at 23.7 percent, than Llano Grande, at 4.9 percent. Proportions of every product form are greater at Navajas, which include non-prismatic polyhedral core blades considered to be utilitarian items, unifaces and steeply edged bifaces interpreted as scrapers, one metate and two apparent ritual/eccentric product types, pikes and laminar jewelry. These data suggest a larger role for Navajas as a lithic consumer site than Llano Grande. Again, this does not mean that a high degree of production did not occur somewhere on-site, but only that lithic production was not well represented within the public ritual architecture at Navajas.

Question 2:

> Does Llano Grande show evidence for a greater emphasis on the production of potential trade than Navajas, including commonly exported forms, known elite items, and/or items which require specialized production techniques?

Evidence for the production of most items known to have been created for trade, however, is not as clear. Items commonly traded within Mesoamerica are prepared (at

minimum, decorticated) cores; bifacial blanks, which were very common trade items at Teotihuacán; and eccentrics. Only prepared core production presented clear evidence of greater emphasis at Llano Grande than at Navajas. Distributions of different percentages of cortex suggest that Llano Grande likely did function as a quarry for core preparation, but not exclusively. Core preparation is clearly indicated by a significantly larger component of flakes with very high amounts of cortex at Llano Grande. However, the lack of cortex on the majority of flakes suggests a larger component of additional processing for specific products, although it is not possible at this point to confidently suggest specific forms which may have been created, solely based on the recorded attributes of the debitage.

The number of bifacial blanks is very low at both Llano Grande and Navajas, and actually accounts for a slightly greater proportion of the Navajas collection. As seen in other sites within the Tequila Valleys, Teotihuacán's strategy of regional distribution of bifacial blanks does not appear to have been shared by the Teuchitlán culture. Bifacial blank production was not necessarily expected, but only provided an indicator of one possible form of trade.

For eccentric or ritual items, the most obvious and intuitive method of simply counting flakes and fragments with laminar characteristics to identify jewelry production resulted in essentially equal proportions between sites. Searching for an uncommon relationship between flake scar densities and flake sizes which suggest reduction that works towards the single scar laminar products did result in potential evidence for laminar production at Llano Grande, which was not present at Navajas. However, this method does not coincide well with any current proposals for the laminar production

techniques, and requires further testing through experimentation to determine whether some form of gradual elimination of flake scars may have been of some benefit.

Finally, the presence of casual cores at Llano Grande suggests the production of some expedient tools more suited to internal use rather than trade. However, most of the cores were more than half covered in cortex, and appear very lightly used. The proportion of flakes produced from those cores within the guachimontón is therefore likely very low, but the caching of both expediently produced flakes and secondary flakes from debitage within the circle, combined with the small percentage of retouched edges on flakes, suggests an emphasis on internal use of expedient items. However, Navajas also contains a large proportion of utility items, including three times Llano Grande's relative proportion of polyhedral blades (mainly 1st series and macroblades), which are also considered internal utility items. Navajas' greater proportion of the more material-efficient polyhedral form (Sheets and Muto 1972) over casual flakes is understandable, considering the site's greater distance to its source. However, the emphasis on different utility forms at each site poses a problem for interpreting relative degrees of internal utilization of lithics. A small number of items specifically created for internal use may be more intensively utilized than a cache of secondary flakes which are stored only for convenience as potentially usefulness edges. The current study also does not provide data on the number of secondary and expedient flakes or blades which were actually used at either site beyond the more obvious edge retouch data. But the tool data thus far suggest active internal utilization of lithic resources typically designated for common uses at both sites.

Overall, the currently available data suggest that Llano Grande elites did embrace more of a trade economy than Navajas, but trade is only substantially evident in prepared cores rather than blanks or eccentrics. Llano Grande was also not overwhelmingly trade oriented, as the differences between the two sites in cortex proportions are statistically significant but not strongly divergent. Flake scar density distributions do hint at possible jewelry production, but the method of analysis needs further confirmation, and the more straight-forward indication of actual counts of laminar debitage do not indicate any difference between sites.

The Origin and Purpose of Guachimontón Obsidian

The question of how obsidian lithic material came to be deposited specifically within the Llano Grande and Navajas guachimontones relates directly to the issues with workshop identification discussed in Chapter IV. Of particular interest is the assertion posed by Moholy-Nagy (1990) that supposed workshop deposits at Colha were actually secondary and therefore Colha was not a workshop but a lithic dumping area. However, as Johnson has argued, regardless of the nature of the deposition, the deposits were evidently the result of workshop activity that had to be nearby, if not directly on the premises (1996:164). Also, in the context of the current study, an active public ceremonial center would not have been a good candidate for what Moholy-Nagy called a "workshop dump" (1990:268). Even though the distribution signatures for both sites suggest an indiscriminant move of all sizes which can be easily transported into each ceremonial center, the lithic deposits there most likely served a specific purpose. As

suggested above, the guachimontón buildings may have been used as a convenient cache for potential expedient tools, to sort through at later occasions. The strategy has some precedent, as it is suspected by Whittaker in another enclosed lithic "waste" context near the corner of one room within an American Southwest pueblo. Whittaker reasons that in the Pueblo example, the usefulness of expedient edges is suspected to have delayed final dumping in a midden context (Whittaker 2001).

Among the Maya, similar lithic deposits which appear to have indiscriminately included most of the debitage as well as products have been found in the ritual center of Classic Period Tikal. The deposits at Tikal have been interpreted as ceremonial offerings, but those items appear to have been buried within the public space (Moholy-Nagy 1989; Johnson 1996:166), whereas the deposits at Navajas and Llano Grande were primarily concentrated just above the living floor and among the building collapse, and were therefore exposed for potential reuse. The guachimontón deposits may have been intended as potential tools for the crafting of ceremonial items, for common everyday use if some degree of secularization of the circle had occurred to allow for more common daily activities within the circle.

But the concentration of expedient flakes in the Llano Grande guachimontón suggests a possibility of more intensive use than what may have been required for internal activity. Utilitarian lithic items may be used for a number of different purposes beyond staple processing, but ceramic studies at Navajas and previously in other areas inhabited by the Teuchitlán culture area have detailed a prominent role for staple related ritual within guachimontones based on vessel forms (Butterwick 1998; Johns 2014; Tyndall and

Beekman 2007), and the density of ceramics by count is approximately nine percent higher at Llano Grande than at Navajas.

It is likely that at least some expedient flakes at Llano Grande were utilized for staple processing, but Llano Grande's high informal flake concentration also suggests obsidian utilization within the ritual center that was similar to that of the previously discussed workshops at Kaminaljuyu (Anderson and Hirth 2009) and Teotihuacán (Spence 1987), where expedient tools were used for craft production. Several additional resources around Llano Grande could have been used for this purpose. The wooded areas of the hills surrounding Llano Grande suggests a possibility of carved wood products, and perhaps animal skins from animals that inhabited the forests. Maguey products, including fibers, hearts, leaves, nectar and pulque are additional potential exports which also likely required cutting edges for processing. All of these examples are more perishable and thus more difficult to detect in archaeological contexts, but some may have also been considered elite items in other areas without these resources (Nassaney 1996).

Conclusion

As anticipated, the geographically and environmentally diverse Tequila Valleys region provided an excellent opportunity to observe differing economic activity in different environments which are nonetheless connected to the same cultural identity. Different positions within the economic structure also suggest different anticipated social roles within the culture which can further affect expected economic strategies (Algaze 1993; Blanton et al. 1996; Chase-Dunn and Hall 1991; Earle 1991; Schneider 1977; Wallerstein

1974). The degree to which different semi-peripheral and peripheral groups fill their expected roles may also depend on each group's degree of independence from the core (Kowalewski et al. 1983; Ohnersorgen and Varien 1996).

Given Navajas' close connection with the core, it is not entirely surprising that the lithic data from the Circle 5 guachimontón shows an emphasize on production for internal use, which would likely have been primarily applied to feasting related activities such as food preparation, and perhaps other agriculture related rituals. However, the lack of any indication of trade production at Navajas is initially surprising, given the clear indication of some Late Formative use of Navajas obsidian within the Sayula Basin. The Sayula obsidian sourced to the Navajas quarry does, however, predate the site at Navajas to Sayula's Early Usmajac phase, ca. 400 - 200 B.C. (Reveles 2006:389). Also, a much stronger cultural influence from the core likely affected Navajas' use of the guachimontón, and how it relates to the local economy. Based on the evidence at both Los Guachimontones and Navajas, the stashing and use of large quantities of lithic material within guachimontones does not appear to be a typical pattern associated with the core. Navajas may have kept large amounts of lithic material from accumulating within the guachimontón due to social norms regarding appropriate use of the guachimontón space, regardless of the site's degree of lithic production and trade.

The evidence at Llano Grande suggests a combination of obsidian, staple and possibly additional craft based economies, rather than a relative trade-off from a prominent staple economic base towards one based on wealth. Llano Grande had less convenient access to fertile agricultural land than Navajas, but evidently Llano Grande's access was not enough to deter the site from continuing a staple economy. Only a minor proportion of

the data currently available from Llano Grande very strongly suggests any specific, known form of production which was commonly traded, namely prepared cores. Most of the obsidian artifacts at Llano Grande can only be argued as the result of workshop production activity for trade on the basis of quantity. The presence of potentially tens of thousands of pieces deposited in a single context, whether primary, secondary or final deposits, is most easily explained by the presence of a workshop in close proximity. This is especially true when considering that the deposits are likely secondary, and therefore probably only a fraction of the total debitage at the site. Specifics about the exact forms of lithic products which were created are more difficult to discern at Llano Grande, based on the morphologies and flake attributes present at the site.

Llano Grande's very similar concentration of ceramics to Navajas is likely the result of the maintenance of staple related activity associated with the core area. The lack of specialized staple specific tools at Llano Grande is problematic to this interpretation, but considering only one object in this category was found at Navajas near an activity context, the lack of excavation coverage at Llano Grande is a more likely explanation for this absence than a lack of staple processing. Some proportion of the utilitarian lithics found at both sites were therefore likely applied to staple processing for ritual purposes, while a large proportion may have also been applied to other crafts, perhaps for other forms of wealth trade.

The more intensive utilization of a guachimontón for storage of production byproducts at Llano Grande also likely reflects some level of increased leverage from social institutions more heavily invested in lithic and/or craft production, and greater institutional sanctioning of the industries for which these lithics were utilized.

Sanctioning may take one of a few forms. The related industries could have been tied to ideology and then incorporated into the ritual system as some scholars view a *ritual economy* (Demarest 2013:372; Wells 2006; Wells and McAnany 2012). Alternatively, they may have been merely tolerated by ritual oriented institutions. Finally, some degree of secularization of the circle could have taken place, resulting in the production or storage of lithics for domestic use.

The possibility of secularization appears unlikely, since Llano Grande does not appear to have abandoned or even reduced the intensity of the staple ritual aspects of the core area, based on the concentration of ceramics. The ceramic data from Llano Grande requires additional analysis to better confirm its use within the guachimontón, but initial observations by Beekman (2001:7) show similar ceramic forms to those found within the Navajas guachimontón (Johns 2014). Specifically, the Llano Grande ceramics are a combination of fine ritual wares and common household vessels which include storage jars and bowls. It is also unlikely that elites would assume a passive role, and simply allow activity centered around a valued resource like obsidian to increase within the ritual space and ignore the opportunity to leverage that resource and the industries for which it was utilized in order to increase their own power.

In Kenneth Hirth's view, ideological ties to production generally appeal to ideas about the benefits of related resources to the group as a whole. The organization of institutions around production of the resource then provides legitimation of unequal resource accumulation within the social structure (1996:225). Economic ideology can then become a vehicle for bringing about ideological change: "It is in this arena that elites promote the development of new ideologies...to shape belief about both the demand for resources and

the specific use for which they are collected" (Hirth 1996:226). But the contention suggested by the concept of the arena does not necessarily lead to simply pitting of two economies against each other, where one economy becomes dominant in the end. Alternatively, contention may be over economic diversification vs. continued specialization on a more traditional resource. Elite appeal to economic diversification is described by Hirth's *matrix control principle* (1996:223-225) as a way to control as many economic and human resources as possible, and reduce the risk of an economic failure through diversification of resources.

Hirth (1996:223-224) further states that control over the accumulation of multiple resources is accomplished through his *context principle*, whereby elites create public spaces for each industry so that all industries can be monitored by a higher level authority in the social structure. Additional differences between Llano Grande and Navajas in the patterns of artifact distribution between buildings suggest that the Llano Grande guachimontón may have transformed to accommodate multiple production contexts. Within the Llano Grande guachimontón, 70 percent of the analyzed lithics artifacts by count (n=962) were found in a single building, 14-6. Also, as mentioned in Chapter III, building 14-6 is associated with the eight buildings outside the circle, positioned closely behind it (figure 3.7), which suggests a special purpose related to lithic or craft production for 14-6. Ceramics, however, are nearly all concentrated in the adjacent building 14-5, including the only whole serving and storing vessels discovered at the site (Beekman 2001:7, 11-12).

Contrastingly, although lithic concentrations at Navajas still varied considerably between buildings, the highest lithics concentration in any one building at Navajas is 48

percent of the total artifact sample by count (n=356). For the Navajas ceramic data, sherds were also variably distributed, but the highest sherd count concentration in any one building was 32 percent (n=9,475), although some buildings held sherd frequencies as low 4% of the total (Johns 2014:figure V-23). Johns concluded that sherds were distributed evenly enough between buildings to suggest the use of pottery for ritual activity in every building. These data suggest that groups associated with each building at the Navajas guachimontón may have handled these industries independently of each other, whereas the Llano Grande guachimontón saw more group specialization for each industry, likely coordinated by a higher authority.

Differences between the core corporate economy and sites which follow Hirth's matrix control model require a replacement of the top-level corporate structure with a more vertical structure which allows an over-arching institution to control even such diverse economies as obsidian trade and agriculture. This form of control would have been most easily accomplished in the semi-periphery, where social distance from the corporate core and outside influences likely brought in new ideas and fostered economic and structural innovation, yet also allowed some continued identification with the core to create a form of hybrid economy. The evidence at Llano Grande suggests that elites appear to have sought to expand their economic basis by adding obsidian trade and perhaps other craft-related industries which required obsidian tools, without losing their hold on existing staple production organization or the accompanying agriculture related ritual.

The presence of the surrounding walls at Llano Grande, however, appear to contradict this interpretation of an independent Llano Grande, since the wall structures appear to have required a labor force beyond that which could have been provided by the

population of the site, which suggests some investment by core elites towards control of the site as a territorial boundary. But such attempts at establishing territorial control are risky, and sometimes fail due to the costs of maintaining transportation and communication links to remote groups (Kowalewsi 1983:37). Llano Grande's distance from the core and relatively difficult access may have made core control too expensive to maintain (Ohnersorgen and Varien 1996), which would have afforded Llano Grande a greater degree of independence than what may have been anticipated by core elites. Llano Grande would likely have had little external social pressure to continue the fragile corporate strategy, which would have allowed the more powerful groups to assume a controlling position **a**nd expand their economy. However, given Llano Grande's moderate size (approximately 75 buildings), economic expansion would have been somewhat limited by a small labor force.

Challenges, Limitations and Lessons Learned

The main limitation with this project was the lack of excavation coverage at Llano Grande. Projections of overall quantities are based on extremely variable artifact densities over only three of eight buildings and a one to two meter wide trench through the patio. The economic implications of unexplored areas of the guachimontón could remove a great deal of ambiguity and change the interpretation the role of the ritual center and the economy of the overall site quite dramatically. The focus on only the guachimontones within each site is also very narrow. The ritual center is an important area to explore because of its central socio-economic role within the site, but the discovery of actual

workshop areas and differences in the use of lithic material within buildings outside of the guachimontones can add critical information to the interpretation of the site's economy.

However, since my own coverage of the existing excavations was not comprehensive, additional excavation may not have mattered for this project. Progress for artifact analysis was somewhat slower than it could have been, for a few reasons. For one, I had made some variable choices that were not actually useful for the current question. Attributes were actually recorded with very different questions in mind that were tied to a larger number of data attributes than the current topic. Consequently, although several attributes were also quite useful for the current project, much time was spent recording data that were never utilized. Also, at least one important attribute, maximum thickness, was among several dropped within the first few days of lab work, partly due to a reduction in time allotted for laboratory analysis. As previously mentioned in Chapters V and VI, thickness would have been quite useful for the identification of laminar flakes. Closer analysis of the laminar flakes available, and especially subtle aspects of their surface features, also could have been a tremendous benefit to the general knowledge about lithic production techniques unique to West Mexico. The slow progress of analysis was also exacerbated by the large proportion of items of unknown artifact status (the "chunk" items) to identify and sort through.

However, the prioritization of lots and units above activity floors then proved quite useful. The majority of actual artifacts recovered from both sites (and nearly exhaustive coverage below ground at Navajas) were covered, as were artifacts from the most desired contexts closest to the activity floors.

Additional time spent on consultation for refinement of the research design would also have been very beneficial, especially given the lack of published literature on lithics within the region. Finally, since debitage analysis has proven to be quite labor intensive and tedious, as one may expect, analysis time is at a premium. Active recruitment of undergraduate or graduate lab partners could also have been tremendously beneficial, as well as a provision of valuable experience to potential future colleagues.

Future Opportunities

As mentioned at the end of Chapter I, this thesis was only intended to be a start in a particular direction on data which had previously undergone only brief preliminary analysis. The project was therefore very much a first pass at a theory driven exploration of the data, and there is a tremendous potential for additional studies.

The numbers and nature of the lithics recovered thus far already set Llano Grande apart from the core area, yet the interpretation of much of the lithic data remains ambiguous, largely due to lack of exploration of the surrounding context. The differences seen thus far likely point to future discoveries to be made in the yet unexplored building mounds and patio space. New information will likely add valuable details or counter the very tentative conclusions drawn in this thesis.

Continued Exploration at Llano Grande

The first priority in regard to studies that may specifically follow the current project should be additional artifact analysis of many of the remaining samples at Llano Grande. Of highest priority among the unanalyzed items are those from within higher collapse contexts than the items analyzed for this thesis, which were deliberately selected from lots immediately above and below activity floors. Additional excavation should then target more contextually representative samples within the Llano Grande guachimontón, within additional buildings and in other areas of the patio. Future excavation, handling and storage protocols should also keep additional residue analysis in mind for some of the recovered artifacts, and take measures to avoid contamination.

This line of questioning can then also benefit from additional residue analyses and use wear studies to determine the proportions of used flakes and blades, and the nature of the local use of different tool forms within both sites. The frequency of tool use for processing possible food items is of particular interest. Additionally, Rodrigo Esparza and Camilo Mireles are conducting further research on the manufacture of laminar flakes, which may inform better methods of identifying less obvious places of manufacture for these items. Studies involving very close observation and experimentation for both laminar flake and pike manufacture will allow better identification of all distinctive West Mexican eccentrics.

Following more representative exploration of the guachimontones, other buildings and patio spaces within the site should be selected for further exploration. Of particular interest are additional buildings immediately behind the Llano Grande guachimontón

building 14-6. One of those buildings has already been excavated, and additional buildings within the group may provide additional information about 14-6's nature and purpose.

Surveys and Additional Excavations

A reasonably complete view of the nature of the Llano Grande and Navajas economies will also require a much more broad exploration of the sites beyond the guachimontones, and additional surveys are needed for the surrounding areas on both sides of the Teuchitlán culture's "boundary" between the semi-periphery and periphery to confirm patterns of settlement and artifact distribution of all forms (pottery, figurines and various elite imports as well as obsidian). Surveys can span multiple seasons, and should be seen as a parallel priority to existing studies of excavated contexts, since resulting architecture maps and surface artifacts can inform questions driving future excavations, and assist in targeting the best strategic sites for answering those questions.

So far, ongoing surveys have concentrated on the semi-periphery areas inside the Tequila Valleys (Heredia 2008). These surveys are targeting a comprehensive view of the Valleys, and certainly should continue before peripheral areas are considered. Much of the core also remains undocumented, despite Phil Weigand's (1975,1985, among others) early survey efforts, and should be re-explored and the data made available via more detailed published reports. Eventually, architecture and artifacts which may be discovered in peripheral areas adjacent to the valleys and in the known peripheral guachimontones

may point to nearby external trade networks, and elemental sourcing techniques of external items can potentially confirm a role for Llano Grande in regional trade.

Finally, other guachimontón sites in both semi-periphery and core areas need to be explored on the same scale as Llano Grande and Navajas and with similar data to determine commonalities and differences between sites. Some evidence of variation in the proportions of lithic forms between different semi-peripheral areas has been briefly discussed within this thesis, and patterns of material culture variation within and between economic zones is another potential topic for exploration. Other sites within the hills west of the Magdalena Basin may have been the most frequent contacts with Llano Grande, and may be high on the priority list of sites to explore.

New Questions with Expanding Exploration

Expanding our scale of exploration into the periphery, and into other semi-peripheral sites can also inform additional questions about the nature of the relationships between core, peripheral, and semi-peripheral groups. What economic bases and strategies might be found in peripheral sites, and how do these areas interact with semi-peripheral and core sites? Do peripheral sites appear to benefit from their relationships with the core, or do they only become dependent as a result? Considering Stein's view of a variable periphery, how much variability do we see between different peripheral groups and their relationships with the core? What are the natures and purposes of peripheral guachimontones? Are corporate ideals of the core adopted by peripheries to some extent,

or do they partly mimic and reinterpret the corporate institutions of the core to fit their own economic circumstances?

Beyond the Tequila Valleys, this study may also have implications for other emergent complex cultures both within Mesoamerica, and throughout the world. Did other semi-peripheral areas challenge the core, both economically and ideologically through changing economic strategies? Variations in how economic strategies may have been altered in different areas may relate to such factors as differing environments, available resources, the economies of other peripheral groups and core ideologies.

Other Paradigms

The Tequila Valleys provide opportunities for the exploration of questions in other theoretical paradigms as well. Niche construction theorists are also interested in the impact of external environments on people groups, but may further ask the reciprocal question of what effects groups had on their surroundings. Together, these questions reveal the overall reciprocal effect of human-environment interaction within the Tequila Valleys. The effects of agriculture, human population expansion into the passes, and other architectural features such as terraces and walls are all important aspects of human niche construction that directly impact available resources. Cultural macroevolutionary theorists may explore the expansion of groups into the semi-periphery and periphery to determine whether patterns of material culture variation seen in culture expansions from other parts of the world (e.g. Chatters and Prentiss 2005) are seen among the sites established during the Early Classic expansion of the Teuchitlán culture, and how the

variation may be generated via cultural mechanisms. These are only a couple of examples of different theoretical directions that may find new ground in the relatively unexplored area of the Tequila Valleys.

The work required to address each of these questions is far-reaching in terms of labor and time investment, and requires a long-term view of research in the area. Each season will certainly bring us new and valuable insight into West Mexican prehistory, but goal-driven archaeological research in West Mexico can no longer afford the short-term, season-by-season view of investment and return, as the implications of economic patterns are far more complex than what can be derived from discrete views of ritual centers, and even whole sites.

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APPENDIX A

CARTA LAND USE AND SOIL MAP SECTIONS.

This appendix contains excerpts from the official Mexican government CARTA maps for soils, land use and geography. Soil unit definitions are from the Food and Agriculture Organization, and are described at http://www.britannica.com/search?query=FAO SOIL

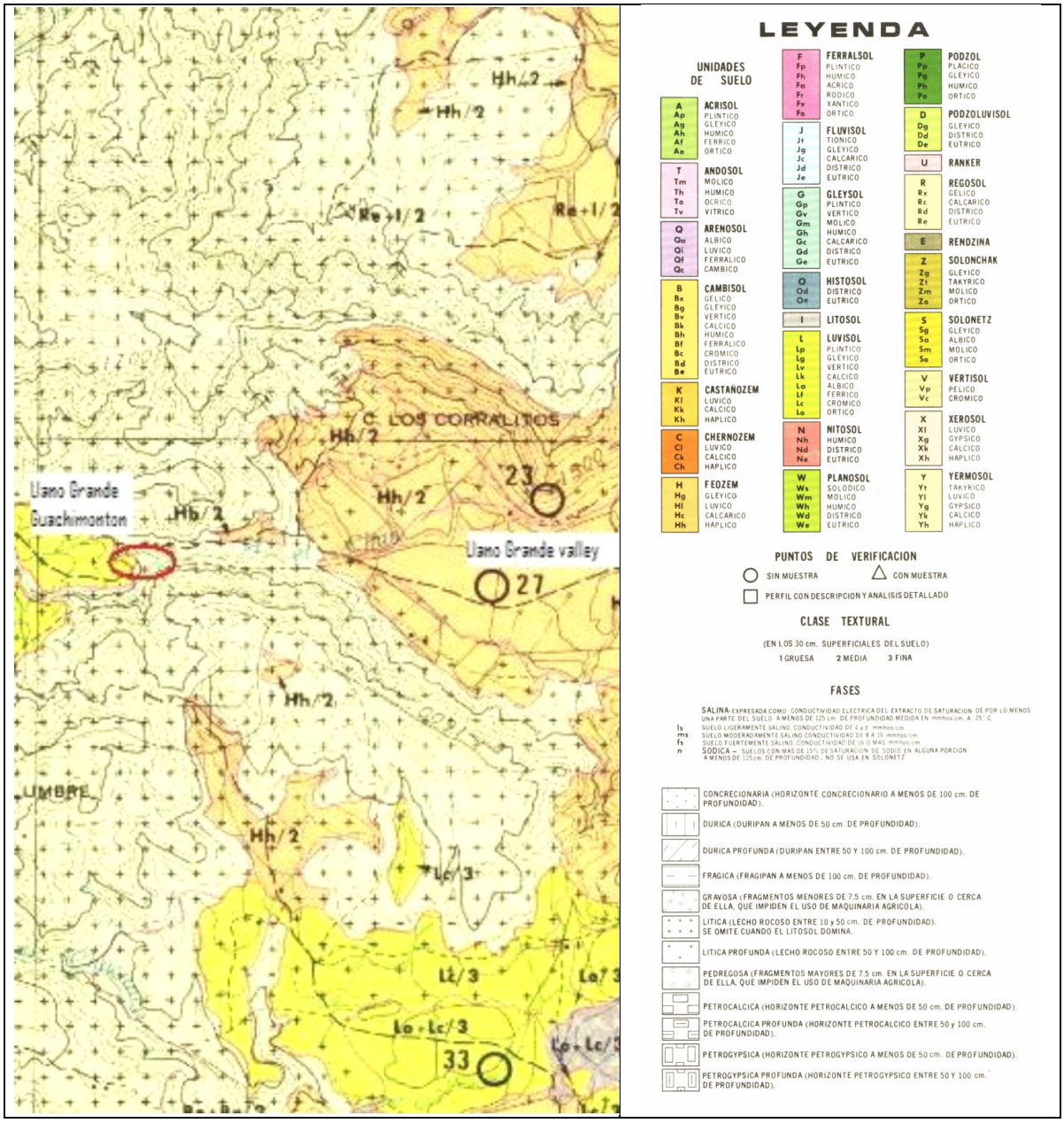


Figure A.1: Soil types around Llano Grande. From Carta Etzatlán F-13-D-53-e soil map.

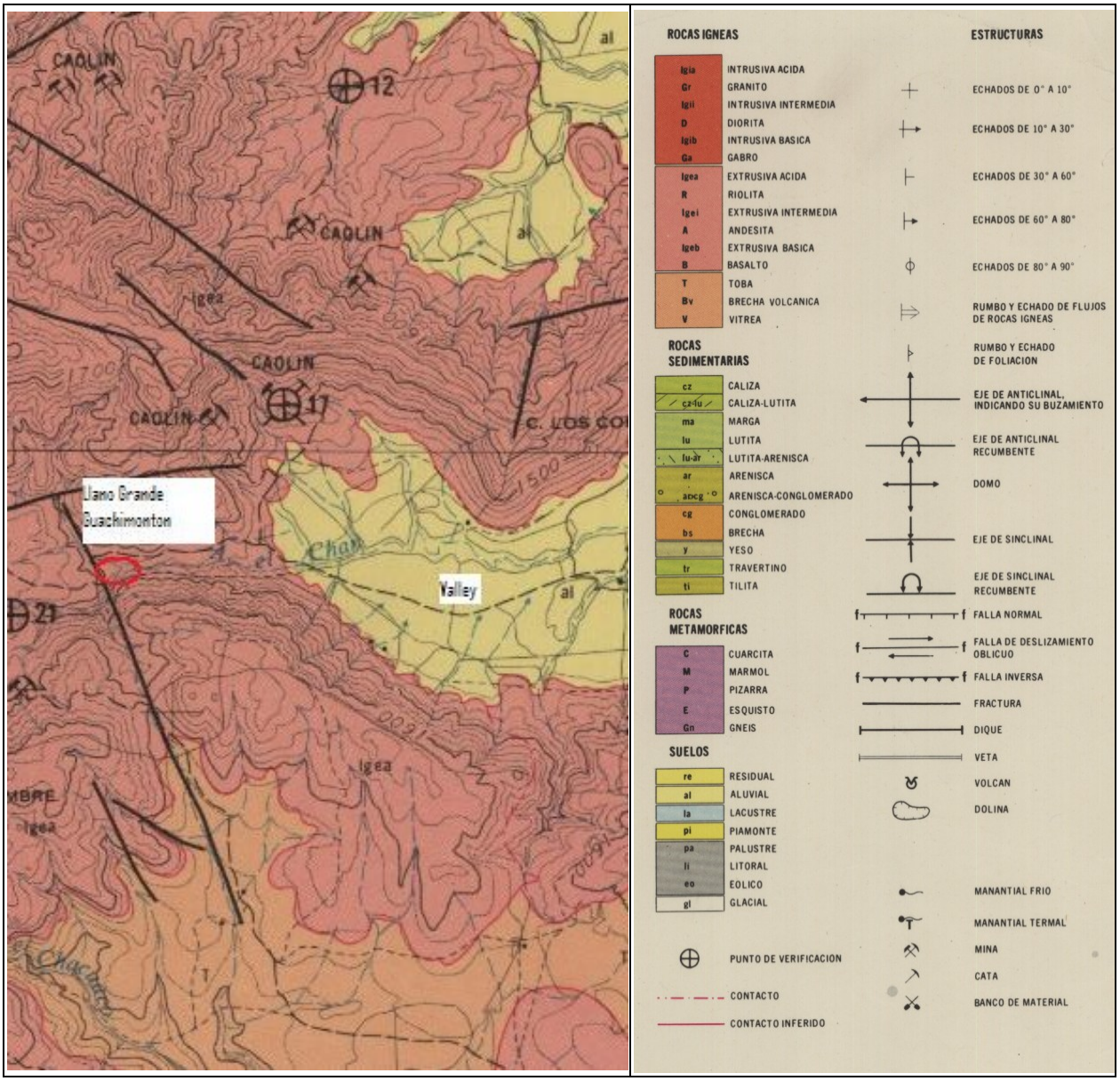
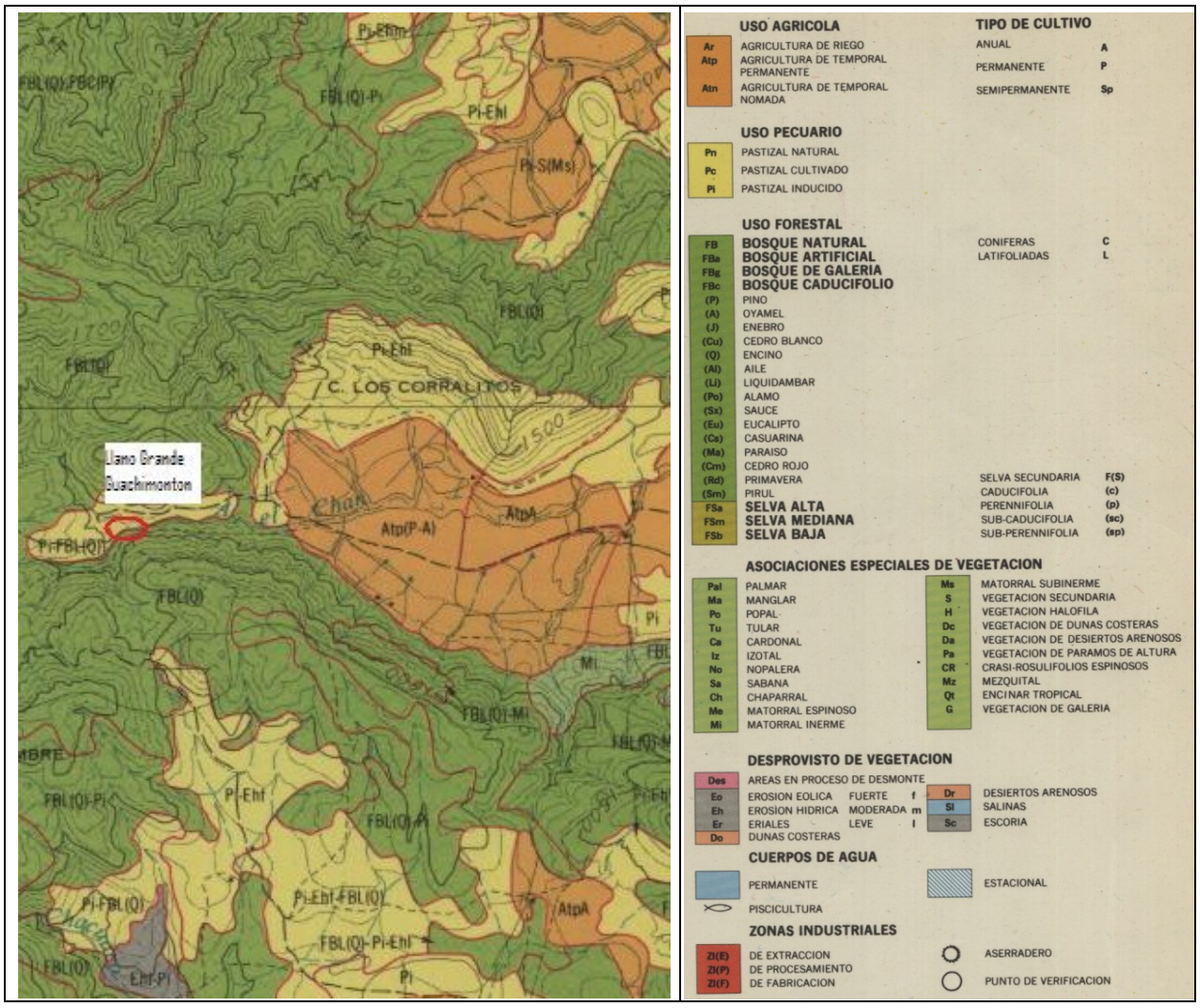


Figure A.2: Geology around Llano Grande. From Carta Etzatlán F-13-D-53-g geology map.



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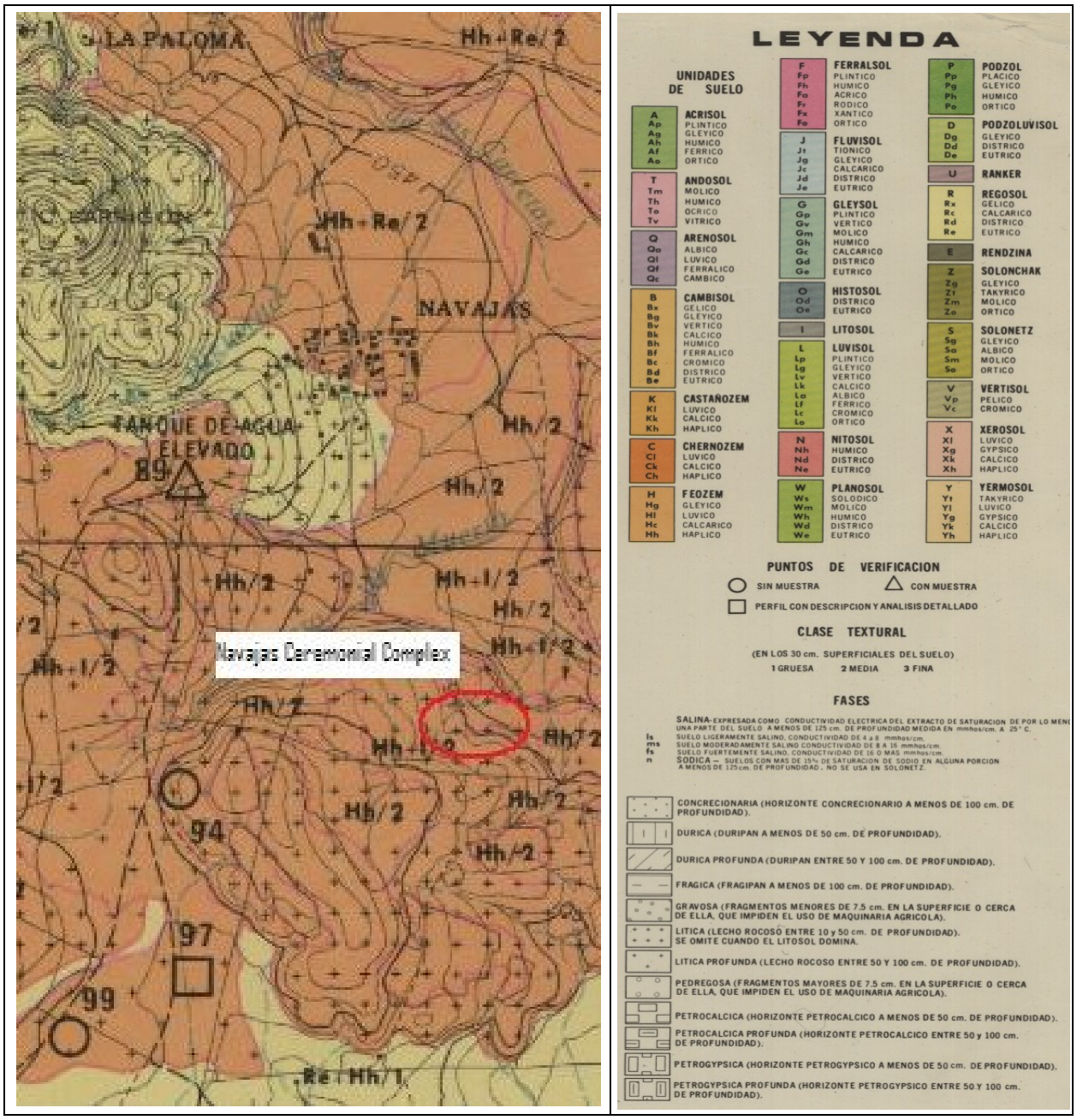

Figure A.4: Soil types around Navajas. From Carta Tala F-13-D-64-e soil map.

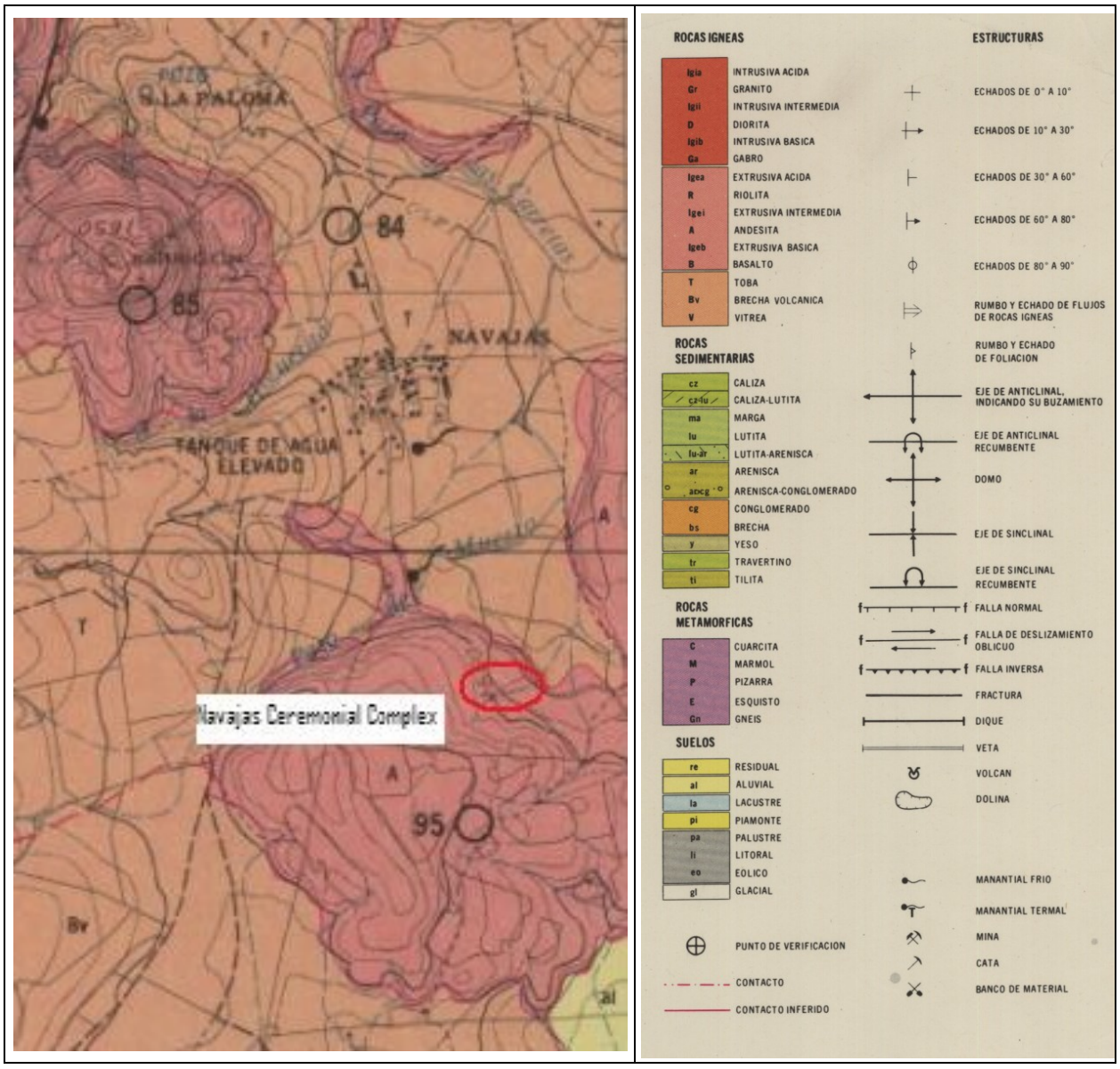

Figure A.5: Geology around Navajas. From Carta Tala F-13-D-53-g geology map.

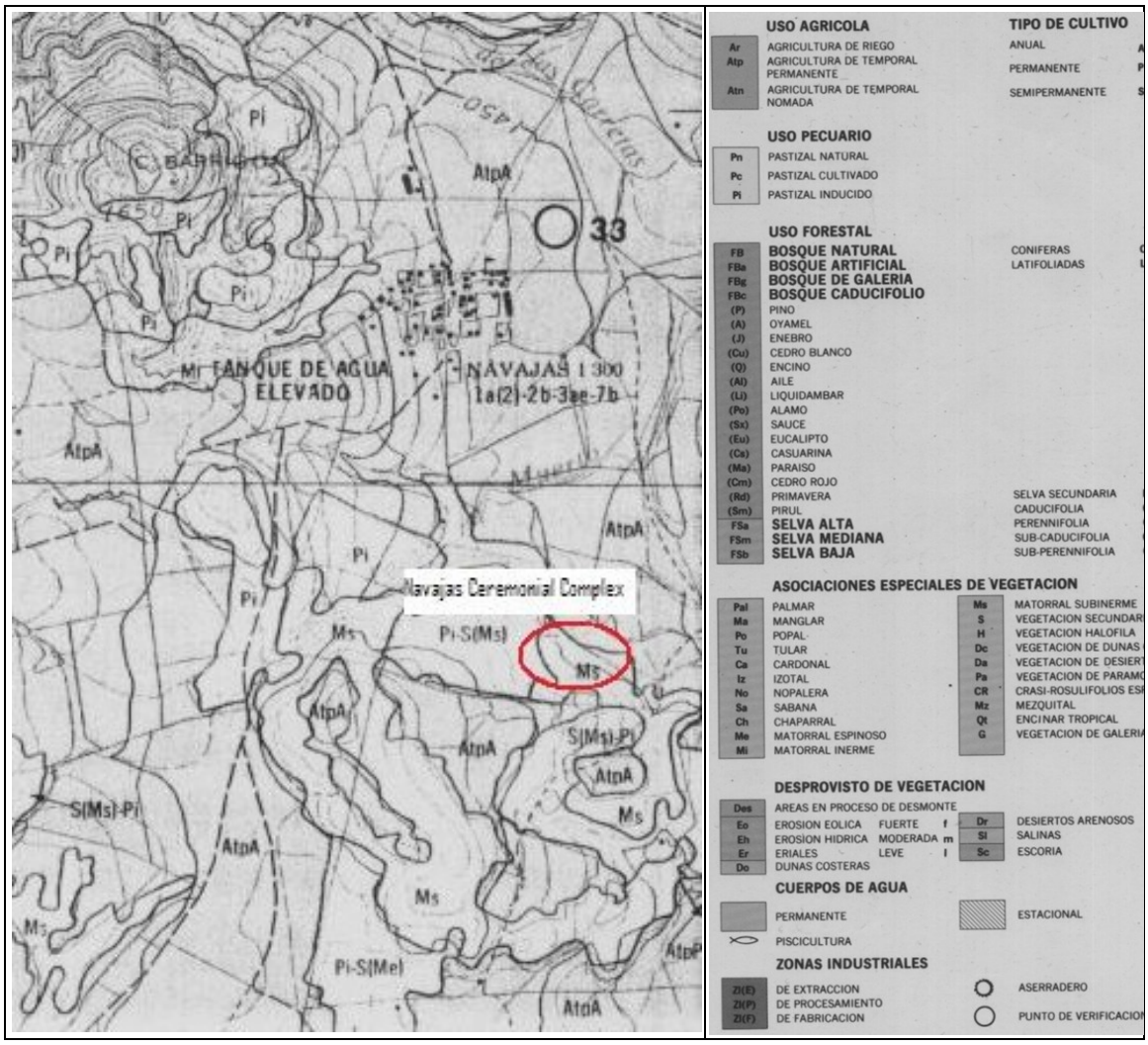

Figure A.6: Land use around Navajas. From Carta Tala F-13-D-64-u land use map.

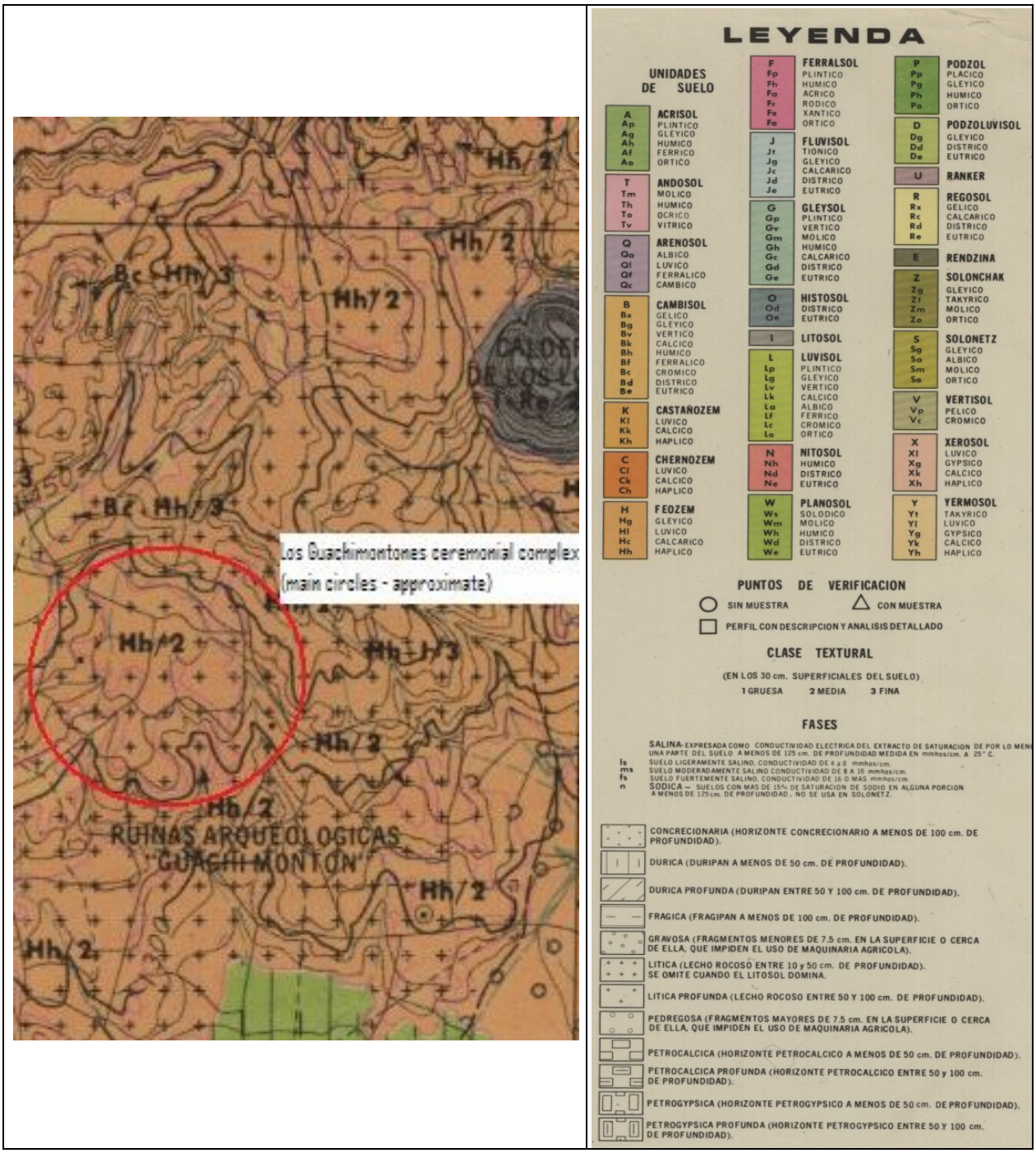

Figure A.7: Soil types around Los Guachimontones. From Carta Tala F-13-D-64-u soil map.

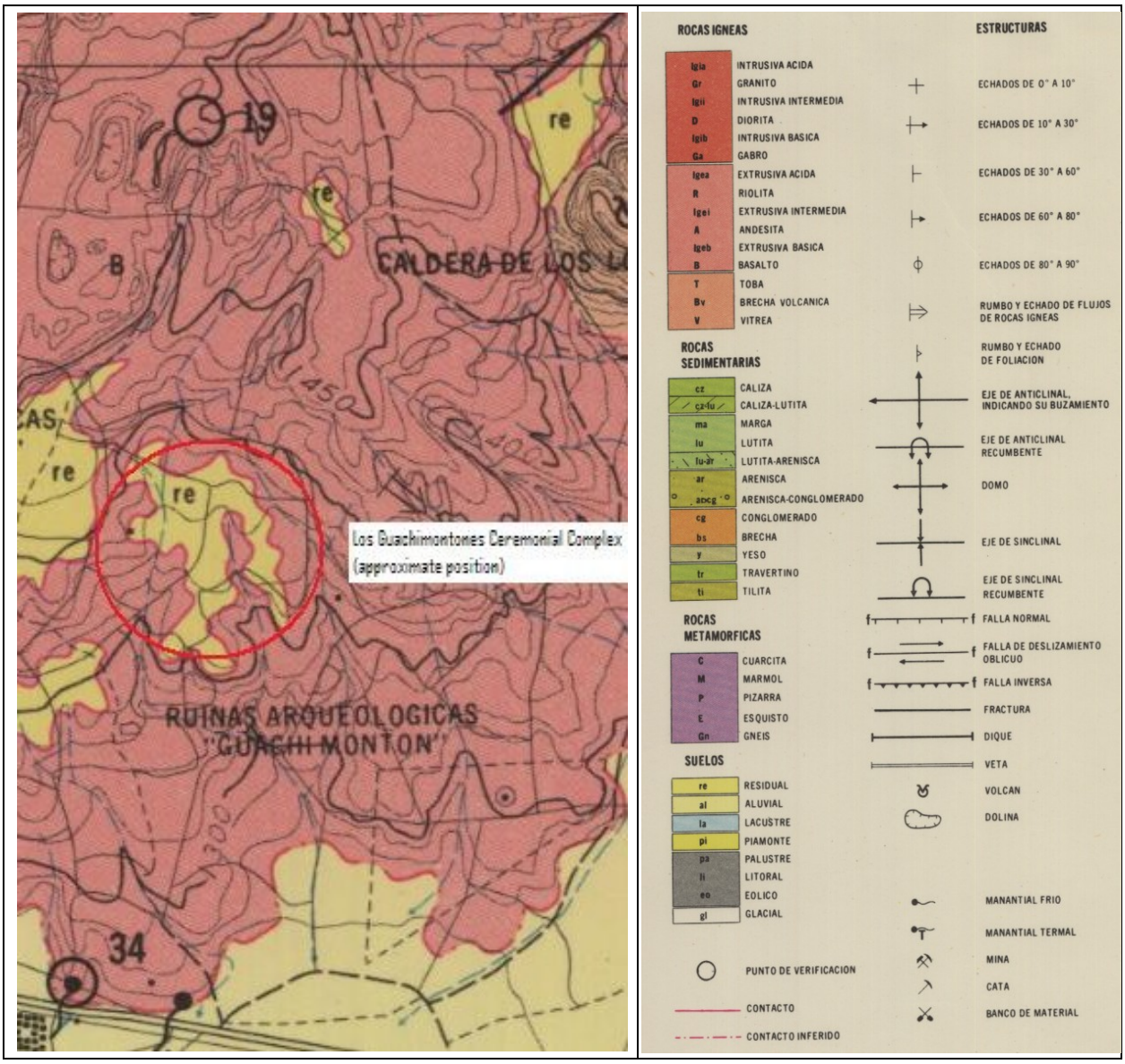

Figure A.8: Geology around Los Guachimontones. From Carta Tala F-13-D-64-g geology map

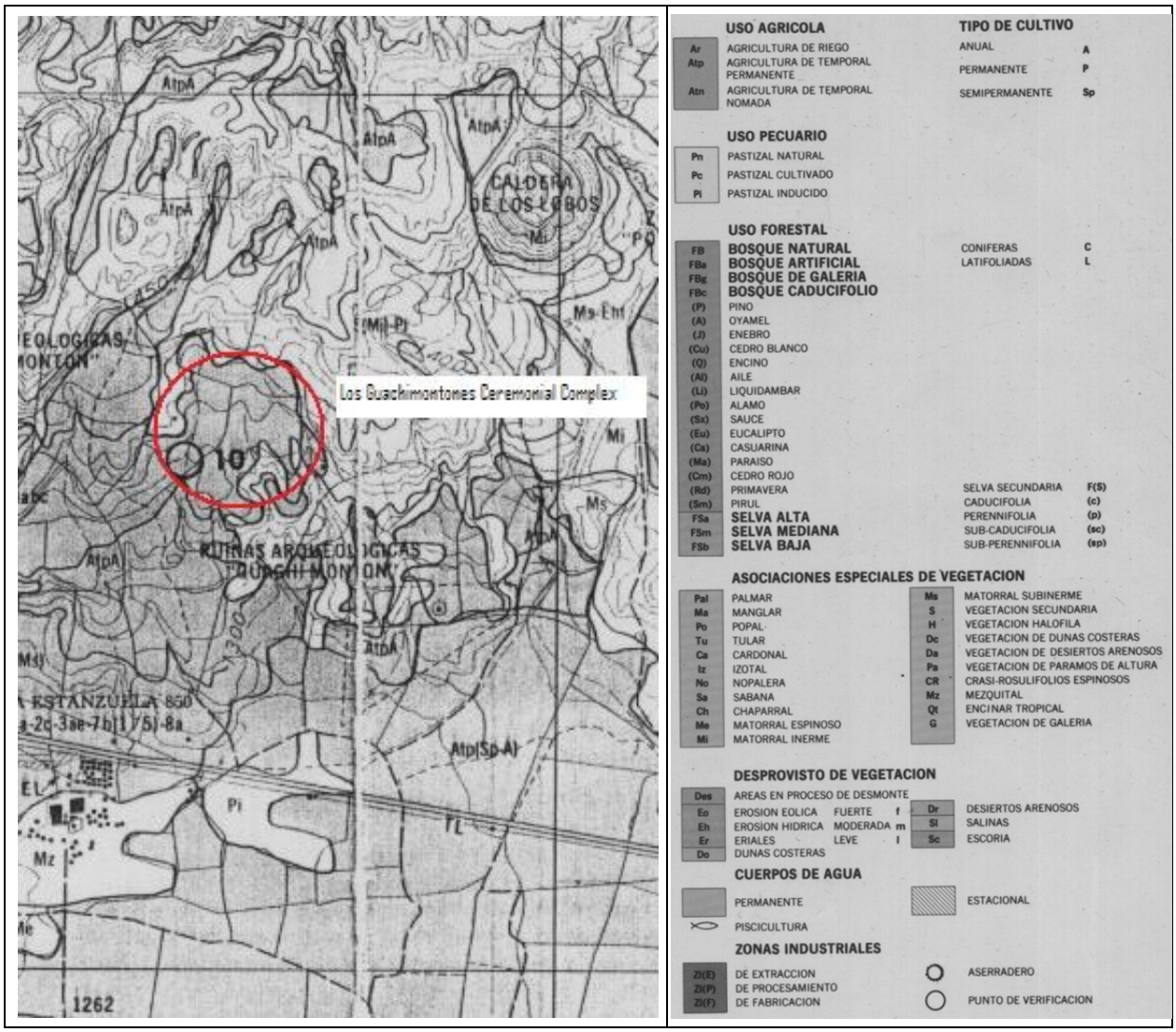

Figure A.9: Current land use around Los Guachimontones. From Carta Tala F-13-D-64-g geology map

APPENDIX B

SCATTERPLOTS OF SCAR COUNTS AND SIZE MEASUREMENTS.

All metric units are centimeters.

Chart 1: Length x width vs. scar count at Llano Grande

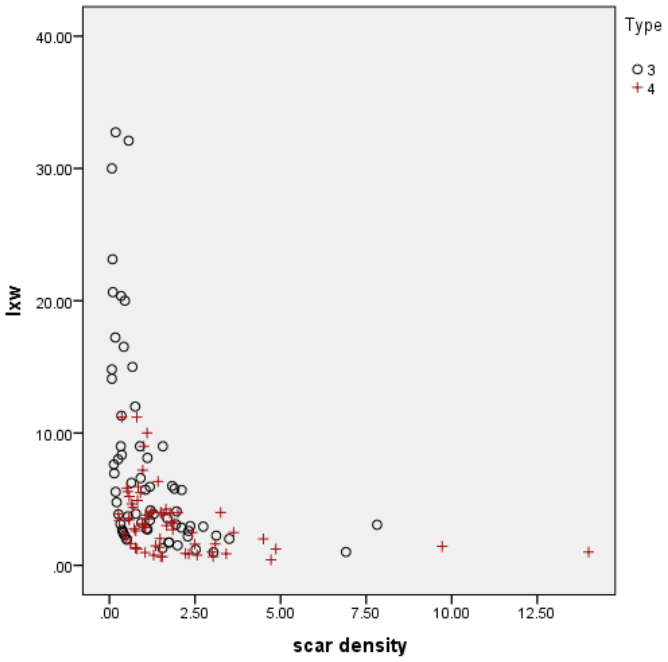

Chart 2: Length x width vs. scar count at Navajas

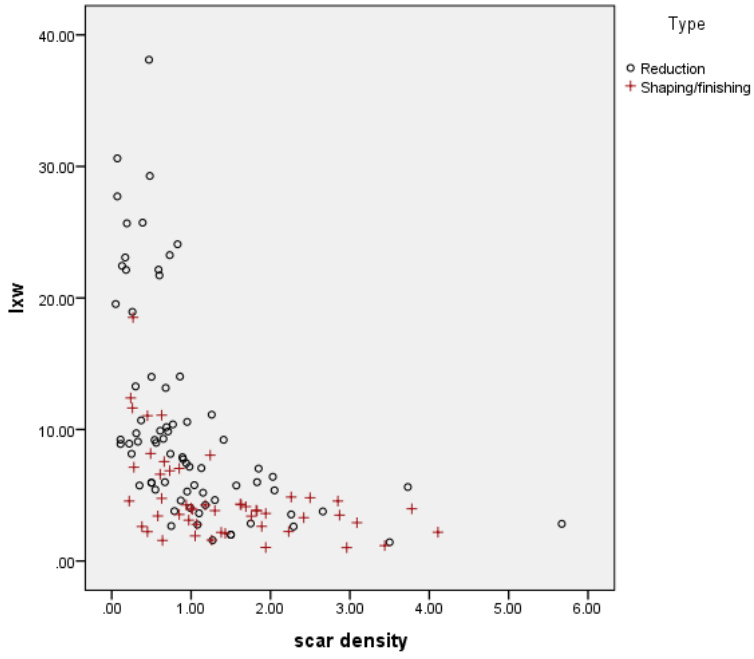

Chart 3: Length vs. scar count at Llano Grande

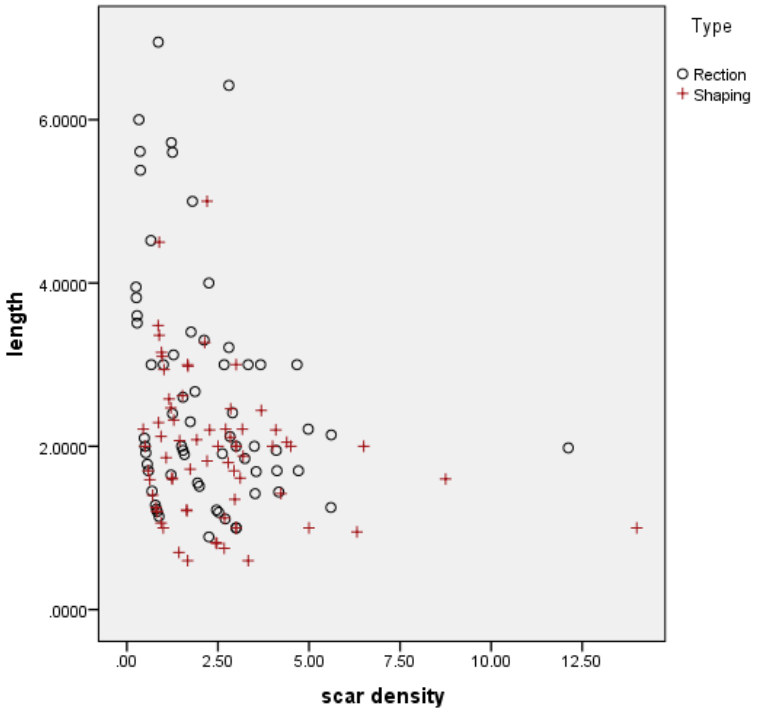

Chart 4: Length vs. scar count at Navajas

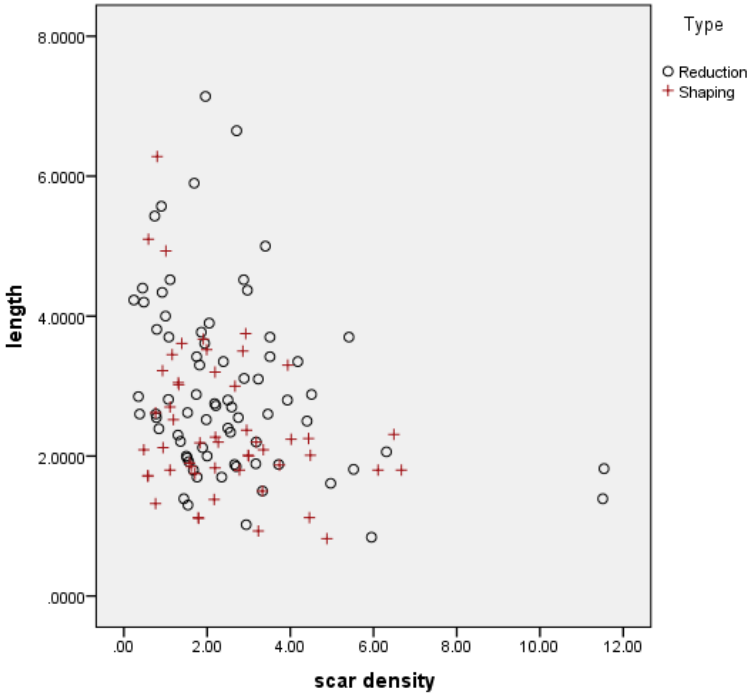

Chart 5: Width vs. scar count at Llano Grande

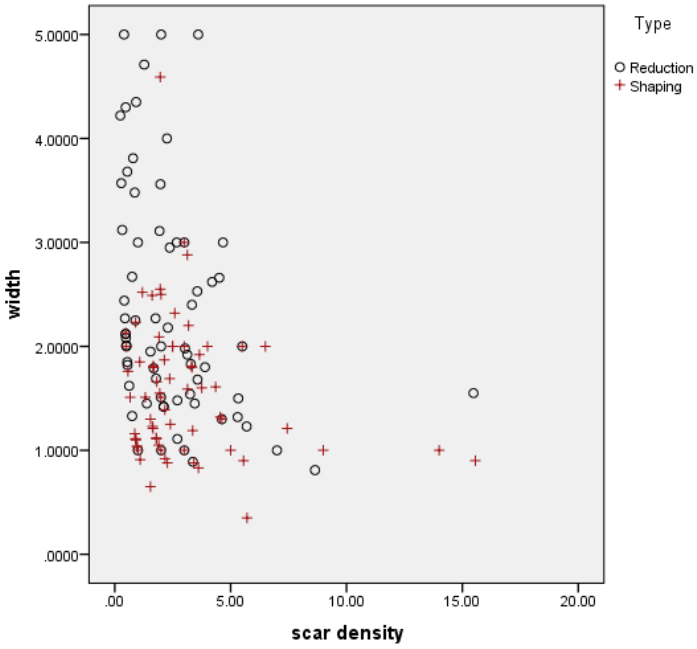

Chart 6: Width vs. scar count at Navajas