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Classic Period Dune Settlement in the Eastern Lower Papaloapan Basin, Southern Veracruz, Mexico

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CLASSIC PERIOD DUNE SETTLEMENT IN THE EASTERN LOWER PAPALOAPAN BASIN, SOUTHERN VERACRUZ, MEXICO

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Arts and Sciences at the University of Kentucky

By
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Lexington, Kentucky

Director: Dr. Christopher Pool, Professor of Anthropology

Lexington, Kentucky

2022

ABSTRACT OF DISSERTATION

CLASSIC PERIOD DUNE SETTLEMENT IN THE EASTERN LOWER PAPALOAPAN BASIN, SOUTHERN VERACRUZ, MEXICO

This dissertation is an archaeological investigation into the long-term settlement change of an ecologically distinct portion of the Eastern Lower Papaloapan Basin (ELPB) of southern Veracruz, Mexico, before, during, and after the fluorescence of the Tres Zapotes polity. This project examines the changing settlement history in an area of near-coastal paleodunes and estuarine lakes in the northern ELPB, addressing the question: "What processes account for variations in the distribution of occupation on the dune landscape through time?" I argue that the answer lies at the intersection of specific environmental, economic, and political factors in the ELPB over time.

KEYWORDS: Settlement Patterns, Classic Period, Mesoamerica, Paleodunes, Political Ecology

Kyle Edward Mullen

February 25, 2022

CLASSIC PERIOD DUNE SETTLEMENT IN THE EASTERN LOWER PAPALOAPAN BASIN, SOUTHERN VERACRUZ, MEXICO

By

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February 25, 2022

For my parents, Ed and Kathy Mullen

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AppendixA.xlsx Ceramic Data……………………..…………………..……..XLSX 13 KB

AppendixB.xlsx Obsidian Data…………………….…………………...……XLSX 27 KB

Chapter 1 - Introduction

This project was initially undertaken with the explicit aim of identifying and excavating an Archaic period site in the dune survey zone. As such, the methods of fieldwork described in this dissertation should be understood in that context. No Archaic site was discovered, contrary to expectations. However, a substantial Classic period occupation was identified and recorded during the dune survey.

Michael Coe (1965:679) commented that the area around El Mesón contained perhaps the greatest density of earthen mounds of anywhere in Mesoamerica. While further research has proven Coe's statement to not be entirely true, his overall point is still important. That is, that this stretch of southern Veracruz contains a largely under-explored archaeological record that can help answer some of the big questions in pre-Columbian history. With the exceptions of expeditions by Stirling (1940, 1943), Weiant (1943, 1952), and Drucker (1943, 1952), research in the Eastern Lower Papaloapan Basin (ELPB) has largely lagged behind the other Olmec centers of La Venta (Drucker, Heizer and Squier 1959) and San Lorenzo (Coe and Diehl 1980a; Coe and Diehl 1980b; Cyphers 1996, 1997a, 1997b; Cyphers and DiCastro 1996; Clark 1997, Symonds et al. 2002). Fortunately, this has begun to change in the past two decades as Pool (1998, 2007) and his students (Loughlin 2012; Pool and Loughlin 2015; Jaime-Riveron 2016) have expanded our understanding of the development, continuity and resilience of the Tres Zapotes polity and the surrounding region. Loughlin's (2012) survey research at El Mesón demonstrates how the secondary center in the ELPB transitioned from being subservient to, to independent from, Tres Zapotes. This project draws on political ecology and settlement ecology theoretical frameworks to better understand long-term settlement change in an area of near-coastal paleodunes and estuarine lakes in the northern ELPB, addressing the question: “What processes account for variations in the distribution of occupation on the dune landscape through time?” I ask, therefore, how did the political and economic landscape of the ELPB evolve in relation to the rise and resilience of Tres Zapotes? I argue that the answer lies at the intersection of specific environmental, economic, and political factors in the ELPB over time.

Research conducted in the Olmec heartland of Olman (Figure 1.1) has historically focused on early Olmec development and fluorescence. This emphasis on the Early and Middle Formative periods (ca. 1500 – 400 BC) led to much research and attention to the Olmec centers of San Lorenzo and La Venta. As our understanding of the Olmec culture has grown, so has an emphasis on the evolution of Olmec culture. Pool’s extensive research at Tres Zapotes demonstrates that the decline of Middle Formative La Venta did not entail a wholesale ‘collapse’ of Olmec civilization as some scholars have proposed (Bernal 1969; Diehl and Coe 1995; Diehl 1989). Instead, during the Late Formative (ca. 400 BC –AD 1) Tres Zapotes rises to become the dominant center in the region (Pool ed 2003). During this fluorescence of the Tres Zapotes polity, it rises to cover over 500 ha, roughly comparable to the size of Early Formative San Lorenzo (Pool 2007:247). Olmec culture from earlier centers evolves and becomes Epi-Olmec in the Late Formative, as Pool identifies new artistic styles that are thematically similar yet distinct from previous times (Pool 2000). Late Formative Tres Zapotes was the dominant political and economic center of the ELPB. Pool argues that at its peak, Tres Zapotes was governed by a group of elite factions represented by four architectural complexes that share a formal layout called the Tres Zapotes Plaza Group (TZPG) (Pool 2006:216; 2007; 2008). This power-sharing arrangement may have been a response to changes in the political structure brought on by the decline of other Olmec centers to the east.

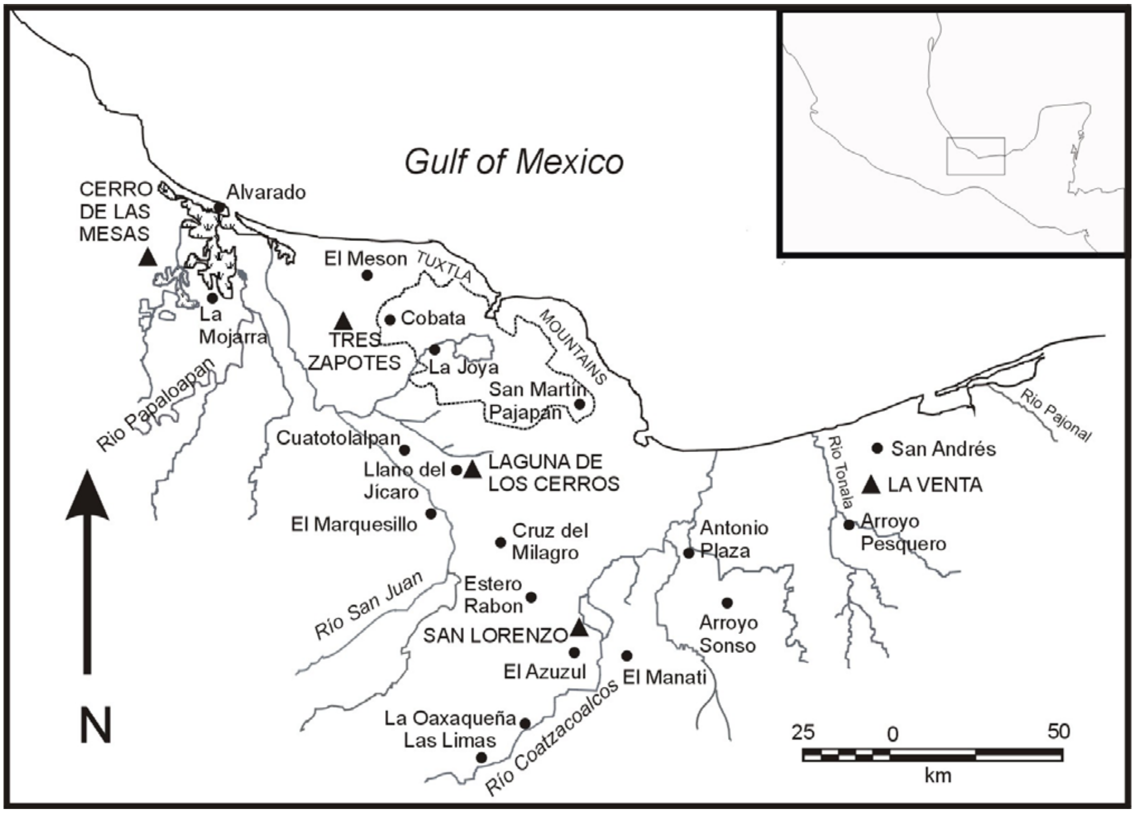


Figure 1.1. Map of Olman. Triangles represent large centers. Tuxtlas boundary indicated by dotted line (Pool 2007a:5, Figure 1.3).

While Tres Zapotes politically and economically dominated the ELPB, to the north, El Mesón rose in prominence during the Late Formative to become a regional secondary center (Loughlin 2012). El Mesón's status as a secondary center is reflected in the Tres Zapotes Plaza Group (TZPG) layout in its central core. By the Proto-Classic however, El Mesón's TZPG had been replaced by other layouts, suggesting a break in ties with Tres Zapotes as its power and influence waned (Loughlin 2012).

This project examines the long-term settlement change in an ecologically distinctive portion of the eastern lower Papaloapan Basin (ELPB) of southern Veracruz, Mexico, before, during, and after the fluorescence of the Tres Zapotes polity. More specifically, it examines the changing settlement history in an area of near-coastal paleodunes and estuarine lakes in the northern ELPB. To address the bigger questions posed in this project, the survey needed to collect data to answer specific questions about the area: 1. How many architectural features and concentrations are found in the survey universe? 2. When did settlement occur in the survey zone and how did it change through time? 3. How are features distributed in the survey universe and how are they associated with one another? 4. And lastly, how does settlement on the dunes compare to other regions in southern Veracruz?

Environment

This dissertation examines 14 square kilometers of coastal paleodunes and near-dune landscapes to understand long-term settlement change in the northern ELPB (Figure 1.2). The dunes are located approximately 8 kilometers north of the modern town of Angel R. Cabada.

The ELPB contains a great deal of ecological diversity with elevations rising to 800 meters above sea level at the peak of Cerro el Vigia. The mountainous eastern region of the ELPB grades westward into piedmont, plains, and finally, swampy wetlands closer to the Papaloapan River (Figure 1.2). The variation in regional topography impacts annual precipitation levels. Rainfall on the northern slopes of the Tuxtla Mountains exceeds 4000 millimeters annually in some places while a rain shadow effect on the plains lowers totals to less than 1700 millimeters (Gómez Pompa 1973; Vivó Escoto

1964). Uplift associated with the emerging Tuxtla Mountains landscape has pushed ancient buried sediments to the surface, resulting in diversity of both bedrock formation and soil types (Pool 1990). All of these factors have led to a rich, ecologically dynamic environment with variation in potential for resource exploitation.

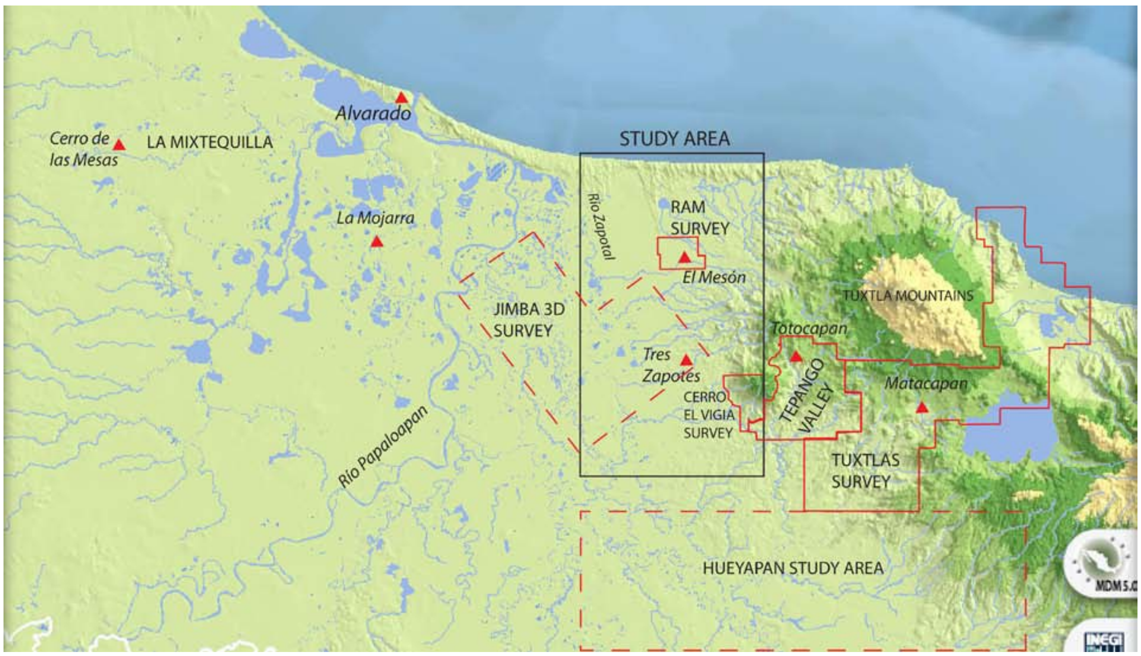
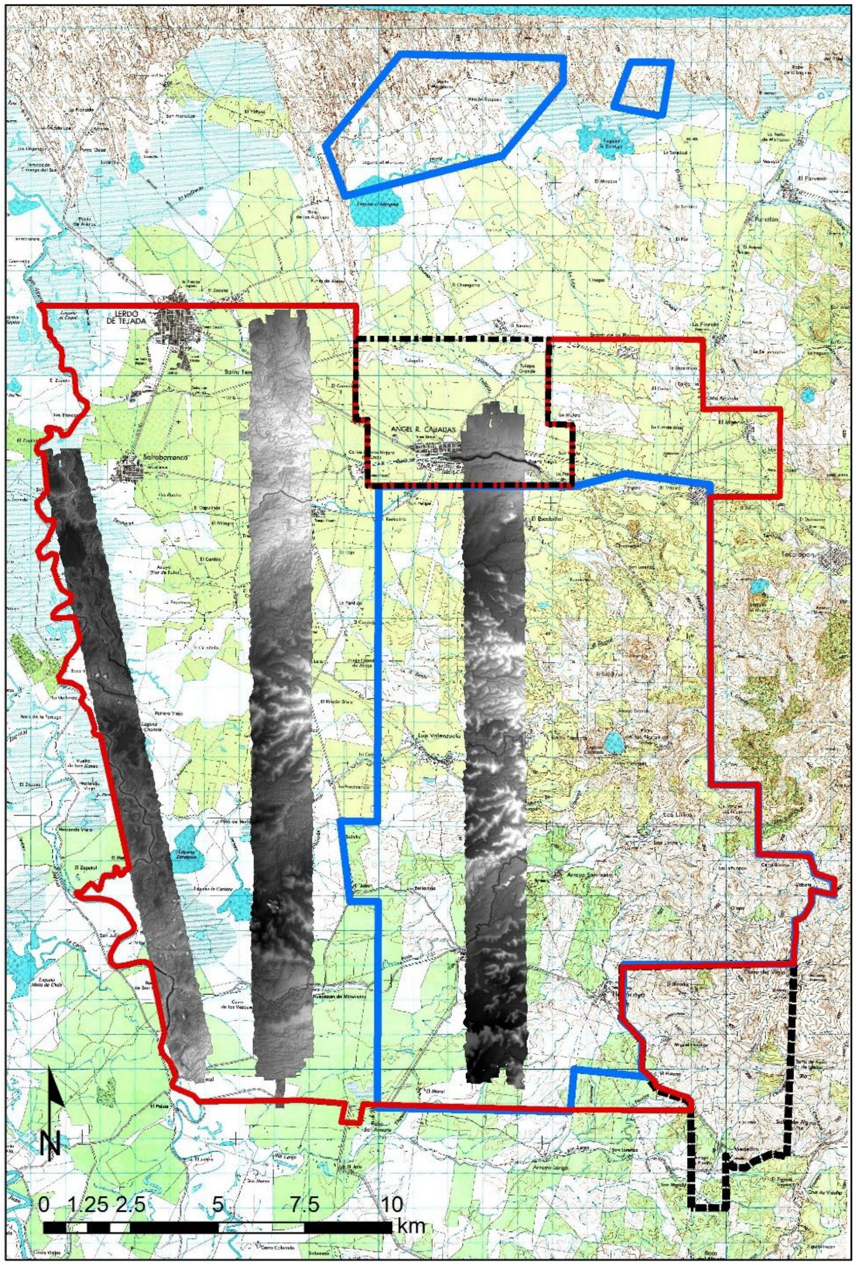


Figure 1.2. Map of the ELPB with Survey Projects (Pool et al. 2015:2).



The survey area for this project is primarily composed of consolidated

longitudinal sand dunes along the coast of the Gulf of Mexico, north of Angel Cabada, Veracruz (Figure 1.3). The sand dunes in this study are part of a larger system that continues northwest along the coast. Sluyter's (1997) analysis of the dune system suggests that the dunes were formed by storms called *nortes* (northers). These northers bring high average wind speeds to the coastal region during the dry season, between October and April (Sluyter 1997:132). Fast moving and intense, these storms are able to transport considerable amounts of sand, uproot plants, and create new coastal dunes (Siemens et al. 2006; Sluyter 1997). Sluyter's hypothesis suggests that longitudinal dunes in central Veracruz formed during the postglacial transgression, starting at approximately 19,000 BP (Pirazzoli 1993). In the model, rising sea-levels over time eroded the central Veracruz shoreline that was about 30 km north of its current position. With wind conditions similar to those of today, successive belts of longitudinal dunes formed. Each eroding longitudinal dune contributed sand to the next as transgression continued (Sluyter 1997:132). Transgression rates slowed around 7000 BP leading to the reduced erosion of the dunes. Since 7000 BP, the dunes in the study area have been stabilized with vegetation.

The consolidated dunes in the study area rise to upwards of 100 meters in height in some locations. Many of the people living on the dunes today have cleared trees and shrub vegetation to let animals graze in pasture. Other residents utilize the thin soils for agricultural purposes. On the landward side of the dunes are two lagoons, Laguna Marquez and Laguna Tortuga, located on the southern boundary of the survey zone (Figure 1.3). These lagoons contain water year-round, though they increase greatly in size during the rainy season. High-water levels during this time bring salt-water aquatic resources (e.g. snook) into this estuary environment, along with migratory birds and various terrestrial animals. During the dry season, the lagoons reduce in size allowing local ranchers to graze cattle and horses on previously inundated land. This survey project was initially developed with the goal of identifying Archaic period hunter-gatherer sites. The dune and near-dune landscape was selected for survey due to its elevated location adjacent to a highly productive estuary environment, ideal for hunter-gatherer occupations. The importance of aquatic resources to the Olmec diet has been documented by VanDerwarker (2006) and Wing (1980).

RRATZ Survey

During the Summer 2014 field season, initial pedestrian survey was conducted on a series of coastal paleodunes in the northern ELPB. Located adjacent to Laguna Tortuga and Laguna Marquez, these dunes were chosen because of their likelihood of containing Archaic period (ca. 8000 – 2000 BC) materials. These dunes were likely consolidated, with vegetation taking root, by the Middle Archaic period (5000 BC) (Sluyter 1997). It was thought that consolidated dunes, safely elevated from the floodplain below, and near rich aquatic resources could contain Archaic period archaeological sites buried just beneath the present ground surface. The idea was that ancient land surfaces were close to the modern surfaces on the dunes. This contrasts with the alluvial bottomlands that cover much of the ELPB, where Archaic surfaces are likely buried 6 to 9 meters beneath modern surfaces. Killion's (2013) Hunter-Fisher-Gardener (HFG) model for Late Archaic and Early Formative subsistence was used in part to select these dunes due to their location in an area with abundant aquatic and terrestrial resources. Killion notes that the earliest microbotanical materials recovered in the southern gulf lowlands were found in areas with abundant aquatic resources. It was these factors that led the Tres Zapotes

Regional Archaeological Survey project (RRATZ), led by Dr. Christopher Pool and Dr. Michael Loughlin, to select the dunes as part of the survey universe.

Within the survey zone, locations with greater than 20% slope were not surveyed as the landscape would have been unsuitable for ancient campsites. Crews conducted pedestrian survey at 20 meter intervals. In areas of pasture, where surface visibility was minimal, crews conducted shovel tests at 20 meter intervals. Shovel-testing followed INAH-approved guidelines as holes were limited to 30 cm. in diameter and 20 cm. in depth (Pool and Ohnersorgen 2003; Stoner 2011). All mounds identified during survey were recorded with handheld GPS units, taking corner and summit points. The surface collections and shovel probes were conducted in order to obtain stylistically datable artifacts as well as to identify potential craft production areas associated with sites. At sites or mounds with good surface visibility, all rims and decorated ceramic sherds were collected. A central point of the collection area was recorded with handheld GPS units and the dimensions of the collection area were recorded in fieldnotes (Stark 1991; Loughlin 2012). When available, 100 rim or decorated sherds were collected. In reality, the majority of mounds and sites did not contain 100 rim sherds. In these cases, all rim sherds were collected and supplemented by the collection of body sherds.

A total of 14 square kilometers of dunes and adjacent lowlands were surveyed in the course of the project. Archaeological features from all time periods were recorded and mapped using GIS software. A representative sample of 100 ceramic rims and decorated sherds were collected from the surface of each site/mound, when possible. Surface visibility varied greatly between sites/mounds, with planted fields having better visibility than pasture. In pasture settings with identified sites, shovel testing was conducted at 5-

meter intervals in order to obtain artifacts for relative dating. Auger tests were periodically utilized to evaluate depth of deposits adjacent to isolated mounds or at plazas of identified mound groups. Obsidian and groundstone tools were also collected.

Organization of this Dissertation

The following chapters present the findings of the dune section of the broader RRATZ survey project, headed by Dr. Christopher Pool and Dr. Michael Loughlin. Chapter 2 describes in greater depth the physical environment of the survey zone. First, I describe the dune environment where the survey took place, including its modern condition as well as the long-term geomorphological processes that formed the paleodunes. Next, I position the dunes in the broader context of the ELPB environment and physical geography. Finally, I position the impact that the diverse ecological setting could have had on human populations and settlement through time.

Chapter 3 outlines the political ecology and settlement ecology frameworks utilized for this project. Both political ecology and settlement ecology perspectives emphasize a strong focus on past environmental conditions to interpreting the archaeological record. I trace the history of the theoretical trajectories of each of these perspectives. I then discuss how a political ecology framework has recently been applied to the archaeological record. Important for this project, I discuss how political ecology lends itself to emphasizing ‘bottom-up’ perspectives in the archaeological record. Settlement ecology seeks to identify the causal factors that determine how settlement patterns change over time. Settlement patterns in the archaeological record are a palimpsest of complicated decisions made by people of the past to navigate complex political, economic, and environmental factors.

Chapter 4 outlines three primary scenarios for Classic period dune settlement grounded in a political ecology and settlement ecology framework. The scenarios broadly consider various *push* or *pull* factors that may have influenced dune settlement over time. Within each scenario, a nested hierarchy of hypotheses are developed along with the data required for evaluation. I justify the rationale for each hypothesis and explain how they will be rejected.

Chapter 5 details the methodology employed for this study, both during fieldwork and analysis in the lab. I start by describing the pedestrian survey methods used to record and collect surface artifacts. I explore and justify why certain methods were preferred over other alternatives. Particular attention is given to the rationale behind utilizing a siteless, full-coverage survey approach in the field. This chapter also details the laboratory methods used to analyze and classify ceramics, lithics, groundstone, special objects, and daub.

Chapter 6 presents an analysis of the artifacts collected in the survey. Much attention is paid to the ceramics collection. This data includes an examination of diagnostic ceramics and how it was determined that the dunes were primarily occupied during the Classic period. This project follows the ceramic typology developed at Tres Zapotes (Ortiz 1975; Ortiz and Santley 1988; Pool 1997, 2010). In addition to ceramics, lithic materials, special objects, figurines, groundstone, and daub are all discussed in this chapter.

Chapter 7 presents an analysis of settlement data. This data includes details on the relative timing of mound group occupations as determined by surface artifacts. The data shows that the dunes were occupied as early as the Early Formative and continued to grow in settlement throughout the Formative Period. The dune occupation hit its zenith during the Early Classic before declining in the Late Classic. By the Post-Classic, the dunes are barely occupied.

Chapter 8 discusses settlement and artifact data to evaluate the scenarios and hypotheses outlined in Chapter 4. I frame the data within the broader issues concerning the ELPB and Mesoamerica and postulate why settlement occurs when it does within the survey zone.

Chapter 2 - Physical Environment

The 14 square kilometer dune and near-dune survey zone is located within the Eastern Lower Papaloapan Basin (ELPB), approximately 8 km north of the modern town of Angel R. Cabada, Veracruz (Figure 2.1). The survey zone lies on the landward side of the coastal dunes and encompasses a lacustrine and estuarine environment.

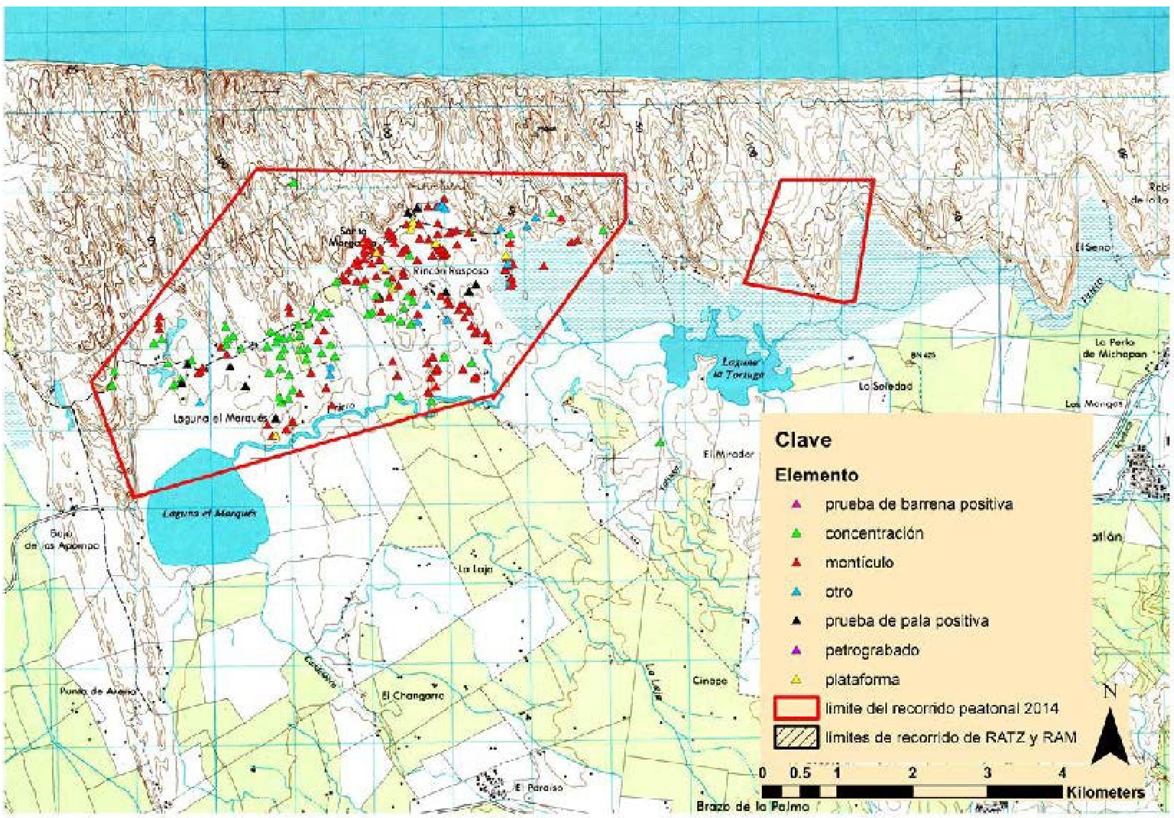


Figure 2.1. Map of Dune Survey Zone with Features (Pool et al. 2015:4). Punta de Arena is seen near the bottom left side of the map.

The main dune road is accessible through Punta de Arena. This road provided us access to the survey zone and is generally passable with a four-wheel drive vehicle. Heading east from Punta Arena, the population becomes more sparse as the road becomes less passable. Driving further east, the road becomes sandier. At a certain point, walking and horseback become the preferred method of transportation. In fact, on our first scouting trip into the dunes, our truck got stuck in the loose sand. Luckily, local residents are well adept at getting stuck vehicles out of the sand! During heavy rain, the main road often becomes impassable. Small trucks can traverse the dune road to deliver snacks and drinks to *tiendas* in a few of the small dune communities. One crew member remarked that he had seen a person who had disappeared from Cabada and nobody knew where he was. All of this speaks to the general isolation of the modern population living on the dunes, even from nearby communities such as Angel R. Cabada and Lerdo.

Though it is a rural population, there are plenty of people that live on the dunes. This includes a few small villages on the western portion of the survey zone (Figure 2.1). In many parts of the survey zone, naturally occurring trees and scrub vegetation has been cleared to promote grass for cow pasture. Cacti are common on the dunes as are a host of other prickly bushes (Figure 2.2). Some dune residents utilize the thin dune soils for agricultural purposes (e.g. sugar cane). Just south of the dunes are Laguna Marquez and Laguna Tortuga which make up an estuarine environment. While these lagoons are wet year-round, they expand significantly during the wet season. Local residents describe how salt-water fish from the Gulf enter these lagoons when water levels rise with the rains. During the dry season, saturated land retreats, allowing dry land for horses to graze (Figure 2.3).

Figure 2.2. Photo on the Dunes Showing Cacti and Pasture (photo by author).

Figure 2.3. Horses graze on seasonally dry land near Laguna Marquez (photo by author).

This chapter examines the physical environment of the survey zone. First, I describe the historic climatic changes that were occurring in ancient Mesoamerica and the New World during the Holocene. Next, I examine dune formation processes with specific attention to the longitudinal dunes in the study area. Thirdly, I examine the impact eolian activities have on the archaeological record. Lastly, I explore the flora and fauna of the region.

Archaic Period Climate Change

A large chunk of the Archaic period (8000 – 2000 BC), which marks a transitional time in the prehistory of Mesoamerica, coincides with the Holocene Thermal Maximum (HTM). This 5,000 year period of warm, moist, stable air conditions throughout the New World tropics ended at approximately 3000 BC (Haug et al. 2001). It is during this time that forests expanded broadly throughout tropical lowland Mesoamerica. Neff et al. (2006) suggest that this expansion of forests set the stage for conditions that would favor horticulture over hunter-gathering. Changing climatic conditions likely had a profound effect on the evolution of Mesoamerican cultures.

Records form the Cariaco Basin, off the coast of Venezuela, are able to provide comparable climatic records to the data available in Mesoamerica. The Cariaco Basin is significant because it documents the movement of the Intertropical Convergence Zone (ITCZ). The ITCZ impacts the climate in Mesoamerica. Cores taken at Cariaco (Peterson et al. 1991) support Haug's analysis that warm, moist stable conditions persisted until around 2000 BC. Neff et al. (2006) conducted environmental reconstructions in coastal Guatemala. Using a coring program (MAN015), they recovered pollen and phytoliths from this time period. The data also correlates with the moist period that continued till around 2000 BC. The authors did note that a dry episode appears to have occurred between 3000 BC and 2750 BC.

Conditions appear to change after 2000 BC. Both coastal Guatemala and the Cariaco Basin experienced a series of extreme dry events in the 2nd millennium BC. The most extreme dry event occurs from 2000 BC to 1800 BC, with the last 50 years showing the worst of the drought. Haug et al. (2001) show that low titanium coincides with dry periods, as titanium comes from sediment washed into the basin from South America. Higher titanium levels equate to more runoff, and thus, more rain. The lowest levels of titanium between 9,000 BC to the Little Ice Age (1350 AD) are found in this dry event at 2000 BC. It is worth noting that a very dry period in Mesoamerica coincides right as the Archaic Period is transitioning into the Initial Formative.

Examining deep sediment cores from Lake Peten Itza in Guatemala, Hodell et al. (2008) notice that alternating wet and dry conditions are prevalent in the last 10,000 years of the Pleistocene before getting into a more consistent warmer, wetter environment in the Holocene. Dunning et al. (2015:169) note that “Extreme aridity is clearly associated with Heinrich Events and cold sea surface temperatures in the North Atlantic, reduced circulation and the southward displacement of the Intertropical Convergence Zone (ITCZ).” In the Basin of Mexico, paleosols found in the context of a paleolake show drying conditions in the early Holocene give way to wetter conditions in the mid-Holocene. In the late Holocene, the dry conditions return (Sedov et al. 2001). Climate conditions in the Holocene, overall, experience variability in rainfall. The wetter mid-Holocene gives way to drier conditions around 2000 BC. Hodell et al. (2001) have proposed that short term fluctuations in rainfall may have been driven by the 208 year solar output cycle.

Pacific climate patterns began to influence Caribbean weather patterns in the mid-Holocene. El Nino-Southern Oscillation (ENSO) cycles gained greater influence during this time. Correlating with ENSO is a general decrease in precipitation. ENSO cycles are most apparent in western and central Mexican lakes (Metcalfe and Davies 2007). Historical documents dating from 1450 to 1900 AD show correlation between ENSO events and droughts in these regions (Mendoza et al. 2006).

Climate Change in Mesoamerica

The last two decades of research has expanded our understanding of both climate variability and environmental reconstructions in ancient Mesoamerica (Ortega et al. 2006; Lozano-Garcia et al. 2007b; Lozano Garcia et al. 2007a; Goman and Byrne 1998). The Maya lowlands is one region where much of the research has concentrated. Some scholars have argued that drought was a primary reason for the decline of many Maya capitals at the end of the Classic period (Hodell et al. 1995; Haug et al. 2003; Gill 2007). This research has been criticized as being environmentally deterministic and does not account for all the archaeological data. Arthur Demarest et al.'s (1997) and Demarest's (2004) work with the Vanderbilt Petexbatun Project complicates the idea of a Maya collapse primarily caused by drought. Demarest points to Punta de Chimino, a peninsula site that projects into Lake Petexbatun. Punta de Chimino was defended by three concentric moats that turned the site into an 'island', isolated from the mainland. These moats also protect the gardens that fed the population of Punta de Chimino. While many other sites in the Petexbatun region fell into disarray by 830 AD, Punta de Chimino, in its well-defensed position, continued to construct architecture and survived until 950 AD. While other Maya centers were collapsing, Punta de Chimino was growing.

Demarest et al.'s (1997) research demonstrates that the collapse of the Classic Maya was variable and non-linear. It also shows the need for paleoecological reconstructions to continue to look for, and incorporate, variation found around different regions of Mesoamerica. Research must be conducted that links broad scale climate trends with localized realities found in the archaeological record.

Veracruz

Closer to the survey zone for this project, a handful of core samples taken from around the nearby Tuxtla Mountains provides an understanding of past climate conditions and change. In particular, pollen, charcoal and other minerals recovered from the lakes Lago Verde and Laguna Pompal have allowed scientists to link climatic changes with the archaeological record. By understanding past climatic events, happening both locally in southern Veracruz and more broadly throughout Mesoamerica, it makes archaeological interpretations of cycles of abandonment and occupation more robust.

Ortega et al. (2006: 445) compare rock magnetic properties with geochemical data from Lago Verde in an effort to reconstruct paleoclimatic shifts associated with the Classic Maya collapse, the Medieval Warm Period (950-1350 AD), and the Little Ice Age (1400-1800 AD). Lago Verde is a closed-lake basin located on the eastern edge of the ELPB in the Tuxtla Mountains. Lago Verde is also a maar, formed when magma contacts the water table, creating an explosion of steam. The comparison of magnetic and geochemical data has been applied where ratios of immobile elements (Ti, Zr) and Fe were utilized to detect post-depositional dissolution of magnetic minerals and changes in detrital input (451). Ortega et al.'s (2006) pollen data corresponds with data from Laguna Pompal and Lake Punta Laguna (in the northern Maya area). It is argued elsewhere by Hodell, that favorable, wet climatic conditions between 550 and 750 AD allowed for Maya populations to increase in size to their maximum capacity. Multiyear drought events that occurred from 750-950 AD may have contributed to the Maya collapse. The Lago Verde data contradicts this hypothesis as relatively dry conditions in the Gulf lowlands occurred between the Late Formative and Middle Classic (456). Conversely, *high lake levels and forest recovery at Lago Verde and Laguna Pompal after 850 AD appear to correlate to an increase in precipitation during the Medieval Warm Period*. This trend of wetter conditions in the Tuxtlas continues during the Little Ice Age (1350-1850 AD).

Lozano-Garcia et al. (2007b) examine the Little Ice Age (1350-1850 AD) and reconstruct the climatic history of the last 2000 years at Lago Verde. They look at pollen, charcoal, and a diatom analysis on the sediment record from Lago Verde. The authors argue that the high quantities of arboreal taxa in the LIA suggests that there was higher moisture availability and a shorter dry season than is currently found (16202). These authors argue that the Tuxtlas region remained a relatively wet climate during the LIA while other sites in the Caribbean and northern Yucatan demonstrate drier conditions. The dry conditions in the northwest Yucatan are related to the southward displacement of the Intertropical Convergence Zone (ITCZ) (Haug et al. 2003). This displacement results in reduced trade winds carrying moisture to the area. The reduction in summer precipitation was not great enough to generate a 'moisture deficiency' in the

Tuxtlas, as it produced a water surplus of 900 mm/year. Therefore, the reduced summer moisture supply was not enough to generate droughts like those in the Yucatan. The authors argue that a shorter dry season occurred during the LIA. They argue that this can be explained by the increased frequency in outbursts of polar air into the region, creating winter precipitation in the form of *nortes*. This shortened dry season made up for the less wet, wet season. Higher moisture during the LIA at the Tuxtlas is evidenced by deep lake levels and an expansion in forest cover (Lozano Garcia 2007a:16203).

Goman and Byrne's (1998) research examines cores taken from Laguna Pompal and Lago Catemaco in the Tuxtla Mountains region. Laguna Pompal is a small, spring-fed lake on western side of Volcan Santa Marta. Goman and Byrne (1998) argue that conditions drier than today existed in southern Veracruz from the Late Formative to the Middle Classic. Spores from the *Osmunda* plant, which grows on the bottoms of lakes is present, indicate to the authors that there is a decrease in lake level during this broad stretch in time. They argue that this is likely linked to a decrease in overall precipitation in the area.

In southern Veracruz overall, it appears that drier conditions than today began sometime around 300 BC and continued until approximately 800 AD. After 800 AD and onward, while the Maya lowlands are experiencing dry conditions, southern Veracruz is getting more wet.

Dune Basics

Eolian processes work to erode, transport, and deposit sediments all over the world but are most profound in arid and sandy coastal environments. In order for eolian processes to create a sand dune, there are a few conditions that must first be met. First, there must be a proper amount of unconsolidated sediment available for transport. Second, wind must be sustained and of high enough velocity in order to entrain sediment particles. Third, in order for a dune formation processes to begin, there must be little in the way of vegetation. Vegetation inhibits wind erosion on dunes (Waters 1992). Lastly, there must be low soil moisture.

Wind speed and sediment particle size are the biggest factors in inhibiting or allowing the creation of dunes. Sand particles often move by wind through saltation. Saltation is when sediment particles bounce and become temporarily airborne less than a meter from the ground. When particles crash back to the ground, they entrain other particles creating a snowball effect from there. This process is the dominate mode by which sediment particles move by wind. Larger and coarser particles may be transported by wind in what is known as creep. Creep may also be caused by saltating particles crashing down on other particles and moving them slightly, but not in the air. Approximately 25% of sediment load is transported through creep processes. Lastly, suspension sends fine-grain clay and silt particles into the air, allowing them to be transported much further distances. Saltation bouncing and crashing sends many fine particles into suspension.

Sand dunes form when an obstruction on the landscape stops these moving sediment particles. In the beginning of dune formation processes, sediment particles need something to latch onto. This is often a tree or a bush or some other kind of vegetation. Once a few particles begin accumulating around the obstruction, the process snowballs and a dune begins to form. As saltating grains are blown up the windward side, they eventually reach the crest and then fall down the steeper slipface on the back side of the dune (Waters 1992). In this state of repeated disequilibrium, the process of saltating grains repeats itself, causing the migration of the dune field downwind. The morphology of a dune is influenced by wind direction, wind velocity, topography, and the nature of the sediment load (McKee and Bigarella 1979). McKee and Bigarella's (1979) dune classification system is one of the most well-known and will be used here to define several dune types found in Veracruz, Mexico.

A barchan dune is defined as a crescent-shaped ridge of sand with 'horns' that point downwind. These dunes traditionally form from the presence of a strong unidirectional wind, limited sand supply, and in landscapes with sparse vegetation (Waters 1992:190-191). Barchan dunes maintain their unique shape because the horns migrate downwind more rapidly than main body of the dune.

A parabolic dune is a crescent-shaped ridge of sand with horns oriented upwind. Like barchan dunes, these dunes develop in settings with a strong unidirectional wind. Parabolic dunes form when pre-existing dunes are modified. Essentially, these dunes form when barchan dune horns become anchored by vegetation growth (Waters 1992:192). The horns stay in place while the main body of the dune continues to migrate downwind, essentially creating the inverse of a barchan dune.

Transverse dunes are straight, elongated ridges of sand oriented parallel to the prevailing wind direction (Waters 1992:193). These dunes develop from a strong, uniform wind direction that is accompanied with spiral wind cells that "flow parallel to the axis of the dune on either side of the dune crest" (193). Transverse dunes are also known as longitudinal dunes.

Blowouts on dunes can occur on any of the previously mentioned dune types. A blowout occurs when a stabilized dune loses localized vegetation. With no vegetation to anchor the area, eolian processes work to erode and carve out a crater-like depression. These blowouts can occur in an otherwise stable dune field. Blowouts will continue to erode until the crater becomes re-stabilized through increased plant growth. Depending on the length of time it takes to stabilize, blowouts can vary greatly in size and shape (Waters 1992:193).

Dunes Specific to Veracruz

The coastal paleodunes in southern Veracruz appear to have been created by the same processes and climatic conditions that fostered the development of a series of dunes to the northwest in central Veracruz. These central Veracruz dunes have been explored and analyzed in a number of publications (Siemens et al. 2006; Sluyter 1995; 1997). This section explores what is currently understood about the formation of the central Veracruz dunes and what it can tell us about the paleodunes in the survey zone.

Climate

Vivó-Escoto (1964) long ago recognized that latitudinal position, extent of land mass, topography, altitude and adjacent oceans all play an important role in determining weather and climate patterns in Mexico. The climate of southern Veracruz is classified as hot and humid (Garcia 1970). Average temperatures in the Tuxtla Mountains range between 22 and 24 degrees Celsius while the surrounding coastal plain reaches temperatures between 26 and 30 degrees Celsius. The Tuxtla Mountains are also one of the wettest places in Mexico with annual precipitation amounts ranging between 1700 and 3000 millimeters in most areas. Only the northern slopes of San Martin and the eastern shore of Lake Catemaco have upwards of 4000 millimeters of annual precipitation (Santley 2007:14). Tres Zapotes and the ELPB in general, however, receive less rain as the Tuxtla Mountains create a rain shadow effect on the microregion. Much of the precipitation that occurs in the region is due to global wind patterns. Trade winds are large flows of easterly air. Warm, humid, unstable air masses are brought into the region by trade winds from the Caribbean. Rainfall is produced when moisture in the air is forced to rise and cool as trade wind air masses come in contact with equatorial calms (Vivo-Escota 1964:192). During the months of June, July, and August the thermal equator migrates northward. It is this northern migration that causes the rainy season in southern Veracruz.

Veracruz Dunes

Most importantly for the dunes in southern Veracruz is winds brought into the region by *nortes*. These fast and intense storms occur between October and April and are known to produce heavy rain. *Nortes* originate as polar air masses associated with mid-latitude cyclones in the United States and Canada. As these polar air masses come in contact with warm tropical air, a strong storm front develops. These fronts have been known to drop the temperature by more than 10 degrees in less than twenty-four hours. Winds associated with *nortes* can transport considerable amounts of sand, uproot plants, and create new coastal dunes (Siemens et al. 2006; Sluyter 1997). The same *nortes* that impact southern Veracruz also influence dune formation further up the coast in central Veracruz.

Researching the dunes of central Veracruz, Sluyter (1995, 1997) is interested in how longitudinal dunes formed in the distant past. He argues that wind vectors associated with *nortes* are reflected in the dune types he finds in central Veracruz. He notes the fact that *nortes* produce high velocity winds at periodic intervals. Trade winds entering Veracruz from the east, on the other hand, are more moderate in terms of velocity and consistent throughout the summer. The climate of central Veracruz is generally sub-humid but also semi-arid in some areas. During the dry season winter months, there is a general lack of soil moisture in the region. The mean annual precipitation is 1250 millimeters, while the driest section of his study area suffers from a 715 millimeter moisture deficit based on mean precipitation and potential evapotranspiration (Sluyter 1995:100). In the wetter Tuxtla Mountains, the town of San Andres Tuxtla, for example, has a moisture surplus of 772 millimeters. Sluyter's study region in central Veracruz is significantly drier than the lowlands of southern Veracruz. While these drier conditions likely increased eolian activity in central Veracruz, it is very likely that the coastal dunes of southern Veracruz also formed by dry season *nortes*.

Nordstrom et al. (1990) and Pye and Tsoar (1990) both developed models to understand coastal dune formation. Both models posit that dune morphologies derive not from climate change, but from changing deflation conditions based on the amount of sand available through time. These models are based on the assumption that modern wind conditions were responsible for the formation of past dunes. Drawing on this theory, Sluyter (1997) developed a working hypothesis about dune formation in central Veracruz. Sluyter's hypothesis suggests that longitudinal dunes in the region formed during the postglacial transgression, starting at approximately 19,000 BP (Pirazzoli 1993). In this model, rising sea-levels over time would have eroded the central Veracruz shoreline that was approximately 30 km east of its current position. With wind conditions assumed to be similar to those of today, successive belts of longitudinal dunes formed. Each eroding longitudinal dune contributed sand to the next as transgression continued (Sluyter 1997:132). Transgression rates slowed at approximately 7000 BP, leading to the reduced erosion of sand dunes. This reduced erosion led to an overall decrease in sand supply load, which in turn encouraged dune stabilization through vegetation. Once vegetation had taken hold, it worked to stabilize the dunes further. When plants die over long periods of time, this helps create soil on the dune landscape. Living plants also help create soil too.

Sluyter also proposes an alternative hypothesis in which longitudinal dunes are older than the early Holocene. This hypothesis seems unlikely however as Ward (1973) identified only minimally developed organic and calcic soil horizons on the same dunes. The lack of soil development from Ward's (1973) exposed road-cuts provides more evidence that the dunes of central Veracruz are of mid-Holocene origin.

Today, the dunes of central Veracruz offer the best comparison to the dunes of southern Veracruz. Sluyter explains how these stabilized longitudinal dunes are covered with vegetation with crests upwards of 120 meters in height. These dunes often run up to several kilometers in length. He notes the presence of localized blowouts throughout these otherwise stable dunes. Sluyter's work shows that the dunes in the research area have been formed and consolidated since approximately 7000 BP.

Eolian Impacts on Archaeological Sites

Dunes will continue to migrate until they become consolidated by vegetation. As described previously, vegetation may take root when wind velocity decreases and precipitation increases. Sand dunes then, offer what can be referred to as a double-edged sword. Quick burial of a site by eolian processes may work to preserve the behavioral context of the site. This means that the character of the spatial distribution of the human occupation may remain largely intact. Such instances are ideal, yet rare. In fact, Waters (1992:213) describes finding such a site as "truly unique." More often, post-depositional processes work to destroy the behavioral context of dunes sites. Understanding how dunes form, migrate, and consolidate is of the utmost concern for archaeologists working in dune contexts.

Dune migration works to conceal archaeological materials beneath, within, or near the surface of dunes. By securing the approximate age of a dune's migration and consolidation, it allows for a fuller archaeological interpretation of the site. It may be possible to predict the age of an archaeological site based upon its position beneath, within, or on a given sand dune. Stratigraphic integrity is often completely lost when a site is discovered by a dune blowout. Recall that blowouts occur locally in an otherwise stabilized sand dune environment. Wind erodes a poorly vegetated area of the dune to create a crater-like hole. In these instances, artifacts become mixed together with the absence of the sandy matrix that once held them together. These are called deflated sites. Examples of blowout archaeological sites can be found in northern Veracruz. Wilkerson's (1972; 1973; 1975) work at the site of Santa Luisa was in sand blowouts on a deltaic island in the river mouth. The archaeological deposits resulted from the deflation of multiple impermanent settlements in the past. Wilkerson, however, misinterpreted the blowout archaeological deposits as a large permanent settlement in the Late Archaic Palo Hueco phase (Stark 2021). In this example, deflation of the Santa Luisa site led to the misinterpretation of a Late Archaic continuous, permanent occupation.

In addition to dune migration, eolian processes can work to directly alter the position and composition of artifacts. Artifacts exposed to eolian processes will often move laterally in the direction of the wind. Wind acts as a powerful sorting agent. The degree of artifact movement will greatly depend on size, shape, and weight. Rick et al.'s (2006) work in the Channel Islands, California, demonstrated how small faunal materials were virtually absent from the eolian scavenged site. Steady wind velocities coming off the ocean blew fine materials away. The authors were left with a biased archaeological record in which heavy, lag deposits were all that remained.

Lastly, it is important to keep in mind the impact wind can have on artifacts that remain *in situ*. Wind abrasion of artifacts, shell, and bones can severely alter the original form of the material. Often this develops in the form of a sheen that can severely inhibit the analysis of artifacts back at the lab.

Eolian processes often work to hinder archaeological investigations on dune sites. To even begin to interpret patterns of archaeological variability, and how they relate to human behavior, it is of the utmost importance to understand the post-depositional processes at work on dune sites (Rapp and Hill 2006:63). The preservation of the behavioral context of a sand dune site is rare (Waters 1992:213). However, Albanese (1978) provides one of the few examples in which an archaeological site was rapidly buried after abandonment, preserving the behavioral context. In recreating dune histories, it is important to remember that dune migration can be *reactivated* during times of extended drought or vegetation loss. Each of these issues must be accounted for in order to accurately interpret any archaeological site remains in dune contexts.

In this study, the survey zone contains dunes that became consolidated and stopped migrating at the end of the Middle Holocene. Archaic period sites were not identified during survey. Artifact analysis indicates that settlement in the dune survey zone lasted from the Early Formative through the Late Classic. Thus, the archaeological remains detected during survey were deposited on top of already consolidated dunes.

Modern Fauna

The Eastern Lower Papaloapan Basin (ELPB) is on the Isthmus of Tehuantepec, a unique geographic location at the intersection of North and South American flora and fauna. This environment of abundance contains animals and plant life that is often only associated with one continent or the other. At the regional level, the environment includes estuaries, swamps, oxbow lakes, and rivers that provide an abundance of turtles, fish, shrimp, crabs, crocodilian and mollusks. Additionally, the isthmus is a prime area for migratory flocks of birds. The Tuxtla Mountains just east of the ELPB, is currently home to 129 species of mammals, 561 birds, 116 reptiles, 43 amphibians, and 109 freshwater and estuarine fish (Pool 2007:72; Fuentes Mata and Espinosa Perez 1997: Apendice 5.1; Martinez-Gallardo and Sanchez-Cordero 1997: Apendice 5.7; Ramirez-Bautista and Nieto-Montes de Oca 1997:523; Schaldach et al. 1997:5.2; Winker 1997:535). Pool (2007) notes that tapirs, white lipped peccaries, spider monkeys, howler monkeys, jaguars, ocelots, and other small cats held both economic and symbolic importance for the Olmec. While most of the species found in the area today were also present during

Formative and Classic Periods, modern day environmental destruction, in the form of forest clearing and overhunting, has reduced the variation and quantity of both flora and fauna in the ELPB.

Aquatic Resources in the Past

Wing (1980) and VanDerwarker (2006) have identified the importance of aquatic resources in Olmec subsistence. Research of faunal remains at the Formative Olmec site of San Lorenzo shows that estuarine species such as snook (*robalo*), freshwater fish (catfish and cichlids) and salt water fish like snapper, sea-catfish, and tarpon were all readily exploited in the past (Pool 2007:77). At San Lorenzo, aquatic resources were more abundant in Olmec diets than terrestrial animals. It was specifically estuarine, brackish and marine aquatic species that were the most abundant in the San Lorenzo archaeological record (VanDerwarker 2006:35). Pope et al.'s (2001) research at San Andrés, Tabasco demonstrates that estuarine gar, oyster, clam, crocodile, turtles and manatee were also exploited the region during pre-Columbian times. Besides aquatic resources, and turtles in particular, domesticated dog figured prominently in the early Olmec diet (Wing 1980). Settlement data supplemented by Borstein (2001) may provide evidence to the argument that aquatic resources were the most important foodstuff in the rise of Olmec power. It also forms the basis of Killion's (2013) Hunter-Gatherer-Forager (HGF) Hypothesis that posits that it was the exploitation of aquatic resources that allowed for the rise of San Lorenzo. Killion's hypothesis also suggests that subsistence patterns revolving around aquatic resources may have been in place by the Late Archaic. Archaic hunter-gatherer groups would have been drawn to locations in the area where aquatic resources were easily exploitable.

Recent research analyzing faunal data at Tres Zapotes highlights the importance of aquatic resources in the Formative period diet at the site (Pool, Peres, and Loughlin 2022). This is particularly interesting because Tres Zapotes also contains evidence of greater maize consumption in the Early and Middle Formative when compared to sites in the Tuxtla Mountains and near San Lorenzo. Peres et al. (2012) previously found that aquatic fauna comprised 62% of the minimum number of individuals from the Tres Zapotes assemblage. These levels are on par with Wing's (1980) findings at San Lorenzo.

Pool, Peres, and Loughlin (2022) analysis of excavation materials from both elite and non-elite contexts in Tres Zapotes finds 13 different aquatic species in the assemblage. These include six species of fish, mullet, catfish, Peten catfish/juil descolorido, jack crevalle, snapper, shark, aquatic turtles (Mexican giant must turtle, snapping turtle, box turtle), and manatee. While Tres Zapotes exploited saltwater and estuary aquatic resources, their findings show an emphasis of freshwater resources in the assemblage.

Conclusion

This chapter has explored the large-scale climatic changes occurring throughout the Holocene and its impact on the physical environment of the survey universe. Sluyter's (1995; 1997) work in central Veracruz dunes provides a prime analogy to the survey zone in this study. Sluyter convincingly argues that the paleodunes of central Veracruz have been consolidated and stabilized with vegetation since 7000 BP. The dunes investigated in this project were likely formed by the same processes, most importantly, through *nortes*. Knowing that the paleodunes in this project have been consolidated and in place for the past 7000 years allows archaeologists to more accurately interpret what was found during survey. This area was originally chosen for survey because of the expected likelihood of finding Archaic period materials. The dune and near-dune environment could have provided elevated, well-draining soil in a location well-situated to exploit an environment of abundance that included migratory birds, terrestrial animals, and both fresh and saltwater aquatic resources. Pollen data found in cores also allows researchers to make some generalizations about past climatic conditions. Most importantly for the purposes of this project, the data shows that during the Late Classic the Maya lowlands were experiencing a significant dry period. At the same time, southern Veracruz appears to be getting more wet. Fluctuations in rainfall can impact how people of the past interacted with their environment. Regional increases in rainfall may positively impact agricultural output and attract more animals for hunting. Decreases in rainfall may negatively impact agricultural output. Long-term drought would likely lead to demographic shifts as people move to where there is stable food. Changes in rainfall can greatly impact settlement patterns in the past.

Chapter 3 – Theoretical Frameworks

Brumfiel and Earle (1987) summarize much of the traditional archaeological understandings of wealth allocation and resource management in the past. They emphasize two primary models for how elites organized economies in the past. These are the political and adaptationist models. Political models view elites as acting in ways to accumulate personal prestige, wealth, and power. For example, elites following this model might organize an economic system where prestige goods are brought in from foreign regions. Elites gain power through the personal accumulation and control of such goods and networks. Brumfiel and Earle (1987) also propose an adaptationist model in which political elites operate as economic administrators with local societies receiving benefits from this elite intervention in the production and exchange networks. This adaptationist perspective still emphasizes the role of the elites, but in this model, they help secure important utilitarian resources for their population.

Rather than emphasize the role of a few elite individuals and how they controlled ancient economies, recent archaeological perspectives tend to emphasize the role of commoners. More specifically, archaeologists are interested in how everyday commoner activities bring sociopolitical economies into existence (Blanton and Fargher 2010; Hutson 2010; Joyce 2004, 2008). This shift in Mesoamerican archaeology follows broader shifts within anthropology, political economy, and political ecology. This chapter lays bare the theoretical grounding for this project. First, I trace the history and evolution of both political economy studies and human-environment studies. I then introduce a political ecology framework and discuss how it is related to political economy. I emphasize the 'bottom-up' perspective that political ecology brings to archaeological studies. Finally, I discuss settlement ecology and its usefulness as a lens to examine settlement patterns. Lastly, I bring the two frameworks together and describe how this project bridges these theoretical perspectives.

Origins of Political Economy

While political ecology was born out of studies of the political economy (Wolf 1972, 1982), political economic thinking has its roots in environmental studies. Early political economists were interested in the environment, albeit, they spoke about it with regard to private property and power. Thomas Hobbes' (1909 [1651]) understanding of the *sovereign* was based on the combination of a specific understanding of the meaning of nature, power, and politics. Nature, according to Hobbes, was a pure form of power. Power could become political if it was channeled through cultural institutions created by society (industry, commerce, culture, private property). Without such institutions in place, life in a pure state of nature was 'solitary, poor, nasty, brutish, and short' (Hobbes 1909 [1651]:99). Hobbes argues that the creation of private property was one of the original societal institutional acts that protected humans from nature, thus creating political subjects (Hobbes 1909 [1651]:189-190).

Another early political economy philosopher that focused on the concept of private property is John Locke. Like Hobbes, Locke viewed private property as one of the original political acts in the Western world (Locke 1980 [1689]:20). Locke argues that private property is the product of human labor. For Locke, human labor creates property, which in turn, exists in both the natural world and in civil society. Civil society develops based on a social contract that protects individual property rights (humanized nature) (Dumont 1986:81). From its earliest philosophical foundations, political economists have been keenly interested in the creation and protection of private property, which is directly related to the physical environment.

Issues of property, taxation, surplus production, and rent were important to later philosophies of Adam Smith (1991 [1776]) and Karl Marx (1973 [1858]). For both, however, *labor* was the key process that transformed and humanized nature (Morehart et al. 2018:6). Smith believed that the transformative effects of labor on nature were part of a natural evolution of society and man. Societies, in turn, could be compared based on their efficiency to harness the environment through extraction, accumulation and trade. Marx's critical view of political economic relations focuses more on the transformation of power through societies across history and time. It is labor that connects the physical environment to the social and power structures in society. Social structures come into being through labor, and in turn, are reinforced by the production and commodification of things (Harvey 1974; Sahlins 1972).

While other political economists were focused on the concept of labor, Marx's political economy differed in that labor arrangements were locally conditioned. Cultural and historical forces shaped the labor relationship for production. Morehart et al. (2018:7) summarize this idea when they write "Marx re-articulated property and power via the mechanism of inequality and exploitation – consequences of political economic relationships that were not immediately incorporated into early understandings of culture and society, especially in North American anthropology."

Background on Political Economy

The modern academic study of political economy traces its roots to Marx and Engels (1978 [1845]). They argue that the study of political economy focuses on the structural relationships between class factions around the control of labor and its products (Hirth 1996:204). While Marxist thinking went out of fashion for some decades in the field of anthropology, it came back in force during an important time in the discipline's history. More specifically, Marx's ideas resurfaced in anthropology during a time of crisis in the field during the 1970s and 1980s. Traditional methodologies in anthropology were struggling to comprehend the complexities of life in an increasingly globalized world (Roseberry 1988:162). A Marxist perspective helped solve this problem.

Sidney Mintz's seminal account of the production and consumption of sugar marked an important step forward in studies of political economy. *Sweetness and Power* (1985) traces sugar as a commodity while demonstrating how production and consumption systems directly affected global power relations. Mintz's analysis demonstrates how anthropologists can utilize a Marxist critique of production couched in a discussion of the various meanings of a specific commodity for diverse actors. Mintz (1985) writes:

> "Studies of the everyday in modern life, of the changing character of mundane matters like food, viewed from the joined perspective of production and consumption, use and function, and concerned with the differential emergence and variation of meaning, may be one way to inspirit a discipline now dangerously close to losing its sense of purpose" (213).

World systems frameworks (Wallerstein 1974) came to prominence in the 1970s and 1980s because of a recognition that traditional anthropological methods did not account for how broad structural forces both created and maintained inequality. World systems theorists (Wallerstein 1974) used political economy concepts to draw attention to core-periphery models that emphasize the integrated nature of the local and global. According to Roseberry (1988), the goal of political economy is "to understand the formation of anthropological subjects at the intersection of local interactions and relationship and the larger processes of state and empire making" (163).

The critiques of political economy at the time seem obvious in retrospect. World systems, dependency, and mode-of-production approaches in the social sciences took *agency* away from anthropological subjects. Roseberry goes so far to say that anthropological subjects are "flipped into a kind of functionalist reasoning…in terms of the functions they served for capital accumulation" (1988:170).

Eric Wolf (1982) argued successfully that the study of political economy needs to pay greater attention to the linkages between history and culture. Wolf (1982:201) writes that "the property connection in complex societies is not merely an outcome of local or regional ecological processes, but a battleground of contending forces which utilize jural patterns to maintain or restructure the economic, social and political relations of society." With Wolf (1982), anthropology now had a political economy that balances both structure and agency. This is possibly the greatest strength of utilizing a political economy framework in anthropology. It is inherently concerned with both long-term change and the broader governing factors that shape the everyday human experience. Each of these authors help lay the groundwork a new anthropological political economy.

Archaeology and Political Economy

Archaeologist utilizing a political economy framework emphasize how ancient polities sustained themselves through the mobilization of staple surpluses and/or the distribution of exotics to preferred clients (Lohse 2013:1; Hirth 1996; Blanton et al. 1996). Brumfiel and Earle (1987) identify two main approaches to understanding the rise and maintenance of polities. The adaptationist and political models have been very influential over the last 30 years in archaeology. Adaptationist models view elite intervention in major economic projects as done for the good of the society as a whole. This perspective brings attention to how elites integrated society (Brumfiel and Earle 1987). In the **political** model, leaders are considered the primary benefactors of the generated surplus of staple goods. Rulers are motivated by self-interest. Hirth's (1996) four principles (accumulation, matrix control, context, ideology) provide a framework for how elites may interject themselves into key points in the economy for personal gain.

Hirth's accumulation principle states that whenever political economies are present, the accumulation of strategic resources will occur (Hirth 1996:221). Brumfiel and Earle's (1987) models provide different perspectives for the *impetus* for the accumulation of resources. The adaptationist perspective suggests that a centralized authority will accumulate resources in order to ensure a more reliable supply. Through this lens, resources are viewed as inherently unreliable. A system is created to adapt to resource shortfalls and to create more predictable supplies (Hirth 1996:221). In contrast, the political perspective of resource accumulation sees *individuals* accumulating resources to serve their own social needs. This type of accumulation tends to occur in instances of resource abundance (Hayden 1990; Cowgill 1975). Hirth's context-principle concerns how and where resource accumulation takes place. Do individual households accumulate resources or does a centralized leadership coordinate accumulation in special-purpose contexts? In the latter, context-oriented accumulation systems will be under direct supervision of elites (e.g. attached specialists (Brumfiel and Earle 1987). Elites will also interject themselves at key points in the production, accumulation, or flow of resources in order to directly or indirectly control networks. This is Hirth's matrix-control principle. Key points can refer to geographic locations in trading networks or structurally institutionalized ideological locations.

Blanton et al. (1996) posit that ancient Mesoamerican polities oscillated between varying degrees of exclusionary and corporate strategies. This model has been rightly criticized and Blanton has moved beyond this model at this point (Blanton and Fargher 2010). Blanton and Fargher (2010:5) now argue for an approach that favors inclusionary political strategies, or consensus politics. However, ideas of exclusionary and corporate strategies remain a helpful conceptual tool. Exclusionary strategies tend to be utilized by aspiring leaders, or aggrandizers, who try to control access to resources, or establish exclusive trade agreements. Power is gained by the aggrandizer through the monopolization of resources. In situations where exclusionary practices dominate, artwork tends to focus on individual rulers while elite residences will be distinct in regard to size and elaboration. Exclusionary strategies should be more pronounced with factionalizing authority, as various individuals compete for both followers and power. Factionalism can be seen in de-centralized settlement patterns with competing civic-ceremonial centers in a region. Blanton et al. (1996) argues that resources will be unevenly distributed across sites and the region as aggrandizers monopolize and distribute resources to followers.

On the opposite end of Blanton et al.'s dual-processual model are corporate strategies that tend to emphasize the cohesion of a group. When corporate strategies are more pronounced the economy will be based on foodstuffs rather than prestige goods. Additionally, the political economy will be knowledge-based, with few wealth distinctions present in regard to architecture. Art will tend to de-emphasize the individual while craft production tends to favor utilitarian goods. The settlement patterns of the region will be centralized, reflecting the consolidation of political power.

Some authors (Pool 2007; Stark 2008; Loughlin 2012) argue that rarely was one strategy (exclusionary or corporate) alone utilized in ancient polities. Pool (2008:122) states that "exclusionary and corporate strategies are alternatives potentially available in all societies, which may operate simultaneously at different scales of political integration." Elsewhere he points out that Olmec colossal heads (2007:287) and elite residences (exclusionary practices) at Early Formative San Lorenzo are complemented with zoomorphic and composite supernatural sculptures (corporate practices). Additionally, offerings at the site of El Manati may reflect corporate strategies through the emphasis of cosmological themes.

Human Environment Interactions

The study of human-environment interactions has a long history in the social sciences. Early unilineal evolutionary anthropologists like Tylor and Morgan draw on Darwinian theory, using the notion of environmental determinism to explain the perceived cultural and material similarities between groups living in similar natural environments (Milton 1997). However, ethnographic accounts by Boas and Malinowski detailed how environmental determinism could not account for many of the observed realities of different cultural groups (Milton 1997). It is in this context that Julian Steward developed his ideas of cultural ecology. Cultural ecology centered around the 'cultural core', or features related to subsistence and economic arrangements (Steward 1955:37). Steward was reacting against the historical particularism and culture history approaches. Instead, Steward's cultural ecology emphasized the role of the environment in a culture's evolutionary trajectory. This idea of multi-linear evolution was directly at odds with Boas' notion of the uniqueness of all cultures. Cultural ecology, a methodological approach, argues for a detailed comparison of cultures living in similar environments, yet separated geographically (Barfield 1997:449).

Political Ecology

Since the 1970s, ecological approaches in anthropology have been moving away from deterministic models in favor of methods and theories that emphasize global, political, economic and social forces and interactions between groups. Political ecology has spread rapidly and expanded throughout the social sciences since Julian Steward's student, Eric Wolf (1972) first coined the term. The field of political ecology is directly concerned with the power dynamics in human-environment relationships. More specifically, political ecology explores the role of power relations in determining human uses of the environment (Biersak 1999). While the early cultural ecology of Steward tended to study a small group over a long period of time, political ecology approaches focus on the larger forces *acting on* a group at a single point in time (Sutton and

Anderson 2013). While older ecological approaches were considered value-neutral, political ecology is inherently influenced by political awareness of the globalized world today.

Political ecology, similar to political economy, grew out of the dissatisfaction of anthropological methods for understanding human conditions and redefined the unit of analysis for research. Rather than utilizing older understandings of culture, political ecology seeks to understand the intersection of a variety of relationships at various scales (specifically including the environmental factors). Older ecological anthropological studies often failed to acknowledge broader structural factors that impacted local environmental usage and change. According to Bryant and Goodman (2004), political ecology was born out of the desire to contextualize persistent environmental crises around the world with scholars wanting to understand how local environmental problems were related to broader issues of class, production and consumption, and most broadly, the global capitalist system.

While research programs in both political ecology and political economy are similar in some regards, they also differ. There is a greater emphasis on the hard science associated with the environment in political ecology. Political ecology frameworks will incorporate the work of biologists, geologists, climate scientists, etc. into cross-disciplinary research. The biggest difference that is becoming apparent in archaeology is that political economy models of the past have focused on the actions of elites, while ignoring commoner agency. Political economy models that focus on leader extraction of surplus (Brumfiel and Earle 1987) ignore the actions of the commoner who helps create the surplus that the leader co-opts (Lohse 2013). Because of the mutual interdependence of both elites and commoners, Lohse argues that a political ecology framework expands on older political economy models to include individual agency.

Bridging the Gap Between Political Ecology and Mesoamerican Archaeology

Recently, Mesoamerican archaeologists have begun to bridge the gap between political economy and political ecology (Lohse 2013; Scarborough 1998, 2003, 2007, 2008; Morehart et al. 2018). While it may take some time for some political economy researchers to begin to explicitly refer to their work as 'political ecology', there will likely be an increase in the number of journal article and books with this term title. One possible reason that it has been slow to get archaeologists on board with political ecology is due to confusion about what it actually means to call oneself a political ecologist. Hutson (2013:212) discusses the relationship between political ecology and political economy when he writes (my emphasis):

> I do not see political ecology as a paradigm that supersedes political economy. The compelling argument that arises from Lohse's presentation of political ecology is not that political economy lacks the tools for integrating different sectors of Maya society but that our understanding of the relationship between these sectors should be triangulated as best as possible through the economic possibilities afforded by diverse and dispersed environmental resources. In other words, *political ecology is political economy with an emphasis on environmental-resource management* (Hutson 2013:212).

I agree with Hutson's assessment. Much like political economy, a political ecology perspective necessitates the researcher to explicitly map power dynamics operating at various scales. These include relationships between commoners and elites or the local and the supralocal.

Advantages of a Political Ecology Framework on this Project

Political economy frameworks allow for researchers to focus on the relationships between the local and the supralocal and the ways that certain relationships defined the mobilization of labor and resource allocation. Political ecology frameworks are ideally suited to examine commoners in the archaeological record. As John Lohse (2013) writes in his introduction to his volume *Classic Maya Political Ecology*, political ecology is a "useful framework that centralizes and politicizes the roles of utilitarian and subsistence producers as a complement to pre-Columbian personages more traditionally recognized as political agents: elites" (xvii). Lohse's call to action for Mesoamerican archaeologists to embrace political ecology frameworks stems from a basic critique of political economy approaches, where commoners are viewed as pawns, always manipulated by elites. By viewing elites and commoners as separate entities, influence is always coming from the top-down. That is, commoners who are most involved in basic subsistence production hold little influence on elites in most political economy frameworks utilized in Mesoamerica archaeology.

A major problem with the elite/non-elite dichotomy that has plagued Mesoamerican archaeology is that it leaves our understanding of the past in non-nuanced terms. Demarest (2004:173) talks about how we still fail to understand the *infrastructure* of Maya economic systems. Demarest argues that the dichotomy between elites and non-elites has historically created models where the actions of elites are viewed as having little or no impact on commoners, and vice versa (Lohse 2013:4). This is why political ecology is uniquely positioned to have a profound impact on Mesoamerican archaeology in the decades ahead. It insists that researchers map out the power asymmetries between ancient centers and their hinterlands. More specifically, how did elites in regional centers negotiate the productive activities and negotiated interdependencies with peoples far away (Greenberg and Park 1994:1)? In order to enter into a deeper understanding of the systems and infrastructure of the ancient past political and economic systems, archaeologists must understand all actors involved in food production systems that produce and sustain polities (Blanton and Fargher 2010). More to the point, a political ecology approach to Classic period Mesoamerica is important because "the institutions, networks, and rituals that sustained society have their roots in the collective success of local subsistence-production strategies" (Lohse 2013:5). Non-elite actors of the past had agency and their roles in political economic systems must be further studied.

Areas of Inquiry for a Political Ecology Approach

Lohse (2013:5) lays out three distinct areas of archaeological inquiry regarding the political ecology approach. First, this approach seeks to contextualize and understand environmental change from the perspective and scale of human societies. Secondly, a political ecology approach may seek to better understand conflict that arises over access to key environmental and social resources in the past. Lastly, a political ecology approach may explore the ramifications of environmental change and its impact on political systems in the past (Bryant 1992:13).

Assumptions

A political ecology approach has been described as a 'bottom-up' approach as it insists on equal weight, importance, and attention being given to the role of local households in regional polities (Lohse 2013:5). In this approach, it is assumed that *relationships between* households and political elites were inherently political. These relationships were integral to maintaining the sustainability of communities and economies in the past. Scoones writes (1999:485) that "fundamentally political issues of structural relations of power and domination over environmental resources are critical to understanding the relationship of social, political, and environmental processes." Another important assumption to this approach is the changing nature of the environment. This approach assumes that changes over time in the environment directly and indirectly impacted the people who relied on the environment and their social relationships. For example, the occurrence of a long-term drought would both directly and indirectly impact the relationship between the commoners that grow the food and the elites who rely on agricultural yields to feed their followers.

Settlement Ecology

This project specifically takes a settlement ecology approach. Settlement ecology has developed as a multi-discipline field of inquiry that draws on theories from anthropology, economics, geography, and ecology. The beginnings of settlement ecology as a distinct framework can be traced back to Glenn Davis Stone's (1996) research in Nigeria. There, he took a multi-faceted approach to chart the historic changes that took place at the settlement of Kofyar. Recognizing that settlement theory had largely been applied to hunter-gatherer studies, Stone argues that settlement theory can be applied to food producing peoples. Stone's innovative approach emphasized the identification of *causal factors* that determine how settlement changes over time and space. This approach goes beyond settlement pattern descriptions in archaeological analyses. Stone proposed that it was possible and imperative to study cause and effect relationships on settlement arrangements and how they change through time (Stone 1996:13).

A key aspect of Stone's framework hinges on the idea that inputs should not be held constant through time. For example, while analyzing a given settlement, the researcher must account for how that landscape changed over time while it was occupied. If a landscape was occupied continuously for 1000 years, causal factors influencing settlement the first 500 years could be very different from the latter half millennium. By not holding input variables constant, a more robust version of the past settlement causes can be interpreted.

Recently, Kellett and Jones' (2016) edited volume *Settlement Ecology of the Ancient Americas* adds to Stone's foundation. The authors identify the primary question that serves as the basis for all archaeological investigations of settlement patterns: Why do people settle in a particular place, in a particular time, and in that particular arrangement? (Kellett and Jones 2016:1). While this seems straightforward, it is a complicated question that is difficult to answer. Settlement patterns identified in the archaeological record are a palimpsest of complicated decisions made by people in the face of complex political, economic, and environmental factors. Additionally, issues of equifinality further complicate this pursuit (Stone 1996).

Change occurred in the field of archaeology when researchers in the 1950s and 1960s began to shift their analysis from site-specific to regional in scope (Willey 1953). This newly formed focus on settlement pattern analysis developed out of the New Archaeology and often utilized cultural ecology or systems approaches (Binford 1968; Flannery 1968; Plog 1975). These settlement pattern studies were often overly deterministic, attempting to identify single triggers that could explain the observed settlement history. Settlement pattern studies were reduced down to adaptations to outside forces (e.g. population pressure, water availability, etc.). Nevertheless, this movement birthed many settlement pattern studies and large-scale ground survey projects, elevating the importance of regional settlement studies in archaeology (Flannery 1976; Blanton 1978, 2005; Peterson and Drennan 2005; Sanders 1965; Sanders, Parsons and Santley 1979; Willey 1956). Since this time, settlement pattern studies has developed into its own subfield of archaeology with its own methods and frameworks (Kowalewski 2008; Kantner 2008). The GIS and LIDAR revolution that has occurred over the last decade has spawned new and greater interest to the study of settlement patterns.

Drawing and expanding on Stone's (1996) seminal work, Kellett and Jones (2016) developed their own conceptual framework for settlement ecology. First and foremost, the authors insist that settlement ecology studies are inclusive. This approach can be utilized to better understand why people lived where they did, whether they are hunter-gatherers, pastoralists or agriculturalists. It is an approach that can also be applied to populations today that are impacted by migration, war, climate change, and urbanization. Secondly, settlement ecology should best be understood as a conceptual or methodological approach, not as a universal theory of settlement patterns. In other words, the environment, political, economic, ideological, and historical factors must all be considered when understanding and interpreting why people settle on a landscape. Kellett and Jones's third point is that a settlement ecology approach is inherently concerned with interactions between entities. They explain that push/pull factors to human decision-making are especially complex. More thorough interpretive frameworks will consider multi-faceted interactions between entities at various scales. Fourth, Kellett and Jones (2016) maintain that interpretations must maintain human agency. Created landscapes and settlement patterns must be viewed through a lens in which they are the end result of many decisions made by humans interacting with their environment over time. Lastly, a settlement ecology approach requires an interpretive framework with a spatial component. More specifically, it must account for how settlement features relate to one another on the landscape.

Political Ecology from a Regional Perspective

This project uses a regional perspective in order to move beyond understandings of the past that are polity-centered. By taking a regional perspective, it allows for researchers to examine the relationships between urban centers and their hinterlands in the distant past. The survey covers an area that is seemingly removed from the direct control or influence of any regional center in the ELPB. It was likely a rural population in an ecologically abundant environment that provided ample hunting, fishing, and foraging opportunities. However, the major occupation of the dunes occurs during the Classic period, a time when intensive agriculture is the primary subsistence strategy in both ELPB and southern Veracruz more broadly. This makes the dunes a less-than-ideal location. Thinly developed soils only allow for some small-scale cultivation today. These factors make the region an interesting case study for a political/settlement ecology framework. The dune environment is most intensively occupied during a time where it does not make much sense from an economic and food production perspective.

Political ecology and settlement ecology frameworks emphasize a strong focus on past environmental conditions. This opens the door for archaeologists to continue to work together with researchers in the hard sciences interested in environmental reconstructions. The physical environment of the past played an integral role in conditioning the placement and density of settlement, as well as the nature of economic production (Lohse 2013:8). By understanding how the environment changes, it opens the interpretive door for better understanding how rural commoners adapted to, and influenced, changes in ancient economic activities, social organization, and ritual practice.

This research offers the opportunity to apply a political ecology framework to better understand the Classic period in the ELPB. Through its emphasis on environmental reconstructions and emphasis on commoners, I hope to demonstrate the usefulness of political ecology and settlement ecology frameworks for understanding seemingly paradoxical settlement histories. Additionally, I hope to contribute to the broader understanding of long-term political economic developments in the ELPB. Because political ecology frameworks tend to emphasize more 'bottom-up' approaches/interpretations, it may be possible to understand the dune settlers in this way. The Classic period was a politically tumultuous time during the gradual decline of the region's biggest polity, Tres Zapotes. Thinking about dune settlement as a way for ordinary people to simply 'move away' from unwanted political control elsewhere may allow for a more nuanced understanding of the Classic period in the ELPB and southern

Veracruz more broadly. Just as important as it is to understand how elite's behavior impacted commoners, it is equally important to understand the opposite. How did subtle commoner choices and behavior impact elites and the social organization of southern Veracruz overall.

I follow Morehart et al. (2018) in arguing that the field of political ecology needs the contributions of archaeology. Archaeologists have the unique ability to provide insights into the deep human history of land use as well as the materiality of landscapes. Additionally, our understandings of deep time allows researchers to address issues of human resilience and sustainability that are otherwise unattainable to other social and physical scientists.

Chapter 4 - Hypotheses

This project attempts to better understand the processes that account for variation in the distribution of occupation on the dune landscape through time. It is proposed that the specific environmental, economic, and political conditions combined to allow people of the past to settle on the landscape in certain ways. In order to evaluate the data I collected as a member of the RRATZ project, a number of overarching scenarios and hypotheses regarding dune settlement were developed and expanded on below. The evaluation of hypotheses will occur during the Discussion chapter.

Anchoring the region as its political and economic center for over a millennium is the site of Tres Zapotes (ca. 1250 BC – AD 900). Tres Zapotes developed into an Olmec regional center between 1000 and 600 BC. During this time, the site was less politically and economically significant than other Olmec capitals to the east (e.g. San Lorenzo and La Venta). Nevertheless, the political importance of Tres Zapotes in the ELPB during this time is evidenced by the presence of two colossal heads. The site's importance continued into the late Middle Formative (600 – 400 BC) with the erection of two stelae depicting rulers. Tres Zapotes thrived between 400 BC and AD 300 as the largest and most important Late Formative polity in the region, both politically and economically (Pool and Ohnersorgen 2003). By the Early Classic (AD 300 – 600), the power of Tres Zapotes declined as once subordinate secondary centers gained greater autonomy (Loughlin 2012). The ELPB would come to be influenced by Classic Veracruz culture to the northwest (Arnold and Pool 2008) and later become a tributary region of the Aztec Empire (Venter 2008).

While Tres Zapotes was continuously occupied from ca. 1250 BC to ca. AD 900, the political and economic landscape of the ELPB changed dramatically over the course of time. The Tres Zapotes polity likely controlled the entirety of the ELPB during its apogee in the Late Formative. I ask, therefore, how did the political and economic landscape of the ELPB evolve in relation to the rise and resilience of Tres Zapotes? This study constitutes the second stage of a project begun during Summer 2014 by Dr. Christopher Pool of the University of Kentucky. Dr. Pool's project investigates the evolution and resiliency of the political and economic system centered at the site of Tres Zapotes. This study looks temporally beyond the Tres Zapotes polity in order to better understand the ELPB during the Classic Period.

In order to develop these settlement scenarios, an understanding of the kinds of data that may be found in the field was necessary. This includes the architectural layouts of mounds and how layouts can very through time and space in Veracruz. For example, the Standard Plan architectural layout is common in central Veracruz during the Classic Period. First defined by Annick Daneels, it refers to a plaza group with a dominant conical mound, an elongated lateral mound or two, and a ball court with an associated platform on the fourth side (Figure 4.1).

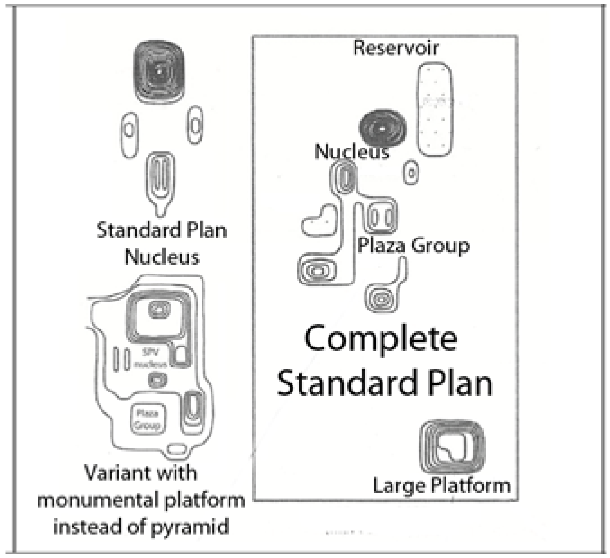


Figure 4.1: Layout of Standard Plan Architecture (redrawn from Daneels 2008, Figure 3).

The size and orientation of elongated mounds may have served a calendric function, similar to Maya E-groups (Daneels 2008:202). Tracking the path of the sun from the Standard Plan's west platform, the equinox sun *sometimes* rises over the center of the eastern platform, however there is much variation in layouts. Summer and winter solstice sunrise would enter through the northeast and southeast corners of the plaza (Stark 1999:202). Standard Plan architectural groups were an important part of social life in the past, likely hosting ritual events throughout the year (Stark 2008:100). While Daneels first defined the Standard Plan, Stark has 'simplified' the concept to include architectural groups without ballcourts in order to apply her ideas more broadly. Applying this simplified Standard Plan concept to Cerro de las Mesas in the western lower Papaloapan Basin (WLPB) at least six standard plan layouts are identified, representing corporate segmentation (2008:99-100). Standard Plan layouts separated by greater distances than are found in the WLPB are interpreted as secondary centers. To the northwest of the WLPB, Daneels (2008) uses the presence of two or more Standard Plan layouts to identify capital zones in the Cotaxtla and Jamapa basins. Similar to Stark (2008), Daneels (2008) interprets sites with a single Standard Plan as a secondary center. Tertiary centers contain only one or two components of the complete Standard Plan.

In the ELPB, formal architectural layouts differ. In fact, Pool (2008) once observed that no Standard Plan layouts had been identified in the region – a position he has revised based on new lidar data (Loughlin and Pool 2016; Pool 2021). The Tres Zapotes Plaza Group (TZPG) is the hallmark of Tres Zapotes' power in the ELPB during the Late Formative. The TZPG contains a tall conical mound or pyramid to the west with a long, narrow mound to the north (Pool 2008:128). A low mound on the centerline of the plaza serves as a shrine. Pool (2008) argues that the repetitive nature of the TZPG in four locations across the Tres Zapotes core signifies a power-sharing political structure devised by competing factions. The site of El Mesón, 13 km north, became a secondary center during the Late Formative when they constructed a TZPG in the main civic-ceremonial section of the site (Loughlin 2012:192). Despite the TZPG's association with power and the Tres Zapotes polity, this architectural layout is rarely found *outside* the ELPB. This contrasts to the Standard Plan, which is found across a wide swath of central and southern Veracruz. As demographic and political change took place during the Proto-Classic and Early Classic periods, El Mesón escapes its status as a secondary center to TZ, replacing the TZPG with new architectural forms (Loughlin 2012:11-12).

Standard Plan layouts were common formal architecture plans in central and south-central Veracruz during the Late Formative through Early Classic period (Daneels 2002, 2008; Stark 2003, 2008). However, only more recently have Standard Plan layouts been identified in the ELPB (Loughlin et al. 2016). More recent LIDAR survey undertaken as part of the larger RRATZ project identified 6 Standard Plans in the ELPB survey zone (Pool and Loughlin 2017). Two of the identified Standard Plans were previously explored (Leon Perez 2003:30; Loughlin 2012:287), however high vegetation conditions during pedestrian survey likely prohibited the identification of the mounds as formal layouts.

The architecture of El Meson South was first identified and recorded as part of the RAM project during pedestrian survey (Loughlin 2012). Cross-cutting numerous agriculture fields of maize and sugar cane, poor visibility at the time led Loughlin to identify the two large conical mounds (7-9 meters height) and several low long mounds less than 2 meters in height (Loughlin 2012:287-292). These low mounds were identified initially as domestic structures. LIDAR mapping shows that the obscured architectural complex is centered on an east-west plaza. The large conical mound and remnant of a large quadrilateral platform are on the east side of the plaza. North and sound plaza ends are bounded by two low, long mounds. The west side contains two small parallel mounds that form a ball court (Loughlin et al. 2016:307).

A second Standard Plan was identified during the LIDAR section of the RRATZ project (Figure 4.2). The Lagartera site was first recorded by Leon Perez (2003:30) during a petrochemical survey of the area. Leon Perez recorded 28 large platforms and mounds at the center of the site. Some of these mounds contain heights greater than 5-7 meters. No map was made at the time, likely due to the site's location within dense tree cover. Knight (2007) later visited the site and noted the presence of three plazas at the site's core. Again, no map of the site was ever recorded. The LIDAR map below shows the site center laid out in east-west orientation, same as at El Meson South. The map shows a large conical mound, paired long mounds and ball court within the larger plaza. A large platform mound sits west of the ball court, on the west end of the plaza.

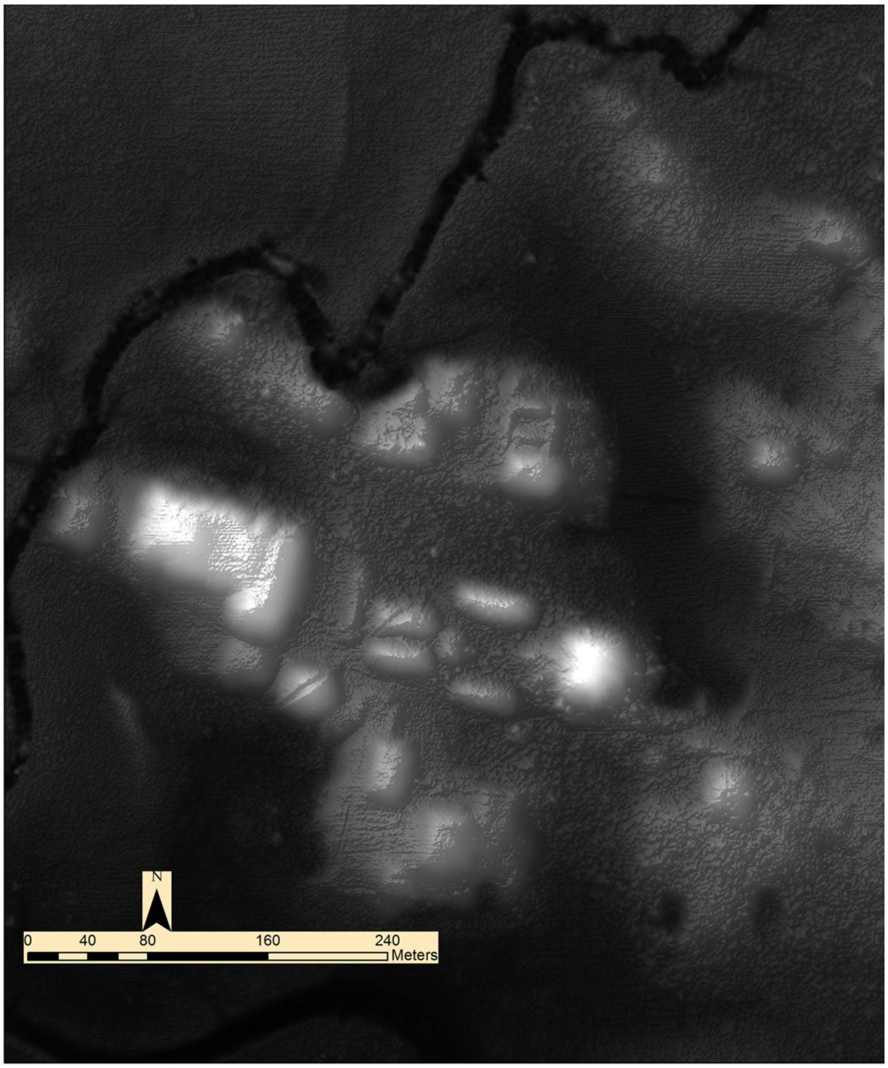


Figure 4.2: LIDAR Map Showing Standard Plan at Lagartera Site (From Loughlin et al. 2016:308).

The application of Blanton et al.'s (1996) dual-processual model to research in the Gulf Lowlands (Loughlin 2012; Pool 2007, 2008; Stark 2008) over the last decade provides a baseline for framing questions for this project. By understanding the kinds of data that can be linked to exclusionary/corporate strategies it helps ask better questions and link theory and data. A political ecology approach is used to emphasize more 'bottom-up' perspectives to the understanding of the past. A political ecology approach emphasizes the notion that marginalized groups can be pushed into undesirable environments. This project also takes a settlement ecology approach to better understand the causal factors that account for settlement patterns and how they changed over time in the distant past (Stone 1996; Kellett and Jones 2016).

Overarching Scenarios

With these issues in mind, below I lay out three broad scenarios that help address a basic, nested hierarchy of three questions: First, what factors contributed to significant increase in dune occupation in the ELPB during the Classic period? Second, did the environment attract people to the dunes or were people forced into an undesirable habitat by population growth or political exclusion? Third, is the increase in occupation gradual or sudden? The following overarching scenarios are summarized and then elaborated on below. These scenarios should not be understood as completely exclusive of one another, nor absolute in scope to explain the Classic period occupation of the coastal dunes in the ELPB.

Scenario 1

This scenario posits that the exploitation of a specific resource or a combination of resources attracted people to the dunes during the Classic period. Under this scenario, a resource present on or near the dunes became important and settlement moved to the dunes to capitalize on the resource. The attraction to the dunes for resource accumulation purposes may have been politically motivated either by a distant site (Matacapan or Central Veracruz) in search for a steady supply of dune resources or by aspiring local elites looking to increase prestige. Possible resources include, but are not limited to: aquatic resources, clays for ceramic production, and productive soil for cotton production. Additionally, following a bottom-up settlement ecology approach, non-elites may have been attracted to the dunes due to the abundance of subsistence resources available at adjacent lakes and wetlands. If resource exploitation was a driving force for dune occupation, I expect population growth to be gradual rather than sudden. This is especially true for non-elite settlers who may have moved to the dunes for personal subsistence needs.

Scenario 2

This scenario considers the idea that the dunes became an important geographic location to occupy during the Classic period for reasons other than resource exploitation. Under this scenario, Classic period people came to occupy the dune landscape, not to exploit a natural resource, but to occupy the area in order to control an economically strategic position in the landscape (Hirth's matrix-control principle). The significance of the landscape may have developed because of its access to a coastal trade route.

Scenario 3

This scenario considers the idea that people were *pushed* into the dunes during the Classic period. This scenario conforms to a political ecology model in which marginalized populations are forced into less desirable geographic locations. This scenario suggests that the dunes were not an ideal place to settle, as is suggested by the general late occupation of the landscape. Instead, changes occurring in the region during the Late Formative to Early Classic transition made the occupation of the dunes necessary. Possible explanations for this *push* into the dunes include population pressure, defensive positioning, changing political allegiances, or natural disasters.

Scenario 1 Hypotheses

Under Scenario 1 dune occupation increased during the Classic Period in order to accumulate key dune or near-dune resources. Increased interaction in the ELPB with both Central Veracruz and Matacapan may have prompted new exploitation and exchange networks. Hirth's (1996) context principle of political economies is concerned with where and how the accumulation of resources takes place. Hirth differentiates between individual-oriented accumulation systems which take place at the household level and context-oriented accumulation systems which are supervised by elites and take place in special-purpose contexts (e.g., attached craft specialists).

If a context-oriented accumulation system was in place during the Classic Period on the dunes I expect to find specialized workshops (e.g. ceramic production or shellfish processing) in close proximity to large, elite mounds. Workshops that are attached, or closely adjacent, to elite mounds would likely be under elite control. Proximity to elite mounds will signify elite control Ceramic production zones can be identified through the presence of 'waster' sherds and kiln debris. Shellfish processing sites can be identified through the presence of shell middens. If a workshop is closely related to a large mound, a context-oriented accumulation system is in place.

Hypothesis 1A – Aquatic Resources: dune occupation increased significantly during the Classic period in order to exploit aquatic resources in nearby Laguna Tortuga and Laguna Marquez. Preliminary survey of the dunes demonstrated that occupation occurs in areas very near productive aquatic environments. These occupations were on high ground, staying dry even when low-lying areas were seasonally inundated with water. These advantageous locations could have served as a stable settlement used to exploit and process large amounts of aquatic resources.

If this hypothesis is valid, I expect to see a large proportion of obsidian tools with serrated edges on the dunes. Elsewhere coastal archaeologists have argued that serrated-edged tools are ideal for processing of aquatic resources (Erlandston et al. 2011). I also expect to find a significant number of netsinkers -- grooved ceramic spheres or perforated stones used to aid in fishing with nets. Lastly, if aquatic resource exploitation was the primary driver for Classic period dune occupation, I expect to find shell middens, or shell mounds that might include both brackish water and marine species from the coast. These would differ from the common earthen mounds prevalent throughout the ELPB.

Hypothesis 1B - Clay Extraction: Dune occupation increased during the Classic period in order to exploit localized clays that occur in and around the lagoons in the survey area. If this hypothesis is confirmed, I expect to find ceramic production localities in the survey area. If people were attracted to this area in order to exploit local clays, I expect that ceramic production would take place near the clay resources in the survey area. Ceramic production areas have been identified in the region through high quantities of deformed and overfired 'waster' sherds (Pool 2003:57). Another indicator of ceramic production areas is the identification of kiln debris. Constructed of mud and fiber, the repeated firing of kilns documented in the Tuxtlas and ELPB creates a vitrified surface interior with color zonation on fired earth pieces (Pool 2003:57). If clay extraction pulled occupants to the dune environment, I expect to find large quantities of waster sherds, kiln debris, and undeformed sherds broken in the firing process (de facto wasters), all indicative of the ceramic production process.

Hypothesis 1C – Cotton Growing. Barbara Stark (2008) and Stark et al. (1998) argue that cotton production drove the Classic Period economy in the nearby Mixtequilla region of the WLPB. While dune soils are classified as regosols, thinly developed and of poor quality for the production of crops, soils near the dunes have excellent potential for growing cotton. These phaeozem soils, very dark in color, nutrient rich, and agriculturally productive, are found up to the edge of the dunes.

This hypothesis suggests that dune occupation occurs during the Classic period in order to utilize nearby soils for cotton production. If this hypothesis is confirmed, I expect to identify a large number of spindle whorls on the dunes, evidence of textile production. I also expect to see a general increase in the use of regalia on stone monuments and figurines in the region as a whole. An increase in the use of textile regalia may have driven an increase in cotton production in southern Veracruz.

Scenario 2 Hypotheses

Hypothesis 2A – Transportation Route: In this hypothesis dune occupation increased during the Classic period in order to control a key coastal transportation route. While the survey area is on the landward side of the dunes, sites in this location would have had water access to the Gulf of Mexico. In a time of great political turmoil in the

ELPB, ties to both Central Veracruz and Central Mexico were increasing (Stoner 2011; Loughlin 2012; Santley 2007). This increased interaction may have facilitated the need to control a coastal transportation route to efficiently move goods between regions. The coastal location of the dunes would provide an ideal location to control this route. Hirth's (1996) matrix-control principle suggests that elites will attempt to interject themselves at key geographic points on a landscape in order to influence/control the flow of resources between regions. This can be through the physical control of points along trading routes.

If the coastal control of a trade route was the primary reason for occupation, I expect to identify a distribution network of foreign goods. For example, do ceramics recovered from the dunes show similarities in paste attributes, form, surface treatment, and decoration with Central Veracruz or Matacapan? Central Veracruz ceramics appear near the site of El Mesón (Loughlin 2012) and in the Tepango Valley (Stoner 2011) during the Classic Period. Meanwhile, Teotihuacan-style ceramic forms and figurines appear at Tres Zapotes yet appear to be scarce and highly localized in other parts of the ELPB (Stoner and Pool 2015). By examining ceramic types, forms, figurines, and special objects it will provide evidence as to the system in which they participated. The primary obsidian sources utilized in the Classic period were the visually distinctive Zaragoza-Oyameles, Pico de Orizaba, and Pachuca (Knight 1999; Barrett 2003; Stark et al. 1992). While exchange networks that brought Zaragoza-Oyameles obsidian into the region were widespread, the presence of Pachuca green obsidian can provide strong evidence for economic linkages with Teotihuacan. Do we see overlap of these networks on the dunes? For the transportation route hypothesis to be considered valid, ceramics and obsidian from the dunes will be part of a distribution network with other near-coastal sites outside the ELPB.

Settlement layouts can also help identify interaction networks. Daneels (2008) argues that the Mesoamerican ballgame played a critical role in the social cohesion of the lower Cotaxtla Valley. If the dunes had strong ties to Classic Veracruz civilization, I expect to find ballcourts in the survey area. Additionally, if any Standard Plan layouts, or segments of a Standard Plan layout are identified on the dunes it will demonstrate ties to Central Veracruz.

Scenario 3 Hypotheses

Hypothesis 3A – Defensive Positioning: The highly contested political landscape of the ELPB during the Classic Period may have pitted polities in the region against one another based on their place in distant distribution systems. In the WLPB, Cerro de las Mesas consolidated power and became a prosperous center through the Early Classic. By the Late Classic, the site's centralized power had been fractured and divided into three different centers (Stark 2008:94). One of these centers was the site Los Ajitos-Los Pitos, located on the paleodunes of the northern WLPB. While Los Ajitos controlled the lower Tlaxicoyan drainage, Stark (2008:104) suggests that the Classic period occupation may be due to its defendable position provided by the elevated dunes. An initial analysis of the distribution of Standard Plan layouts in the ELPB (Loughlin and Pool 2016; Pool 2021) suggests that a similarly balkanized political landscape may have existed in the region surrounding the dunes. Hypothesis 3A suggests that an uneasy political arrangement was in place during the Classic period in the ELPB. The dunes were occupied as a way to guard against the threat of violence from their neighbors.

If this hypothesis is supported, I expect to see settlement condensed into areas that are easily defendable. Defendable positions may only have one point of easy land access to a settlement with hills or water surrounding the other areas.

Hypothesis 3B – Aspiring Elite Settlement. This hypothesis suggests that dune settlement increases from the Formative to the Classic Period due to the changing political climate. While the Late Formative Tres Zapotes polity dominated the ELPB, incorporating secondary centers (e.g., El Mesón) under its control (Loughlin 2012), the Classic period may have been a politically volatile time. Further south in the greater RRATZ survey block, multiple Standard Plan architectural layouts were identified. This suggests the ELPB was a balkanized, competitive political landscape. This hypothesis supposes that certain elite segments may have settled the dunes during the Classic Period in order to establish autonomy. This hypothesis will be supported if two criteria are met. First, there should be evidence of only a small Formative occupation. I do not expect to find a TZPG architectural layout that would link the dunes directly to the Tres Zapotes polity in the Late Formative. Secondly, I expect to find multiple large rectangular platforms with mounds atop. Stark (2008) has interpreted these platforms in the WLPB as representative of the estates of landed elites. Aspiring elites may have moved into the previously under-occupied dunes during the Early Classic to accumulate wealth and retain some level of autonomy away from the dynasties of Cerro de las Mesas.

If a Standard Plan architectural layout is recorded in the dunes, it may represent a corporate segment that allowed landed elites to maintain some autonomy while staying politically and economically linked Central Veracruz.

Summary

The above scenarios and hypotheses reflect the settlement ecology framework of this project. Each of these track different causal factors. These scenarios were developed as a way to conceptualize the different combinations of political, economic, and environmental factors that contributed to changing settlement patterns over time.

Chapter 5 - Methods

This survey was conducted as part of the larger NSF-funded RRATZ project co-directed by Dr. Christopher Pool and Dr. Michael Loughlin. This sub-section of the RRATZ project was originally designed with the primary goal of identifying and recording Archaic period archaeological sites. Many hunter-gatherers groups are mobile and tend to invest less energy in building shelter (Kelly 1995). Often, the only physical remains of a hunter-gatherer site is a scattering of lithic debitage. Wilkerson's (1973, 1975) research on and near dune landscapes in northern Veracruz demonstrates that Archaic period occupations occurred in coastal dune areas. While Wilkerson did not set out to find Archaic materials, he discovered lithic scatterings at dune 'blowout' sites. 'Blowouts' occur when unconsolidated sections of dunes migrate, exposing a buried archaeological site but losing all stratigraphic integrity. His findings remain some of the best known Archaic archaeological sites in all of Veracruz. The dunes in this survey were consolidated and stabilized during the Middle Holocene (approximately 7000 years ago) and the hope was to identify intact Archaic sites on or below the dune surface, or even under the dune on the edges for really early sites.

The biggest hurdle in finding Archaic sites in southern Veracruz and the ELPB is the alluvial landscape of the Papaloapan River basin. In most of the floodplain, Archaic sites are buried 6 to 9 meters beneath the modern ground surface. The dune and near-dune landscape in this study was specifically chosen because it is elevated above the alluvial plain. Sediment has not covered the dunes. Therefore, Archaic period sites *could be found* much closer to the modern ground surface than in other areas of the ELPB.

The dunes in this study are located 8 kilometers north of Angel Cabada along the coast of the Gulf of Mexico. These consolidated, longitudinal dunes are part of a larger system that runs northwest along the coast into central Veracruz. Transgression rates on the dunes slowed around 7000 BP leading to reduced erosion. Since 7000 BP, the dunes in the study area have been stabilized with vegetation (Sluyter 1997).

The dunes rise upwards of 100 meters in height in some locations. Many of the people living on the dunes today have cleared trees and shrub vegetation to let animals graze in pasture. Other residents utilize the thin soils for agricultural purposes. On the landward side of the dunes are two lagoons, Laguna Marquez and Laguna Tortuga, located on the southern boundary of the survey zone. These lagoons contain water year-round, though they increase greatly in size during the rainy season. High-water levels during this time bring salt-water fish into this estuary environment, along with migratory birds and various terrestrial animals. During the dry season, the lagoons shrink allowing local ranchers to graze cattle and horses on previously inundated land. The dune and near-dune landscape was selected for survey due to its elevated location adjacent to a highly productive estuary environment, ideal for hunter-gatherer occupations.

Killion's (2013) Hunter-Fisher-Gardener (HFG) model proposes that a mixed subsistence strategy developed during the Late Archaic period (3000 - 2000 cal. BC) and underwrote the development of Olmec society in the Early Formative period (1450 – 1000 cal. BC) at San Lorenzo. He notes that much of the earliest microbotanical remains found in the southern Gulf lowlands are in areas with abundant aquatic resources (Goman and Byrne 1998; Pohl et al. 2001). Killion (2013:572) proposes that a mixed subsistence strategy, that combined hunting, fishing, and gardening, developed in the Gulf lowlands during the Late Archaic (3000 – 2000 BC) and persisted into the Formative period. While microbotanical remains of domesticate cultigens have been recovered in the region (Goman and Byrne 1998; Pohl et al. 2001), there are few known Archaic archaeological sites. Killion's hypothesis has made the need to find Archaic archaeological sites in southern Veracruz more urgent.

Questions This Survey Seeks to Address

While the goals of this project are numerous, the overarching thrust of it revolves around attempting to understand the processes that account for variation in the distribution of dune occupation through time. Dune landscapes in Mesoamerican archaeology are an understudied landscape. This project attempts to highlight dunes and near-dune landscapes not as barren regions of sparse populations, but instead thriving areas of settlement worthy of much greater archaeological attention.

While southern Veracruz and the Tuxtla Mountains region has seen pedestrian survey projects of various scales over the last twenty years (Stoner 2011; Loughlin 2012; Borstein 2001; Killion and Urcid 2001; Kruszczynski 2001; Santley and Arnold 1996; Stark 1991; Symonds et al. 2002), few have included coastal dunes in their universe. As such, no archaeological survey had ever been conducted on this specific stretch of dune and near-dune landscape. Therefore, some of the goals of this project are basic, but important, in nature and scope. This survey needed to collect data on to answer these questions: 1. How many architectural features and concentrations are found in the survey universe? 2. When did settlement occur within the survey zone and how did it change through time? 3. How are features distributed in the survey universe and how are they associated with one another? 4. And lastly, how does settlement on the dunes compare to other regions in southern Veracruz?

The last thirty years has seen the knowledge of settlement patterns in southern Veracruz expand greatly. Numerous survey projects near the ELPB (Santley and Arnold 1996; Stoner 2011; Loughlin 2012; Stark 1999; Daneels 1997; Killion and Urcid 2001) have generated a coarse image of the region's occupation as both varied and complex. In general, sites to the east in the Tuxtla Mountains are more discrete and nucleated. The Mixtequilla region to the west (WLPB) contains a near continuous distribution of housemounds, punctuated by civic-ceremonial complexes (Stark 1999; Pool and Ohnersorgen 2003).

When determining the specific field methods to employ in any a given survey, there are a few primary concerns to consider. First, what is the basic unit of analysis? Next, what is the ideal level of coverage intensity? Lastly, how should the materials be collected?

The basic unit of analysis must be considered while developing a research strategy. For example, does your research question require a fine-grained analysis in which the household is considered? Or does the research question pertain to a broader scale of analysis (e.g. the civic-ceremonial centers)? The kinds of data to be collected is a primary consideration in determining survey methods. Considerations of the basic unit of analysis in pedestrian survey are linked directly to definitions of an archaeological 'site' and how they are identified in the field. Site definitions are often vague and not critically evaluated (Dunnell and Dancey 1983:271). This leads to interpretations where any datable artifact on the landscape can be considered a 'site' (Gallant 1986:408).

Additionally, using the ‘site’ as the unit of analysis can ignore the background noise of continuous, low-density artifact concentrations on the landscape (Dunnell and Dancey 1983; Foley 1981; Gallant 1986; Pool and Ohnersorgen 2003). By replacing the ‘site’ concept with features (e.g. mounds) and artifact concentrations as the basic unit of analysis, surveyors can avoid the headaches associated with how to define a site. The scale of the RRATZ survey zone and high artifact densities in occupied areas made it necessary to adopt an intermediate scale (the feature) as the unit of analysis. This practical adaptation to the siteless survey approach was modeled after Stark’s work in the Mixtequilla (1991, 1997, 1999). This differs from other approaches common in North American archaeology in which a ‘siteless survey’ approach is utilized to record the locations of individual artifacts.

Siteless surveys utilize this lower order unit of analysis (Dunnell and Dancey 1983; Foley 1981; Gallant 1986). Rather than viewing the landscape as discrete sites, the siteless survey approach sees the landscape as a continuous distribution of artifacts and features. The siteless approach is particularly well-suited for southern Veracruz where numerous long-term occupations have obscured easy-to-delineate site boundaries with continuous surface artifacts (Stark 1991). Siteless survey approaches allow the researcher to analyze settlement data prior to delineating specific sites. Due to the nature of the siteless approach, tighter transect spacing is required in order to identify small features and artifact concentrations.

In any scientific research project it is important to be cognizant of potential biases in the research one is conducting. Depending on the methods the archaeologist chooses, different types of biases are possible and should be understood before undertaking any data analysis. In site-based surveys, transect spacing will tend to be greater than in siteless surveys. This is due to the site being the unit of analysis. As such, smaller housemounds that typically measure 20 meters in diameter (Stark 1991:42) will be often be missed as they fall between transect lines. These household level features and artifact concentrations will be underrepresented in site-based surveys (Daneels 2002:109-122). By missing smaller housemounds, features, and artifact concentrations, researchers may interpret the settlement patterns to be more nucleated and discrete than it is in reality.

Pool and Ohnersorgen (2003) sought to better understand survey bias in southern Veracruz by utilizing two kinds of pedestrian survey techniques and evaluating the results at Tres Zapotes. The authors first modeled a broad systemic interval survey across the landscape at 100 meter intervals. This method is reminiscent of previous strategies utilized in the Tuxtlas region (Santley et al. 1997). Surface collections occurred at 20 meter intervals along transects. Concurrently, Pool and Ohnersorgen (2003) utilized methods previously employed by Barbara Stark (1997, 1999) in the Mixtequilla region. This portion of the survey utilized a lower-level unit of analysis as its focus. As such, crews walked transects with 20 meter spacing between the 100 m systematic collection transects. When features were discovered, a systematic 3 x 3 meter surface collection was made every 20 meters.

In their evaluation of the different survey methods, Pool and Ohnersorgen (2003) determine that each has its own biases. The more serious bias occurs with the systematic broad interval survey in which low mounds and artifact concentrations are underrepresented. This is particularly problematic because this bias will impact population estimates and socio-economic reconstructions. Surveys with tighter intervals (like Stark 1997, 1999 in the Mixtequilla) tended to underestimate the extent of low-density artifact concentrations as surveyors became de-sensitized to this type of feature. In the end, Pool and Ohnersorgen (2003) argue that these two techniques are complementary of one another and should be utilized as such.

Survey Coverage

The level of coverage in pedestrian survey is also directly related to the research questions of the project and the types of data needed to be collected. Settlement pattern survey projects can be full coverage or probabilistic samples. Full coverage is the more common approach in which the entire survey universe is investigated with consistent intensity (Fish and Kowalewski 1990:2). Within full-coverage survey projects there is variation in survey intensity based on the kinds of data needed. As discussed previously, if household-scale data is needed, transect spacing will need to be tight enough (for example, 20 m) in order to identify smaller housemounds (see Stark 1991). In contrast, researchers targeting large civic-ceremonial centers can cover great distances and cut down on time and labor costs by expanding transect spacing up to 400 m (see Daneels 1997, 2002). No matter the spacing determined by the researcher, full-coverage surveys record all features in the survey universe with consistent methods.

Transect spacing is also determined by the average size of the unit of analysis. If housemounds in a given region tend to be 25 meters in diameter, transect spacing should be no larger than 25 meters. With transect spacing at the same size or smaller than as a normal housemound (in this example), theoretically, no mounds will ever escape the view of the survey team because it will fall along at least one transect line. This is an idealized case. In reality, transect spacing considerations must also take into account time and labor costs as well as ground surface visibility. In southern Veracruz, sugarcane cultivation can greatly impact visibility. Growing rows can provide clearly delineated transect lines with 100% ground surface visibility. Early in the growing season, low sugar cane can provide easy visibility to identify low housemounds. However, sugarcane can also grow up to 3 m tall, making visibility exceptionally difficult during times of the growing season.

Another type of survey strategy is a probabilistic survey. The goals for this kind of survey project are different than a full-coverage survey. In a probabilistic survey, the project is designed to provide a statistically valid view of a broad area. Borstein's (2001) probabilistic survey of the San Juan drainage is one of the few examples of this kind of project undertaken in southern Veracruz. Borstein's (2001) goals were to examine upland vs. lowland settlement between the lower Coatzacoalcos drainage and the southern Tuxtla Mountains foothills. Systematically placing 25 sq. km. survey blocks in different ecological settings, Borstein was then able to conduct full-coverage pedestrian survey within each block. As a result, of the 800 sq. km. survey universe, he was able to survey 109 sq. km. of lowland and 211 sq. km. of upland areas (2001:21). The obvious benefit of this kind of research is that Borstein was able to characterize a very large area that would have been otherwise impossible with regards to time and money.

Unfortunately, this type of sampling survey has a number of drawbacks. First, data collected using this kind of sampling strategy cannot be analyzed with spatial tools. Statistical methods, such as nearest neighbor analysis, central places analysis, catchment analysis, etc. are not possible because they require the entirety of the data universe (Plog 1990:246). Another general weakness to this kind of strategy is its inability to identify variation within the survey area. Flannery (1976:135) notes that the expectation is that the settlement data found in the sampling area will be representative of the entire survey area, in the same proportions. By making this assumption, any variation within the settlement pattern is not identified (Kowalewski 1990:41-47).

Surface Collections

Once a feature is identified during survey, the next important step is collecting a sample of artifacts that will help determine the relative age of feature. Archaeologists working in Mesoamerica know this can be an overwhelming proposition and it often goes undertheorized. Possibly the most common surface collection strategy on survey projects is the ‘grab’ sample. Grab sampling is done for convenience and speediness. The idea is that the researcher can quickly grab a number of surface artifacts and can get a rough idea as to when a given feature was occupied. This is fine in many cases, however the researcher must be aware of a few drawbacks to this kind of sampling by convenience.

The first critique of a ‘grab’ sampling strategy is that it is impossible to know if the collected artifacts are in fact representative of the occupation (Stark 1991:47). By using such an unstructured strategy of collection, it is possible that the most convenient place to collect artifacts represents an outlier in the feature’s occupation history. Additionally, it makes it difficult to identify activity areas if a more formal sampling strategy is not in place. Nevertheless, grab samples have provided useful chronologic data for survey conducted in the Cotaxtla Basin (Daneels 2002:113), San Juan Drainage (Borstein 2001:32), and the ELPB (Leon Perez 2002).

A different surface collection strategy is one that is systematic. Systematic sampling has the advantage over ‘grab’ sampling because it is easier to identify differences in occupational intensity, as well as activity areas. The most obvious drawback to a systematic surface collection strategy is the time and labor costs associated. Survey projects that are required to collect large-scale regional data may find the time and labor costs requirements for a systematic collection strategy as cost prohibitive. In these cases, a coarser chronological picture obtained by a ‘grab’ collection may suffice.

Barbara Stark’s PALM survey provides a third approach utilized in the southern Veracruz region. The PALM’s collection strategy relied on the targeting of features and artifact concentrations identified during survey. From each feature or artifact concentration 100 ceramic sherds were collected that could provide the most chronologic and occupational information. Stark specifically collected rims, decorated sherds, and any unusual sherds. She notes (1991:47) that because PALM surveyors were not specifically targeting diagnostic sherds only, the resulting surface collections are able to say much more about potential activity areas and other functional purposes. Like all collection strategies, there are drawbacks to Stark’s approach. First, because features were the targeted collection areas, artifacts could only be collected if visibility was good. Therefore, some features could not have any collections made. Secondly, because collections were not made in a systematic way across the entirety of the survey universe, some statistical techniques are unavailable for use in analysis (e.g. trend surface analysis).

Field Methods for this Project

For this project, a full-coverage 'siteless' survey was conducted. This approach was guided primarily by the lack of information about dune settlement prior to this survey. The RAM survey (Loughlin 2012), conducted 8 km south of the dune survey zone, recorded a dispersed distribution of mounds that was in between the continuous distribution of features seen in the Mixtequilla (Stark 1991) and the discrete sites found in the Tuxtla Mountains (Santley and Arnold 1996). It stood to reason that the dune and near-dune occupation could be similar. Additionally, the focus on this portion of the RRATZ survey was to identify and record Archaic period sites, often found as small lithic scatters. By approaching the dunes with a siteless approach, smaller transect spacing was utilized allowing for survey teams to identify small artifact concentrations.

Crews conducted pedestrian survey at 20 meter intervals. In areas of pasture, where surface visibility was minimal, crews conducted shovel testing at 20 meter intervals. In addition to our 20 meter transects, crews were specifically on the look-out for dune 'blowouts', and special attention was paid to road cuts, stream cuts, and any other areas of erosion where Archaic materials may be found. All mounds identified during survey had the center and corner points taken with a handheld Garman GPSmap 62s unit.

Artifact Collection Strategy

The objective of the surface collections for this project was to identify diagnostic ceramic and lithic materials while also identifying potential craft production areas. In areas of good surface visibility, all rim and decorated ceramic materials were collected until 100 sherds were collected. The size of the collection area was recorded in field notes to better understand settlement density (Stark 1991, Loughlin 2012). In reality, the majority of mounds and sites did not contain 100 rim sherds. In these cases, all rim sherds were collected and supplemented by the collection of body sherds. Additionally, all lithic materials (up to 100 count), both formal tools and production debris were collected and bagged separately from ceramic materials. Figurines, special objects, spindle whorls, burned earth, and some groundstone was also collected and bagged separately. When groundstone artifacts were too large for transport, a GPS point was taken of its location, measurements were taken, as were photographs and sketches.

In many instances, mounds were identified in a pasture setting where ground visibility was poor or nonexistent. In these instances, shovel testing was conducted in two parallel lines (5 meters apart) over the top of a mound. Shovel-testing followed INAH-approved guidelines as holes were limited to 30 cm. in diameter and 20 cm. in depth (Pool and Ohnersorgen 2003; Stoner 2011).

Lab Analysis Methods

A total of 6,008 artifacts were collected during pedestrian survey in the summer of 2014. Ceramic sherds account for the majority of the collection (n=5,248; 87.4%). Lab analysis found 1,709 of sherds were diagnostic (32.5%) (See Appendix). Obsidian tools and debris were the next largest category of artifact collected on the dunes (n=210; 3.5%). The remaining materials contained 426 pieces of burned earth (8.1%), 67 groundstone tool fragments (1.1%), 43 special objects (0.7%), and 14 figurine fragments (0.2%). All materials collected in the field were transported to the project field lab on the grounds of the Tres Zapotes Museum. Materials were washed, cataloged and analyzed on the Museum grounds where they remain in storage. All materials were analyzed in the summer of 2015 using the following lab methods.

Ceramics

Ceramic sherds comprised the largest category of artifacts in the survey (n=5,248), accounting for 87.4% of all materials collected (see Appendix A). Diagnostic ceramics accounted for 32.5% of all pottery sherds collected (n=1,709) (Table 5.1). Surface collection strategy was designed to collect the maximum number of rim and decorated pieces. When possible, 100 rim or decorated sherds were collected from each context.

Table. 5.1. Diagnostic Ceramic Assemblage with Count.

Phase	**Type Code**	**Type Name**	**N**	**% for Phase**
Arroyo	2905	Specular Red	3	37.50%
		Tecomates	5	62.50%
Total			8	100
Tres Zapotes	2113	Coarse Gray	1	2.50%
	2123	Polished Medium Black with Quartz Temper	25	62.50%
	2302	Cream Slipped Coarse Whiteware	5	12.50%
	2512	Plain Coarse Polished Black	9	22.50%
Total			40	100
Hueyapan	2111	Plain Coarse Gray with White Temper	5	2.72%
	2122.4	Thin-walled Polished Black with Orange to Gray Paste	28	15.22%
	2225	Coarse Black and Tan	11	5.98%
	2225.1	Incised Coarse Black and Tan	2	1.09%
	2226	Medium Black and Tan	118	64.13%
	2656	White Slipped Coarse Red with Coarse White Temper	11	5.98%

	2904	Plain Polished Orange	9	4.89%
			184	100
Nextepetl	1212	Sandy Fine Orange	80	23.05%
	1240	White-slipped Sandy Fine Orange	7	2.02%
	2224	Fine Paste Black and Tan	31	8.93%
	2224.1	Plain Fine Paste Black and Tan	2	0.58%
	2653	Coarse Orange with White Temper (Dark Core)	31	8.93%
	2654	Coarse Brown with Coarse White Temper	196	56.48%
Total			347	100
Ranchito	1211	Fine Orange	269	25.31%
	1213	Fine Buff	2	0.19%
	1231	Red Wash on Fine Orange	13	1.22%
	1232	Brown-Slipped Fine Orange	2	0.19%
	1233	Polished Brown-Slipped Fine Orange	2	0.19%
	1234	Orange-Slipped Fine Orange	1	0.09%
	1236	White-Slipped Fine Orange	22	2.07%
	1262	Incised Red on Fine Orange	1	0.09%
	1271	Red on White-Slipped Fine Orange	1	0.09%
	1272	Orange on White-Slipped Fine Orange	1	0.09%
	2611	Brown-slipped Coarse Brown	373	35.09%
	2612	White-Slipped Type 22	50	4.70%
	2614	Brown-Slipped Coarse with a Paste with White Inclusions	107	10.07%
	2615	Pink Coarse	8	0.75%
	2616	Coarse Brown with Soft Rastreado	2	0.19%
	2624	Related to Patarata Coarse Red-Orange, Acula Red-Orange	55	5.17%
	2811	Coarse Orange	73	6.87%
	3006	Patarata Coarse Red-Orange	1	0.09%
	3008	Acula Red-Orange Monochrome	80	7.53%
Total			1063	100
Quemado	1111	Plain Fine Gray	47	71.21%
	1112	Black-Slipped Fine Orange	10	15.15%
	1113	Burnished Gray	3	4.55%
	1114	Burnished Milky Light Brown	1	1.52%
	1115	Mottled Light Brown with Matte Finish	1	1.52%
	1132	Brown-Slipped Fine Gray	2	3.03%
	1281	Polychrome on Unslipped Fine Orange	2	3.03%
Total			66	100

Post-Classic	1252	Black-Slipped Incised Fine Orange	1	100
Total			1	100
Grand Total			1709	

Table 5.1 (continued)

All ceramics were categorized according to the previously defined typology initially developed by Ortiz (1975) at Tres Zapotes and at Matacapan (Ortiz and Santley 1988) and expanded by Pool (1997, 2003, 2010). This typology was developed to identify technological and stylistic variation and change. It also incorporates differences in paste characteristics. These characteristics include the presence or absence of temper, temper type (volcanic ash or quartz/feldspar sand), paste color, temper size, decoration, incision, etc. Waster sherds exhibiting firing errors resulting in warping, cracking, or vitrification of the paste were also recorded and classified with respect to type. This typology has continued to be adapted as categories are created or consolidated with more recent contributions from Michael Loughlin's (2012) research at El Mesón, Stoner's (2011) in the Tepango Valley, and Venter's (2008) at Totocapan.

After sherds were classified based on the Tres Zapotes typology, individual pieces were categorized based on morphology. The goal of this part of ceramic analysis was meant to identify basic vessel form related to function as well as chronologically sensitive variations. Overall vessel form was determined based on wall, lip, and rim form as well as any incision or decoration. Sherds were counted and weighed (in grams) based on provenience.

Ceramic data was analyzed and input into spreadsheets using the Microsoft Excel software program. Basic frequency and percentage data was first broken down based on ceramic codes to determine relative age of occupation of various locations of the site. Additionally, each ceramic code was broken down by vessel form. These basic descriptive statistics will give a detailed picture of the total ceramic assemblage of the dunes.

Lithics

Lithics are the second most abundant artifact category recovered during survey (n=206) (Table 5.2), accounting for 3.5% of all collected materials. The lithic assemblage includes formal obsidian tools and production debris, as well as a single chert biface. There are no obsidian outcrops near the dune survey zone, meaning all obsidian needed to be imported from faraway sources. By identifying where dune occupants were obtaining their obsidian it may be possible to reconstruct trade and the political economy of the past. Recent XRF analyses of Tres Zapotes obsidian have largely supported traditional color analysis (Pool, Knight, and Glascock 2014).

Table 5.2. Obsidian Assemblage with Count.

Description	Stage	Count	%
Percussion Blades	Macro Core Reduction	1	0.49
Percussion Flake	Macro Core Reduction	1	0.49
Initial Series Blades - 1s	Polyhedral Core Red.	2	0.97
Pressure Blade Core	Polyhedral Core Red.	1	0.49
Irregular Pressure Blade - 2s	Prismatic Blades	36	17.48
Prismatic Pressure Blade - 3s	Prismatic Blades	123	59.7
Exhausted Pressure Blade Core	Prismatic Blades	1	0.49
Blades Retouched to Points (Tula Point)	Blade Tool	2	0.97
Blade used as a drill	Blade Tool	5	2.43
Blades as Scrapers - diagonal snap	Blade Tool	6	2.91
Sheared Flake	Bipolar	1	0.49
Bifacial Reduction Flake	Bifacial Flake Debitage	1	0.49
Flake with Platform	Undetermined Flake Debitage	9	4.37
Flake without Platform	Undetermined Flake Debitage	2	0.97
Undetermined Flake Debitage	Undetermined Flake Debitage	9	4.37
Shatter	Undetermined Flake Debitage	3	1.46
Other	Other	3	1.46
Total		206	100

Identifying colors and sub-colors with the naked eye can be helpful in identifying some obsidian source locations. For example, on the Gulf coast green obsidian is sourced exclusively from Pachuca, an obsidian source controlled by Teotihuacan during the Classic period. This project utilizes the same color system employed at Tres Zapotes (Knight 1999, 2003; Pool et al. 2014). This system employs three base colors (black, clear, green) and eleven sub-colors (Table 5.3). By utilizing Knight's system of primary and sub-colors it is possible to get a better understanding of dune obsidian sources without expensive XRF analysis.

Table 5.3: Lithic Color and Sub-color Categories with Probable Source.

Color	Sub-Color	Probable Source
Black	Black	Zaragoza
	Gray	Pico de Orizaba
	Cloudy	Zaragoza/GV
	Banded	Zaragoza/Paredon
	Transparent Gray	Paredon
	Pale Bluish	Guadalupe Victoria
	Light Gray with Specks	Guadalupe Victoria
Clear	Bottle Clear	Pico de Orizaba
	Bottle Clear with Clouds	Guadalupe Victoria
	Cloudy	Guadalupe Victoria
	Banded	GV/Pico de Orizaba
	Transparent Gray	Paredon
	Smokey with Specks	Guadalupe Victoria
	Pale Bluish	Guadalupe Victoria
	Light Gray with Specks	Guadalupe Victoria
Green	Green	Pachuca

In addition to color analysis, lithic morphological analysis was conducted on all lithic debris following Knight's (1999, 2003) ninety-nine point typology from Tres Zapotes. Knight's stage type definitions evolved out of previous lithic studies in Mesoamerica. Healan developed a lithic reduction typology for Tula, Hidalgo (Healan, Kerley, and Bey III 1983) which was later refined for projects at Matacapan and the Tuxtlas survey (Barrett 1996; Santley et al. 1984). Edge wear and retouch was recorded, paying particular attention to serrated edges, which could be indicative of the processing of aquatic resources (Erlandston et al. 2011).

Obsidian production technologies in the ELPB vary through time (Knight 2011). For example, clear obsidian blades with ground platforms are primarily found in Post-Classic times, but Knight found that black obsidian blades with ground platforms date primarily to the Proto-Classic Period at Tres Zapotes. This analysis pays particular attention to platform types in order to utilize Knight's findings to better understand the occupational history of the dunes. Lastly, platform type, section, termination, length (mm.), width (mm.), and thickness (mm.), weight (g.), edge modification, retouch, and edge continuity were all recorded (see Appendix B).

Groundstone

Groundstone collected in the field was analyzed in the lab following the methods previously developed by Pool, Kruszczynski, and Jaime- Riverón at Tres Zapotes. This analysis follows Kruszczynski's (2001) analysis, as refined by Jaime- Riverón (2016) that divided groundstone artifacts into 13 morphological types. These types include the most common forms found in the field in Mesoamerica, manos and metates, as well as pestles, celts, axes, donut stones, etc. (see Appendix C). Additionally, groundstone production debris flakes were classified based on the appearance of platforms, bulb of percussion, etc. Cross-section type of the longitudinal axis was recorded as well as artifact completeness, use-wear, weight (g.), and phenocryst size. Length, width, and thickness (cm.) were also recorded.

Raw material analysis focuses on identifying where dune occupants were getting their stone. Almost the entire assemblage of groundstone collected during survey was basalt. This is not surprising, considering there is a long history throughout southern Veracruz of basalt use. Basalts were divided between massive or vesicular, porphyritic or fine-grained, and pyroxene or olivine phenocrysts, which broadly reflect geographically patterned variation in basalt flows in the Tuxtlas (Jaime-Riverón 2016; Nelson et al. 1995).

Daub

Construction debris is another main artifact class. This analysis follows Hoag's (1997, 2003) classification of burned earth artifacts at Tres Zapotes. Hoag divides construction debris into three categories: daub, kiln debris, and burned earth. Daub is the building material found in wattle-and-daub construction throughout Mesoamerica, both archaeologically and ethnographically (Hoag 1997, 2003). Hoag observes that archaeological daub has usually been fired, albeit unintentionally. Through the burning process, daub often retains organic impressions (Hoag 2003:43). Daub pieces will have pole impressions or smoothed surfaces indicative of a prepared wall (Hoag 2003:50). Organic and pole impressions are the defining characteristic of daub's identification in the laboratory.

Updraft ceramic kilns are well-documented archeologically and ethnographically in southern Veracruz (Arnold 1991; Pool 1990, 1997, 2000; Stark 1992). These kilns are constructed with fiber-tempered mud and are sometimes partially dug into the ground. Ceramic sherds are used to cover the load of pottery in the upper chamber of the kiln. Kiln debris pieces will have color zoning or a vitrified surface. Zoning will be black on one side and red, orange, yellow, or buff on the other. Additionally, any burned earth pieces resembling parts of a kiln (e.g. bun-shaped pieces) will be recorded as kiln debris.

Pieces not displaying any of the above characteristics were simply classified as burned earth with its origin undetermined (Hoag 2003:50). This catch-all category includes many small fragments of burned earth that may have come from hearths or bonfires in the past. All daub, kiln debris, and burned earth were weighed (g.) and any colors, pole impressions, etc. were recorded (see Appendix E).

Figurines

Figurine types in the ELPB have a long history of study. A typology for Early and Middle Formative figurines from Tres Zapotes was developed by Weiant to include solid and hollow "baby-face" figurines, Morelos type, Uaxactun type, and "Vaillant's A" type (Weiant 1943: Plates 10, 11, 16-21, 28; see also Pool 2017). Late Formative figurine types include Weiant's Classic Pointed Chin type, Classic Prognathous type, Classic Rectangular Face type, Classic Beatific type, and Typical Grotesque Variants (Weiant 1943: Plates 1-4, 6, 7, 13). Other figurine types that may be present on the dunes include: Teotihuacan-style figurines that date to the Classic Period and have a signature triangle face with appliques; Los Lirios-style figurines that are defined by their large size, red paste, and hollowness; and San Marcos figurines that are hollow, molded and made of Fine Orange paste with a white slip.

Figurines and figurine fragments were analyzed in order to determine relative time period of occupation. Each figurine fragment was first classified into anthropomorphic or zoomorphic categories. Next, it was determined if the figurine was mold-made or hand modeled. Figurine fragments were analyzed to determine the body part, as well as sex, if possible (see Appendix D). Because there is a long history of figurine analysis at Tres Zapotes, figurine fragments were classified into previously identified categories whenever possible. These categories include solid and hollow 'baby-face', Morelos type, Uaxactun type, Los Lirios, San Marcos, Teotihuacano, Marionette, etc. (Drucker 1943; Weiant 1943; Pool 2017).

Special Objects

Special objects are a category that contains a wide variety of objects recovered during survey. Included in this category are objects such as ceramic handles, supports, incensarios, spindle whorls, stamps, beads, ear spools and more. This project utilized previously defined special object categories that have been developed based on commonly found artifacts in the region. Particular attention was paid to diagnostic vessel supports and appendages reflecting interaction with Teotihuacan and Central Veracruz. Due to the broad nature of this category, data recorded depended on the object. Special objects made of pottery had the ceramic type recorded and were weighed (g.) (see Appendix F). For perforated objects, beads, ear spools, and spindle whorls, both overall and inside diameters were measured.

Settlement Data and Architecture Data

Survey data was analyzed to identify common formal architectural layouts on the dunes, the overall distribution of features, the identification of dune sites, and to chart demographic changes over time. Common formal architectural groups in the region include the Tres Zapotes Plaza Group (TZPG) and the Standard Plan. Formal architectural layouts can be used to make inferences regarding a site's political affiliations or the relative time period of a site's occupation.

Architecture was recorded for height (m.), dimensions (length and width or diameter), and type (platform, conical mound, long mound, etc.) in the field. Architecture was analyzed by examining the frequency and percentage of each mound type. Mounded architecture is dated using diagnostic ceramics recovered from the surface. A “mound center” was defined as a group of mounds in which one or more is greater than 5 meters in height.

Data collected on architectural type and the size of mounds can be analyzed to better understand if exclusionary or corporate strategies dominated at different times in the past. Loughlin argues that architecture represents the physical manifestation of power and authority of a leader (2012:262). I expect palaces or elite residences to dominate a polity when exclusionary strategies are emphasized, as aspiring leaders show their prestige. Data were analyzed to determine ratios of non-elite to elite mounded architecture by time period.

Mound architecture was analyzed for changes in mound height and size through time. This data was then compared to other regions (Mixtequilla, Tuxtlas) to understand differences in exclusionary/corporate strategies. Additionally, it is important to examine if there is a difference in how domestic mounds and platforms were used through time. For example, did craft production occur on domestic mounds, or just off domestic mounds, change through time?

Nearest neighbor statistical analysis was conducted to determine the degree of agglomeration in dune settlement through time. The nearest neighbor statistic shows the observed distance between mounds to the mean distance expected if mounds were randomly distributed in the survey area. Ratios closer to 0 indicate high clustering while ratios closer to 2.1491 represents even distribution (Earle 1976; Whallon 1973; Pinder et al. 1979).

Chapter 6 - Architecture and Settlement

This chapter presents settlement data recorded in Summer 2014 while covering more than 14 square kilometers of dune and near-dune landscape. A total of 207 features were recorded during fieldwork, including mounded architecture and artifact concentrations. The survey zone sequence shows a continuous occupation of over 2000 years in the dunes. Settlement contains 14.79 features per square kilometer (Figures 6.1 and 6.2).

Survey projects in the ELPB have generated a coarse image of the region's occupation that is both varied and complex (Santley and Arnold 1996; Stoner 2011; Loughlin 2012; Stark 1999; Daneels 1997; Killion and Urcid 2001). During fieldwork and analysis, special attention was paid to the identification of formal architecture complexes commonly found in this part of Mesoamerica. Specifically, survey crews were looking for Standard Plan layouts and Tres Zapotes Plaza Groups (TZPG). These architectural layouts have been utilized in the ELPB and nearby regions to understand political economic relations during specific time periods.

ArcGIS analysis of GPS data collected during fieldwork identifies two discrete clusters of occupation (based on buffers) located in the main survey zone. In the western section of the primary survey zone, the naturally-elevated dune landscapes were utilized, thus reducing labor costs for domestic structures. The western half of the survey block contains the majority of artifact concentration features. To the east, there is greater concentration on mounded architecture. A separate, smaller zone was also surveyed. This survey block is located two kilometers east of the primary survey zone. It is greater than one square kilometer in size and located just NE of Laguna Tortuga (Figure 6.2). No materials were identified in this survey zone. The rolling dune landscape in this section, with high narrow dunes located above deep dune valleys likely made occupation not ideal compared to other areas to the west.

The recovery and analysis of diagnostic ceramics collected from the surface of features or through shovel-testing allows us to re-create the relative occupational sequences at the dunes. This data provides potential evidence for the earliest known occupation in the survey zone during the Archaic period. This comes in the form of a single chert biface recovered during shovel-testing in a mound (D0070) that was primarily occupied during the Early Classic. Ceramics in the survey zone date as far back as the Early and Middle Formative, when dune settlement was likely no more than a small hamlet. Ceramic data frequencies demonstrate that occupation of the dunes continued to grow throughout the Formative and Proto-Classic, before reaching its settlement zenith in the Early Classic. By the Late Classic, settlement is in decline and by the Post-Classic, settlement is almost completely abandoned. This project uses feature counts as a general proxy for population change in the past. Features are assigned to time periods based on diagnostic ceramics collected during survey. While imperfect, this method provides the best way to examine broad settlement change over time in the dune survey zone. This method assumes that earthen mounds of the survey zone were used repeatedly over long stretches of time, as is demonstrated by Santa Margarita 5.

This chapter presents the results and analysis of the dune segment of the greater RRATZ survey. First, I examine the architectural typology used for this project, defining architectural features and reporting the raw data for each category. Architecture was recorded for height (m.), dimensions (length and width or diameter), and type (platform, conical mound, long mound.) in the field. Architecture is analyzed by examining the frequency and percentage of each mound type. Data collected on architectural type and the size of mounds can be analyzed to better understand if exclusionary or corporate strategies dominated at different times in the past. Loughlin argues that architecture represents the physical manifestation of power and authority of a leader (2012:262). I expect palaces or elite residences to dominate a polity when exclusionary strategies are emphasized, as aspiring leaders show their prestige in an attempt to attract power and followers. Data will be analyzed in order to determine ratios of non-elite to elite mounded architecture by time period. Next, I discuss changes in dune settlement over the course of its 2000 years of occupation. How did settlement and architecture change through time? Nearest neighbor statistics will be conducted to determine the degree of agglomeration in dune settlement through time.

Lastly, I examine specific sites within the survey zone in order to better contextualize how settlement change over time related to larger social, economic, and political processes occurring in the greater Mesoamerican World. It will be important to examine if there is any difference in how domestic mounds and platforms were used through time. For example, does the occurrence of craft production on domestic mounds, or just off domestic mounds, change through time?

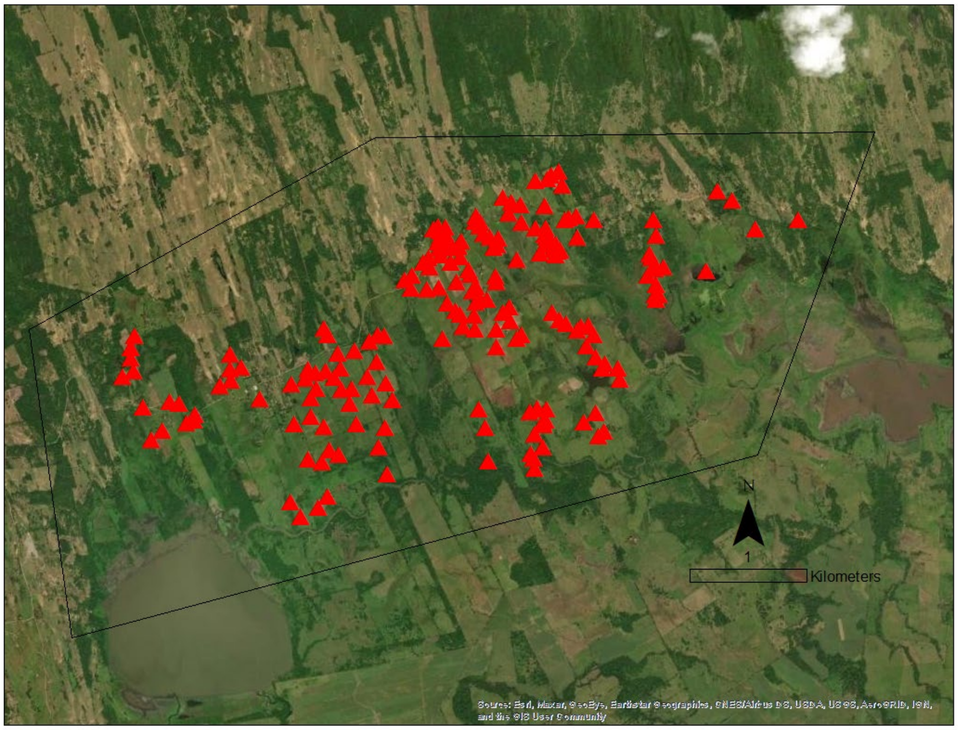


Figure 6.1: Map of all features recorded during survey.

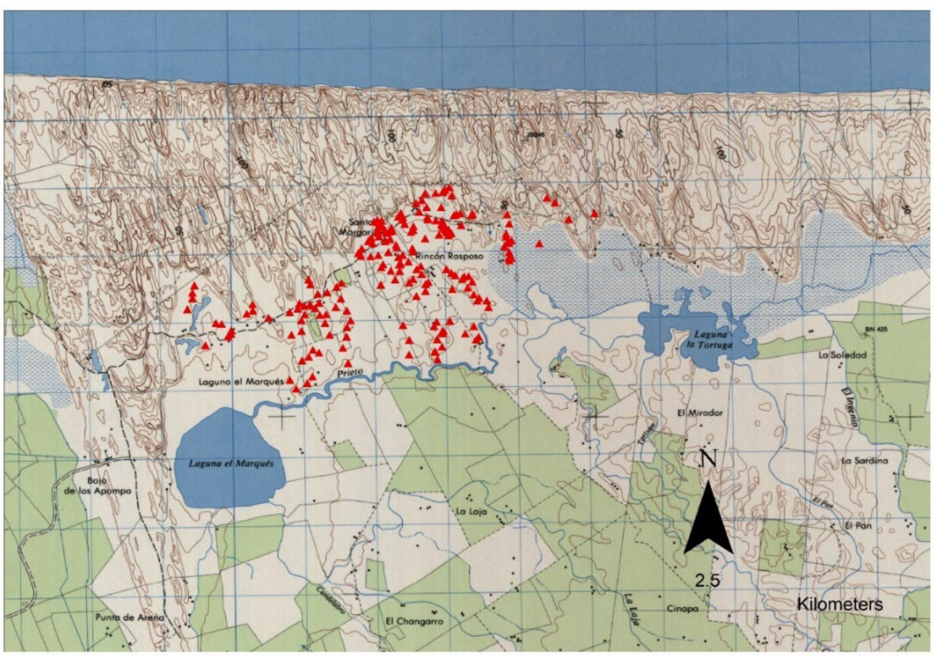


Figure 6.2: Map of all features showing topography.

Architectural Features of the Survey

The basic unit of analysis for this project is the feature, the smallest of which is the artifact concentration identified on the surface during survey. Architectural features found in the dune and near-dune survey zone are entirely earthen in construction. Earthen mounds, found throughout southern Veracruz, can be formed through gradual accretion over long periods of time (Hall 1994), or through formal construction processes. The dune survey zone also includes some large modified natural elevations, some of which show signs of long-term occupation. After all mounds were recorded during fieldwork, they were categorized into three primary types, including: conical mounds, platforms, and long mounds. Furthermore, mounded architecture was subdivided into low and tall categories. Mounds less than 5 meters in height were classified as low. Mounds 5 meters in height or greater were classified as tall, following Killion and Urcid (2001). Flat-top platforms greater than 9 meters, found in the nearby Mixtequilla region of southern Veracruz, were not identified in the survey zone. Overall, architecture height on the dunes is low, with the majority of features listed as less than 1 meter in height (n=111). Another 56 features fall between 1 and 2 meters in height, meaning 80.67% of all built features are less than 2 meters in height (Figure 6.3). Feature heights in the dunes are comparable to those at Tres Zapotes (Pool and Ohnersorgen 2003). This section presents the raw data of all features recorded in the survey zone.

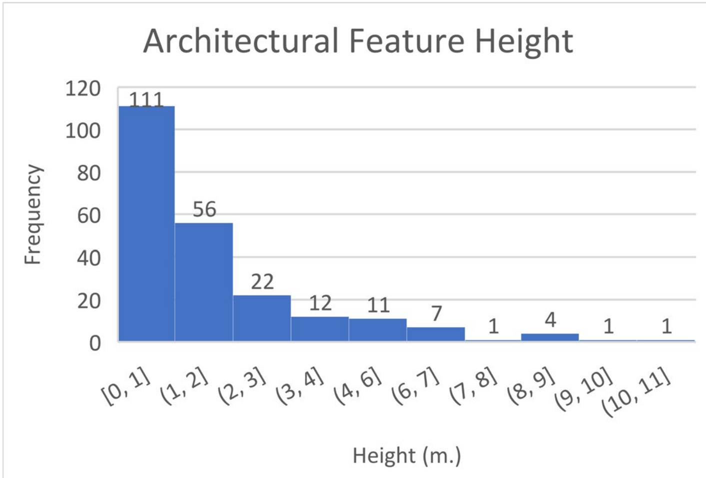


Figure 6.3: Histogram showing frequencies of mound height (m.).

Conical/Pyramidal Mounds

Conical mounds are a type of earthen architecture that have a round or oval footprint today. During the use life of these mounds, they may have been pyramidal in shape. However, natural erosion and slumping processes create the rounded and oval shape found today across southern Veracruz (Daneels 2002:165). Conical mounds (n=108) are the most common architectural feature found in the dune survey zone. These mounds account for 52.17% of all features identified during fieldwork (Table 6.1).

Table 6.1: Architecture Feature Typology and Count.

Feature Type	Count	Percent
Low Conical	97	46.86
Tall Conical	11	5.31
Low Platform	13	6.28
Tall Platform	0	0
Low Long Mound	16	7.73
Tall Long Mound	2	0.97
Concentration	58	28.02
Rampa/Calzada	4	1.93
Modified/Natural Elevation	6	2.9
Total	207	
Settlement Density (features/sq. km.)	14.79	

Low Conical Mounds

Low conical mounds are the largest feature category in the survey zone and account for 46.86% (n=97) of all features (Table 6.2). Table 6.2 shows dimensions of all low conical mounds identified in the survey block. Each mound is identified by its feature number. Feature numbers on the dunes are numerical but start with the letters 'D' or 'E' to identify the survey team that recorded the feature during fieldwork. Low conical mounds have an average length of 39.84 m., a width of 37.09 m., and a height of 1.74 m. Low conical mounds are defined as any rounded base earthen mound that is less than 5 meters in height. Over two-thirds of low mounds were under 3 meters in height. In the survey zone, these mounds are frequent in number, low in height, and small in size. These features presumably make them base platforms for domestic structures that were made of perishable materials, as seen elsewhere in Veracruz (Daneels 2002:171). Raised basal platforms provide domestic refuge in a region with frequent and significant precipitation. Stark (1991:45) refers to these types of mounds as the basic residential units of the Mixtequilla. These domestic mounds are widespread throughout the survey zone in this study, though they tend to cluster in greater density in the northeastern part of the study area (Figure 6.4).

In his survey at El Mesón, Loughlin (2012:195) identified 47% of features as low conical mounds (defined as less than 3 meters in height). Including his medium conical mounds, defined as mounds between 3 and 6 meters, these two categories at El Mesón account for 49.8% of all features. Domestic mounds account for similar percentages of overall features identified at both El Mesón and the dunes.

Table 6.2. Low Conical Mound Length, Width, and Height.

Feature No.	**Length (m.)**	**Width (m.)**	**Height (m.)**
D0001-1	52	37	2
D0006-1	32	26	1.5
D0008-1	33	25	2.5
D0019-1	40	36	1
D0027-1	33	27	1.5
D0028-1	22	22	1.23
D0030-1	28.3	19.7	1.49
D0032-1	53	44	0.58
D0036-1	26	26	3
D0037-1	28	22	1
D0038-1	42	35	0.45
D0039-1	34	34	1.1
D0041-1	70	70	4

D0042-1, 2, 3	60	48	2
D0043-1, 2	22	22	0.5
D0044-1	22	22	0.5
D0049-1	55	39	1.5
D0053-1	42	42	1.5
D0056-1	58	58	1
D0061-1	40	40	2
D0064-1	46	46	1.5
D0065-1	38	38	1.5
D0066-1	37	30	1.5
D0069-1	44	44	2
D0070-1, 2	32	32	3
D0071-1	26	26	1.5
D0072-1	46	46	2.25
D0073-1	20	20	0.75
D0074-1	23	23	0.3
D0076-1	30	30	0.5
D0078-1	44	44	2
D0079-1	40	40	3
D0081-1	60	45	1
D0085-1	39	39	0.12
D0086-1	31	26	0.15
D0094-1	55	55	1.5
D0095-1	30	30	3
D0100-1	40	40	1.2
D0101-1	64	44	2
D0106-1	40	40	1
D0107-1	36	36	1
D0111-1	48	48	1.3
D0113-1	50	46	1
D0115-1	70	50	2
E0001-1	55	55	2.5
E0003-1	32.6	32.6	2
E0014-1	48.75	42.1	3.5
E0015-1	53	42	2
E0016-1	50	49.4	3.1
E0017-1	66	58	1.75
E0020-1	65	52	1.75
E0021-1	62	60	1
E0023-1	14.18	12	1
E0024-1	45	45	3.5
E0025-1	51.1	36.6	3.3
E0026-1	51.14	36.6	1.8
E0027-1	16.3	15.5	1.12

E0030-1	14.5	14.5	0.39
E0031-1	24.4	24.4	1.04
E0032-1	10	10	0.4
E0033-1	25	25	0.39
E0034-1	21.2	21.2	1.24
E0035-1	14.6	14.6	1.04
E0036-1	22	22	1.14
E0037-1	28.8	28.8	1.39
E0038-1	20.6	20.6	0.45
E0039-1	68.4	68.4	4.77
E0040-1	24	24	4.01
E0047-1	63	63	1.3
E0049-1	43	43	3
E0052-1	41	41	2
E0053-1	39	39	2
E0054-1	36.5	36.5	3.3
E0055-1	36.8	36.8	2.8
E0056-1	52.2	52.2	3.3
E0061-1	27	27	1.3
E0064-1	50	50	2.5
E0066-1	65	55	2
E0067-1	70	70	1.7
E0068-1	36	36	1.2
E0070-1	22	22	1.24
E0071-1	15	15	0.49
E0076-1	11.6	11.6	1.09
E0078-1	13.3	13.3	1.09
E0080-1	52.4	52.4	3.1
E0081-1	23.6	23.6	1.19
E0082-1	21	16	1.04
E0086-1	34	34	1.65
E0090-1	39	39	2
E0091-1	47.1	37.2	1.69
E0092-1	32	32	1.29
E0101-1	45	45	3.4
E0105-1	82	82	3
E0106-1	36	36	1.09
E0127-1	35.08	35.08	1.5
E0128-1	48.8	48.8	3.2
E0129-1	82	82	4.49
Average	39.84	37.09	1.74

Table 6.2 (continued)

Tall Conical Mounds

Tall conical mounds have a round or oval footprint and are five meters or greater in height. Eleven tall conical mounds (n=11) were identified during survey, accounting for 5.31% of all features. Tall conical mounds have an average length of 74.36 m. and a width of 67.36 m. Their average height is 6.07 m. tall (Table 6.3). While tall conical mounds have a similar form to low conical mounds, there is a difference in where each is found. Tall conical mounds may have been used as a domestic basal structure, similar to the function of low conical mounds. However, this type of pyramid is often constructed as part of formal architecture planning. This contrasts with low conical mounds that are likely to have formed slowly, through accretion (Hall 1994). Tall conical mounds are distinguished from low conical mounds in both their location and frequency on the dunes (Figure 6.5).

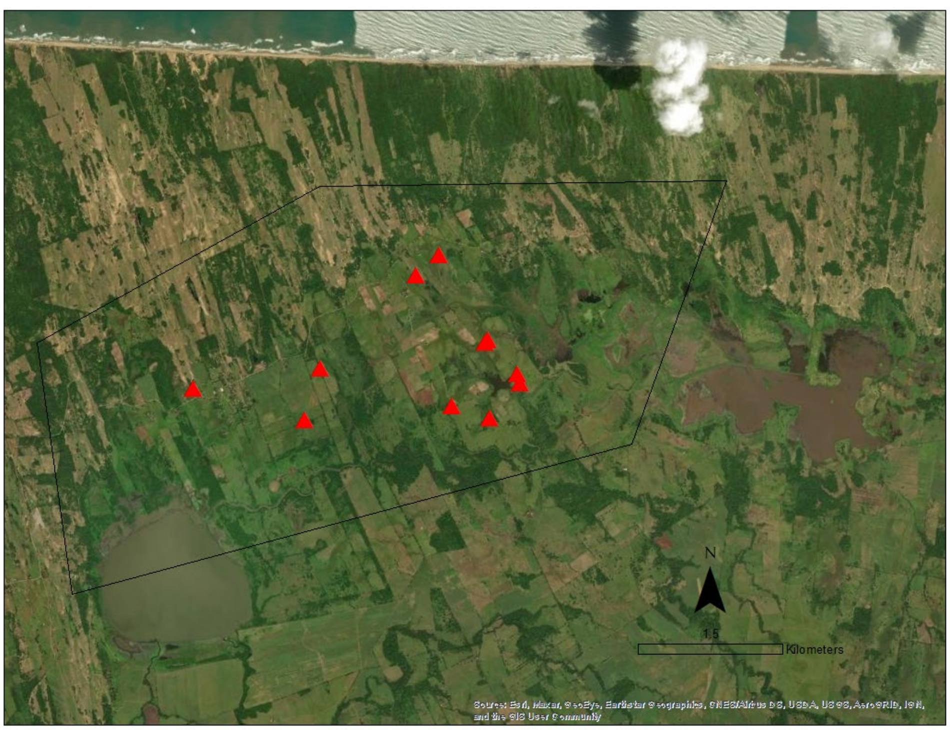


Figure 6.5. Tall conical mounds in the survey zone.

Table 6.3: Tall Conical Mound Data.

Feature No.	Length (m.)	Width (m.)	Height (m.)
D0088-1	54	54	5
E0045a-1	20	20	7.49
E0051-1	70	70	5.1
E0063-1	95	95	7
E0065-1	85	60	6
E0069-1	72	72	5.5
E0072-1	74	60	6
E0074-1	98	79	5
E0079-1	70	67	6
E0097-1	86	86	5.3
E0107-1	94	78	8.4
Average	74.36	67.36	6.07

Conical Mounds with Fronting Platforms

Another architectural type found in the dune survey zone is the conical mound with a fronting platform (Figure 6.6). These features, which combine two architectural features, were recorded as separate entities during fieldwork with each structure having its own unique feature number. This allows for the opportunity to potentially distinguish construction phases between conical mound and platform. This category has been identified elsewhere in southern Veracruz and contains a footprint that has been described as 'keyhole' in shape (Loughlin 2012:198). Loughlin encountered 14 of these features during his survey at El Mesón. Stark (2003:401) has identified this architectural type in the Mixtequilla and argues that fronting platforms likely provided extra space for domestic activities. Additionally, due to the extra labor costs associated with attaching an elevated platform to a domestic conical mound, these types of features likely reflect higher social status.

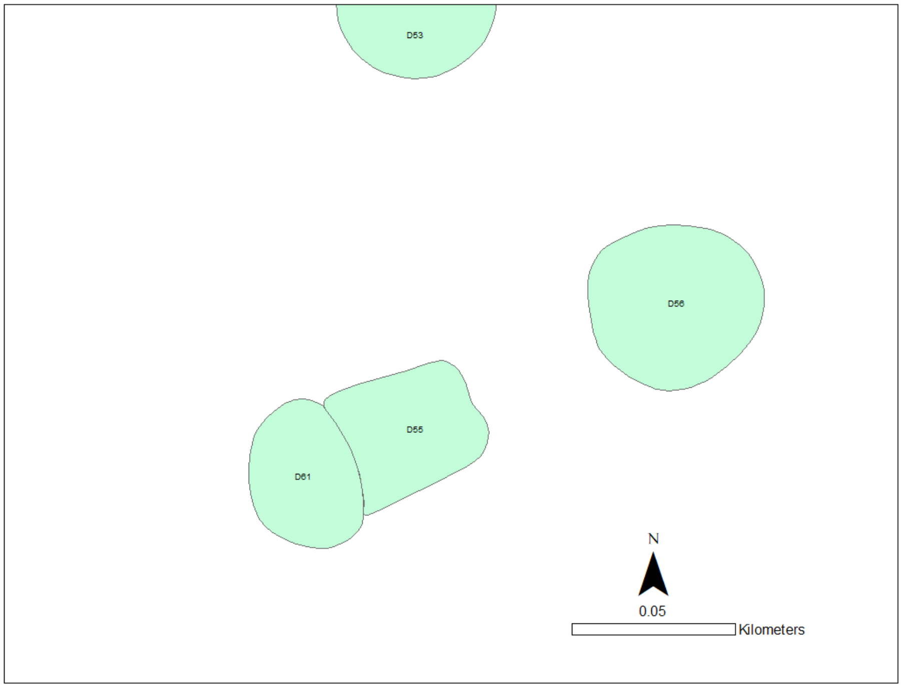


Figure 6.6: Plan map showing example of a ‘keyhole mound’ found in the dunes (D0061/D0055).

A total of eight keyhole features (n=8) were identified in the dune survey zone (Figure 6.7). Conical mounds for these features averaged a length of 50.5 m., width of 40.9 m., and height of 2.39 meters. Fronting platforms attached to these conical mounds had an average length of 46.1 m., width of 36.4 m., and a height of 0.74 meters. The average keyhole feature in the dunes contain a conical mound with a fronting platform less than half its height.

Keyhole features identified in the dunes are similar in size to those found at El Mesón. El Mesón conical mound features had average dimensions of 44 m. x 48 m. with a height of 2.26 m. (Loughlin 2012:198). Fronting platforms in the dunes, however, are notably larger in length/width dimensions as El Mesón fronting platforms had dimensions of 32.1 m. x 27.3 m. They did however have an average height of 1.1 m., taller than the 0.77 m. of the dunes.

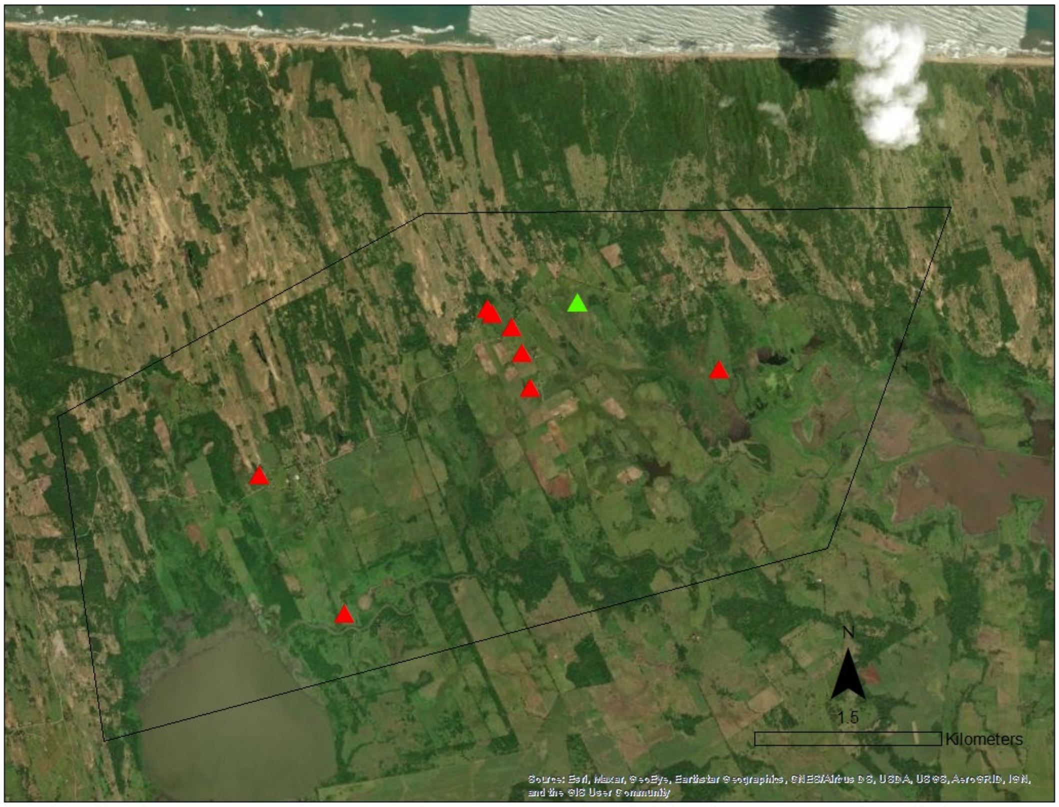


Figure 6.7: Map showing ‘keyhole’ features (conical mounds with fronting platforms) in red and conical mound atop a platform in green (E0045).

Conical Mounds Atop Platforms

Another category of mounds identified during survey was a conical mound atop a platform. Only one such feature was recorded in the survey zone (E0045) (Figure 6.7). This feature had a long, thin platform with dimensions of 112 m. x 27.5 m. with a height of 1.49 meters. The conical mound atop this platform had dimensions of 20 m. x 20 m. with an overall height of 7.49 meters. This type of feature has been recorded in previous surveys at El Mesón (Loughlin 2012) and the Mixtequilla (Stark and Hall 1993). Six such features were recorded at El Mesón which were likely domestic in nature based on their general smaller size. Stark and Hall (1993:261) argue that under 4 m. in height, this feature type was likely relegated to domestic mounds. Taller ones, such as E0045, may have served a variety of functions including ceremonial or administrative. Further north in the Cotaxtla Basin, Daneels (2002:167) finds these features next to formal complexes, providing further weight to the idea of ceremonial or administrative functional use.

Long Mounds

Low long mounds are earthen mounds with a long, loaf-shaped plan with one axis significantly greater than the other. This dissertation identifies long mounds when one axis is 1.5 times greater than the short axis. Sixteen low long mounds were identified during pedestrian survey, accounting for 7.73% of all features. These mounds have an average long axis of 55.68 m. and a short axis of 29.19 m. with a height of 1.64 meters (Table 6.4). Low long mounds are spread throughout the dune survey zone (Figure 6.8). Tall long mounds (n=2) are located close together (Figure 6.9). These mounds have an average length of 123 m., a width of 55 m., and a height of 5.7 meters (Table 6.5).

Low long mounds, in particular, likely served a variety of functions while in use. Many were likely basal structures for domestic houses, especially those found removed from formal complexes. Additionally, what today is identified as a long mound, may have not been such a feature in the past. For example, some long mounds identified today may have been two closely-spaced conical mounds that slumped together over time. Or, long mounds today may be the result of a millennia of slumping of a tall mound.

Long mounds are often thought to have served in civic-ceremonial capacities around southern Veracruz and elsewhere in Mesoamerica. It is likely then that many long mounds were formed as part of a formalized construction plan, rather than through accretion. Stark (1999:209) argues that long mounds atop large flat platforms may have been palaces in the Mixtequilla region. In the ELPB, Pool's (2007:248) excavations of refuse deposits associated with long mounds at Tres Zapotes suggests elite residential and administrative functionality.

Paired parallel long mounds with a narrow space in-between are often interpreted as ballcourts in southern Veracruz (Daneels 2002; Stark 1999; Killion and Urcid 1999; Santley 2007; Borstein 2001). Ballcourts are specifically associated with Classic Veracruz culture. The ballgame likely played a key role in integrating smaller regional centers with distant polities in ancient Mesoamerica. No ballcourts were identified in the dune survey zone.

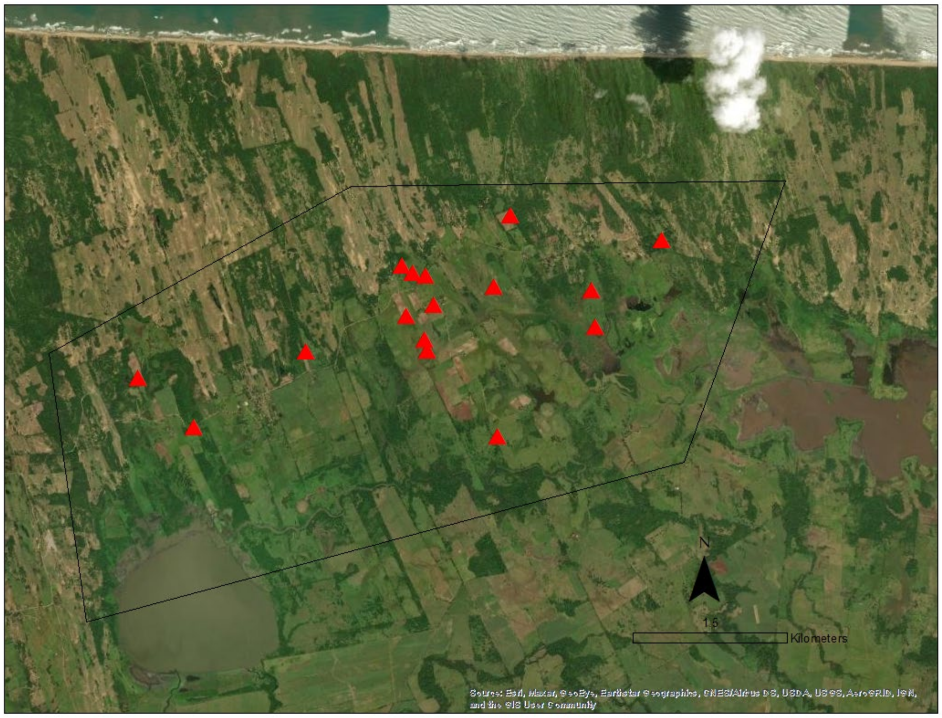


Figure 6.8: Low long mounds identified in the survey zone.

Table 6.4: Dimensions of Low Long Mounds.

Feature No.	Length (m.)	Width (m.)	Height (m.)
D0018-1	44	28	1.75
D0029-1	33	22	1.35
D0031-1	75	39	1
D0034-1	70	37	3
D0047-1	34	18	0.3
D0048-1	52	34	1
D0051-1	79	46	1.7
D0082-1	68	29	0.75
D0102-1	68	36	1
D0105-1	60	35	1
E0002-1	59.5	34.6	4.87
E0012-1	50.8	28.9	0.55
E0018-1	43.1	24.5	4.1
E0046-1	86	36.9	1.5
E0077-1	23.5	9	1.09
E0089-1	45	9.2	1.2
Average	55.68	29.19	1.64

Figure 6.9: Map of tall long mounds in the survey zone.

Table 6.5: Tall Long Mounds.

Feature No.	Length (m.)	Width (m.)	Height (m.)
E0028-1	120	45	5.9
E0029-1	126	65	5.5
Average	123	55	5.7

Platforms

A third major category of earthen architecture in the survey zone are platforms. Platforms are defined by their flat top. These mounds often have a rectangular footprint, but slumping may make it appear to be more rounded in plan view. Low platforms (n=13) account for 6.28% of all dune features. The average height of these features is 0.75 meters, with dimensions of 50.58 m. x 31.42 m. (Table 6.6).

Tall monumental platforms, greater than 9 meters in height, have been identified frequently in the nearby Mixtequilla region. These monumental platforms have been interpreted as estates for the landed elites during the Classic period. It is noteworthy that monumental platforms are absent from the dune survey zone.

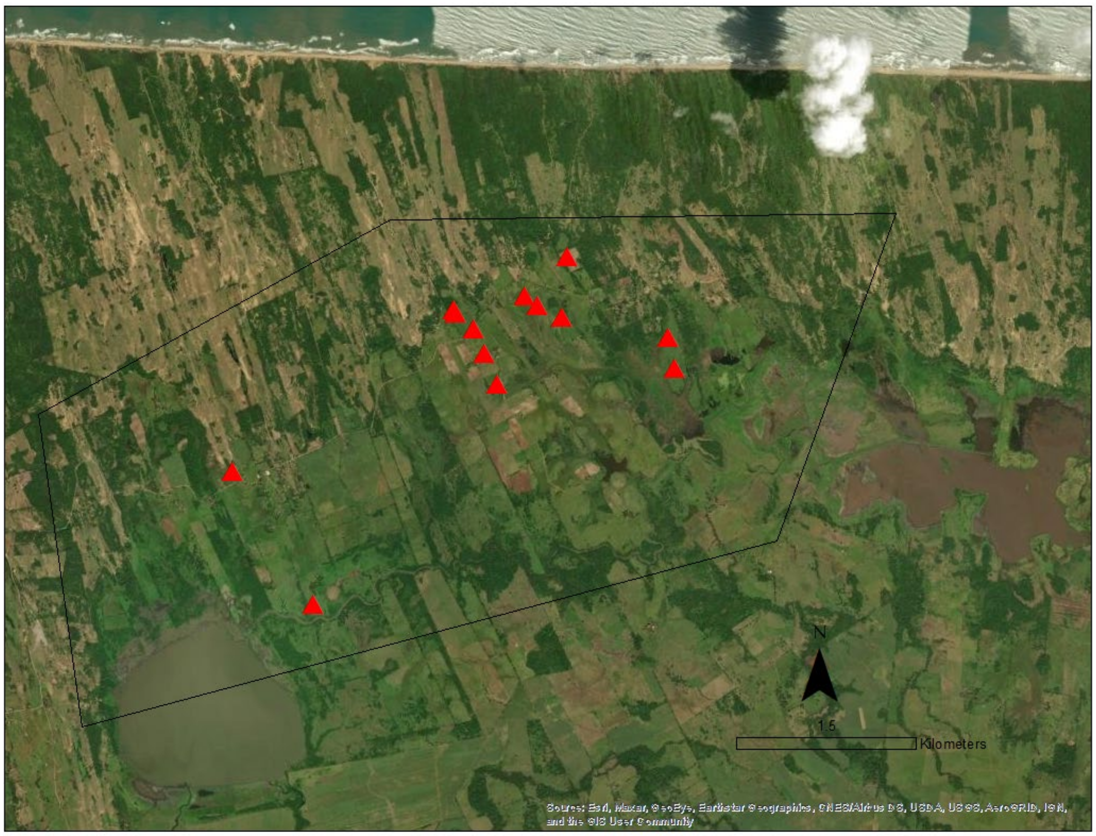


Figure 6.10. Low Platforms in the Survey Area.

Table 6.6: Dimensions of Dune Platforms.

Feature No.	Length (m.)	Width (m.)	Height (m.)
D0020-1	70	43	1
D0033-1	44	41	1.6
D0035-1	42	32	0.5
D0040-1	18	18	0.3
D0052-1	25	23	0.5
D0055-1, 2	45	35	0.5
D0089-1	45	18	1
D0112-1	40	30	0.5
E0015b	110	94	1
E0019-1	22	16	0.5
E0041-1	44.5	12	0.4
E0044-1	40	19	0.4
E0045b-1	112	27.5	1.49
Average	50.58	31.42	0.75

Modified Elevations

Six modified dune elevations were recorded during survey. This definition contains natural dunes that have been added to or otherwise modified to occupy and become part of the built landscape of the dunes. Abundant artifacts found at some of the sites appears to show that these modified dunes were domestically occupied.

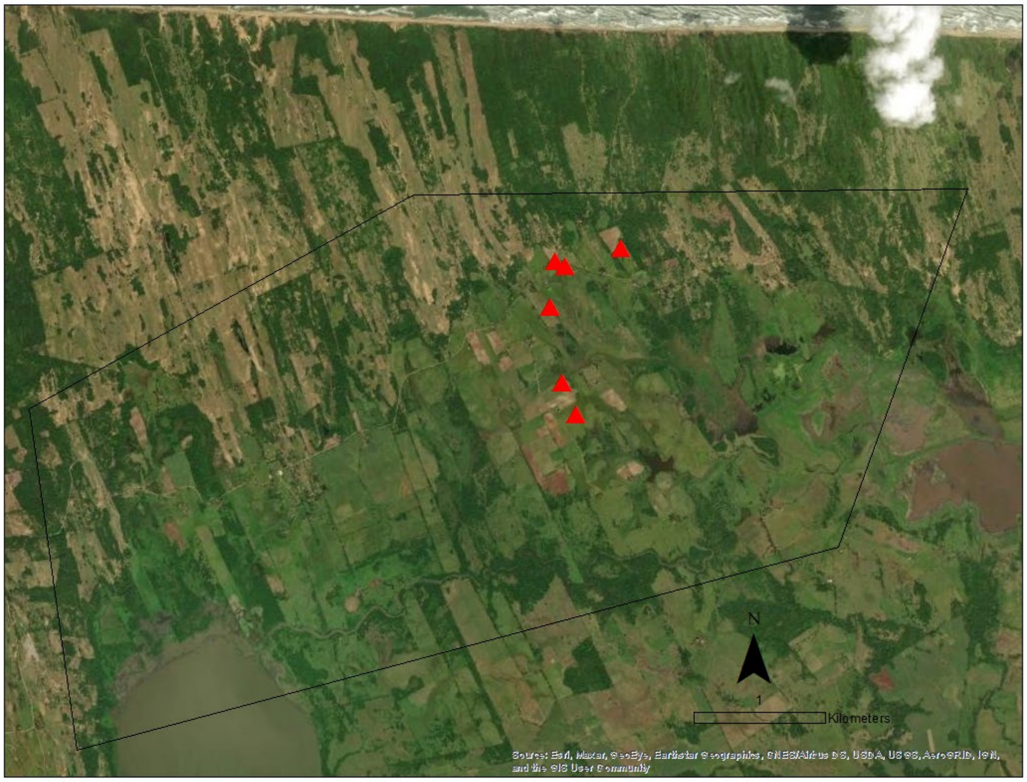


Figure 6.11: Map of Modified dune locations.

Table 6.7: Table of Modified Dune Dimensions.

Feature No.	Length (m.)	Width (m.)	Height (m.)
D0022-1	92	62	2
D0062-1	46	46	3
E0042-1	150	70	4
E0043-1	130	55	4
E0048-1	89	21	5.1
E0060-1	58.5	58.5	9.3
Average	94.25	52.08	4.57

Ramps

Four ramps (n=4) were recorded during survey, accounting for less than 2% of all features (Figure 6.12). Ramps are often observed as an entryway, leading onto an earthen mound (Figure 6.13). While in use, it is possible these features functioned more as a staircase. Additionally, at least one ramp connected two low conical mounds to one another (Figure 6.14).

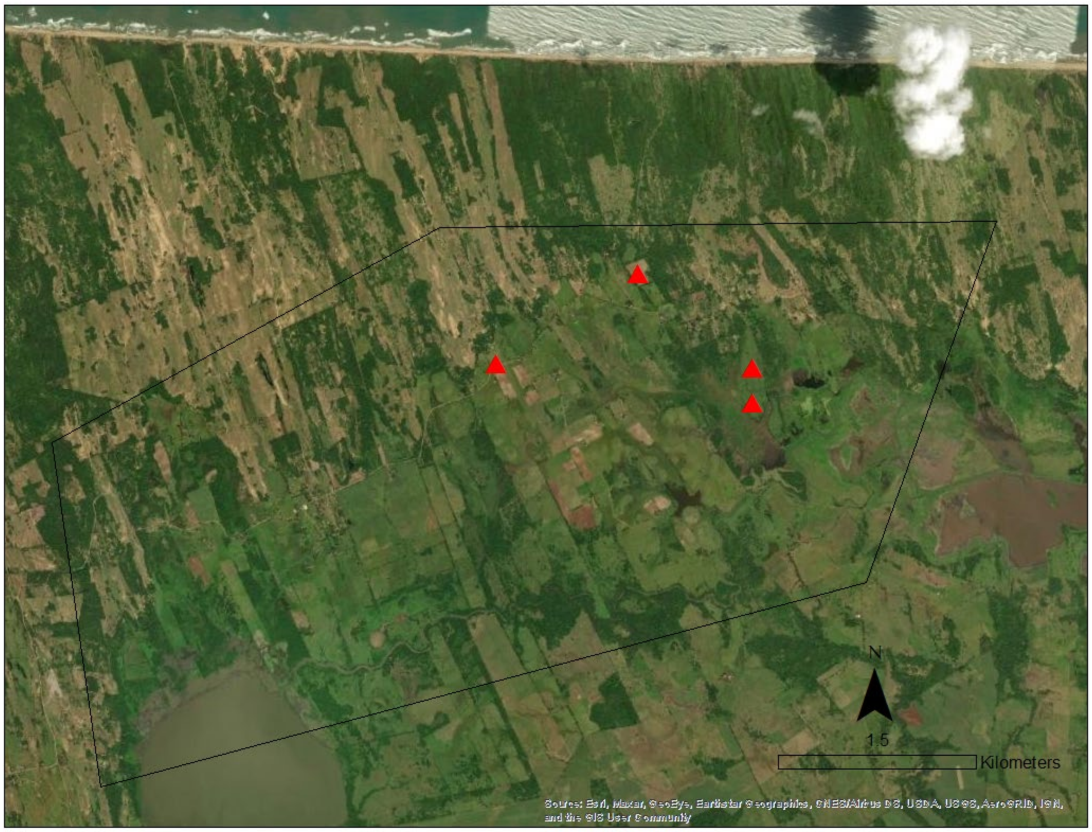


Figure 6.12. Map showing location of ramp features.

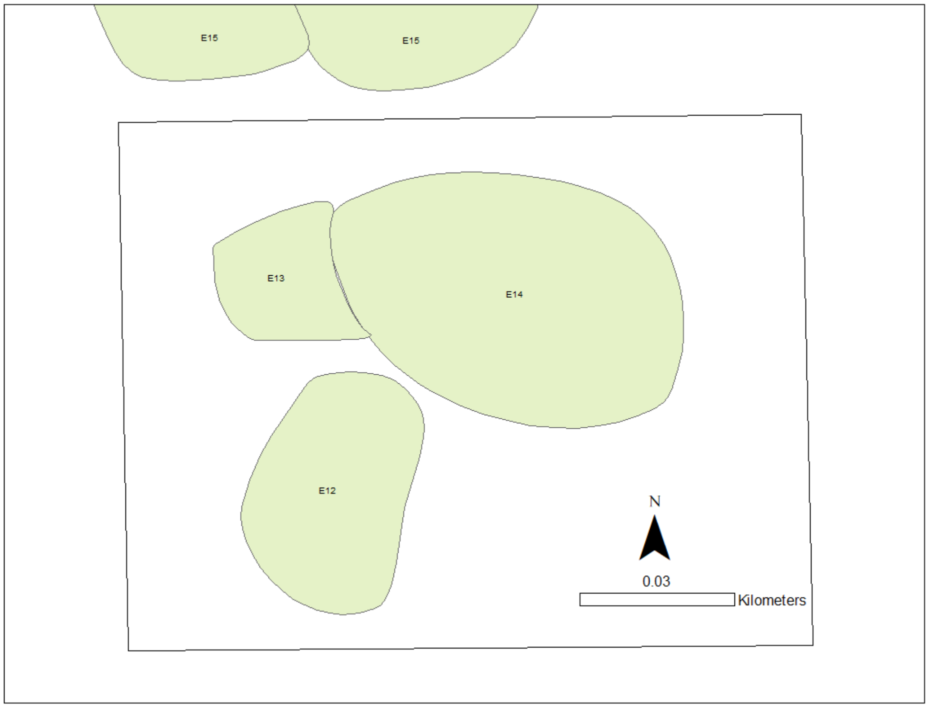


Figure 6.13. Ramp E0013 leading to mound E0014 (ramp possibly used as staircase).

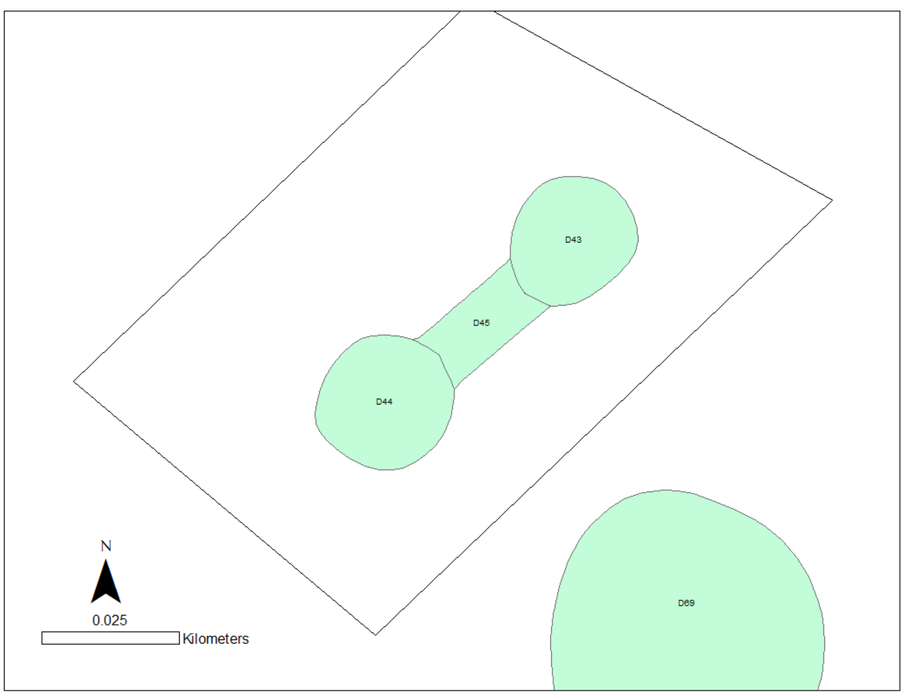


Figure 6.14. Ramp D0045 connecting conical mounds D0044 and D0043.

Artifact Concentrations

Concentrations are defined as any discrete clustering of artifacts that are not associated with an architectural feature on the landscape. A concentration was recorded during survey when it was estimated that artifact density exceeded one artifact per square meter. Concentrations ranged from small scatterings of artifacts to thousands of ceramics covering areas over 100 meters. Boundaries for concentrations are defined by the area when artifact density drops below 1 artifact per square meter.

Overall, artifact concentrations (n=58) accounted for 28.02% of all features in the survey zone. This frequency makes this feature the second most abundant type in this study, after low conical mounds. The average concentration dimensions on the dunes are quite large, with a length and width of 72.66 m. x 41.03 m. (Table 6.8). Concentrations in the dunes appear to be prevalent on natural rises where people of the past could occupy dry land, elevated above the surrounding estuary. While concentrations are recorded throughout the survey zone, they cluster in the western half, especially around the site of Rio Prieto 4 (Figure 6.15). Mounded architecture, by contrast, appears in greater frequencies in the eastern end of the survey zone. This likely has to do with the terrain of the dunes. Concentrations dominate in the western end where the landscape is more sloped with natural dune rises. These slopes would make the construction of mounded architecture less needed than in the lower, more flat landscape to the east.

Artifact concentrations may develop through a multitude of ways. First, artifact concentrations may be the only remains of a past domestic structure constructed on the dune surface without a basal platform (e.g. low conical mound). Additionally, many of the concentrations in the dune survey zone are in active sugar cane fields. Field plowing by modern farmers may have destroyed mounded architecture inadvertently, leaving only a scattering of ceramic and lithic materials in the present day.

Figure 6.15: Map of artifact concentrations in the survey zone.

Table 6.8: Dimensions of Artifact Concentrations.

Feature No.	Length (m.)	Width (m.)	Height (m.)
D0002-1	55	10	0
D0005-1	10	3	0
D0015-1	20	20	0
D0054-1	25	25	1
D0057-1	20	13	1.75
D0058-1	10	10	0
D0059-1	50	50	0
D0075-1	5	5	0
D0077-1	50	50	3

D0087-1	3	1	-
D0090-1	30	6	0
D0091-1	50	30	0
D0092-1	10	1	0
D0093-1	15	1	0
D0096-1	25	12	0
D0099-1	30	30	0
D0103-1	8	1	0
D0104-1	20	1	0
D0116-1	30	30	0
E0004-1	145	20	0
E0011-1	72.5	46	1.39
E0050-1	300	100	0
E0057-1	270	80	0
E0073-1	120	60	0
E0075-1	180	120	0
E0085-1	126	110	0
E0087-1	120	70	0
E0088-1	106	45	0
E0093-1	42	28	6
E0094-1	80	45	0
E0095-1	81	29	0
E0096-1	215	82.5	10
E0098-1	74	34.4	1.49
E0099-1	50	50	2.9
E0102-1	3	3	0
E0103-1	120	33	0
E0104-1	71	67	0
E0108-1	138	100	0
E0109-1	80	72	0
E0110-1	128	80	0
E0111-1	70	50	0
E0112-1	82	66	0
E0113-1	132	82	0
E0114-1	106	78	0
E0116-1	5	5	0
E0117-1	30	8	8
E0118-1	100	40	8
E0119-1	100	40	8
E0120-1	80	20	6
E0121-1	60	60	4
E0122-1	30	30	4
E0123-1	160	160	0

E0124-1	3	3	0
E0125-1	20	20	0
E0126-1	100	42	0
E0130-1	74	48	0
E0130-2	60	48	0
E0133-1	15	6	0
Average	72.66	41.03	NA

Table 6.8. (continued)

Dune Settlement

Initially, the impetus for surveying the dune environment was the potential this area held for identifying Archaic period sites. While no Archaic period sites were identified, a single chert biface (n=1), likely dating to the Archaic, was recovered during shovel-testing of a conical mound near the Rio Prieto (Feature D0070, Figure 6.16). Nearby riverbank cuts were searched for additional evidence of chert tools to no avail. The likely Archaic chert biface was used as moundfill and probably came from nearby dirt. While the goal of this part of the RRATZ survey was to identify an Archaic site available to excavate, an Archaic presence near the dunes can be suggested from the single chert biface. The dune and near dune landscape of the survey zone remain a ripe area for future exploration of the Archaic period in southern Veracruz.

The first evidence of architecture in the survey zone dates to the Early Formative Arroyo phase (1250 – 1000 cal. B.C.). Settlement in the dunes follows regional trends seen elsewhere at El Mesón. From sparse Early Formative settlement, occupation grows consistently through the Middle, Late and Proto-Classic. The Early Classic sees an explosion in growth and settlement density, followed by a decrease in occupation in the Late Classic and near abandonment in Post-Classic times.

Figure 6.16: Location of chert biface near Rio Prieto.

Arroyo Phase

Early Formative Arroyo phase (1250 – 1000 cal. B.C.) settlement in the dune survey area is sparse, accounting for the smallest amount of ceramic materials recovered for any time period. Evidence of Arroyo phase occupation is found with the presence of *tecomate* vessel sherds (n=5) and Specular Red ceramic type sherds (Code 2905, n=3). It must be noted that these two diagnostic types, though most common in the Arroyo phase also continue into the early Middle Formative Tres Zapotes A phase. Therefore, solid evidence for Arroyo phase occupation is very sparse. Arroyo phase ceramics were recovered from five features on the dunes (see Table 6.9 and 6.10). This includes three low conical mounds, one low platform, and one modified elevation. The settlement density for the Arroyo phase is 0.294 features per square kilometer, the lowest settlement density for all time periods on the dunes. Figure 6.17 shows that the earliest architectural evidence on the dunes is in the northeastern section of the survey zone.

Evidence of occupation during the Arroyo phase centers around the modern hamlet of Santa Margarita. This area, made up of sites Santa Margarita 5, 6, and 7 form a 'core' region of dune settlement. This core area contains evidence of 2000 years of continuous occupation in the dunes. Even as dune occupation expands and contracts, the area surrounding Santa Margarita is always occupied. Arroyo phase settlement elsewhere in the ELPB and southern Veracruz is primarily found near rivers and streams (Killion 2013). While Arroyo phase occupation on the dunes is not particularly close to the Rio Prieto, the seasonally inundated area of the survey zone would allow for ease of access to aquatic resources. Arroyo phase occupation may have been seasonal in nature.

Table 6.9: Features Containing Early Formative Arroyo Phase Evidence.

Feature Type	Total	Percent
Low Conical	3	60%
Low Platform	1	20%
Modified Elevation	1	20%
Total	5	100%
Settlement Density (Features/Sq. km)	0.294	

Table 6.10 Conical Mounds Containing Early Formative Evidence.

Feature No.	Length (m.)	Width (m.)	Height (m.)
D0049-2	55	39	1.5
D0042-1	60	48	2
D0044-1	22	22	0.5
Average	45.67	36.33	1.33

Arroyo phase mounds and settlement in the dunes all contain higher densities of artifacts dating to later time periods. This means that Early Formative artifacts were included as fill in later construction episodes. This is a safe suggestion considering that only eight (n=8) artifacts dating to this time were recovered. This also suggests that mounds identified here as dating to this time may have not been the exact location of Early Formative occupation. It stands to reason however, that fill to construct these mounds would have come from close nearby. Also, unlike the vast majority of southern Veracruz, the dunes do not have alluvium buildup that works to cover early occupation in the region. Therefore, I am confident that the low settlement density during the Arroyo phase is an accurate reflection of the light occupation during this time.

Figure 6.17: Map of features containing Early Formative Arroyo Phase evidence.

Middle Formative

The Middle Formative Tres Zapotes phase (1000 – 400 cal. BC) sees a significant expansion in dune occupation based on greater quantities of artifacts recovered and the number of features dating to this time. A total of twenty-eight features (n=28) contain diagnostic artifacts dating to this time period (Table 6.11). All identified Early Formative features (n=5) have a Middle Formative component as well. Middle Formative occupation follows a similar pattern as the Early Formative, occupying more features in the northeastern portion of the survey zone (Figure 6.18). The largest cluster of Middle Formative occupation includes Early Formatives features as well around Santa Margarita. The Middle Formative occupation continues further west in the survey zone where the elevated natural landscape lends itself more to artifact concentration features.

Table 6.11: Features Containing Middle Formative Evidence (Tres Zapotes Phase).

Feature Type	Total	Percentage
Low Conical	15	53.57%
Tall Conical	2	7.14%
Low Platform	1	3.57%
Low Long Mound	2	7.14%
Concentration	7	25.00%
Modified Elevation	1	3.57%
Total	28	100
Settlement Density (Features/Sq. km)	2.0	

Table 6.12: Low Conical Mounds Containing Middle Formative Evidence.

Feature No.	**Length (m.)**	**Width (m.)**	**Height (m.)**
D0008-1	33	25	2.5
D0038-1	42	35	0.45
D0042-1	60	48	2
D0044-1	22	22	0.5
D0049-2	55	39	1.5
D0094-1	55	55	1.5
E0024-1	45	45	3.5
E0025-1	51.1	36.6	3.3
E0031-1	24.4	24.4	1.04
E0036-1	22	22	1.14
E0049-1	43	43	3
E0055-1	36.8	36.8	2.8
E0056-1	52.2	52.2	3.3
E0090-1	39	39	2
E0129-1	82	82	4.49
Average	44.17	40.33	2.2

Table 6.13: Tall Conical Mounds Containing Middle Formative Evidence.

Feature No.	**Length (m.)**	**Width (m.)**	**Height (m.)**
E0069-1	72	72	5.5
E0072-1	74	60	6
Average	73	66	5.75

Figure 6.18: Map of features containing Middle Formative evidence.

Architecture with Middle Formative diagnostic ceramics yielded greater quantities of artifacts for later time periods. In fact, all but three Middle Formative mounds (D0008, D0044, E0129) contain Late Formative occupations as well. Both D0044 and E0129 are occupied during the Terminal Formative. This suggests that these two mounds were not abandoned after the Middle Formative, but instead that Late Formative diagnostics were simply not recovered in surface collections.

In addition to the frequency of features, features containing Middle Formative ceramics are also larger than features containing Early Formative ceramics. The average height of low conical mounds (n=15) is 2.2 m. in the Middle Formative, up from 1.3 m. in the Early Formative (Table 6.12). Additionally, two tall conical mounds (> 5 m.

height) E0069 and E0072 contain Middle Formative diagnostic materials (Table 6.13). Architecture expanded in quantity and size from the Early Formative.

Late Formative Hueyapan Phase

The Late Formative (400 BC – 1 AD) dune occupation continues the trend of expansion seen throughout the ELPB. It is during this time that Tres Zapotes is at its apogee in size and influence in the region. In the dunes, there is a total of 51 features (Table 6.14) that date to the Hueyapan phase, nearly double the frequency identified in the Middle Formative. There is great continuity in occupation from the previous period, as 85% of features containing Middle Formative ceramics (17 of 20) contains Late Formative evidence as well. Overall settlement density rises to 3.64 features per square kilometer during this period. Settlement continues to grow in the Santa Margarita core zone, but also expands westward (Figure 6.19).

There is a significant increase in frequencies of low conical mounds with Late Formative materials (n=26, Table 6.15). Despite this increase, there is a decrease in average conical mound height. Low conical mounds with evidence of Late Formative occupation have an average height of 1.69 m., down from 2.2 meters from the previous period. Two of three tall conical mounds of this period are continued occupations from the Middle Formative (Table 6.16). E0045a is a 7.49 meter tall conical mound atop a 1.49 meter platform.

Table 6.14: Feature Types Containing Late Formative Evidence.

Feature Type	Total	Percentage
Low Conical	26	50.98%
Tall Conical	3	5.88%
Low Platform	3	5.88%
Low Long Mound	5	9.80%
Concentration	11	21.57%
Modified Elevation	3	5.88%
Total	51	100%
Settlement Density (Features/Sq. km)	3.64	

Table 6.15: Low Conical Mounds with Late Formative Evidence.

Feature No.	Length (m.)	Width (m.)	Height (m.)
E0017-1	66	58	1.75
E0020-1	65	52	1.75
E0024-1	45	45	3.5
E0025-1	51.1	36.6	3.3
E0031-1	24.4	24.4	1.04
E0032-1	10	10	0.4
E0033-1	25	25	0.39
E0034-1	21.2	21.2	1.24
E0035-1	14.6	14.6	1.04
E0036-1	22	22	1.14
E0038-1	20.6	20.6	0.45
E0039-1	68.4	68.4	4.77
E0049-1	43	43	3
E0053-1	39	39	2
E0055-1	36.8	36.8	2.8
E0056-1	52.2	52.2	3.3
E0090-1	39	39	2
D0030-1	28.3	19.7	1.49
D0038-1	42	35	0.45
D0042-1, 2	60	48	2
D0043-1, 2	22	22	0.5
D0049-1	55	39	1.5
D0053-1	42	42	1.5
D0086-1	31	26	0.15
D0094-1	55	55	1.5
D0113-1	50	46	1
Average	39.56	36.17	1.69

Table 6.16: Tall Conical Mounds with Late Formative Evidence.

Feature No.	Length (m.)	Width (m.)	Height (m.)
E0045a-1	20	20	7.49
E0069-1	72	72	5.5
E0072-1	74	60	6
Average	55.33	50.67	6.33

Figure 6.19: Map of features with Late Formative materials.

Proto-Classic Nextepetl phase

The trends seen in previous periods continue into the Proto-Classic Nextepetl phase (1 AD – 300 AD). Dune occupation continues to grow with the highest frequencies of features to date (n=73) (Table 6.17) (Figure 6.20). The number of low conical mounds (n=34) with diagnostic materials of this period continues to steadily increase from previous periods, with an average height of 1.69 m. during this time (Table 6.18). There are six low conical mounds that are greater than 3 meters in height (E0024, E0025, E0039, E0054, E0056, and E0129). E0039 and E0129 are 4.77 meters and 4.49 meters respectively, close to being considered their own centers (greater than 5 meters in height).

Low conical house mounds from the previous Hueyapan phase continue to be largely occupied in the Nextepetl phase (80.8%). Two of three tall conical mounds (E0051, E0107) date to the Nexteptel phase for their earliest occupation, with only one tall mound with continuity in occupation from previous times (Table 6.19). This may suggest that there is a break from previous leadership and a new leadership or political movement ensued.

Loughlin's RAM survey at El Mesón demonstrates that a political reorganization is occurring during this time. During the Late Formative, while Tres Zapotes was at its zenith, El Mesón copies the Tres Zapotes Plaza Group (TZPG) layout in its central core. Loughlin (2012) interprets this 'copying' as evidence of a subordinate secondary center to the larger and more powerful Tres Zapotes. During the Nextepetl phase however, El Mesón's leaders reorganize the layout of their city and appear to break ties with the Tres Zapotes polity.

Table 6.17: Architectural Features with Proto-classic (Nextepetl Phase) Evidence.

Feature Type	Total	Percentage
Low Conical	34	46.58%
Tall Conical	3	4.11%
Low Platform	3	4.11%
Low Long Mound	7	9.59%
Tall Long Mound	1	1.37%
Concentration	21	28.77%
Modified Elevation	3	4.11%
Calzada	1	1.37%
Total	73	100%
Settlement Density (Features/Sq. km)	5.21	

Table 6.18: Low Conical Mounds with Proto-Classic Evidence.

Feature No.	Length (m.)	Width (m.)	Height (m.)
D0030-1	28.3	19.7	1.49
D0032-1	53	44	0.58
D0038-1	42	35	0.45
D0039-1	34	34	1.1
D0042-1, 2, 3	60	48	2
D0043-1, 2	22	22	0.5
D0044-1	22	22	0.5
D0049-1	55	39	1.5
D0053-1	42	42	1.5
D0056-1	58	58	1
D0066-1	37	30	1.5
D0081-1	60	45	1
D0085-1	39	39	0.12
D0086-1	31	26	0.15
E0020-1	65	52	1.75
E0024-1	45	45	3.5
E0025-1	51.1	36.6	3.3
E0030-1	14.5	14.5	0.39
E0031-1	24.4	24.4	1.04
E0034-1	21.2	21.2	1.24
E0035-1	14.6	14.6	1.04

E0036-1	22	22	1.14
E0038-1	20.6	20.6	0.45
E0039-1	68.4	68.4	4.77
E0049-1	43	43	3
E0052-1	41	41	2
E0053-1	39	39	2
E0054-1	36.5	36.5	3.3
E0055-1	36.8	36.8	2.8
E0056-1	52.2	52.2	3.3
E0081-1	23.6	23.6	1.19
E0090-1	39	39	2
E0092-1	32	32	1.29
E0129-1	82	82	4.49
Averages	39.85	36.70	1.68

Table 6.18. (continued)

Table 6.19: Tall Conical mounds with Proto-Classic evidence.

Feature No.	Length (m.)	Width (m.)	Height (m.)
E0045a-1	20	20	7.49
E0051-1	70	70	5.1
E0107-1	94	78	8.4
Averages	61.33	56	6.99

Figure 6.20: Map of Features with Proto-Classic evidence.

Early Classic Period

The Early Classic period marks the apex of dune occupation. By both frequency of features and density, the Early Classic period marks the dunes population at its height (Figure 6.18). Notable is the increase in frequency of low conical mounds with evidence of occupation during this time (n=53; Table 6.20). The net increase of nineteen additional housemounds from the previous period suggests that people in the ELPB were attracted to the dunes at this point in its history. Low conical mounds that date to the Early Classic have an average height of 1.74 meters, only slightly taller than the two previous time periods. In this category, there are eight low conical mounds that are greater than three meters in height (D0041, E0024, E0025, E0039, E0054, E0056, E0080, and E0129).

D0041, E0039, and E01029 are all 4 meters or taller, very close to being considered their own small centers.

Tall conical mounds with diagnostics of this time period increase in frequency as well (n=6) (Table 6.20). There are three additional sites from the previous Proto-Classic period. The new tall conical mounds with materials from this time period are south and west of the Santa Margarita core zone.

Table 6.20: Architectural Features with Early Classic Evidence.

Feature Type	Total	Percentage
Low Conical	53	44.92%
Tall Conical	6	5.08%
Low Platform	3	2.54%
Low Long Mound	3	2.54%
Tall Long Mound	1	0.85%
Concentration	47	39.83%
Modified Elevation	4	3.39%
Calzada	1	0.85%
Total	118	100%
Settlement Density (Features/Sq. km)	8.43	

Figure 6.21: Map of features containing Early Classic evidence.

During this time, the distant powerful polities of Teotihuacan and Classic Veracruz cultures were active in the region, with their influence seen at other sites in southern Veracruz. Interaction with outside culture areas can be found in the dunes through various lines of evidence, including figurine styles, ceramic decorations/types, and Pachuca green obsidian. Table 6.24 shows features that contain diagnostic Matacapan-style artifacts. When compared with the features found containing Mixtequilla-style ceramics, the results are strikingly similar. There is one more (n=18) low conical mound with Matacapan-style artifacts (Coarse Orange pottery associated with Matacapan) than Mixtequilla-style. However, there is a tall conical mound that contained Mixtequilla-style artifacts. Overall, frequencies of features and settlement density are almost identical between the two interaction spheres (Table 6.21 and Table 6.22).

Where some variation between the groups occurs is in the location of the mounds within the survey zone. Features with Mixtequilla-style artifacts tend to cluster near the Santa Margarita core zone and then extend south towards the Rio Prieto (Figure 6.23). Coarse Orange pottery also occupies the Santa Margarita core zone but then extend westward while staying away from the Rio Prieto (Figure 6.22). This difference may suggest that different factions on the dunes were involved in differing trade networks with outside areas. The high proportion of features with Matacapan and Mixtequilla-style artifacts suggests dune occupants were involved with multiple long-distance exchange networks.

Table 6.21: Early Classic Architectural Features with Matacapan Influence.

Feature Type	Total	Percentage
Low Conical	18	54.54%
Tall Conical	0	0.00%
Low Platform	1	3.03%
Low Long Mound	1	3.03%
Tall Long Mound	0	0.00%
Concentration	10	30.30%
Modified Elevation	3	9.09%
Total	33	100%
Settlement Density (Features/Sq. km)	2.36	

Figure 6.22: Map of features with Matacapan Coarse Orange pottery.

Table 6.22: Early Classic Architectural Features with Mixtequilla Influence.

Feature Type	Total	Percentage
Low Conical	17	53.13%
Tall Conical	1	3.13%
Low Platform	1	3.13%
Low Long Mound	1	3.13%
Tall Long Mound	0	0.00%
Concentration	9	28.12%
Modified Elevation	3	9.37%
Total	32	100%
Settlement Density (Features/Sq. km)	2.29	

Figure 6.23: Map of features with Mixtequilla-style artifacts.

Late Classic

The Late Classic sees a decline in feature frequencies for the first time in the dunes' settlement history. There is a net reduction of 91 features from the previous period. Low conical mounds continue to be the feature type with the largest frequency (n=12) (Table 6.23). Notably absent at this time are any tall conical mounds (greater than 5 meters in height), platforms, or tall long mounds with evidence of occupation. This suggests that by the Late Classic, the dunes had primarily lost their major population. Despite this reduction in size, Late Classic settlement is divided into two distinct sites that appear of roughly similar size. The Santa Margarita core zone continues to be occupied, as it has for over a millennium. But there is also Rio Prieto 4, a site composed of both mounded architecture and numerous concentration features (Figure 6.24).

Table 6.23: Features Containing Late Classic Evidence.

Feature Type	Total	Percentage
Low Conical	12	44.44%
Tall Conical	0	0.00%
Low Platform	0	0.00%
Low Long Mound	2	7.41%
Tall Long Mound	0	0.00%
Concentration	11	40.74%
Modified Elevation	2	7.41%
Total	27	100%
Settlement Density (Features/Sq. km)	1.93	

Figure 6.24: Map of features with Late Classic evidence.

Post-Classic Phase

The decline in settlement continues in the Post-Classic. Only two dune concentrations contain diagnostic materials dating to this time, marking an almost complete desertion of the near-dune survey zone not seen since the Archaic Period (Table 6.24). The light occupation in the survey zone would have been a hinterland at this time. The near complete abandonment of the dunes in the Post-Classic follows similar patterns seen in the RAM survey around El Mesón (Loughlin 2012:236-237). It is surprising however, when one considers that there is a pronounced northern population shift in the main RRATZ survey block during this time. The settlement migration seen in the RRATZ survey block does not extend all the way to the coastal dunes in this survey. The only concentrations during the Post-Classic occur as concentrations found on hilly dune terrain (Figure 6.25). The Santa Margarita core of the dune occupation for 2000 years had been completely abandoned.

Table 6.24: Features with Post-Classic Artifacts.

Feature Type	Total	Percentage
Low Conical	0	0.00%
Tall Conical	0	0.00%
Low Platform	0	0.00%
Low Long Mound	0	0.00%
Tall Long Mound	0	0.00%
Concentration	2	100.00%
Modified Elevation	0	0.00%
Total	2	100%
Settlement Density (Features/Sq. km)	0.14	

Figure 6.25: Map of Features with Post-Classic Artifacts.

Monumental vs. Non-Monumental Architecture

The presence of monumental architectural structures is one method to better understand ancient political economies. Monumental buildings in the ELPB are large earthen structures that require greater labor inputs during the construction process. In the Mixtequilla region, Stark identifies 9-meter tall flattop platforms as the palaces of landholding elites. For the purposes of this project, monumental structures are identified as mounds greater than 5 meters in height (Killion and Urcid 2001). While tall conical mounds and long mounds were identified in the dunes, the large platforms identified by Stark in the Mixtequilla are notably absent in the survey zone. By comparing the ratios of monumental to non-monumental architecture in each time period, it is possible to gain a better understanding of changing political economic relationships in the past.

Table 6.25 below shows that evidence of monumental architecture is first found in the Middle Formative as the dune occupation begins to grow from its humble Early Formative occupation. As dune occupation grows through the Late Formative, Proto-Classic, and the Early Classic, the ratio of monumental to non-monumental architecture stays relatively steady. As the population of the dunes declines in the Late Classic and Post-Classic times, no monumental architecture is identified. The number of monumental structures with evidence of occupation for each phase varies with the number of non-monumental structures in that phase from the Middle Formative through the Early Classic (Table 6.25).

Table 6.25: Monumental to Non-monumental Architecture Ratios by Time Period.

	Monumental	**Non-monumental**	**Rate**
Early Formative	0	4	0
Middle Formative	2	18	0.11
Late Formative	3	34	0.09
Proto-Classic	4	44	0.09
Early Classic	7	59	0.12
Late Classic	0	14	0
Post-Classic	0	0	0

Settlement agglomeration

The RRATZ project utilized a full-coverage pedestrian survey approach during fieldwork that allows for the utilization of spatial analysis techniques, like the nearest neighbor analysis (Kowalewski 1990:39-41; Plog 1990:246). Full coverage surveying, as opposed to sampling, allows us to confidently understand the *entirety* of the survey universe. The nearest neighbor analysis works to assess spatial patterns found within the dataset. In this instance, the null hypothesis states that datapoints are randomly distributed in the survey universe. By testing the observed data against the null hypothesis, the nearest neighbor analysis can say with confidence if a settlement pattern leans toward a clustered, dispersed, or random distribution.

After plotting all features in ArcGIS 10.7.1 layers by time period, a nearest neighbor analysis was conducted. This is done by measuring the Euclidean distance (as the crow flies) of every feature to its single nearest neighbor in the survey universe and calculating an average distance. The tool then creates a hypothetical dataset with the same number of features and randomly plots them within the study area. An average distance of the randomly assigned features is then compared to the real dataset.

The resulting nearest neighbor ratio is a descriptive statistic measuring the dataset's deviation from a random distribution (Plog 1990). The ratio is presented on a scale from 0 to 2.1491, with ratios < 1 indicative of clustering. The closer to 0, the greater the clustering in the dataset. Ratios of observed vs. hypothetical data greater than 1 indicate more dispersal in the settlement. Z-scores determine if the ratio indicates a pattern happening, or if clustering or dispersal is part of simple random variation. Z-scores between -1.96 and 1.96 indicate randomness.

Table 6.26: Nearest Neighbor Ratios by Time Period.

	Nearest Neighbor Ratio	z-score	p-value	
Early Formative	1.941013	4.025422	0.000057	Dispersed
Middle Formative	0.900061	-1.011687	0.311688	Random
Late Formative	0.726403	-3.663872	0.000248	Clustered
Proto-Classic	0.737309	-4.204598	0.000026	Clustered
Early/Middle Classic	0.691127	-6.364136	0	Clustered
Late Classic	1.168205	1.640807	0.100838	Random
All Dune Features	0.684064	-8.440097	0	Clustered

The nearest neighbor analysis is conducted to better understand degrees of agglomeration in settlement on the dunes through time. Table 6.26 shows the results of the nearest neighbor analysis of the dune dataset including ratios, z-scores, and p-values. The small Early Formative occupation was dispersed, followed by growing Middle Formative settlement that is random in distribution. Moderate settlement agglomeration occurs at a statistically significant level beginning in the Late Formative, the same time that the Tres Zapotes polity is reaching its zenith. Similar levels of moderate clustering continue in the Proto-Classic, even as the dune occupation continues to grow. The Early Classic shows a slight increase in clustering (0.69) as the dune occupation reaches its apex. By the Late Classic, the population in the survey zone is in decline and settlement is random before the near complete abandonment during the Post-Classic.

Sites on the Dunes

Up to this point, this chapter has focused on the individual elements associated with settlement patterns. That is, the count, size, and shape of architectural features in the survey zone and their associated temporal designations. Additionally, I examined their spatial relationships to one another and designated feature types as monumental or non-monumental. The rest of this chapter focuses on the specific sites identified during survey.

In Oaxaca, Kowalewski et al. (1989) utilized 50 m. buffering around all features in the survey universe in order to see bigger patterns in the data. Pool and Loughlin use wider spacing in the southern lowlands, utilizing 75 m. buffers. This project follows their lead of applying 75 m. buffers to the survey data. Buffers were taken between the edges of features in ArcGIS, not the centroids. The first thing to notice is the delineation of two large clusters, broadly divided into east and west sides of the survey universe (Figure 6.26). An empty gap in settlement is seen running north-south in the middle of the survey zone. This gap is over half a kilometer wide (east-west) and acts as a boundary between the two large sites.

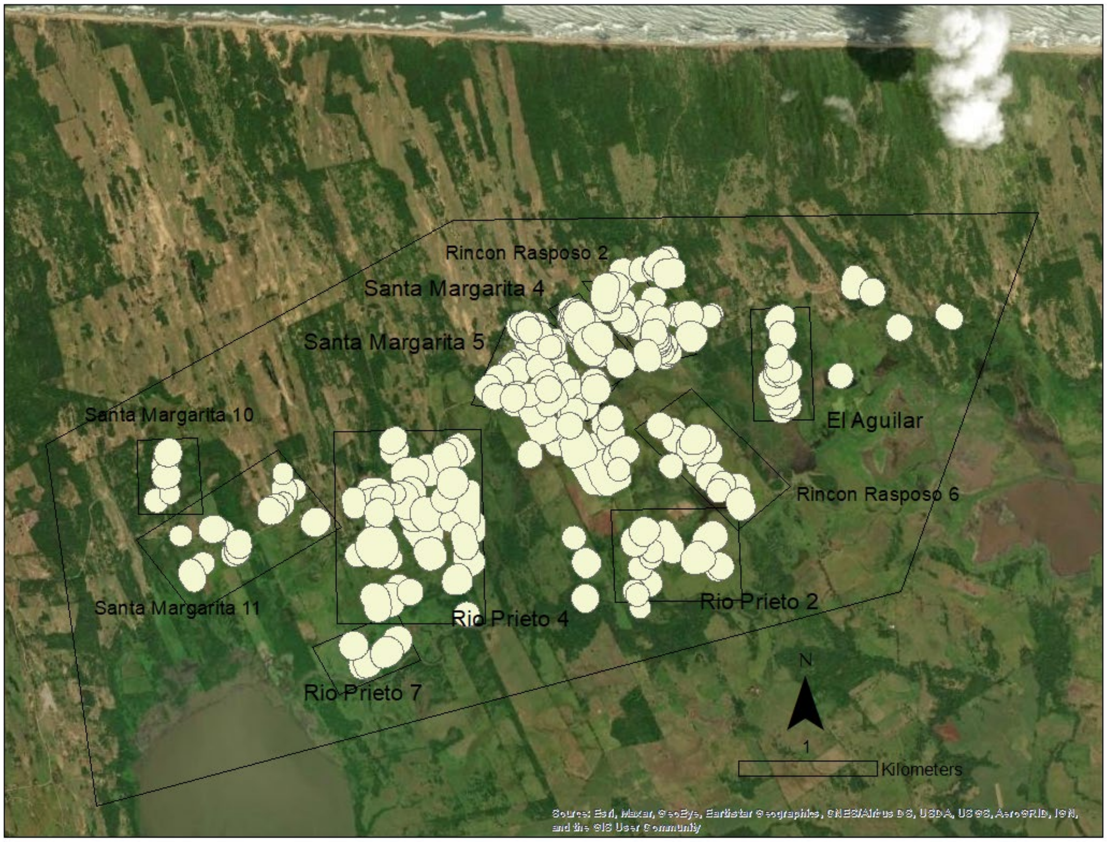


Figure 6.26: Map Showing 75-meter Buffers Around All Features.

Temporal designation of dune sites was done through an analysis of surface artifacts collected during survey. Diagnostic ceramic artifacts were usually the best temporal indicators available. Stylistic variations in figurine fragments recovered, as well as small amounts of Pachuca green obsidian further helped develop architectural sequences on the dunes. Once an understanding of when mounds were occupied is established, it is then possible to make greater statements regarding the political organization in the dunes throughout time. However, utilizing surface ceramics as the primary method for dating can be problematic. The collection of surface artifacts may favor, or exaggerate, the latest occupation of a feature. Mounded architecture was likely used and reused for long stretches of time. The presence of numerous ceramic sherds on the surface from any time period may hide or obscure older occupational indicators. Thus, older occupations may be underrepresented. Additionally, new construction phases on mounds may borrow dirt from the surrounding area that contains older artifacts, thus obscuring the proper temporal identification. These concerns however, should not be considered a significant issue because older artifacts used as moundfill are still evidence of earlier occupation in the immediate area.

Monumental architecture has long been understood as a material manifestation of power in Mesoamerica. Formal architecture is often monumental in scale and organized in an orderly manner. Additionally, formal architecture takes on greater significance because it is often associated with political power. While small domestic mounds are prevalent throughout southern Veracruz and often are found randomly on the landscape, formal architecture expresses a level of planning and organization beyond a small hamlet. Stark (1999:205) explains that formal architecture and its planned layouts express political power. Smith (2003:76) argues that rather than simple reflections of political power, formal architectural landscapes actively recreate the political order in daily life.

Formal architectural redundancy can reflect inclusion into a regional settlement hierarchy. This has been documented elsewhere in southern Veracruz. Stark (2008:100) identifies Standard Plan layouts as segments within the overarching Cerro de las Mesas polity. In outlying areas, Standard Plan segments may have indicated local affiliation with the larger polity. In the Cotaxtla Basin, Daneels (2008:203) argues that Standard Plan layouts may reflect nodes of political control, however, as Standard Plan layouts become ‘abbreviated’ (meaning only one element of the full plan), it may suggest incorporation into a larger center. Closer to the dunes, Loughlin (2012) argues that the Tres Zapotes Plaza Group (TZPG) layout at El Mesón symbolizes the site's subordinate status to the larger Tres Zapotes.

Santa Margarita 5

The site of Santa Margarita 5 is large in area, stretching N-S for almost 800 m. and E-W for over 600 m. For the purposes of this dissertation, Santa Margarita 5 also encompasses previously identified dune sites Santa Margarita 1, 6, 7, 8, and Rincon Rasposo 4 (Figure 6.27). This consolidation is meant to simplify, as all sites are never separated by more than 100 m. Containing thirty-nine features (n=39), the site is unique for its role as the 'heartland' of dune occupation. This refers to the point that the site is the most densely occupied for the longest duration. At the same time, it also stands out for the lack of tall mounds in the area. Closer to the Rio Prieto to the south, smaller domestic sites contain mounds greater than 5 m. in height. This may be a product of necessity as settlement to the south was occupying more inundated land. Taller mounds were likely constructed to live elevated, above the wetlands. Nevertheless, Santa Margarita 5 does contain multiple 'keyhole' mounds (D33/34, D35/36, D39/40). These conical mounds with fronting platforms require extra labor inputs for construction. Meaning, labor costs may have been invested horizontally at the site, rather than vertically as seen elsewhere.

I refer to Santa Margarita 5 as the 'heartland', or core, of the dunes due to the depth, longevity, and area size of occupation. The site is home to the greatest frequency of dune features containing Early Formative artifacts (n=4; D0042, D0044, D0049, D0055). Minor hamlet occupation during the Early and Middle Formative gave way to a great increase in occupational intensity during the Late Formative. Seventeen (n=17) features contain diagnostic artifacts dating to this time. Occupation continues to increase as the site records 27 features with artifacts dating to the Proto-Classic eriod. Santa Margarita 5 hits its apex during the Early Classic (n=30 features), before occupation recedes in the Late Classic (n=15 features) (Table 6.27).

The overall picture of occupation of Santa Margarita 5 reflects the overall dune settlement history primarily, yet it is distinct. This level of Early Formative occupation clustered together is not found elsewhere in the survey universe. Like other sites on the dunes, Santa Margarita 5 sees a modest Early and Middle Formative settlement expand substantially in the Late Formative. This expansion continues more gradually into the Proto-Classic and Early/Middle Classic. After the Early Classic apex, a sizeable yet significantly smaller occupation remains in the Late Classic. The site is abandoned by the Post-Classic, with not materials dating to this time period recovered during surface collections.

Table 6.27: Features Associated with Each Time Period at Santa Margarita 5.

Time Period	Features
Early Formative	D42, D49, D43/44/45, D55/D61
Middle Formative	D42
Late Formative	D29, D30, D31, D35/36, D42, D43/44/45, D49, D51/52, D53, D55/61, D86, E90
Proto-Classic	D29, D30, D31, D32, D33/34, D35/36, D38, D39/40, D42, D43/44/45, D47, D49, D51/52, D53, D55/61, D85/86, D56, E88, E90
Early Classic	D29, D30, D31, D32, D33/34, D35/D36, D37, D39/D40, D41, D42, D43/D44/D45, D49, D69, D78, E91, E92, E90, D51/D52, D53, D85, D86, D56, E87, E88
Late Classic	D30, D42, D43/D44/D45, D49, D69, E92, E90, D51/D52, D53, E88, E55/E56

The Santa Margarita 5 core zone today occupies flat land adjacent to the dunes. The modern main dune road cuts directly through the archaeological site, splitting the mounds to either side of the road. Today, the mounds at the site are covered in pasture grass for grazing animals (Figure 6.26). As such, thick grass covering the mounds made surface collections near impossible, making shovel-testing the primary means of artifact collection. Modern road cuts in mound D0029 (the east end of the site) provide some of most notable artifacts at the site. Items recovered include a donut stone, ceramic bead, and numerous pottery sherds.

This northern section of the core zone stretches approximately 400 m. x 200 m. and contains 17 features. These include 14 conical mounds and 3 platforms. Despite the deep occupation history of these mounds, they are generally small in stature. Most are under 3 m. in height with only D0041 and D0038 rising higher at 4 m. and 4.5 m. respectively. Moving west down the main dune road lies the previously identified Santa Margarita 6 site, mounds D0043 and D0044, connected by ramp D0045 (Figure 6.26). Each of these mounds are low, rising to only 0.5 m. in height.

Mounds at Santa Margarita 7 continue in the same SW-SE orientation as Santa Margarita 5 mounds. Santa Margarita 7 contains four conical mounds and two platform mounds. Mound D0051 stands at 1.9 m. in height and contains a smaller fronting platform, D0052, with dimensions of 25 m. x 23 m. x 0.5 m. Conical mound D0061 is 40 m. x 40 m. and 2 m. in height while its fronting platform has similar dimensions of 45 m. x 35 m. but a height of 0.5 m.

The broad Santa Margarita 5 core zone encompasses 39 recorded features that stretch 800 m. N-S and 600 m. E-W. The mounds at the site are predominately domestic in nature. The northern end of the site sees greater clustering of mounds, while the mounds that form the E-W axis are separated from one another at a distance of 50 – 90 m.

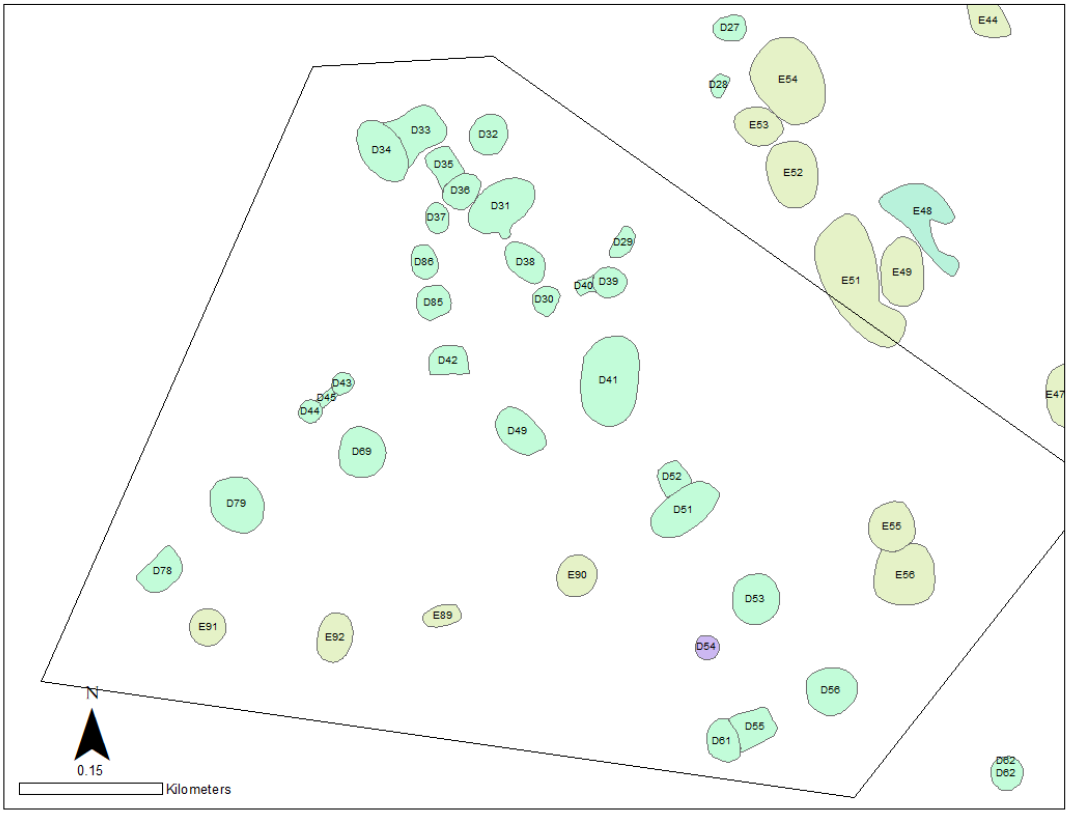


Figure 6.27: Map of Santa Margarita 5, the dune heartland. Features on eastern edge of map are from adjacent site.

Figure 6.28: Photo of Mound D0036 at the Santa Margarita 5 Core Zone.

Figure 6.29: Photo of Ramp D0045 and Mound D0043 Cut into by Modern Road.

Santa Margarita 4

Just to the east of Santa Margarita 5 is the site of Santa Margarita 4. This site is located between 500 m. and 1 km. from the modern town of Rincon Rasposo (Figure 6.30). While Santa Margarita 5 is located in a flat area between dune rises, Santa Margarita 4 is found within the natural dune rises. This created problems in the field as it was difficult to delineate elevations as mounds or natural dunes. Compounding this issue was dense vegetation that further obscured some boundaries.

While the site contains fewer features (n=7) than its neighbor, the life trajectory of the site remains similar. Diagnostic ceramics collected during survey show the earliest occupation of the site dating to the Middle Formative (E0049). Occupation increases during the Late Formative with three features containing ceramics dating to this time. Density of settlement continues to increase during the Proto-Classic and remains steady through the Early Classic (Table 6.28). Matacapan and Mixtequilla-style ceramics are both represented at the site with E0049 and E0048 containing both kinds. This suggests that trade networks associated with faraway distant centers likely overlapped in the dunes, rather than operating as exclusionary networks. By the Late Classic (n=1), occupation wanes before total abandonment during Post-Classic times.

Table 6.28: Santa Margarita 4 Features by Time Period.

Time Period	Features
Early Formative	
Middle Formative	E49
Late Formative	E53, E49, E48
Proto-Classic	E54, E53, E52, E51, E49, E48
Early Classic	E54, E53, E52, E51, E49, E48
Late Classic	E48

Figure 6.30: Map of Santa Margarita 4 Mounded Architecture.

Rincon Rasposo 2

The Rincon Rasposo 2 site is spread over approximately 13 ha., located approximately one half-kilometer north of the modern-day Rincon Rasposo community. This site lies roughly 200 m. directly to the east of Santa Margarita 4. It consists of nineteen (n=19) features spread out with an NW-SE orientation (Figure 6.33). The composition of the site varies between its north and south end points. Anchoring the site in its midway are two large parallel long-mounds (E0028 and E0029), each at a length of approximately 120 m. and almost 6 m. in height. A distance of 60-65 m. separates the two tall long-mounds. While vegetation on these mounds was especially dense, ceramic and obsidian artifacts were recovered. Tall long-mound E0029 contains Proto-Classic and

Early Classic diagnostic ceramics. Sixty-five meters to the west of E0029 stands E0045, a tall conical mound atop a platform. Standing at roughly 7.5 meters in height, E0045 is impressive in its stature with a nearly 1.5 m. tall platform with dimension stretching at 112 m. x 27.5 m. (Figure 6.32). Diagnostic ceramics recovered during survey date to the Late Formative and Proto-Classic periods.

Approximately 130 meters to the northwest of E0045 are two modified dunes or natural dunes with substantial occupation. E0042 and E0043 run side-by-side each other, however, the dense vegetation on the dunes made conditions less than ideal to clearly delineate the boundaries of the dunes (Figure 6.31). Artifacts collected during survey make it clear that occupation on these dunes was substantial and long in scope. E0042 provides diagnostic ceramics dating as far back as the Early Formative. From there, there is continuous occupation from the Late Formative through the Late Classic with ceramics relating to both Matacapan and Mixtequilla present. When combined with the Middle Formative evidence found at D0008 and E0036, we begin to see Rincon Rasposo 2 as an epicenter of early dune occupation.

Figure 6.31: Domestic Mounds E30 and E38.

Figure 6.32: Mound E45, on Top of Platform.

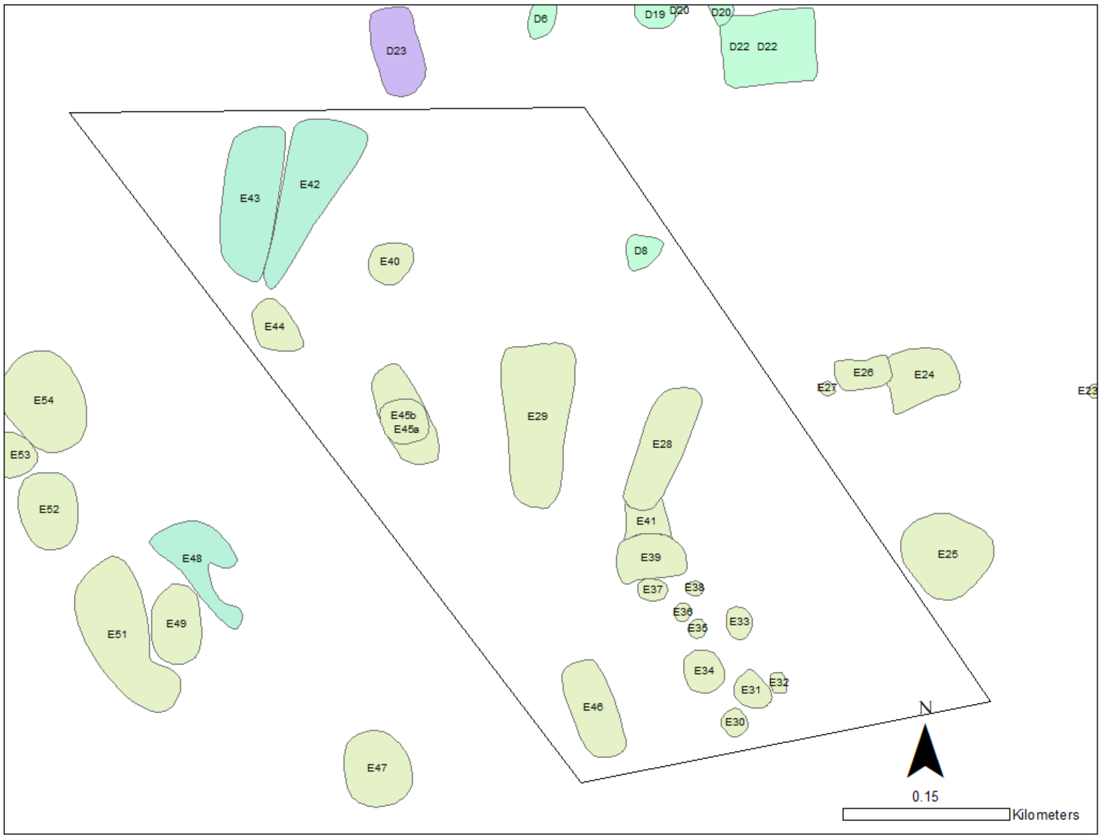


Figure 6.33: Map of Mounded Architecture at Rincon Rasposo 2. Includes two large modified/natural dunes (E42/E43) at north end of the site.

The site's density of occupation increases in the Late Formative, with thirteen features (n=13) containing diagnostic sherds identifiable to this time. Ceramics dating to this time appear throughout the site, from tall conical mound on a platform (E0045), both large modified dunes with occupation (E0042/E0043) down through the domestic mounds at the southern end of the site. Proto-Classic occupation maintains a steady level of occupation with 10 features containing ceramics dating to this time. Like elsewhere in the survey universe, the site's apex occupation occurs during the Early Classic with close representation for both Matacapan- and Mixtequilla-style artifacts. Domestic mound E0036, as well as modified dunes E0042/E0043, contain artifacts of both styles.

By the Late Classic, occupation density of Rincon Rasposo 2 had decreased sharply with only two features (E0036 and E0042) containing artifacts identifiable to this period. By this time, the primary occupation had shifted a half kilometer to the west at Santa Margarita 5. The occupation of the Rincon Rasposo 2 site is deep in time, stretching from the Early Formative through the Late Classic. The relatively sparse Early and Middle Formative occupation clears way for a steady, much greater occupation that begins in the Late Formative and carries through the Early Classic (Table 6.29).

Table 6.29: Rincon Rasposo 2 Features by Time Period.

Time Period	Features
Early Formative	E42
Middle Formative	E36, D8
Late Formative	E31, E32, E33, E34, E35, E36, E38, E39/E41/E28, E45, E42, E43
Proto-Classic	E29, E30, E31, E34, E36, E39/E41/E28, E45, E42
Early Classic	E29, E30, E31, E32, E33, E34, E35, E36, E37, E38, E39/E41/E28, E29, E42, E43
Late Classic	E36, E42

El Aguilar

The site of El Aguilar sits in the east end of the survey zone, approximately 1 km. east of the modern town of Rincon Rasposo. Located in a low-lying area just south of the coastal dunes, the area surrounding the El Agular site is seasonally inundated with overflow water from nearby Laguna Tortuga and Rio Prieto. Mounds elevated above the inundated areas during the rainy season would have provided dry land for domestic purposes while bringing aquatic resources right to the occupant's doorstep. The site is aligned in a north – south orientation, containing a total of 12 features, including: nine mounds, one concentration (E0011), one ramp (E0013), and one causeway (E0022) (Figure 6.35).

Figure 6.34: Mound at El Aguilar Covered in Pasture Grass.

Occupation at El Aguilar spans from the Late Formative through the Early Classic periods based on diagnostic ceramic sherds recovered through surface collections and shovel-testing. Concentration E0011, at the north end of the site, contains evidence for continuous occupation through these time periods while also contain a Coarse Orange sherd (Code 2811), evidence of interaction with Matacapan in the Tuxtla mountains. Just to the south of E0011 is conical mound E0020, which also contains evidence of continuous occupation from the Late Formative through the Early Classic.

The tallest mound at El Aguilar is E0018 which stands at 4.1 m. in height (Figure 6.34). This unique mound has a clear rectangular form, unlike the normal conical form in the region. Causeway E0022 extends south, connecting platform E0018 to conical mound

E0017. Platform E0018 contained no diagnostic materials, however E0022 contains ceramics from the Proto-Classic and Early Classic, while occupation of E0017 shows evidence from the Late Formative through the Early Classic with both Matacapan and Classic Veracruz influences. Conical mound with fronting platform E0015 dates to the Early Classic and likely provided an elevated living space 2 m. above the inundated land. The 1 m. tall fronting platform may have provided extra space for domestic activities.

El Aguilar was occupied from the Late Formative through the Early/Middle Classic. Its location in a seasonally inundated area likely made this site an ideal place continuous occupation to exploit terrestrial and aquatic resources. The presence of both Matacapan and Mixtequilla style ceramics at E0017 suggests that the occupants of El Aguilar were interacting in multiple trade networks.

Figure 6.35: Map of Site El Aguilar.

Rincon Rasposo 6

The site of Rincon Rasposo 6 sits approximately 900 meters southeast of the modern-day town of Rincon Rasposo. The site is located in the southeast portion of the survey universe. This site contains 13 conical mounds, including four tall conical mounds greater than 5 meters in height (Figure 6.36). This series of domestic mounds runs northwest – southeast and is located near the Rio Prieto to the south, and the lagoon to the east. While the surrounding area of the site is affected by season inundation of water, the mound group utilizes the natural elevations.

Figure 6.36: Map of Site Rincon Rasposo 6.

Surface collection recovery was hampered by general poor visibility at the site with many mounds covered in pasture. Surface collections recovered at tall conical mounds E0069 and E0072 provide diagnostic sherds showing an occupation during the Middle Formative and Late Formative periods and also in the Early Classic. E0069 had one Mixtequilla-style artifact collected. Conical mound D0066 provides evidence of Proto-Classic occupation, in addition to Early Classic evidence with both Matacapan- and Mixtequilla-style sherds.

Taken as a whole, this site of domestic mounds was likely first occupied during the Middle Formative and stayed occupied in some capacity through Early Classic times. Mixtequilla and Matacapan Coarse Orange sherds provide evidence that residents were engaged in both exchange networks. Tall mounds (E0063, E0065, E0069, E0072) greater than five meters in height were likely due to accumulation of occupation over long periods of time in an already elevated location (Figure 6.37). The natural elevation above the surrounding seasonally inundated area likely provided an easy location to occupy and built atop.

Many of the mounds are covered in pasture, making surface collections difficult. Based on diagnostic ceramics, the primary occupation of the site occurred during the Early Classic. However, ceramics dating to the Middle to Late Formative were identified at features E0072 and E0069. Seven mounds at this site contain no diagnostic artifacts during collection. D0066, for example, contains sherds that relate to both the Mixtequilla and Matacapan (Coarse Orange pottery). Tall conical mounds E0063 and E0065 contain no diagnostic artifacts. The tall status of these mounds can likely be attributed to the accumulation associated with the long-term occupation of domestic mounds rather than from centralized planning. This site sits near the Rio Prieto, meaning that taller domestic mounds would likely occur, in part, due to the convenience of being elevated off the ground in an inundated area.

Figure 6.37: Mound E0069.

Rio Prieto 2

Rio Prieto 2 encompasses previously identified sites of Rio Prieto 1, 2, 4, and 6 (Figure 6.38). These sites are evaluated as one site here due to their closer proximity to one another. Bordered to the south and east by the Rio Prieto, the Rio Prieto 2 site contains 15 total features, including: 9 low conical, 2 tall conical, 1 low long mound, and 3 concentrations. Anchoring this site are tall mounds E0074 and E0079. E0074 is 5 m. in height and irregular in shape. The irregularity in shape was compounded by difficulties in recording during fieldwork due to thick vegetation. Despite poor visibility on its surface, ceramic sherds diagnostic of the Early Classic were recorded. E0079 is a 6 m. tall, semi-rectangular mound located 350 m. northwest of E0074. While no artifacts were recovered on this tall mound, concentration E0075, located in the area between the tall mounds, contains diagnostic artifacts showing continuous occupation of the area from the Late Formative through the Early Classic. Coarse Orange and Mixtequilla-style ceramics were both recovered in this surface concentration. Concentration E0073, located northeast of E0074, also contains diagnostic artifacts dating from the Proto-Classic to the Early Classic, including a Mixtequilla-style ceramic.

Southeast of E0074, low conical mounds D0070 and D0071 are located. D0070 is a low domestic mound, 3 m. in height. During shovel-testing, a likely Archaic chert biface was recovered. This biface is the best evidence to date of an Archaic occupation on the dunes. Although it was found in mound fill, its original provenience was likely close nearby as the individuals constructing mound D0070 would have borrowed dirt from the vicinity. River-banks to the east and south of the mound were searched for further Archaic materials to no avail. A ‘waster’ sherd created from over-firing in the ceramic production process was also recovered at D0070, likely indicating that production occurred nearby.

The site of Rio Prieto 2 comprises multiple domestic mound groupings near the Rio Prieto. The location would be ideal for exploiting both terrestrial and aquatic resources in the dune region. Tall mounds E0079 and E0074 were likely used for domestic purposes with their height attributed to the buildup from long-term occupation in an area prone to inundation. The likely Archaic biface recovered in mound fill from

D0070 suggests that deep occupational history of this area in the dunes. Occupation at these sites became more permanent during the Late Formative and Proto-Classic times, with the most intensive occupation occurring in the Early Classic.

Figure 6.38: Map of Site Rio Prieto 2.

Rio Prieto 4

The site of Rio Prieto 4 includes previously identified sites of Santa Margarita 2 and 9. This large site is the primary occupation in the western portion of the survey zone. Unlike sites to the east, Rio Prieto 4 is primarily made up of 27 concentration features, with only seven features of mounded architecture (Figure 6.39). This difference is primarily due to the topography of the area, which contains ample elevations above the seasonally inundated wetlands. Elsewhere in the survey zone, occupants had to construct mounded architecture to stay dry above the water. The natural elevation of this portion of the survey zone lends itself to less-intensive building projects (Figure 6.40).

Despite the lack of emphasis on mounded architecture at this site, two tall conical mounds are present. E0107 and E0097, both greater than 5 m. in height anchor the site. E0107 contains diagnostic ceramics from the Proto-Classic and the Early Classic periods. E0097 contains artifacts from the Early Classic. While the abundance of Early Classic occupation is obvious in the artifacts recovered in so many features, the site is also notable for its mix of Matacapan and Mixtequilla influence.

The earliest evidence of occupation at the site is in the Middle Formative, with ceramics from this time found at only a single feature (E0130). Late Formative occupation continues to be sparse in this area of the dunes, as ceramics dating to this time period were recorded at D0082 and E0116 only. The transition to the Proto-Classic shows an increase in occupation, with evidence of occupation found in eight features (n=8) at the site, including tall mound E0107.

Like the overall dune occupation, the Early Classic at Rio Prieto 4 sees a large expansion in occupation, with 27 features containing diagnostic ceramics dating to this time. This boom in occupation also provides evidence of external trade networks. Matacapan Coarse Orange ceramics are identified at 8 features at Rio Prieto 4, while Mixtequilla-style ceramics are found at 5 features. Three features (D0081, E0108, and E0113) at the site contain artifacts of both Matacapan- and Mixtequilla-styles. This overlap suggests that trade networks on the dunes with faraway centers were not exclusionary in nature. Rather, households may have been able to participate in each.

The Late Classic occupation at Rio Prieto 4 is substantial, with 10 features containing datable ceramics to this time. By this time in the dune occupation, many smaller sites in the survey universe have been abandoned. Rio Prieto 4 maintains its identity as an autonomous site during this time, alongside Santa Margarita 5. The continued use of the elevated natural landscape of this area of the survey zone may speak to the ease of which houses could be built without mounds, while remaining in close proximity to aquatic resources.

The site of Rio Prieto 4 shows a history of long-term and sustained occupation in the western half of the survey universe. This landscape of natural elevations shows slow Formative development before a fast expansion in occupation during the Early Classic (Table 6.30). During peak in settlement, Rio Prieto 4 stood out clearly from its neighbor to the east, Santa Margarita 5. Most notably, Rio Prieto 4 was primarily made-up concentration features with less mounded architecture. While occupation declined in the Late Classic, Rio Prieto 4 is notable for its status as one of the last settlements of dune occupation.

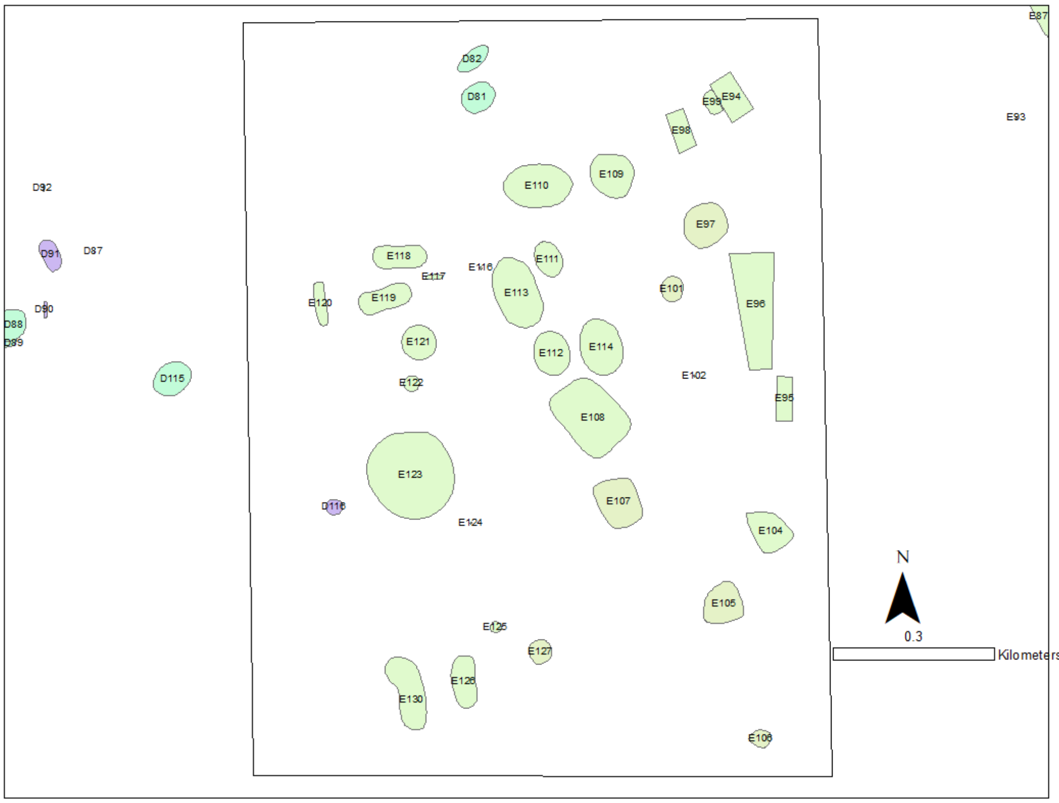


Figure 6.39: Map of Rio Prieto 4 Features.

Table 6.30: Features by Time Period at Rio Prieto 4.

Time Period	Features
Middle Formative	E130
Late Formative	D82, E116
Proto-Classic	E107, D82, D81, E96, E98, E113, E114, E130
Early Classic	D81, D82, E94, E95, E96, E97, E98, E99, E102, E104, E107, E108, E109, E110, E111, E112, E113, E114, E116, E117, E119, E121, E122, E123, E125, E126, E130
Late Classic	D82, E94, E95, E96, E108, E109, E110, E113, E114, E117

Figure 6.40: Photo of Rio Prieto 4, Overlooking E0101.

Rio Prieto 7

Site Rio Prieto 7 sits in the southwest of the survey universe. It is located just 140 m. north of the Rio Prieto and 700 m. east of Laguna Marquez (Figure 6.42). The site contains five features, the largest of which are E0128 and E0129 standing at 3.2 m. and 4.49 m. in height respectively. The irregular shape of E0129 does raise the possibility that this feature is a concentration on a natural dune rise. It is officially recorded as a low conical mound. Nevertheless, surface diagnostic ceramics show the earliest occupation of the feature in the Middle Formative. Proto-Classic and Early Classic sherds were also recovered during surface collections. One-hundred meters to the west of E0129 lies D0111 and D0112, a low conical mound with a fronting platform (Figure 6.41). Another one-hundred meters to the north is D0113, a low conical mound of irregular shape covered in pasture. Shovel-testing recovered three diagnostic ceramics dating to the Late Formative and Early Classic.

These five mounds make a domestic group occupying flat land near both Laguna Marquez and Rio Prieto. Elevated domestic mounds would have provided dry land for habitation while close to aquatic and terrestrial resources.

Figure 6.41. Photo of Mound D0111.

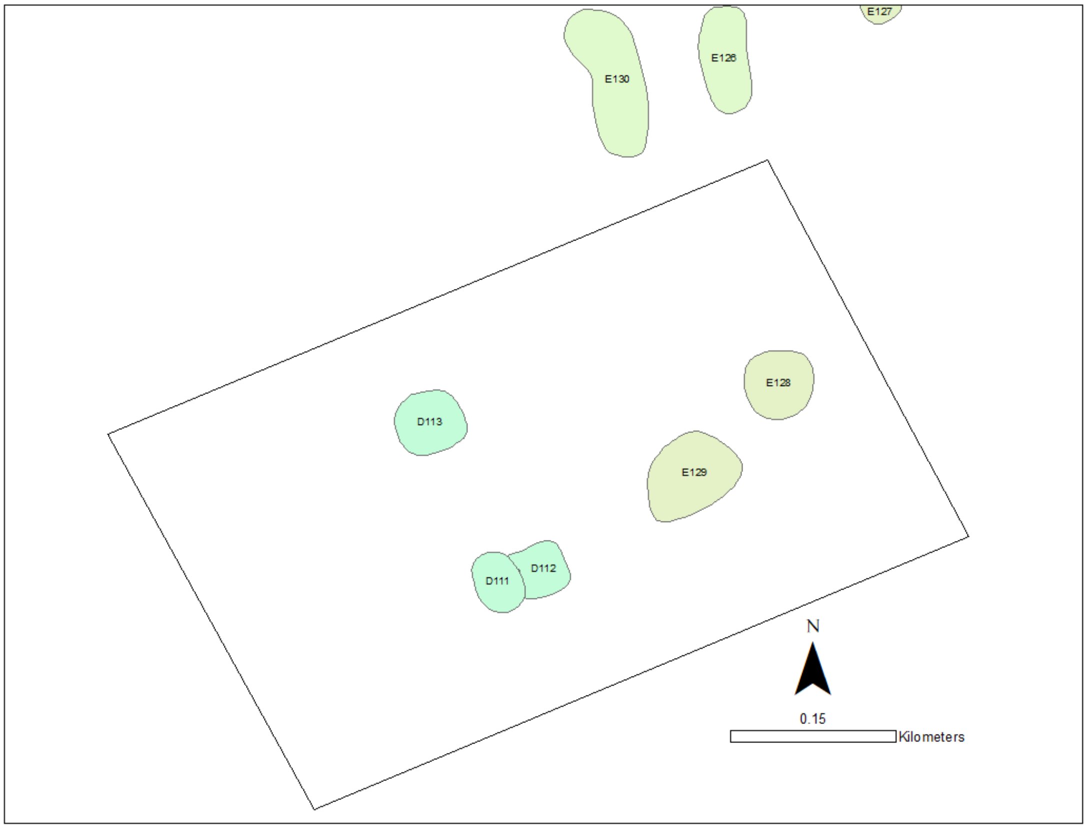


Figure 6.42: Map of Rio Prieto 7 Site.

Santa Margarita 11

The site of Santa Margarita 11 includes thirteen features, seven of mounded architecture and six concentrations (Figure 6.43). Anchoring the site is tall mound D0088 (5 m. height) with fronting platform D0089 attached on its south and west sides. Low conical mound D0094 contains surface ceramics dating to the Middle Formative, Late Formative, and Proto-Classic periods. Low long mound D0105 also contains diagnostic materials dating from the Middle Formative through the Proto-Classic. No relative dating artifacts were recovered at low conical mounds D0106, D0107, and D0115. Concentrations at the site also contain ample evidence for Early Classic occupation, with concentrations E0133, D0087, D0090, D0091, D0092, and D0093 all containing diagnostic data from this time. Concentration D0091 provides evidence of a deeper history with continuous occupation from the Middle Formative through the Early/Middle Classic. D0092 provides the only evidence of Late Classic occupation at the site, while also containing Matacapan Coarse Orange pottery.

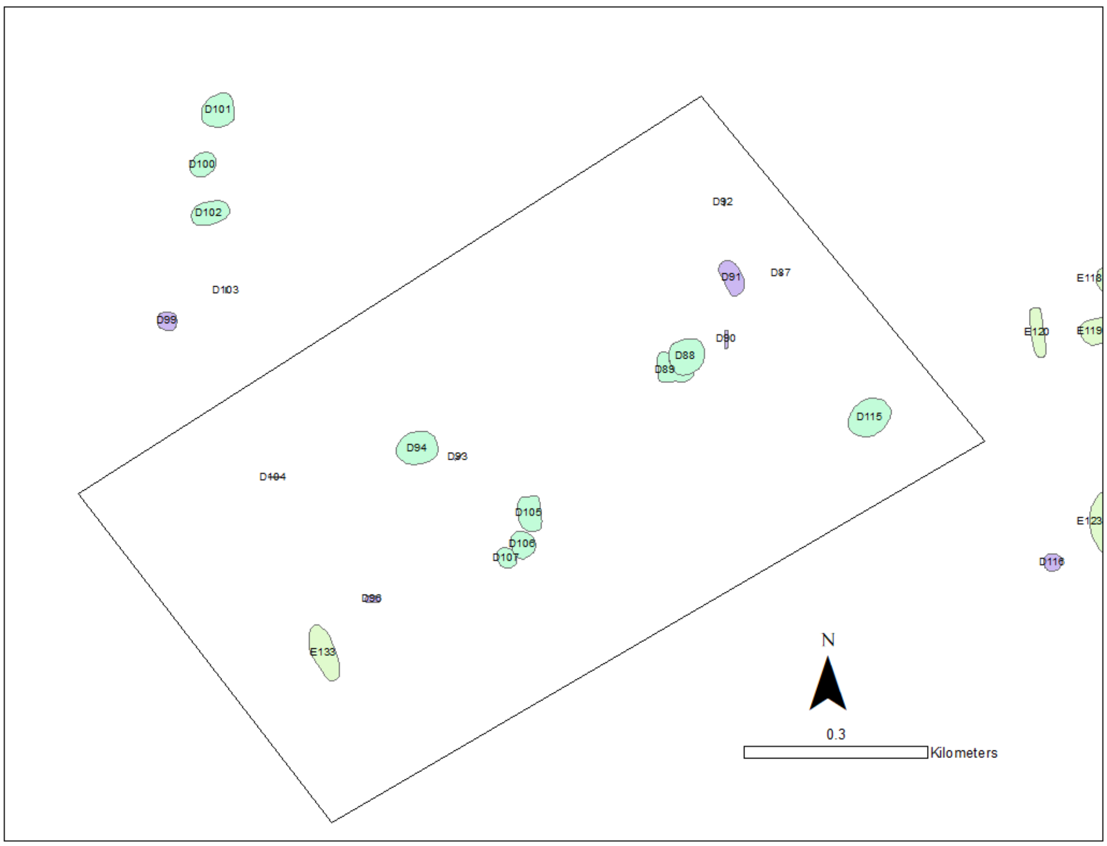


Figure 6.43: Map of Santa Margarita 11.

Santa Margarita 10

Santa Margarita 10 is a small domestic group of five features in the western end of the survey zone. The domestic group consists of two low conical mounds (D0100 and D0101), low long mound D0102, and concentrations D0099 and D0103 (Figure 6.44).

Diagnostic ceramics from D0099 date to the Late Formative, Proto-Classic, Early Classic (including Coarse Orange, important for its connection with Matacapan) and Post-Classic. Concentration D0099 is notable for being only one of two features with identifiable Post-Classic period occupation on the dunes. Early/Middle Classic period diagnostics are also identified at D0101 and D0103, suggesting that like elsewhere in the survey universe, site Santa Margarita 10 had its greatest occupation during this time.

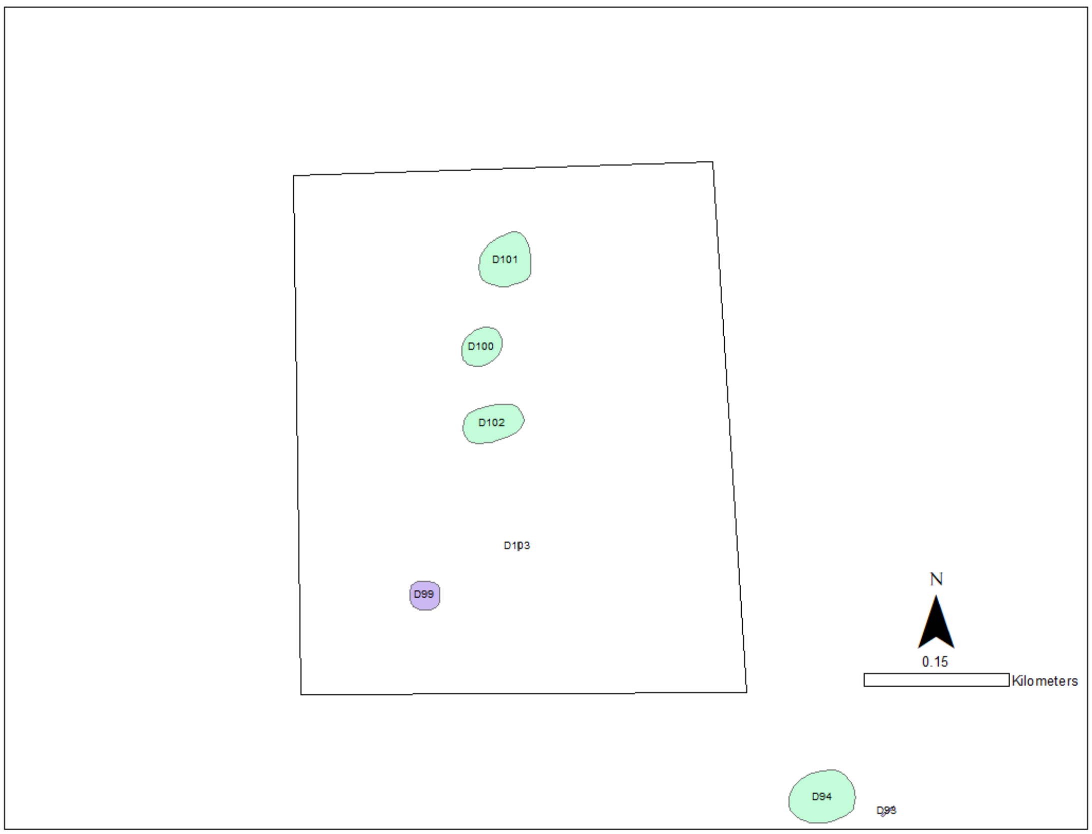


Figure 6.44. Map of Santa Margarita 10.

Conclusions

This chapter details the archaeological features identified and recorded during pedestrian survey in Summer 2014 of the dune and near-dune landscape. The impetus for surveying this section of coastal paleodunes was to identify small-scale Archaic period occupation. While this goal ultimately fell short, an interesting dataset of occupation emerges from a geographically distinct landscape that has largely been neglected in the literature.

The Santa Margarita 5 core zone is the location of the earliest settlement on the dunes, with the exception of the likely Archaic biface found at Rio Prieto 2. Sparse Early and Middle Formative settlement gives way to expansion within and beyond the site during the Late Formative. It is during the Proto-Classic when the two primary sites on the dunes become clearly defined. That is, the Santa Margarita 5 core zone and the Rio Prieto 4 site to the southwest. These two sites continue to grow and flourish through the Early Classic. By the Late Classic, occupation at sites elsewhere on the dunes had largely regressed, leaving Santa Margarita 5 and Rio Prieto 4 as the primary centers of occupation before abandonment in the Post-Classic. While Santa Margarita mounds were likely reused again and again over centuries of occupation, the Rio Prieto 4 site contains less mounded architecture, instead making use of the natural dune elevations above the estuarine zone.

The dune survey zone shows broadly similar settlement trends as seen in in the nearby RAM survey at El Mesón and the ELPB in general (Loughlin 2012). Early Formative occupation on the dunes is sparse, however the population and the architecture steadily grow throughout the Formative Period as nearby Tres Zapotes comes to power in the Late Formative. Even as Tres Zapotes falters, and El Mesón emerges as its own regional center, the dune occupation continues to grow in the Proto-classic, reflecting the general trend for the ELPB regional population outside of Tres Zapotes (Pool and

Loughlin NSF). It is important to note that no Tres Zapotes Plaza Groups (TZPG) nor Standard Plan layouts were identified during the dune survey. This is significant due to the dunes close proximity to both El Mesón and Tres Zapotes. During a period of reorganization, power-sharing factions at Tres Zapotes expressed themselves through the repetitive layouts found at the site. This same layout is also found at the core of the El Mesón site, likely symbolizing a subordinate center status to the larger Tres Zapotes polity. Despite the regional geopolitical realities occurring during this time, the dunes appear to avoid being directly under the control of the polity.

The Early Classic is the apex of dune occupation as influence from distant sites in the Tuxtla Mountains and Central Veracruz flourish. The dunes quick decline in the Late Classic continues with the near complete abandonment of mound centers by the Post-Classic. This is significant because the greater RRATZ survey project identifies a noticeable northward shift toward the Gulf of Mexico in Post-Classic settlement. This noticeable northward settlement shift in the region did not extend all the way to the coastal paleodunes.

Chapter 7 - Data Analysis and Economic Organization

All artifacts for this project were analyzed in the lab at the Tres Zapotes museum in Summer 2015. Artifacts recovered during survey are similar to those found elsewhere in the course of pedestrian surveys in southern Veracruz. Ceramic sherds were the highest frequency artifact collected (n=5,248), followed by obsidian (n=206), groundstone (n=60), special objects/figurines, and daub. This chapter examines the raw data in each artifact category paying special attention to production indicators. Production indicators, whether in the form of kiln debris, waster sherds, or lithic flakes are vital in recreating ancient political economies. Of particular interest is both where in the survey universe these production indicators occur; and also, what types of features are associated with these production indicators. In addition to production indicators, this chapter also focuses on issues of cotton production, long-distance exchange, and interaction between the dunes and faraway centers.

Ceramics

This project utilizes ceramic sherds as the primary method for dating sites, mounds, and features on the dunes. Because diagnostic ceramic sherds can provide information about the relative time of occupation of space, this chapter will focus primarily on diagnostic wares identified during analysis. Overall, the 5,248 ceramic sherds collected are the largest artifact class in this survey and account for 87.4% of all artifacts collected (see Appendix A). Diagnostic ceramics accounted for 32.5% of all sherds collected (n=1,709) (Table 7.1). The results of the ceramic analysis are presented here by time period and phase. Vessel form was recorded whenever possible. However, the majority of sherds collected during survey were body sherds, revealing little information about vessel form or shape. This makes any statements about the kinds of vessels found on the dunes difficult. General vessel forms are coded the following way: 40s represent Plates/Dishes; 50s represent Silhouette Bowls; 60s represent Cylindrical Vessels; 70s represent Necked Jars; 81 represents Tecomates; 82 represents Neckless Jars; 99 represents Unidentified forms.

Table 7.1. Diagnostic Ceramics Count and Time Period.

Phase	**Type Code**	**Type Name**	**N**	**% for Phase**
Arroyo	2905	Specular Red	3	37.50%
		Tecomates	5	62.50%
Total			8	100
Tres Zapotes	2113	Coarse Gray	1	2.50%
	2123	Polished Medium Black with Quartz Temper	25	62.50%
	2302	Cream Slipped Coarse Whiteware	5	12.50%
	2512	Plain Coarse Polished Black	9	22.50%
Total			40	100
Hueyapan	2111	Plain Coarse Gray with White Temper	5	2.72%
	2122.4	Thin-walled Polished Black with Orange to Gray Paste	28	15.22%
	2225	Coarse Black and Tan	11	5.98%
	2225.1	Incised Coarse Black and Tan	2	1.09%
	2226	Medium Black and Tan	118	64.13%
	2656	White Slipped Coarse Red with Coarse White Temper	11	5.98%
	2904	Plain Polished Orange	9	4.89%
			184	100
Nextepetl	1212	Sandy Fine Orange	80	23.05%
	1240	White-slipped Sandy Fine Orange	7	2.02%
	2224	Fine Paste Black and Tan	31	8.93%
	2224.1	Plain Fine Paste Black and Tan	2	0.58%
	2653	Coarse Orange with White Temper (Dark Core)	31	8.93%
	2654	Coarse Brown with Coarse White Temper	196	56.48%

Total			347	100
Ranchito	1211	Fine Orange	269	25.31%
	1213	Fine Buff	2	0.19%
	1231	Red Wash on Fine Orange	13	1.22%
	1232	Brown-Slipped Fine Orange	2	0.19%
	1233	Polished Brown-Slipped Fine Orange	2	0.19%
	1234	Orange-Slipped Fine Orange	1	0.09%
	1236	White-Slipped Fine Orange	22	2.07%
	1262	Incised Red on Fine Orange	1	0.09%
	1271	Red on White-Slipped Fine Orange	1	0.09%
	1272	Orange on White-Slipped Fine Orange	1	0.09%
	2611	Brown-slipped Coarse Brown	373	35.09%
	2612	White-Slipped Type 22	50	4.70%
	2614	Brown-Slipped Coarse with a Paste with White Inclusions	107	10.07%
	2615	Pink Coarse	8	0.75%
	2616	Coarse Brown with Soft Rastreado	2	0.19%
	2624	Related to Patarata Coarse Red-Orange, Acula Red-Orange	55	5.17%
	2811	Coarse Orange	73	6.87%
	3006	Patarata Coarse Red-Orange	1	0.09%
	3008	Acula Red-Orange Monochrome	80	7.53%
Total			1063	100
Quemado	1111	Plain Fine Gray	47	71.21%
	1112	Black-Slipped Fine Orange	10	15.15%
	1113	Burnished Gray	3	4.55%
	1114	Burnished Milky Light Brown	1	1.52%
	1115	Mottled Light Brown with Matte Finish	1	1.52%
	1132	Brown-Slipped Fine Gray	2	3.03%
	1281	Polychrome on Unslipped Fine Orange	2	3.03%
Total			66	100
Post-Classic	1252	Black-Slipped Incised Fine Orange	1	100
Total			1	100
Grand Total			1709	

Table 7.1. (continued)

Early Formative Arroyo Phase

The Arroyo phase in the ELPB dates to around 1200 to 1000 BC (calendar calibrated years BC). While artifacts during this time are generally rare, there are a few types that are diagnostic of this time. First identified by Coe and Diehl (1980) at San Lorenzo, Limón Carved-Incised and Calzadas Carved ceramics date to the San Lorenzo B phase (contemporary with Arroyo). Calzadas Carved in particular is associated with complex carving designs on the exterior surface of the vessel that are closely associated with Olmec cosmology (Coe and Diehl 1980:159-187). In addition to these ceramic types, the tecomate vessel type is also associated with this phase. Pool et al. (2010:96) acknowledge the similarities in vessel types between the Arroyo phase and San Lorenzo phase but add that pottery such as black ware, differentially fired, and white-slipped wares were more common in the Arroyo phase at Tres Zapotes (Pool et al. 2010:96-97). In the dunes, Specular Red (Code 2905) sherds (n=3) are the most common ceramic type. Tecomate vessel forms (n=5) account for most Arroyo to TZ A phase evidence.

Middle Formative Tres Zapotes Phase

The Middle Formative in the ELPB is defined by the Tres Zapotes phase. Dating between 1000 – and 400 BC, it roughly corresponds to Matacapan A (Tuxtla Mountains), the Initial Picayo (El Picayo), and Gordita phases (La Joya) around southern Veracruz (Arnold 2003; Coe and Diehl 1980; Ortiz Ceballos 1975; Ortiz Ceballos and Santley 1988). A total of 52 sherds representing 7 ceramic types were identified on the dunes corresponding to the Tres Zapotes phase. Polished Medium Black with Quartz Tempter (n=25) accounts for nearly half of ceramic sherds dating to this phase.

2113 Coarse Gray

Only a single Coarse gray with volcanic ash temper (Code 2113) sherd was recovered during the dune survey. This body sherd cannot provide any information regarding the vessel form, Loughlin (2012:103) found that simple silhouette bowls and plates/bowls were the most common forms for this ceramic type. Coarse Gray accounted for 15% of Tres Zapotes phase ceramics at Loughlin's RAM survey (2012:103).

2123 Polished Medium Black with Quartz Temper

Twenty-five sherds were classified as Polished Medium Black with quartz temper. This ceramic type (n=25) accounts for almost half of Tres Zapotes phase ceramics (n=52) recovered in the dunes. All twenty-five sherds were classified as Code 2123, Plain Medium Polished Black with none containing any incisions (Code 2123.11). At El Mesón, Loughlin (2012:104) identifies plates/bowls and simple silhouette bowls as the most common vessel forms associated with this ceramic type.

2302 Cream Slipped Coarse Whiteware

Dating to the Tres Zapotes B phase is the pottery type Cream Slipped Coarse Whiteware. Five sherds (n=5) were recovered in the dune survey of this ceramic type.

2512 Plain Coarse Polished Black

A total of nine (n=9) Plain Coarse Polished Black pottery sherds were recovered during pedestrian survey.

Late Formative Hueyapan Phase

In the Late Formative, the Hueyapan phase dates to approximately 400 – 1 BC, corresponding to the Remplas, Picayo, and Bezuapan phases at San Lorenzo, the Tepango Valley and Tuxtla Mountains respectively (Coe and Diehl 1980; Ortiz Ceballos 1975; Pool 2007; Stoner 2011). A total of 218 sherds were recovered from the dunes dating to the Hueyapan Phase. At the nearby RAM survey at El Mesón, Loughlin (2012:111) found this phase of ceramics to be dominated by simple silhouette bowls and flat-bottomed plates and bowls. Decorations during this time period are often found as incised lines on the exterior rims of sherds. Some of the primary ceramic types found in the region at this time include Coarse Paste Black and Tan, Fine Paste Black and White, Polished Orange and Polished Black.

2122.4 Thin walled polished black with orange to gray paste

Twenty-eight (n=28) Thin Walled Polished Black with Orange to Gray Paste sherds were recovered and identified in analysis. Body sherds account for the majority of pottery recovered during survey, accounting for 89.2% of this type (n=25) (Table 7.2). Loughlin (2012:114) identified over 67% of this sherd type to be simple silhouette bowls at El Mesón.

Table 7.2: Vessel Type of Thin Walled Polished Black with Orange to Gray Paste.

Vessel Form Code	Count
48m	1
49e6b.85	1
51a0	1
cuerpo	25
Total	28

Medium Black and Tan (Code 2226)

Medium Paste Differentially Fired Black and Tan sherds account for 2.2% (n=118) of all diagnostic ceramics in the dunes (Table 7.3).

Table 7.3: Medium Paste Black and Tan Vessel Forms.

Vessel Form Code	Count
45c1	1
45c3.85/45c3.82	1
48a2	2
48b1	1
48h2.88	1
49a0	1
49a0.88	1
51a0	2
51a5	1
52a0	1
99	4
Base	6
cuerpo	95
cuerpo.88	1
Total	118

Proto-Classic Nextepetl Phase

The Nextepetl phase is defined from 1 – 300 AD and the Proto-Classic period in the ELPB. The Proto-Classic period, by definition, is a transitional time between the Formative and Classic periods. This means that ceramics from this period can display both Formative and Classic period characteristics. In the ELPB, fine paste ceramics emerge during this time. Most importantly, Sandy Fine Orange pottery is frequently found in the ELPB. Sandy Fine Orange is a ceramic type that is an early attempt at fine paste pottery. While later fine paste ceramics were without temper, Sandy Fine Orange sherds displays a gritty ‘sandier’ feel between the fingers.

During the Nextepetl phase, there is also a general movement towards finer pastes on ceramic types that were coarse during the Formative period. Examples of this movement include Fine Paste Black and Tan and Fine Polished Black. These two ceramic types existed previously, however, the size of the temper become noticeably smaller and used in lesser frequencies. Decorative aspects on sherds typical of this time often show horizontal incised lines on the exterior rim surface.

A total of 351 Nextepetl phase ceramics were collected and identified during the dune survey. These sherds account for approximately 20% of all diagnostic sherds collected during fieldwork.

Sandy Fine Orange (Code 1212)

Eighty (n=80) sherds were classified as Sandy Fine Orange during lab analysis (Table 7.4). Sandy Fine Orange pottery accounts for 22.8% of all Proto-Classic sherds in the survey zone. While a large percentage, Loughlin’s (2012:123) RAM survey found Sandy Fine Orange accounting for 40% of sherds from this time period. The most common vessel form identified at El Mesón is the simple silhouette bowl, accounting for 41% of all Sandy Fine Orange sherds. Plates and bowls were the second most common vessel form at the El Mesón survey, accounting for another 23.6% of the Sandy Fine Orange assemblage (Loughlin 2012:123). Seventy-six percent of dune Sandy Fine Orange sherds collected were body sherds, leaving any further assessment of vessel shape unreliable.

Table 7.4: Sandy Fine Orange Vessel Forms.

Vessel Form Code	Count
41a2	1
42b2	1
42d5	1
42g	1
48h2	4
49e1	1
49e5	1
51a1	1
51b2	2
51f1	1
82a4	1
99	4
cuerpo	61
Total	80

Coarse Orange with White Temper (Dark Core) (Code 2653)

Approximately 8.8% of Nextepetl phase ceramics (n=31) were classified as Coarse Orange with White Temper (Dark Core).

Table 7.5: Coarse Orange with White Temper (Dark Core) Vessel Forms.

Vessel Form Code	Count
46c7	1
99	4
cuerpo	26
Total	31

Coarse Brown with Coarse White Temper (Code 2654)

Over 55% of Nextepetl phase sherds were classified as Coarse Brown with Coarse White Temper (n=196). In the RAM survey, Coarse Brown with Coarse White Temper accounted for only 26.2% of Nextepetl phase ceramics. The most common vessel forms at El Mesón were bowls, accounting for 45% of the assemblage. The next most common vessel form was necked jars. In the dune survey, 89.2% of Coarse Brown with Coarse White Temper sherds were body sherds.

Table 7.6: Coarse Brown with Coarse White Temper (Code 2654) Vessel Forms.

Vessel Form Code	Count
42c1	1
42d0	1
42d5	1
48a2	1
48b1	1
48b3	2
48e	1
48g1	1
48k	1
48m	1
49a0	1
49e1	1
79b1	1
99	6
base	1
cuerpo	175
Total	196

Early Classic Ranchito Phase

The Early Classic in the ELPB is represented by the Ranchito phase. This phase dates from 300 – 600 AD. The Ranchito phase represents the widespread adoption of fine paste ceramic wares. Surface treatments such as slipping become more prominent during this time. Fine Orange, a finer paste ceramic from its predecessor Sandy Fine Orange (Proto-Classic), is at its most popular during the Ranchito phase. Earlier, Formative period ceramic styles and types, like the differentially fired types and tecomates, completely disappear during this time.

Occupational density increases during the Early Classic to the dune's zenith. This is reflected in the high frequencies (n=269) of Fine Orange pottery. This is also a time when 'outside' ceramic types like Coarse Orange (a style associated with Matacapan in the Tuxtla Mountains) and Mixtequilla-style pottery are found in the dune collection. These Mixtequilla-style ceramics are somewhat rare in the ELPB.

A total of 1,063 sherds were collected during pedestrian survey that date to the Ranchito phase. This is the highest frequency of ceramics of any time period in the dune survey. Ranchito phase ceramic sherds account for 61.57% of all diagnostic sherds recovered on the dunes. Importantly, Ranchito phase ceramics on the dunes provide evidence of interaction outside the ELPB. Mixtequilla-style ceramics, rare in the ELPB, make up 12.81% (n=136) of the Early Classic ceramic assemblage. Matacapan-style ceramics account for only 6.87% (n=73) of Early Classic ceramics.

Fine Orange (Code 1211)

A total of 269 Fine Orange sherds were identified during analysis, accounting for 5.1% of the total ceramics collected during survey. Fine Orange ceramics also account for 25.3% of Early/Middle Classic sherds from the dunes. Over 88% of Fine Orange sherds collected during the survey were body sherds, leaving any generalizable conclusions about vessel forms difficult to state confidently. Loughlin (2012:140) identified 80.4% of Fine Orange sherds at El Mesón to be classified as plate/bowls with outsloping-straight walls.

Table 7.7: Fine Orange Vessel Forms.

Vessel Form Code	Count
31b1	1
41a0	1
41a2	3
42a0	2
42a7	1
43a	1
45c2	1
48c1	1
48g2	1
48h2	2
48k	4
48L	1
49a0	1
49b1	1
51a2	1
98	1
99	4
99.14	1
cuerpo	238
handle	1
Mat. 12	1
Mat. 23	1
Total	269

Brown-slipped Coarse Brown (Code 2611)

"Brown-slipped Coarse Brown" pottery is actually not brown in color, nor slipped, but a brighter shade of orange with a fine white temper. It is a common pottery type in the ELPB. This ceramic type has the highest frequency of sherds (n=373) recovered during survey. This accounts for 35.12% of Ranchito phase ceramics and 7.1% of all ceramics recovered on the dunes. This type of pottery is common on cazuelas with loop handles at Matacapan (Ortiz Ceballos and Santley 1988). At Tres Zapotes, it is commonly used for small bowls and cylindrical jars (Pool n.d.).

Coarse Orange (Code 2811)

Coarse Orange is a ceramic type in the ELPB that is widely associated with the Middle Classic site of Matacapan in the Tuxtla Mountains. Matacapan's close association with Teotihuacan implies that Coarse Orange ceramics *may* be evidence of a Teotihuacan-based trade network. To be clear, Coarse Orange ceramics are not evidence of direct trade with Teotihuacan. In the nearby RAM survey, Loughlin identifies only 54 sherds classified as Coarse Orange. This is somewhat surprising given the significantly higher frequencies of ceramic materials around El Mesón.

A total of seventy-three (n=73) Coarse Orange sherds were recovered from the dunes. This accounts for 6.87% of all Early/Middle Classic sherds identified during survey and 1.4% of all diagnostic dune sherds. This may suggest that the dune occupation may have had greater interaction with Matacapan than El Mesón.

Non-local Classic Ceramics

Several ceramic types closely associated with the Mixtequilla region of south-central Veracruz were also identified in the dune survey zone. These ceramic types are non-local to the ELPB and likely show evidence of an alternative sphere of interaction that is different from the Coarse Orange sphere. These ceramic types are Patarata Coarse Red-Orange with Stick Polish and Acula Red-Orange Monochrome.

Patarata Coarse Red-Orange

Patarata Coarse Red-Orange (Code 6006) is non-local ceramic type from the Mixtequilla region. Its presence in the dunes indicates interaction, direct or indirect, between those living on the dunes and people of the Mixtequilla. Patarata Coarse Red-Orange pottery is defined by a medium brown surface with coarse quartz sand temper with a dark core (Stark 1989:80). These ceramics have an orange to red slip. Stark first identified and described this ceramic type as "moderately gritty, medium texture or very gritty, coarse texture" (Stark 1989:70). An often-defining characteristic of this ceramic type is the "stick-polish" burnished decoration that is generally in horizontal wavy, crisscrossed, vertical or slanted lines on basins and large open jars (Stark 1989:71). Only a single sherd on the dunes contained the signature 'stick-polish'.

Acula Red-Orange Monochrome

Acula Red-Orange Monochrome is a Mixtequilla-style ceramic type. Originally identified in the WLPB, Stark describes this type as having a "moderately fine paste with sand inclusions" and red-orange slip (1989:27). In the Mixtequilla, it is common to have a dark core, however examples exist without. In the nearby RAM survey, 341 sherds were identified as this type, 9% of all Ranchito phase ceramics (Loughlin 2012:158). Over 72% of Acula Red-Orange sherds were identified as plates/bowls, with predominately out flaring walls.

In the dune survey zone, a total of 80 ceramics were identified as Acula Red-Orange Monochrome. This accounts for a total of 7.56% of Early/Middle Classic sherd types, and 1.5% of all diagnostic ceramic types on the dunes.

Table 7.8: Acula Red-Orange Monochrome Vessel Forms.

Vessel Form Code	Count
48a	1
48a2	1
48a3	1
48g1	2
48i	1
49a0	2
49e2	1
51a0	2
99	4
Base	2
cuerpo	63
Total	80

Fifty-five sherds (n=55) were identified as a Code 2624, as related to Patarata Coarse Red-Orange and Acula Red-Orange. These sherds did not fit neatly into either category, yet they shared many similarities to these related Mixtequilla-style pottery. This accounts for 5.2% of all Early/Middle Classic ceramic types, as well as 1% of all dune diagnostic ceramic types.

Table 7.9: Ceramic Code 2624 related to Patarata Coarse Red-Orange, Acula Red-Orange Vessel Forms.

Vessel Form Code	Count
73	1
10a0	1
45a3	1
48a0	1
48a2	2
48c2	1
48i	1
49a0	8
49b1	2
49b6	1
51a2	1
51a5	2
52a	2
99	1
base	2
cuerpo	28
Total	55

Late Classic

The Late Classic period in the ELPB is represented by the Quemado Phase, dating to 600 – 900 AD. While Fine Gray appears during the Early Classic, it significantly increases in frequency during the Late Classic, especially in the Tuxtla Mountains (Ortiz and Santley 1988). Fine Gray ceramics are common across southern Veracruz and are one of the primary relative dating methods of occupation during this time. The dune survey found a total of 66 sherds that date to the Late Classic period.

Plain Fine Gray (Code 1111)

A total of 47 Plain Fine Gray sherds were recovered during survey, accounting for over 71% of sherds dating to the Late Classic. Due to poor visibility throughout much of the dune survey zone, body sherds were retrieved during collections to supplement to the poor supply of rimmed sherds. Loughlin's RAM survey (2012:163), with a much greater frequency of rim sherds, found that plates/bowls (n=22) and simple silhouette bowls (n=15) are the primary Fine Gray vessel forms in the region.

Table 7.10. Vessel Form of Plain Fine Gray (Code 1111) Sherds.

Vessel Form Code	Count
42a0	1
48k1	1
48L	1
48m	1
Undetermined	2
Body Sherd	41
Total	47

Black-Slipped Fine Orange (Code 1112)

This type is part of the Fine Gray ceramic type family because the sherds are incompletely reduced Fine Gray. The name 'black-slipped' is deceiving because the black exterior is created through the firing process, not from adding a slip (Pool 1990). A total of 10 Black-slipped Fine Orange sherds were recovered during survey. This is the second most frequent ceramic type of the Late Classic. Loughlin's (2012:164) survey found that simple silhouette bowls make up the majority of vessel forms for this type.

Table 7.11. Vessel Form of Black-Slipped Fine Orange (Code 1112) Sherds.

Vessel Form Code	Count
46a2	1
Body Sherds	9
Total	10

Post-Classic

The Post-Classic period in the ELPB lasted from 900 AD – 1500s with arrival of the Spanish conquistadors. Archaeological investigations of the Postclassic in southern Veracruz have largely lagged behind other time periods in exploration. Despite this, Post-Classic presence has long been identified in the region, including at Tres Zapotes (Drucker 1943:122). This is especially true for the Soncautla Complex ceramic type that was likely associated with burials during this era. Drucker argues that the Complex has similarities to Postclassic pottery found in the Central Highlands of Mexico (Drucker 1943:123). Michael Coe (1965:711), on the other hand, found similarities with the Soncautla Complex in pottery from Central Veracruz. More recently, Venter's (2008) groundbreaking work at Totogal and Arnold and Venter's (2004) research at Agaltepec has further identified significant Postclassic occupations in the Tuxtla Mountains.

One of the very few diagnostic ceramics of the Post-Classic in the region, is the Fondo Sellado type. This stamped-base pottery type has a unique stamp on the base of the vessels, resulting in a design that is raised above the vessel base. Loughlin's (2012:173) RAM survey at El Mesón identified five Fondo Sellado sherds but could not determine any vessel forms. In the Mixtequilla, Stark (n.d.) finds the Fondo Sellado type often includes curved motifs. Other diagnostic types from the time period include the plumbate ceramic types and introduction of the comale vessel form. Comales were likely utilized for cooking tortillas due to their distinctly flattened shape.

The dune survey identified a single sherd that likely dates to the Post-Classic period (Code 1252). Despite a general settlement shift north in the RRATZ survey zone during this time, the northward shift in occupation does not extend all the way to the dunes in the far northern edge of the survey universe.

Special Objects

Artifacts under the special objects category include all handles, supports, beads, spindle whorls, pendants, etc. This project utilizes the previously defined special object categories that were developed based on commonly found artifacts in the region. Specific special object codes and class categories follow those previously developed by the PATZ 2005 project. During lab analysis, special attention was paid to diagnostic vessel supports and appendages reflecting interaction with Matacapan and Central Veracruz (See Appendix F).

This project was particularly interested in evidence of the cotton manufacturing process. It is well-documented that the southern Veracruz region was a haven for cotton production and used as both trade and tribute with the Aztec Triple Alliance during the Post-Classic times (Anawalt 1981; Barlow 1949; Berdan and Anawalt 1992; Hall 1997:115; Stark 1974, 1978). Stark et al. (1998) argue that cotton production was likely a major factor in the economies of the Mixtequilla region during the Classic period. Because the largest dune occupation occurs during the Classic Period, it was hypothesized that cotton production may have played a prominent role. While dune soils are classified as regosols, thinly developed and of poor quality for the production of crops, soils near the dunes have excellent potential for growing cotton. These phaeozem soils, very dark in color, nutrient rich, and agriculturally productive, are found up to the edge of the dunes.

Cotton fabrics do not survive in the tropical climate of the Gulf Lowlands, therefore the best indicators of cotton production in the past are spindle whorls. These spindle whorls are often made from ceramics, meaning cotton spinning production evidence can be inferred through their presence. Spindle whorls used with cotton production tend to have smaller center hole diameters compared to spindle whorls used for other textiles (Parsons 1972).

Figure 7.1: Selected Spindle Whorls from the RAM Survey (from Loughlin 2012:339).

Nearby in the ELPB, Loughlin (2012:336) recovered eight (n=8) ceramic spindle whorls during the RAM survey (Figure 7.1). Their wide distribution across the survey zone at El Mesón makes any confident statements about the context of their use difficult. In the dune survey, no spindle whorls were recovered during pedestrian survey. It appears cotton textile production was not a major part of the ancient dune economy.

Figurines

Figurine types in the ELPB have a long history of study (see Pool 2017). A typology for Early and Middle Formative figurines from Tres Zapotes was developed by Weiant to include solid and hollow "baby-face" figurines, Morelos type, Uaxactun type, and "Vaillant's A" type (Weiant 1943: Plates 10, 11, 16-21, 28). Late Formative figurine types include Weiant's Classic Point Chin type, Classic Prognathous type, Classic Rectangular Face type, Classic Beatific type, and Typical Grotesque Variants (Weiant 1943: Plates 1-4, 6, 7, 13). Other figurine types that may be present on the dunes include: Teotihuacan-style figurines that date to the Classic period and have a signature triangle face with appliques; Los Lirios-style figurines that are defined by their large size, red paste, and hollowness; and San Marcos figurines that are hollow, molded and made of Fine Orange paste with a white slip.

A total of 14 figurine fragments were recovered during survey reconnaissance in the dunes (Table 7.12). Five fragments show evidence of a zoomorphic nature, including resemblances to monkeys (n=2), a possible jaguar (n=1), and a possible duck (n=1). Of the previously defined figurine types in the region, only a single San Marcos figurine fragment was identifiable, recovered from a naturally modified feature E0048 (Rincon Rasposo 3). Additionally, the site of Santa Margarita 5 contained numerous distinct figurine fragments. These include fragments (n=4) at feature D0086, D0049 (n=1), and D0055 (n=1). A female torso with a deep belly-button feature was recovered at E0049, also at Rincon Rasposo 3 and likely dating to the Late Formative. To the south, near the Rio Prieto, an additional two figurine fragments were identified at concentrations E0075 and E0073. Lastly, two fragments were found at the concentration-heavy site of Rio Prieto 4 (E0111 and E0112). No discernable patterns can be identified in the locations of these figurine fragments (Figure 7.2). They are all recovered from contexts with heavy domestic occupations.

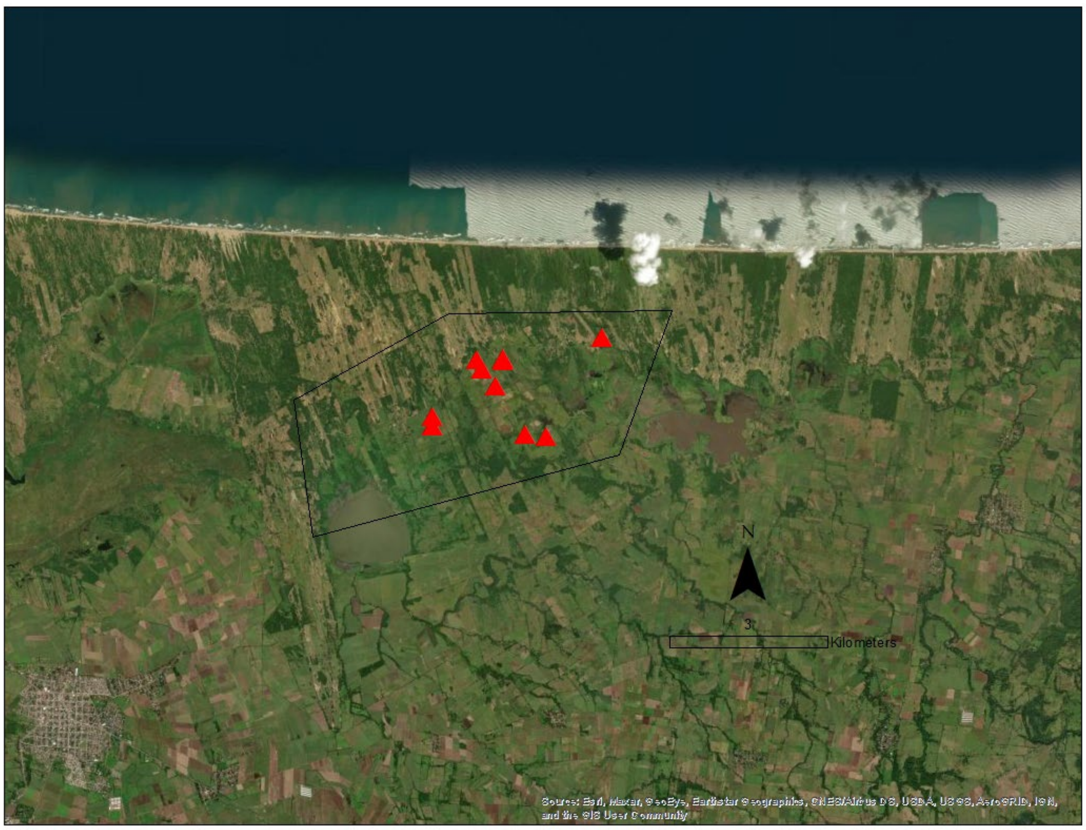


Figure 7.2: Map of Location of Figurine Fragments.

Table 7.12: Figurine Fragments Identified During Survey.

Recoleccion	E	N	Class	Fig Tech	Fig Part	Fig Type	Cer Type	Vessel	freq	wt (G.)
E0004-1	244359	2068637	1299	1200	CABEZA	-	1211	-	1	19.4
E0048-1	242512	2068210	1100	2200	PIE-IQUIERDA	3 SAN MARCOS	1236	-	1	8.2
E0049-1	242480	2068189	1110	1100	TORSO FEMENIN	-	2906.4	-	1	68.1
			1211	2100	CARA	-	2620 W/O C	-	1	10.5
E0073-2 (DONA	243310	2066765	1211	2223	CABEZA	-	1211	-	1	42.4
E0075-1	243036	2066685	1100	1100	CARA	-	2701	-	1	21.2
E0111-1	241150	2067137	1211	2100	CARA	-	1212	-	1	8.9
E0112-1	241158	2066956	1200	1100	CARA	-	-	-	1	13.2
D0049-2	242050	2068019	1299	1100	INDETERMINAD	-	1211	-	1	4.4
D0055-2	242341	2067740	1100	1100	BRAZO	-	2701	-	1	5.3
D0086-1	241976	2068180	1100	2200	ARM ON BELLY	-	1211	-	1	9.1
			1100	1200	SKIRT?	-	2620	-	1	15.1
			1100	2200	CARA Y FRENTE	-	1215	-	1	4.8
			1999	2200	INDETERMINAD	-	1215	-	1	17

Lithics

This region of southern Veracruz is devoid of obsidian raw material outcrops, making all obsidian recovered during survey particularly important in understanding ancient long-distance exchange networks. Mesoamerican archaeologists have long been interested in understanding the processes that connected economic and political systems of the past (Hester, Jack, and Heizer 1971; Cobean et al. 1971; Hirth 1996; Santley 1989). Careful analysis of the type of obsidian, the kind of tool recovered, and the provenience of discovery allow archaeologists to begin to untangle the linkages in the political economy of the past. Obsidian tools and production debris form the second largest artifact category collected in the survey zone (n=206), accounting for 3.5% of the total artifact assemblage.

INAA and XRF analyses of obsidian found previously in southern Veracruz demonstrates a correlation between geographic source and identifiable color (Cobean et al 1992; Knight 1999, 2003; Knight and Glascock 2009; Pool et al. 2014; Santley et al. 2001; Stark et al 1991). These studies conclude that Guadalupe Victoria and Pico de Orizaba are the primary sources in southern Veracruz when obsidian color is clear to light gray. These obsidian sources are located near one another close to the Veracruz/Puebla border. Dark gray to black obsidian found in this region of southern Veracruz primarily comes from the Zaragoza-Oyameles source in the state of Puebla. Finally, green obsidian, well-known for its association with Teotihuacan comes from the Pachua source in Hidalgo state. It is important to note that each of the primary obsidian sources utilized by the ELPB are in the highland Mexico region. No obsidian sourcing from Guatemala can be confidently ascertained through naked-eye color analysis, and previous chemical studies have shown Guatemalan sources to be rare in the region.

The obsidian source analysis for this project utilizes and expands upon Knight's (2003:73) color system. Each obsidian artifact, tool and production debris, was first analyzed and assigned one of three primary colors (Black, Clear, or Green). Obsidian identified with a primary color of Black were then further divided into one of seven sub-colors (Table 7.13). All Clear obsidian pieces were further divided into one of eight sub-colors (Table 7.14). By linking obsidian color and sub-color to source location it is possible to identify probable obsidian source locations without utilizing expensive geochemical techniques (Table 7.15).

Table 7.13: Primary Color of Obsidian Artifacts.

Color	Count	Percent
Black	170	82.5
Clear	34	16.5
Green	2	1
Total	206	100

Table 7.14: Obsidian Frequency and Count by Color/sub-color.

Color	Sub-Color	Probable Source	Count	Percent
Black	Black	Zaragoza	60	35.3
	Gray	Pico de Orizaba	3	1.8
	Cloudy	Zaragoza/Paredon	17	10
	Banded	Zaragoza/Paredon	39	22.9
	Transparent Gray	Paredon	2	1.2
	Pale Bluish	Guadalupe Victoria	49	28.8
	Light Gray with Specks	Guadalupe Victoria	0	0
	Total		170	100
Clear	Bottle Clear	Pico de Orizaba	4	11.8
	Bottle Clear with Clouds	Guadalupe Victoria	2	5.9
	Cloudy	Guadalupe Victoria	9	26.5
	Banded	GV/Pico de Orizaba	9	26.5
	Transparent Gray	Paredon	4	11.8
	Smokey with Specks	Guadalupe Victoria	1	2.9
	Pale Bluish	Guadalupe Victoria	3	8.8
	Light Gray with Specks	Guadalupe Victoria	2	5.9
	Total		34	100
Green	Green	Pachuca	2	100
	Total		2	100

Pool, Knight, and Glasscock (2014) more recently analyzed a random XRF sample from Tres Zapotes based on color and sub-color categories. Their findings present more nuance to the color and sub-color categorization and sourcing than previously defined by Loughlin (2012). While more expensive analytical tools (e.g. XRF, INAA) should still be utilized when possible, this new analysis lends more confidence to the color/sub-color classification of obsidian and the likely obsidian source. For example, XRF analysis of a random sampling of Black-Black obsidian (n=15) from Tres Zapotes finds that 80% was sourced from Zaragoza. Black-Pale Bluish obsidian samples from Tres Zapotes show that 80.77% was sourced from Guadalupe Victoria. When taken together, XRF samples suggest that obsidian found on the dunes across categories, including both production indicators and blades were mostly from Guadalupe Victoria and Zaragoza sources. Both kinds of obsidian are found in roughly equal proportions across production debris and finished blade categories.

Table 7.15: Probable Obsidian Sources Based on Naked-eye Color Identification.

Color	Sub-Color	Probable Source
Black	Black	Zaragoza
	Gray	Pico de Orizaba
	Cloudy	Zaragoza/GV
	Banded	Zaragoza/Paredon
	Transparent Gray	Paredon
	Pale Bluish	Guadalupe Victoria
	Light Gray with Specks	Guadalupe Victoria
Clear	Bottle Clear	Pico de Orizaba
	Bottle Clear with Clouds	Guadalupe Victoria
	Cloudy	Guadalupe Victoria
	Banded	GV/Pico de Orizaba
	Transparent Gray	Paredon
	Smokey with Specks	Guadalupe Victoria
	Pale Bluish	Guadalupe Victoria
	Light Gray with Specks	Guadalupe Victoria
Green	Green	Pachuca

Another issue related to political economies is the location of craft production in the dunes. By examining production indicators (e.g. debitage), it is possible to determine which segments of ancient society controlled access to lithic resources. In addition to long-distance exchange, obsidian artifacts contain data on the organization of craft production. For example, were prismatic blades produced on site in the dunes, or were finished blades imported from other sites? A primary indicator of craft production on the dunes is the identification of production debris. Production debris includes debitage, exhausted cores, and core fragments (Hirth et al. 2003; Knight 1999). Of the 206 obsidian artifacts recovered, 31 were identified as indicators of obsidian craft production (Tables 7.16 and 7.17). By mapping, where production debris is located on the dunes, it is also possible to understand who controlled obsidian imports and production (elites vs. commoners).

Table 7.16: Obsidian Artifacts by Category and Count.

Description	**Stage**	**Count**	**%**
Percussion Blades	Macro Core Reduction	1	0.49
Percussion Flake	Macro Core Reduction	1	0.49
Initial Series Blades - 1s	Polyhedral Core Red.	2	0.97
Pressure Blade Core	Polyhedral Core Red.	1	0.49
Irregular Pressure Blade - 2s	Prismatic Blades	36	17.48
Prismatic Pressure Blade - 3s	Prismatic Blades	123	59.7
Exhausted Pressure Blade Core	Prismatic Blades	1	0.49
Blades Retouched to Points (Tula Point)	Blade Tool	2	0.97
Blade used as a drill	Blade Tool	5	2.43
Blades as Scrapers - diagonal snap	Blade Tool	6	2.91
Sheared Flake	Bipolar	1	0.49
Bifacial Reduction Flake	Bifacial Flake Debitage	1	0.49
Flake with Platform	Undetermined Flake Debitage	9	4.37
Flake without Platform	Undetermined Flake Debitage	2	0.97
Undetermined Flake Debitage	Undetermined Flake Debitage	9	4.37
Shatter	Undetermined Flake Debitage	3	1.46
Other	Other	3	1.46
Total		206	100

A total of 31 obsidian artifacts (15% of obsidian artifacts) recovered during pedestrian survey are identified as evidence of production indicators during lab analysis. Production indicators identified in analysis included obsidian artifacts in the macro-core reduction stage (Stage 2), polyhedral core reduction phase (Stage 3), bipolar reduction (Stage 6), bifacial flake debitage (Stage 8), and undetermined flake debitage (Stage 10) (Tables 7.16 and 7.17). These 31 artifacts were found at eighteen (n=18) unique features in the dune survey zone.

Table 7.17: Lithic Production Indicators.

Description	**Stage**	**Count**
Percussion Blades	Macro Core Reduction	1
Percussion Flake	Macro Core Reduction	1
Initial Series Blades - 1s	Polyhedral Core Red.	2
Pressure Blade Core	Polyhedral Core Red.	1
Exhausted Pressure Blade Core	Prismatic Blades	1
Sheared Flake	Bipolar	1
Bifacial Reduction Flake	Bifacial Flake Debitage	1
Flake with Platform	Undetermined Flake Debitage	9
Flake without Platform	Undetermined Flake Debitage	2
Undetermined Flake Debitage	Undetermined Flake Debitage	9
Shatter	Undetermined Flake Debitage	3
Total		31

Understanding where lithic production takes place helps archaeologists recreate ancient political economies by better understanding if production is controlled by elites in a given region. For example, is lithic production found adjacent to elite architecture? If so, elites may have controlled the means of lithic production. If however, lithic production indicators are primarily found at small domestic mounds, lithic production may have been organized at the household level. This is what we find in the dunes. The thirty-one (n=31) production indicators were recovered from eighteen (n=18) unique features in the survey zone (Table 7.18). Ten (n=10) of these features are concentrations (D15, D50, D57, D59, D116, E75, E96, E108, E113, E114), six (n=6) are low conical mounds (D30, D37, D49, D53, D85, E49), one low long mound (D47), and one modified dune (E48).

Table 7.18 Obsidian Production Indicators by Probable Obsidian Source and Feature Type. Eighteen unique features contained production indicators in the survey zone. Each feature contained one production indicator unless otherwise noted.

Feature Types	Zaragoza	Pico de Orizaba	Zaragoza/Paredon	Guadalupe Victoria	GV/Pico de Orizab	Total Features
Concentrations	E113		D59	D15(2), D50, D57, D116, E75, E96 (2), E108, E114	E96(2), E113	10
Low Conical Mound	D30(2), D37, D49, D85	D30	D49	D30(3), D53, E49		6
Low Long Mound	D47					1
Modified Dune	E48			E48(2)		1
Total Production Indicators	8	1	2	17	3	

Comparing locations of where groundstone and obsidian production indicators were recovered reveals both differences and similarities. Figure 7.3 shows that production indicators for both types of artifacts occur widely throughout the dune survey universe, while clustering somewhat near the two primary dune sites, Rio Prieto 4 and Santa Margarita 5. Production indicators of both obsidian and groundstone do not directly overlap as no features contained both kinds of artifacts. Overall, the picture that emerges is household-level production for both artifact types.

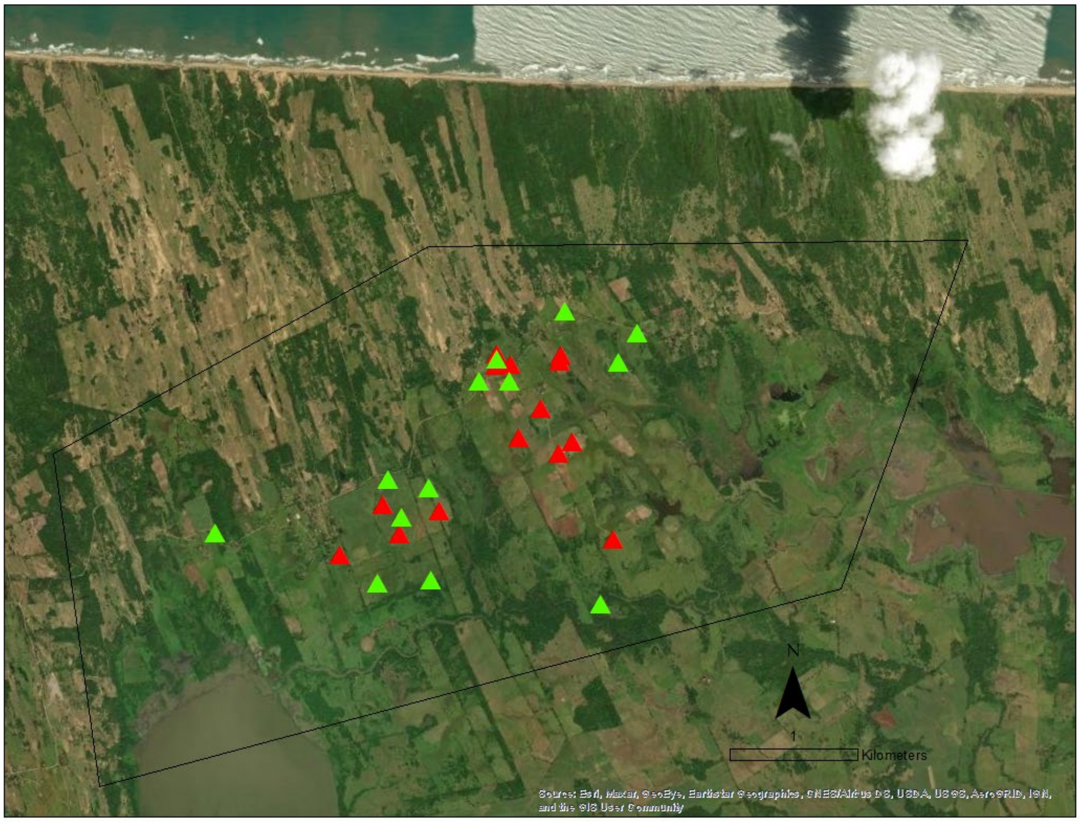


Figure 7.3: Map of Groundstone Production Indicators (green) with Obsidian Production Indicators (red).

Groundstone

Groundstone materials account for the third largest artifact class. Groundstone artifacts collected during survey were recorded following the same characteristics developed by Pool and revised by Kruszczynski (2001) and Jaime-Riveron (2016) during their dissertation research in the ELPB. Groundstone pieces were first broadly categorized by their artifact type (e.g. metate, mano, adze, etc.). Additional variables recorded during analysis included: cross section, artifact completeness (fragment or whole), use-wear (present or absent), weight (g.), material type, porosity, and average phenocryst size (mm.) (see Appendix C).

A total of 60 groundstone artifacts were collected during survey and brought back to the lab for further analysis. Groundstone artifacts identified in the field but too heavy to collect had their measurements recorded in field notes and a GPS point taken. All groundstone artifacts identified in the dune survey were made from basalt. This is not surprising considering the easy access to ample basalt outcrops in the nearby Tuxtla Mountains. Utilitarian manos (n=5) and metates (n=18) account for 38.3% of all groundstone artifacts in the survey zone. Manos and metates have a long history in Mesoamerica as utilitarian household tools. Survey data from the dunes shows that the majority of these artifacts were found in domestic contexts (e.g. low conical mounds and concentrations). Other artifacts identified include donut stones (n=3), celts (n=3), axes (n=1), and pics (n=2) (See Table 7.19).

Table 7.19. Groundstone Artifact Types and Frequencies by Basalt Type.

Code	Groundstone Artifact	Basalt Type	Count
1.15	Metate, Planar/No footing	Massive Pyroxene Porphyritic Basalts	2
		Massive Fine-Grained Basalts	1
		Vesicular Pyroxene Porphyritic Basalt	1
		Vesicular Olivine Porphyritic Basalt	2
		Total	6
1.25	Metate, Convex/No footing	Massive Pyroxene Porphyritic Basalts	5
		Massive Olivine Porphyritic Basalts	1
		Massive Fine-Grained Basalts	2
		Vesicular Pyroxene Porphyritic Basalt	3
		Total	11

1.46	Metate, Indeterm./Indeterm. Footing	Vesicular Olivine Porphyritic Basalt	1
		Total	1
2	Mano (misc.)	Massive Pyroxene Porphyritic Basalts	3
		Vesicular Olivine Porphyritic Basalt	1
		Vesicular Fine-Grained Basalt	1
		Total	5
5	Polishing Stones	Massive Pyroxene Porphyritic Basalts	1
		Massive Fine-Grained Basalts	2
		Vesicular Pyroxene Porphyritic Basalt	2
		Total	5
6	Misc. Objects	Massive Pyroxene Porphyritic Basalts	2
		Massive Olivine Porphyritic Basalts	1
		Vesicular Pyroxene Porphyritic Basalt	1
		Vesicular Olivine Porphyritic Basalt	1
		Total	5
10.1	Celt (hacha)	Massive Pyroxene Porphyritic Basalts	3
		Total	3
10.2	Axes	Massive Olivine Porphyritic Basalts	1
		Total	1
13	Donut Stones	Massive Fine-Grained Basalts	1
		Vesicular Pyroxene Porphyritic Basalt	2
		Total	3
15	Unidentified Worked Stones	Massive Pyroxene Porphyritic Basalts	1

		Massive Fine-Grained Basalts	1
		Total	2
20	Flakes	Massive Olivine Porphyritic Basalts	2
		Total	2
20.01	Flake with Percussion Platform	Massive Pyroxene Porphyritic Basalts	1
		Massive Fine-Grained Basalts	2
		Total	3
20.0124	Flake w Percussion Plat, Bulb, Feather Edge	Massive Olivine Porphyritic Basalts	1
		Total	1
26	Pics	Massive Pyroxene Porphyritic Basalts	1
		Vesicular Fine-Grained Basalt	1
		Total	2
27	Hammerstones	Massive Pyroxene Porphyritic Basalts	3
		Massive Olivine Porphyritic Basalts	1
		Massive Fine-Grained Basalts	1
		Vesicular Pyroxene Porphyritic Basalt	1
		Vesicular Fine-Grained Basalt	4
		Total	10
Total			60

Table 7.19. (continued)

Production indicators are important datapoints for recreating past political economies. For basalt tools, production indicators can include flakes, polishing stones, and hammerstones. Flakes are the most obvious production indicator, as they are the result of direct percussion in the past. Flakes likely represent production indicators where they were recovered, or close nearby. Polishing stones are included as a production indicator for the purposes of this study, however these are also utilized in the ceramic production process. When polishing stones are found in the same location as other production indicator artifacts, the evidence is more compelling for their use for production. Thirty-five percent of basalt artifacts recovered on the dunes were production indicators (Table 7.20). This is higher than Loughlin's (2012:333) findings of 12.2% production indicators at El Mesón.

Table 7.20. Types of Basalt Production Indicators Recovered on the Dunes.

Production Indicators	**Count**
Polishing Stones	5
Flakes	6
Hammerstones	10
Total Count	21
Total % of groundstone artifacts	35%

Basalt production indicators are found in a total of fourteen (n=14) different features in the survey zone. These are primarily comprised of household features, including low conical mounds (n=7) and concentrations (n=5) (Tables 7.21 and 7.22). Production indicators are found in areas of the primary occupation on the dunes, including multiple indicators found at the sites of the Santa Margartia 5 'core zone' and Rio Prieto 4 (see Figure 7.4). All of this suggests a household level of production for utilitarian groundstone tools.

Table 7.21. Feature Type Associated with Basalt Production Indicators.

Production Indicators by Feature Type	Count
Low Conical Mounds	7
Tall Conical Mounds	1
Concentration	5
Modified Elevation	1
Total Features with Production Indicators	14

Table 7.22. Cross-tabulation of Basalt Production Indicators by Feature Type.

Feature Type	Polishing Stones	Flakes	Hammerstones
Low Conical Mounds	5	2	7
Tall Conical Mounds	0	0	1
Concentrations	0	3	2
Modified Elevation	0	1	0
Totals	5	6	10

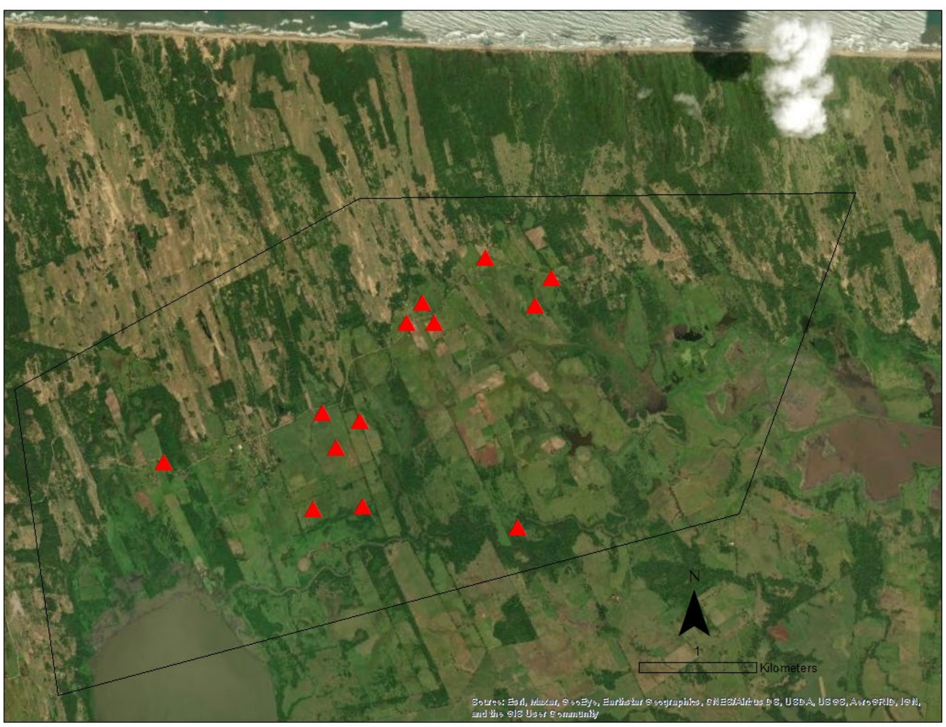


Figure 7.4. Map Showing Groundstone Production Indicators.

Burned Earth

Burned earth recovered during survey was analyzed following the methods developed by Hoag (2003) for the RATZ project. Burned earth was classified into three categories, including daub, kiln debris, and burned earth. Daub pieces have pole impressions or smoothed surfaces indicative of a prepared wall (Hoag 2003:50). Kiln debris pieces have color zoning or a vitrified surface. Zoning will be black on one side and red, orange, yellow, or buff on the other. Additionally, any burned earth pieces resembling parts of a kiln (e.g., bun-shaped pieces) were recorded as kiln debris. Pieces that did not display any of these characteristics were classified as the general burned earth category, with the origin undetermined (Hoag 2003:50). This category serves as a catch-all for any unclassified material of burned earth that may have come from hearths or bonfires in the past. After recovery from the field, burned earth was analyzed in the lab and classified, counted and weighed (Table 7.23).

Four pieces of kiln debris were recovered during survey (Table 7.23). These pieces were recovered from three features, suggesting ceramic production may have occurred nearby (D59, D86, and E45) (Figure 7.5). One piece of kiln debris was identified from feature D86, which also contains a polishing stone and two hammerstones, also likely production indicators. D86 is a low conical mound, part of the Santa Margarita 5 site. Two large pieces of kiln debris (284.4 g.) were also recovered at concentration D59, located at the site of Rincon Rasposo 5. Lastly, a single piece of kiln debris was identified at tall conical mound E45. Located at the site of Rincon Rasposo 2, tall conical mound E45 stands at 7.49 m. in height when including its platform.

Table 7.23. Count and Weight (g.) of Burned Earthen Material.

	Count	Weight (g.)
Daub	148	8205.6
Kiln Debris	4	429.6
Burned Earth	274	2919.8
	426	11,555

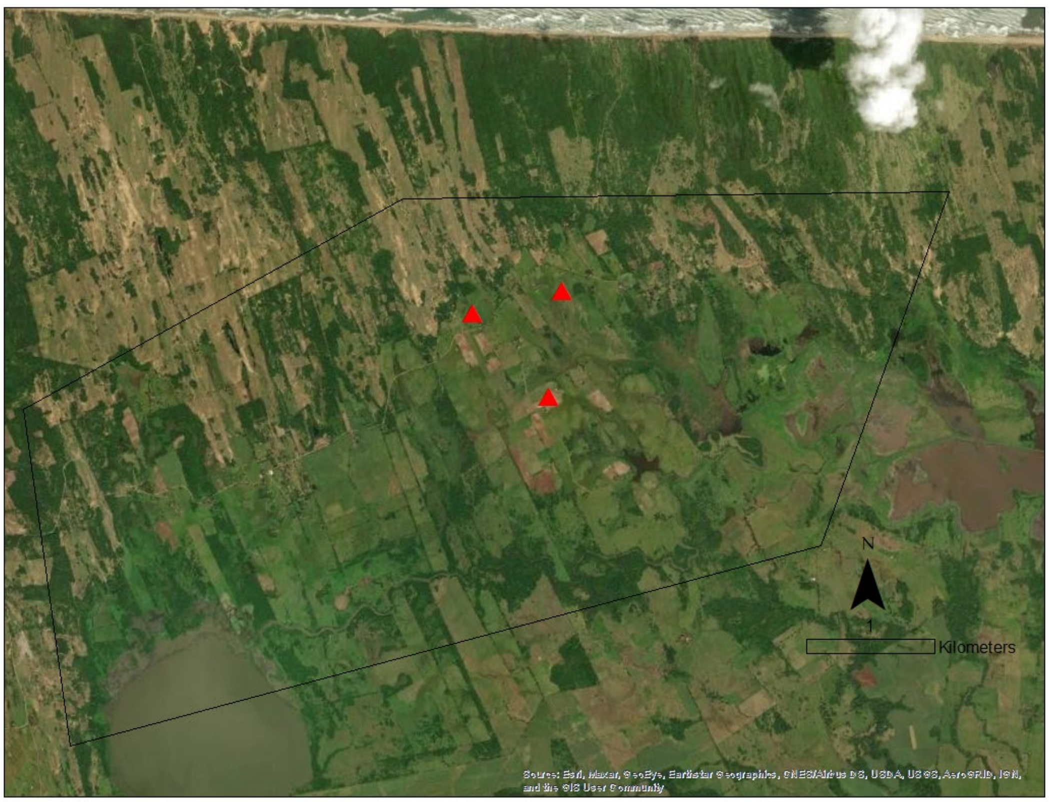


Figure 7.5. Map of Features Containing Possible Kiln Debris.

Conclusions

Together, the data of ceramics, lithics, figurines, and special objects on the dunes demonstrates a clear pattern of settlement occupation through time. An Early Formative presence on the dunes gives rise to gradually increasing occupation through each time period before a doubling of settlement in the Early Classic Ranchito phase. The Late Classic sees a decline, but still substantial dune occupation before a near complete abandonment of settlement in the Post-Classic.

Chapter 8 – Discussion

The purpose of the archaeological study, a sub-section of the greater RRATZ project, is to investigate long-term settlement change in an ecologically distinct portion of the Eastern Lower Papaloapan Basin (ELPB). Of particular interest is understanding how settlement in the greater ELPB changed before, during, and after the fluorescence of the Tres Zapotes polity. Using the near-coastal paleodunes and estuarine lakes in the northern ELPB, the primary thrust of this project is to explore the processes that account for variation in the distribution of occupation on the dune landscape over time. This chapter specifically addresses environmental, economic, and political factors that contributed.

Chapter 4 of this dissertation laid out a nested hierarchy of research questions this project set out to answer. To review, the questions that framed the research hypotheses were simple in nature. First, why does dune settlement appear to increase significantly in the Classic period? Second, what attracted settlement to the dune landscape? Were Classic period peoples *attracted to* the physical environment or were they *pushed* into a less desirable location due to population growth or political exclusion? And thirdly, did the increase in dune occupation occur gradually or quickly?

To answer these overarching questions, three scenarios were developed with hypotheses to test. Scenario 1 examines the exploitation of specific natural resources attracting settlement to the dunes during the Classic period. In this scenario, the dunes became an attractive geographic location for resource accumulation purposes and settlement may have been politically motivated by either Central Veracruz or Matacapan. These distant polities may have wanted their people 'on the ground' to ensure a steady supply of dune resources. Conversely, aspiring local elites may have been looking to accumulate resources to increase prestige and power.

Scenario 1 Hypotheses

Three hypotheses were developed to evaluate Scenario 1. Drawing on Hirth's (1996) context principle of political economies, these scenarios emphasize where and how the accumulation of resources occurs. If individual-oriented accumulation systems are in place, I expect that accumulation will take place at the household level. If, however, a context-oriented accumulation system in place during the Classic period, I expect to identify specialized workshops on the dunes in close proximity to elite mounds.

Hypothesis 1A

The dune's location near both Laguna Tortuga and Laguna Marquez provides an ideal backdrop for the exploitation of estuarine resources. The well-draining dune soils, located next to a productive aquatic environment, may have provided an ideal location for Classic period settlement. In this scenario, occupants stay high-and-dry with their homes on the dunes while maintaining direct access to bountiful aquatic resources, terrestrial animals and migratory water fowl. Hypothesis 1A posits that the advantageous geographical location of the dunes served as a stable setting to use, exploit, and process large quantities of aquatic resources.

To test this hypothesis, I need to provide expectations of the types of artifacts that could provide evidence of support. First, I expect to identify large quantities of serrated obsidian tools in the dune survey zone. Erlandston et al. (2011) argues that serrated-edge tools were utilized by coastal peoples of the past for the purposes of processing aquatic resources. Secondly, I expect to recover significant numbers of net sinkers. These grooved ceramic spheres, or sometimes perforated stones, were used to assist in the process of fishing with nets. Archaeologists working in other estuarine and riverine environments throughout North American have identified shell middens and shell mounds as evidence for the large-scale exploitation of aquatic resources. If dune occupants were processing large quantities of marine life, I expect shell midden or shell mounds to be present and identified in the dune survey zone. These shell mounds should be easy to identify separately from the high frequency earthen mounds found through the ELPB.

Hypothesis 1B

A second, nested hypothesis under Scenario 1 for this project posits that dune occupation increased in the Classic period to better exploit localized clay raw material found in and around the lagoons of the survey zone. If dune occupants were attracted to the geographic location of the dunes because of easy access to clay extraction, I expect to find evidence of ceramic production activities within the survey zone. Research elsewhere in southern Veracruz demonstrates that pottery production will likely take place near where clay extraction occurs. Ceramic production areas in the nearby Tuxtla Mountains site of Matacapan were identified through the high frequencies of 'waster' and overfired sherds (Pool 2003:57). Another line of evidence for ceramic production is the presence of kiln debris in the survey zone. Kiln debris, constructed of mud and fiber, develops through the repeated firing of kilns to create a vitrified surface interior with color zonation on fired earth pieces (Pool 2003:57). If clay extraction was driving force *pulling* settlement toward the dunes, I expect to identify ceramic production indicators (waster sherds, kiln debris, an de facto wasters) in high frequencies in the dune survey zone.

Hypothesis 1C

Cotton production may have driven the Classic period economy of the Mixtequilla region of the WLPB (Stark 2008). Hypothesis 1C posits that cotton production activities drove the dune occupation of the Classic period. Very dark, nutrient rich, and agriculturally productive phaeozem soils are found up to the edges of the dune landscape. While the dune soils are primarily thin, poorly developed regosols, they may have provided enough easy drainage to make living in the elevated dunes 'high and dry' in a very wet environment. This hypothesis posits that dune occupation expanded significantly in the Classic period due to an increasing need for cotton. If this hypothesis is confirmed, I expect to identify and recover high frequencies of spindle whorls, evidence of textile production, in the survey zone. Additionally, I also expect to see a general increase in the use of regalia on stone monuments in the region.

Scenario 1 Results

Scenario 1 hypotheses are broadly concerned with the accumulation of resources, Hirth's (1996) context principle of political economies. Pedestrian survey failed to identify any specialized workshops in the dune survey zone. The survey did recovered production indicators, but they were not concentrated or in frequencies that would be expected for a specialized workshop. No specialized workshops were found in close proximity to large mounds, meaning there is no evidence to suggest that local elites controlled context-oriented accumulation systems during the height of dune occupation.

Current evidence points to household level accumulation, or individual-oriented accumulation systems on the dunes.

Hypothesis 1A Results

Hypothesis 1A posits that the dune's geographic location would be ideal for the large-scale exploitation and processing of aquatic resources. The need to exploit aquatic resources at scale would have driven increases in dune settlement during the Classic period. Pedestrian survey of over 14 square kilometers failed to identify any shell mounds or shell middens that would provide evidence for the large-scale production and processing of aquatic resources. Additionally, no serrated lithic tools nor net sinkers were identified in the lab during analysis. While local residents of the dunes likely exploited aquatic resources for household consumption, the dune survey failed to provide evidence for the large-scale aquatic resource exploitation of Hypothesis 1A.

Hypothesis 1B Results

Overall, few ceramic production indicators were recovered during pedestrian survey of the dunes. A total of four pieces (n=4) of kiln debris weighing 429.6 grams was recovered and identified during lab analysis. Additionally, no 'waster' sherds, evidence of over-firing in the ceramic production process were collected or identified. I can reject hypothesis 1B. Increase in dune settlement does not appear to be linked to locally available clays and ceramic production. The high frequencies of waster sherds and kiln debris identified at ceramic production sites in the region (e.g. Matacapan) are not present in the dune survey zone.

Hypothesis 1C Results

While cotton production was likely an important part of the Classic period economy in the broader southern Veracruz region, survey data provides little evidence that cotton production was an important economic driver during dune settlement. In fact, no spindle whorls, the hallmark of textile production, were identified during lab analysis. This dearth of spindle whorls suggests that large-scale cotton production was not taking place in the dune survey zone. Hypothesis 1C is not supported, as there is little evidence that cotton production was a driver of Classic period dune settlement expansion.

Scenario 2 Hypotheses

This scenario of dune occupation centers on the idea that the survey zone served as a key geographic location during the Classic period for reasons other than resource exploitation. Under this scenario, Classic period dune occupation occurs specifically to control the landscape. Hirth's (1996) matrix-control principle suggests that elites will attempt to control key geographic locations in a landscape to influence/dictate the flow of resources between regions. This hypothesis specifically examines if the dunes were physically controlled as part of trading network.

The survey takes place on the landward side of the dunes, however, Classic period occupants would have had easy access to the Gulf of Mexico. Seasonal inundation of the land between Laguna Tortuga and Laguna Marquez demonstrates that dune occupants would have found it easy to navigate quickly to the Gulf of Mexico, while being protected from *nortes* and other storms. The dunes gain population density in a time of political turmoil in the ELPB. During the Classic period in the region, ties to both Central

Veracruz and Central Mexico were increasing (Stoner 2011; Loughlin 2012; Santley 2007). This increased interaction with distant polities may have facilitated the need to control a coastal trading and transportation route.

If a coastal trading route was a primary driver of dune occupation, I expect to identify a distribution network of foreign goods. Did the ceramics of the dunes show similarities to those of Matacapan or Classic Veracruz? Central Veracruz ceramics appear the El Mesón (Loughlin 2012) and the Tepango Valley (Stoner 2011) in the Classic period. At Tres Zapotes, Teotihuacan-style figurines and ceramics are present, yet they are scarce and highly localized in other parts of the ELPB (Pool and Stoner 2005). This hypothesis examines trade networks to better understand if the dunes served as a transportation/economic hub for a distant center. To test this hypothesis, I examine ceramic and obsidian data from the dunes and their distribution.

Scenario 2 Results

Previous chapters discuss the presence of both Classic Veracruz and Matacapan-style artifacts in the dune survey zone. Artifacts from these culture areas are found in very close numbers with regards to both frequency of mounds and the types of mounds (primarily low conical mounds) (See Settlement Chapter). Settlement density for mounds containing Matacapan-style artifacts (Coarse Orange ceramics) was 2.36 features/sq. kilometer, compared to 2.29 features/sq. kilometer for Classic Veracruz settlement. Features with Mixtequilla-style artifacts tend to cluster near the Santa Margarita core zone and then extend south towards the Rio Prieto (Figure 8.2). Matacapan-style artifacts also occupy the Santa Margarita core zone but then extend westward while staying away from the Rio Prieto (Figure 8.1). This difference may suggest that different factions on the dunes were involved in various trade networks with outside regions that sometimes overlap.

Trade networks that interacted with both Classic Veracruz and Matacapan polities were not mutually exclusive. The presence of both artifact styles on the same mounds likely means that some households had access to goods from both places. The dune survey zone was not controlled by a single foreign entity during the Classic period. Scenario 2 explores whether a foreign polity directly controlled the dunes location in order to control the flow of goods up and down the coast. If Hirth's matrix-control principle (1996) was being utilized at the dunes during the Classic period, I would expect ceramic materials on the dunes to show stylistic similarities exclusively from that polity. Instead, I find artifact styles from multiple foreign polities. As such, I can partially reject hypothesis 2. The evidence does not suggest that a foreign entity established a settlement on the dunes during the Classic period in order to control the flow of goods on a coastal trade route. The presence of foreign artifact styles from multiple areas (likely Matacapan and Central Veracruz) may suggest that a coastal trade route was operating and that the geographic location of the dunes was important in terms of Hirth's matrix-control principle. Evidence from Scenario 2 may support the idea that individuals were *pulled* to the dune region in order to participate in the social and economic benefits of living on a trade route. The evidence may support the idea that individual households were participating in long-distance, or inter-regional exchange networks, without foreign-polity oversight of their activities.

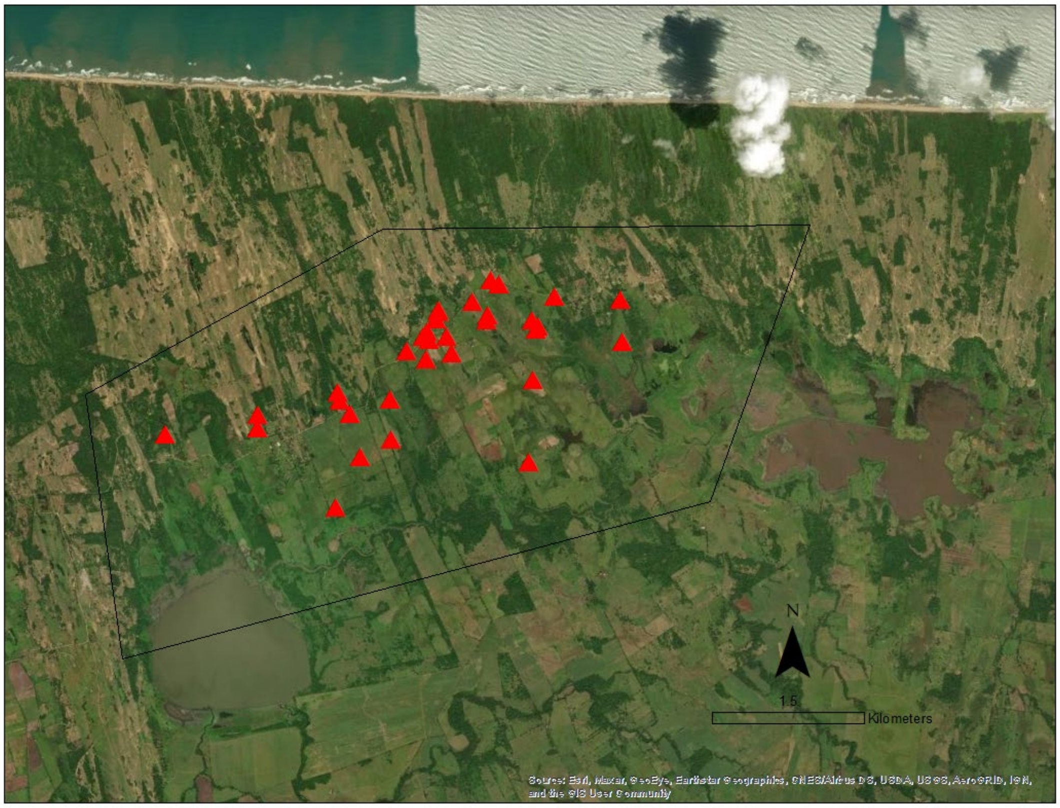


Figure 8.1: Map of Features Where Matacapan Coarse Orange Pottery Recovered.

Figure 8.2: Map of Features Containing Mixtequilla-style Artifacts.

Scenario 3

Scenario 3 considers the idea that occupants were *pushed* into the dunes during the Classic period. While the previous scenarios assume that the dunes were an attractive location for settlement, this scenario explores the idea that the dunes were not an ideal place to settle, as is suggested by the generally late occupation of the landscape. Rather than being attracted to the dunes, it was changes occurring in the region during the Late Formative to Early Classic transition that made dune occupation necessary. Scenario 3 considers multiple *push* factors, including: population pressure, defensive positioning, and changing political alliances.

Hypothesis 3A

The Classic period in the ELPB was time of political contestation. In the WLPB, Cerro de las Mesas consolidated its power and became a prosperous center through the Early Classic. By the Late Classic, however, the site's centralized power had fractured into three different centers (Stark 2008:94). Los Ajitos-Los Pitos, one of the fractured centers, is located on paleodunes in the northern WLPB. Los Ajitos controlled the lower Tlaxicoyan drainage, and Stark (2008:104) suggests that the Classic period occupation may have been due to its defendable position provided by the elevated dune landscape. This hypothesis suggests that a similar, uneasy political arrangement was in place in the ELPB during the Classic period. This is demonstrated by the newly identified six complete and two partial Standard Plan layouts elsewhere in the RRATZ survey zone. These Standard Plans are widely and regularly dispersed. If this hypothesis is supported, the dunes may have been occupied to guard against a threat of violence from neighbors.

If the defensive positioning hypothesis is supported, I expect to see settlement condensed into areas that are easily defendable. This may include areas with only a single point of access or surrounded by water.

Hypothesis 3B

Dune settlement expansion from the Formative through Classic periods may have been due to a changing political climate in the region. The Late Formative ELPB was dominated by the Tres Zapotes polity which incorporated secondary centers in the region under its control (Loughlin 2012). As Tres Zapotes power and influence wanes in the Classic period, this may have created a power-vacuum, beginning a more politically volatile time in the region. Hypothesis 3B supposes that certain elite segments may have settled the dune survey zone in the Classic Period in an effort to establish greater autonomy. This hypothesis will be supported by two criteria: First, evidence of Formative occupation on the dunes should be sparse in general. This hypothesis posits that no TZPG (Tres Zapotes Plaza Group) architectural layouts, directly linking control of the dunes to Tres Zapotes, will be present during the Late Formative zenith of the Tres Zapotes polity. Secondly, there will be a presence of large rectangular platforms with mounds atop, which Stark (2008) argues represents estates of landed elites in the nearby WLPB. These lines of evidence could suggest that aspiring elites moved into a previously under-occupied dune landscape in the Early Classic in an effort to accumulate wealth and retain autonomy, removed from the dynasties of Cerro de las Mesas.

Stark (2008:99-100) simplifies the Standard Plan architectural layout defined by Daneels (2008:202) to include segments without the presence of ballcourts. She identifies six simplified Standard Plans at Cerro de las Mesas in the WLPB, representing corporate segmentation. Stark interprets the presence of complete Standard Plan layouts further away as secondary centers, and sites with only one or two components of the layout as Tertiary centers. Prior to the RRATZ project, no Standard Plans had been identified in the ELPB (Pool 2008). If Hypothesis 3B is supported, I expect to identify elements of a Standard Plan which may represent a corporate segment, where landed elites were able to maintain some autonomy while remaining politically and economically connected to Cerro de las Mesas during the Classic period.

Scenario 3 Results

Scenario 3 hypotheses that the Classic period dune settlement was caused by *push* factors can be partially rejected. There is little evidence to suggest that Classic period dune settlement expands due to push factors of defensive positioning or political pressures when aspiring elites are trying to establish autonomy. At the peak of dune occupation, settlement continued to expand throughout the survey zone. Population pressure may have been a contributing *push* factor in dune settlement expansion in the Classic period. The population throughout the ELPB was increasing during this time. This likely put pressure on the amount of desirable land available and contributed to social crowding. As the broader ELPB landscape increases in population, people may have been *pushed* to settle in greater frequencies in the dune survey zone. The natural environment would have provided ample subsistence opportunities for these new arrivals.

The complex political landscape during the Classic period may also be a contributing *push* factor in dune settlement, just not in the way I initially proposed. Hypothesis 3B was designed to explore the idea that aspiring elites settled the dunes to gain greater autonomy and control. Instead, its possible that average people may been drawn to the previously under-settled dunes as a way to reject the intensifying political landscape in the ELPB. A competitive political landscape in the ELPB (with 6 Standard Plans and 2 partial Standards Plans) may have worked to *push* average people to seek greater autonomy in their lives by moving to the dune survey area.

Hypothesis 3A Results

Settlement on the dunes reaches its apex in the Early Classic. This expansion reaches all sections of the survey zone. If Hypothesis 3A is supported, I would expect to see settlement clustering during the Classic period around easily defendable areas. This does not occur. Instead, settlement expands throughout the survey zone during this time, reaching its greatest expansion. Additionally, there are no signs of violence in the material record. This leads to the rejection of Hypothesis 3A.

Hypothesis 3B Results

Part one of Hypothesis 3B is supported in that no TZPG architectural layouts were identified in the dune survey zone. TZPG layouts are found in the Late Formative at Tres Zapotes and El Mesón. The lack of a TZPG layout in the survey zone suggests that dune settlement remained outside the direct purview of the Tres Zapotes polity at its zenith. Part two of Hypothesis 3B is not supported. The large rectangular platforms with mounds atop that Stark (2008) argues represent the landed elite in the WLPB are not identified in the dune survey zone. Nor are elements of Standard Plan architectural layouts (Daneels 2008). I can mostly reject Hypothesis 3B.

Review

After reviewing the hypotheses that guided the research in this project it is possible to posit a few ideas. First, the gradual population increases that begin in the Middle Formative and continue through the Early Classic suggest *some push factors* at work in explaining the dune development. The broader population increases occurring during this time throughout the ELPB likely put increasing pressure on people as desirable lands became occupied with more dense populations. Secondly, the Early Classic dune population maintained connections equally to distant centers of Central Veracruz and Matacapan. These connections may suggest *pull factors* working to draw people to the dunes because of a route of exchange and communication between Matacapan (Tuxtla Mountains) and Central Veracruz.

The dune survey examines a vastly underrepresented landscape in Mesoamerican archaeology. Little archaeological research has been conducted on coastal paleodunes both in Veracruz and throughout Mesoamerica (Daneels 2008). This project is valuable for that reason, examining an underrepresented natural feature in the Mesoamerican culture area. This project was originally developed with survey methods designed to identify the remains of Archaic period campsites. While we did not achieve our goal of identifying an Archaic period site for further excavation, an uninterrupted 3,000 year period of settlement occupation was identified. A single chert biface was recovered during shovel-testing, providing evidence of Archaic period occupation on the dunes near the Rio Prieto. There is Archaic period occupation on the dunes, however a larger site could not be identified.

Mounds

The basic unit of analysis for this project is the feature. Earthen mounds, prevalent throughout southern Veracruz, are abundant in the dune survey zone. These earthen mounds formed through long-term accretion or from formalized construction sequences. Standard Plan architectural layouts, common in the WLPB, were not identified in the dune survey zone. The larger RRATZ survey did identify some of the first Standard Plan layouts in the ELPB during the 2014 field season. Tres Zapotes Plaza

Group (TZPG) architectural layouts, a signifier of the Tres Zapotes polity’s power, are also notably absent from the dune survey zone.

The most frequently recorded feature in the survey zone is the low conical mound (n=97), accounting for 46.86% of all features. A total of 111 features (including 58 concentrations) are less than one meter in height. Another 56 features are between one and two meters tall. Overall, 80.67% (n=167) of all dune features documented during pedestrian survey are less than two meters in height (Figure 8.3).

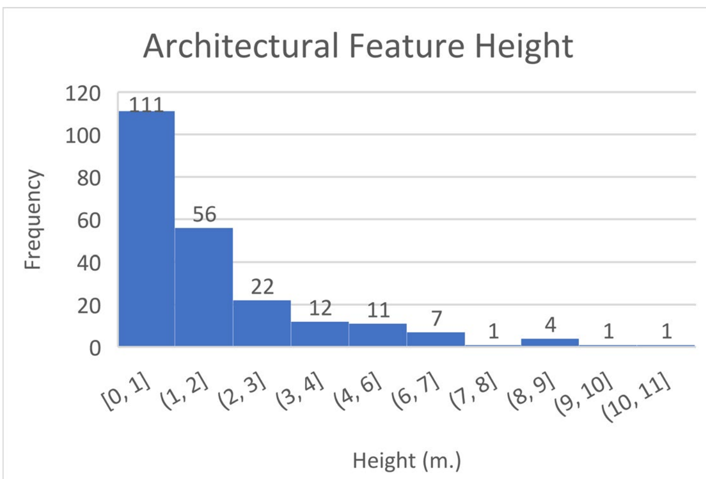


Figure 8.3: Histogram Showing Frequencies of Mound Height (m.).

Settlement Through Time

Diagnostic ceramic and artifact data provide a general sketch for changes in dune occupation through time. The Early Formative Arroyo phase (1250 – 1000 cal. B.C.) ceramic materials were collected at five features during survey collection. Most of the occupation occurs near the modern hamlet of Santa Margarita, at the sites of Santa Margarita 5, 6, and 7 (Figure 8.4). These sites form the core settlement on the dunes, showing evidence of 2000 years of occupation.

Figure 8.4: Early Formative Settlement.

Settlement during the Middle Formative expands to include twenty-eight features (n=28) for a settlement density of 2.0 features/sq. km. Middle Formative occupation further develops around Santa Margarita while also expanding in the western end of the survey zone (Figure 8.5). Late Formative settlement sees feature numbers nearly double (Figure 8.6). This expansion in settlement coincides with the zenith of the Tres Zapotes polity. Despite the polity being at its height in economic and political power, the dunes do not contain a Tres Zapotes Plaza Group (TZPG) layout, as seen at nearby El Mesón. In fact, as settlement density increases to 3.64 features/sq. km. during the Late Formative, low conical mounds average a modest 1.69 m. height.

Figure 8.5: Middle Formative Settlement.

Figure 8.6: Late Formative Settlement.

Steady dune settlement growth continues in the Proto-Classic with a total of 73 features containing surface artifacts dating to this time (for a settlement density of 5.21 features/sq. km). The primary occupation continues in the core region around Santa Margarita, while continuing to grow in the western, naturally elevated region of the survey zone (Figure 8.7).

Figure 8.7: Map of Features Containing Proto-Classic Artifacts.

Peak dune settlement occurs in the Early Classic (8.43 features/sq. km.). Settlement expands south in the survey zone toward the Rio Prieto boundary (Figure 8.8). There is significant increase in the number of concentration features (n=47) in the naturally elevated western half of the survey zone. Low conical mounds (n=53) and concentrations account for 84.75% of features during this time.

Figure 8.8: Map of Features Containing Early Classic Artifacts.

The Late Classic sees the first reduction in dune settlement frequencies with a net loss of features (n=91) from the Early Classic. Still, the Santa Margarita core zone of the dunes remains occupied, as it has since the Early Formative (Figure 8.9). Rio Prieto 4, a site composed of both mounds and concentrations, continues its occupation that began in the Proto-Classic and expanded in the Early Classic. Settlement density in the Late Classic dips to 1.93 features/sq. km., a significant drop from the Early Classic. By the Post-Classic, the dune survey zone is all but abandoned with only two features (n=2) showing evidence of occupation during this time.

Figure 8.9: Map of Features Containing Late Classic Artifacts.

What's Happening?

This study started with the preliminary notion that the dune landscape was a hinterland of the ELPB during Pre-Columbian times. Data collected during pedestrian survey shows otherwise. Rather than being a hinterland, surface collections suggest a much more robust dune occupation through time. Instead of conceptualizing the dunes as an out-of-the-way place, it may be better to understand the dunes as a location where people of the past wanted to live. Rather than conceptualizing the dunes as a location where people were *pushed* into out of necessity, it is better to understand the dunes as a location that people also sought out.

Importantly, the dune survey zone does not contain a Tres Zapotes Plaza Group (TZPG) or Standard Plan architectural layout. The TZPG is considered a hallmark of Late Formative Tres Zapotes power. This layout, found primarily in the ELPB, contains a tall conical mound to the west with a long, narrow mound to the north and a low mound on the centerline of the plaza to serve as a shrine (Pool 2008:128). The repeated use of this layout at four locations within Tres Zapotes makes Pool (2008) interpret this repetition as evidence of a power-sharing arrangement between competing factions. Only 13 km to the north of Tres Zapotes, the secondary center status of El Mesón is indicated by the presence of a TZPG at the site in the Late Formative (Loughlin 2012:192). Multiple TZPG layouts were identified elsewhere in the RRATZ survey zone.

Standard Plan layouts are common in central Veracruz during the Classic period and have now been identified in the ELPB. Six complete Standard Plan layouts and two incomplete layouts were identified elsewhere in the RRATZ survey zone (Pool et al. 2017). These layouts are widely and regularly dispersed throughout the area, varying in terms of mound size and area covered. The Standard Plan refers to a plaza group with a dominant conical mound, an elongated lateral mound (or two), and a ballcourt with an associated platform on the fourth side (Daneels 2008:202). These layouts may have served calendrical functions similar to Maya E-groups. Standard Plan layouts likely played an important part of social life in the past (Stark 2008:100). Stark simplified the definition of the Standard Plan to include layouts without ballcourts, applying the idea more broadly to her work in the WLPB. Further northwest, Daneels argues for the presence of two or more Standard Plans to identify capital zones in the Cotaxtla and Jamapa basins. Single Standard Plan layouts at a site are interpreted as secondary centers, while single elements of the layout may represent tertiary centers. Standard Plan layouts identified in the ELPB during the RRATZ survey are single layouts.

Tres Zapotes evolves into the dominant polity in the Late Formative, becoming the economic and political center of power in the region (Pool and Ohnersorgen 2003). Power shifts again in the Early Classic (300-600 AD) as nearby El Mesón re-arranges its civic architecture to signal a break from previous political economic arrangements with Tres Zapotes (Loughlin 2012). Still, El Meson was not larger nor more powerful than Tres Zapotes. Around the same time, Classic Veracruz culture and Matacapan exert influence in the southern Veracruz region. As the Tres Zapotes polity slowly declines in economic and political power, a re-organization is taking place. New social, economic, and political arrangements are coming into existence.

Part of this new existence in the region is the growth seen in the dunes. With the rise of Tres Zapotes in the Late Formative, dune settlement increases and expands. While Late Formative dune occupation nearly doubles during this time, it is significant that this period is not the settlement apex on the dunes. Despite Tres Zapotes being at its height in power, the dunes will continue to see settlement increases through the Proto-Classic and Early Classic, which is the general pattern seen outside of Tres Zapotes. Additionally, no TZPG is found at the dunes. This suggests greater levels of autonomy, away from the Tres Zapotes polity, when compared to El Mesón.

Increases in settlement continue into the Proto-Classic period as Tres Zapotes slowly declines in power, yet remains the most powerful polity in the region. The Early Classic sees a greater increase in settlement on the dunes. Elsewhere in the RRATZ survey project, six complete Standard Plan layouts and two incomplete layouts were identified (Pool et al. 2017). These ELPB Standard Plans are widely and regularly dispersed throughout the survey zone. At El Mesón, Loughlin (2012:11-12) notes the replacement of the TZPG with new architectural forms. In the Tuxtla Mountains, the Classic period site of Matacapan contains evidence for large-scale ceramic production or Coarse Orange jars. Additionally, the site of Matacapan is noteworthy for its close ties to the distant center of Teotihuacan at the time. To the northwest of the dunes, Classic Veracruz culture is flourishing over a wide area from the WLPB to Central Veracruz. The Early Classic period in the ELPB was likely a politically tumultuous time as faraway influence was coming into the region from both the east and west. It is during this time that the dunes reach their most extensive settlement.

Influences from faraway centers can be seen in the artifacts collected during pedestrian survey. Maps presented earlier in this chapter show the widespread distribution of features containing Classic Veracruz and Matacapan-style ceramics. While there is much overlap in the Santa Margarita area, there may be slight variation with where these different styles are found. Matacapan-style artifacts tend to spread further west in the survey zone and are found primarily on the northern end of the survey (following the modern dune road). Mixtequilla-style artifacts reach further south, with more of a presence closer to the Rio Prieto. The proportion and dispersion of both Matacapan and Mixtequilla-style artifacts in the survey zone suggests bottom-up involvement in interregional trading.

Nearby El Mesón sees new architectural complexes develop to replace the TZPG arrangement seen in previous times. Loughlin (2012:369) notes that each of these new architectural complexes is unique in organization, yet all maintain the use of large, quadrilateral platforms. Drawing on Daneels (2008) and Stark (2008) interpretations of palaces and landed estates, Loughlin argues the quadrilateral platforms of El Mesón may have functioned in a similar manner. All of this speaks to the general politically volatile times that occur in southern Veracruz in the Proto-Classic and Early Classic. The population in the dune survey zone continues to increase in a time of regional intensification of exclusionary political strategies (Pool 2008:146).

But the dunes are different. Rather than seeing increases in monumental architectural or the construction of large, quadrilateral platforms seen elsewhere in southern Veracruz, the dunes appear to maintain autonomy from the rest of the region. Instead, low conical mounds and concentrations dominate the survey zone. Rather than participating in the factionalism and exclusionary strategies being employed elsewhere in the region, the people on the dunes may have been attempting to *get away* from aggressive political aggrandizers. Rather than competing elites attempting to hoard and control resources for personal and political gain, dune settlement suggests that it may have been average people coming together and rejecting such exclusionary practices.

Their ability to pursue this strategy is due to the physical environment of the dunes. Rising over 100 m. in height in some areas, this line of coastal paleodunes provides unique exploitative abilities. Modern day dune residents utilize the thin soils for horticulture and agricultural purposes, the same was likely done in the distant past. This smaller scale horticulture could have been supplemented with abundant terrestrial and aquatic resources. The occupation on the dunes is found on the landward side of the dunes, meaning settlement is protected to some degree from seasonal storms that hit the area. The two lagoons on either side of the survey zone, Laguna Marquez and Laguna

Tortuga, maintain water year-round. Water levels increase significantly during the rainy season and inundate dry-season land. This estuary environment brings salt-water aquatic resources (e.g. snook) into the survey zone. The elevated location of the dunes, immediately adjacent to the estuary, likely provided ideal settlement for thousands of years. Settlements stayed high and dry during the rainy season and residents had ample terrestrial and aquatic resources to exploit year-round.

This project suggests that the impetus for settlement in the distant past at the dunes was not driven by either exclusionary or corporate strategies, but in more of a bottom-up way in which normal people, looking to escape a politically volatile time in the region, sought more autonomy. In this sense, dune occupation may have developed and expanded through the Early Classic, not for the intensive exploitation of a specific resource, or for a foreign polity to control a trading route, but as a rejection of those kinds of strategies that were being utilized elsewhere in southern Veracruz.

Chapter 9 – Conclusions

This pedestrian survey project was initially developed with the intention of identifying and documenting Archaic period sites on a series of coastal paleodunes in the Eastern Lower Papaloapan Basin. While no Archaic sites were recorded during survey, material remains provide evidence of over 2000 years of continuous human settlement. A total of 207 features (14.79 per km.) and 5,248 ceramic sherds were documented and analyzed for this project. Obsidian, groundstone, figurine fragments, and other special objects were all recovered and analyzed.

This dissertation attempts to look beyond the Tres Zapotes polity to better understand the processes that account for the distribution of dune occupation through time. To do this, I apply settlement ecology and political ecology frameworks to the data. These approaches emphasize the role of the environment in human decision making while accounting for political and economic factors. This approach frames settlement patterns as a palimpsest of many complex decisions made by individuals over time in the distant past.

By applying this framework to a regional perspective of the ELPB, it is possible to move beyond polity-centered interpretations of the past in Mesoamerica. This regional perspective gives equal weight and emphasizes the relationships between polities and their hinterlands. This allows researchers to better understand average people in the distant past through a lens that gives equal weight to 'bottom-up' interpretations. The reasons settlement on the dunes happened the way it did, has just as much to do with the decisions of average people as it does with elite decision-making.

The frequency of features containing Matacapan-style and Mixtequilla-style artifacts came somewhat as a surprise. It was initially thought that one of these artifact styles would dominate in frequency if a foreign entity had worked to establish a settlement on the dunes (as seen at Matacapan in the Tuxtla Mountains). It was thought a foreign entity may find the dune location geographically advantageous to control coastal trading. For this to be supported, I expected only one extra-local region's artifacts to dominate.

The proportion and dispersion of both Matacapan-style and Mixtequilla-style artifacts in the survey zone may suggest bottom-up involvement in long-distance trading. There is overlap in where surface artifacts of these two styles were recovered. Numerous features contain artifacts from both Central Veracruz and Matacapan. If a coastal trade route existed near the dune survey zone, it is possible that people were *pulled* to settle in the dunes to participate in foreign exchange networks. In a sense, a localized version of Hirth's matrix-control principle (1996), without the powerful elites in charge. In this scenario, the gradual and continuous population increase from the Middle Formative through the Early Classic may have come from people wanting to participate in the social and economic advantages involved with foreign trade.

Additionally, there are likely *push* factors operating to bring increasing settlement to the dunes. At the transition to the Early Classic, Tres Zapotes is declining in economic and political importance in the region. At El Meson, the Tres Zapotes Plaza Group (TZPG) layout is rearranged in a break from the established political order (Loughlin 2012). Elsewhere in the ELPB, the RRATZ survey identified 6 complete Standard Plan layouts and 2 incomplete layouts. This political turmoil in the Early Classic ELPB likely contributed to dune settlement. As elites competed over new social, economic and political arrangements, average people continued to settle in the dunes. I view these increases in dune settlement as average people removing themselves from the competitive politics of the ELPB. All of this is happening in the context of increasing populations throughout the ELPB. Political and population pressures likely served as background *push* factors working to bring increased settlement to the survey zone.

As Tres Zapotes' power and influence in the ELPB declined in the Classic period, it undoubtedly opened opportunities for new ways of imagining the social, political, economic, and ideological order of the world. By understanding the range of human adaptability to the social and natural environment in the past it is possible to gain a greater appreciation of sustainable political and economic practices in the present.

Limitations and Future Directions

A limitation to this project was the low frequency of ceramic rim sherds recovered during pedestrian survey. Research design for the project sought to collect 100 rim sherds from each feature. Unfortunately, 100 rim sherds were rarely able to be collected during fieldwork. This is partly due to the lower frequencies of surface ceramics on the dunes as well as poor visibility associated with pastureland in many parts of the survey zone. Survey crews supplemented by collecting body sherds. The limited number of rim sherds make any commentary about vessel forms on the dunes difficult.

There has been a dearth of archaeological research conducted on dune landscapes in Mesoamerica. This project attempts to shine light on the archaeological record in this unique and under-researched natural landscape. The data presented in this dissertation demonstrates that dune landscapes in the region were occupied for millennia and are ripe for future research projects. In particular, the dune survey zone shows great promise for future excavations. Excavations can fine-tune the chronology of dune occupation as well as parse out differences between sites within the survey zone. It will be important to increase our understanding of the relationships between households (and sites) and foreign polities. Did households trade exclusively with a single distant entity or were they entangled in multiple long-distance trading networks? It also must be determined if these exchange networks were operating concurrently or during different times.

Future projects targeting Archaic occupation should look toward the Rio Prieto near mound D0070 (Figure 9.1). This is where, during shovel-testing, a likely Archaic chert biface was recovered from fill. The context of the recovery of the biface strongly suggests that the biface was from borrow dirt nearby. This suggests an Archaic camp could be identified by combing the bed of the Rio Prieto or instituting an intensive shovel-testing program in the area.

Figure 9.1. Map Showing Mound D0070 Where Chert Biface Recovered.

More broadly, this survey suggests that dune landscapes around Mesoamerica may be areas of archaeological importance. Rather than being a land of last resort, coastal dune landscapes may have been much more appealing to past peoples than initially understood. Future research in coastal Mesoamerica should not discount dune landscapes in surveys. Surveys specifically targeting Archaic materials should continue throughout the coastal dunes of Veracruz. In the future it will be important to compare Archaic materials between river valleys to better understand hunter-gatherer adaptations.

Appendix A: Ceramics

This appendix contains the raw data for ceramic artifacts recovered during the survey.

This appendix is appended in the file: AppendixA.xlsx

Appendix B: Obsidian

This appendix contains the raw data for obsidian artifacts recovered during the survey.

This appendix is appended in the file: AppendixB.xlsx

Appendix C: Groundstone

This appendix contains the raw data for groundstone artifacts recovered during survey.

Recoleccion	Type	X-section	Frag	Mat.	PHENOCRYST SIZE (MM.)	Usew	Freq	Wt. (G.)	LENGTH (MM)	WIDTH (MM)	THICKNESS (MM)
D0001-1	2	20	1	11.3	-	0	1	601.2	95.25	76.18	55.38
	26	99	0	11.3	-	1	1	1420	131.8	94.8	56.9
D0029-2	13	99	0	11.1	0.95	3	1	432.4			46.3
D0030-4	1.25	33	1	10.1	0.87	3	1	525	92.46	89.2	38.87
	10.1	12	0	10.1	0.76	1	1	131.3	76.03	32	27.7
	6	99	1	11.2	1.05	3	1	81.2	43.98	34.19	38.7
D0043-2	1.25	33	1	10.1	0.55	3	1	460.3	100.32	88.72	29.07
D0044-1	27	20	0	11.3	-	3	1	234.1	73.35	58.85	42.59
	5	10	0	11.1	0.6	0	1	20.2	33.73	31.48	12.18
	5	99	0	11.1	0.75	0	1	35.7	51.33	35.69	13.58
D0049-2	1.15	34	1	11.1	0.85	3	1	256.2	82.08	54.58	37.15
	27	99	0	10.2	0.9	1	1	435	73.5	67.15	52.9
	10.1	20	0	10.1	1.04	1	1	83.3	65.15	40.02	24.4
	27	99	0	10.1	1.23	1	1	110.5	67.87	49.74	31.54
D0053-1	1.25	33	1	10.1	1.71	0	1	970	160	135	37.53
D0075-1	20.01	30	0	10.3	-	1	1	640	116.71	104	32.8
D0086-1	27	99	0	11.3	-	1	1	675	100.5	77.87	66.4
	27	99	0	11.1	0.84	3	1	303	75.79	68.98	44.34
	5	99	0	10.1	0.55	0	1	38.4	53.93	34.46	14.52
	50										
D0096-1	13	99	1	11.1	2.5	3	1	123.3			47.55
D0108-1	26	12	0	10.1	6.92	3	1	820	135.63	71.7	57.14
D0092-1	1.25	33	1	10.3	-	3	1	307	68.8	73.2	39.6
Recoleccion	Type	X-section	Frag	Mat.	PHENOCRYST SIZE (MM.)	Usew	Freq	Wt. (G.)	LENGTH	WIDTH	THICKNESS
E0001-1	20.01	99	0	10.1	0.58	3	1	25.6	37.31	40.3	14.07
	50										
E0010-1	1.25	33	1	10.2	3.09	3	1	795	72.5	147.6	65.3
E0011-1	2	30	1	11.2	0.47	3	1	219.7	69.06	58.81	42.35
	50										

E0016-1	50	30		36			1	400.5			
E0024-1	10.1	12	0	10.1	0.61	3	1	104.4	78.7	33.88	24.8
	1.15	32	1	11.2	0.62	3	1	151.7	74.3	55.21	37.02
	15	30	1	10.3	-	0	1	118.5	46.08	33.58	32.43
E0024-1	15	99	1	10.1	0.76	3	1	37.4	34.8	34.38	27.13
E0026-2	50			30				77.1			
E0026-1	1.25	33	1	11.1	1.23	3	1	1200	160	140	29.88
	5	12	0	10.3	-	0	1	35.6	40.9	30.2	20.45
	1.15	32	1	10.1	0.3	3	1	855	117	75.2	53.47
	27	99	0	11.3	-	3	1	238.1	86.89	73.36	51.63
	27	99	0	11.3	-	3	1	159.2	61.34	49.31	35.86
E0029-1	1.15	34	0	10.3	-	3	1	1360	135	115	54.3
E0035-1	20	99	1	10.2	0.57	0	1	74.4	69.91	62.2	18.48
E0043-1	50										
	20	30	1	10.2	0.73	0	1	20.4	38.28	35.52	9.7
E0048-1	1.25	33	1	10.1	0.78	3	1	520.3	99.57	81.14	40.07
E0054-1	1.25	33	1	10.1	1.83	0	1	501.8	130	95	35.5
E0056-1	1.25	35	1	11.1	1.32	3	1	197.4	75.89	67.42	38.3
	6	30	1	10.2	0.6	3	1	254.7	71.88	81.8	28.6
	6	99	0	10.1	0.5	1	1	334.4	66.66	68.77	48.5
E0069-1	1.46	99	1	11.2	1.5	3	1	815	110.38	104.55	109.1
	1.15	34	1	11.2	0.75	3	1	174	60.13	68.8	35.55
E0072-1	50							2.4			
E0081-1	2	20	1	10.1	2.3	3	1	810	107.25	75.35	60.8
Recoleccion	Type	X-section	Frag	Mat.	PHENOCRYST SIZE (MM.)	Usew	Freq	Wt. (G.)	LENGTH	WIDTH	THICKNESS
E0088-1	1.25	35	1	10.3	-	3	1	529.8	112.14	94.09	43.7
	6	99	1	11.1	1.13	3	1	34.5	48.37	27.88	26.02
E0094-1	6	99	1	10.1	2.03	3	1	245.7	73.27	85.18	34.05
E0097-1	27	12	0	10.3	-	3	1	200.3	76.66	50.6	25.72
E0105-1	5	99	0	10.3	-	0	1	14	37.07	26.83	11.54

E0107-1	13	99	1	10.3	-	0	1	37.5			22.97
E0110-1	27	20	0	10.1	1.79	0	1	166.1	54.95	46.37	40.53
E0111-1	10.2	20	0	10.2	0.56	1	1	158.2	71.07	46.53	30.05
E0111-1	2	99	1	10.1	0.98	0	1	93.2	52.11	44.96	32.21
E0114-1	2	20	1	10.1	1.4	0	1	990	105	85	66.88
	20.01	50	1	10.3	-	0	1	9.6	33.48	21.92	10.61
	1.15	32	1	10.1	1.6	3	1	209.7	86.7	70.31	38.56
E0125-1	1.25	33	1	11.1	1.46	3	1	1510	150	130	58.53
	27	99	0	10.1	1.96	1	1	980	98.05	83.33	65.2
D0093-1	20.012	99	0	10.2	0.3	0	1	12.2	31.79	26.13	12.16

Appendix D: Figurine Fragments

This appendix contains the raw data for figurine fragments recovered from the survey zone.

Recoleccion	E	N	Class	Fig Tech	Fig Part	Fig Type	Cer Type	Vessel	freq	wt (G.)
E0004-1	244359	2068637	1299	1200	CABEZA	-	1211	-	1	19.4
E0048-1	242512	2068210	1100	2200	PIE-IQUIERDA	3 SAN MARCOS	1236	-	1	8.2
E0049-1	242480	2068189	1110	1100	TORSO FEMENINO	-	2906.4	-	1	68.1
			1211	2100	CARA	-	2620 W/O CORE	-	1	10.5
E0073-2 (DONATION)	243310	2066765	1211	2223	CABEZA	-	1211	-	1	42.4
E0075-1	243036	2066685	1100	1100	CARA	-	2701	-	1	21.2
E0111-1	241150	2067137	1211	2100	CARA	-	1212	-	1	8.9
E0112-1	241158	2066956	1200	1100	CARA	-	-	-	1	13.2
D0049-2	242050	2068019	1299	1100	INDETERMINADO	-	1211	-	1	4.4
D0055-2	242341	2067740	1100	1100	BRAZO	-	2701	-	1	5.3
D0086-1	241976	2068180	1100	2200	ARM ON BELLY	-	1211	-	1	9.1
			1100	1200	SKIRT?	-	2620	-	1	15.1
			1100	2200	CARA Y FRENTE	-	1215	-	1	4.8
			1999	2200	INDETERMINADO	-	1215	-	1	17

Appendix E: Burned Earth

This appendix contains the raw data for burned earth artifacts recovered during the survey.

Equipo	Bolsa	Recoleccion	E	N	CLASS	COUNT	WEIGHT g.
D	4013	D0012-1	243136	2068463	DAUB	4	18.9
D	4023	D0024-1	242806	2068568	BURNED EARTH	3	5.8
D	4027	D0026-1	242428	2068614	BURNED EARTH	1	3.1
D	4029	D0028-1	242293	2068393	BURNED EARTH	1	45.8
D	4033	D0029-1	242170	2068222	BURNED EARTH	1	6.7
D	4034	D0029-1	242170	2068222	DAUB	1	256.5
D	4036	D0030-1	242105	2068175	BURNED EARTH	3	10.6
D	5069	D0030-3	242112	2068162	DAUB	4	54.4
D	5070	D0030-1	242104	2068154	DAUB	1	21.6
					BURNED EARTH	4	18.8
D	4037	D0031-1	242061	2068244	BURNED EARTH	3	12.4
D	4056	D0031-1	242029	2068252	DAUB	1	62.6
D	4042	D0033-1	241982	2068333	DAUB	3	73
					BURNED EARTH	11	35.8
D	4044	D0034-1	241936	2068318	BURNED EARTH	1	6.7
D	4045	D0035-1	241987	2068315	DAUB	2	6.4
					BURNED EARTH	6	10
D	4046	D0035-1	241976	2068309	DAUB	8	122.4
D	4052	D0036-1	242021	2068267	BURNED EARTH	1	36.3

D	4063	D0042-1	242010	2068080	DAUB	1	17.7
D	4136	D0042-2	241999	2068099	BURNED EARTH	6	25.3
D	4135	D0042-3	241999	2068099	DAUB	3	49.3
					BURNED EARTH	3	13.6
D	4137	D0042-3	241988	2068112	DAUB	1	7.3
					BURNED EARTH	9	14.4
D	4066	D0043-1	241890	2068053	DAUB	6	465
					BURNED EARTH	11	45
D	4069	D0044-1	241850	2068035	DAUB	9	401.4
					BURNED EARTH	13	57.2
D	4073	D0046-1	242157	2067614	BURNED EARTH	4	4.1
D	4077	D0049-1	242085	2068033	DAUB	10	682
					BURNED EARTH	12	138.4
D	4148	D0049-2	242050	2068019	DAUB	21	1541.5
					BURNED EARTH	39	643.4
D	4082	D0051-1	242250	2067937	BURNED EARTH	2	17.5
D	4084	D0053-1	242311	2067864	DAUB	1	13
					BURNED EARTH	2	7
D	4085	D0053-1	242312	2067865	DAUB	13	640.8
					BURNED EARTH	12	159
D	4091	D0055-2	242341	2067740	BURNED EARTH	1	67.3
D	4092	D0056-1	242390	2067726	DAUB	5	325.2
D	4097	D0057-1	242466	2067478	NO HAY		

D	4101	D0059-1	242578	2067559	DAUB	3	257.3
					BURNED EARTH	6	75.1
					KILN DEBRIS	2	284.4
D	4104	D0062-1	242580	2067659	DAUB	1	20.5
					BURNED EARTH	4	18.7
D	4110	D0067-1	243293	2067662	BURNED EARTH	1	8.3
D	4128	D0082-1	240993	2067460	DAUB	5	202.5
					BURNED EARTH	4	17
D	4139	D0085-1	241987	2068139	DAUB	2	47.4
D	4144	D0086-1	241985	2068204	KILN DEBRIS	1	91.7
					DAUB	2	82.2
					BURNED EARTH	13	232.9
D	4153	D0087-1	240309	2067145	NO HAY		
D	4157	D0092-1	240215	2067261	BURNED EARTH	1	27.4
D	FROM 4162	D0093-1	239780	2066844	BURNED EARTH	4	13.2
D	FROM 4163	D0094-1	239730	2066868	BURNED EARTH	6	40.9
D	4173	D0103-1	239400	2067117	BURNED EARTH	4	10.4
E	5004	E0004-1	244359	2068637	DAUB	8	1118.7
E	5012	E0011-1	243830	2068379	DAUB	1	34
E	5032	E0024-1	243145	2068426	BURNED EARTH	1	25.4
E	FROM 5042	E0025-1	243157	2068277	DAUB	1	121.5
E	FROM 5048	E0029-1	242797	2068326	BURNED EARTH	2	8.7

E	FROM 5050	E0029-2	242797	2068326	BURNED EARTH	3	9.5
E	FROM 5052	E0030-1	242971	2068103	BURNED EARTH	4	7.4
E	5071	E0030-4	242104	2068154	BURNED EARTH	2	22.3
E	FROM 5057	E0035-1	242941	2068183	DAUB	2	58.3
E	FROM 5058	E0036-1	242926	2068197	BURNED EARTH	1	13.6
E	FROM 5060	E0038-1	242935	2068217	BURNED EARTH	1	4.9
E	5065	E0040-1	242652	2068527	BURNED EARTH	1	4.5
E	5076	E0042-2	242597	2068547	DAUB	1	321.6
					BURNED EARTH	1	39.2
E	FROM 5074	E0042-1	242597	2068547	DAUB	3	215.3
					BURNED EARTH	17	171
E	5078	E0045-1	242689	2068343	BURNED EARTH	4	19.3
					KILN DEBRIS	1	53.5
E	5083	E0048-1	242512	2068210	DAUB	7	380.7
					BURNED EARTH	2	177.8
E	FROM 5081	E0048-1	242512	2068210	BURNED EARTH	12	103.6
E	FROM 5085	E0049-1	242480	2068187	DAUB	4	121.8
					BURNED EARTH	4	46.3
E	5088	E0051-1	242449	2068160	BURNED EARTH	4	41.2
					DAUB	1	71.6
	FROM 5092	E0053-1	242330	2068340	DAUB	2	38.3
					BURNED EARTH	2	13.9
E	FROM 5093	E0054-1	242340	2068375	DAUB	1	15.8

					BURNED EARTH	2	27.6
E	5099	E0056-1	242473	2067872	DAUB	4	64.4
					BURNED EARTH	5	44.2
E	5112	E0073-1	243310	2066765	DAUB	3	192.9
E	5113	E0073-1	243310	2066765	DAUB	1	34.5
E	5118	E0075-1	243036	2066685	DAUB	2	47.3
E	5137	E0090-1	242130	2067872	BURNED EARTH	1	17.9
E	5149	E0096-1	241535	2067018	BURNED EARTH	1	233.1
E	5157	E0103-1	241533	2066737	BURNED EARTH	10	16.5
E	5170	E0110-1	241130	2067266	BURNED EARTH	1	25.8
E	FROM 5186	E0121-1	240948	2066968	BURNED EARTH	1	18
						426	11555

Appendix F: Special Objects

This appendix contains the raw data for special objects recovered during survey.

Recoleccion	**E**	**N**	**Class**	**Cer Type**	**freq**	**wt (G.)**	**Comments**
D0053-1	242311	2067864	2141	2654	1	12.6	ASA OREJA
D0077-1	242398	2066358	2150	1215	1	8.5	ASA-VERTEDERA
D0079-1	241796	2067919	2141	2654	1	22.6	COARSE WHITE TEMPER, DARK CORE, RED SLIP.
D0081-1	240997	2067408	2141	2655	1	19.8	ONLY SMALL PORTION REMAINS
D0086-1	241976	2068180	2242	2611	1	36.8	TEOTIHUACAN STYLE
D0116-1	240754	2066672	2141	2654	1	27.7	ASA OREJA
Recoleccion	E	N	Class	Cer Type	freq	wt (G.)	Comments
E0004-1	244359	2068637	2141	2655	1	147.6	big lug handle
E0004-1	244359	2068637	2320	2611	1	74.5	CYLINDRICAL SPOUT
E0004-1	244359	2068637	2320	2600	1	14.7	CYLINDRICAL SPOUT
E0011-1	243830	2068379	2141	2701	1	41.7	LUG HANDLE
E0024-1	243145	2068426	2141	2611	1	8.1	SMALL LUG HANDLE FRAGMENT
E0029-2	242797	2068326	2121	2611	1	3.2	SOLID CYLINDER HANDLE, SMALL FRAGMENT
E0031-1	242991	2068128	2121	2611	1	4.4	SOLID CYLINDER HANDLE, FRAGMENT
E0036-1	242926	2068197	2121	2821	1	7.3	SOLID CYLINDER HANDLE FRAGMENT
E0042-1	242597	2068547	2121	2600	1	6.7	SOLID CYLINDER HANDLE
E0043-1	242533	2068500	2221	2651	1	7.6	SMALL SUPPORT, SHORT, CONICAL.

E0045-2	242675	2068408	2160	1112	1	25.9	UNSURE…POSSIBLE HAND/SUPPORT
E0048-1	242512	2068210	2999	2611	1	7	UNIDENTIFIABLE OBJECT. HOLLOW.
E0048-1	242512	2068210	2131	2701	1	4.8	FLAT, PLANAR OBJECT.
E0048-1	242512	2068210	2999	2611	1	7.4	CURVED OBJECT
E0049-1	242480	2068187	2121	2701	1	9.3	CYLINDRICAL HANDLE SOLID
E0049-1	242480	2068187	2141	2620	1	22.5	LUG HANDLE
E0053-1	242330	2068340	2141	2655	1	21.7	LUG HANDLE WITH VESSEL WALL ATTACHED
E0075-1	243036	2066685	2141	2655	1	34.2	LUG HANDLE
E0085-1	242311	2067375	2214	2611	1	8.8	SOPORTE CASCABEL. 2 PIECES, NO RATTLE.
E0087-1	242125	2067626	2141	2620	1	46.5	LUG HANDLE
E0087-1	242125	2067626	2121	2701	1	3.9	CYLINDER SOLID HANDLE
E0090-1	242130	2067872	2231	2600	1	24.2	CYLINDER SUPPORT.
E0096-1	241535	2067018	2300	1215	1	29.1	SPOUT, NOT MUCH REMAINS. CYLINDRICAL OR SIMPLE.
E0108-1	241228	2066840	2121	2611	1	10.3	CYLINDER HANDLE SOLID
E0108-1	241228	2066840	2141	2620	1	29.9	LUG HANDLE
E0108-1	241228	2066840	2141	2655	1	16.3	LUG HANDLE
E0121-1	240948	2066968	2200	2600	1	6.9	GENERAL SUPPORT

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