GIS ANALYSIS OF OBSIDIAN ARTIFACT DISTRIBUTIONS AT HOLTUN FROM THE PRECLASSIC THROUGH THE CLASSIC PERIODS

by

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ABSTRACT

The nature of social organization at an archaeological site can be interpreted from many types of material remains. Exotic goods are particularly useful for making inferences about social organization because of their scarcity, utilitarian demand, and symbolic characteristics. Obsidian artifacts are some of the most abundant exotic goods among the Lowland Maya. The acquisition of these artifacts was the result of a wide net of commerce from the highlands of Guatemala and central Mexico into the Maya lowlands. The patterns of consumption and distribution of obsidian artifacts vary according the time and location. This variation is seen as the result of complex dynamics of trade and social interactions among the ancient Maya. Therefore, I argue that there is variability perceptible in the patterns of consumption and local distribution of obsidian between the elite residential groups at the site of Holtun. This study presents a descriptive and comparative analysis of the patterns of obsidian consumption observed in the samples from the excavations performed by the Holtun Archaeological Project from 2011 through 2016. The analysis contributes to the understanding of local processes in association with regional socioeconomic and political dynamics in the Maya Lowlands.

Previous research has suggested that obsidian distribution in some times and places was centralized and controlled by powerful Maya polities. In addition, research performed on obsidian artifacts reveals a change in the consumption of different obsidian sources at other sites in the Yaxhá basin, the geographic location of Holtun. The data collected by Holtun Archaeological Project provide information that correlates with the broader trends of obsidian preferences in the area. Our findings suggest that during the Preclassic period (c. 600 BC to AD 250) the frequency of obsidian artifacts from San Martin Jilotepeque was higher than other

sources and the artifacts from El Chayal were restricted to households especially associated with the first ritual and monumental construction at the site. Then, during the Classic Period (AD 250 to 950), the frequency of artifacts from San Martin Jilotepeque experienced a decrease in quantity and the artifacts from El Chayal were more accessible across the site. The process of excavation and mapping, and the subsequent laboratory analyses have allowed for the documentation of this variability in accessibility and consumption preferences within different elite residential groups. To facilitate these interpretations, a map of Holtun was created using Geographic Information Systems. It allows the inclusion of layers of information obtained during this research, constituting a point of reference for the understanding of socioeconomic and political changes experienced within the site during the intriguing transition from the Preclassic to the Classic period.

For the good of mankind

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ELC: El Chayal, obsidian source

EC: Early classic Period

GIS: Geographic Information System

HAP: Holtun Archaeological Project

LC: Late Classic Period

LPC: Late Preclassic Period

MAMSL: Meters above Mean Sea Level

MPC: Middle Preclassic period

ND: No date

NS: No source

PXRF: Portable X-Ray fluorescence device

SMJ: San Martin Jilotepeque, obsidian source

TC: Terminal Classic Period

CHAPTER 1: INTRODUCTION

The results presented in this thesis correspond to GIS analysis performed on the obsidian artifacts at the site Holtun, Guatemala. The research focused on the distribution of obsidian artifacts across the settlement and during all periods of human occupation at the site. The general objective was to find an association between obsidian source distribution and the cultural processes that occur during the occupation of the site. In order to investigate the connections between artifact distribution and cultural processes, settlement pattern analysis was employed. It will facilitate the understanding of cultural changes across time from a spatial perspective. This approach includes methodological and theoretical contributions provided by schools of archaeological thought that focus on settlement patterns, settlements systems and cultural landscape. Holtun is located in the northeast section of the Department of Peten, Guatemala. This site has been monitored since the mid-1990s (Fialko 2011; Ponciano 1995; Quintana 1996) and investigated continuously since 2010 (Kovacevich et al. 2011; Callaghan et al. 2016). During the course of the research seasons, the project has produced a detailed map of Holtun settlement (Guzman 2017) as well as a considerable dataset of archaeological materials. Such information allows for the formulation of research questions and the elaboration of specific research projects that facilitate the interpretation of cultural processes within the site. The aim of this thesis was performing a plotting of obsidian artifacts found at the site and classified by frequency and source data. It revealed patterns and changes through time that could suggest variability in the process of obsidian procurement. Consequently, it can show the level of involvement of Holtun in regional political and economic dynamics.

The social organization of an ancient Maya archaeological site can be understood from multiple perspectives through material remains. In many cases, non-local goods provide valuable information about procurement, exchange, and consumption (Moholy-Nagy et al. 1984: 105; Taube 1991). Among the exotic goods traded by the ancient Maya, obsidian artifacts are some of the most abundant. These artifacts were imported from the highlands of Guatemala and central Mexico since the origins of Maya civilization (Moholy-Nagy et.al. 1984; Sidrys 1979). The trade of products also included the transaction of other materials and technologies, which can uncover sociopolitical relationships and commercial links among polities (Golitko et al. 2012; Sidrys 1976). The demand, distribution and use of ceramic and obsidian artifacts vary according the period and context (Brown et al. 2004). This variation responds to the complex dynamics of interaction among the Maya and the patterns of temporal cultural transformation. For that reason, I argue that the cultural and sociopolitical changes that characterize ancient Maya history can be perceived in the patterns of consumption and distribution of obsidian artifacts between the elite residential groups at the site Holtun, Guatemala. These patterns can suggest that the internal organization of the site is adapting or reacting toward economic, cultural, or sociopolitical dynamics in the region.

Maya archaeologists have observed that the provenience of obsidian fluctuates across time, and some have argued that obsidian was a product that was susceptible to control and centralization by powerful polities (Sidrys 1977: 104). Holtun is located in an archaeological region influenced by larger sites, the closest of which was Yaxha. These sites share an environment constituted by a lacustrine basin, where a series of sites create a cultural landscape that was a major economic and political hub. Prudence Rice (1984) and Rice and colleagues (1985) observed changes in the provenience of obsidian consumed in the basin during the apogee of Maya civilization. During the Preclassic period (c. BC 2000 to 250 AD) the obsidian artifacts from a source in the Guatemalan highlands named San Martin Jilotepeque had higher frequencies (see Figure 1). Later, during the Classic Period (450 to 850 AD), the basin experienced a decrease in the use of obsidian from that source. That is associated with an increase in quantity and distribution of artifacts from another source on the highlands named El Chayal (see Figure 1). Finally, during the Terminal Classic period (850 to 950 AD), it is possible to observe an increase in the practice of artifact reuse, which evidences a process of scarcity.

The archaeological samples collected during the excavations at the site Holtun generally support these patterns. Interestingly, settlement pattern analysis seems to show a restriction of the source El Chayal obsidian during the Preclassic period to primarily elite context associated with the earliest ceremonial architecture at the site. Then, El Chayal becomes more widely available and the dominant source during the Classic and Terminal Classic periods with San Martin Jilotepeque becoming more restricted. This may reflect social and political changes taking place at the site during the shift from the Preclassic to the Classic periods.

The Holtun Archaeological Project has conducted a research based on excavations and mapping of residential structures with subsequent laboratory analyses. This process has allowed for the documentation of cultural patterns experienced in the site across the time. Therefore, comparative analysis of obsidian artifact dispersion will provide a tangible evidence of the social relationship within the site across time and space. Likewise, it evidences the process of interaction of people with their cultural and natural environment. The interpretations obtained in the course of this research contribute to the understanding of sociocultural changes experienced within a Maya site, during the cultural transformations from the Preclassic through the Terminal Classic periods.

This thesis presents an interpretation of the sociopolitical processes at Holtun related to obsidian importation and distribution associated to the larger cultural dynamics in the Northeast Maya Lowlands. This analysis allows for the understanding of the distribution of materials in relation to the internal organization of elite residence households. The research presented here produced a geographic database of obsidian and ceramic artifacts collected at the site during the 2010-2016 field seasons. In addition, the research allowed for the performance of comparative analysis of such materials, based on their location and chronologic reference.

The entry of each obsidian artifact into Geographic Information System (GIS) dataset allowed the analysis of the level of variation in the source of obsidian employed in artifacts across time and space within the site. These variations were correlated with ceramic material, which provides the chronological context for the obsidian artifacts. These distributions suggest that the location and time period of architectural complexes correlate to specific obsidian sources. Finally, it was possible to perceive dynamics of social and economic power based on the location of plazas and the access to exotic goods. Variability in obsidian artifact sources distributed across the site and through time can be understood as a result of sociopolitical transformations.

Maya Archaeology

Archaeological research on ancient Maya urban centers began in the 19th century and continues to the present day (Becker 1979; Maudslay 1883; Marcus 2003). The research questions have tried to clarify physical facts like demography and sustainability of ancient populations, as well as trying to understand the political and economic dynamics that held Maya society together (e.g. Lucero 1999). Some of the most persistent questions focus on the nature of the social structure of the people that build those monumental centers in the middle of the jungle. Interpretations have changed through the time from the belief that Maya settlements were exclusively ceremonial centers to the acceptation that there were cities with complex social dynamics (Becker 1979: 7-10, 17). In order to understand the nature of social complexity, archaeologists have studied archaeological materials aided by the most advanced technology available at their time (see Ashmore and Sharer 2013). In addition, they have sought to apply the most adequate theoretical approach that provides an explanatory interpretation about ancient processes (e.g. Johnson 2010; Trigger 2006).

A focus on technology and scientific advancement have positively affected Maya Archaeology in method and theory during recent decades (Robin 2001). The data collected from archaeological research is now being analyzed from a new perspective. Methodological approaches range from a microscopic perspective using molecular science (Price et al. 2000) to a geodesic perspective using earth and geospatial sciences (Chase et al. 2012). These methodological advancements allow for a more holistic approach to research questions (Marcus 2003), which is used in this thesis. Both chemical and geographical analysis are used in the interpretation of Maya history. This approach fosters the analysis of settlements through the study of both cultural and natural landscapes. Subsequently, it considers the household as a unit of analysis for the study of urban centers (Fash 1994: 188). In this particular case, the obsidian of Holtun is analyzed according its geochemical composition, the chronology of context, and the location within the site. The information obtained will seek to explain the nature of social organization at the site.

Ancient Maya Periods

The ancient Maya civilization experienced distinctive cultural changes during its history. These changes are perceptible in the material culture and evidence transitions in the cultural manifestations of the society. Archaeologists have created a detailed system of classification for these time periods in order to standardize a chronology for the Maya history. These periods are known as Preclassic (c.2000 BC to AD 250), Classic (AD 250 to 950) and Postclassic (AD 950 to Spanish conquest), which are separated in sub-periods characterized by cultural particularities. The Prelcassic period is subdivided in Early Preclassic (c.2000 to 300 BC), Middle Preclassic (600 to 300 BC) and Late Preclassic (300 BC to AD 250). The Classic period is subdivided in Early Classic (AD 250 to 600), Late Classic (AD 600 to 850) and Terminal Classic (AD 850 to 950). Finally, the Postclassic period is subdivided in Early Post Classic (950 to 1200 AD) and Late Postclassic (AD 1200 to Spanish conquest 1519-1542). Archaeological evidence at Holtun suggests that the site was occupied from the early stages of the Middle Preclassic period through the late stages of the Terminal Classic period, with some Postclassic-period activity (Callaghan and Castillo 2011).

Maya Archaeological Regions

As a result of years of comparative analysis on sites around the Maya area, archaeologists have created a classification of ancient Maya civilization according the geographic context where the cultural features are located. These areas are classified according the environment, elevation above mean sea level and the geomorphology. This classification recognizes three main regions known as Highlands, Lowlands and Pacific Coast (McKillop 2004: 7). The Lowlands have subdivided in southern and northern. The southern Lowlands comprehend the Department of

Peten and Izabal in Guatemala, the neighboring areas of Chiapas, Campeche and Quintana Roo in Mexico, the whole territory of Belize and the northwestern portion of Honduras. The northern Lowlands comprehend the rest of the Yucatan Peninsula, in Mexico.

The region of interest for this research is the southern portion of the Maya Lowlands. This region is characterized by a high level of humidity and a geomorphology that allows the existence of water reservoirs. Such conditions provide the proper environment for a rainforest with an exotic diversity of flora and fauna. Architectural evidence suggests a high density population in many regions of this tropical forest. This particular environment required complex sociopolitical organization to maintain sustainability over centuries of occupation. Understanding these factors has been one of the most enduring research questions in Maya Archaeology (Rice and Culbert 1990: 2-3).

The Ancient Maya and the Central Peten Lakes Region

The ancient Maya were located in the southeastern region of Mesoamerica. The territory of Mesoamerica was defined by Paul Kirchhoff in 1943 (1960, 1994) to refer a region that hosted several civilizations that flourished, collapsed, and coexisted in different periods before the arrival of the Spaniards to the Americas. According to Kirchhoff, this region shared several cultural features, including monumental architecture, human sacrifice, the sacred ballgame, and a ritual calendar. The territory covers the modern boundaries of Mexico, Guatemala, Belize, Honduras and El Salvador. The remnants of these civilizations, including the Aztec, Maya, Olmec, and Toltec, among others, are still present in archaeological remains and cultural practices of descendent communities (Sharer and Traxler 2006: 8-11).

The Maya region is constituted by the southeastern territory of Mexico, the territory of Guatemala and Belize, and the western portions of Honduras and El Salvador. This region was occupied by the Maya from approximately 1000 BC through the Spanish conquest around 1542 (Demarest 2004: 15; McKillop 2004: 4). In the course of this thesis, the Maya will be referred as *ancient* to differentiate its cultural remains from the modern Maya descendant communities (e.g. Demarest 1992; Foias 2004; Sharer and Traxler 2006).

The ancient Maya are well known by their particular ideology, evidenced in art and decoration of physical elements (See Schele and Miller 1986; Demarest 1992). They are also known by their monumental architecture, which often features a well-developed sculpture tradition (e.g Proskouriakoff 1963). A complete writing system was featured in pictorial and sculpture works, as well as a complex calendar system based on astronomic observations (see Coe 2012; Coe and Van Stone 2001). Also, they were known to have developed a system of trade that allowed the exchange of goods through a complex system of riverine and overland trade routes. Those routes supported the economy and status of Maya society during centuries and are associated with the origins and transformation of the civilization (see Masson and Freidel eds. 2002). Finally, the sociopolitical system was characterized by a hierarchy between the polities as well as the social strata within them. This resulted in a complex dynamic of interactions; including dynastic kingships, alliances, and warfare (see Martin and Grube 2000).

The Central Lakes Region

The area of interest for this thesis is constituted by the central portion of the southern Lowlands. This area is characterized geologically by the karstic composition of the soils. The geomorphology consists on low elevation mountains and water bodies, which rank from small reservoirs to considerably large lagoons and lakes (~100 km²). The high amount of bodies of water is the consequence of the geology and soil composition. Limestone tends to dissolve by the erosion caused by water precipitation, which results in the creation of a sinkhole or lake. Some of these bodies of water have their own closed basin, which is not dependent on tributary rivers or drainages. In closed basins, the water levels rely on rainfall, humidity, evapotranspiration and undercurrents, which contributes to the presence of rainforests and humidity preservation (Brenner et al. 2002: 2). The central area of Peten is characterized by the presence of these geologic phenomena manifested in two systems of lakes and lagoons. Archaeologists refer to this region as the *Central Peten lakes region* (Segura 2012; Rice and Rice 1985). The western basin contains Peten Itza Lake, and the eastern basin contains the lagoon system Yaxha-Labna (Brenner et al. 2002: 2). The latter constitutes the landscape where the site Holtun was settled and interacted with other archaeological sites. The largest site within this basin is Yaxha and it is located on the Northshore of the lagoon of the same name. These natural and cultural elements owe their names to deciphered hieroglyphic texts (Culbert 1991: 130).

Archaeology of Yaxha

As mentioned above, the site Yaxha is located in the lower portion of an eastern lacustrine basin that encloses the system of Central Peten lakes. The monumentality of the site is visible from other sites in the basin and its dimensions are comparable with some of the main sites of the northeast Lowlands, like Naranjo, Nakum and Holmul. The site was officially reported the first time by Teobert Maler (1908: 71) in 1904, and later in 1915 by the Carnegie Institution of Washington (1915: 345). The first map of the site was created in the 1930s and it was mapped again in the 1970s. Subsequently, the Guatemalan government began a project of architectural conservation (Sharer and Traxler 2006: 375). The endeavors for conservation have extended to the whole basin. The Yaxha National Project has conducted research and monitoring of sites in the neighboring area (Quintana 1996; Fialko 2011). In the 1980s, archaeologists Don Rice and Prudence Rice (1980) and Rice et al. (1985) conducted a research project on the settlement around the shores of Yaxha lagoon system, which observed the influence of environmental factors on political dynamics in the basin. Consequently, they argue that the sites in the Yaxha basin were major players in economic and political spheres during the apogee of ancient Maya civilization.

Ancient Maya Political and Economic History

The site of Holtun is a close neighbor of Yaxha in the northeast of the Maya Lowlands in the same lacustrine basin. The larger Central Peten Lakes region constitutes an epicenter for political and economic activities, evidenced by the presence of other political centers, like Tikal, that once led the dynamics of interactions among the Maya. In order to understand the relevance of Holtun within the ancient Maya history, it is necessary to know the political and economic history of the region. A brief summary of the ancient Maya politics and economics will be discussed below, with a particular attention to trade activity, procurement of exotic products, and the processes of social stratification.

The origins of Maya civilization in the southern Lowlands extend back to the Preclassic period (c. 2000 BC to AD 250). Small villages emerged in the area, which after a process of developing social complexity became the monumental cities of Tikal, Ceibal and El Mirador, in Peten, Guatemala. Contemporaneously, other cities like Kaminaljuyu and Tak'alik Ab'aj were gaining similar complexity in the Highlands and Pacific Coast respectively (Foias 2013: 3-7;

Inomata et al. 2014; Schieber 1994; Shook et al. 1979). During the Middle Preclassic period (800- 300 BC), manifestations of public architecture known as E-Groups began in cities like El Mirador, Nakbe, Tikal, Yaxha (Doyle 2012) and Holtun (Callaghan 2017; Fialko 2011). E-Groups (named for the first one identified at the site of Uaxactun in "Group E", see Ricketson 1928; Sharer and Traxler 2006:182) are architectural complexes with an eastern range structure and a western pyramidal structure. These complexes were often used for the astronomical observation of equinoxes and solstices, although not all may have served an astronomical function and the function may have changed through time (Doyle 2012; Estrada-Belli 2010; Estrada-Belli et al. 2006; Ortiz et al. 2012; Smith 1982). These E-Group complexes were often some of the first or the very first monumental architecture at Preclassic-period Maya sites, including at Holtun.

In the last part of the Preclassic, known as the Late Preclassic period (300 BC to AD 250), some sites like Tikal (W. Coe 1965) and Lamanai (Pendergast 1981) continued on a path of cultural florescence that allowed many of them to survive into later periods (Foias 2013: 11). However, the end of the period also brought some social instability, ideological changes, and resulted in a partial collapse (Freidel and Schele 1988: 549): for example, the site El Mirador, which previously contributed with the development and configuration of Maya culture, was abandoned at the end of the Late Preclassic Period (Hansen et al. 2007; Matheny 1987).

The imbalance caused by the social transitions at the end of the Preclassic period benefited other polities like Calakmul, Caracol, Holmul, Tikal and Yaxha, among others (Foias 2013: 11, Freidel and Schele 1988). This is how a complex and heterogeneous civilization began to experience the constant fluctuations in florescence and power during the Classic period in the Maya Lowlands. One of the main characteristics in Maya politics is the territorial expansion and contraction of political hegemony (Demarest 1992: 11). For that reason, it is not possible to consider the Maya civilization as a unified region or Empire. Maya sites could be characterized as city-states, fluctuating in power through time. This model implies that a main center was supported by a network of secondary cities. However, the network of cities expanded and contracted according the control of ideological identity and the capacity of main centers to hold the hegemony over its network (p.17). Trade and warfare was part of the system of interaction between these cites during the Classic Period (p. 16). Apparently, warfare had a high impact on symbolic power over the allied and defeated cities (Schele and Freidel 1990: 165-171).

During the Early Classic period, cities like Tikal and Yaxha shared with other cities the controversial episode of contact with the remote city Teotihuacan in Mexico. This interaction is evident in architecture, iconography in monuments and ceramics, and the importation of green obsidian from the Pachuca source (Iglesias 2003; Foias 2013: 12; McKillop 2004: 183). The presence of green obsidian in the northeast Peten (Moholy-Nagy 1999; Spence 1996) shows a wide network of interaction in Mesoamerica. Its presence indicates the incorporation of new materials to the trade routes and as a consequence, new exotic commodities and gifts procured by the elite factions of certain sites.

Within the Classic period, some Maya sites experienced a transition or hiatus between the Early Classic and the Late Classic. This transition was characterized by the interruption of ritual activities, such as the dedication of monuments and the construction of monumental architecture (Willey 1979: 416). As during the Preclassic cultural transition, the ancient Maya again showed the capacity to be resilient in the face of turbulent social phenomena (Chase et al. 2014).

The Late Classic was a period of political fluorescence for cities like Calakmul, which emerged as a powerful center. That allowed to this monumental city to conduct trade and warfare though the Lowlands, resulting in political alliances with Dos Pilas, Naranjo, el Peru-Waka and Yaxha. The site of Yaxha was itinerant in its participation in that sphere of interaction during the late seventh and early eight centuries (Rice 2004: 188). The participation of Yaxha in these dynamics of interaction can be tracked through epigraphic records (Demarest 1992: 110). The emblem glyph of this site reads Yax-Ha and literally means *Green-Water*. It is mentioned in hieroglyphic texts at other sites and in local monuments (Culbert 1991: 130). The end of the Classic period, known as the Terminal Classic, was characterized by social instability, scarcity of goods, and demographic decrease in populations at many city centers. During this period, the Maya experienced a series of events that were transformational for Lowland Maya society and resulted in what has been called a collapse (Demarest 2004: 266, P. Rice et al. 2004).

Obsidian distribution analysis may support these broad cultural patterns that have been identified, but it may also give a more detailed account of changes in power strategies through time. The fluctuation of power of hegemonic centers might have affect trade routes and the capacity to acquire products. Therefore, the presence of exotic goods at Holtun might indicate continuities and changes of trade routes and the participation of the site in political and economic dynamics during the history of Maya civilization in the Lowlands.

Ancient Maya Trade

Elite groups headed political relations between sites, in constant flux between alliances and aggression. In certain cases, elite groups also controlled trade routes (Hammond 1991: 264-265) and maintenance of the ideological system (Demarest 1992). The topography of the land (as seen in Figure 1) and the lack of complex transport technology made trade routes a combination of pedestrian transportation and navigation on rivers or other substantial bodies of water

(Houston and Inomata 2009: 253-254). Therefore, the control of trade routes also implied the control of the transit areas.

One of the most prevalent trade goods was obsidian, which is argued to have reached in the lowlands through central places like Yaxha (Sidrys 1977: 104), which is located at the center of the lacustrine basin where Holtun is settled. It is believed the demand for exotic goods was an economic and social phenomenon that stimulated the creation of trade routes. Prudence Rice (1984: 189) suggests that the large centers in the Northeast Peten were responsible for the redistribution of imported goods. In addition, the procurement, distribution, and restriction of exotic goods contributed with the maintenance of the status of elite groups in Maya sites (Feinman 2001).

As discussed above, the access to trade routes was conditioned by the political changes in Maya history and the sociopolitical bonds between cities. Therefore, it is important to mention that Holtun is located between the basins of the rivers San Pedro Martir, Mopan, Holmul (Figure 2). Many important Maya cities that were major political players are settled along these rivers, (e.g. Bullard 1960: 355-356, Estrada-Belli et al. 2003: 59, Laporte and Mejía 2006, Leal and López 2000, Quintana 1998: 105-110). The presence and fluctuation of consumption patterns of obsidian in the sites in northeast Peten and particularly in Holtun indicates that this site was participating in the complex dynamics of interactions of the ancient Maya.

The fluctuation in hegemony in the Lowlands caused perceivable changes in the trade routes and consequentially in the exotic goods procured in the sites. For example, it is believed that the access to obsidian (especially from the El Chayal source) from the Guatemalan Highlands became difficult to obtain during the Terminal Classic period. The argument rests on the considerable increase of importation of obsidian from Ixtepeque (see Figure 1), and the decline of obsidian from El Chayal (Golitko 2012: 514). Ixtepeque is the third major source for obsidian that traditionally satisfied the demand of this product in the eastern portion of the Maya area (Aoyama 2001, Brown 2004). In addition, there was an increase of obsidian from highland Mexico during the Terminal Classic period as evidenced in a secular palace known as Structure III at the site Calakmul. The incorporation of a new sources may suggest a transformation in the process of obsidian procurement by the elite in monumental sites at the end of the Classic period (Folan et al. 201: 238). This transformation may have presaged an economic shift during the Postclassic period with an increasing focus on mercantilism and international trade (McKillop 2004).

In conclusion, the study of long-distance exchange allows to us understand how economic systems operated and possibly even why they might undergo change. The study of type and quantity of materials transported, as well as the origins and distances from where they were moved, allows for the examination of the dynamics of exchange systems (Renfrew and Bahn 1991: 351-384). The implementation of geochemical methods in archaeological procedures has revolutionized the studies of long-distance exchange. Principles of physics, chemistry and earth sciences merge in archaeological methods to explain the mineralogical, chemical and isotopic proprieties of materials that facilitate the traceability of exotic goods (Glascock 2002: 1).

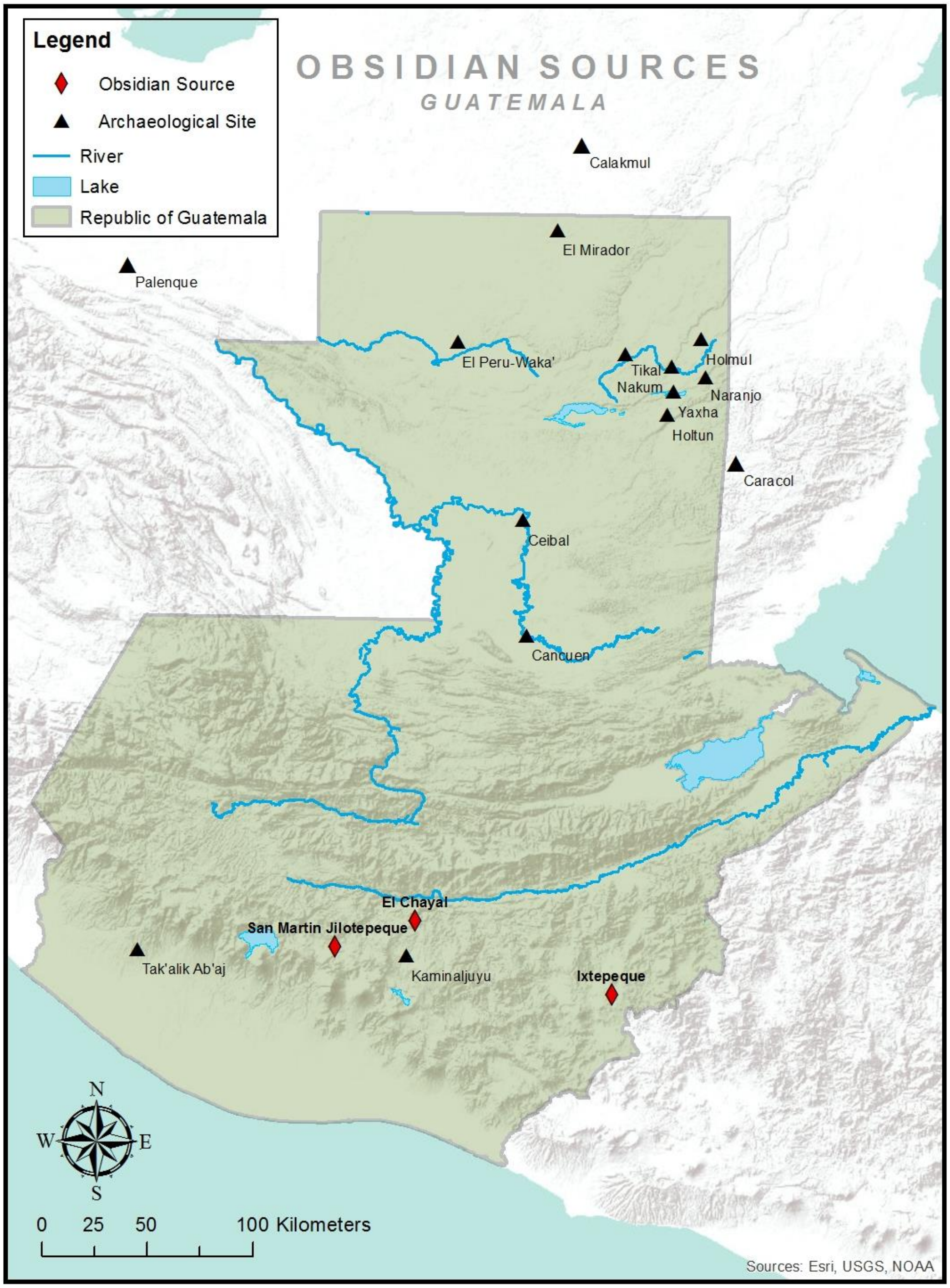

Figure 1: Obsidian sources in Guatemala (Map created by the author).

Obsidian Artifacts as Exotic Goods

A representative settlement pattern analysis was performed in the lacustrine basins of Peten, Guatemala by Prudence Rice (1984) and Rice and colleagues (1985). This research uncovered obsidian artifact proveniences and featured the frequency of these artifacts across the sites samples in the area. Also it featured the changes of consumption and distribution patterns across time. Due the exotic character of obsidian, this material has been used by archaeologists to understand the sociopolitical dynamics between ancient Maya sites (e.g. Aoyama 2014, Golitko 2012).

Obsidian artifacts are particularly important for the study of ancient Maya sites and archaeological regions. This is due to the association that artifacts have with socioeconomic and politic interactions, as well as ritual and utilitarian activities (Aoyama 2014:127). Obsidian is an igneous rock with high concentration of silica and microcrystalline structure that forms as volcanic glass. Obsidian can range in color from black, grey, green, brown and occasionally other colors. Since obsidian results only from volcanic activity, the nearest sources are located in the volcanic regions of the Guatemalan Highlands and the central Mexico. The physical composition of the material allows it to have a predictable conchoidal fracture as does regular glass. Based on this property, it is possible to manufacture several types of sharp objects and complex tools (Witschey ed. 2016: 249). The chemical composition of the artifact is correspondent to each particular source of obsidian and to the specific sector where the obsidian was collected. It provides a chemical signature that can be measured with archaeometric procedures, like X-ray fluorescence or Inductively Coupled-Plasma Mass Spectrometry with a Laser Ablation introduction system (LA-ICP-MS) (Kovacevich et al. 2015: 145; Moholy-Nagy 2003).

Obsidian was imported by Lowlands Maya sites from sources in the Guatemalan Highlands since the Early Middle Preclassic period (Moholy-Nagy 2003: 304). This material was obtained mainly from three sources in the Guatemalan Highlands, San Martin Jilotepeque or Río Pixcayá, El Chayal and Ixtepeque (Golitko et al. 2012: 508). During the Preclassic period, obsidian was used for utilitarian functions while during the Classic period some ceremonial artifacts and ornaments start being manufactured with this material (Moholy-Nagy 2003: 304). In some cases, artifacts with an specific type and function could be manufactured from the same source (p. 307).

At many lowland Maya sites, during the Preclassic period, the dominant source of obsidian was San Martin Jilotepeque (Nelson 1985). It was predominately replaced by El Chayal source during the Classic period; however, San Martin Jilotepeque obsidian was still an imported product. The obsidian from Ixtepeque was present mainly in southeastern sites of the Maya Area but was more accessed in the rest of the Lowlands during the Terminal Classic period (P. Rice 1984). In addition, the ratio of obsidian imported from the central Mexico region was low, and depended on the site and context. For example, during the Terminal Classic period the presence of Mexican obsidian increased in the Maya area, suggesting the opening of a new trade route through Yucatan (Golitko 2012: 511).

At Holtun, the analysis of source and chronology of the context can provide information related with the participation of the site in the dynamics of obsidian procurement of northeast Peten. The comparative analysis of obsidian frequencies by source and period between elite households suggests the presence of competing factions at Holtun that may have been able to control the distribution of obsidian within the site.

Social Stratification among the Ancient Maya

In order to understand the dynamics of power between social entities within a site, it is important to understand symbols of political status. In that sense, archaeological materials are important to identify the status of a person or a group. Exotic goods have been used by archaeologists to measure the status of the residents of palaces and domestic structures (Feinman 2001: 164). Its scarcity and acquisition from a long-distance trade system implies that obsidian is a prestigious good. Its presence and distribution has been used as an element of analysis for site classification and stratification. For this reason, it is argued by some that large cities or elites were in control of the redistribution of this material (Sydris 1976: 339). Also, the distribution of such artifacts within the site can be a source of power and social stratification (Aoyama 2009).

Nevertheless, the presence or absence of prestige goods could be a false indicator of status because they often can be found in all type of social contexts (Jackson 2013: 64). But, at the same time, it may suggest that the ancient Maya had a high diversity of social statuses within a site and across time (p.81), allowing for the existence of secondary and tertiary elites (Elson and Covey 2006) and even a *middle class* (Chase and Chase 1996). This thesis attempts to identify those elements of status variability observed through the distribution patterns of exotic goods. Consequently, this analysis identifies the location of these elite households that might have derived power from the importation and control of such goods, and how that changed through time. Such analysis allows the observation of local dynamics of materials accessibility and control, and its relationship with larger dynamics of commerce within and between ancient Maya polities.

The analysis of obsidian frequencies and distribution at Holtun feature two different patterns. The first is a distribution pattern that occurs during the Preclassic period and the second occurs during the Classic period. During the Preclassic period, the distribution of obsidian from El Chayal seems to have been restricted by the elite factions associated with the *E-Group* astronomical observatory, the first monumental architecture at the site (see Figure 15). On the other hand, obsidian from San Martin Jilotepeque had more accessibility at other elite groups in Holtun during the Preclassic period. However, during the Classic period, a process of sociopolitical or economic transformation allowed obsidian from El Chayal to become more evenly distributed in other elite groups at the site. In addition, during the Terminal Classic period, El Chayal became the dominant source and was more evenly distributed throughout the site. Meanwhile, the use of obsidian from San Martin Jilotepeque became restricted to the ceremonial center of the site associated with the *E-Group*.

While the obsidian distribution patterns presented in this thesis are interesting, they are still preliminary, and more obsidian data will be uncovered in future seasons. However, it is possible to see general patterns based on the information observed in previous studies that relate obsidian procurement with social control and status maintenance (Aoyama 2001; Folan et al. 2001; Moholy-Nagy et al. 1984; Rice et al. 1985, Sidrys 1976). During the Preclassic there is evidence of the ability to control the distribution of the high-quality obsidian from El Chayal. This pattern could correspond to the authority developed during the Late Preclassic period (Freidel and Schele 1998) that may be manifested in economic as well as ideological means. The nature of the authority during the Late Preclassic remains unclear, but some scholars believe that it was held by an elite group (Willey 1977) or a religious entity. David Freidel and Linda Schele (1988) believe that the Late Preclassic period was transcendental for the development of centralized authority in the Maya Lowlands, and the transformation of egalitarianism towards kingship (p.549, also Schele 1985; Freidel 1986). On the other hand, the distribution of obsidian from San Martin Jilotepeque during the Preclassic indicates that obsidian in general was not a restricted good at Holtun. It was just the obsidian from El Chayal that was restricted during this period.

During the Early Classic period, Holtun may experience a decline in occupation, as material culture evidence from that period is sparse. The obsidian artifacts, though few, were nucleated towards the foundational center of the site. The practice of nucleation at the central plazas is a characteristic observed during the Preclassic in sites like Cerros, Uaxactan, Colha, Seibal and Tikal (Laporte and Fialko 1995; Tourtellot et al. 1996). However, during the Late Classic and Terminal Classic the cultural activity increases and feature new patterns in the obsidian distribution at the site. During this period, the obsidian from El Chayal is not as restricted as it was during the Preclassic period. During the Terminal Classic period El Chayal becomes the dominant source and the obsidian from San Martin Jilotepeque that was more widely distributed at the site, now is clustered towards the foundational center of the site. In addition, the absence of green obsidian from Central Mexico and obsidian from Ixtepeque from the eastern Highlands of Guatemala indicates that Holtun might not have participated in some regional dynamics or interactions during the Terminal Classic period (cf. P. Rice 1984).

The obsidian distribution at Holtun might indicate the ability of the elite of the society to mediate the access to exotic goods. It is possible that these residential compounds belonged to competing factions of the society that interacted during the history of Holtun. Those factions, as defined by Brumfield (1994: 10) can be interpreted as sub-groups of the society, like clans or families that competed for power and prestige. This pattern is clear during the Postclassic period, though not addressed in this thesis, where a coalition of families integrated the groups that configured the epicenter of a site (Fox 1994: 158; Pohl and Pohl 1994: 141). Nevertheless, it is believed that social competition was a characteristic of elites and emerging leaders that characterized the dynamics of interactions among the Maya (Marcus 1996; Bove 1981).

The patterns of obsidian distribution at Holtun can be interpreted as the result of a social process to mediate and even compete for the access of exotic goods. The nature of the relationship between the factions at the site are still unclear. However, it is possible to approach some interpretations based on the obsidian distribution. One interpretation could be the social organization based on a "network" mode of interaction (Blanton 1998; Blanton et al. 1996; Feinman 1995, 2000). "Network" and "corporate" modes have been applied by Feinman (2001: 156) as explanatory models to analyze the origins of social complexity and the paths of action within Teotihuacan and Maya civilizations.

The corporate mode refers to a society or community, which is organized with more egalitarian tendencies. They are characterized by social segments that have joined through ideological and integrative means. The Network mode refers to a society or community based on individual endeavors. In this case the leadership has a tendency toward linear patterns and status can be inherited. The corporate-to-network continuum is a theoretical economic scale that transcend the linear progression of rank and status in a society (Feinman 2001: 160). The adaption of each of the modes is considered a dialectic of control, as described by Giddens (1984: 374) and Spencer (1993) where political and economic interests fluctuate from individual to collective strategies. In this case the network-mode is based on more exclusive power strategies, while the corporate-mode is based on more inclusive power strategies (Feinman 2001: 157). The corporate mode is not exclusive of non-egalitarian societies and can be observed in ranked societies.

The Network mode can be associated with the existence of secondary and tertiary elites proposed by Elson and Covey (2006) that structured pre-Columbian civilizations, which includes the ancient Maya. It has the potential to explain the complexity of sociopolitical organization between sites and within them. In addition, it may suggest that changes in the distribution of exotic goods across time may be the result of a fluctuation in the power strategies of the society. At Holtun we may be seeing network, or exclusionary economic strategies, earlier than we might have expected, during the Late Preclassic period. Although arguments for political development have identified kingship much earlier than once thought (Schele and Freidel 1998), economic exclusionary strategies during this time have less support. Additionally, especially during the Terminal Classic period, we may be seeing a more inclusive or network strategy in terms of the shift of distribution of El Chayal obsidian throughout the site as we may be witnessing a political "devolution" or breakdown into competing factions due to political upheaval in the region.

In conclusion, through the distribution of obsidian as an exotic good, it is possible to place Holtun within larger regional, sociopolitical dynamics. In addition, it suggests that the internal organization of the site fluctuated in terms of political strategies highlighted by access to exotic goods. The transition from the Middle Preclassic through the Terminal Classic period indicates processes of transformation in the capacity to acquire exotic goods at the site. Although the faction that administrated the foundational site has a permanent influx of obsidian, through time the groups that coexisted in the epicenter of the site developed the faculty to access an exotic good that was previously restricted.

Summary and Conclusions of Chapter 1

Maya society was characterized by political activities that were highly intertwined with ritual. The level of social stratification changed through time and it was manifested at the individual level as well as a regional level. The settlements and cities were also stratified with ranking and subordination by powerful polities. The maintenance of hegemony was important for the success of a polity, and it caused complex dynamics of interactions among Maya polities. Prestige and status were supported by displays of material culture, which were enhanced by the acquisition of exotic goods. Therefore, the support of exchange systems and trade routes was vital for the maintenance of power and hegemony. Obsidian artifacts are some of the most abundant exotic goods in Mesoamerica. The geochemical characteristics of these objects allows for the traceability of the source. This thesis will describe the evidence associated with acquisition and distribution of obsidian artifacts at Holtun from the Middle Preclassic through the Terminal Classic periods.

The first chapter of the thesis includes a brief introduction to ancient Maya archaeology and the research performed in the Central Lakes Region in Peten, Guatemala. The second chapter is a description of the theoretical and methodological approach addressed to perform the analysis on the obsidian artifacts. The third chapter consists of the description of frequencies of artifacts by source, by period, and by location. With the aid of maps created with GIS methods, it is possible to observe the variability in consumption and distribution of obsidian at Holtun across time and space. Finally, Chapter 4 presents a discussion of how that variability is associated with the processes experienced by the ancient Maya from the Preclassic through the Terminal Classic periods. In the conclusion, the impact and benefits of using GIS for the spatial analysis of artifacts to highlight cultural processes is discussed.

CHAPTER 2: METHODS FOR SAMPLING AND ANALYSIS

Settlement Pattern and Mapping in Maya Archaeology

Settlement archaeology is the subfield of archaeology that encompasses the studies focused on the spatial distribution of archaeological remains. According to the theoretical and methodological approach, they can be called Settlement Pattern, Settlement System, or Landscape Archaeology. Settlement Pattern analysis is a theoretical and methodological approach that has been applied in archaeology for the study of ancient cultures through the distribution and adaptation of its remains over the landscape (Kowalewsky 2008; Parson 1972; Trigger 1965, 1967). These remains are related with all the stages of ancient human occupation at the site and evidence the social processes experienced by the residents across the time (Chang 1968: 3). Settlement Pattern analysis can be a theoretical as well as a conceptual approach due to its capacity to formulate theory, which helps archaeologists to interpret the human processes through the cultural landscapes of sites. It can also be methodological, because it consists of a scientific procedure that performs measurements over the landscape to analyze the relationship among ancient people, and associate them with their natural and social environments (Parsons 1972: 145).

Surveying and mapping procedures in the Maya area began with the arrival of new explorers. For example, in the 19th century, the pioneering explorer John Lloyd Stephens published within his famous *Incidents of Travel in Central America, Chiapas, and Yucatan* a map of the site Copan made by Frederick Catherwood (1854: 81). The beginning of formal archaeological projects included the elaboration of site maps and, consequentially, an interest for the cultural patterns implicit in the particular organization of the sites (Ricketson 1933;

Wauchope 1934). One of the earliest maps created by an archaeological project in the Maya area occurred at the site Uaxactun, Guatemala by the Carnegie Institution of Washington (Ricketson 1933). On this map, archaeologists were able to see the relationship of residential areas within the ceremonial center and begin to question the nature of such relationships.

The first two international attempts to do settlement pattern analysis were performed by Gordon R. Willey in South America and Graham Clark in Europe (Siebert 2006: xiii; see Clark 1951). Willey (1948) geographically described and organized the horizon styles in Peruvian archaeology and later published the results of an archaeological project on his *Prehistoric Settlement Patterns in the Viru Valley* for the Bureau of American Indians (Willey 1953). This is considered historically as one of the more transcendental publications related to Settlement Pattern analysis. Nevertheless, it was the publication of *Prehistory Settlement Patterns in the New World* in 1956 which started the consideration of Settlement Pattern studies as an archaeological topic (Parson 1972: 129). Soon, Settlement Patterns were adapted to the regional variation of archaeological contexts around the world and developed particularly in Europe and America (Kowalewsky 2008: 229).

Mesoamerican archaeology played an important role in the development of Settlement Pattern archaeology, with the development of two main traditions, one in the Maya area and the other in Mexico. The Maya tradition began with Willey and colleagues (1965), who conducted the Middle Belize Valley Project. This tradition was later followed by other scholars, who performed settlement studies around the Maya area (e.g. Ashmore 1981; Vogt and Leventhal 1983). During the same period, the Mexican tradition was generating Settlement Pattern research in the Central Mexico (see Sanders, et al. 1979; Parsons et al. 1982) and the Oaxaca Valley (see Flannery 1976). Likewise, Settlement Pattern archaeology was performed across the world during the 20th century (Kowalewsky 2008), resulting in information that has been used for comparative analysis. For example, settlement pattern studies from ancient Southeast Asia have been used to understand patterns in the settlement of the Lowland Maya (Coe 1957; Demarest 1992).

The 20th century experienced methodological and theoretical advances in archaeology, the study of archaeological settlements experienced some variations. The first variation is the result of a movement known as the New Archaeology, which incorporates the study of behavioral aspects of the culture with a focus on larger social processes (Trigger 2006: 418-420). One of the variations was the modification of methodological and theoretical approach of Settlement Pattern studies to Settlement Systems. This variant incorporates the conditions that generated the physical organization of cultural settlements on regional landscapes (Flannery 1976: 162). It included the incorporation of sampling methods and statistics to guarantee the accuracy and reliability of each study (Plog 1976: 148).

Later, nearing the beginning of the 21st century, with the influence of postmodernism in anthropological thought, settlement archaeologies experienced a new variant called Landscape Archaeology (Ingold 2000: 195; Trigger 2006: 473). Contrary to the rigorously scientific approach of Settlement Pattern and Settlement Systems archaeologies, Landscape Archaeology incorporates subjective variables. This phenomenological approach stems from developments Post-processual archaeology, which criticizes the lack of consideration of human subjectivities in archaeological remains (Johnson 2010: 199). As Hodder (1977: 258-259) indicates, archaeological settlement not only features frequency and distribution of artifacts, it evidences the cultural practices embedded in the process of accessing and exchanging the products. Likewise, variables like agency (e.g. Barret 2001: 148; Pauketat and Alt 2005), gender (see

Conkey and Spector 1984), materiality (see Taylor 2008), and memory (e.g. Knapp and Ashmore 1999: 13; and Sassaman 2010) begin to be considered in archaeological research. For that reason, considering subjective variables as part of the experiential interaction with the landscape allows for a better understanding of the interconnected process of artifacts with their social and natural environment (Lazzari 2005). Therefore, the cultural landscape is the environment materialized by people during the process of experiencing it (Ingold 2000: 195). This means that the archaeological traits remain attached to the environment, creating the archaeological landscape that is subject of study and interpretation (Knapp and Ashmore 1991: 1).

In order to perform a Settlement Pattern/System or Landscape archaeology analysis, a survey and, as a result, a map are created as a source of analysis. The aim of this is to provide physical and cultural information of archaeological traits on the mapped site. This information will include the exact position of the element, its physical appearance and the relationship of it within its context (Howard, 2007: 7). The performance of an archaeological survey and mapping project will require the employment of techniques and methods introduced from Earth Sciences.

The most recent contribution of Settlement archaeologies to archaeological theory and method is the implementation of Geographic Information System analysis, known as GIS (Weatley & Gillings 2000). This type of analysis allows for deconstruction of the elements recorded on a map, allowing for the separation of these elements and resulting in their classification into categories for further analysis. That information can be physical, geographical, cultural, environmental or even symbolic. As it is classified, it is entered into standardized datasets to be stored, manipulated, analyzed, compared and displayed in the shape of a cartographic product. As a complementary improvement, the recent technological innovations have achieved the integration of Computer Science with Earth Science cartographic methods, including GIS. Such combination of methods and techniques is known as Geomatics, which is a discipline that performs all cartographic procedures on a digital format (Ghilani and Wolf 2014).

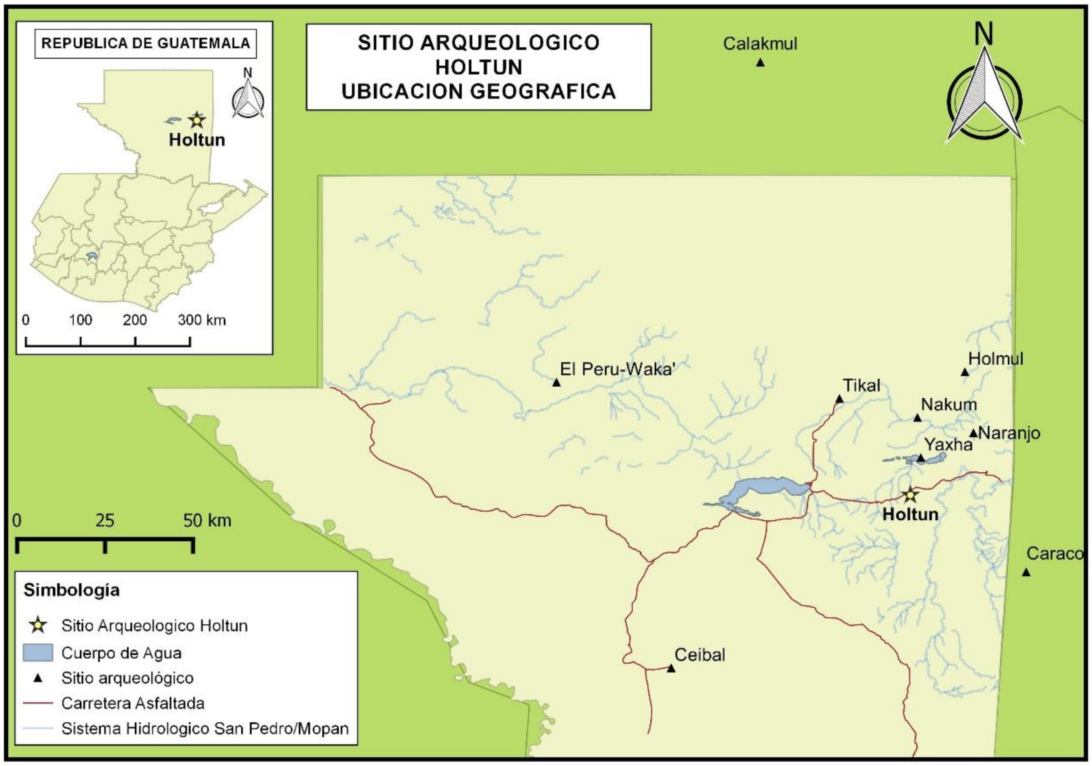

Figure 2: Localization of Holtun in the northeast of Peten, Guatemala. (Elaborated by the author in Callaghan et al. 2016 and Callaghan et al. 2017b)

<u>Holtun</u>

The site of Holtun is an archaeological complex located in the lakes region at the northeast extreme of the department of Peten, Guatemala. It is adjacent to the modern village of La Maquina, in the municipality of Flores, 12 km southwest from the monumental site of Yaxha (Kovacevich et al. 2011: 226). The site is located approximately 35 kilometers southeast of Tikal and 12.3 kilometers southwest of Yaxha in the coordinates UTM 241907-1877690 (Ponciano 1995: 485).

The settlement of Holtun is positioned on top of a karstic elevation, which is the beginning of a mountain chain that defines the morphology of Yaxha-Labna basin. The site consists of approximately 300 mounds organized into residential and ceremonial groups. These groups are organized around patios and plazas in areas that the topography allowed for settlement. The patios and plazas are open areas between the architectural compounds that utilize limited horizontal space available. The site is organized in four sectors: the Northeast Sector, the Southwest Sector, the Northwest Settlement, and the Southeast Settlement as shown in Figure 8.

The Northeast Sector is a compound of five architectural groups organized around 8 plazas. The Southwest Sector is a locus of 6 architectural groups organized around 12 plazas. The Northwest Settlement is a cluster of 30 groups settled on a slope and headed by the mound compound known as Group G. The Southeast Settlement is an area with five architectural groups settled in the top of the hills that connect Holtun with the mountains of Yaxha-Labna basin. The architectural group known as Group H heads this group to the northwest.

Although the extension of Holtun is modest in comparison with other archaeological centers in the area, it contains elements that evidence the intensity of cultural practices and the integration to Maya cosmovision. The site contains a building in Group B with a tripartite compound of elements at the top of the structure (see Figure 10). In Plaza F-B the structures comprise and *E-Group* ceremonial plaza for astronomical commemorations (see Figure 15). In addition, Groups B and F contain buildings with architectural facades made of stucco known as *mascarones* as the one shown in Figure 7. One of those *mascarones* was the inspiration for name the site as Holtun or *head of stone* in Mayan language. Finally, in a recent discovery at the site, archaeologists have found a cruciform cache dug into bedrock in one of the main buildings in Group F that has similarities with foundational dedicatory offerings in other sites like Ceibal and

Holmul (Callaghan et al. 2016; Callaghan 2016b, Callaghan 2017). All the elements previously listed are associated with ritual activity performed at sites during the Preclassic period, some of which continue during the Classic period.

The Environment of Holtun

The settlement of Holtun is characterized by its location atop a karstic plateau shown in Figure 5. That location could have conditioned the economic and political history of the site during its different periods of occupation. The site is located in the southwestern extreme of a lacustrine closed basin that drains into the Yaxha-Labna lagoon system. This is the eastern extreme of a region in the Maya Lowlands known as Central Peten lakes region (Rice and Rice 1985; Segura 2012). The lagoons are the result of a geological formation, which resulted in two elongated bodies of water placed one next to the other. They have an east-west orientation, with shoreline lengths of 20 km for Yaxha and 12 kilometers for Sacnab (Rice and Rice 1980: 434). A distinctive geographic characteristic is the closed morphology of the basin; it does not have any alluvial interaction with the neighboring basins. The lakes and the forests rely on the rainy season and humidity, which seasonally floods some adjacent areas. (Brenner et al. 2002: 2).

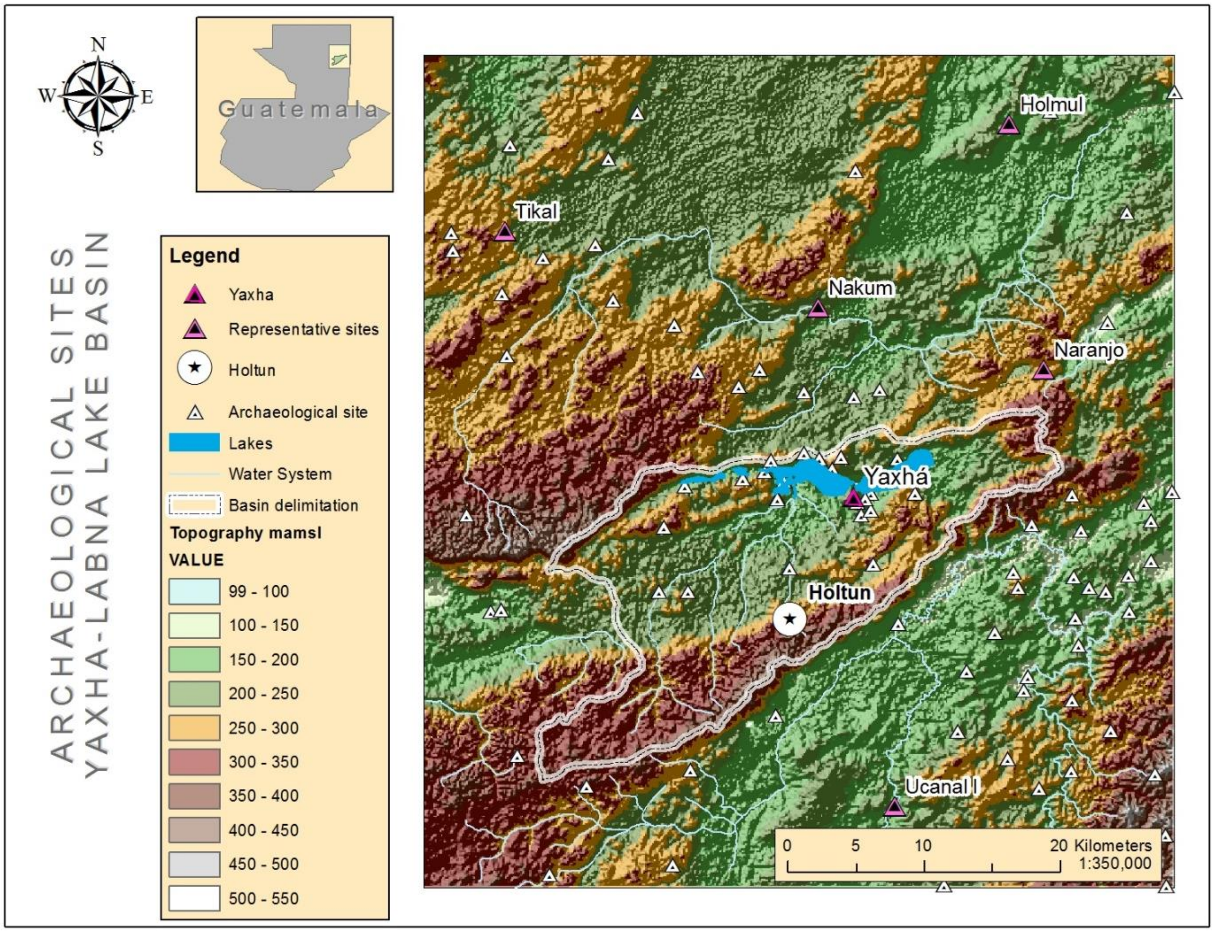

Figure 3: Regional Map of Yaxha basin featuring the topography of the area and the sites settled within it (Created by the author).

The orography of the basin creates a contour of mountains with low elevation that barely surpass 450 meters above the mean sea level. These elevations are part of mountain chains that run through the Maya Lowlands and terminate in the Central Peten lakes basins. Botanical analysis has revealed that the basin supports four different types of vegetation. The tall upland forest and the forest in humid slopes, the upland forest in no-inundation areas, the swamp forest and thickets, and the zones that are seasonally or partially inundated as shown in Figure 3 (D. Rice 1977; 1978; Rice and Rice 1980: 435).

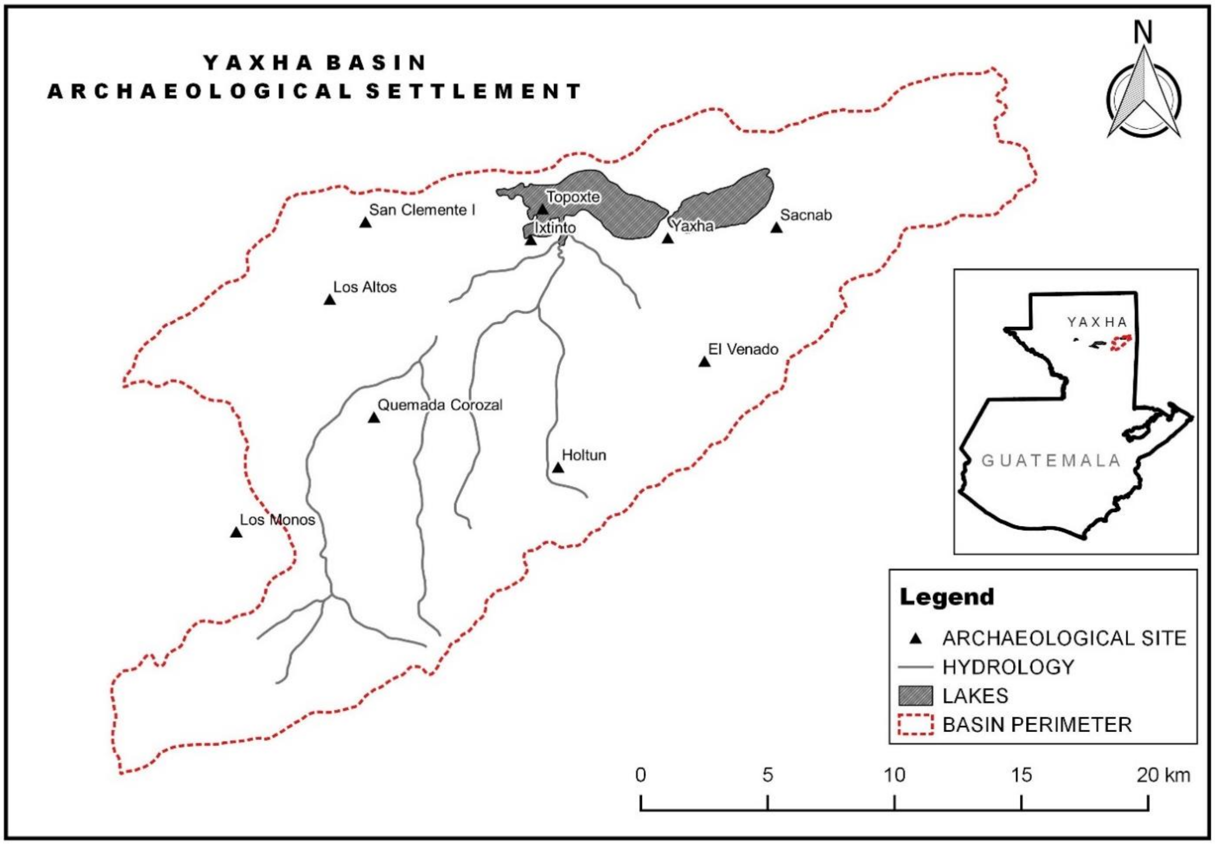

Figure 4: Map of Yaxha-Labna basin featuring the location of important archaeological sites (Created by the author).

Topography of Yaxha-Labna basin features an aperture to the northeast that connects to the Holmul river system, and to the west connecting with other Central Peten lakes. However, the water within the basin never drains toward these directions as seen in Figure 2. These two geographic connections place the basin in a special location that constitutes a watershed between two important hydrographic slopes. The first is the hydrographic system that drains to the east towards the Gulf of Mexico, and the second drains to the east, towards the Atlantic Ocean through Belize. For that reason, Yaxha-Labna basin represents a node of interaction between the riverine systems of Holmul, Mopan, and San Pedro Martir rivers as seen in Figure 2 and Figure

3. In addition, the basin hosts a variety of sites settled in elevations across the area, including the monumental Yaxha and Holtun. It demonstrates that the basin has the appropriate conditions to develop settlements that participated in the complex dynamics of the ancient Maya world (see Figure 4). Rice and Rice (1980: 449) suggest a general trend in the settlement patterns of the region. They observed that the sites within the basin experienced an apogee in cultural activities at the end of each period of Maya history.

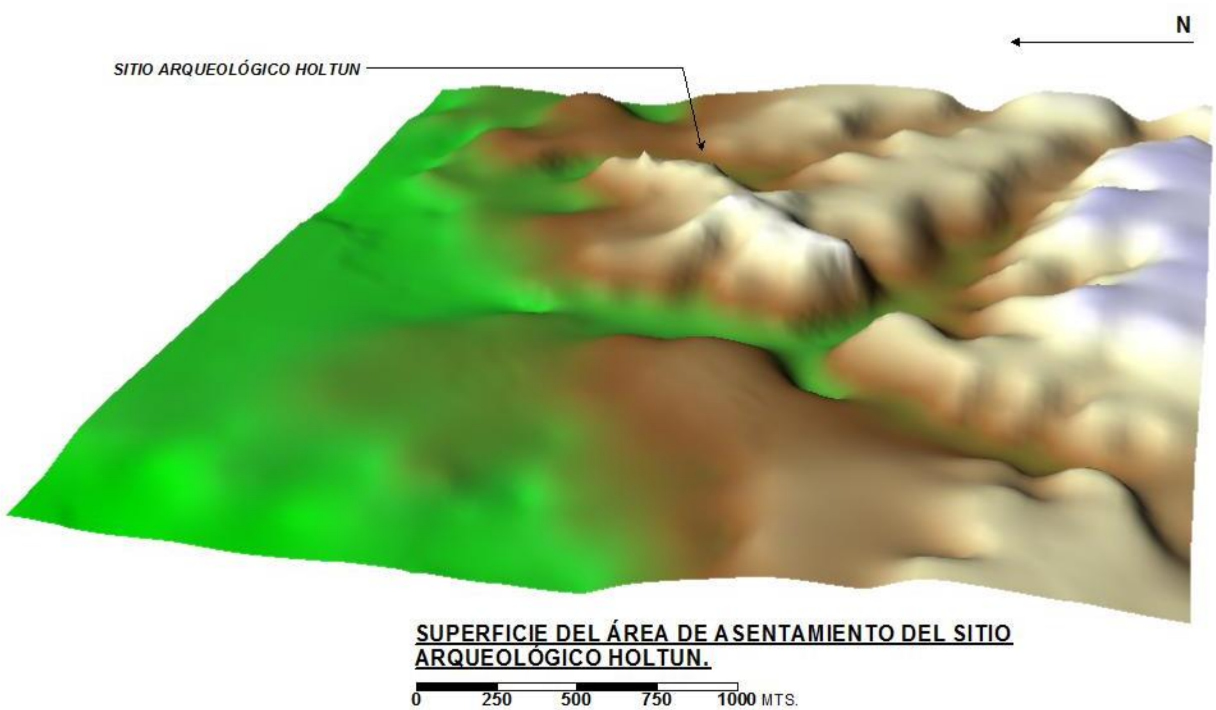

Figure 5: Digital representation of the topography where the site Holtun is settled (Guzman 2014).

Archaeology at Holtun

The first site reconnaissance was performed by E. Ponciano (1995) who created the first sketch of the architectural distribution and coordinated the protection of the ruins, which resulted in the declaration of Holtun as a national park. Since then, Holtun has constituted a point of interest in the endeavors of conservation of the cultural landscape by the functionaries of Yaxha National Park (Quintana 1996: 25). In 1997 and 1998, Vilma Fialko conducted an archaeological project at the site, which included the creation of a topographic map, excavation of test pits and consolidation of vulnerable architecture (Fialko 1999; 2002). Later, beginning in 2010, the site of Holtun has been researched by American archaeologists from University of Central Florida (UCF) and previously Southern Methodist University (SMU) in collaboration with local archaeologists from San Carlos and Del Valle Universities of Guatemala. The multidisciplinary project has focused on excavations, material analysis, and archaeological cartography (Callaghan et al. 2016; Kovacevich and Castillo 2011; Kovacevich et al. 2012). Research objects for the current project focus primarily on the rise of social inequality by comparing settlement patterns and material culture from elite and commoner residences.

Holtun Archaeological Project

The information used for this thesis is based on data collected during the field and laboratory seasons of Holtun Archaeological Project (HAP). The Project originated as an academic initiative by Brigitte Kovacevich and Michael G. Callaghan, both faculty members in the Department of Anthropology at the University of Central Florida, in Orlando, FL. The project conducted its first field season in 2010, however the preparation and selection of the site began years before. Today, the project has performed research in the area for more than six years. It has included the participation of archaeologists and students from a diversity of universities in the United States and Guatemala. As a consequence, the project has hosted a diversity of specialists in different areas of expertise within archaeological research. Since 2010, the author has participated as the specialist in archaeological mapping and cartography for the HAP.

As mentioned above, the first season was performed between July and August of 2010. Fieldwork was conducted by Brigitte Kovacevich and Guatemalan co-director Patricia Rivera Castillo, with the collaboration of Michael Callaghan and the author (Kovacevich and Rivera 2010: ii). The general objective of the project was to understand the elements that conformed the Preclassic period in Holtun, focusing on political and economic changes, which occurred at the end of this period and the transition towards the Classic period. The specific objectives of the season were: 1. The creation of an archaeological map with digital technologies; 2. Surveying the surrounding areas of the architectural epicenter to assess the physical extension of the site; and 3. Monitoring of the presence of looter's excavations perpetrated in the main structures (Kovacevich 2010: 7). The existence of previous maps created with analogous methods (Fialko 2002; Ponciano 1995: 491) contributed to the rapid finding and measurement of architectural features at the site. As a result, the project was able to plan further research based on an accessible, reliable and accurate map of the site (Rivera and Kovacevich 2010: 33).

The second field season was performed between May and July of 2011. Conducted by Brigitte Kovacevich and Guatemalan co-director Patricia Rivera, with the aid of a team archaeologists and students from the United States and Guatemala. The objective of this season was the excavation of test pits in the main plazas of the site. It allowed for the identification of constructive stages for each architectural group as well as the establishment of an initial chronology of the site. Special attention was given to the plazas associated with elements of Preclassic architecture, like Group F where the *E-Group* ceremonial complex is located (see Figure 15). This type of architecture consist of eastern ranges structures and western, pyramidal observation structures with open plazas that are commonly associated with rituals of astronomical commemoration. In addition, E-Groups were used for a ritual of a public commemoration of a site foundation including offerings that represented the recreation of the quadripartite cosmos (Callaghan 2017; Estrada-Belli et al. 2006; Doyle 2014). Also, during this season the process of mapping continued providing updates to the general map by including other architectural groups and archaeological features present in the site (Kovacevich and Rivera 2011: 7-8). As a result, the season ended with the excavation of 30 test pits across the site and the mapping of 7 new architectural groups that added to the map of the site (Kovacevich and Rivera 2011: 267; Guzman 2011: 264).

The 2012 field season consisted of the analysis of artifacts collected during the season 2011 (Kovacevich and Cardona 2014: 13). The research on materials followed the general objective of the project, which was to understand the emergence of social complexity at the site. During this season, the first obsidian samples collected during the excavation season in 2011 were analyzed using a portable X-Ray Fluorescence instrument. In addition, the project selected ceramic samples to perform Petrographic Analysis and Instrumental Neutron Activation Analysis (INAA). And finally, the project selected samples of charcoal found at the excavation in order to perform radiocarbon analysis.

Two years later, in 2014, the project performed the third excavation season and the fourth research season in the area. During the field season, a team of American and Guatemalan archaeologists performed excavations on the plazas D, F-A and F-B as a continuation of the test pits performed there on 2011 (Kovacevich and Cardona 2015). The methodology of excavation changed this year under a governmental requirement. Starting this season, all the excavation units were restricted to the dimension of 1.00 by 1.00 meters and any extension should follow this parameter. The project performed cruciform trenches on the plazas and took soil samples from perforations made with a soil auger. In addition, the mapping process continued and more elements were integrated into the map.

The next research season was performed in June of 2015. It consisted of excavations in the plazas F-A, F-B and H. It included excavations to uncover architectural elements from the eastern and western buildings in the group of buildings surrounding Plaza F-B (Callaghan et al. 2016). The season also included the continuation of the mapping project. The map was augmented with the integration of a new cluster of n=89 mounds organized in 29 groups settled on a slope in the northwest side of Group F (Guzman 2015: 33). In addition, the laboratory season allowed for the analysis of materials collected from the excavation, like obsidian (Kovacevich and Crawford 2016), faunal remains and shells (Bishop 2016) and Ceramics (Callaghan 2016a).

Finally, the most recent research season was performed between June and July of 2016 (Callaghan et al. 2017). The season consisted in the performance of excavations on plazas E, F-A, F-B, F-C, F-D, and H. The excavations were extended towards the eastern and western buildings in the architectural compound known as Group Plaza F-B. The excavations in Groups Plaza F-A and F-B allowed for the discovery of early ritual activity. These ritual practices were represented by the presence of altars and a cruciform cache. The cruciform cache was found under an early building discovered beneath the eastern mound at Group Plaza F-B. These type of caches have been found in several early sites dating Middle Preclassic period. They are associated with the ritual process of site foundation; the design and content suggests the symbology of ancient Maya cosmovision based on the quadripartite vision of the universe (Estrada-Belli et al. 2006: 699, Smith 1982). The finding allowed for the interpretation of Plaza

F-B as the foundational center of Holtun (Callaghan et al. 2016; Callaghan 2017). The season also included the continuation of the mapping process. This allowed for the integration of other residential households settled in the southeast segment of the site. In addition, the reconnaissance activities allowed for the documentation of water springs that could have been used by the ancient inhabitants as a source of food and water (Guzman 2017).

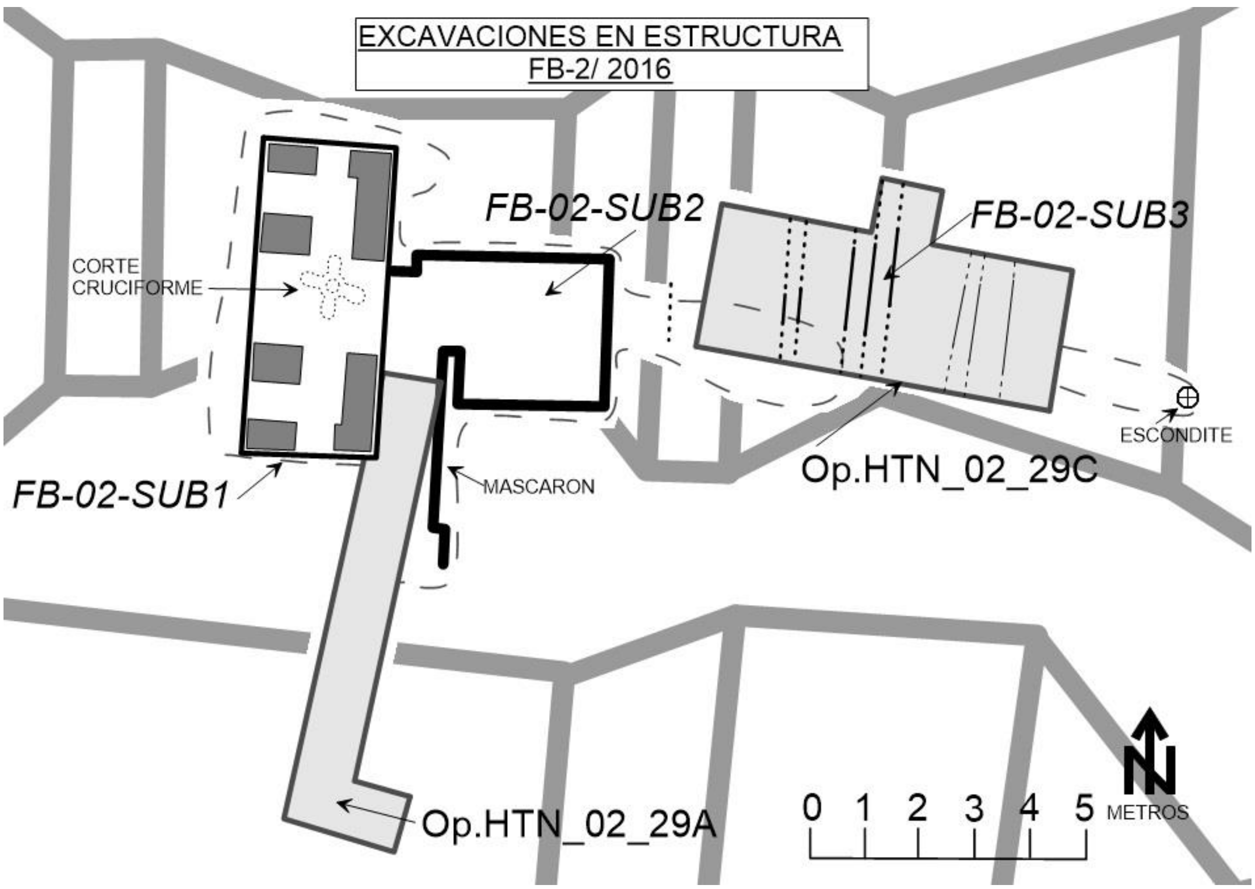

Figure 6: Excavations at the eastern structure of Group F-B featuring the location of the cruciform cache (*corte cruciforme*) and the southern *mascaron* (May by the author, from Callaghan 2017)

Figure 7: Photogrammetry and volume digital rendering of southern *Mascaron* from eastern structure in Group F-B (Image created by the author).

The Map of Holtun

The first version of the map was created by the Guatemalan archaeologist Erick Ponciano (1995), who in 1994, visited the area and drew a sketch of the monumental epicenter of the site. In his report, he indicated that the site was composed of 86 structures organized in four groups identified with the letters A, B, C and D. Later, in 1997 and 1998, a project of reconnaissance and mapping was conducted by Vilma Fialko (1997; 2002) and a team of archaeologists. In addition to mapping, they performed some excavations and important conservation work on the looted structures.

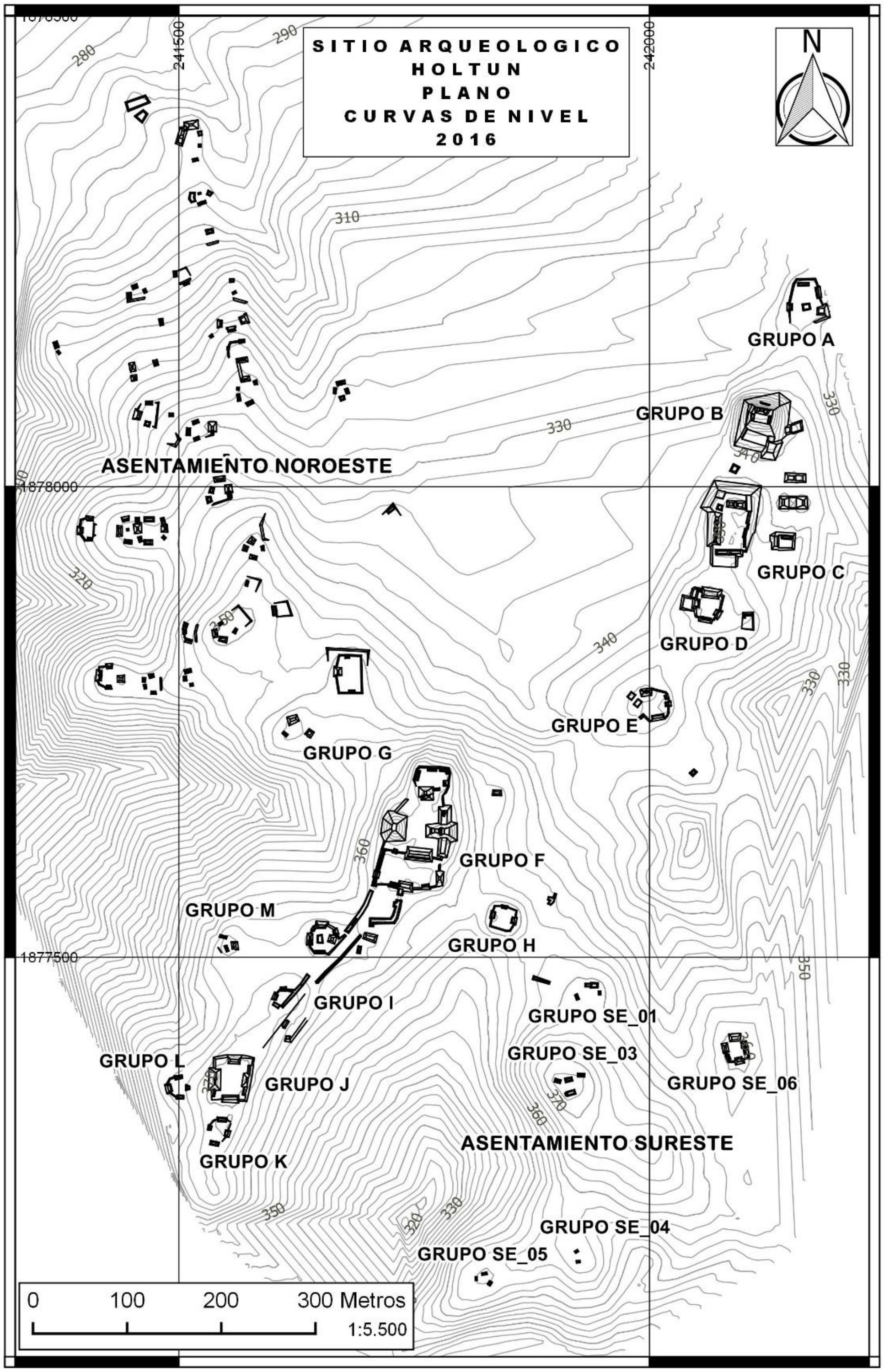

Figure 8: Topographic map of Holtun featuring the spatial distribution of the architectural groups (Guzman 2017).

The main product of the 2010 season was the creation of a new map of the site. This new map was created on a cartographic software based on digital information collected at the site. This map was intended to be updated according to the advancement of mapping procedures at the site. In addition, the new map offered the possibility to be digitally manipulated using Geographic Information Systems and 3D modeling (Guzman 2010). The subsequent seasons allowed for the continuity of mapping and reconnaissance activities. As a product of this, in 2011 the map included all the groups and plazas in the epicenter of the site as well as the location of the excavations performed that year (Guzman 2011). In 2012 and 2013 the mapping project of Holtun was focused on regional information, collecting part of the cartographic information associated with the site provided by the National Institute of Geography of Guatemala. In 2014, the mapping project integrated the boundaries of the site and some mounds on the periphery. During that process, some mounds were observed on a slope at the northwest of the site. Mapping those groups became one of the objectives of the 2015 season. Those groups constituted a cluster of mounds organized in groups that were integrated into the map as the Northwest Settlement. The map of 2016 integrated a settlement of medium-sized groups in the southeast segment of the site (see figures 8 and 26). The land surveying was performed with the following instruments: Total Station Sokkia SET6F (Guzman 2010: 11), Total Station Sokkia SET 5 10/D21866 (Guzman 2010: 11; Guzman 2011: 239; Guzman 2015: 166), Total Station Trimble M3 (Guzman 2016: 29), and Total Station Leica FlexField Plus TS06 (Guzman 2016: 33).

The creation of the map allowed for the classification of the site into mounds, groups, and plazas. The mounds are the evidence of construction found on the surface that are undergoing the effects of taphonomic processes, including gravity, decomposition of materials, rain, forest growth, and looting. The groups consist of clusters of mounds organized around patios and plazas. There are 56 groups of all dimensions documented at the site. Some of these groups are organized around a leveled platform that constitutes a plaza. The main groups at the site are categorized in alphabetic order and the plazas are given same letter as their corresponding group. For example, Plaza F-A is the open space that exists between the cluster of mounds that compose Group F-A (see Figure 14).

Description of the Groups

The map of the groups and the settlements around the site was created by the author during the 2010-2016 field seasons of HAP. The groups A through H were mapped during the first field season (Guzman 2010). Groups I through L were mapped and added to the map in the following season (Guzman 2011). The Northwest Settlement of the site was mapped and integrated into the map during the field season in 2015 (Guzman 2016). Finally, the Southeast Settlement was mapped and added to the map in the most recent field season in 2016 (Guzman 2017). The mapping process included the topographic surveying of land morphology. All the groups will be described individually in the following segment.

Group A is located on the northeast limit of the settlement at Holtun, as observed in Figure 9. It is composed of a cluster of five mounds nucleated around a patio and dispersed towards the south. The whole compound is settled on a leveled platform that allowed for the distributions of all the architectural elements. The mounds feature a batter on their external segments that works as a counterfort for the stabilization of the structure on the elevated platform. The group is characterized for the presence of a mound in the center of the patio/plaza.

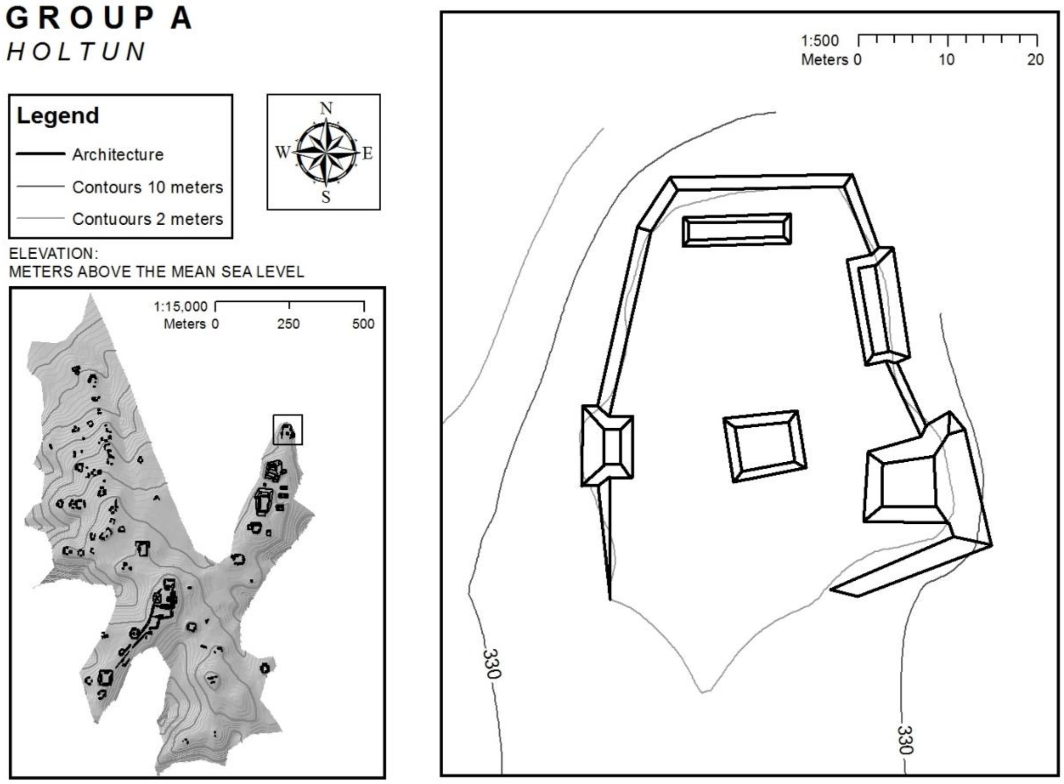

Figure 9: Group A at Holtun (Map created by the author).

Group B is located in the northeast portion of the settlement, southwest from Group A and northeast from Group C, as shown in Figure 10. It is composed of a colossal structure of four architectural volumes. The first one is the basement, and it has an open patio oriented towards the south. The second is placed on top of the basement and has a group of three mounds placed at the top of the architectural body. The third joins the structure in the southeast portion. Finally, the fourth adjoins on the eastern side, at the level of the surface. The tripartite composition of mounds at the top indicate that this is probably a triadic group (Fialko 2011: 482; Ponciano 1995). Triadic groups are architectural compounds associated with the ritual foundation of sites, especially during the Preclassic period. In addition, the earlier constructive phases of the group contain sculptural facades in the shape of deity masks (Fialko 2003). The largest facade, uncovered by a looter trench, was the inspiration for the modern name of the site: *Head of Stone* or Holtun in Mayan.

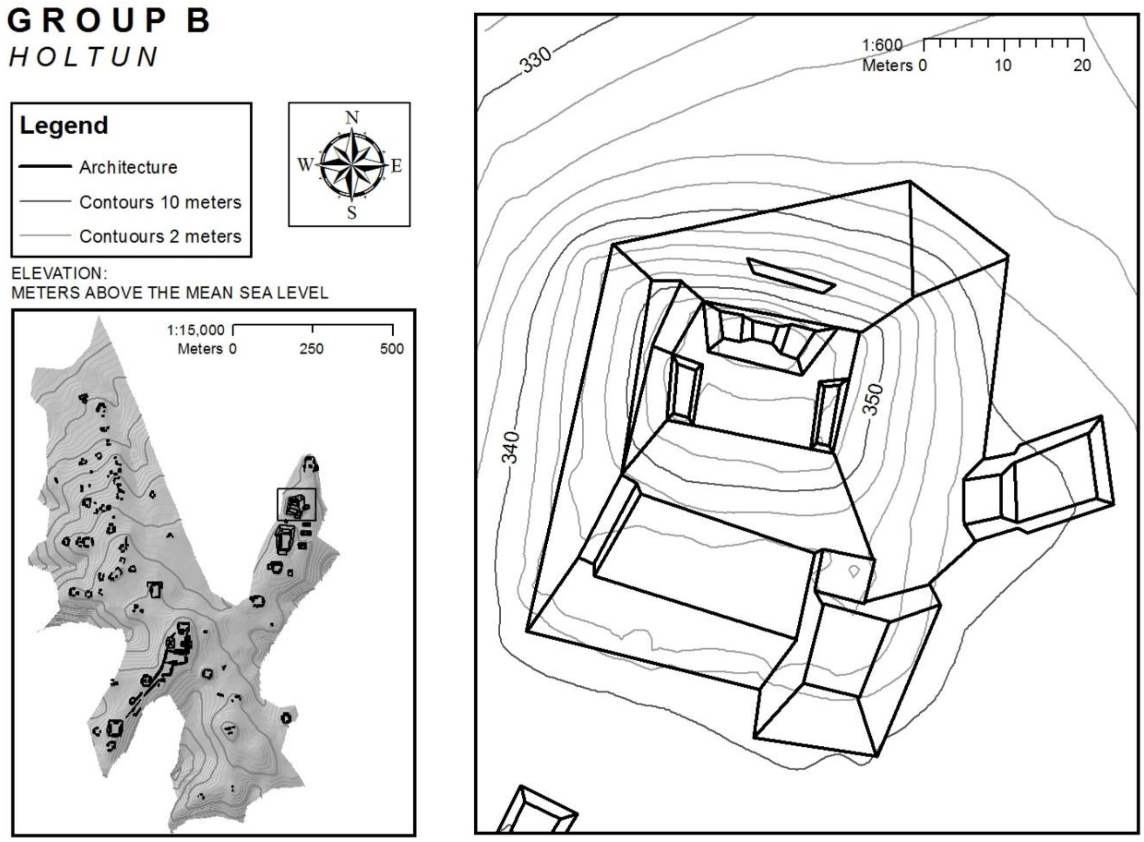

Figure 10: Group B at Holtun (Map created by the author).

Group C is located in the norteast portion of Holtun, to the south of Group B and north of Group D, as described in Figure 11. It is composed of three architectural compounds neighboring each other. The first is a palace-style compound located in the western extreme of the group. It consists of a group of seven structures organized aound a closed square patio. The whole compound is placed on an elevated platform that creates a separation from the other patios of the groups, but joins the level of Group D with the plaze to the south in Group C. The second compound consists of three mounds located in the northeast portion of the group. One of the mounds heads this compound and the other two are located one across from the other in the south. It is possible that these two mounds constitute a ballcourt (Fialko 2011: 482). The third compound is conformed for another elevated platform in the southeast of the group, that contains two mounds on top of the platform. In addition, the open space between Group B and Group C known as Plaza BC is a leveled surface with a mound in the center.

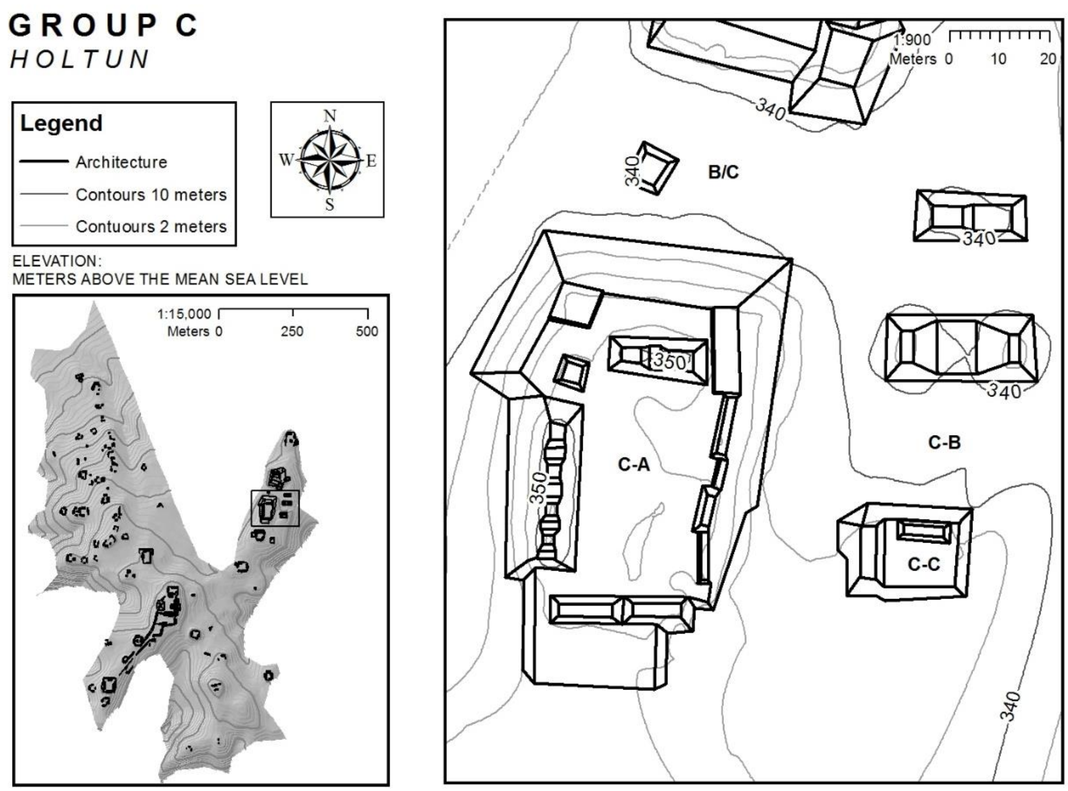

Figure 11: Group C at Holtun (Map created by the author).

Group D is a compound of two platforms located in the northeast portion of the site, north of Group E and south of Group C, as seen in Figure 12. The western platform cointains four mounds organized around a closed patio known as Plaza D. The mounds are settled in a cruciform shape at the north, south, east, and west of the plaza. One platform adjoins to the west side of this compound. The eastern platform is smaller that the western and contains only one mound with an L-shape.

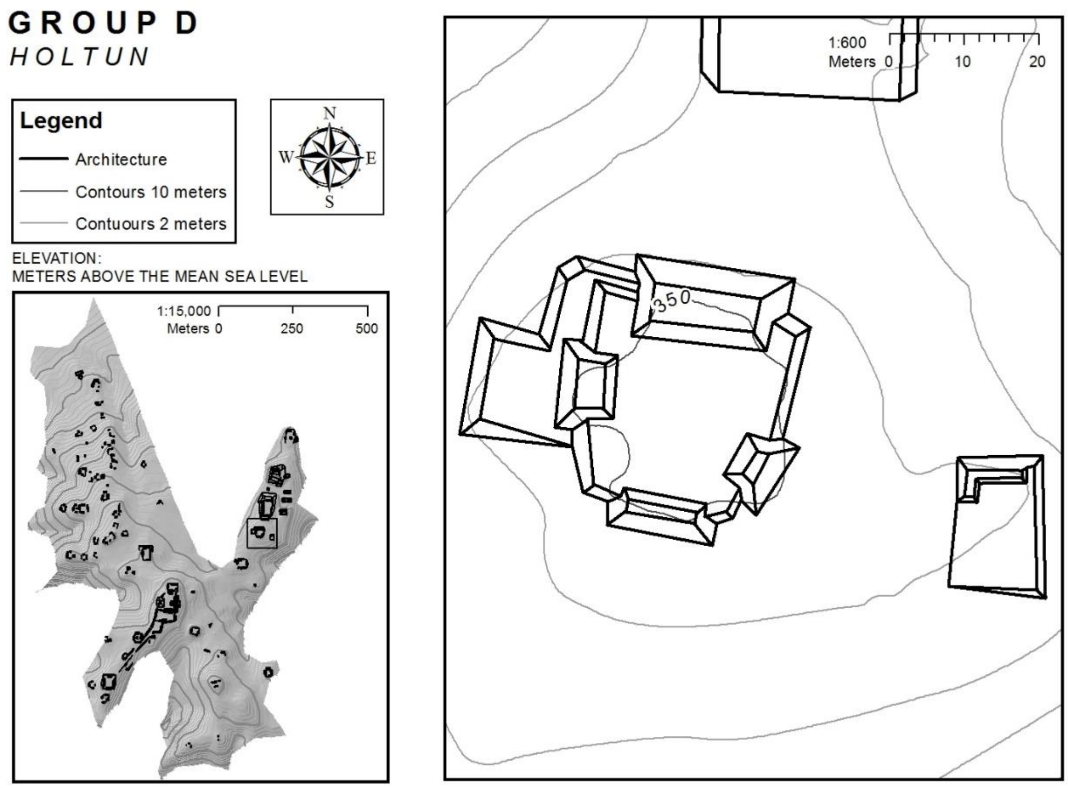

Figure 12: Group D at Holtun (Map created by the author).

Group E is located at the soutwestern side of the northeast protion of the site, northeast of Group F-B and southwest of Group D, as seen in Figure 13. It consists of a cluster of seven mounds organized around a plaza, and an individual mound located at the southeast of the plaza. The highest structures are situated on the north and east side of the plazas.

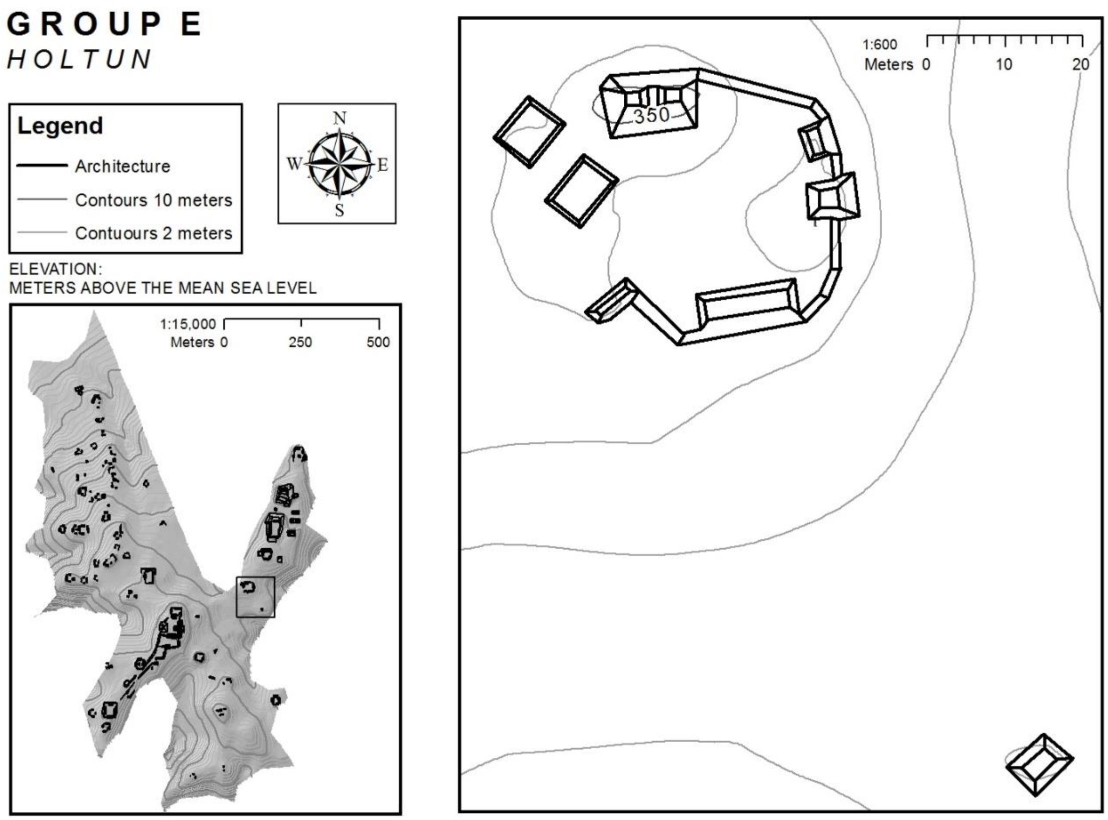

Figure 13: Group E at Holtun (Map created by the author).

Group F-A is an elevated platform located north of Group F-B as seen in Figure 14. It is even with the level of the adjacent Group F-B and surrounded by steep surfaces on its north, east, and west side. It is composed of five mounds organized around Plaza F-A. The higher mounds are located in the south and east of the group. This group constitutes the northern portion of the central sector of Holtun. The mounds are primarily residential and are associated directly with the ceremonial architecture located in Group F-B.

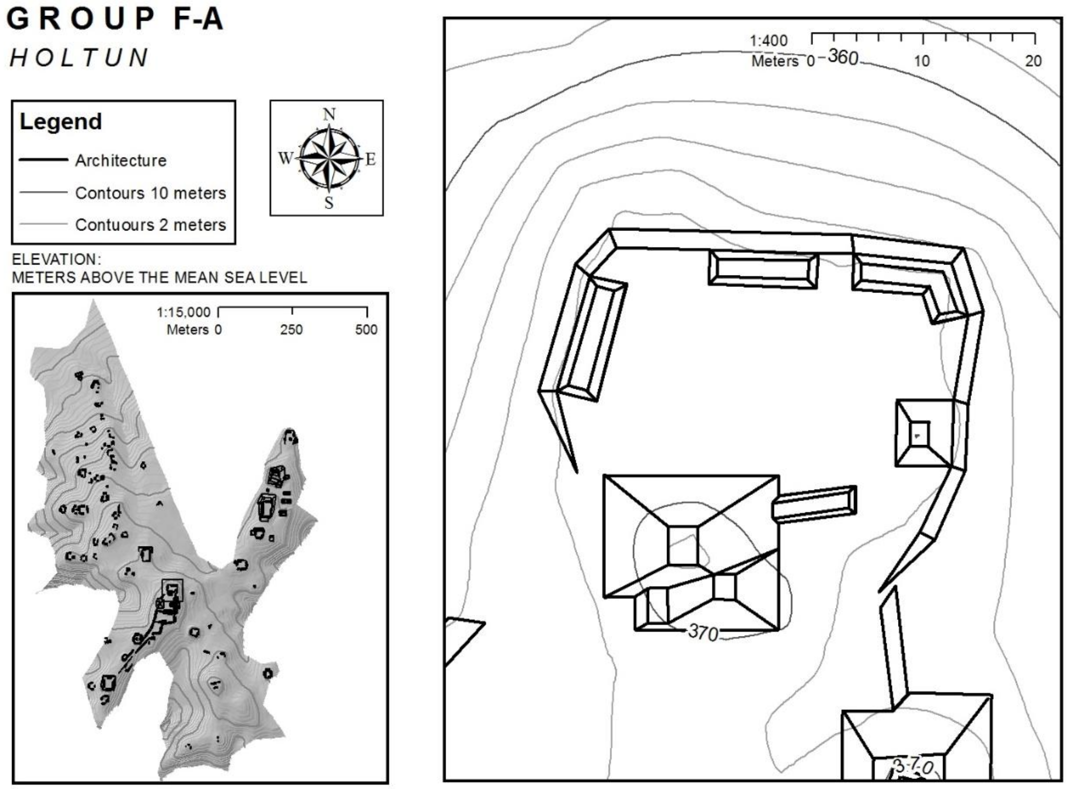

Figure 14: Group F-A at Holtun (Map created by the author).

Group F-B is located in the central sector of Holtun, north of Group F-D and south of Group F-A, as seen in Figure 15. This group is a compound of four structures organized around Plaza F-B. The northern structure is joined with the southern structure of Group F-A. In the same way, the southern structure becomes the northern structure of Group F-C. The western and eastern structures are a compound known as an *E-Group* a type ceremonial complex, the former being a pyramid and the later, a building a range structure for ritual commemoration. This was probably the foundational center of the site where the dedicatory cruciform cache was first cut into bedrock before monumental construction began (see Figure 6) (Callaghan 2017; Callaghan 2016 et al. 2016).

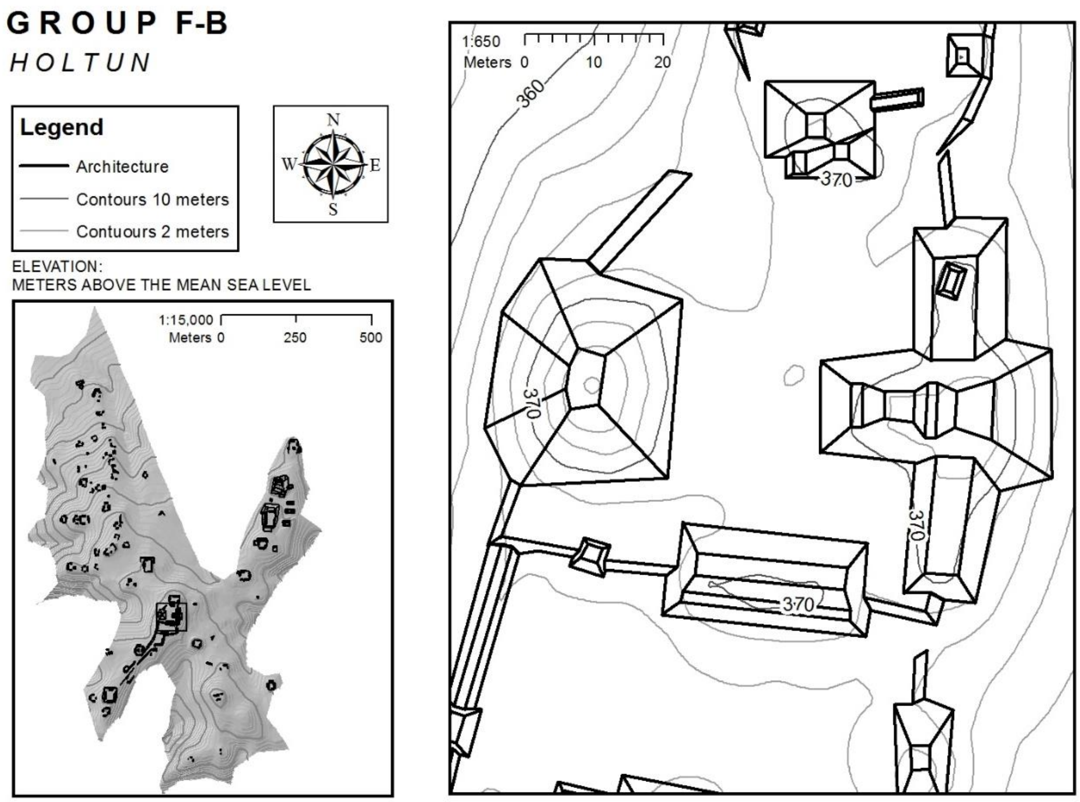

Figure 15: Group F-B at Holtun (Map created by the author).

Group F-C is located south of Group F-B and north of Group F-D in the central sector of Holtun, as seen in Figure 16. It consists of a group of six mounds organized around Plaza F-D, which are distributed over an elevated platform one meter lower than Plaza F-B. In addition, the northern structure is joined with the southern structure of Group F-B. The western extreme is delimited by a long, low-rise structure, likely a wall.

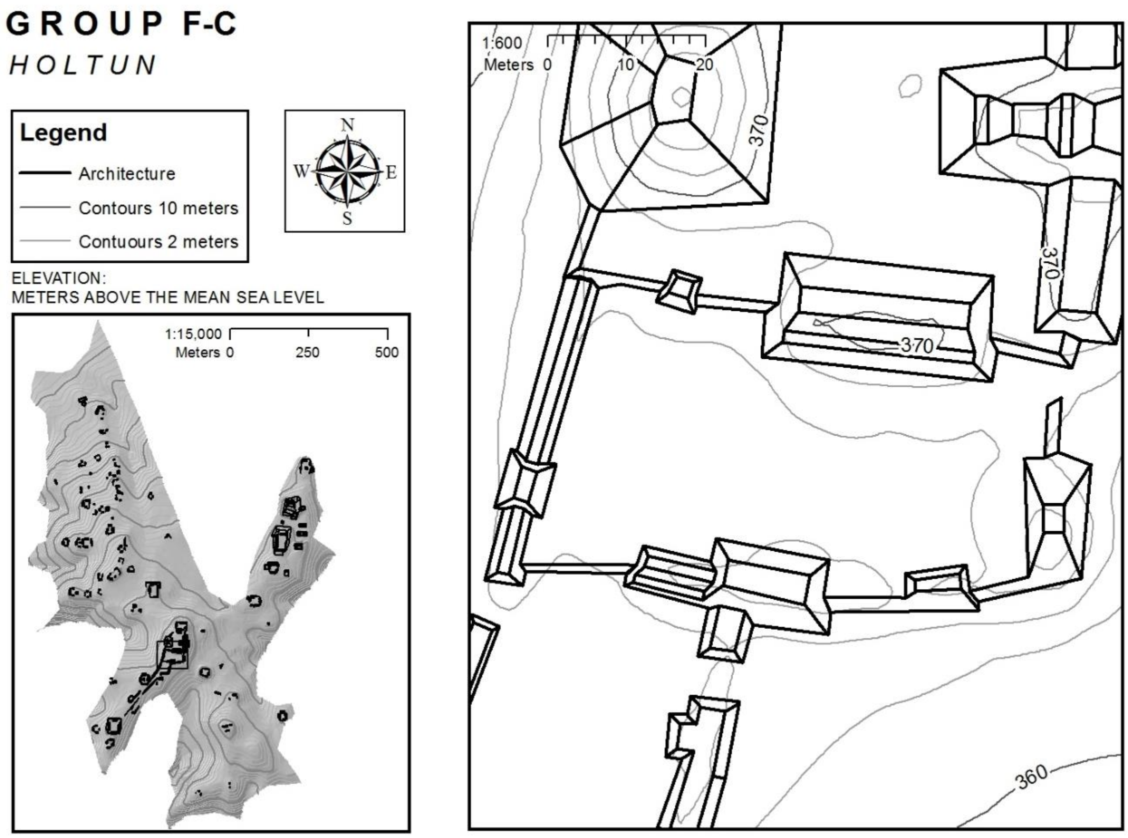

Figure 16: Group F-C at Holtun (Map created by the author).

Group F-D is located in the central sector of Holtun, south of Group F-C and North of Group I, as shown in Figure 17. It consists of a group of two long, low-rise structures that surround Plaza F-D. These structures have entrances in the north side of both structures and perhaps they are walls, as the one seen in Group F-C. The western wall ends in the south with a structure of higher dimension than the rest of this architectural element. The eastern wall has an angled shape that allows it to close the eastern and southern side of the plaza.

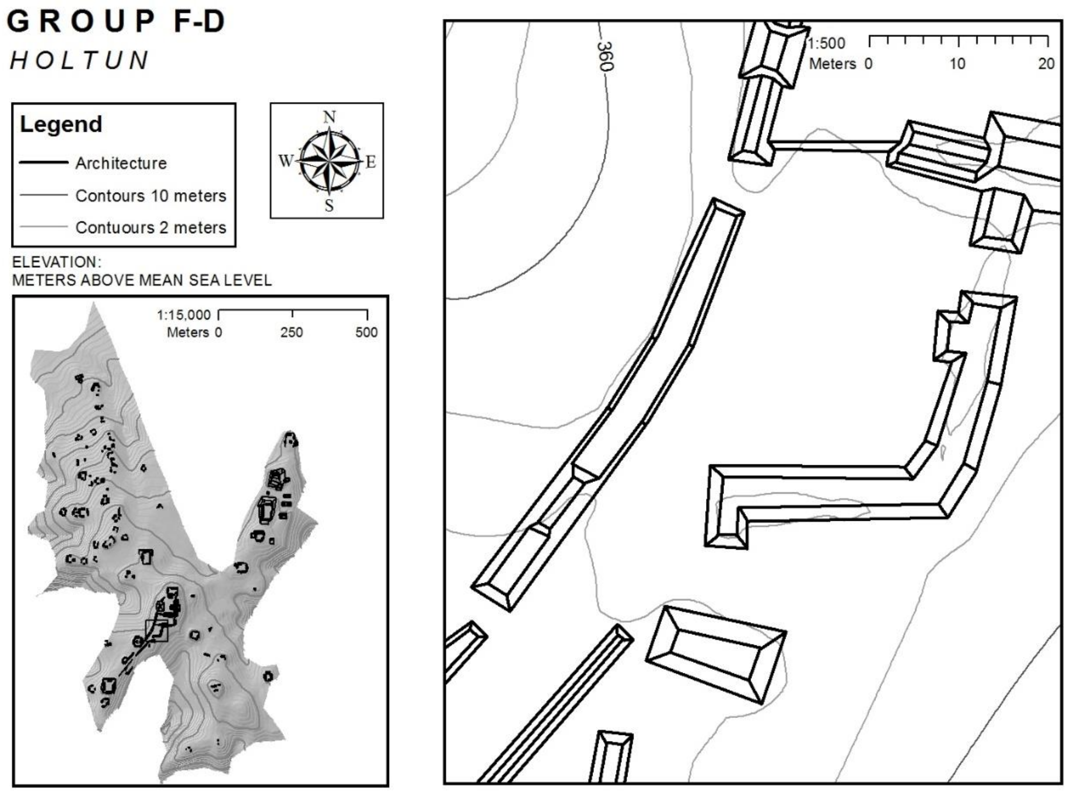

Figure 17: Group F-D at Holtun (Map created by the author).

Group G is located at the beginning of the northwestern sector of Holtun, situated northwest of Group F-A and southwest of the Northwestern Settlement, as seen in Figure 18. It consists of a cluster of three mounds organized around a patio, which is open in the south portion. The topography of the land connects this group with Group F-A.

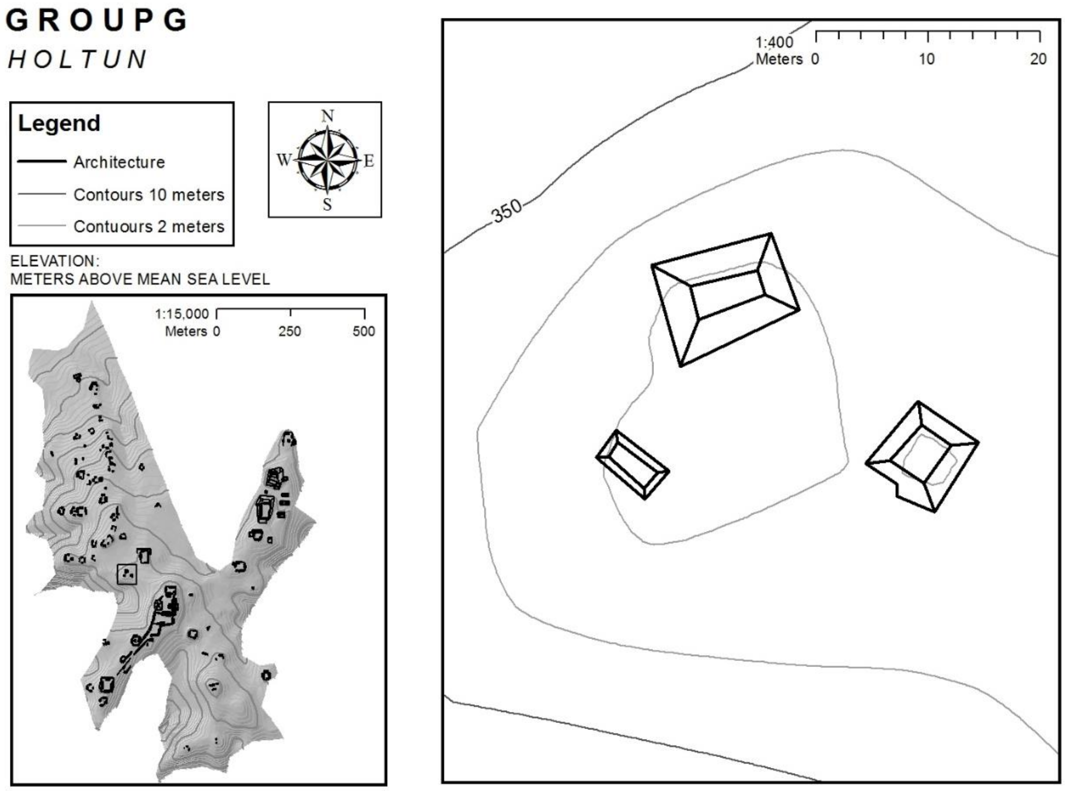

Figure 18: Group G at Holtun (Map created by the author).

Group H is located in the southeastern section of Holtun, situated southeast of Group F-C and northwest of the Southeast Settlement of the site, as shown in Figure 19. It consists of four mounds organized around Plaza H, which is placed on the top of an elevated hilltop platform. The mounds are placed in the north, east, and west sides of the plaza. In addition, the plaza is open on the south side that faces the Southeast Settlement of Holtun.

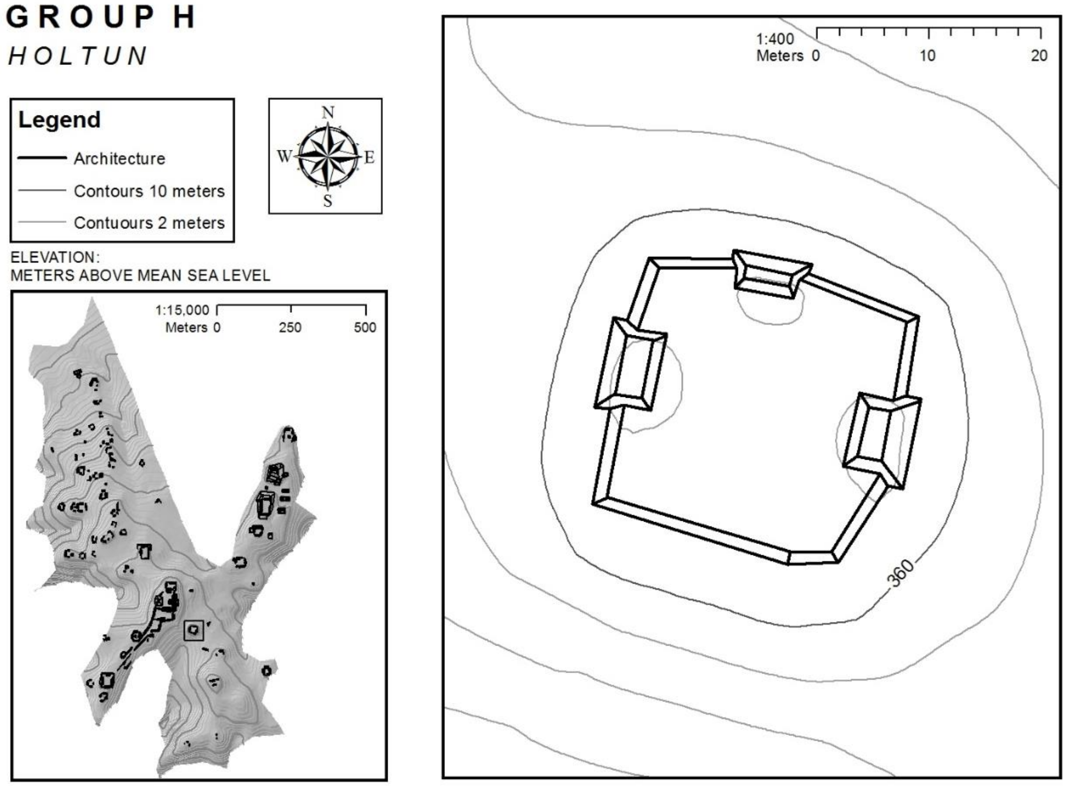

Figure 19: Group H at Holtun (Map created by the author).

Group I is located in the southwest sector of Holtun, placed south of Group F-D and north of Group J, as seen in Figure 20. It is constituted by two clusters of mounds divided by a long, low-rise structure that runs from northeast to southwest. The first compound is a cluster of seven mounds nucleated around Plaza I-A. One of the mounds is placed in the center of the plaza. The second compound is located in the east of the group and consists of two mounds organized around Plaza I-B.

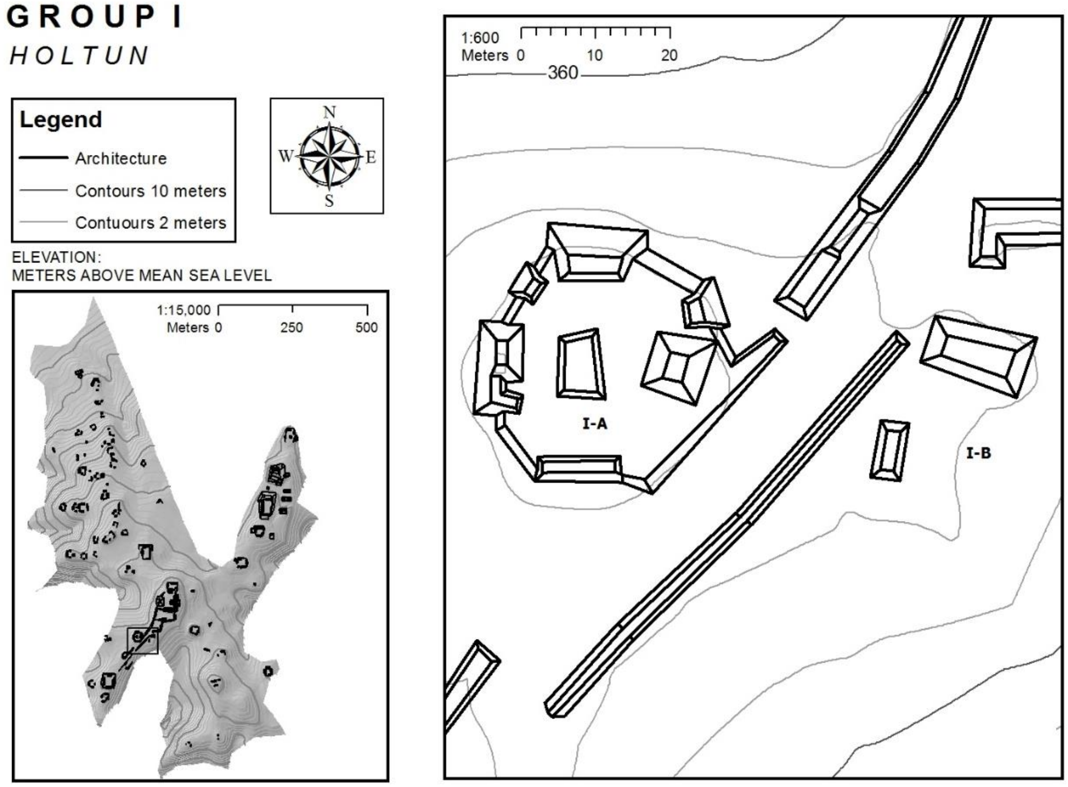

Figure 20: Group I at Holtun (Map created by the author).

Group J is located in the southwestern side of the southwest sector of Holtun, placed southwest of Group I and north of Group K, as seen in Figure 21. It consists of two clusters of mounds organized around a closed plaza. The first compound is located in the southeastern side of the Group and consists of four mounds organized around Plaza J-A, which is situated on an elevated platform. The second compound is located in the northeastern portion of the group and consists of three mounds organized around Plaza J-B. This group is closed in the southeastern side by a low-rise structure which could be a wall. In addition, two small mounds are located in the southeastern side of the group, beneath a leveled surface that has been identified as a causeway (Fialko 2011: 481).

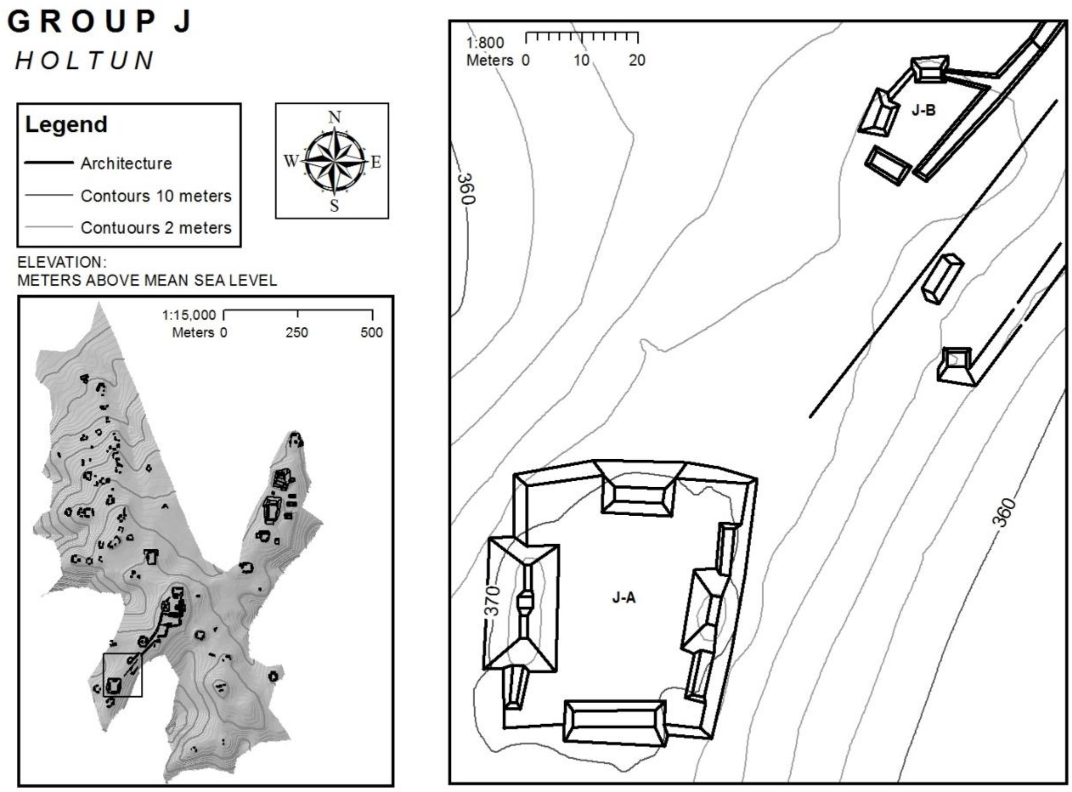

Figure 21: Group J at Holtun (Map created by the author).

Group K is located in the southwestern portion of the southwest section of Holtun, south of Group J and southeast of Group L, as seen in Figure 22. It consists of a cluster of four mounds organized around Plaza L, which was built on a leveled surface in a slope. This group closes the southwest sector of the site and faces a slope that descends toward a ravine.

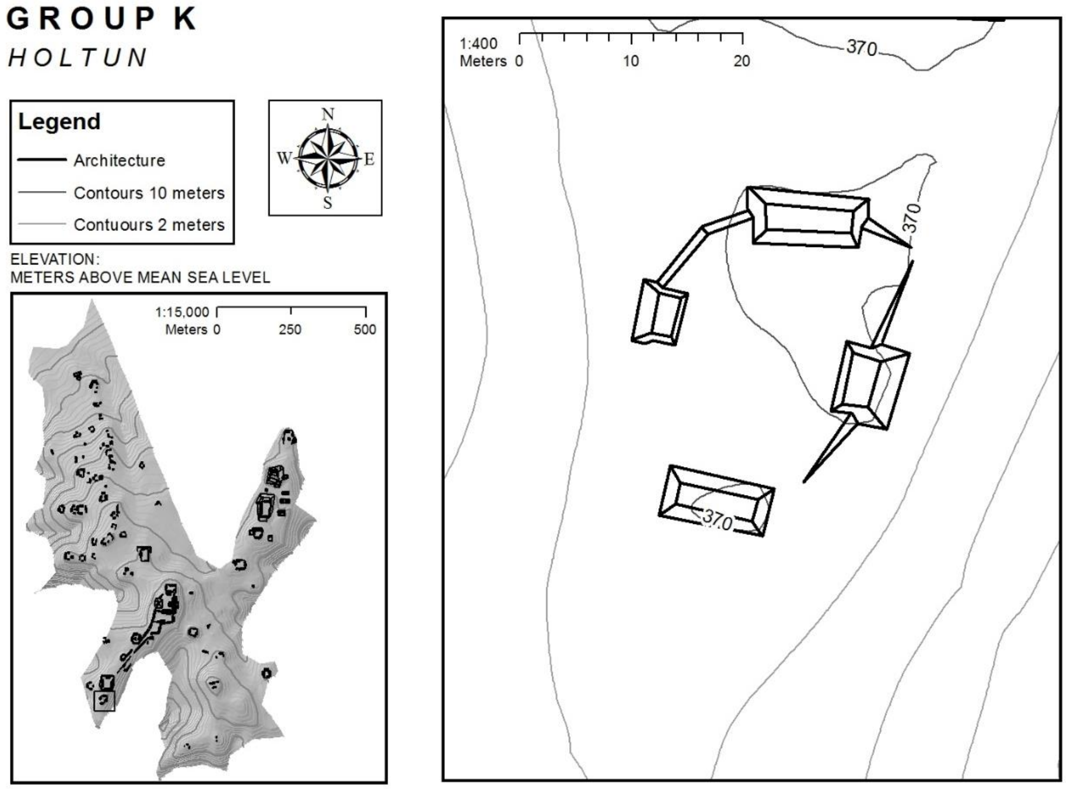

Figure 22: Group K at Holtun (Map created by the author).

Group L is located in the southwestern side of the southeast sector at Holtun, northwest of Group K and west of Group J, as shown in Figure 23. This group consists of a cluster of four structures nucleated around Plaza L. The group is placed in an elevated platform, which is placed on a slope which also descends toward a ravine.

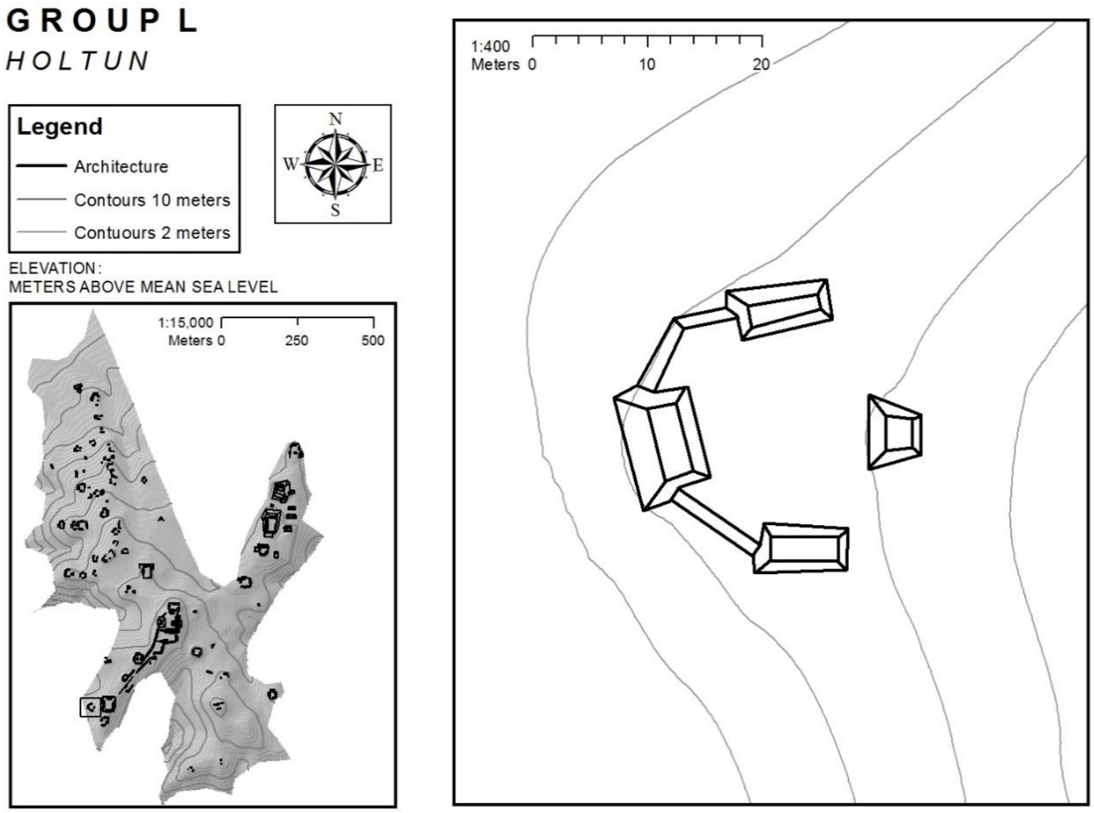

Figure 23: Group L at Holtun (Map created by the author).

The Causeway consists of a leveled and elongated surface identified in the southwest sector of Holtun (Fialko 2011: 481) and shown in Figure 24. It connects Group F-D with Group I and Group J, and it is delimitated by long, low, raised mounds on both sides. It has a length of approximately 150 meters and is placed in the top of the natural elevation of Holtun.

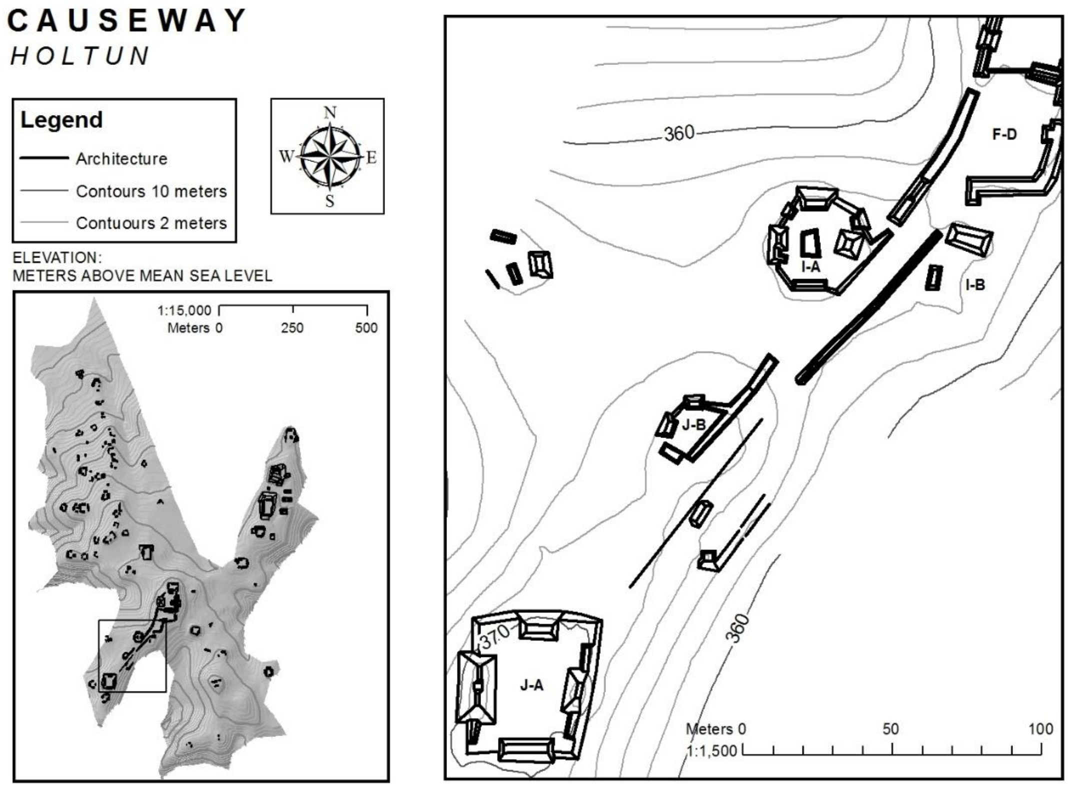

Figure 24: Area with the shape of a causeway that connects Group F, Group I, and Group J (Map created by the author).

The Northwest Settlement of Holtun consists of a cluster of 29 groups of mounds located in the northwest slope of the site as shown in Figure 25. The mounds have small dimensions as well as low elevations in comparison with the architecture in the central sector of Holtun. These mounds are placed on flat surfaces in a sloped area that descends toward the low areas of the Yaxha-Labna Basin. These clusters are similar to clusters of mounds observed by Bullard (1960) in the settlement pattern of many other sites in the northeast Peten.

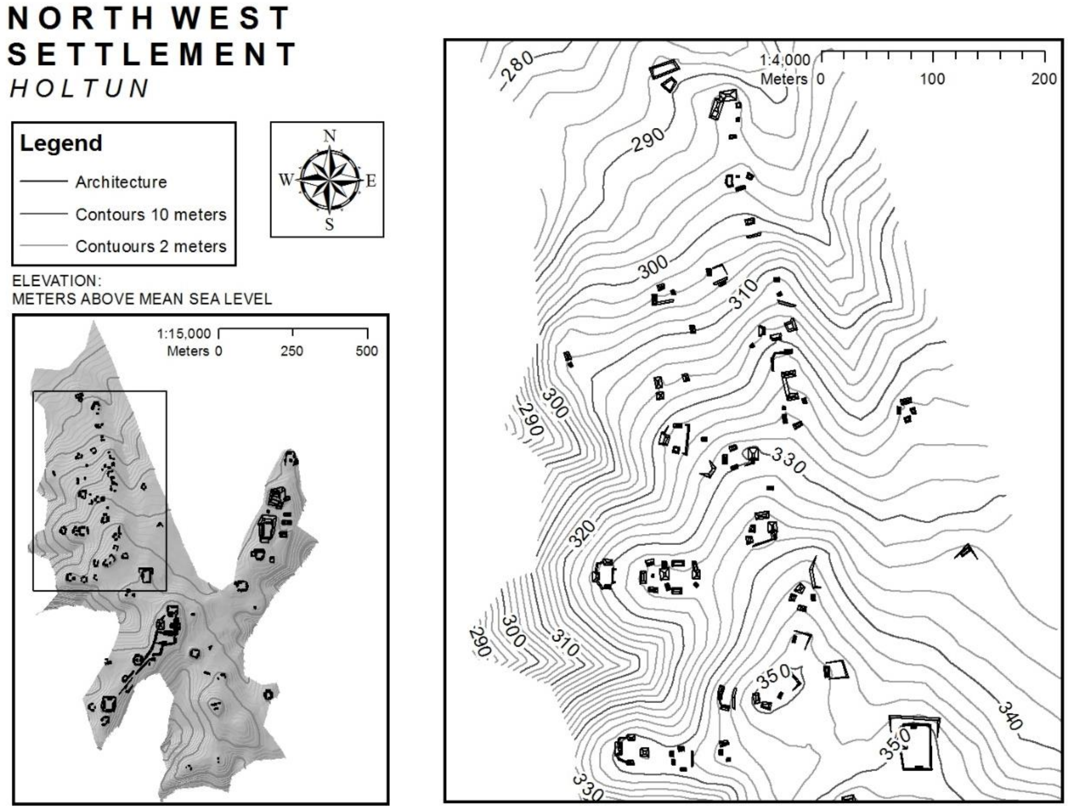

Figure 25: Cluster of mounds and groups in the northwest of the site (Map created by the author).

The Southeast Settlement consists of six architectural groups placed on the hilltops at the southeastern sector of the Holtun shown in Figure 26. The groups are composed of 1 to 6 mounds organized around small plazas. These groups delimit the extension of the site on this side and are surrounded by a system of ravines and creeks. The larger group is SE_06, which has seven mounds organized around an elevated plaza.

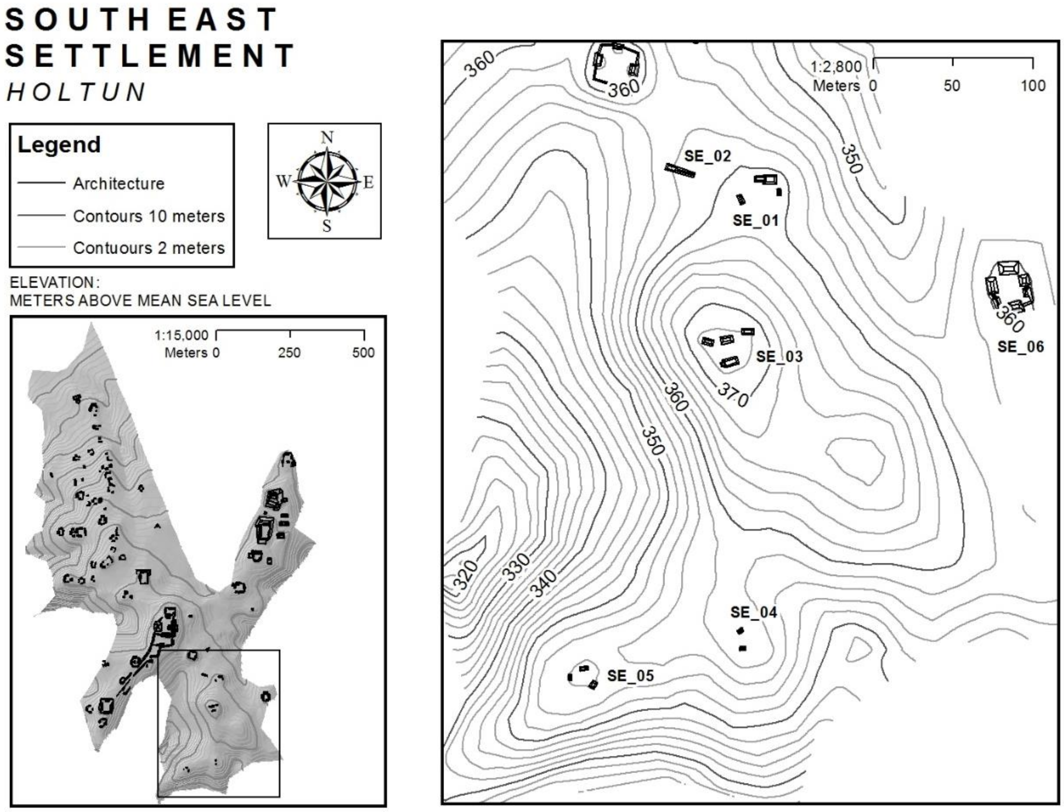

Figure 26: Settlement of groups at the southeast of the site (Map created by the author).

Excavations and Sampling

As mentioned above, the first excavation season performed by HAP was done in 2011. During this season, test pits were traced at the center of 19 plazas. The test pits had a dimension of 2 X 2 meters and were excavated until finding sterile soil, which in this case is bedrock. These test pits were the starting point of 19 operations at the site, some of which have been extended in the subsequent field season. In HAP, an operation is a group of excavations with respective extensions performed in the same area. An operation has the capacity to contain an undetermined quantity of pits. It can be subdivided in sub-operations when an archaeological trait needs to be investigated separately.

Since 2014, test pits measured 1 X 1 m due to a mandatory requirement from the Guatemalan government. The excavations in 2014, 2015, and 2016 consisted of operations extended across the site. The operations included trenches through plazas that extended the original test pits, which were excavated in 2011. The pits within the trenches were excavated with an interval of 2 to 3 meters. When trenches involving architectural elements were excavated, there was no interval within the pits and they developed into extensive pits, and horizontal excavations. A sample of the excavations performed in Group F-A is shown in Figure 27.

Test pits are subdivided into lots, which correspond to the stratigraphic or arbitrary level that is being systematically excavated; or to a particular feature found during the excavation. The stratigraphic levels correspond to changes in the soil caused by human modifications or natural sedimentation. The arbitrary levels are subdivisions that archaeologists made when a natural level was too wide. A lot can consist of features varying from a cache, deposit, offering, burial, or other specific element that requires a distinction from the rest of the materials.

The obsidian samples collected during the excavations correspond to a lot. Therefore, the identification for each artifact includes the operation, sub-operation if present, number of excavation, and number of lot. This system allows for contextualization of each artifact within a specific archaeological context. The next step is to associate each artifact with the chronology of the lot and ascertain the source from where the artifact was imported.

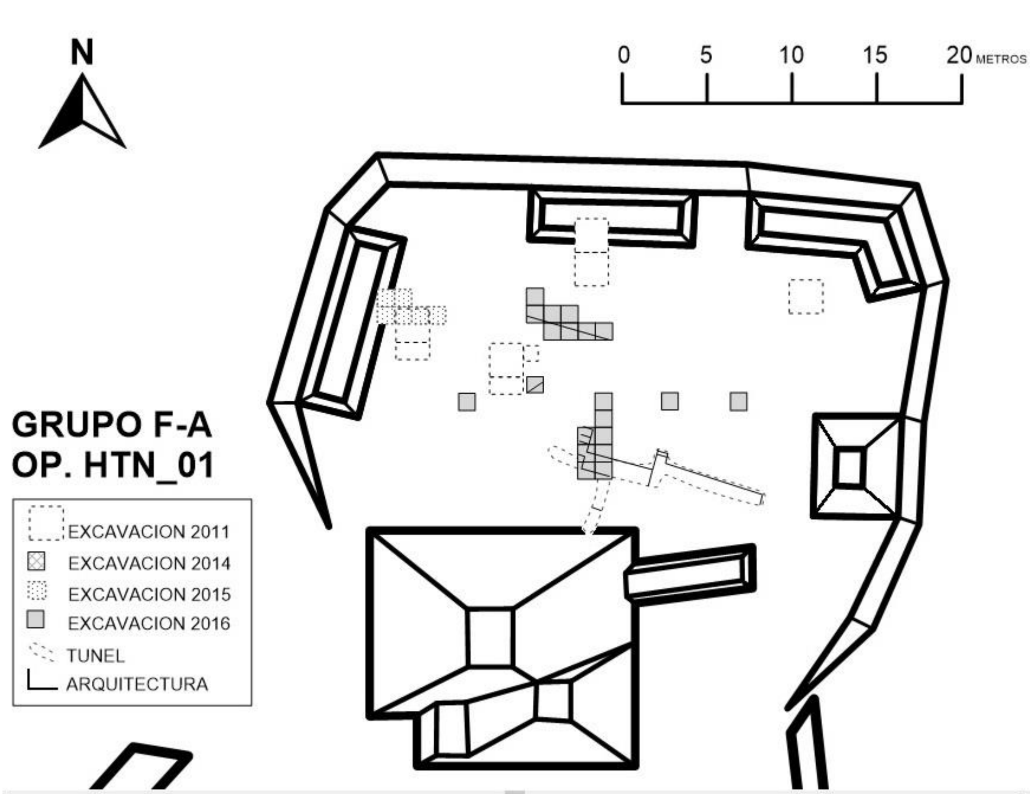

Figure 27: Excavations performed in Group F-A from 2011 through 2016 (Created by the author from Callaghan et al. 2016)

Archaeological Materials and Artifacts

The excavations performed at Holtun during four field seasons have provided a set of archaeological materials that evidence the cultural activities at the site. The materials that are typically found in excavations are ceramic, obsidian, lithic, human remains, and faunal remains. Ceramics are found as broken sherds as well as complete vessels, when they come from contexts like caches, offerings and burials. Obsidian artifacts are found within the lots of materials extracted from the excavations. Lithic artifacts are found in the same way as ceramics and obsidian, they consist of projectile points or artifacts made from chert, jade, green stone, basalt and other stone materials. The only human remains found in the area consist of bone because the nature of soils and environment does not allow for the survival of organic remains. Human bones have been found in 13 burials across the site, some of them in architectural contexts and others beneath construction stages of a plaza. Finally, the most common faunal remains at the site consist of animal bones and shells.

The two materials considered in this thesis are obsidian and ceramics. The importance of obsidian, its quantity and the source of the sample will be discussed in the course of this chapter and subsequent chapters. Ceramics are important because of their potential to associate a context with a period. In this way, ceramics help to build the chronology of the site. Ceramics at Holtun are classified using the type: variety-mode system of classification (Callaghan and Neivens de Estrada 2016; Gifford 1976; Kosakowsky 1987; Sabloff 1975). Ceramic type: varieties correspond to time periods (ceramic Complexes), which can be shared across regions (ceramic spheres). Ceramics from Holtun generally correspond to the Lowland Maya ceramic spheres as defined by Willey et al. (1967) and originally documented as complexes by Smith (1955) at the site of Uaxactun, Guatemala. These include the Mamom sphere dated to the Middle Preclassic period, the Late Preclassic period Chicanel sphere, the Early Classic Takol (1-3) spheres, the Late Classic Tepeu (1-2) spheres, and the Terminal Classic period Tepeu 3 sphere (see Figure 28).

The association of ceramic types at Holtun with ceramic spheres in the Peten allowed for the relative dating of contexts (Callaghan 2014, 2015; 2016a; Callaghan and Rivera 2011; Mendez 2017). The dates were confirmed by the performance of radiocarbon analysis with organic materials collected in 2011. The association of each context with a specific period of Maya history has allowed for the establishment of a chronology for the site. In consequence, the obsidian artifacts can be associated to a date when they come from a lot that has been dated by a ceramic sequence. The complex process of building a chronological sequence of Holtun and briefly described previously, allowed the correlation of each obsidian sample to a particular period of Maya history.

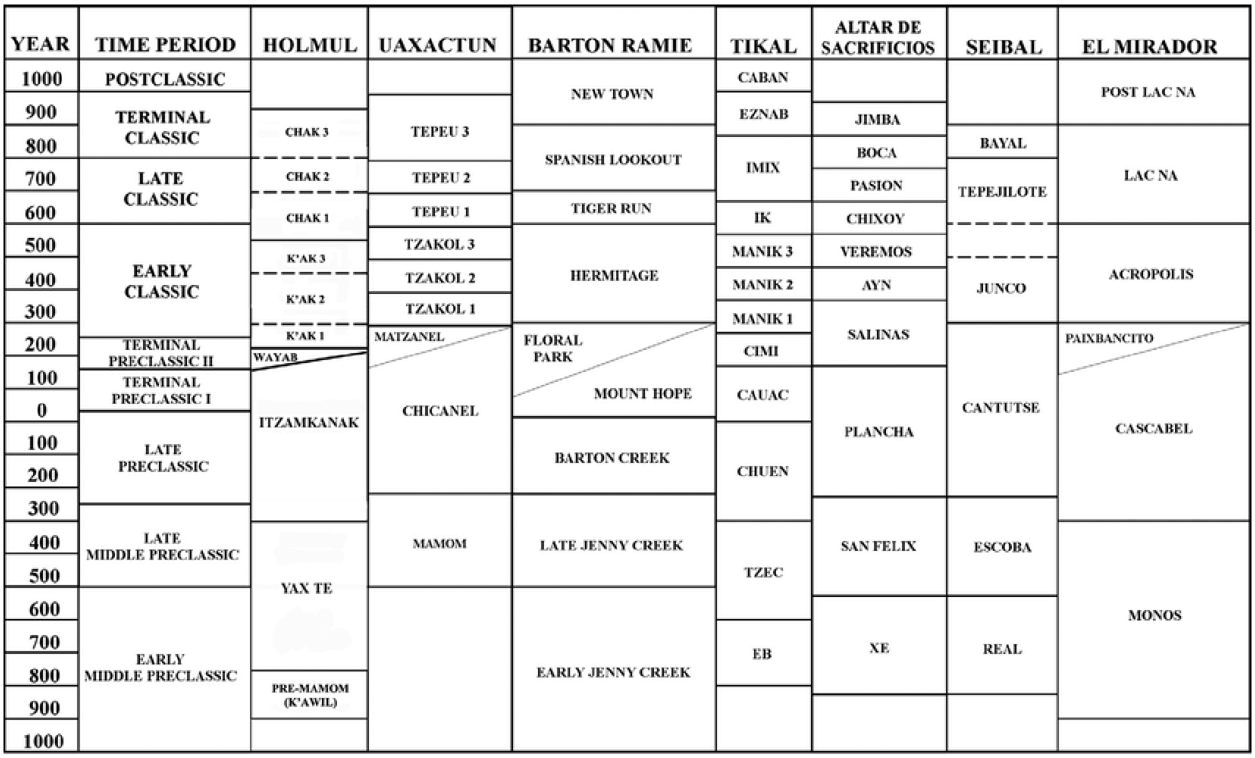

Figure 28: Ceramic sequence of Maya areas (Callaghan and Neivens de Estrada 2016).

Data Analysis

The objective of this thesis is to describe, from a spatial perspective, the nature of acquisition and distribution of obsidian at Holtun during all the periods of occupancy. To reach this point it is necessary to know three variables effecting each obsidian sample. The first variable is the source from where the artifact was extracted. The geological origin of the samples was obtained by means of a pXRF analysis where the chemical composition of the sample reveals the geological origin. The second variable is time, referring to the period of history when the artifact was used and integrated into the archaeological context. The relative dating of the context by the type-variety method allows for a relative date of the artifact. The third variable corresponds to location, referring to the position of the artifact across the site. The GIS analysis displays and combines the three variables using topographic and archaeological information as a base map. The comparative analysis of artifacts allowed for the interpretation of cultural patterns as related to the acquisition and distribution of obsidian artifacts. The process of sourcing the artifacts and analyzing the distribution of them across the site will be discussed in the following sections.

Obsidian Analysis with Portable X-Ray Fluorescence

Obsidian is one of the best traceable materials in the archaeological record and is therefore considered as an ideal for geochemical source attribution (see Glascock 2002: 2). This is due to its chemical composition, associated with the source and process of creation. This constitutes a chemical signature that is unique for each source and can be used to confirm the source location. There are some instruments and techniques developed to reveal the molecular composition of the material of which each artifact is composed. Some of the better known are neutron activation analysis (NAA), inductively coupled plasma mass spectrometry (ICP-MS) and X-ray fluorescence spectrometry (XRF).

X-ray fluorescence spectrometry or XRF is a technology developed for applications in geological sciences. Its applications are mainly for the analysis of volcanic rocks (See Shackley 2005, 2011). Therefore, since some of the archaeological artifacts are made of volcanic materials, an increase in the utilization of XRF in archaeological analysis has been observed (Shackley 2012).

The implementation of XRF analyses in archaeology has had a great acceptance among North American archaeologists (Shackley 2012). It has been applied to the analysis of volcanic rocks, other types of stone, ceramics and soils. It is also considered that this technique is having a considerable impact on archaeological theory, as exemplified by Joyce (2011). Particularly, the portable version of XRF, known as portable X-ray fluorescence spectrometry or pXRF is gaining acceptance among scholars specializing in material culture and geoarchaeology. One of its principal benefits is the capacity to operate onsite in distant locations.

Several specialists address the importance of the implementation of pXRF in their analysis rather than other, more complicated archaeometric techniques. This type of analysis is rapid, easy, cost effective and nondestructive versus other techniques like NAA and ICP-MS. There are some negative aspects associated with this technique, such as a minimum size required for the sample, a limited sensibility to elements, as well as the inability to discriminate different components of the same artifacts (Shackley 2012). Despite these limitations pXRF has proven to be a valuable tool for sourcing certain kinds of materials..

The visual analysis of obsidian based on color and texture is still considered useful by some archaeologists as a first approach to the analysis (e.g. Aoyama 2014; Braswell et al. 2000). However, it is the instrumental analysis that, spanning four decades, has provided accuracy in the determination of the particular geological origins of the artifacts (Moholy-Nagy 2003: 301). Sometimes, the size or thickness of the artifact is so reduced that it is impossible to distinguish the visual variability between sources (see Moholy-Nagy 2003). In specific case studies at Tikal (Moholy-Nagy et al. 2013: 74) and the Valley of Oaxaca (Feinman et al. 2013: 63) it was possible to determine with high precision the variability of sources based on the chemical composition of artifacts. The authors of these researches agree that it could be impossible to determine such variability just by a visual analysis. That is why pXRF analysis provides reliable information for the traceability of an artifact and its contextual analysis.

The use of XRF in Mesoamerica has been applied to source studies of materials in an effort to understand long distance trade (see Cobean et al. 1971; Hammond 1971). The Provenance Postulate of Weigand and colleagues (1977: 24) modified by Neff (2001: 107-108) seeks to perceive the differences between the qualitative or quantitative chemical or mineralogical composition of the sources, which exceeds the natural variation within each source (Glascock 2002: 2). In that sense, obsidian is considered as an ideal archaeological material for sourcing. This is due to the significant differences between the sources, or areas of the sources, and homogeneity of its composition. Another reason obsidian is ideal for sourcing is because the obsidian sources are geographically restricted, but obsidian use is geographically extended sometimes hundreds of miles from the source. Other lithic materials like chert, stealite and basalt have more complex geological histories, making them more difficult to source (Glascock 2002: 2). In addition these artifacts are more frequently produced and consumed locally making them poor candidates for long distance exchange.

The Obsidian at Holtun

During the field work at Holtun, a considerable quantity of obsidian artifacts were collected. The artifacts are typically prismatic blades, but in some cases they could be fragments of cores or small fragments of artifacts, see Figure 29. These artifacts were analyzed during laboratory seasons after fieldwork. In order to attribute the artifacts to a source, the samples were analyzed with a portable X-ray fluorescence instrument (pXRF). This technique indicates the provenience through chemical compositional analysis.

Figure 29: Obsidian prismatic blade found at Holtun (Kovacevich 2014a: 79).

In 2014, Dawn Crawford and Alejandro Gonzalez analyzed the 96 samples from excavations in 2011. The analysis was performed on a Bruker Tracer III-V pXRF instrument belonging to the Southern Methodist University, Department of Anthropology. Based on the chemical composition of these artifacts it was possible to argue that the artifacts came from sources at El Chayal and San Martin Jilotepeque (Kovacevich, et al. 2015: 145). In 2017 Dawn Crawford analyzed the samples from excavations in 2016. The analysis was performed again on the same Brucker Tracer III-V pXRF instrument. During the process of reading the chemical signature, the instrument was set into *heavy element* mode (40 KeV 25µ) with a green filter adequate for the elements Potasium (K), Calcium (Ca), Titanium (Ti), Manganese (Mn), Iron (Fe), Zinc (Zn), Rubidium (Rb), Strontium (Sr), Argon (Ar), and Niobium (Nb). It is important to mention that the samples from 2011 were measured on similar setting but with 10µ instead of

25μ. The calibration was increased to adapt the instrument to the settings of the data used as a comparative reference (Crawford 2017). Based on the chemical composition of the materials, Crawford (2017) concluded that the main sources for obsidian were still El Chayal and San Martin Jilotepeque. Based on this information, each artifact was labeled with the provenience obtained by the pXRF analysis.

Spatial Analysis using Geographic Information Systems

The spatial analysis in this thesis was performed from the perspective of Settlement Systems theory. Settlement Systems is a theoretical approach that studies the relationship of an archaeological settlement with the environment, and how different factors interact to satisfy the needs of a society. In this case, the relationship with the environment occurs through the indirect exploitation of obsidian. This consumer activity is influenced by commerce and redistribution, thereby creating a complex network of economic and social interactions. In addition, Settlement Systems analysis considers how social and natural factors have influenced the spatial organization of society (Flannery 1976; Plog 1976). That means that it is possible to understand social processes through the observation of material distribution in archaeological contexts within the site across different periods of human occupation.

In recent decades, settlement archaeology has been enriched with theoretical approaches from other disciplines like Cultural Anthropology, History, Philosophy, and from an internal reflection from scholars towards archaeological performance and interpretations. Such integration allows for the incorporation of more variables in the perception of the landscape involving a phenomenological approach (Ingold 2000: 195; Trigger 2006: 473). Such theoretical and methodological change of paradigms started a new approach known as Landscape

Archaeology. From any theoretical approach, a distribution analysis of artifacts is often useful for archaeologists to observe particular patterns of behavior in the process of goods distribution. As Hodder (1977: 258-259) exemplified, the settlement pattern of material culture not only features its frequency and distribution, but also the cultural practices that are embedded in the accessibility and exchange of the products.

Another important contribution to settlement archaeology is the implementation of Geographic Information System analysis or GIS (Wheatley & Gillings 2002). This analysis implies the separation of all the elements that conform the landscape, be they cultural, geographical, environmental, or symbolic. That information can be entered into standardized datasets that can be stored, manipulated, analyzed, compared and displayed as a cartographic product. As a complement, the technological innovations of the recent decades have allowed for the integration of computer science applications into GIS and other cartographic techniques. This combination of technology is known as Geomatics, which is a discipline that performs all the cartographic procedures on a digital format (Ghilani and Wolf 2014).

The strategy used to perform the present research consisted of organizing and categorizing artifacts by source of provenience and the chronology of the corresponding archaeological context. The information was transformed into Microsoft Excel spreadsheets that contain standardized information manageable to be described and compared. The data set included the particular information of each artifact, including the location of the excavation unit where the artifact was found, the excavation lot from where it comes, the relative date of the lot, and the source of obsidian. As a complement, each artifact was identified with the operation where the excavation was performed and in consequence with its location at the site. All this information created a set of attributes that gave to each artifact a unique contextualization in time and space. At the same time, it allowed for the process of artifact grouping. The samples were organized into groups of artifacts that came from the same period, from the same source and from the same operation. It allowed for the comparison of the frequencies in time, source and location within the site.

The data compiled was analyzed on a platform of Geographic Information Systems using the cartographic software, ArcGIS 10.4.1. The data indexed was displayed as a layer of information in the format of a Shape File. The resulting file consisted of a set of points located in the center of the plazas to create an arbitrary uniformity. Each point contained a table of attributes with the frequencies of artifacts grouped by period and source. For each period, the correspondent attributes were displayed as the cartographic symbol of each point. In that way, it is possible to see the frequencies of obsidian artifacts from each of the main sources during the five periods of archaeological history at Holtun.

The maps were compared visually and quantitatively in order to provide support to the arguments posed in the research questions. The data from the maps and dataset is addressed in four ways. The first is a descriptive analysis of the data, the second a comparative analysis of artifact frequency across time, the third is a comparative analysis of source preference during each period, and finally, a comparative analysis of distribution range between the different periods addressed by this research as detailed in Chapter 3.

CHAPTER 3: DATA AND OBSERVATIONS

The following information corresponds to a descriptive and comparative analysis of the obsidian artifacts collected by Holtun Archaeological Project (HAP) since 2011. As mentioned in Chapter 2, obsidian pieces consist of all types of artifacts found at the excavations, ranging from blades, cores, and fragments, among other elements. The focus of the analysis is determine the frequency of obsidian elements present on each plaza by during each period of Holtun history and perform a comparative analysis. Each obsidian sample comes from a lot within a systematic excavation. Each excavation constitutes a unit from an operation performed on a specific residential or ceremonial plaza. These lots were dated according a relative chronology based on the ceramic sphere associated with the ceramic materials recovered from it. The chronology was confirmed by radiocarbon dates from organic samples taken within contexts that contain ceramic materials that are characteristic from early periods of Maya history (Kovacevich 2014). During the performance of excavations, archaeologists collected the obsidian artifacts and documented them according their corresponding stratigraphy. The association of obsidian artifacts with the chronology of their lots allowed for the establishment of a temporal component for the chronological variable. In addition, the second variable consists of the source of provenience of each artifact. This information was obtained by means of a pXRF analysis. Finally, the third variable is the location of the plaza from where each artifact comes from. It allows for the comparative analysis of obsidian frequencies throughout the site and across the time.

Obsidian Distribution: Frequencies by Period, Source and Location

This research is based on a comparative analysis of n=316 obsidian artifacts at Holtun. These artifacts derive from archaeological contexts found in excavations performed at Holtun during 2011 and 2016 field seasons. The periods of the contexts are based on the chronology provided by the ceramic analysis at the site. The chronological analysis was led by Callaghan (Callaghan and Rivera 2011; Callaghan 2017; Mendez 2017), one of the principal researchers of the project from University of Central Florida. The information facilitated the creation of a ceramic seriation related with the ceramic spheres from the northeast Peten (See Callaghan and Neivens 2016), which allowed dating of the contexts. The chemical compositional analysis was performed by Dawn Crawford (2017), a graduate student from Southern Methodist University, with the guidance of Brigitte Kovacevich of the University of Central Florida. The results from this analysis indicate that obsidian artifacts at Holtun originate from two of the most important sources in the highlands of Guatemala: El Chayal (ELC) and San Martin Jilotepeque (SMJ). From the n=316 samples, n=236 fulfilled the minimum requirements to be used in this research. The remaining samples came from mixed contexts where the chronological association was ambiguous and difficult to certainly attribute to any period. The frequency of obsidian artifacts used in this research are featured in Table 1. The artifact frequencies are organized according to the period of correspondence for each source.

Table 1: List of obsidian artifacts at Holtun with a date of context and known provenience.

	MPC	**LPC**	**EC**	**LC**	**TC**	**PC**	**Totals**
El Chayal	8	101	2	8	20	2	141
San Martin Jilotepeque	28	50	2	12	3	0	95
Totals	36	151	4	20	23	2	236

Information courtesy of Holtun Archaeological Project (See Appendix B).

The quantity of artifacts from San Martin Jilotepeque (SMJ) is n=95, which is a lower quantity than the n=141 artifacts from El Chayal (ELC), as listed in Table 1. As the graphic in

Figure 30 depicts, the two obsidian sources utilized at Holtun show a mutual increase from the Middle Preclassic through the Late Preclassic period and an equal decrease of frequency towards the Early Classic. Obsidian from SMJ is more widespread distributed during the Middle Preclassic period, with an increase frequency during the Late Preclassic period. The peak of samples from ELC featured in Figure 30 corresponds to a deposit of n=88 pieces in a single funerary context at Operation 6 in Plaza E, burial 13. This deposit makes the frequency of obsidian from ELC higher, but contrasts with the wider distribution across the site of obsidian from SMJ.

During the transition from the Late Preclassic towards the Early Classic period, it is possible to observe an equal decrease in obsidian from both sources. Then, during the transition towards the Late Classic period, both sources have a slight increase in quantity of artifacts. However, the transition towards the Late Classic period features a noticeable change in the preference or accessibility of sources, SMJ is represented slightly more, but ELC is more widespread. During the Terminal Classic, samples from ELC are more numerous than samples from SMJ. Finally, the limited evidence of activity during the Postclassic period is associated with n=2 pieces of obsidian from El Chayal.

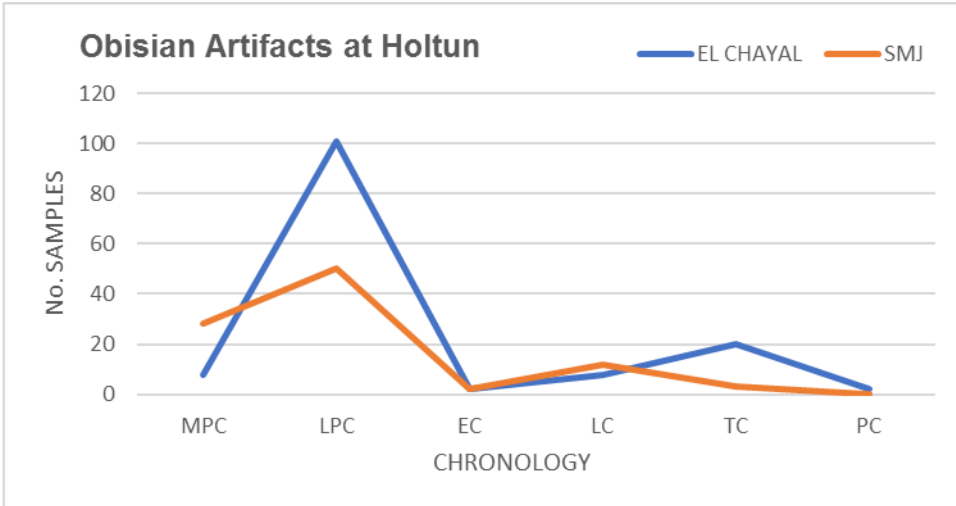

Figure 30: Graphic depicting the changes of the frequencies of obsidian artifacts during the span of site occupation (Created by the author).

The previous information emphasizes the preferences or accessibility of source for the procurement of obsidian at Holtun. The deposit of obsidian in Operation 6 is an outlier that indicates the ability to restrict acquisition of obsidian from one source. Despite that, the general frequencies of obsidian indicate changes in procurement patterns across time at the site. Therefore, it is important to contextualize those frequencies according to spatial distribution among the architectural groups that constitute the site. The spatial distribution of artifacts is described and depicted below using the periods of Maya history as the chronological variable for classification. This system illustrates the variability of distribution of obsidian artifacts that happened in elite household compounds at Holtun across its history.

Middle Preclassic Period (800 – 300 B.C.)

The obsidian artifacts recovered from Middle Preclassic contexts come from operations Nos. 1, 2, 3, 6 and 11. These operations correspond to the plazas F-A, F-B, F-C, E and C, respectively. As described in Table 2, the quantity of artifacts from this period are n=36, n=10 from ELC and n=26 from SMJ. These frequencies depict a majority of artifacts from SMJ, which indicates the accessibility or preference for this obsidian source across the site.

Table 2: List of obsidian artifacts from the Middle Preclassic period at Holtun.

Operation	**Plaza**	**El Chayal**	**San Martin Jilotepeque**	**Total**
01	F-A	1	21	22
02	F-B	4	3	7
03	F-C	2	3	5
06	E	1	0	1
11	C	0	1	1
	Total	10	26	36

Information courtesy of Holtun Archaeological Project (see Appendix B).

The graphic in Figure 31, shows the proportional differences in obsidian frequencies among the groups. The graphic features a high concentration of artifacts from SMJ in Plaza F-A, which contrasts with the lower frequency of artifacts from CH. Plaza F-B that presents a much lower quantity of artifacts in a modest sample. Plaza F-C also presents a modest sample with a slight difference of source frequencies. There is no evidence of artifacts from SMJ in Plaza E during this period and only one sample from CH, but this will change drastically in the next period. Likewise, Plaza C presents a single sample from SMJ and no samples from CH. Middle Preclassic obsidian artifacts are displayed on the map of the site (see Figure 32), which depicts the nature of the distribution of these artifacts during this period.

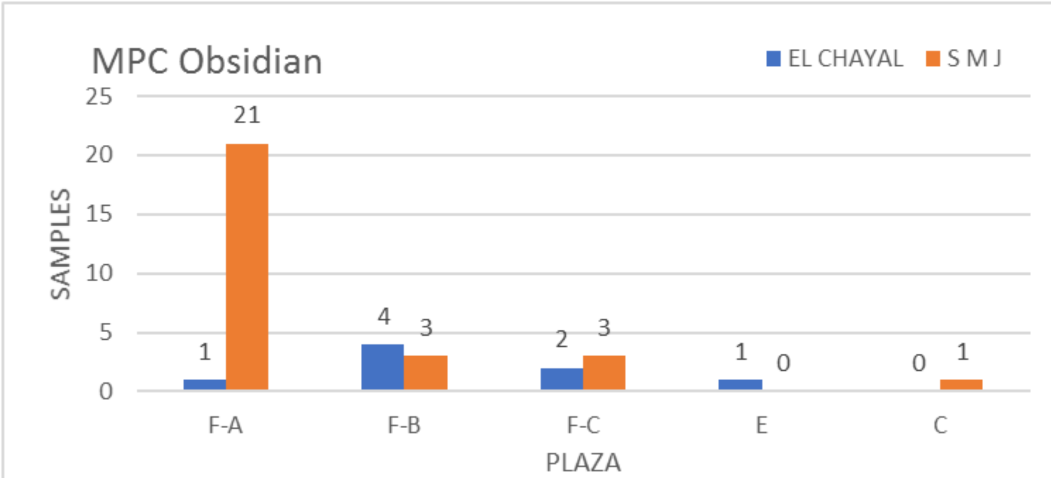

Figure 31: Graphic depicting the frequency of obsidian samples and their sources during the Middle Preclassic period, organized by the plazas where the contexts was found (Created by the author).

The major concentration of artifacts is located near Group F, which contains both residential and ceremonial plazas including the *E-Group* ceremonial complex in Plaza F-B (see Figure 15). The maps on Figure 32 feature the distribution of artifacts across the plazas of the site. On this map, it is possible to see some slight differences in the distribution of artifacts from SMJ and CH sources. Obsidian samples can be found only in five plazas from the 19 excavated by HAP. The distribution of obsidian artifacts from SMJ is more widespread than artifacts from ELC during this period occupation. The presence of samples from SMJ reaches Plaza C, which is part of an elite household palace-style compound. On the contrary, the samples from ELC tend to be nucleated toward the foundational center of the site, with a small presence in Plaza E.

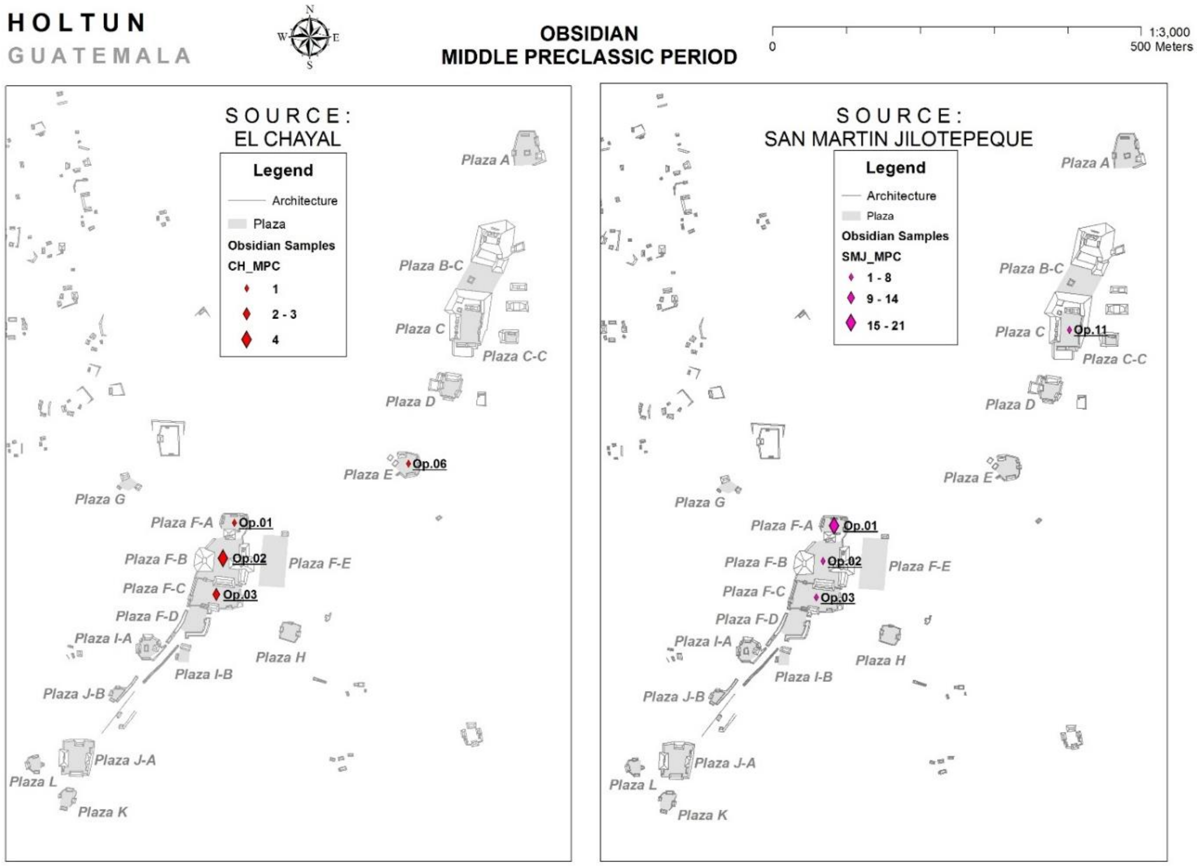

Figure 32: Comparison of Holtun maps featuring the distribution of obsidian samples by source during the Middle Preclassic period. (Map by the author).

Late Preclassic Period (300 B.C. – A.D. 250)

The obsidian artifacts recovered from archaeological contexts dating to the Late Preclassic period come from the operations No. 1, 2, 3, 6, 10, 13, 14 and 16. These operations correspond to the plazas F-A, F-B, F-C, E, F-D, H, A and L, respectively. As shown in the Table 3, the artifacts from this period are n=151, being n=101 from ELC and n=50 from SMJ. These higher frequencies of obsidian from ELC are the result of the high amount of artifacts found in operation 6 at Plaza E. This context consists of a deposit of n=88 artifacts of obsidian clustered in a deposit on a funerary context that constitutes Burial 13 at Holtun (Sagastume 2017: 94-95).

Table 3: List of obsidian artifacts from the Late Preclassic Period at Holtun.

Operation	**Plaza**	**El Chayal**	**San Martin Jilotepeque**	**Total**
01	F-A	3	13	16
02	F-B	2	7	9
03	F-C	1	13	14
06	E	95	11	106
10	F-D	0	1	1
13	H	0	1	1
14	A	0	1	1
16	L	0	3	3
	Total	101	50	151

Information courtesy Holtun Archaeological Project (See appendix B).

The graphic represented in Figure 33 features the differences in the proportion of obsidian from both sources in the plazas where samples were found. It depicts a wide dispersion of obsidian artifacts from SMJ through the eight plazas that had samples. In contrast, samples from ELC were found only in four of those plazas. The graphic also depicts the high concentration of samples in Plaza E, which correspond to the deposit of obsidian from ELC found in the funerary context described previously. Despite that contrasting value, it is possible to observe that in the other three plazas where artifacts from ELC were found, the proportion of artifacts from SMJ is noticeably higher. In addition, the frequencies of artifacts in plazas F-D, H, A and L are lower and present only samples from SMJ.

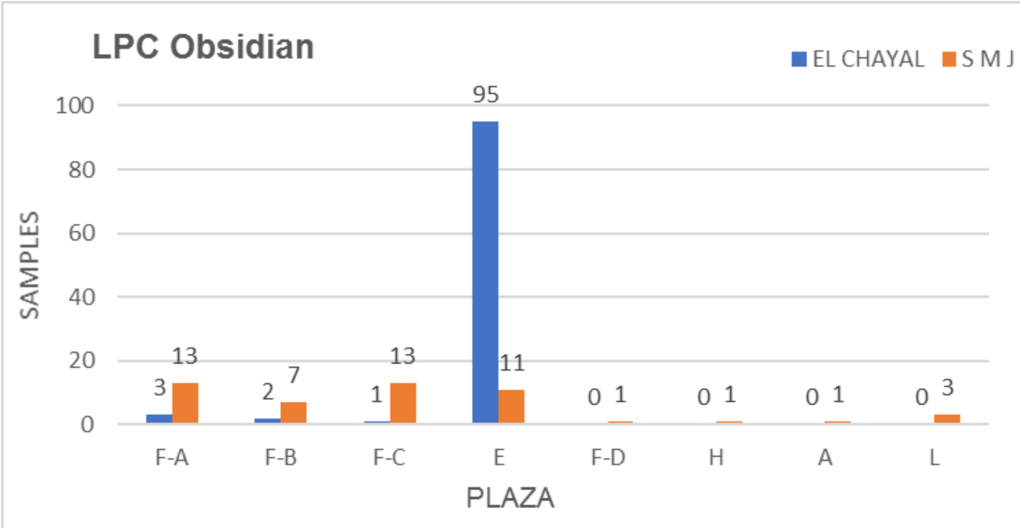

Figure 33: Graphic depicting the frequency of obsidian samples and their sources during the Late Preclassic period, organized by the plazas where the contexts was found (Created by the author).

The map presented in Figure 34 features the pattern of distribution of obsidian artifacts at Holtun in Late Preclassic period. Obsidian artifacts were found at eight plazas from the nineteen excavated by HAP between 2011 and 2016. Despite the higher quantity of samples from ELC than samples from SMJ, the distribution of the later is more widespread than the former. Artifacts from ELC are concentrated near the foundational center of the site, while the artifacts from SMJ are present in plazas at the northeast and southwest segment of the site. The spot of high concentration of samples from ELC is localized in Group E, near the foundational center at Group F-B. As seen in Figure 34, the frequency of obsidian from ELC in Plaza E indicate the pattern of restriction of this material during this period. The frequency of obsidian artifacts is displayed on the following map of the site, which depicts the nature of the distribution of these artifacts during this period.

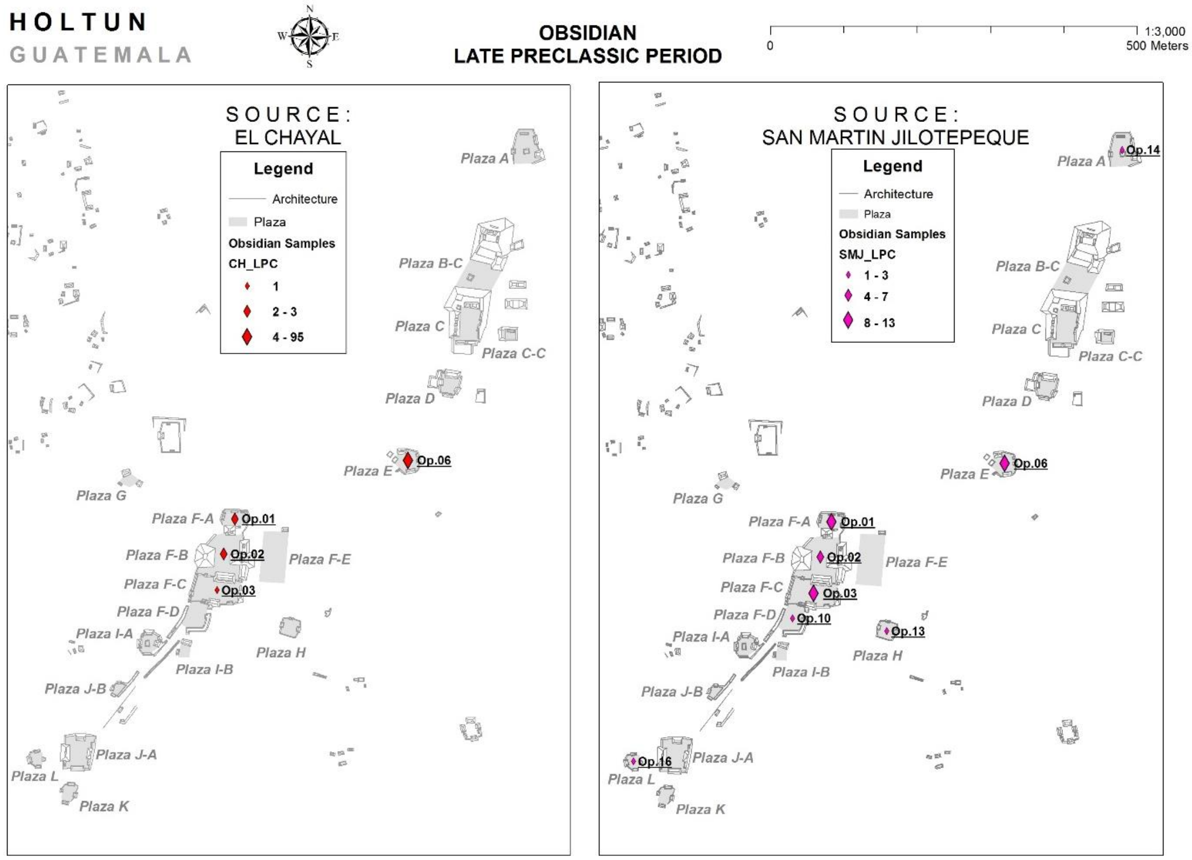

Figure 34: Comparison of Holtun maps featuring the distribution of obsidian samples by source during the Late Preclassic period. (Map by the author).

Early Classic Period (A.D.250 – 500)

Obsidian artifacts recovered from archaeological contexts dating Early Classic period come from operations No. 1, and 2. These operations correspond to the plazas F-A and F-B, respectively. As described in the Table 4, the artifacts from this period are a modest quantity of n=4, being n=2 from ELC and n=2 from SMJ. These frequencies indicate an even proportion of artifacts from both sources. Although the sample is small, it corresponds with the lack of other cultural evidence from this period.

Table 4: List of obsidian artifacts from the Classic Period at Holtun.

Operation	**Plaza**	**El Chayal**	**San Martin Jilotepeque**	**Total**
01	F-A	1	0	1
02	F-B	1	2	3
	Total	2	2	4

Information courtesy Holtun Archaeological Project (see Appendix B).

The graphic represented on Figure 35 indicates the relationship of the proportion of the frequency of obsidian artifacts found in Early Classic contexts at Holtun. The sample is small and limited, but it indicates the presence of obsidian in two of the most exclusive plazas at Holtun in Group F. One piece from ELC in F-A and F-B plazas, and n=2 pieces in F-B plaza are all the samples available to indicate the frequency of obsidian at Holtun during this period. However, it is important to mention that plazas F-A and F-B contain the operations with the major quantity of excavation units at the site. Early Classic obsidian artifacts are displayed on the map of the site, which depicts the nature of the distribution of these artifacts during this period.

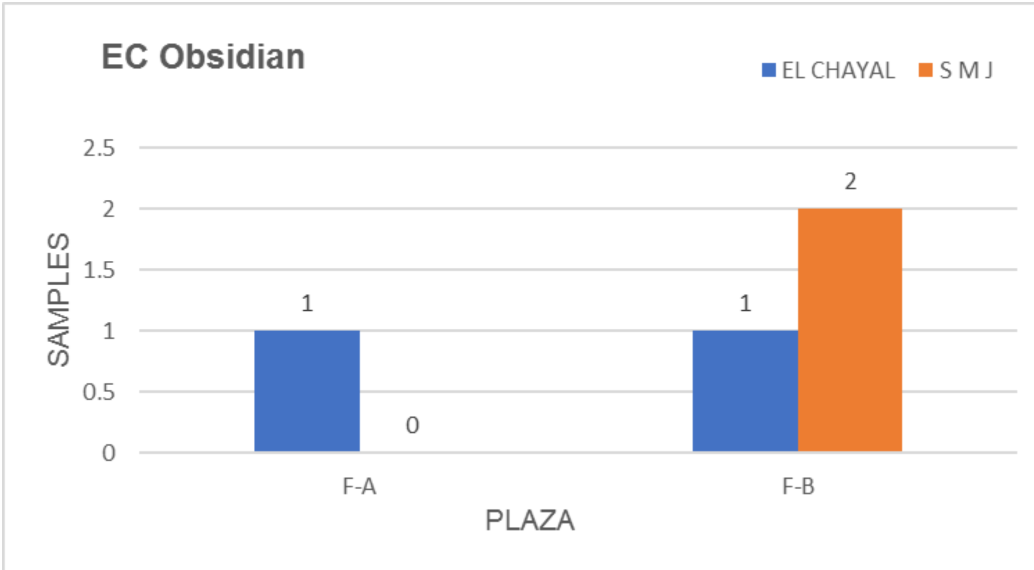

Figure 35: Graphic depicting the frequency of obsidian samples and their sources during the Early Classic period, organized by the plazas where the contexts was found (Created by the author).

The maps presented in Figure 36 features the distribution of obsidian artifacts at Holtun during the Early Classic Period. As mentioned above, the samples are limited presumably due the decrease of cultural activity and possibly even abandonment during this period at the site. However, it is possible to observe that the few samples are concentrated in the foundational center of the site. This characteristic in the distribution coincides with the pattern of distribution of nucleation of obsidian in Group F from previous periods. Figures 32 and 34 show the concentration of obsidian near the foundational center of the site.

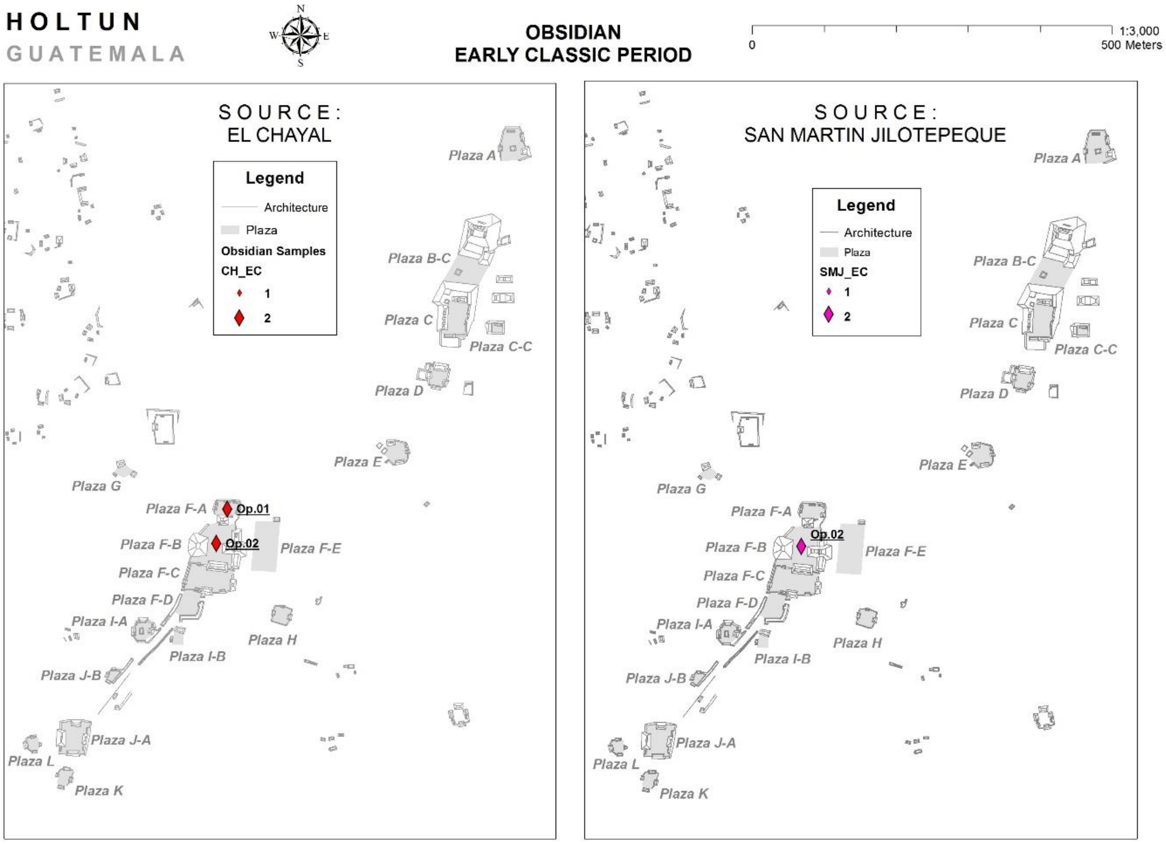

Figure 36: Comparison of Holtun maps featuring the distribution of obsidian samples by source during the Early Classic period (Map by the author).

Late Classic Period (A.D. 500 – 800)

Obsidian artifacts recovered from archaeological contexts dating to the Late Classic period comes from the operations No. 1, 9 17 and 18. These operations correspond to the plazas F-A, A-B, G and I-B, respectively. As shown in Table 5, the total of artifacts from this period are n=20, being n=8 from ELC and n=12 from SMJ. The frequencies indicate that there is still a majority of artifacts from SMJ; however, it also depicts a uniform distribution of artifacts from ELC across the plazas. It is also noticeable that artifacts from ELC are present in more plazas than artifacts from SMJ.

Table 5: List of obsidian artifacts from the Late Classic Period at Holtun.

Operation	**Plaza**	**El Chayal**	**San Martin Jilotepeque**	**Total**
01	F-A	2	2	4
09	B/C	2	0	2
17	G	2	4	6
18	I-B	2	6	8
	Total	8	12	20

Information courtesy of Holtun Archaeological Project (see Appendix B).

The graphic depicted in Figure 37 indicates the proportion of obsidian artifacts found in Late Classic contexts at four plazas of the site. The graphic features the uniform distribution of artifacts from ELC described previously. In addition, it is possible to observe a larger proportion of artifacts from SMJ, which in this case, have a tendency to nucleate towards groups that are distant from the foundational center of the site. On Plaza F-A, it is possible to observe a modest sample with a uniform distribution of obsidian artifacts from both typical sources. On Plaza B/C, only two samples were found and both of them correspond to ELC source. Finally, in plazas G and I-B the majority of artifacts come from SMJ sources. The highest concentration of artifacts occurs in Plaza I-B, where the majority of samples come from the SMJ source.

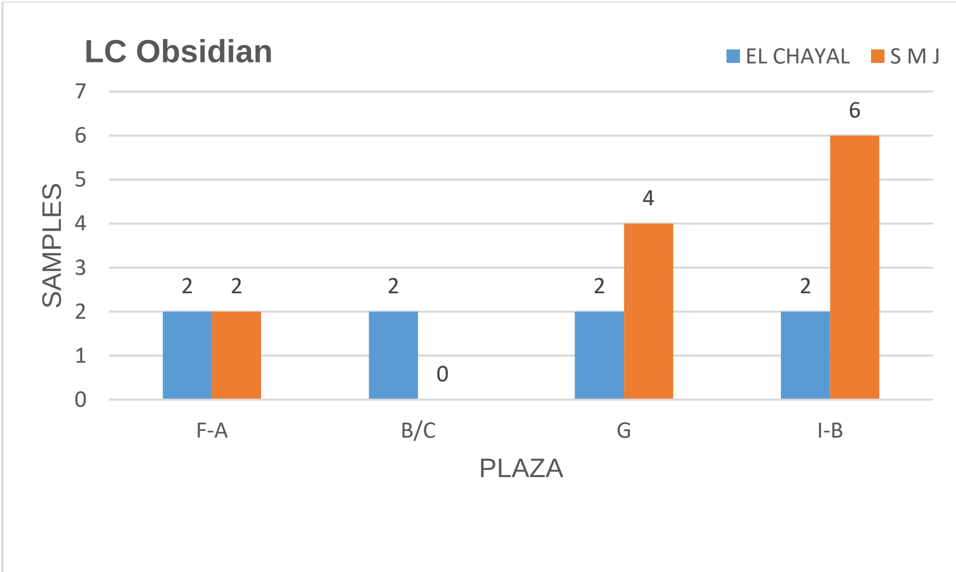

Figure 37: Graphic depicting the frequency of obsidian samples and their sources during the Late Classic period, organized by the plazas where the contexts was found (Created by the author).

The maps presented in Figure 38 show the distribution of obsidian artifacts at Holtun during the Late Classic period. The spatial distribution of artifacts indicates that the higher quantity of samples from SMJ are concentrated more closely near the foundational center of the site, including plazas F-A, G and I-B. On the contrary, samples from ELC are broadly extended across the site, having presence in the distant Plaza B/C, as well as the other plazas featuring samples from SMJ during this period. That indicates a transformation in the pattern of obsidian distribution observed in previous periods on which artifacts from ELC were concentrated near the foundational center. During the Late Classic period, artifacts from ELC are present in plazas near the foundational center as well as than plazas farther away. On the other hand, the presence of samples from SMJ tend to be more distant from the foundational center of the site.

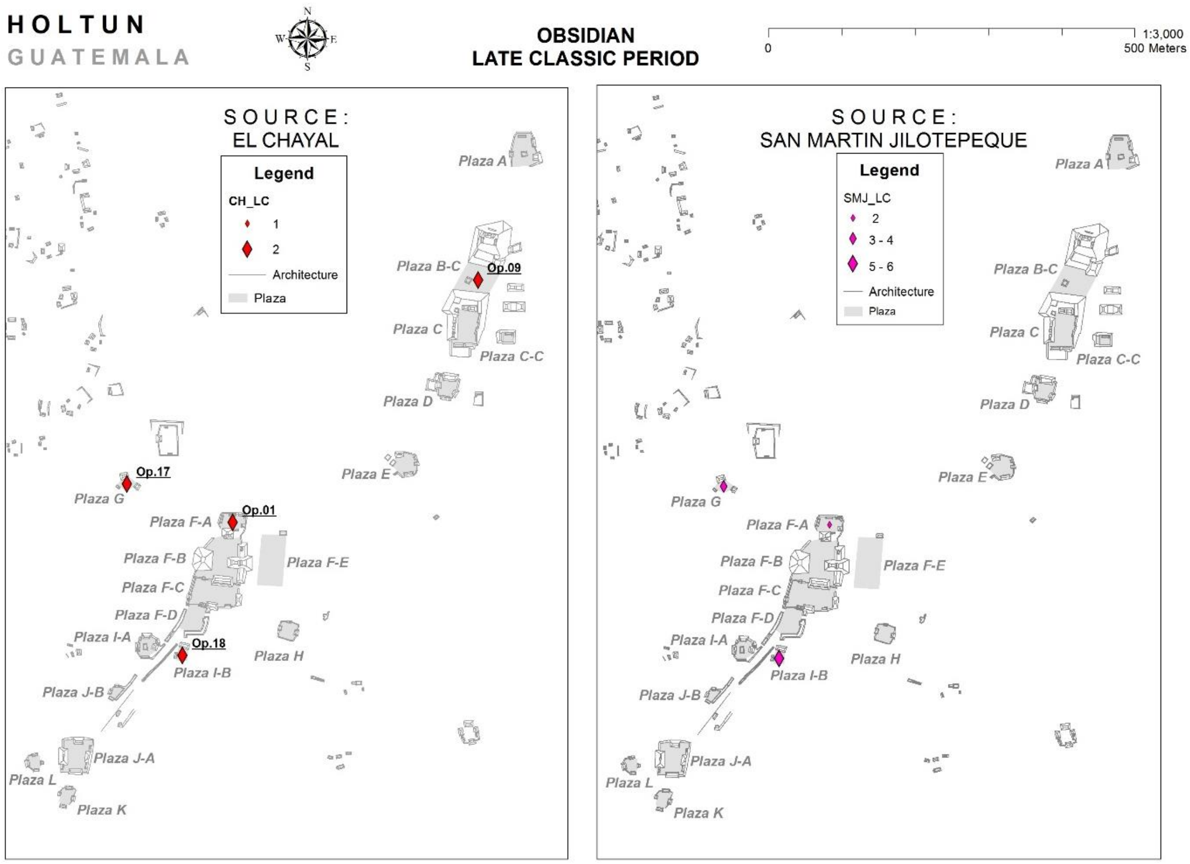

Figure 38: Comparison of Holtun maps featuring the distribution of obsidian samples by source during the Late Classic period (Map created by the author).

Terminal Classic Period (A.D. 800 – 1000)

Obsidian artifacts recovered from contexts dating Terminal Classic period come from the operations No. 1, 2, 5, 6 and 13. These operations correspond to the plazas F-A, F-B, K, E, and H respectively. As described in the Table 6, the quantity of artifacts from this period is n=36, being n=20 from ELC and n=3 from SMJ. These frequencies depict a majority of artifacts from ELC, contrasts with previous periods when artifacts from SMJ were more typical for the site. Also, it is important to observe that artifacts from ELC are present in more plazas than artifacts from SMJ.

Table 6: List of obsidian artifacts from the Terminal Classic Period at Holtun.

Operation	Plaza	El Chayal	San Martin Jilotepeque	Total
01	F-A	9	1	10
02	F-B	3	2	5
05	K	1	0	1
06	E	2	0	2
13	H	5	0	5
	Total	20	3	23

Information courtesy Holtun Archaeological Project (see Appendix B).

The graphic depicted in Figure 39 features the distribution of obsidian artifacts at Holtun. Based on Table 6, it features the frequencies of artifacts found through the operations in five of the plazas at the site. During this period, a higher amount of artifacts from ELC were found, as well as a broader distribution of them across the site. The materials from SMJ are not only fewer, but they are concentrated in plazas at the foundational center of the site. The proportion of artifacts in Plaza F-A indicates a higher presence of samples from ELC than SMJ; the later has only one sample. In Plaza F-B, the modest sample of obsidian artifacts feature an equal relationship between sources, with only one sample more from ELC. Then, the sampling from plazas K, E and H contains obsidian artifacts exclusively from ELC (Figure 39).

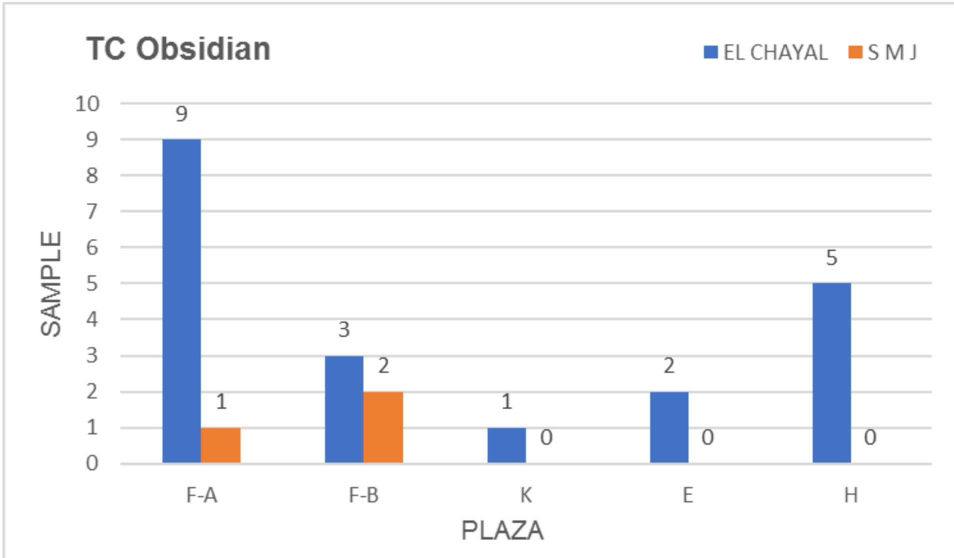

Figure 39: Graphic depicting the frequency of obsidian samples and their sources during the Terminal Classic period, organized by the plazas where the contexts was found (Created by the author).

The map presented in Figure 40 depicts the geographic distribution of obsidian artifacts at Holtun during the Late Classic period. The spatial distribution of artifacts indicates that artifacts from ELC were not only present in higher quantity but were widely distributed across the site. On the contrary, artifacts from SMJ are not only fewer but also concentrated around the foundational center of the site on plazas F-A and F-B. The map depicts a pattern of distribution that begin during the previous period, when the samples from ELC developed a broader distribution. During this period, it is possible to observe a transformation in the patterns of procurement and distribution of obsidian artifacts across the site. The map features an opposite distribution than the one observed in maps of obsidian artifact distribution from the Middle and Late Preclassic periods (see Figures32 and 34).

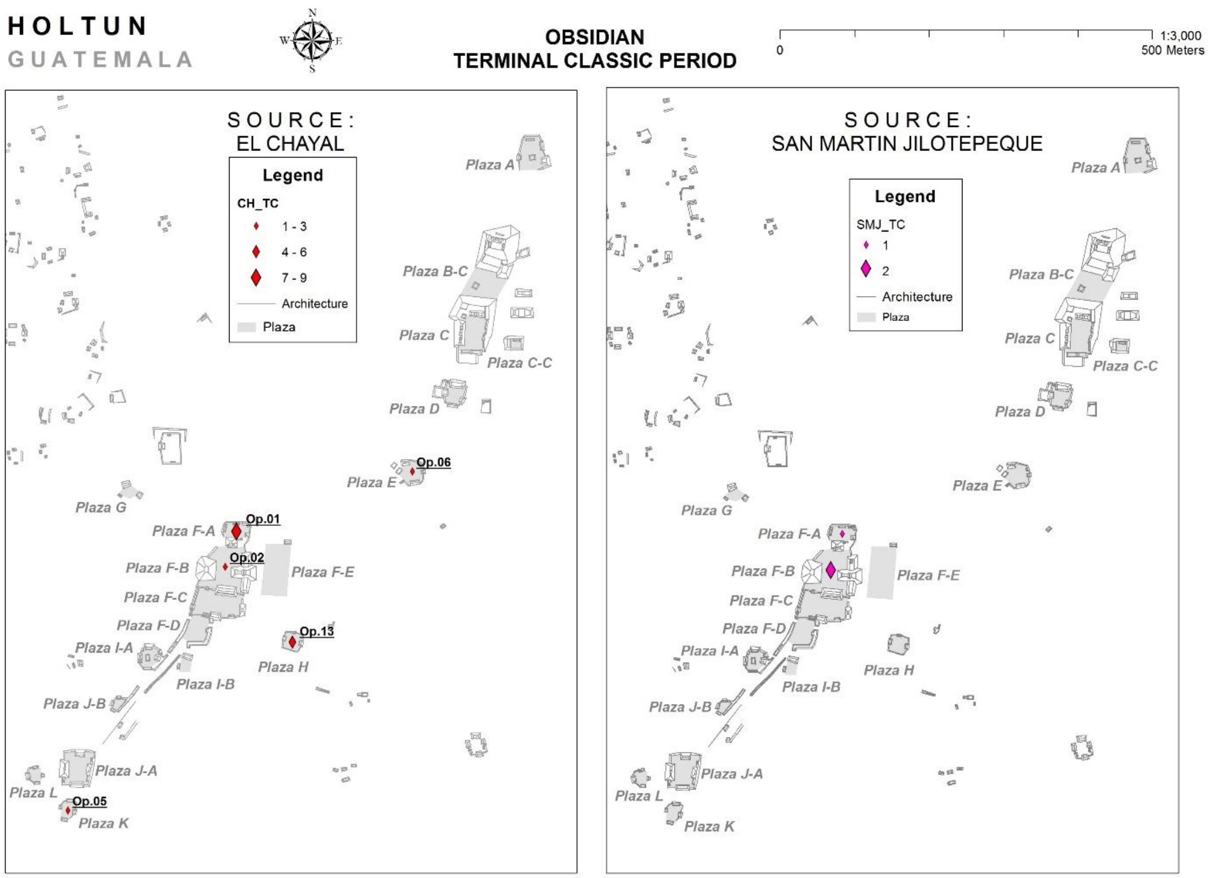

Figure 40: Comparison of Holtun maps featuring the distribution of obsidian samples by source during the Terminal Classic period (Map created by the author).

Observations: Changes on Distribution Patterns

As described in the beginning of this chapter, a descriptive and comparative analysis was performed on a sample of n=236 obsidian artifacts. These samples come from excavations performed between 2011 and 2016 by Holtun Archaeological Project. The total population of obsidian artifacts is n=316, but not all met qualifications for this analysis. The methodology for the analysis required the contextualization of all the artifacts by the chronology, location, and source of provenience. Unfortunately, some obsidian artifacts at Holtun come from contexts that have mixed materials from Late Preclassic and Terminal Classic periods. These periods represent the times of highest cultural activity according with archaeological evidence (Callaghan and Rivera 2011; Fialko 2011). Therefore, the mixture of these contexts could result in the fusion of two different periods with their own cultural manifestations and sociocultural dynamics.

All artifacts used for this analysis are listed in Appendix 1. Each artifact was associated with an archaeological context, which correspond to a lot within an excavation unit. Each of these units correspond to a numbered operation. As described in Chapter 2, the Holtun Archaeological Project has excavated an operation on each of the elite residential household groups at the site. In this analysis, the artifacts were organized by operation and in sequence by plaza.

Archaeological contexts are associated to a period by a relative chronology based on ceramic evidence. However, some contexts cannot be associated with a period due the lack of ceramic evidence or the broad mixture of ceramic types. Nevertheless, the process of association of each artifact with a particular dated context allowed for the classification and quantification of artifacts by period. In this case, as observed in Table 1, Holtun presented n=36 artifacts during the Middle Preclassic period, n=151 during the Late Preclassic period, n=4 during the Early Classic period, n=20 during the Late Classic period, and n=23 during the Terminal Classic period.

After organizing the total number of obsidian artifacts by period, they were also organized by source of provenience. For this information, the pXRF analysis was valuable to have an accurate assignation of a geochemical origin of each piece. The results of the provenience analysis indicate that El Chayal and San Martin Jilotepeque were the typical sources for obsidian procurement at Holtun. From the total of n=236 samples analyzed and listed in

Table 1, the results indicate that n=141 originate from El Chayal and 95 from San Martin Jilotepeque.

The chronological and geological information of the obsidian samples constitute the variables assigned to the artifacts that allowed for an assessment of distribution and restriction during each period of Holtun history. Table 1 indicates the quantity of samples associated with each period and it is organized by the source of provenience. In summary, during the Middle Preclassic period, n=8 samples came from ELC and n=28 from SMJ. During Late Preclassic, n=101 samples came from ELC and n=50 from SMJ. During Early Classic period, n=2 samples came from ELC and n=2 from SMJ. During Late Classic, n=8 samples came from ELC and n=12 from SMJ. Finally, during the Terminal Classic period, n=20 samples came from ELC and n=3 from SMJ. Additionally, there are two samples coming from ELC associated with Postclassic activity. The previous information allows for the perception of frequencies by source and period depicted on the graphic featured in Figure 30 and based on Table 1.

The graphic in Figure 30 indicates the changes in obsidian frequencies at Holtun across time, based on the samples available. The Middle Preclassic period features an initial set of samples with a preference on SMJ source. Then, during the Late Preclassic period, the quantity of obsidian experiences a peak and the data features a preference for ELC source. A deposit of obsidian fragments found in a funerary context influences the high frequency of ELC artifacts during this period. However, there is a general tendency of increase in the quantity of materials for this period. The transition toward the Early Classic period presents a notable decrease in the quantity of artifacts from both sources. Next, the transition toward the Late Classic period presents a slight increase in the quantity of artifacts. At this period, the samples from SMJ still constitute the majority. Later, the transition toward the Terminal Classic period features a divergence on the preference of sources. Artifacts from ELC present a noticeable increase in quantity, with SMJ restricted to the ritual epicenter of the site. Finally, the inadequate evidence from Postclassic period activities at the site is associated with two obsidian samples from ELC.

To understand the nature of the distribution of obsidian artifacts, it was necessary to classify the artifacts by operation, and in consequence, by plaza. In this case, the plaza constitutes the unit of analysis by which each set of obsidian samples are organized by source and period. Tables 2 through 6 present the quantity of artifacts on plazas that contain obsidian samples on the archaeological contexts excavated by HAP. Each table corresponds to one of the five sub-periods of ancient Maya history addressed in this thesis, from the Middle Preclassic through the Terminal Classic. In addition, the quantity of artifacts was organized by source of provenience in order to understand the process of procurement of obsidian from each source. The quantity of artifacts and the dominance of one source over the other was not always evident and consistent. For that reason, it was necessary to depict graphically the proportions of artifacts by source in each plaza and subsequently represent these frequencies on a map.

The graphics depicted in figures 31, 33, 35, 37, and 39 represent the information listed on the tables described in the previous paragraph. These graphics feature the proportion of artifacts from each source in plazas that contain obsidian pieces during each cultural period at Holtun. The graphics aid in the understanding the presence of obsidian in the plazas, as well as the proportion of accessibility or preference for each of the sources. These images feature the tendency of prevalence of San Martin Jilotepeque obsidian during the earlier periods. Likewise, it is possible to observe the changes in the latest periods when the obsidian from El Chayal tends to prevail over San Martin Jilotepeque samples. The graphics also illustrate cases in which one source prevails in quantity over the other, but the source with fewer samples has more presence across the site. This scenario is observable in Figures 33 and 39, which demonstrate, based in the information on their respective tables, that the superiority in quantity does not represent a major dispersion across the site. For that reason, the next step required examination of the frequencies of artifacts across the site through geographic analysis.

The next process during the analysis of the materials was the creation of a map using ArcGIS 10.4.1 software. It allowed for comparison of the information from each of the plazas that presented obsidian evidence. The base map consisted of the information already collected during the 2010 to 2016 field seasons of HAP. This map layer included the topography of the land and the location of architectural elements. A new layer of information was created as a Shape File of points, indicating the center of each plaza that contained obsidian evidence. Each point contains attributes referring to the quantity of materials found in corresponding plazas organized by period and source of provenience, respectively. The layer of obsidian frequencies was formatted separately in five maps in representation of each of the Maya periods addressed in this thesis. The result was a geographical comparison of obsidian artifacts distribution by period, source, and location within the site.

The maps presented in this chapter as Figures 32, 34, 36, 38, and 40 feature a seriation of material distribution at the site across time. Figure 32 represents the distribution of materials associated with the Middle Preclassic period. The maps indicate the prevalence of materials from San Martin Jilotepeque is noticeable over the materials from El Chayal. The first type (SMJ) is distributed in three of the F plazas as well as Plaza C, indicating a wide range of distribution for this material. On the contrary, obsidian from ELC was less concentrated in the F plazas, with a modest presence in Plaza E. At this point, the distribution can be observed as differential, with a higher preference or accessibility to materials from SMJ.

In Figure 34, the maps feature the distribution of materials during the Late Preclassic period. This transition indicates a wider distribution of artifacts from SMJ, which reaches plazas L and A at the southwest and northeast extremes of the site. The artifacts from ELC feature a tendency to be nucleated towards the F plazas, with an important presence in Plaza E. A particular characteristic in Plaza E is the funerary context where the obsidian deposit was found. This finding could suggest some access exclusivity or distribution control by certain elite faction. This could be inferred due to the otherwise general scarcity and limited distribution of obsidian from this source during this period.

In Figure 36, the maps feature the distribution of obsidian during the Early Classic period. During this period, the frequency of samples decreases drastically. However, it is possible to observe that the small sample has still the tendency of clustering toward the foundational group. Obsidian artifacts have been constantly present in Plaza F-A and Plaza B since the Middle Preclassic period.

In Figure 38, the maps feature the distribution of obsidian artifacts during the Late Classic period. During this period, it is possible to observe a slight transformation in the pattern of obsidian distribution. The samples from SMJ are still prevalent in quantity over the samples from ELC. However, it is now possible to perceive a wider distribution of artifacts from ELC around the site. In addition, the samples from ELC feature a consistency in quantity by plaza, which could suggest a tendency of a uniform distribution of this material. The samples from SMJ tend to be nucleated towards the F plazas with a considerable presence in Plaza G, not far from Plaza F-A.

In figure 40, the maps feature the distribution of obsidian artifacts during the Terminal Classic period. This period presents a general increase in the frequency of artifacts in comparison with the two previous periods. At this time, the samples from ELC exceed the quantity of the samples from SMJ. Likewise, it is observed that the distribution of artifacts from ELC is more widespread than that from SMJ. The novel pattern of distribution contrasts with the patterns observed during the Middle and Late Preclassic period, where artifacts from SMJ were more widely dispersed across the site and artifacts from ELC were still clustered toward the foundational center.

In conclusion, there is a clear change in the patterns of distribution of obsidian artifacts at Holtun across time. This difference is perceptible throughout the systematic and comparative assessment of obsidian artifact frequencies by context. Likewise, it is possible to observe the change in the proportion of material accessibility and distribution. Nevertheless, it is the spatial analysis shown in the maps that provides a complete perspective of the pattern of non-local commodity consumption at the site. The ancient inhabitants of Holtun had the ability to create restricted and privileged spaces on the steep land where the site is located. It allowed for the utilization of natural features to aid in the restriction of their individual spaces. Therefore, the analysis of distribution of obsidian artifacts as non-local exotic goods not only indicates the participation of Holtun in a widespread net of commerce but also suggests a dynamic of exclusivity and privilege on an inter- and intra- group basis involving elite populations that used and occupied those plazas.

CHAPTER 4: DISCUSSION AND CONCLUSIONS

Distribution of obsidian artifacts at Holtun

The site of Holtun is located on a hilltop within the Yaxhá-Labná lagoon system basin, in the Central Peten lakes region, of the Maya Lowlands. The obsidian artifacts analyzed for this thesis were collected from various archaeological contexts during excavations carried out by the Holtun Archeological Project since 2011. Ceramic analysis performed by Michael Callaghan of University of Central Florida, provided the chronological context for each obsidian artifact. Portable X-Ray fluorescence (pXRF) analysis, performed by Dawn Crawford of Southern Methodist University, provided the source attribution of each artifact. Mapping and GIS analysis provided the spatial distribution of artifacts and correlated them to their associated architectonic groups. The fusion of these three methods allowed for an integral representation of obsidian artifacts from Holtun across space and time.

During the 2011 and 2016 field seasons, the Holtun Archaeological Project collected n=316 obsidian artifacts. From these samples, n=236 were used to perform the analysis presented here; some were excluded due to mixed or ambiguous chronological contexts. Through the process of organizing and classifying the obsidian artifacts by period and source, it was possible note patterns in the nature of acquisition and consumption of this material during the full temporal span of occupation at Holtun. Obsidian artifacts were present in excavations with contexts dating the Middle Preclassic, which was the earliest period of occupation at the site. During the Late Preclassic period, obsidian artifacts increase in quantity and distribution across the site, especially those from San Martin Jilotepeque source, while obsidian from El Chayal appears to be restricted to the ceremonial center of the site.

Later, during the Early Classic period, the quantity of artifacts from both sources decreased considerably. The observed trend is likely related to the decrease of cultural activities at many Maya sites during that period as result of social instability and even collapse in some cases during the last segment of Late Preclassic period (Freidel and Schele 1988: 549). This is a phenomenon observed at other sites in the Maya Lowlands, where the Early Classic activity is concentrated in the central plazas (Laporte and Fialko 1995; Tourtellot et al. 1996). Then, during the Late Classic period, the quantity of artifacts increases again, and both sources that are utilized at the site, El Chayal and San Martin Jilotepeque, become more widely distributed through the site. Finally, during the Terminal Classic period, the number of obsidian artifacts increases and the El Chayal source becomes even more widespread across the site. In addition, the obsidian from San Martin Jilotepeque was more restricted to the elite residential groups associated with the ceremonial core of the site.

The change in patterns of distribution and sources of obsidian during the Terminal Classic period could indicate changes in regional trade routes, which may have caused scarcity of the San Martin Jilotepeque source and possibly forced residents to reuse obsidian artifacts from previous periods. Further analysis of the obsidian artifacts from excavations in 2014 and 2015 will investigate this possibility now that the pattern has been detected. The widespread nature of El Chayal obsidian during the Terminal Classic period may be due to the breakdown of elite power during this tumultuous time just before the abandonment of Holtun and many other Maya sites. This pattern will be further investigated by Brigitte Kovacevich and Dawn Crawford through blade refitting analysis (see also Aoyama 2006), which may indicate elite redistribution of obsidian resources during earlier period and the potential breakdown of these systems. Additionally, the quantity and dispersion of obsidian artifacts during the Terminal Classic is still not high and widespread as during the Late Preclassic period. This may be due to the fact that Holtun was politically and economically eclipsed by more powerful neighbors like Yaxha and Tikal during the Classic period. During the Preclassic period, Holtun still held its own among its neighbors in terms of settlement, monumental architecture, and ritual function. Interestingly, we do not see the influx of Ixtepeque obsidian from the Guatemalan Highlands and Mexican obsidian from the Basin of Mexico as is seen at other larger neighbors of Holtun (P. Rice 1984; Rice et al. 1985). This again could likely be explained by Holtun's waning power during the classic.

This thesis presents a descriptive analysis of the distribution of obsidian artifacts at Holtun. It depicts a clear fluctuation on the quantity of artifacts and sources of provenience between each period of occupation at Holtun. It is suggested here that such fluctuation corresponds to a reaction to economic and sociopolitical dynamics in the greater Lowland Maya area, especially those involving the Yaxhá basin. Although the obsidian samples cannot represent all the cultural processes at work at Holtun, the spatial-temporal contextualization of the artifacts could highlight some economic dynamics. These fluctuations coincide with regional cultural activity as well as consumption patterns observed in the basin by other scholars (e.g. P.Rice 1984; Rice et al. 1985), such as the dominance of San Martin Jilotepeque obsidian during the Preclassic which is later suppressed by El Chayal obsidian in the Classic Period.

The Preclassic period also experienced a term of intense cultural activity that is highly evident at Holtun. During the Middle Preclassic period, when sites like Ceibal, El Mirador and Tikal were developing complexity, Holtun was seeing construction of its first buildings and displaying social complexity as well. The architecture at the site included architectonic groups with patios an plazas in privileged hilltop areas and the elaboration of monumental architecture for public ritual, as observed in the *E-Group* in the center of Group F (Callaghan 2017; Fialko 2011). During this period, San Martin Jilotepeque was the dominant obsidian source in the residential plazas.

During the Late Preclassic period, Holtun underwent a similar florescence as other contemporary sites (Fialko 2011; Freidel and Schele 1988). It is possible to observe massive remodeling at main buildings in the architectural groups in the epicenter of the site. Despite its restricted dimensions, the site contains many elements that are similar to other prosperous Maya sites of its time. Among those elements are the sculptured facades or *mascarones* in groups B and F (see Figure 7), the *E-Group* (see Figure 15), and a triadic pyramid compound in Group B (see Figure 19) (Fialko 2011). Correspondingly, excavations from this period produced the greatest quantity of obsidian artifacts. The nucleation of artifacts from the El Chayal source towards the foundational plaza and residences associated with the first ritual and monumental architecture at the site is evident in the maps shown in Chapter 3. Likewise, the widespread distribution of artifacts from San Martin Jilotepeque among the plazas can be observed on the map (see Figure 34).

At the end of Late Preclassic period, it is believed that some sites experienced a social crisis (Foias 2013: 11). Some of the sites never overcame such crises while others initiated a new era of hegemony. It is possible that this was the case at Holtun, which, after experiencing a period of social instability, exhibited limited cultural activity during the Early Classic period. If this is the case, this pattern coincides with the scarcity of obsidian artifacts and cultural material associated to this period. During the Early Classic period, monumental cities like Tikal start having a strong political activity, centralizing the authority to a king or a lord called *Ajaw* (Rice 2004: 92). This is the beginning of an expanding and constricting fight for hegemony among big

Maya polities. It created a cluster of allies around the bigger Maya polities, which changed sides according to the ability of the former to keep the ideological and political power over the latter (Demarest 1992: 15). Political activity increased in the basin of Yaxhá as well, manifesting strong affiliations with the city of Tikal. Sites like Yaxhá, Topoxté, Labná and La Naya began to carve monumental sculpture. With the exception of La Naya, these sites developed an emblem glyph, which is a symbol of political presence in the area (Rice 2004: 145; Stuart and Houston 1994). It can be seen that cultural activity did not cease at Yaxhá-Labná basin, but for some reason, it did at Holtun, which to date does not have a recorded emblem glyph.

In the Early Classic period, it is important to consider circumstantial evidence that could suggest the lack of participation of Holtun in regional and international cultural dynamics during that time. One of the most iconic events during this time is the contact with the city of Teotihuacan in Central Mexico. This contact was evident in iconography on monuments and painted ceramics, as well as architectural elements across the Maya Lowlands (Iglesias 2003; Foias 2013: 12; McKillop 2004: 183). Also indicative of that contact is the presence of green obsidian from Pachuca source in Central Mexico. Central Mexican architectural features, sculpture, and green obsidian blades have all been documented as evidence of this contact at the near center of Yaxhá (Hermes, et al. 2006: 985). Excavations at Holtun have to date uncovered none of this evidence.

Nevertheless, the period that contains more information about politics among the Maya is the Late Classic period. Again, the monumental site of Yaxhá is the closest site that participated in such political interactions. The site is known for its participation in the conflictive dynamics during the Late and Terminal Classic Periods. This information is based on decipherment of the emblem glyph Yax-Ha *Green-Water* and its mention on hieroglyphic texts from other sites (Culbert 1991: 130).

Ancient Maya political history is known by the decipherment of hieroglyphic texts found throughout the Maya Lowlands. These texts have been widely used to create interpretative models of ancient Maya political organization. The evidence not only includes names of cities, but ranks of rulers and relationships of power (Rice 2004: 36). It has been observed that ancient Maya politics are characterized by the stratification of power within polities, generating patterns of centralization and bureaucracies (Foias 2013: 111). However, the interpretations of such stratified and conflictive dynamics also require the utilization of archaeological evidence. Relying only on hieroglyphic information might provide an incomplete tableau of the society (see Chase et al. 2008), and this limitation worsens when texts are found in the area, but not at the site studied. There are a few samples of hieroglyphic inscriptions found at the site of Holtun in the form of graffiti etched into plaster (Callaghan 2016b; 2017; Callaghan et al. 2017; Fialko 2002). This could indicate cultural relationships and status of local elites, but so far have not provided much information of political relationships.

The quantity of obsidian samples at Holtun increases during the Late Classic period from the Early Classic period, but are still lower than the numbers form the Late Preclassic. However, there is not a clear dominance of one source over the other. As observed on the tables, graphics, and maps from Chapter 3, the artifacts from San Martin Jilotepeque are higher in quantity but the artifacts from El Chayal are more widely distributed throughout the site.

The Terminal Classic period is characterized by changes in the socioeconomic composition of the landscape in the Maya region. New trade routes was open and many sites start to interact widely east to west through the Peten lakes region. In general, the dominance over traditional sources of obsidian decreases and different sources from new trade routes appear in the Lowlands. During this period at other sites is possible to find Mexican obsidian from a expanding trade routes (Folan et al. 2001: 238) and artifacts from Ixtepeque, an obsidian source in the east of Guatemala (Rice and Rice 2004: 129). However, there is no evidence at Holtun of obsidian from central Mexico or Ixtepeque. The quantity of obsidian artifacts at Holtun does not increase much from the Late Classic period. Nevertheless, the El Chayal source becomes more dominant in quantity and distribution over the samples from San Martin Jilotepeque source.

The patterns of distribution of obsidian artifacts also suggest internal relationships of power at Holtun. The nucleation of certain sources in and around the foundational center indicates that the social factions that inhabited the site epicenter had the ability to restrict the access and distribution of obsidian. From the Preclassic through the Early Classic periods, the samples from El Chayal were concentrated near Group F and Group E. During the Late and Terminal Classic, the artifacts from El Chayal were more widespread across the site. However, during these periods, the artifacts from San Martin Jilotepeque had the tendency to be nucleated in the center of the site. It is possible that this is the consequence of changes in political or socioeconomic interactions of Holtun that affected the accessibility of this source. And elites my have gained access to restricted trade and/or reused earlier materials to maintain exclusivity.

To understand the relationship of power between social entities in a site, it is necessary to interpret the symbols that represent status. In that sense, archaeological materials like obsidian artifacts are important to identify the status of a person or a group. However, the presence or absence of prestige goods could be a false indicator of status because they are often found in a diversity of social contexts (Jackson 2013: 64; Rice 1984). At the same time, the wide distribution of obsidian within Maya sites may suggest that the ancient Maya experienced a high diversity of statuses within the site and across time (Jackson 2013: 81), demonstrating the existence of secondary and tertiary elites (Elson and Covey 2006) and even possibly a *middle class* (Chase and Chase 1996).

The accessibility of obsidian, among other materials, can be seen as an indicator of rank and stratification within the site. The nucleation of a source and the deposition of a large quantity of pieces in a funerary context strengthen the probability that it was a privileged and/or restricted material. The nature of the Preclassic Maya architecture and cultural traits suggests the idea of public, communal rituals in plazas, while the nature of the Classic Maya suggests the tendency to conduct the ritual activities towards the authority of an individual. Therefore, the status may have been manifested differently during Preclassic and Classic periods.

The nature of obsidian distribution could contribute with the study of social organization at Holtun. In certain ways this distribution supports the Dual Processual model proposed by Banton and colleagues (Blanton 1998; Blanton et al. 1996; Feinman 1995, 2000, 2001: 156), but in other ways the results are surprising. The Maya Preclassic society has the tendency to perform common endeavors to create public architecture and rituals without the glorification of individuals. However, it seems that the faction that controlled the ritual activity during the Late Preclassic and also had the ability to control or restrict the distribution of obsidian from El Chayal. Strategies for ritual/ceremonial power seem to focus more on inclusive or corporate modes, while economic power, in the case of obsidian, seems to focus more on restrictive or network modes.

During the Classic period ritual and political power becomes focused on a singular ruler or *K'uhul Ajaw*, but the coveted source of El Chayal becomes more evenly distributed throughout the elite residential groups at the site. We might expect that social or ideological power and economic power might have corresponding network or corporate strategies, but in some cases the picture may be more complex, as is also argued by Blanton et al. (1996). During the Late Classic period powerful elites may have redistributed obsidian to other groups in order to maintain favorable relationships. This hypothesis will be further tested by future blade refitting analysis (see also Aoyama 2006).

During the Terminal Classic period, we see El Chayal obsidian become even more widely distributed and surpass San Martin Jilotepeque in quantity. This could be due to the breakdown of elite power during this period associated with the Maya collapse. Elite factions who had been unified during the Classic period with network strategies in the realm of ritual and political power and more corporate economic strategies, may have once again enjoyed more heterarchical (Crumley 1995) relationships of power during this tumultuous time. The once more powerful elites in the site epicenter may have then defined and elevated themselves by restricting and/or reusing obsidian from San Martin Jilotepeque, which had not been favored for hundreds of years.

In conclusion, the aim of this thesis was to identify elements of variability in status highlighted by the patterns of distribution of exotic goods. The analysis has shown how the residential groups at Holtun possibly derived power from the importation and control of obsidian. Such analyses can allow for the observation of local dynamics of accessibility and control of exotic goods, in the context of larger dynamics of commerce between ancient Maya polities.

Implications of Spatial Analysis in the Assessment of Obsidian Distribution

The spatial analysis of obsidian artifacts distribution at Holtun contribute to the understanding of procurements patterns of these exotic goods at the site. It constitutes a first step in the spatial analysis of archaeological materials that evidence cultural activities at the site; that are available through archaeological sampling. Therefore, the use of settlement archaeology as a source for theoretical and methodological approaches provides supplementary information for the understanding of an archaeological site, its internal composition and its relationship with the social and natural environment.

The regional and local maps of Holtun presented in Chapter 2 and Chapter 3 are the result of years of data collection in the field and digital media, as well as years of data manipulation in cartographic software. The maps show that Holtun is settled on the edge of a mountain chain, which starts the morphology of Yaxha-Labna basin. Through the observation of the topography, it is possible to understand how exclusivity and privileged might have been the space for the proper settlement of an architectonical group. The elite architectonical compounds are localized in the highest hills, associated with the plazas and monumental architecture. Likewise, the non-elite households are nucleated in a cluster at the northwest slope of the site as shown in Figure 25. The monumental architecture at Holtun follows the tendency of Maya sites to be public during the Preclassic period (e.g. Folan et al. 2001:229). Later, during the Classic period, the plazas delimited by structures acquire individualistic characteristics and contain the diverse activities of elite groups, as described by Becker (2003) in his analysis of function of plazas in Maya sites. The plazas, as the spaces within the architectural groups, constitute a microcosm where the elite groups performed their activities under their own autonomy. Comparing these units of cultural performance allows for the understanding of the internal economic relationships through the obsidian artifacts. Future analyses will incorporate multiple artifact categories within the database (including faunal and human bone data, as well as the results from isotopic analyses), which will provide a more complete picture of social relations and political and economic changes within the site.

The analysis of obsidian dispersion across the site facilitated the observation of patterns of distribution and frequency of artifacts on each plaza throughout the occupation of the site. It features the nucleation and centralization of artifacts from El Chayal during the Preclassic period and the dispersion of this source within the site during the Late and Terminal Classic periods. The superimposition of layers featuring the variables of quantity, chronology and location for obsidian samples at Holtun provides an accurate, precise and accessible source for materials comparison. The performance of this method of analysis on a cartographic software such as ArcGIS or QuantumGIS allow for the rapid display of information and the possibility of comparison between this dataset and further information from the site.

For example, the area of Group F is considered a space of centralized social power. This argument is supported by the monumentality of the architecture in comparison with the rest of the site and the position of privilege on the topography of the land. This information is complemented by archaeological evidence featuring a cruciform cache dug into bedrock (Callaghan 2016; Callaghan et al. 2017) suggesting that the eastern building in Plaza F-B was a foundational center. Cruciform offerings were found as foundational dedicatory ritual in buildings of this type at Ceibal (Smith 1982; Ortiz et al. 2012) and Cival (Estrada-Belli et al. 2006: 699). Artifact distribution patterns support this evidence that Group F-A was an important ritual and economic power throughout Holtun's occupation, but especially during the Preclassic period.

Therefore, the use of GIS technology has the potential to grant versatility to the analysis of archaeological material through its spatial and chronological settlement. It allows for the comparison of artifacts from different levels of interaction. The spatial pattern of obsidian at Holtun can be analyzed and compared with samples from the rest of the basin or the Maya Lowlands. At the same time, the obsidian can be analyzed by the plaza where it was found, the pit where it was collected, the context to which it belongs or an analysis can be performed comparing each individual piece of obsidian if desired. The scope and flexibility of GIS analysis constitute a methodological contribution to the settlement studies that have been performed in the area with traditional maps.

Significance of the Outcomes

The significance of this thesis is to contribute to the understanding of the complex nature of Maya political and socioeconomic dynamics. These dynamics can be understood on both local and regional levels, according to the territory covered by the sampling process. The local perspective is constituted by the information resulting from the research performed on the samples collected within the known perimeter of Holtun.

These results have the potential to enrich the information provided by scholars regarding the changes in obsidian consumption patterns at the central lakes region from Preclassic through Classic periods (e.g. P.Rice 1984; Rice and Rice 2001; Rice et al. 1985). The analysis of the artifacts of Holtun complement the information about the cultural patterns related with obsidian consumption, but perceived from a local view within one archaeological site. Therefore, these results have the potential be used in future research that seeks to understand cultural processes experienced by archaeological sites in response to larger political and socioeconomic dynamics. The trends of dominant sources at Holtun in some ways support larger trends in the Maya Lowlands (i.e., the replacement of San martin Jilotepeque as the dominant source by El Chayal), but at the same time there is no diversification during the Terminal Classic period in terms of other Guatemalan and Mexican sources (e.g. P. Rice 1984). This may represent Holtun's secession from power in the region after the Preclassic period. Future research on obsidian at Holtun and other sites in the central lakes region may further illuminate these patterns.

Limitations and future directions

This analysis contains two limitations that have to be considered for future research. The first limitation is the presence of mixed contexts at Holtun due to taphonomy process and looting practices. These mixed contexts create a wide range for the possible chronology of contexts, which could considerably affect the analysis of frequencies of obsidian by period. Although all mixed contexts were excluded from this analysis, this caused many of the samples to be unusable and the sample size to be smaller. The second limitation is the consideration of obsidian alone as the only evidence considered for exotic products and symbol of status. It is important that other materials like fauna remains, jade, lithic, and architectural features are considered for an integrated analysis of economy, status, and power relationships at Holtun. Future research will address this by adding all recovered artifacts to the database created here.

The obsidian sample size will also be increased with the inclusion of material from future excavations in the site center and will hopefully include excavations form lower status residences in the northwest and southeaster portions of the site. The scope of variables can also be increased in future analyses to include aspects like artifact type, relative measures of quantity (i.e., grams of obsidian per cubic meter of excavated fill), degree of use, retouch, and spatial connections of refitted blades, etc.

GIS analysis has traditionally been used to understand visual and physical relationships among sites, exploring the accessibility and the relationship with the environment. However, the results obtained by this analysis suggest the potential benefits of performing GIS analysis of material in a local, site-based perspective. The spatial analysis of materials can reveal important details of the cultural behavior of a society across time within an archaeological center, while also allowing contextualization in larger regional, social, and economic patterns.

APPENDIX A:
OBSIDIAN FROM HOLTUN

Table 7: List of obsidian artifacts from the excavations performed during the field seasons in 2011 and 2016.

No	ID	Lot	Op.	Unit	Season	Source	Period
1	HTN_obs_01	HTN-1-1-12	1	1	2011	SMJ	LMPC
2	HTN_obs_02	HTN-1-1-14	1	1	2011	SMJ	LMPC
3	HTN_obs_03	HTN-1-1-14	1	1	2011	SMJ	LMPC
4	HTN_obs_04	HTN-1-1-15	1	1	2011	SMJ	LMPC
5	HTN_obs_05	HTN-1-1-15	1	1	2011	SMJ	LMPC
6	HTN_obs_06	HTN-1-1-15	1	1	2011	SMJ	LMPC
7	HTN_obs_07	HTN-1-1-15	1	1	2011	SMJ	LMPC
8	HTN_obs_08	HTN-1-1-15	1	1	2011	SMJ	LMPC
9	HTN_obs_09	HTN-1-1-15	1	1	2011	SMJ	LMPC
10	HTN_obs_10	HTN-1-3-10	1	3	2011	CH	LMPC
11	HTN_obs_11	HTN-1-3-1	1	3	2011	CH	TC
12	HTN_obs_12	HTN-1-3-1	1	3	2011	SMJ	TC
13	HTN_obs_13	HTN-1-3-17	1	3	2011	SMJ	LMPC
14	HTN_obs_14	HTN-1-3-16	1	3	2011	SMJ	LPC
15	HTN_obs_15	HTN-1-3-3	1	3	2011	CH	TC
16	HTN_obs_16	HTN-1-3-3	1	3	2011	CH	TC
17	HTN_obs_17	HTN-1-3-4	1	3	2011	CH	TC
18	HTN_obs_18	HTN-1-3-4	1	3	2011	CH	TC
19	HTN_obs_19	HTN-1-3-4	1	3	2011	CH	TC
20	HTN_obs_20	HTN-1-4-10	1	4	2011	SMJ	LPC
21	HTN_obs_21	HTN-1-4-13	1	4	2011	SMJ	LPC
22	HTN_obs_22	HTN-1-4-15	1	4	2011	SMJ	LPC
23	HTN_obs_23	HTN-1-4-15	1	4	2011	SMJ	LPC
24	HTN_obs_24	HTN-1-4-15	1	4	2011	SMJ	LPC
25	HTN_obs_25	HTN-1-4-6	1	4	2011	CH	LPC
26	HTN_obs_26	HTN-1-4-3	1	4	2011	CH	TC
27	HTN_obs_27	HTN-1-4-4	1	4	2011	CH	TC
28	HTN_obs_28	HTN-1-4-10	1	4	2011	SMJ	LPC
29	HTN_obs_29	HTN-1-4-6	1	4	2011	CH	LPC
30	HTN_obs_30	HTN-1-5-1	1	5	2011	CH	ND
31	HTN_obs_31	HTN-1-5-10	1	5	2011	CH	LPC
32	HTN_obs_32	HTN-1-5-5	1	5	2011	CH	TC
33	HTN_obs_33	HTN-1-5-1	1	5	2011	CH	ND
34	HTN_obs_34	HTN-1-5-9	1	5	2016	SMJ	LC
35	HTN_obs_35	HTN-1-6-1	1	6	2011	CH	LC
36	HTN_obs_36	HTN-1-6-1	1	6	2011	SMJ	LC
37	HTN_obs_37	HTN-1-6-17	1	6	2016	SMJ	LMPC

No	ID	Lot	Op.	Unit	Season	Source	Period
38	HTN_obs_38	HTN-1-6-17	1	6	2016	SMJ	LMPC
39	HTN_obs_39	HTN-1-6-18	1	6	2016	SMJ	LMPC
40	HTN_obs_40	HTN-1-11-13	1	11	2016	SMJ	LMPC
41	HTN_obs_41	HTN-1-11-13	1	11	2016	SMJ	LMPC
42	HTN_obs_42	HTN-1-11-13	1	11	2016	CH	LMPC
43	HTN_obs_43	HTN-1-11-13	1	11	2016	CH	LMPC
44	HTN_obs_44	HTN-1-13-10	1	13	2016	CH	LMPC
45	HTN_obs_45	HTN-1-13-10	1	13	2016	SMJ	LMPC
46	HTN_obs_46	HTN-1-16-11	1	16	2016	CH	LMPC
47	HTN_obs_47	HTN-1-21-10	1	21	2016	SMJ	LMPC
48	HTN_obs_48	HTN-1-21-3	1	21	2016	SMJ	EC
49	HTN_obs_49	HTN-1-23-10	1	23	2016	SMJ	LPC
50	HTN_obs_50	HTN-1-3a-2	1	3a	2011	CH	LC
51	HTN_obs_51	HTN-1-3a-2	1	3a	2011	NS	LC
52	HTN_obs_52	HTN-1-3a-8	1	3a	2011	SMJ	LPC
53	HTN_obs_53	HTN-1-3a-7	1	3a	2011	SMJ	LPC
54	HTN_obs_54	HTN-1-3a-7	1	3a	2011	SMJ	LPC
55	HTN_obs_55	HTN-1-3a-7	1	3a	2011	SMJ	LPC
56	HTN_obs_56	HTN-1-3a-8	1	3a	2011	SMJ	LPC
57	HTN_obs_57	HTN-1-4a-9	1	4a	2011	SMJ	ND
58	HTN_obs_58	HTN-1-4a-9	1	4a	2011	SMJ	ND
59	HTN_obs_59	HTN-2-2-2	2	2	2011	CH	ND
60	HTN_obs_60	HTN-2-2-2	2	2	2011	CH	ND
61	HTN_obs_61	HTN-2-3-3	2	3	2011	CH	LPC
62	HTN_obs_62	HTN-2-5-1	2	5	2011	SMJ	TC
63	HTN_obs_63	HTN-2-5-1	2	5	2011	SMJ	TC
64	HTN_obs_64	HTN-2-29A-6-9	2	29A	2016	SMJ	LPC
65	HTN_obs_65	HTN-2-29A-9-1	2	29A	2016	SMJ	TC
66	HTN_obs_66	HTN-2-29A-11-1	2	29A	2016	CH	EC
67	HTN_obs_67	HTN-2-29A-10-1	2	29A	2016	SMJ	LPC
68	HTN_obs_68	HTN-2-29A-0-1	2	29A	2016	CH	LMPC
69	HTN_obs_69	HTN-2-29A-0-1	2	29A	2016	CH	TC
70	HTN_obs_70	HTN-2-29A-10-2	2	29A	2016	SMJ	EC
71	HTN_obs_71	HTN-2-29C-10-8	2	29C	2016	CH	LPC
72	HTN_obs_72	HTN-2-29C-7-2	2	29C	2016	SMJ	TC

No	ID	Lot	Op.	Unit	Season	Source	Period
73	HTN_obs_73	HTN-2-2a-2	2	2a	2011	SMJ	LPC
74	HTN_obs_74	HTN-2-36A-9-2	2	36A	2016	SMJ	ND
75	HTN_obs_75	HTN-2-36A-10-3	2	36A	2016	CH	EC
76	HTN_obs_76	HTN-2-39A-6	2	39A	2016	SMJ	LPC
77	HTN_obs_77	HTN-2-39A-1-2	2	39A	2016	SMJ	ND
78	HTN_obs_78	HTN-2-39C-6	2	39C	2016	SMJ	LMPC
79	HTN_obs_79	HTN-2-39C-6	2	39C	2016	SMJ	LMPC
80	HTN_obs_80	HTN-2-39C-6	2	39C	2016	SMJ	LMPC
81	HTN_obs_81	HTN-2-39C-6	2	39C	2016	SMJ	LMPC
82	HTN_obs_82	HTN-2-39C-6	2	39C	2016	SMJ	LMPC
83	HTN_obs_83	HTN-2-39D-6	2	39D	2016	SMJ	LPC
84	HTN_obs_84	HTN-2-39D-6	2	39D	2016	SMJ	LPC
85	HTN_obs_85	HTN-2-39E-2	2	39E	2016	SMJ	ND
86	HTN_obs_86	HTN-2-39F-3	2	39F	2016	CH	LMPC
87	HTN_obs_87	HTN-2-39F-6	2	39F	2016	CH	ND
88	HTN_obs_88	HTN-3-1-6	3	1	2011	SMJ	LMPC
89	HTN_obs_89	HTN-3-1-6	3	1	2011	CH	LMPC
90	HTN_obs_90	HTN-3-3-4	3	3	2016	SMJ	LPC
91	HTN_obs_91	HTN-3-3-4	3	3	2016	SMJ	LPC
92	HTN_obs_92	HTN-3-3-4	3	3	2016	SMJ	LPC
93	HTN_obs_93	HTN-3-3-4	3	3	2016	SMJ	LPC
94	HTN_obs_94	HTN-3-5-8	3	5	2016	SMJ	LPC
95	HTN_obs_95	HTN-3-6-9	3	6	2016	SMJ	LMPC
96	HTN_obs_96	HTN-3-6-9	3	6	2016	CH	LMPC
97	HTN_obs_97	HTN-3-8-3	3	8	2016	SMJ	LPC
98	HTN_obs_98	HTN-3-9-5	3	9	2016	CH	LPC
99	HTN_obs_99	HTN-3-12-5	3	12	2016	SMJ	LPC
100	HTN_obs_100	HTN-3-12-5	3	12	2016	SMJ	LPC
101	HTN_obs_101	HTN-3-12-5	3	12	2016	SMJ	LPC
102	HTN_obs_102	HTN-3-13-4	3	13	2016	SMJ	LPC
103	HTN_obs_103	HTN-3-15-4	3	15	2016	SMJ	LPC
104	HTN_obs_104	HTN-3-19-5	3	19	2016	SMJ	LMPC
105	HTN_obs_105	HTN-3-24-2	3	24	2016	SMJ	ND
106	HTN_obs_106	HTN-3-26-2	3	26	2016	SMJ	LPC
107	HTN_obs_107	HTN-3-8k-3	3	8k	2016	CH	LPC
108	HTN_obs_108	HTN-5-2-1	5	2	2011	CH	TC
109	HTN_obs_109	HTN-6-1-3	6	1	2011	CH	TC
110	HTN_obs_110	HTN-6-1-3	6	1	2011	CH	TC
111	HTN_obs_111	HTN-6-1-5	6	1	2011	SMJ	LPC

No	ID	Lot	Op.	Unit	Season	Source	Period
112	HTN_obs_112	HTN-6-1-5	6	1	2011	SMJ	LPC
113	HTN_obs_113	HTN-6-1-9	6	1	2011	SMJ	ND
114	HTN_obs_114	HTN-6-1-9	6	1	2011	SMJ	ND
115	HTN_obs_115	HTN-6-2-2	6	2	2016	CH	LMPC
116	HTN_obs_116	HTN-6-4-2	6	4	2016	CH	ND
117	HTN_obs_117	HTN-6-4-7	6	4	2016	SMJ	LPC
118	HTN_obs_118	HTN-6-4-7	6	4	2016	SMJ	LPC
119	HTN_obs_119	HTN-6-4-7	6	4	2016	CH	LPC
120	HTN_obs_120	HTN-6-4-7	6	4	2016	CH	LPC
121	HTN_obs_121	HTN-6-4-7	6	4	2016	SMJ	LPC
122	HTN_obs_122	HTN-6-4-7	6	4	2016	CH	LPC
123	HTN_obs_123	HTN-6-5-2	6	5	2016	SMJ	LPC
124	HTN_obs_124	HTN-6-5-2	6	5	2016	CH	LPC
125	HTN_obs_125	HTN-6-6-1	6	6	2016	CH	ND
126	HTN_obs_126	HTN-6-6-1	6	6	2016	CH	ND
127	HTN_obs_127	HTN-6-6-3	6	6	2016	CH	ND
128	HTN_obs_128	HTN-6-6-3	6	6	2016	SMJ	ND
129	HTN_obs_129	HTN-6-6-3	6	6	2016	CH	ND
130	HTN_obs_130	HTN-6-9-3	6	9	2016	SMJ	ND
131	HTN_obs_131	HTN-6-9-3	6	9	2016	SMJ	ND
132	HTN_obs_132	HTN-6-9-3	6	9	2016	SMJ	ND
133	HTN_obs_133	HTN-6-11-3	6	11	2016	SMJ	LPC
134	HTN_obs_134	HTN-6-11-3	6	11	2016	SMJ	LPC
135	HTN_obs_135	HTN-6-11-3	6	11	2016	SMJ	LPC
136	HTN_obs_136	HTN-6-11-3	6	11	2016	SMJ	LPC
137	HTN_obs_137	HTN-6-11-3	6	11	2016	SMJ	LPC
138	HTN_obs_138	HTN-6-11-3	6	11	2016	SMJ	LPC
139	HTN_obs_139	HTN-6-11-3	6	11	2016	SMJ	LPC
140	HTN_obs_140	HTN-6-11-3	6	11	2016	SMJ	LPC
141	HTN_obs_141	HTN-6-11-3	6	11	2016	SMJ	LPC
142	HTN_obs_142	HTN-6-11-3	6	11	2016	SMJ	LPC
143	HTN_obs_143	HTN-6-11-3	6	11	2016	SMJ	LPC
144	HTN_obs_144	HTN-6-11-3	6	11	2016	SMJ	LPC
145	HTN_obs_145	HTN-6-11-3	6	11	2016	CH	LPC
146	HTN_obs_146	HTN-6-11-3	6	11	2016	SMJ	LPC
147	HTN_obs_147	HTN-6-11-3	6	11	2016	CH	LPC
148	HTN_obs_148	HTN-6-11-3	6	11	2016	CH	LPC
149	HTN_obs_149	HTN-6-11-3	6	11	2016	CH	LPC
150	HTN_obs_150	HTN-6-11-3	6	11	2016	SMJ	LPC
151	HTN_obs_151	HTN-6-11-3	6	11	2016	SMJ	LPC

No	ID	Lot	Op.	Unit	Season	Source	Period
152	HTN_obs_152	HTN-6-11-3	6	11	2016	SMJ	LPC
153	HTN_obs_153	HTN-6-11-3	6	11	2016	SMJ	LPC
154	HTN_obs_154	HTN-6-11-3	6	11	2016	SMJ	LPC
155	HTN_obs_155	HTN-6-11-3	6	11	2016	CH	LPC
156	HTN_obs_156	HTN-6-11-3	6	11	2016	SMJ	LPC
157	HTN_obs_157	HTN-6-11-3	6	11	2016	SMJ	LPC
158	HTN_obs_158	HTN-6-11-3	6	11	2016	SMJ	LPC
159	HTN_obs_159	HTN-6-11-3	6	11	2016	SMJ	LPC
160	HTN_obs_160	HTN-6-11-3	6	11	2016	SMJ	LPC
161	HTN_obs_161	HTN-6-11-3	6	11	2016	SMJ	LPC
162	HTN_obs_162	HTN-6-11-3	6	11	2016	SMJ	LPC
163	HTN_obs_163	HTN-6-11-3	6	11	2016	SMJ	LPC
164	HTN_obs_164	HTN-6-11-3	6	11	2016	SMJ	LPC
165	HTN_obs_165	HTN-6-11-3	6	11	2016	SMJ	LPC
166	HTN_obs_166	HTN-6-11-3	6	11	2016	SMJ	LPC
167	HTN_obs_167	HTN-6-11-3	6	11	2016	SMJ	LPC
168	HTN_obs_168	HTN-6-11-3	6	11	2016	SMJ	LPC
169	HTN_obs_169	HTN-6-11-3	6	11	2016	SMJ	LPC
170	HTN_obs_170	HTN-6-11-3	6	11	2016	SMJ	LPC
171	HTN_obs_171	HTN-6-11-3	6	11	2016	SMJ	LPC
172	HTN_obs_172	HTN-6-11-3	6	11	2016	SMJ	LPC
173	HTN_obs_173	HTN-6-11-3	6	11	2016	SMJ	LPC
174	HTN_obs_174	HTN-6-11-3	6	11	2016	SMJ	LPC
175	HTN_obs_175	HTN-6-11-3	6	11	2016	SMJ	LPC
176	HTN_obs_176	HTN-6-11-3	6	11	2016	SMJ	LPC
177	HTN_obs_177	HTN-6-11-3	6	11	2016	SMJ	LPC
178	HTN_obs_178	HTN-6-11-3	6	11	2016	SMJ	LPC
179	HTN_obs_179	HTN-6-11-3	6	11	2016	CH	LPC
180	HTN_obs_180	HTN-6-11-3	6	11	2016	SMJ	LPC
181	HTN_obs_181	HTN-6-11-3	6	11	2016	SMJ	LPC
182	HTN_obs_182	HTN-6-11-3	6	11	2016	CH	LPC
183	HTN_obs_183	HTN-6-11-3	6	11	2016	SMJ	LPC
184	HTN_obs_184	HTN-6-11-3	6	11	2016	SMJ	LPC
185	HTN_obs_185	HTN-6-11-3	6	11	2016	SMJ	LPC
186	HTN_obs_186	HTN-6-11-3	6	11	2016	SMJ	LPC
187	HTN_obs_187	HTN-6-11-3	6	11	2016	SMJ	LPC
188	HTN_obs_188	HTN-6-11-3	6	11	2016	SMJ	LPC
189	HTN_obs_189	HTN-6-11-3	6	11	2016	SMJ	LPC
190	HTN_obs_190	HTN-6-11-3	6	11	2016	SMJ	LPC
191	HTN_obs_191	HTN-6-11-3	6	11	2016	SMJ	LPC

No	ID	Lot	Op.	Unit	Season	Source	Period
192	HTN_obs_192	HTN-6-11-3	6	11	2016	CH	LPC
193	HTN_obs_193	HTN-6-11-3	6	11	2016	SMJ	LPC
194	HTN_obs_194	HTN-6-11-3	6	11	2016	SMJ	LPC
195	HTN_obs_195	HTN-6-11-3	6	11	2016	SMJ	LPC
196	HTN_obs_196	HTN-6-11-3	6	11	2016	SMJ	LPC
197	HTN_obs_197	HTN-6-11-3	6	11	2016	SMJ	LPC
198	HTN_obs_198	HTN-6-11-3	6	11	2016	CH	LPC
199	HTN_obs_199	HTN-6-11-3	6	11	2016	SMJ	LPC
200	HTN_obs_200	HTN-6-11-3	6	11	2016	SMJ	LPC
201	HTN_obs_201	HTN-6-11-3	6	11	2016	SMJ	LPC
202	HTN_obs_202	HTN-6-11-3	6	11	2016	SMJ	LPC
203	HTN_obs_203	HTN-6-11-3	6	11	2016	SMJ	LPC
204	HTN_obs_204	HTN-6-11-3	6	11	2016	SMJ	LPC
205	HTN_obs_205	HTN-6-11-3	6	11	2016	SMJ	LPC
206	HTN_obs_206	HTN-6-11-3	6	11	2016	SMJ	LPC
207	HTN_obs_207	HTN-6-11-3	6	11	2016	SMJ	LPC
208	HTN_obs_208	HTN-6-11-3	6	11	2016	SMJ	LPC
209	HTN_obs_209	HTN-6-11-3	6	11	2016	CH	LPC
210	HTN_obs_210	HTN-6-11-3	6	11	2016	SMJ	LPC
211	HTN_obs_211	HTN-6-11-3	6	11	2016	SMJ	LPC
212	HTN_obs_212	HTN-6-11-3	6	11	2016	SMJ	LPC
213	HTN_obs_213	HTN-6-11-3	6	11	2016	SMJ	LPC
214	HTN_obs_214	HTN-6-11-3	6	11	2016	SMJ	LPC
215	HTN_obs_215	HTN-6-11-3	6	11	2016	SMJ	LPC
216	HTN_obs_216	HTN-6-11-3	6	11	2016	SMJ	LPC
217	HTN_obs_217	HTN-6-11-3	6	11	2016	SMJ	LPC
218	HTN_obs_218	HTN-6-11-3	6	11	2016	CH	LPC
219	HTN_obs_219	HTN-6-11-3	6	11	2016	SMJ	LPC
220	HTN_obs_220	HTN-6-11-3	6	11	2016	SMJ	LPC
221	HTN_obs_221	HTN-6-11-3	6	11	2016	SMJ	LPC
222	HTN_obs_222	HTN-6-11-3	6	11	2016	SMJ	LPC
223	HTN_obs_223	HTN-6-11-3	6	11	2016	SMJ	LPC
224	HTN_obs_224	HTN-6-12-1	6	12	2016	CH	LPC
225	HTN_obs_225	HTN-6-12-1	6	12	2016	CH	LPC
226	HTN_obs_226	HTN-6-12-1	6	12	2016	SMJ	LPC
227	HTN_obs_227	HTN-6-12-1	6	12	2016	SMJ	LPC
228	HTN_obs_228	HTN-6-12-1	6	12	2016	CH	LPC
229	HTN_obs_229	HTN-6-CH-7	6	CH	2016	SMJ	ND
230	HTN_obs_230	HTN-6-CH-7	6	CH	2016	SMJ	ND
231	HTN_obs_231	HTN-6-CH-7	6	CH	2016	SMJ	ND

No	ID	Lot	Op.	Unit	Season	Source	Period
232	HTN_obs_232	HTN-6-CH-7	6	CH	2016	SMJ	ND
233	HTN_obs_233	HTN-6-CH-7	6	CH	2016	SMJ	ND
234	HTN_obs_234	HTN-8-1-2	8	1	2011	CH	ND
235	HTN_obs_235	HTN-8-1-2	8	1	2011	SMJ	ND
236	HTN_obs_236	HTN-8-1-2	8	1	2011	SMJ	ND
237	HTN_obs_237	HTN-8-1-2	8	1	2011	SMJ	ND
238	HTN_obs_238	HTN-8-1-2	8	1	2011	CH	ND
239	HTN_obs_239	HTN-8-1-2	8	1	2011	CH	ND
240	HTN_obs_240	HTN-8-1-3	8	1	2011	SMJ	ND
241	HTN_obs_241	HTN-8-1-3	8	1	2011	SMJ	ND
242	HTN_obs_242	HTN-8-1-3	8	1	2011	CH	ND
243	HTN_obs_243	HTN-8-1-4	8	1	2011	SMJ	ND
244	HTN_obs_244	HTN-8-1-4	8	1	2011	SMJ	ND
245	HTN_obs_245	HTN-9-1-2	9	1	2011	SMJ	ND
246	HTN_obs_246	HTN-9-1-3	9	1	2011	CH	LC
247	HTN_obs_247	HTN-9-1-3	9	1	2011	CH	LC
248	HTN_obs_248	HTN-10-4-7	10	4	2016	SMJ	LPC
249	HTN_obs_249	HTN-11-1-2	11	1	2011	NS	PC
250	HTN_obs_250	HTN-11-1-7	11	1	2011	SMJ	LMPC
251	HTN_obs_251	HTN-12-1-1	12	1	2011	CH	ND
252	HTN_obs_252	HTN-12-1-1	12	1	2011	CH	ND
253	HTN_obs_253	HTN-12-1-2	12	1	2011	SMJ	ND
254	HTN_obs_254	HTN-12-1-2	12	1	2011	CH	ND
255	HTN_obs_255	HTN-12-1-2	12	1	2011	SMJ	ND
256	HTN_obs_256	HTN-12-1-4	12	1	2011	CH	ND
257	HTN_obs_257	HTN-13-1-1	13	1	2011	CH	TC
258	HTN_obs_258	HTN-13-10-3	13	10	2016	SMJ	TC
259	HTN_obs_259	HTN-13-10-3	13	10	2016	CH	TC
260	HTN_obs_260	HTN-13-13-4	13	13	2016	SMJ	TC
261	HTN_obs_261	HTN-13-13-4	13	13	2016	SMJ	TC
262	HTN_obs_262	HTN-13-16-1	13	16	2016	CH	ND
263	HTN_obs_263	HTN-13-16-3	13	16	2016	CH	LPC
264	HTN_obs_264	HTN-13-21-2	13	21	2016	SMJ	ND
265	HTN_obs_265	HTN-13-26-1	13	26	2016	SMJ	ND
266	HTN_obs_266	HTN-13-28-4	13	28	2016	SMJ	ND
267	HTN_obs_267	HTN-13-28-2	13	28	2016	CH	ND
268	HTN_obs_268	HTN-13-28-3	13	28	2016	CH	ND
269	HTN_obs_269	HTN-13-28-3	13	28	2016	CH	ND
270	HTN_obs_270	HTN-13-31-1	13	31	2016	SMJ	ND
271	HTN_obs_271	HTN-13-31-1	13	31	2016	SMJ	ND

No	ID	Lot	Op.	Unit	Season	Source	Period
272	HTN_obs_272	HTN-13-31-2	13	31	2016	SMJ	ND
273	HTN_obs_273	HTN-13-31-4	13	31	2016	SMJ	ND
274	HTN_obs_274	HTN-13-31-4	13	31	2016	SMJ	ND
275	HTN_obs_275	HTN-13-33-2	13	33	2016	CH	ND
276	HTN_obs_276	HTN-13-33-2	13	33	2016	CH	ND
277	HTN_obs_277	HTN-13-33-2	13	33	2016	CH	ND
278	HTN_obs_278	HTN-14-1-2	14	1	2011	CH	PC
279	HTN_obs_279	HTN-14-1-4	14	1	2011	SMJ	LPC
280	HTN_obs_280	HTN-14-1-2	14	1	2011	CH	PC
281	HTN_obs_281	HTN-14-2-4-5	14	2	2011	SMJ	ND
282	HTN_obs_282	HTN-14-3-3	14	3	2011	CH	ND
283	HTN_obs_283	HTN-14-3-3	14	3	2011	SMJ	ND
284	HTN_obs_284	HTN-14-3-3	14	3	2011	NS	ND
285	HTN_obs_285	HTN-15-1-3	15	1	2011	NS	ND
286	HTN_obs_286	HTN-15-1-3	15	1	2011	SMJ	ND
287	HTN_obs_287	HTN-15-1-3	15	1	2011	SMJ	ND
288	HTN_obs_288	HTN-15-1-3	15	1	2011	CH	ND
289	HTN_obs_289	HTN-15-1-2	15	1	2011	CH	ND
290	HTN_obs_290	HTN-15-1-2	15	1	2011	SMJ	ND
291	HTN_obs_291	HTN-15-1-2	15	1	2011	CH	ND
292	HTN_obs_292	HTN-15-1-2	15	1	2011	SMJ	ND
293	HTN_obs_293	HTN-16-1-2	16	1	2011	SMJ	LPC
294	HTN_obs_294	HTN-16-1-2	16	1	2011	SMJ	LPC
295	HTN_obs_295	HTN-16-1-2	16	1	2011	SMJ	LPC
296	HTN_obs_296	HTN-17-1-0	17	1	2011	SMJ	LC
297	HTN_obs_297	HTN-17-1-1	17	1	2011	SMJ	LC
298	HTN_obs_298	HTN-17-1-1	17	1	2011	CH	LC
299	HTN_obs_299	HTN-17-1-1	17	1	2011	SMJ	LC
300	HTN_obs_300	HTN-17-1-1	17	1	2011	CH	LC
301	HTN_obs_301	HTN-17-1-0	17	1	2011	SMJ	LC
302	HTN_obs_302	HTN-18-1-2	18	1	2011	SMJ	ND
303	HTN_obs_303	HTN-18-1-2	18	1	2011	CH	ND
304	HTN_obs_304	HTN-18-1-2	18	1	2011	SMJ	ND
305	HTN_obs_305	HTN-18-1-2	18	1	2011	CH	ND
306	HTN_obs_306	HTN-18-1-3	18	1	2011	SMJ	LC
307	HTN_obs_307	HTN-18-1-3	18	1	2011	SMJ	LC
308	HTN_obs_308	HTN-18-1-3	18	1	2011	CH	LC
309	HTN_obs_309	HTN-18-1-3	18	1	2011	SMJ	LC

No	ID	Lot	Op.	Unit	Season	Source	Period
310	HTN_obs_310	HTN-18-1-3	18	1	2011	SMJ	LC
311	HTN_obs_311	HTN-18-1-3	18	1	2011	SMJ	LC
312	HTN_obs_312	HTN-18-1-3	18	1	2011	SMJ	LC
313	HTN_obs_313	HTN-18-1-3	18	1	2011	CH	LC
314	HTN_obs_314	HTN-19-1-3	19	1	2011	SMJ	ND
315	HTN_obs_315	HTN-19-1-3	19	1	2011	SMJ	ND
316	HTN_obs_316	HTN-2-29C-2-2_01/01	02	29C	2016	SMJ	LPC

Source: courtesy Holtun Archaeological Projext (See Annex B).

APPENDIX B:
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April 20, 2017

To Whom It May Concern:

Melvin Rodrigo Guzman Piedrasanta has the permission of the Holtun Archaeological Project to use all data, images, and copyrighted material presented in this thesis presented for the fulfillment of the degree of Master of the Arts in Anthropology at University of Central Florida.

Sincerely,

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