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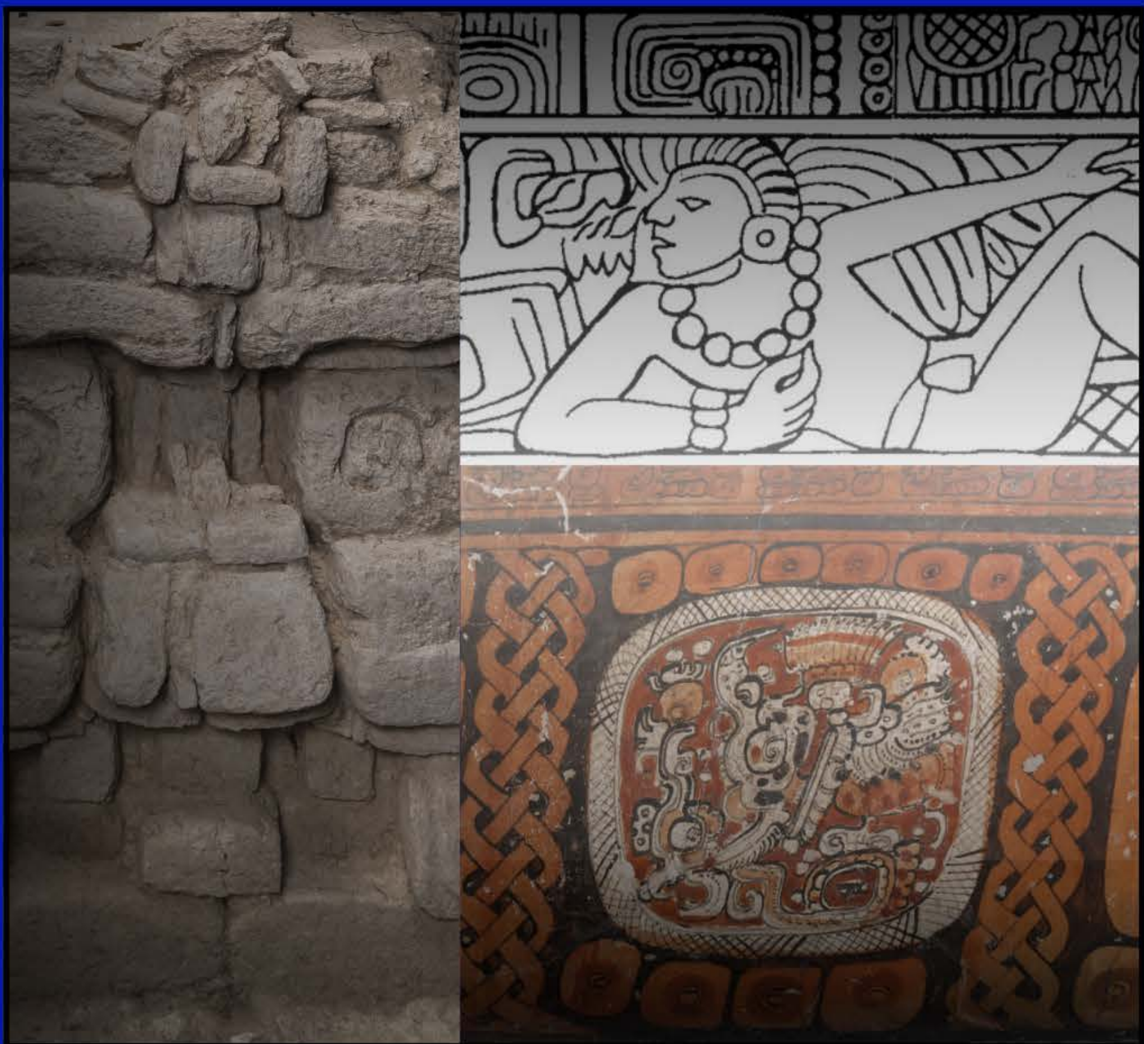
Transformations, Transitional Expressions, and Adaptations during Critical Periods of Ancient Maya Civilization



Edited by
Melissa M. Badillo, Rumari Ku, and Paul Smith
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Research Reports in Belizean Archaeology Volume 18

Archaeological Investigations in the Eastern Maya Lowlands: Papers of the 2022 Belize Archaeology Symposium

Edited by Melissa M. Badillo, Rumari Ku, and Paul Smith

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CONTENTS

page

SECTION ONE: *TRANSFORMATIONS, TRANSITIONAL EXPRESSIONS, AND ADAPTATIONS DURING CRITICAL PERIODS OF ANCIENT MAYA CIVILIZATION*

Rollout photograph of Vessel 3 from Feature 385-30 from Buenavista de Cayo, Belize

1 TRANSITIONS AND TRANSFORMATIONS IN ANCIENT CIVILIZATIONS: INTERPRETING CHANGE AND REALIGNMENT BETWEEN TEMPORAL PERIODS IN THE MAYA ARCHAEOLOGICAL RECORD

Arlen F. Chase and Diane Z. Chase

Archaeological interpretation of ancient civilizations is characterized by periods of stasis and times of rapid change. While archaeologists can easily segment phases of material culture into sequent units, the points of transformation between these units are difficult to define archaeologically. The combined rapidity and lack of uniformity that can be associated with transitions makes it more difficult to model and to interpret cause and effect. Yet, these material shifts are precisely the most interesting part of the archaeological quest for knowledge. In the Maya area, times of transition fall at the beginning and end of each of the major recognized units of time. Thus, while the Preclassic, Classic, Postclassic, and Historic Periods can all be readily documented and explicated, what happened in the interstices between these periods foments differences of opinion. Recognizing the theoretical issues associated with the frameworks that are imposed onto our archaeological databases helps with making interpretations about the sequence of transformations that define Maya civilization. This paper looks first at transitions within the archaeological record of the Maya and then attempts to contextualize these pivotal timeframes.

Introduction

Archaeological investigations recover the residues of the past and produce artifactual materials and building remnants that must be interpreted to assign meaning. By its very nature, archaeology collects a body of diverse data, the interpretation of which actively incorporates modern biases and perceptions. This is why an understanding of hermeneutics (the study of interpretation or "how you know what you know") is so important (Shanks and Tilley 1987: 107-108; D. Chase and A. Chase 2004 for the Maya). In making interpretations, there also may be an unstated reliance on single classes of data – such as ceramics, cache patterns, or building styles – because of the expertise of the analyst, the size and nature of the collected archaeological sample, or simply frame of reference used. Thus, interpretations about how change, transformation, and transition occurred in the archaeological record may not accurately reflect past situations, but rather are conditioned by a host of other factors.

Change occurs at varying scales both within and between time periods. Here, however, we primarily focus on the interstices between the larger blocks of time in the Maya archaeological record, usually designated as: Archaic, Preclassic, Early Classic, Late Classic, Postclassic, and Historic. We also stress how many of our field's research interpretations are guided by external factors and single classes of data.

Archaeology and Change

When identifying transitions and transformations in the archaeological record, considerations of how we see change and how we interpret meaning are essential. Key factors in forming perspectives on change include the kind of archaeological investigations undertaken, the data that were recovered, and the sampling that was done. What are the markers, mechanisms, and material remains in the archaeological record that are used to identify change? Was change widespread or localized (e.g., are considerations of change based on the perspective of a single site or region or on multiple sites and regions)? Is change gradual or rapid and abrupt – or some combination of these two extremes? What importance can be assigned to external versus internal factors in creating change (e.g., climate and/or other populations as opposed to insular socio-political dynamics)? And, can alternative explanations for patterns be identified?

Given differences in training, background, and models used by any given investigator, there can be differences of opinion over why, what, and how something transpired in the past and on a variety of scales – from overarching theory to finer points that are context-dependent. This is a normal part of research and science. Conceptualizations of

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change, transitions, and transformations are linked both to the archaeological methodologies and theoretical premises used by researchers (e.g., A. Chase and D. Chase 2008), and the way in which excavations are conducted affects archaeological interpretations and perceptions of time (D. Chase and A. Chase 2004, 2006). Areal or horizontal excavation usually makes functional analysis of past features possible, providing a more comprehensive understanding of coeval remains; but deeply buried features are rarely areally excavated, meaning that it can be difficult to gain time depth pertaining to form and function. Penetrating excavation yields a sequence of events, but provides less information regarding the form and overall function of each layer in the sequence. Test pitting is useful for gaining an idea what is present at given locales, but often will produce insufficient remains to make functional interpretations without other forms of investigation. How large or small an excavated sample is also affect interpretation. And, primary deposits – representing past materials deposited in meaningful and purposeful ways – are truly key both for firmly anchoring any archaeological sequence in time and for providing insight that can be used for broader understanding, but they may not be present at all sites or for all points in time.

Materials deemed to be similar across sites may be cross-dated across a multitude of sites, creating coeval horizons (e.g., Rice 1993). Material culture that co-occurs in time is used to construct past histories across places. The breaks and punctuations between time periods are usually correlated with perceptible changes in material culture. These breaks can be characterized as being very gradual or as being very abrupt, but are usually portrayed as the latter (see Figure 1). Importantly, material remains may vary across a site or social sectors and change at different rates, but these kinds of considerations only rarely impact synchronic analyses (e.g., D. Chase and A. Chase 2006). Rather, these materials are conjoined into single broad units of time and the breaks in the material content between these broader units results in the definition of larger patterns that become categorized as times of transitions, transformations, and change.

Analysis of materials in a laboratory also impacts interpretation. "Lumpers" or "splitters" each approach change differently. Some analysts group materials together to establish complexes that are viewed as representing a broad span of time, such as the Maya Late Classic Period. Others might break the same materials into smaller groups, seeing slight differences over time or space. By convention – and as a result of many past excavations and analyses – we break Maya history into a series of blocks of time. While methodologies that are used for analysis tend to homogenize time periods (e.g., A. Chase and D. Chase 2009) and may over-emphasize breaks, the eras themselves – just like places today – were often localized and heterogeneous (e.g., A. Chase and D. Chase 2004).

Over time we have come to realize that the horizontal blocks of time established for broader regions incorporate spatial differences at multiple frames of reference. Sites themselves varied in their histories with some peaking during the simultaneously decline of others. And, changing the temporal parameters for a block of time by even 50 years may substantially alter resulting interpretations (especially of population growth rates; see A. Chase 1990 for an example). One of the most described transitions, the Maya collapse, once seen as uniformly abrupt (Culbert 1973), is now viewed as spanning at least 150 years and as being characterized by substantial variation within the Maya region (Okoshi et al. 2021).

It is further important to note potential differences between ancient Maya concepts of time and those of current archaeological practitioners (e.g., Freidel et al. 2023) – and the potential input that these distinctions may have on ancient transitions (e.g., cyclical versus linear time and abrupt versus gradual change). While temporal differences can be ferreted out of the archaeological record by defining and seriating stratigraphic and material sequences e.g., A. Chase and D. Chase 2013), concepts of time and change may be in opposition between the past and the present and have an impact on interpretation. For instance, recovered archaeological materials may be interpreted as simple trash by the archaeologist when they may have actually served as objects of ritual renewal or ritual termination (A. Chase and D. Chase 2020a).

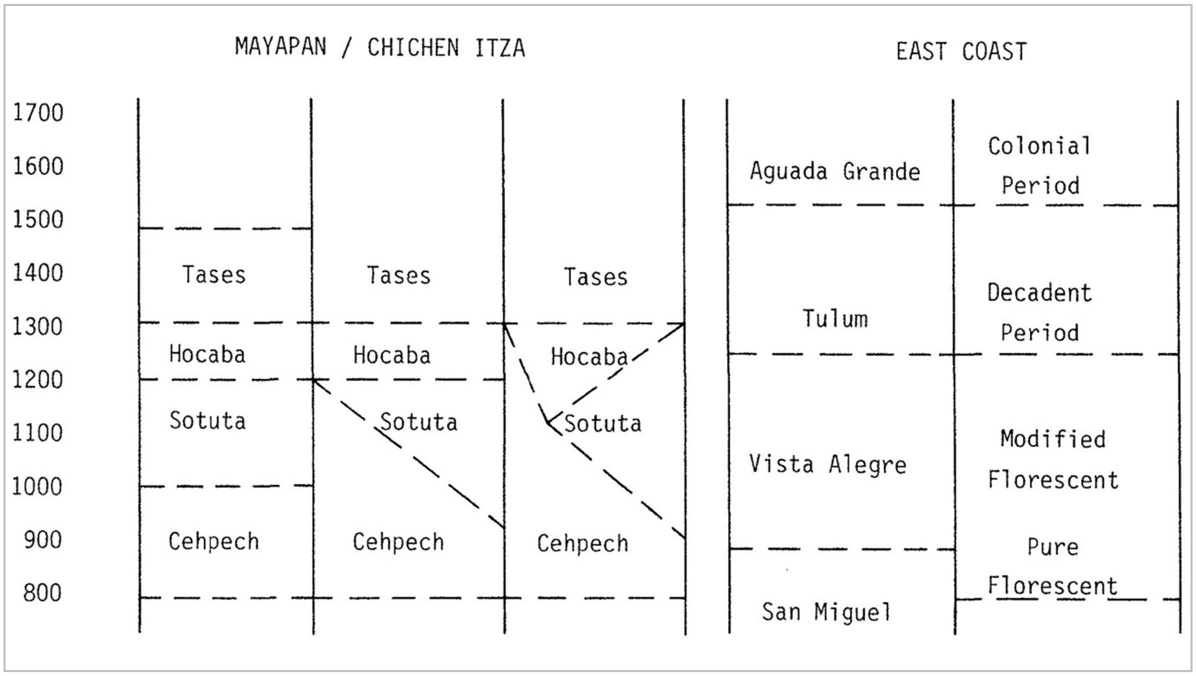

Figure 1. Illustration of the difficulty in portraying (and interpreting) transitions in ceramics and phases; examples to the left show various potential relationships between ceramic complexes in Terminal Classic and Postclassic northern Yucatan; examples to the right show various horizontal phase alignments for eastern Yucatan. Note that the timing for the phase transitions does not always align with ceramic transitions (see A. Chase and D. Chase 1985: Figure 2 for more detail and sources).

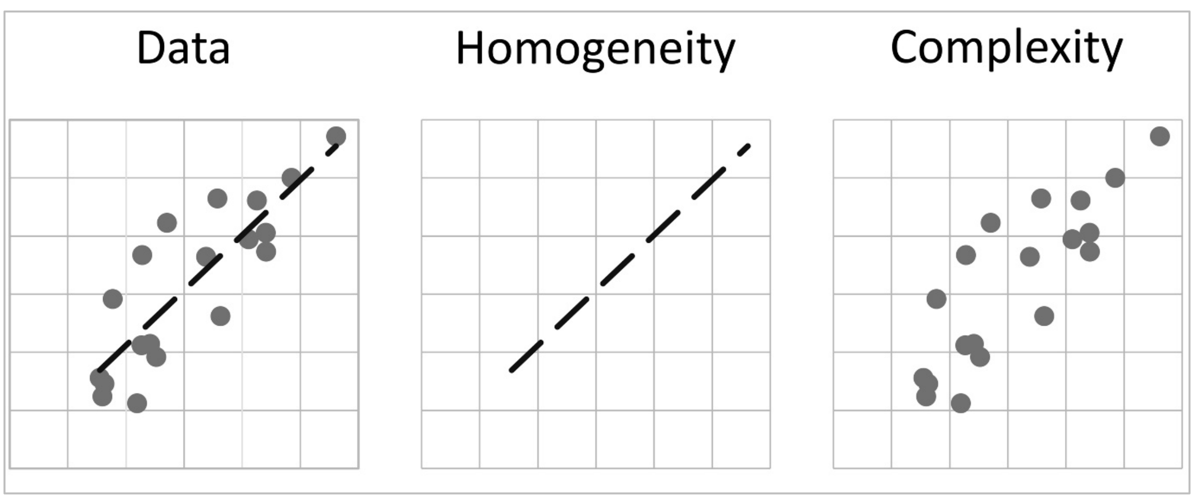

Figure 2. The homogenization of interpretations can eliminate the complexities that actually may exist in a data set; a more in depth analysis of the complexity sometimes elucidates other findings; the more interesting analysis is actually looking at the variance from any global pattern.

The frameworks and models that are used to describe past societies and their change also impacts, and even foreshadows, the way in which transitions and change are described. Many of these models, frameworks, and the associated terminology used by archaeologists derive from bodies of theory that relate to societal evolution or political ideology. Terms like "primitive" and "complex" (e.g., Tylor 1871) as well as "civilization" (Morgan 1878) were infused with meaning in the late 19th century during the formalization of archaeology as an academic discipline. Models and terms applied to recent historic societies (Service 1975: bands, tribes, chiefdoms, states; Fried 1967: egalitarian, rank, stratified) are also used to interpret the past. The remnants of these earlier frameworks remain built into many of modern archaeology's terminology, theory, and resulting interpretations about transitions – whether or not they are apropos. While newer data has changed some views of the past, the frameworks that are used rarely change, even though they may be incorrect or parochial. Preconceptions about past societies have become embedded into these theoretical frameworks and are difficult to modify. Betty Meggars (1954) argued that complex societies could not develop in the tropics and these arguments were infused into a series of theoretical frameworks that were used to look at transitions and change. Urbanization was at one point largely viewed as being only in the purview of Western civilization, thus limiting perceptions of the transitions in societal development elsewhere.

There is a long-standing assumption that cities represented a culmination of societal development, largely deriving from the work of Childe (1950; see also Smith 2009). Even current alternative models for explaining the rise of complexity focus on the importance of cities (Yoffee 2005). Yet, Childe (1950:9) had great difficulty conceptualizing Maya cities and noted that they posed an issue for his interpretive framework, meaning that the recognition of Mesoamerican urbanism was fraught with issues (D. Chase et al. 2023). Frameworks like the one that Childe provided on the urban revolution became so established in archaeology that they are difficult to modify. While we can now define a different kind of tropical city (e.g., Fletcher 2009, 2019) and demonstrate that the structural organization of these early tropical cities does accord with broader organizational theory used for modern cities (ASZ Chase 2021; Klassen et al. 2021; Lobo et al. 2020), past models still hinder our interpretations. For instance, assumptions about urban and rural dichotomies derived from Western societies imply that agriculture remained separate from cities, something we also know does not hold for the Classic Period Maya (Chase and Chase 1998, 2016; Fisher 2014; Graham 1999; also see Lamb 2022 for issues in dealing with "rural"). Thus, the very frames of reference that have become established in the social theory used to illuminate archaeological remains can sometimes predetermine interpretations.

Single well-known researchers can also disproportionately impact interpretive frameworks. J. Eric S. Thompson held back epigraphic interpretation in the Maya area for decades because of his belief that hieroglyphs were neither phonetic nor dealt with history (M. Coe 2012). Using a focus on culture ecology, William T. Sanders (1973; Sanders et al. 1979) stressed the complexity of highland peoples over lowland populations. He incorporated already established narratives (Meggars 1954) of the inability of the tropics to give rise to and maintain civilizations and cities (Sanders and Price 1968; Sanders and Webster 1988) into his published interpretations, in spite of archaeological data to the contrary (Chase et al. 1990; W. Coe 1965; Smith 1990). The echos of Sanders' culture ecological approach are still found in arguments about carrying capacity for Maya archaeological settlements (Dickson 1980; Lentz et al. 2014) and in the debate over Maya social complexity and urbanism (D. Chase and A. Chase 2017). However, current research now recognizes that Maya cities persisted for hundreds of years (D. Chase et al. 2023).

Transitions and Transformations in the Maya Area and Mesoamerica

One of the first collaborative attempts to utilize archaeological data to analyze culture change in the New World was published in a Society for American Archaeology memoir entitled *Seminars in Archaeology: 1955* (Wauchope 1956). Its goal was to illuminate "cultural dynamics and human relations . . . through archaeological techniques." Two of the four papers in this volume are particularly relevant to considerations of change and were "classed with the work of Childe and Steward as attempts to look at the artifactual data of archaeology from the viewpoint of the search for regularities in cultural phenomena" by one reviewer (Spicer 1957: 186). In the first of four papers in the volume, change was viewed in terms of cultural "contact" that could be analyzed in the material record as either "site-unit" or "trait-unit" intrusion, leading to considerations of acculturation in terms of "assimilation, adaptation or fusion, and revivalistic phenomena" (Spicer 1957:186). In the second, change was considered diachronically, focusing on five different traditions: direct (unchanging), converging (fusing diverse traditions into one), diverging (breaking apart into two or more traditions), elaborating (integration of new elements), and reducing (loss of elements); these "tradition segments" were then viewed from the standpoint of "causal factors," 29 of which were listed and included "influences of slowly or rapidly changing physical environment, increasing and decreasing population size," and "compatibility and incompatibility of contacting culture traits" (Spicer 1957:187). This seminar represented a major advance for the culture historical bent of its participants, who previously had focused on change as being caused predominantly by migration, diffusion, and trade; it specifically facilitated a shift to more robust explanations of why and how change occurred. And, it was within this milieu that archaeological paradigms for both the rise and the social composition of Maya civilization were framed (e.g., Adams 1977), using then extent archaeological data as well as models focusing on trade, warfare, and cultural ecology.

When we survey the current state of our understanding of past transitions in the Maya area, it becomes apparent that, while we have progressed beyond the 1955 considerations of change in the archaeological record, we still have much to do. Wauchope (quoted in Spicer 1957: 186) noted that in carrying out the 1955 exercise, it was unclear whether the sponsor "actually had confidence in the intellectual curiosity of archaeologist or whether they just wanted to see how stupid we really were, for … the stereotype of the American archaeologist has somehow come to be a pretty dull sort of clod, with most of his gray matter under his fingernails."

With the above caveats in mind, we now turn to looking at the major transitions, many not yet fully resolved, that can be defined in the Maya area.

Early Developments

Based on general models derived from almost two centuries of intellectual thought and accumulated archaeological data from other parts of the world, interpretations about the early developments in the Maya area have been driven by a focus on the origins of sedentism, agriculture, ceramics, monumental architecture, and increasing populations. Our past approaches, assumptions, and researchers, however, may have blinded us to other possibilities in the past that are now being re-evaluated (e.g., Cagnuto 2021:490). What kind of transition occurred in moving from the Archaic (prior to 1200 BCE) to the Preclassic (1200 BCE to 250 CE)? Was it from foragers to subsistence farmers participating in early village life? Was it a uniform process across Mesoamerica? Was maize the primary focus for early Mesoamerican societies, as research undertaken by Scotty McNeish (1964; Mangelsdorf et al. 1964) assumed?

A full model for the development and transition of Archaic society in Belize was published in a front-page New York Times article shortly after McNeish began his research in 1977. Somewhat in the forefront of the "New Archaeology" with its focus on the hypothetico-deductive model (Watson et al. 1971), McNeish (1978) used this approach in his volume "The Science of Archaeology" and applied a developmental model across the Americas, laying the groundwork for subsequent research. Until recently, it has proven difficult to deviate from already framed, pre-existing developmental frameworks like the ones provided by McNeish (1978) and Adams (1977). However, recent research on the Archaic Period, focusing on palaeoecology and aDNA, is modifying past models of early New World migration of both people and plants (e.g., Kennett et al. 2022; Prufer et al. 2021; see also Awe et al. 2021). But, following the model created by McNeish, much research still focuses on the use of maize in identifying possible sedentary populations. Yet, the early Maya food spectrum was likely far broader than maize, probably also focusing on other items such as chaya, squash, and manioc (Cagnato and Ponce 2017; Schwarcz et al. 2021).

New archaeological research also is shedding light on transitions once considered to be understood. Inomata and his colleagues'

(2021) have discovered the replication of monumental site plans in the Gulf Coast region of Mesoamerica that showcase the early importance of ideology by or before 800 BCE in the physical manifestation of built space, specifically with a focus on 20 structures, viewed as representing early calendric ritual, situated around massive plazas that are often centered on E Group complexes (Freidel et al. 2017). Yet, how these massive built spaces articulated with the other settlements in these early societies is still unknown. Inomata and colleagues (2015) have provided a general model of foragers congregating to build these complexes as they transition towards agriculture, a general model also employed in other parts of the world (see Wengrow and Graeber 2021). The huge built platforms have implications for complexity and organization early in Mesoamerican prehistory no matter the social or economic structure. And, the focus on twenty structures around a large public plaza emphasizes an ideology focused on early calendric ritual that is apropos for ancient Mesoamerica.

This new research, however, disrupts assumptions about the late establishment of settled life, complexity, and agricultural production. Rather than seeing these factors as being the driving force for society and change, ideology and religion come to the forefront. This highlights the issues of seeing traditional prime movers – be they agriculture, population, or ideology – as causing change and transitions. Further research will undoubtedly shed even more light on the transition to what are recognizable as ancient Mesoamerican cultural traditions.

The Maya Preclassic

The Preclassic period (1200 BCE – 250 CE) is viewed as being the developmental era during which the Maya slowly transformed into a civilization characterized by monumental architecture and "high art" (Thompson 1954). As with other time periods, transitions relative to the Maya Preclassic are framed materially by ceramic data with populations reacting to both exterior and interior influences. When first formulated, the Preclassic Period was viewed as the time during which the development of villages, agriculture, and complexity occurred – and these were considered to be the areas in which change would be recognized. Newer archaeological data suggests that high levels of complexity existed from the onset of the Preclassic era and that older models of social development do not actually mirror what occurred.

Based on archaeological data, we can state confidently that the ancient Maya developed in situ (Coe 1965, Inomata et al. 2015) and were not implanted into the lowlands from highland regions, as was once postulated (Meggars 1954; Sharer and Sedat 1987); at the same time, we recognize that population movement was common across time and space (e.g., Arnauld et al. 2021). For the ancient Maya, consistent patterning in their monumental architecture, specifically relative to E Groups (Friedel et al. 2017), indicates that a fully developed and widely shared ideology was in place among the Maya by 300 BCE. They also experimented with a gridded city form even earlier in the Middle Preclassic era (see A. Chase and D. Chase 2020b; Inomata et al. 2020; Pugh et al. 2017). In parts of the lowlands, Late Preclassic road systems indicate the existence of interlinked settlements, viewed as representing multiple state polities (Hansen 2016; 2023); what occurred in the northern Peten Preclassic era likely accords with Renfrew's (1975) model of Early State Modules. Exactly how these socio-political units were composed and governed, however, has not been defined. Their interconnectivity through causeways suggests an extremely large political unit that is not seen in later periods (at least in the archaeological record).

Iconography, as found in murals from San Bartolo, Guatemala dating to minimally 200 BCE, has been used to suggest that these developments may be linked to the rise of divine kingship, as the murals are believed to show the accession of a ruler (Taube et al. 2010). Iconography found in these same San Bartolo murals, focusing on centering and world trees, is also apparent in Postclassic codices from the northern Yucatan (e.g., D. Chase 1985), again suggesting long-term – and spatially broad – Maya ideological consistency. However, given the lack of a stone monumental record, it is probable that any divine rulers in the Preclassic era varied from those found in the Classic Period.

The Early Classic Period

The transition between the Preclassic and Early Classic (250-550 CE) in the Maya lowlands has been a source of puzzlement and debate. There are questions over the impacts of drought, relationships with other parts of Mesoamerica, and volcanic eruption; internally, rulership associated with the erection of stone monuments and accompanying texts becomes widespread, presumably restructuring Maya societies. Ceramic change was not uniform, resulting in many questions over dating. Archaeologists often have had great difficulty in identifying early Early Classic remains in the archaeological record, largely because of a focus on specific ceramic types and the existence of different ceramic traditions (e.g., Pring 1977; Freidel et al. 1982; Sabloff 1975; Sidrys 1983:397-399; Willey 1977: 395-396).

One explanation for the perceived lack of Early Classic remains being recovered in the archaeological record is that the use of Preclassic ceramics continued into the Early Classic (e.g., Lincoln 1985) along with newly introduced forms and finewares that appeared predominantly in special deposits. Larger archaeological samples of materials dating to this transition reveal that it was a time of great cultural experimentation and showcase the need for contextual analysis that goes beyond a type-fossil approach (A. Chase and D. Chase 2018).

Some researchers have associated the transition to the Early Classic era with an extended drought that could have caused a mini-population collapse (Ebert et al. 2019; Haldon et al. 2020; Medina-Elizalde et al. 2016), potentially explaining both a perceived disruption in population levels and the confused ceramic situation. Part of the issue with understanding the Early Classic Period is that the dating assigned to this block of time was poorly framed in its initial definition at Uaxactun, Guatemala (CE 300-600); it was correlated with the presumed hieroglyphic dating of the site's stelae, which lengthened the time period on one end (CE 600 rather than CE 550), making comparative interpretation across sites appear to show a nonexistent decline in Early Classic population (A. Chase 1990:151; A. Chase and D. Chase 2005:18).

We know that there was contact and constant movement of peoples throughout Mesoamerica in this era. An earlier view held that there were migrations into the lowlands from areas to the southeast (El Salvador) due to the eruption of the Illopango volcano, as Willey and Gifford (1961) once argued for the Floral Park ceramic complex in the Belize Valley (see also Sharer and Gifford 1970). Much of this debate centered on ceramic interpretation and dating that has now been superseded by subsequent ceramic analysis and by a better understanding of the timing of events (moving the temporal frame for the associated volcanic eruption forward by over 300 years; e.g., Dull et al. 2019). Ancient aDNA analysis will eventually clarify this situation.

An internal factor in the Early Classic transition is the role that Maya dynastic rulership may have played in the southern lowlands. The earliest carved stone monument, portraying what is thought to be a ruler, was recovered at Tikal, Guatemala and is dated to CE 292 (Coe 1965). Later epigraphic notations about the foundings of Maya dynasties are also generally placed during or at the start of this era (Tikal ca. CE 100-250; Caracol in CE 331; Copan in CE 426), adding another layer to considerations of change, transitions, and transformation. The advent of these dynastic rulers with their textual linkages to Maya cosmology herald a significant transition in ancient Maya societies, presumably associated with changes in governance.

Finally, there are open questions about the role that Teotihuacan, Mexico, may have played in two transitional periods in the Maya area. During the Preclassic to Early Classic transition, both epigraphy and archaeology have been used to suggest that the highland Mexican site was actively involved in the Maya area and may have been responsible for the rise of Classic Period Maya kingship and states during this time (Stuart 2000; Martin 2020:390). Teotihuacan-related deposits at sites in the southern lowlands, such as those recovered from Caracol (A. Chase and D. Chase 2011) and Tikal (Houston et al. 2021) provide archaeological support for dating Maya-Teotihuacan relationships long before the CE 378 epigraphically recorded entrada (e.g., Sugiyama et al. 2020), which has been interpreted as resulting in the installation of a Teotihuacano ruler at Tikal (Stuart 2000). The end of the Maya

Early Classic Period now correlates with the collapse of central Teotihuacan circa CE 550 and, thus, Teotihuacan is being viewed as possibly having played a role in the transition between the Early and Late Classic Periods in the Maya area, building on earlier comments by Willey (1979) relative to the Maya hiatus. Yet another explanation for the Early to Late Classic transition, however, is the "CE 536 Event" (e.g., Gunn 2000), a worldwide climatic event caused by one or more massive volcanic explosions (see Newfield 2018). Rather that looking to exterior causes like Teotihuacan or volcanos (and, indirectly, climate) to explain this transition, it more likely resulted from the development of complex, elaborated, and layered governments as population levels and commerce increased. Research at Caracol suggests that this was period with strong autocratic governance (A.S.Z. Chase 2021).

The Late Classic

The transition to the Late Classic continues trends seen in the Early Classic towards increased population as well as increased economic and political infrastructure. Again, ceramics are typically used to identify Late Classic remains. The Late Classic constitutes the timeframe that is perhaps the best known for the ancient Maya. This was the era of maximum population. Late Classic archaeological remains are well represented both spatially and in terms of excavation. The proximity of Late Classic remains to the surface, at least compared to Preclassic and Early Classic materials, also means that a century of investigations has produced a significant amount of data relative to this era. Yet, questions still exist for this benchmark timeframe. How many Maya people were there in the Late Classic Period? How were they organized? And, how diverse were they? The answers to these questions are interlinked and have implications for any considerations relative to change (e.g., A.S.Z. Chase et al. 2024).

Only with the advent of lidar have we gained an idea of the larger spatial extent of Maya sites and regions – and of differences in these regions with regard to defensive structures, road systems, and population densities (compare Chase et al. 2011, 2014 with Canuto et al. 2018). And, only since approximately 2010 has there been widespread archaeological recognition of marketplaces and market economies at Maya sites (Garraty and Stark 2010; King 2015; Masson et al. 2020). The existence of widespread markets among Maya cities has a profound effect for our interpretations concerning the nature and complexity of Late Classic society. Some sites, such as Caracol, show a more collective governance system and lessened inequality at this time (A.S.Z. Chase 2021). By extension, these conceptualizations affect interpretations regarding transformations and change, adding a series of possible factors to the mix that were not part of the established paradigms.

The Terminal Classic

Perhaps the transition over which there has been the greatest speculation in the scholarly literature is the Terminal Classic Period (CE 790-900/950) or the timespan immediately antecedent to the Postclassic Period (CE 950 – 1542/1697) that is better known colloquially as the "Classic Maya collapse" (Culbert 1973; Demarest et al. 2004; Okoshi et al. 2021). As much of the Late Classic ceramic repertoire continued in use, this era was originally defined through the use of specific types, such as modeled-carved pottery and fine orange ware. Because these materials were not widely distributed at sites like Tikal, Guatemala, the impression of a drastic population collapse was fostered (A. Chase and D. Chase 2008). As in the Early Classic Period, we now realize that a focus on finewares can be misleading without also understanding other aspects of the ceramic assemblage (e.g., A. Chase and D. Chase 2004; Halperin et al. 2021; LeMoine et al. 2022) and changes in the iconography associated with Terminal Classic stone monuments (e.g., A. Chase and D. Chase 2021; D. Chase and A. Chase 2021).

The issues in conceptualizing this transition lie in the diverse factors facing different sites and regions in the Maya area as the Late Classic Period drew to a close (A. Chase et al. 2021). The fact that populations in the southern lowlands never fully recovered to the same kind of population levels and architectural constructions after this collapse (Turner 2018) also has led to the propagation of romanticized views about how a society can vanish. This transformation has long been contextualized as a parable for our current world situations (e.g., Wilk 1985). Explanations for the collapse have included peasant revolts (i.e., the Russian Revolution of 1917; Becker 1979; Thompson 1954); endemic warfare (Demarest 1997; Houk et al. 2016), environmental degradation (Webster 2002), climate change (Gill 2000; Iannone et al. 2014), and global networking (Demarest and Victor 2022). Given the recent COVID pandemic, it would also be easy to see how disease could have disrupted Maya society. We now understand that this "collapse" not only took place over a long period of time, but also that it impacted populations in varied ways in the southern Maya lowlands, meaning that multiple factors must have been involved. At some sites, such as Caracol, there was a return to more autocratic forms of governance and greater socio-economic inequality (A. Chase and D. Chase 2021).

Our views of the Classic Period Maya have changed as a result both of new technologies (like lidar and stable isotopes – Chase et al. 2012, 2024; Price et al. 2015) and of continued archaeological analysis and research (e.g., on economics – Masson et al. 2020; on ceramics – Aimers 2013). Our explanations are becoming more complex and nuanced (e.g., Okoshi 2021). Newer analyses and models permit an understanding of how Late Classic Maya polities were interlinked in terms of economies, making Mesoamerican globalization a potential factor in the southern Maya collapse (A. Chase et al. 2024; Demarest and Victor 2022). Whatever is the actual case, the Terminal Classic to Postclassic transition remains especially difficult to interpret archaeologically. Re-occupation of sites in the same locations usually did not occur. Throughout most of the southern lowlands there is a transition . . . and then nothing at what were previously large thriving cities. Importantly, the Maya did not disappear, but rather changed locations and modified certain aspects of their lifeways.

The Later Maya

Some Postclassic peoples stayed in the southern lowlands after the Classic Maya collapse, but their settlements and remains appear substantially reduced in size and varied from those of the earlier Classic Period (A. Chase and Rice 1985; D. Chase and A. Chase 1988; Sabloff and Andrews 1986). The socio-political structure also changed, with the loss of Classic era divine kings and a return to more collective governance (D. Chase and A. Chase 2021). As with previous transitions, the forms and styles of ceramics changed, but it is sometimes difficult to differentiate Postclassic materials from earlier ceramics, especially when looking at sherds. For many years, researchers found it problematic to identify what was Postclassic within the Maya archaeological record; this was true for the Barton Ramie excavations in the 1950s and for the 1971 Tayasal excavations (e.g., A. Chase and D. Chase 2019:12).

Immediately following the end of the Classic Period, settlement and ceramic assemblages were sparsely distributed, making this era difficult to fully define. We currently have a much better understanding of this later block of time, but as in earlier timeframes, issues in interpretating this era are similarly driven by limited archaeological samples, researchers' preconceptions, and spatial variability in ceramics (A. Chase and D. Chase 2008, 2020c; D. Chase and A. Chase 2004, 2021; Graham 1987; Rice and Rice 2012). Nevertheless, much has been done to change perceptions of the Postclassic Period Maya – and it is now clear that these were vibrant populations with both continuity and variation in patterning from earlier periods of time.

Postclassic peoples and their ceramic traditions continued into the Historic Period. The addition of clearly foreign European artifacts and buildings to the Colonial archaeological record is the primary way to identify Historic Period Maya occupation (Oland and Palka 2016). Even though Colonial Maya might be interred in cemeteries associated with Christian churches, archaeological data still reveal syncretic practices that in some cases obscure the Historic present (e.g., Graham 2011). Amplifying the widespread death due to disease after Spanish contact, the resettlement practices of the Spanish (Farriss 1984) also severely altered pre-contact ways of life, making interpretation about the past using the direct historic approach extremely difficult.

Conclusion

Archaeology has always had difficulty interpreting change, transitions, and transformations. The archaeological record requires interpretation, and each researcher brings their own background and perspectives to that understanding. However, new techniques and technologies, greater site and areal coverage, and convenings of all archaeologists working in the same country (as occurs at the Belize Archaeology Symposium) are making a difference.

Particularly salient in interpretations of the past are the use of external prime movers to explain transitions and the dominance of single bodies of data – be they ceramic, hieroglyphic, or applied models – in modeling change. Searching for simpler explanations, we may also tend to homogenize what happened in the past rather than to emphasize the complexity found in the archaeological record (Figure 2).

Our views of the ancient Maya past have slowly evolved as newer archaeological data have been collected and interpreted. Past societal models often focused on the stability of populations, not realizing the amount of mobility that was present, as is noted by Arnauld and her colleagues (2021). Past research also generally focused on larger "type" sites – e.g., San Lorenzo in the Olmec region and Tikal in the Maya area – seeing each as being exceptional and emblematic of change in their broader regions. Established interpretations, even if contested, have become reified through repetition, and it is only with great difficulty that new research can modify past viewpoints. For instance, both the Olmec site of San Lorenzo and the Maya city of Tikal were once seen as being unique, but both have now lost that status with newer research (e.g. A. Chase and D. Chase 2016; Inomata et al. 2021).

Continued excavation in the Maya area has produced much new data, making simple explanation difficult and highlighting variation in individual site histories (as the fortunes of one center rise, another center suffers decline). The ancient Maya were resilient and continued to adapt to changing situations. With more information, change and transitions have become more difficult to categorize in uniform ways. Instead, we see multiple inter-twined histories. What was once "the" transition, when data were limited, becomes a more general transition with localized variations and caveats. And, it is in the permutations that exist in these variable changes that a better understanding of the vibrant Maya societies that comprise the archaeological record will be delineated.

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2 TRANSFORMATION, GROWTH, AND GOVERNANCE AT CARACOL, BELIZE

Adrian S.Z. Chase

Around 650 CE the city of Caracol was one of the largest cities in the world. However, it did not begin as a large city. Instead Ux Witz Ha' ("three stone place" – the city's hieroglyphic name) came into being from the conurbation of three separate centers. Three architectural complexes formed the initial districts of the larger city – Downtown Caracol, Hatzcap Ceel, and Cahal Pichik – between the Preclassic and Early Classic Periods. This unification resulted in a path dependent urban from with future growth focused on multiple monumental nodes and a dendritic causeway system. Settlement growth relied on the incorporation or construction of public plazas and monumental architecture to provide urban infrastructure and administrative cohesion over the landscape. What follows is a preliminary temporal sequence for the districts, tracing the growth of the city from the Preclassic to the Terminal Classic Periods. By combining lidar, archaeology, and hieroglyphic data a broader interpretation of governance within the city can be elucidated. Over time, Caracol shifted back and forth between more collective and more autocratic governance systems until the political, economic, and demographic collapse of the city around 900 CE.

Introduction

At its height in 650 CE Caracol, Belize has been identified as the 7th largest city in the world (Modelski 2003) and was one of the largest known Classic Period Maya cities. However, Caracol did not begin as a massive civic center, and this paper provides a preliminary overview of how the city of Caracol changed and grew over time. The initial form of growth and civic investment within this landscape guided Caracol's administration towards a more collective form of governance. For most of the city's history it had a more faceless administration with transitions through alternative phases of more collective and more autocratic rule. Understanding these shifts and changes requires integration of the epigraphic, excavation, and geospatial datasets.

Based on ceramic sequences, the Caracol Archaeological Project has identified six time periods for dating excavations (see Table 1 and D. Z. Chase and A. F. Chase 2017:185-249 for additional information). First, the Preclassic from 600 BCE to 250 CE covers the period of initial settlement on the landscape for what later becomes the city of Caracol. Second, Early Classic 1 from 250 to 400 CE correlates with the end of E group construction and the founding of Caracol's dynastic lineage. Third, Early Classic 2 from 400 to 550 CE highlights an upturn in urban growth when the city focused on extensive expansion of its causeway system. Fourth, Late Classic 1 from 550 to 680 covers the timespan of Caracol's wars with and subjugation of Tikal and Naranjo, an era that ends with Caracol's defeat by Naranjo and that is correlated with massive population growth. Fifth, Late Classic 2 from 680 to 800 showcases an era of "faceless" administration associated with widespread wealth sharing during the city's apogee. Finally, the Terminal Classic from 800 to 900 CE covers the reestablishment of rulership at Caracol and ends with the depopulation the city.

While relatively fine-tuned from an archaeological perspective, these periods cover relatively large spans of time for investigating transformations and social change. The smallest represents approximately 100 years while the longest covers over 850 years. In addition, assuming a 20-year generation, the rise and decline of Caracol the city took approximately 1500 years or about 75 generations (or 50 generations at 30-years per generation). Thus, these periods provide a very coarse picture of Caracol's urban development and city growth from the perspective of a single life-span.

At its apogee, Caracol was populated by over 100,000 individuals within its 200 square kilometers of urbanized area within modern-day Belize. This value represents a conservative population estimate based on 10 persons per plazuela group; in contrast, structure or mound-based population estimates would more than double this figure to over 200,000 people (see Chase et al. 2024). Archaeological data provide evidence for slow, internal population growth from the Preclassic through the Early Classic periods (Chase and Chase 2018). The Late

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Table 1. Chronology in use by the Caracol Archaeological Project. Dates are approximate.

Time Period	Start	Length	End	Essential Feature
Terminal Classic	800	100	900	Slow abandonment and emptying of the city
Late Classic 2	680	120	800	Expansion into peripheral areas (i.e., suburbs)
Late Classic 1	550	130	680	Population boom
Early Classic 2	400	150	550	Expanding the east-west causeway system
Early Classic 1	250	150	400	End of E group construction
Preclassic	-600	850	250	Monumental Reservoirs

Classic periods showcase increased population growth and in-migration (due to successful warfare events as per Chase and Chase 1989; Chase and Chase 1998a), and the Terminal Classic shows a tremendous population decline (Figure 1).

Initially, as the population grew, the city incorporated other settlements through the process of conurbation (the joining together of previously separate cities into one), but this process shifted in Late Classic 1 to the construction of planned district nodes (Table 2). While establishment of exact district-by-district incorporation dates requires additional excavation data, this article presents a preliminary set of hypotheses for when districts were added (but not when they were founded) based on current excavation data, the presence of temporal markers like E groups and monumental reservoirs, the causeway construction sequence, and the distribution of apogee population density. The shift from incorporating existing settlements as district nodes into the construction of new district nodes also provides proxy evidence for the development of additional administration and record-keeping between the Early and Late Classic periods.

Historical Periods

While larger time periods can be used to look at large changes in population growth and urban expansion, they do not provide a fine-grained lens for looking at other historical changes. Instead, by combining excavation data, radiocarbon dates, and hieroglyphic information, a more complex history emerges that reveals important social transformations and adaptations.

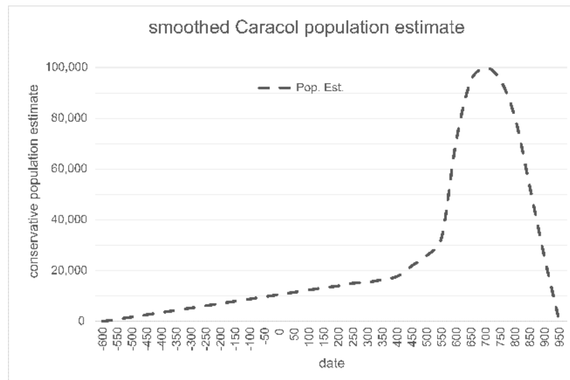

Figure 1. Conservative population estimate for Caracol, Belize (see Chase et al. 2024).

Villages

Based on archaeological data, the initial occupation in what would become Caracol the city began by 600 BCE. These materials are generally deeply buried, thus future excavations may push this date further back in time or provide additional details. During this era, the landscape appears to have been populated by isolated households and incipient villages. These likely provided the foundations for early district centers and their adjacent neighborhoods, but this occupation predates monumental construction, divine kingship, or urban service provisioning at Caracol.

Three Towns

Around 360 BCE the earliest monumental construction is found at Downtown Caracol (A. F. Chase and D. Z. Chase 2017:60), and similar constructions take place at the two centers of Hatzcap Ceel and Cahal Pichik (Chase and Chase 1995:92-93) in what J. Eric S. Thompson (1931) called Mountain Cow. This time period is defined throughout the Maya area

Table 2. Current hypotheses of which districts were added to the city of Caracol by period.

Growth of Caracol the City

Time Period	District Center	Expansion Type
Preclassic	Cahal Pickik	Conurbation
Preclassic	Downtown Caracol	Conurbation
Preclassic	Hatzcap Ceel	Conurbation
Early Classic 1	Ceiba	Conurbation
Early Classic 1	Cohune	Conurbation
Early Classic 1	La Rejolla	Conurbation
Early Classic 2	Monterey	Conurbation
Early Classic 2	New Maria Camp	Conurbation
Early Classic 2	Retiro	Conurbation
Early Classic 2	San Juan	Conurbation
Late Classic 1	Chaquistero	Conurbation
Late Classic 1	Conchita	Planned
Late Classic 1	Midway	Conurbation
Late Classic 1	Puchituk	Planned
Late Classic 1	Ramonal	Planned
Late Classic 1	Round Hole Bank	Planned
Late Classic 1	Terminus D	Planned
Late Classic 2	Terminus A	Planned
Late Classic 2	Terminus B	Planned
Late Classic 2	Terminus C	Planned
Late Classic 2	Terminus E	Planned
Late Classic 2	Terminus F	Planned
Late Classic 2	Terminus G	Planned
Unknown	Las Flores Chiquibul	Conurbation
Unknown	San Jose	Conurbation

by E groups and their role as early community centers (Freidel et al. 2017). This initial process of monumental construction represents a concrete example of collective action (sensu Ostrom 2007) and consensus building (sensu Smith 2016), undertaken without any clear indication of individual rulership. While specific individuals likely took leading roles in their communities, these communities remained small and any leaders remained essentially faceless to us especially given the lack of iconography and text.

Downtown Caracol, Hatzcap Ceel, and Cahal Pichik also become the only district nodes within the urban limits of later Caracol that had monumental reservoirs – those with over 1000 square meters of surface area. Given the size of these districts and their associated features (Chase 2016, 2019, 2021), these monumental reservoirs would have been built during the Preclassic period. All three centers would have likely acted as independent and autonomous settlements with their own local governance. However, they were close enough to have frequently interacted and later population densities are highest between all three suggesting that they quickly became connected and entangled by a continuous landscape of intermixed settlement and agriculture.

City of Caracol

Eventually, Downtown Caracol, Hatzcap Ceel, and Cahal Pichik joined together into a single settlement. After this conurbation, they formed the singular city of Caracol and constructed an essential east-west causeway that linked all three nodes together. This initial backbone road and settlement integration created the preconditions to facilitate the high degree of Caracol's of collective governance observed in subsequent time periods (Chase 2021; Feinman and Carballo 2018) and also those that eventually led to symbolic egalitarianism in the Late Classic period (Chase and Chase 2009; D. Z. Chase and A. F. Chase 2017). This conurbation likely occurred around or after 41 CE but certainly before 331 CE, when Caracol established its rulership.

This era would have required all three monumental nodes and their prominent residents to negotiate and work together thereby creating a power balance that could have prevented the rise of a single individual to power (sensu Blanton and Fargher 2016; Boix 2015). However, another hint of greater cooperation comes from the glyphic name of ancient Caracol – *Ux Witz Ha'* (three stone place / three water mountain). Simon Martin (2020:74) indicates that this emblem glyph does not follow the standard conventions for a dynastic title and potentially harkens back to a Preclassic identity; Tokovinine (2013:69) identifies the title as being "Those of" Caracol. The name could be a reference to a multitude of triadic things (e.g., three cooking stones in a hearth, three stones under an altar, etcetera), but it is likely that *Ux Witz Ha'* actually refers to the conurbation of Downtown Caracol, Hatzcap Ceel, and Cahal Pichik into one urban entity – especially since later rulers sometimes use a separate title that may refer to the Caracol polity as a whole instead of to the city as a place. The later use of this emblem glyph by individual rulers suggests that this name still held political legitimacy throughout the Classic Period.

Wealthy burials of this period exhibit strong ritual associations. For example, around 150 CE a very elaborate burial was made in the Northeast Acropolis (adjacent to Caana) of a woman ritually buried as a personification of Ix Chel (Brown 1998). Not quite 200 years later, this same residential area would house a Teotihuacan-style burial (Chase and Chase 2011).

Dynastic Founding

A dynastic lineage establishes itself at Caracol in 331 CE (A. F. Chase and D. Z. Chase 2021:226). The ruling family probably represents a cadet branch related to the ruling dynasty already established at Tikal, and this likely association then provides a foundation and logic for Caracol's later subjugation of Tikal (Chase and Chase 2020b; Chase et al. 2022). As mentioned earlier, the emblem glyph the Caracol dynasty initially uses does not take the usual form (Martin 2020:74; Tokovinine 2013:69), placing priority on the group and place. Thus, the legitimacy of governing in this time remained focused on the three stone places of Downtown Caracol, Hatzcap Ceel, and Cahal Pichik rather than on a divine ruler.

Another very important event occurs between 300 and 350 CE when a Teotihuacan-style burial is interred in the center of the Northeast Acropolis (Chase and Chase 2011), foreshadowing the Teotihuacan affectations of *K'inich Yax K'uk' Mo'* who established a dynasty at Copan in 426 CE as a cadet-branch from Caracol's ruling family (Helmke et al. 2019:101-103). While the temporal association between Caracol's dynastic founding and Teotihuacan interactions may be a coincidence, Teotihuacan impacted other Maya cities in a similar way (Houston et al. 2021) and the Maya in turn impacted Teotihuacan (Sugiyama et al. 2020).

Empire

The nature of rulership and governance at Caracol changes drastically during the reigns of its most powerful rulers: *Yajaw Te' K'inich* (Lord Water), *K'an* II, and *K'ak' Ujol K'inich* (Smoke Skull). They expand the maximum extent of the Caracol polity including the subjugation of both Tikal and Naranjo (Chase and Chase 1998a, 2020b). At the same time, a second emblem glyph appears for Caracol, *K'uhul K'antu' Mak*. While the first emblem glyph, *Ux Witz Ha'*, referred to the city of Caracol itself, it seems likely that this second emblem glyph, *K'uhul K'antu' Mak*, likely refers to a broader political domain and not a physical location (Helmke et al. 2006:5-6; Tokovinine 2013:69).

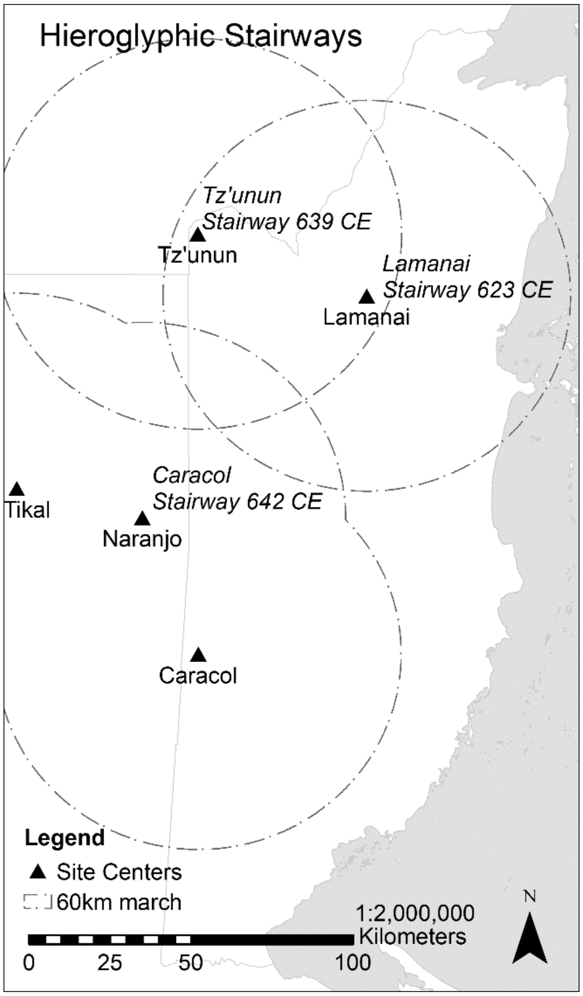

Figure 2. Three hieroglyphic stairways erected at Lamanai, Tz'unum, and Naranjo suggesting three polities in Northern Belize (dates from Helmke 2020:275-276).

The textual information from the early Late Classic contains a detailed epigraphic history for two of these three rulers. First, Lord Water becomes Caracol's ruler in 553 CE under Tikal sponsorship. In spite of this relationship, Tikal attacks Caracol in 556 CE. Six years later in 562 CE Lord Water engages in a war of independence from Tikal and then the historical record becomes cloudy. An individual called *Knot Ajaw* conducts rituals at Caracol in place of the ruler, but is also not identified as the ruler nor ascends to rulership (Chase and Chase 2008:100-101; Houston 1991:41). This distinction suggests that *Knot Ajaw* acts in a ceremonial role and hints at the additional layers of administration that exist beyond the purview of the textual record.

Confusion over rulership continues into the time after Lord Water's death around 600 CE but before *K'an* II (born in CE 588) ascends to the position of ruler in 618 CE (A. F. Chase and D. Z. Chase 2021:228). The presence and unclear role of *Knot Ajaw* suggests that some political turmoil and intrigue was involved in *K'an* II's ascent to rulership; eventually, his legitimacy is firmly established and he commissioned multiple monuments. *K'an* II ties himself firmly to the legacy of Lord Water through the text of Altar 21 (placed in 633 CE), indirectly associating his father's victories over Tikal to his own victories over Naranjo. While Martin (2005:4) attributes this military success to a ruler of the snake dynasty (located at Dzibanche) based on the remaining curl of a single highly effaced glyph (Q4), it seems unlikely that Caracol would be able to govern over and successfully inter two of its rulers at Tikal (see Chase and Chase 2020b) if this had been the case.

The epigraphic record of Caracol describes a series of battles *K'an* II had with Naranjo between 626 and 628 CE before a final conflict in 631 CE (Chase and Chase 2003). At this date, *K'an* II very likely governed from Naranjo (D. Z. Chase and A. F. Chase 2021:229) and garrisoned his military forces there, especially since that city provides an effective starting point for marching to quell either rebellions or incursions between all three cities (Chase and Chase 1998a). It is also a better location to observe and possibly control one of two primary east-west trade routes in the region (Chase and Chase 2012). While at Naranjo, *K'an* II commissioned the Caracol stairway in 642 CE likely in response to those erected at Lamanai in 623 CE and Tzunun in 639 CE (Helmke 2020:275-276). The timing and distribution of these three stairways suggests a three-polity division of northern Belize (Figure 2), especially given the 60 kilometer three-day marching figure for direct territorial control (Hassig 1991).

This period of Caracol's dominance ended well into the reign of Smoke Skull. Of the three Caracol lords from this era, he has the fewest monuments and remains largely unknown. Just as *K'an* II likely would have overseen the burial of Lord Water in Tikal's Temple 5D-32, Smoke Skull likely oversaw *K'an* II's burial in Temple 5D-33 (Chase and Chase 2020b:35). A stucco building text buried within the fill of Caana records Smoke Skull's accession in 658

CE, his defeat by Naranjo in 680 CE, and his return to Caracol three months later (D. Z. Chase and A. F. Chase 2017:206-207). Despite ruling for at least 22 years, the lack of a more detailed record suggests that his monuments were removed and destroyed after his defeat. It is also unclear if he or another individual becomes ruler at Caracol after his 680 CE defeat, but it did lead to the re-establishment of independent dynastic lines at both Naranjo and Tikal (Chase and Chase 2020b:43-46).

Faceless Administration

The defeat of Smoke Skull in 680 CE marks the end of the Caracol polity's largest spatial extent, but this event proved counterintuitive. The defeat actually led to the wealthiest and most equitable phase of governance in Caracol the city through a system that has been called symbolic egalitarianism (Chase and Chase 2009; D. Z. Chase and A. F. Chase 2017:213-217).

This period has faceless rulership with the hieroglyphic identities of those living in the elite complexes remaining unknown. During this time, the city's administrative apparatus maintained peace, prosperity, and relatively collective governance for over a century. Whatever the changes enacted due to the military defeat were, they led to population growth, in-migration, and planned urban expansion that likely benefited from or evolved out of systems established during the previous era of successful warfare and polity growth. They also may have arisen from the requirements of managing the city while the ruler governed from elsewhere.

In any case, this time period, its administration, and its policies led to the most collective governance at Caracol along with the city's highest population (Chase et al. 2024). The maximum expansion of Caracol's agricultural terraces also occurs in this era (Chase and Weishampel 2016; Chase and Chase 1998b), and the widespread wealth of the population can be observed in the low Gini index an era of Caracol's residences at 0.34 (Chase 2017) and the distribution of urban services among its districts (Chase 2016).

Rulership Returns

Despite the successes of Caracol's more collective governance, events eventually led to the re-emergence of rulership and more autocratic governance. *Hok K'awiil* re-established the ruling dynasty in 798 CE; however, his autonomy does not appear to last. Monuments erected in 800 CE focus on external battles, but also show Caracol in alliance with former enemies (A. F. Chase and D. Z. Chase 2021:230). In the larger scheme of things, the resurgence of rulership (and monuments) correlates with a breakdown in social equality and a divide between the haves and have-nots at Caracol with the eventual depopulation of the city about 100 years later (Chase and Chase 2004; Chase and Chase 2008). In fact, the descendants of *Hok K'awiil* saw the burning of Downtown Caracol and the end of occupation in the epicenter around 900 CE (A. F. Chase and D. Z. Chase 2021:234).

Alliance Network

In 820 CE, only 22 years after the return of rulership, Caracol became a junior partner in an alliance network with Ucanal (A. F. Chase and D. Z. Chase 2021:241). Interestingly, Caracol's focus on alliances, just before the twilight of Maya rulership, correlates with a general decline in warfare events from the prior century (Grube 2021). As a whole, the complete network of alliances may have established a confederation that spanned the eastern Peten of Guatemala and the Belize River valley (Chase et al. 2023), something that can be seen in aggregate distributions of model-carved ceramics (LeMoine et al. 2022).

While social inequality increases in the archaeological record (Chase and Chase 2004), the iconography of rulership also abruptly changes. While earlier monuments would frequently depict the ruler as a central figure with a large headdress and ceremonial bar possibly towering over prisoners, later monuments depict the rulers as equals wearing less elaborate headwear and with a smaller aspergillum indicating command (D. Z. Chase and A. F. Chase 2021). While the increasing inequality suggests a more autocratic system as certain goods became restricted to specific residences, these changes in iconography and the short

Table 3. Historical periods at Caracol mixing archaeological and epigraphic datasets.

Historical Period	Start	End	Length	Primary Feature
Alliance Network	820	900	80	Alliance Network under Ucanal
Rulership Returns	798	820	22	Rulership Revived and High Inequality
Faceless Admin.	680	798	118	City's Apogee and Low Inequality
Empire	553	680	127	Caracol "Empire" for Three Rulers
Dynastic Founding	331	553	222	Dynastic founding (possibly from Tikal)
City of Caracol	41	331	290	Conurbation of CAR, HTZ, and CAH
Three Towns	-360	41	401	Monumental Architecture Constructed
Villages	-600	-360	240	Initial Settlement on Landscape

tenures of rulers in this era also suggest a less autocratic form of rulership was in effect.

Despite the governance in place, the Terminal Classic saw the decline of Caracol's population and the eventual depopulation of the city itself. The final on-floor deposits from Caracol suggest that the collapse of the city involved traumatic events. Around 900 CE, Downtown Caracol was burnt with household material and even unburied individuals left on the floors (Chase and Chase 2020a). While individuals may have tried to remain living among the agricultural terraces their families had built generations earlier, the political, economic, and social fabric of the city unraveled.

Summary

Using epigraphic and archaeological data together provides a more detailed narrative of how ancient Caracol grew, changed, and transformed before its depopulation and abandonment. Yet, this story is abridged. The actual history of this city would have included more twists and turns with generational differences at which this set of historical periods only begins to hint (Table 3), but for which other data and analyses can shed additional light.

Governance

The discussion above provides current information on the history of Caracol (Figure 3). In terms of governance and how it changes over time, five distinct periods emerge from aggregating specific historical events. These highlight how Caracol shifts between more collective and more autocratic governance over time (Table 4).

Initial governance at Caracol as it was settled remains unknown. The lack of monumental construction suggests that this phase saw independent residences and early villages form on the landscape, but has no clear indications of monumental architecture or civic structures. This covers the early to middle Preclassic period.

Monumental architecture dating to the late Preclassic at Downtown Caracol, Hatzcap Ceel, and Cahal Pichik demonstrate elements of more collective governance. Construction of E groups and monumental reservoirs likely occurred through collective action and early community collaboration that precedes rulership by almost 700 years. Towards the end of the Preclassic and into Early Classic 1 in the Vaca Plateau, three formerly independent centers joined together into the city of Caracol. This time period combines the "Three Towns" and "City of Caracol" (in Table 4) together.

Divine Kingship and the establishment of the Caracol ruling dynasty represents a more autocratic period of governance from 331 CE through 680 CE. This period sees a massive increase in population at Caracol after successful warfare against Tikal and Naranjo (Chase and Chase 1998a), especially during the reign of *K'an* II. It also demonstrates a shift from urban growth through conurbation towards urban planning in the city's expansion. Even given more autocratic aspects, path dependence from Caracol's founding and landscape (Chase and Chase 2014) ensured less autocracy than its contemporary

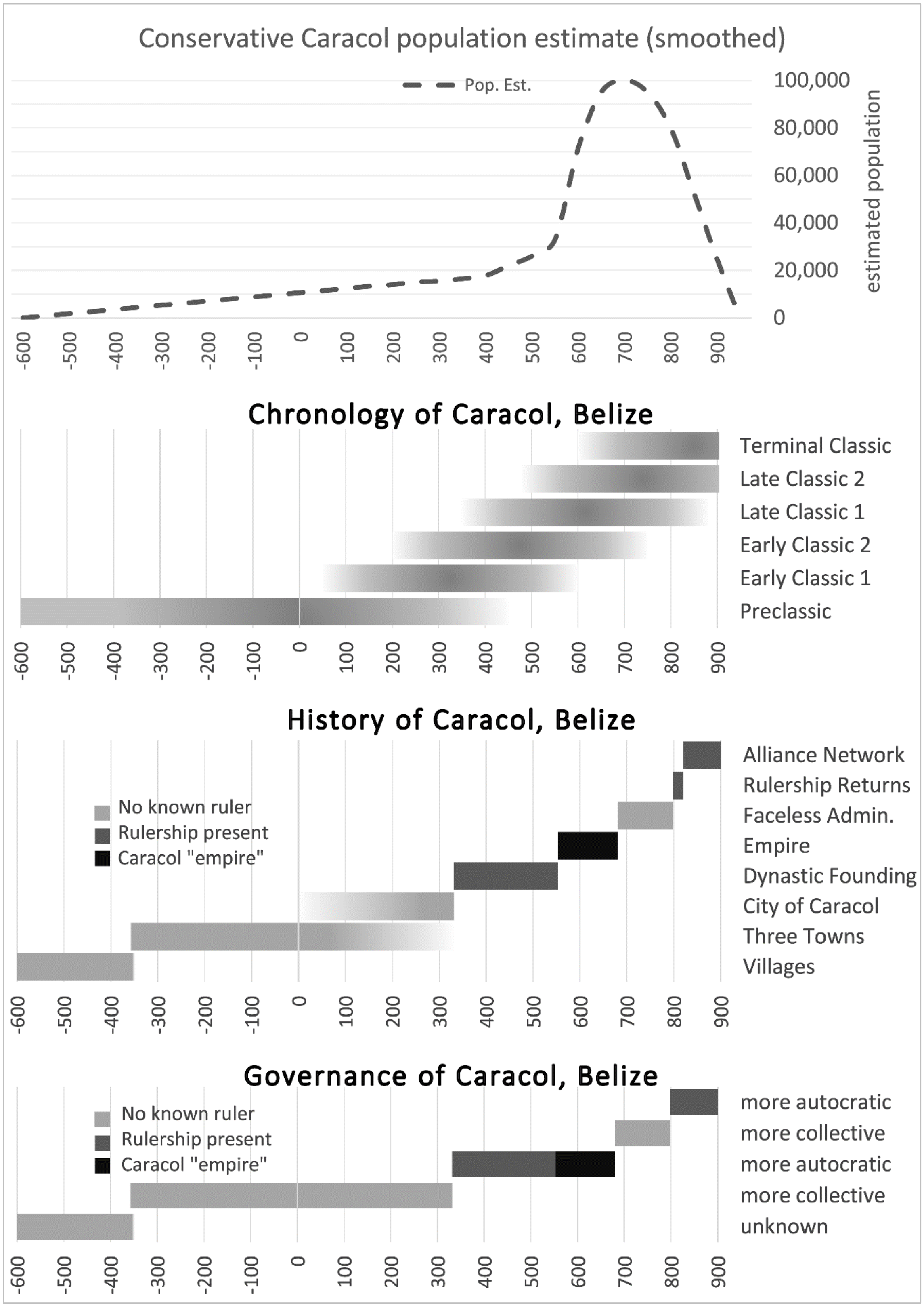

Figure 3. Composite temporal information for Caracol, Belize.

Table 4. Shifts in governance over time between more collective and more autocratic regimes.

Governance Type	Start	End	Primary Feature
more autocratic	798	900	Return of rulership with short reigns
more collective	680	798	Faceless administration & Widespread Prosperity
more autocratic	331	680	Ruling dynasty founded, expanded, and defeated
more collective	-360	331	Monumental architecture constructed
Unknown	-600	-360	Initial settlement on the landscape

polities. Chronologically this period covers the very end of Early Classic 1, all of Early Classic 2, and ends with Late Classic 1, condensing the historical periods of "Dynastic Founding" and "Empire" (from Table 4) together with the same ruling lineage for over 349 years.

While the polity of Caracol shrinks in the period that follows (with the loss of control of Tikal and Naranjo), the local administrative apparatus continues to function and this leads to the most collective form of governance present at Caracol the city with a thriving bureaucratic system. This period has a faceless administration that oversees taxation and the provisioning of urban services; its policies lead to widespread prosperity and low inequality for over 100 years. The symbolic egalitarian practices of shared elite and non-elite practices that emerged before this period provide for Caracol's population apogee and widespread wealth.

The resurgence of rulership may not have caused the decline of Caracol the city, but it co-occurs with more autocratic social practices. The widespread wealth sharing of the earlier period breaks down. The new rulers exhibit new iconography and likely become part of a broader alliance. While Caracol saw out-migration throughout this period, the city center sees traumatic damage and abandonment at the end of the Terminal Classic period as well as massive depopulation by 900 CE.

Conclusion

While Caracol had a population of over 100,000 people and a more collective governance system during its apogee, it did not begin that way. Initial settlement on the landscape that would become the city eventually changed via collective action and the construction of E groups. Three once independent centers joined together, built a long east-west causeway, and created the foundation for *Ux Witz Ha'* (the three stone place). Early governance through more community level aspects was fostered for almost 700 years until the founding of a dynastic lineage in 331 CE. This event roughly co-occurs with the interment of a Teotihuacan individual in the city's downtown, suggesting a potential linkage. Three dynastic rulers in place from 553 until 680 CE expanded the Caracol polity through the subjugation of Tikal and Naranjo. The successful warfare led to population growth, planned urban expansion, and greater wealth sharing within the city of Caracol. Following the breakup of this larger empire, the city exhibited a more collective form of governance until dynastic rule was re-established. This event is followed by increasing inequality and then by depopulation during the city's last hundred years. This outline of Caracol's history demonstrates that its apogee alone does not cover the great transformations and changes the city experienced as it grew. Rather, the city shifted between more collective and more autocratic systems of governance over its 1500-year lifespan, and the three different ways of breaking up time presented here provide unique perspectives on those transformations and changes.

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3 THE ADULT AGE PROFILE AT THE CONTACT PERIOD SITE OF TIPU, BELIZE: HISTORICAL REALITY OR METHODOLOGICAL ARTIFACT?

Marie Elaine Danforth, Rebecca Plants, and Sarah N. Boone

The seventeenth century mission site of Tipu in west central Belize yielded one of the largest and best-preserved Maya populations. However, its age profile is unusually young with nearly 60% of adults having died by age 30 and few surviving past age 40. Several explanations for the profile are considered with a focus on the aging methods employed. Using a sample of 85 individuals, the mean age estimate produced using tooth wear was found to be ten and five years younger than those produced with pubic symphysis and auricular surface analysis, respectively. The sample was also re-aged Transition Analysis 3, a newly revised multifactorial method, which increased the mean age to 35 years as compared to 28 years using traditional methods. Application of TA3, however, was hampered by the numerous scoring sites that could not be evaluated due to taphonomic effects, resulting in extremely broad ranges for age estimates. However, all methods suggested Tipu truly did have a young adult population. The most likely explanation is that it reflects the large number of immigrants who moved to the site because of its strategic location to both the Maya and Spanish during the contact period.

Introduction

One of the foundations of bioarchaeological analysis, the age structure of a community provides essential data for reconstruction of many aspects of past lifeways, from the sociopolitical organization of the settlement to the health conditions and activity patterns of individual inhabitants. Unfortunately, the age profile can be biased by numerous factors. Many of these factors are extrinsic to the actual age estimation process and might include the excavation research design and taphonomic effects to the remains. However, the particular aging methods and even standards within a method that were employed in the demographic analysis can also have an important impact on estimations.

Concern over the accuracy of aging methods has always been a concern in skeletal biology, but Bocquet-Appel and Masset arguably brought it to the forefront in 1982. They identified two major issues affecting the analysis, namely that the age profiles produced with a particular method reflect the profiles of the reference sample and that estimations are so highly inaccurate that no reliable interpretations may be made based upon them (Bocquet-Appel and Masset 1982). The publication prompted a number of responses defending paleodemography, most notably Van Gerven and Armelagos (1983). It also arguably inspired more critical examination of existing aging methods and development of new ones, such as those that extend the aging range beyond age 50 (e.g., Lovejoy et al. 1985), involve new scoring approaches to traditional methods (e.g., Storey 2007), or are multivariate in nature (e.g., Boldsen and Milner 2002).

However, aging those over 35 years old at death still remains problematic (Cox 2001), an issue that has been of concern in the atypical age distribution in the population recovered at the contact period Maya site of Tipu, Belize. There, an unusually large proportion of the adults died before age 30 and few survived past age 40, a demographic pattern for which a number of explanations have been proposed (Cohen et al. 1994). Most involve extrinsic factors, such as migration patterns and the effects of introduced infectious disease, that were a part of the cultural and biological landscapes of the site's inhabitants. However, the methods used in age estimation could also potentially be in part responsible for the unusual age distribution. The efficacy of individual methods used in analysis of the population have been previously considered (Cohen et al. 1994), but their impacts are further investigated in this study, especially in terms of how they compare with each other. Additionally, Transition Analysis 3, a new multifactorial aging method that has been suggested to be particularly effective in identifying older adults, was applied and the results evaluated (Boldsen et al. 2002). The findings here will help evaluation of how the demographic profile at Tipu reveals lifeways on the Spanish frontier in the seventeenth century.

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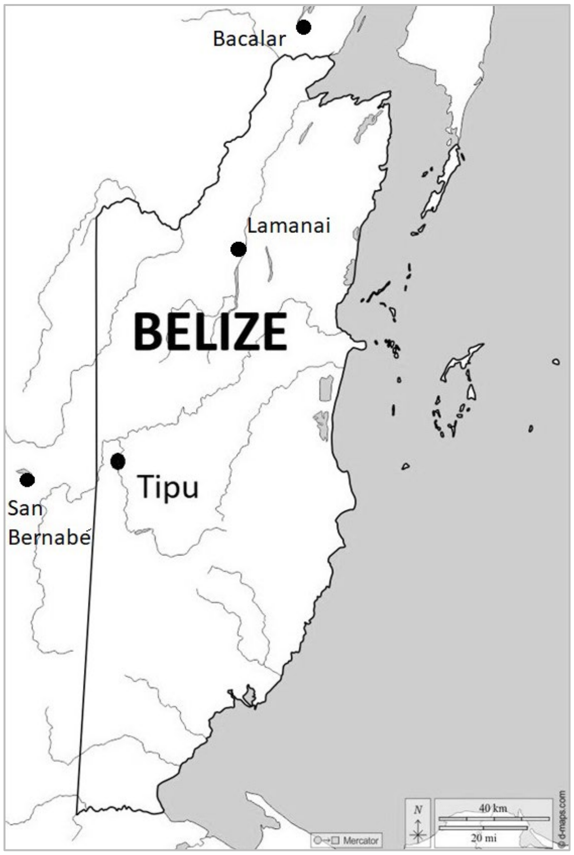

Figure 1. Location of Tipu and other contact period sites.

The Site of Tipu

Although Tipu dates back centuries earlier, a Catholic mission was established there about 1561, and was the furthest removed on a circuit of churches headquartered in Bacalar that also included Lamanai (Graham 2011). With its location on the colonial frontier in west central Belize (Figure 1), the community was critical to both Spanish and Maya efforts to try to control the Petén Itzá region to the west, and its population fluctuated dramatically according to the political landscape at the time. The church appears to have been in use until about 1638 when it was reportedly desecrated during a local rebellion. The history of Tipu ended when the site was forcibly abandoned in 1707 (Graham 2011; Jones 1989).

The nave of the church and surrounding cemetery associated with the mission church held about 600 individuals (Figure 2) and is one of the largest and best-preserved populations recovered at a Maya site. It was excavated in the mid-1980s under the direction of Mark Cohen (SUNY-Plattsburgh) and Elizabeth A. Graham (University College, London now; Royal Ontario Museum then). Nearly all burials at least nominally followed Catholic traditions with individuals interred in a supine position with heads toward the west and presence of few grave goods (Cohen et al. 1994). However, thus far no formal organization has been identified concerning the placement of burials in the church nave and cemetery although a number of factors have been considered, including the temporal sequence (Musselwhite 2015), social status differences as indicated by health (Cohen et al. 1994, 1997), genetic structuring (Jacobi 2000), or area of origin (Trask 2018). However, Jacobi (2000) did identify a few possible family groupings. Overall, those interred appear to have enjoyed relatively good health as evidenced by low prevalences of nutritional deficiencies, infectious conditions, trauma, and childhood metabolic disruptions (Cohen et al. 1994, 1997).

However, one aspect of the population that does not accord with expectations is its demographic distribution (Cohen et al. 1994). Females comprise less than 40% of the adult population, but even more unusual is the age distribution (Table 1). Despite the health patterns seen, life expectancy at birth was only around 19 years (Cohen et al. 1994). This measure is known to be highly influenced by rates of infant mortality (Hoppa 2008), especially in ancient populations. Such is not the case at Tipu where those under age two are in fact quite underrepresented, perhaps because their remains did not preserve as well or that unbaptized babies might not have been allowed burial in the cemetery. Even if only adults are considered, the life expectancy still only increases to just over age 29 with but a handful of individuals appearing to have seen their fortieth birthdays (Cohen et al. 1994). This unusual age profile perhaps is readily appreciated in comparison to the other ancient Maya populations at Jaina and Palenque (Márquez Morfín and Hernández Espinoza 2013) (Figure 3). In a comprehensive evaluation of the demographic patterns at Tipu using a variety of models, O'Connor (1995) also concluded that it was unusually skewed toward a young profile.

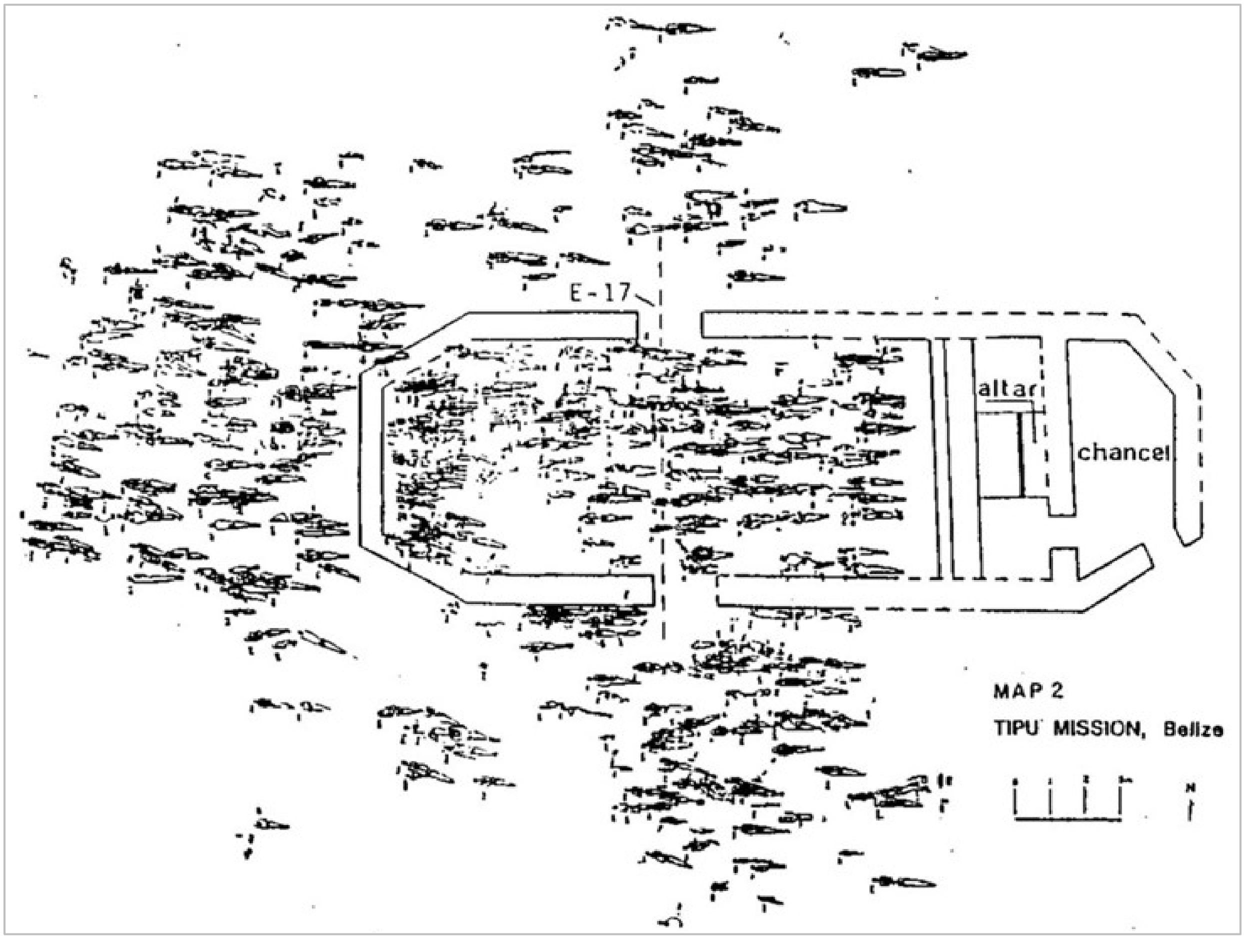

Figure 2. Map of burials in the church nave and surrounding cemetery.

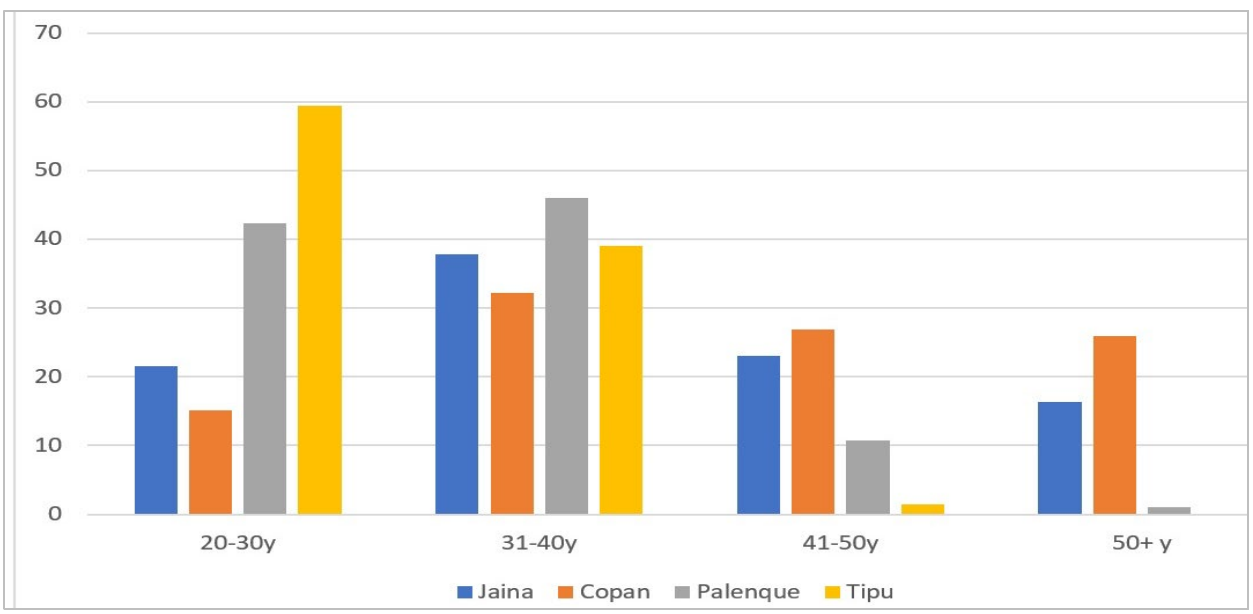

Figure 3. Percentage of population by age decade at Tipu and other Maya sites (data adapted from Márquez Morfín and Hernández Espinoza 2013:Table 3).

The young adult age distribution at Tipu has been attributed to several possible causes (Cohen et al. 1994). The first is that it represents the effects of epidemics and/or famines, both of which were reported were reported in the region around Tipu during the contact period (Jones 1989). Second, it has been suggested that as individuals grew older, they were more likely to have returned to more traditional Maya beliefs and practices; thus, they may have been buried elsewhere outside of the church cemetery. Another explanation offered concerns the nature of the site itself. Since Tipu was located on the fringes of Spanish control, it enjoyed much greater independence than sites located closer to the coast (Graham 2011; Jones 1989). Thus, it became a refugee center of sorts for large numbers of Maya, especially from northern Yucatan, as they tried to escape the effects of contact, such as famine, disease, abuse, or tribute demands. Tipu was also known as a center of rebellious activity which further brought individuals to the site. In response to any or all of these circumstances, younger individuals, especially males, theoretically would have had greater ability to pick up and move (Jones 1989).

A final explanation has been more informally suggested is the accuracy of the aging process itself, especially since identification of older individuals in skeletal populations is challenging using most traditional methods (Cox 2001). Although multifactorial methods are generally considered to be more reliable (Baccino et al. 1999), they had not been widely developed when age patterns were analyzed at Tipu in the 1980s. Thus, the population was aged primarily using individual methods (Table 2). The pubic symphysis morphology is well-regarded as a reliable age indicator (Baccino et al. 1999), but even with the generally good preservation at Tipu, it was able to be analyzed in less than 10% of adults. Changes to auricular surface morphology on the ilium offers another solid age estimation, and, unlike with the pubic symphysis, can be used past age 50 (Lovejoy et al. 1985). However, it is also acknowledged to be difficult to apply (Cunha et al. 2009:5). Suture closure was also frequently evaluated at Tipu in age estimation, but it has become very controversial within bioarchaeology because of its unreliability (Key et al. 1994; Ruengdit et al. 2020). Degree of epiphyseal fusion at certain sites, such as the iliac crest or medial clavicle, can indicate late adolescence or very young adulthood (Cunha et al. 2009:4). At Tipu, however, by far the most common aging technique employed was tooth wear, being scored in nearly 90% of individuals because of the excellent preservation of enamel. Although tooth wear is relatively easy to assess, wear standards can be highly affected by dietary factors as well as antemortem tooth loss (Miles 2001). Other methods have been applied at Tipu, including cementum annulation (Wright 1999) and vertebral fusion (Armstrong n.d.), but have not usually played major roles in final age estimations.

Age Estimation Using Transition Analysis

Although individual aging estimation methods are more well known, some multifactorial methods have been developed, most notably Transition Analysis (TA). Created by George Milner, Jesper Boldsen, and colleagues in the late 1990s, TA was innovative in that it took the scores from various aspects of suture closure as well as pubic symphysis and auricular surface morphologies and combined them into a single multivariate age estimate (Boldsen et al. 2002). One of the most important potential contributions of TA to aging is in better identification of individuals over age 40 (Maaranen and Buckberry 2016). It has been tested in a number of populations of known-aged samples with mixed results (e.g., Clark et al. 2020, Fojas et al. 2018, Jooste et al. 2016, Milner and Boldsen, 2012). TA was applied in aging Janaab'Pakal at Palenque by Buikstra and fellow researchers, who concluded it might work well for producing a population profile but was not sufficiently reliable for use with aging individuals (Buikstra et al. 2006). However, Bullock and others applied Transition Analysis to Postclassic Cholula in 2013 with results suggesting that most adults survived to at least age 70 (Bullock et al 2013).

Several years ago, Boldsen and colleagues released a major update of the original TA logic (Boldsen et al. 2002). Currently in its Beta version, Transition Analysis 3 (TA3) has been developed using more than 15 different skeletal series from around the world in order to ensure population-independence (Milner et al.

2016a). The revision also employs 62 scoring sites across the entire skeleton, and notably none of the sites involve cranial suture or dental observations. In TA3, the scoring of each site has been reduced to only a few options, such as simply smooth or rough, and many landmarks also have quantitative aspects. Thus, much of the subjectivity in scoring is reduced (Milner et al. 2016a)

The TA3 software is free on-line and very user friendly (Milner et al. 2016b) with many photographs of various scoring options provided. Technically only two scorable sites are required to produce an age estimation, although the larger the number of sites that can evaluated, the more reliable the estimation. TA3 uses Bayesian statistics to calculate its estimations, avoiding many of the issues plaguing earlier aging standards. This statistical sophistication makes TA3 especially attractive for use in forensic cases in which the narrowest possible age range is essential (Rogers 2016).

Materials and Methods

In order to assess the role of aging methods at Tipu, a sample of 85 adults was selected for study. All were among best preserved individuals in the population, but they still varied widely in the number and locations of the sites that could be evaluated. As may be seen in Table 3, the demographics of the sample were very similar to those in the larger population with no statistical differences seen.

The primary methods included pubic symphysis morphology (McKern and Stewart 1957, Todd 1921), suture closure (Meindl et al. 1985), auricular surface morphology (Lovejoy et al. 1985), tooth wear (Brothwell 1981, Lovejoy 1985), and epiphyseal fusion (Ubelaker 1978). Tooth development and eruption standards (Ubelaker 1978) were occasionally applied to assess the third molar. All assessments were conducted at SUNY-Plattsburgh in the mid- to late 1980s. Most observations were made by Carl W. Armstrong, which reduced the likelihood of interobserver error. Kathleen A. O'Connor worked with Armstrong in the evaluation of the auricular surfaces, and Sharon Bennett was also occasionally involved in making observations, especially with the suture closure analysis. Armstrong then compiled a composite age estimation for each individual based on the greatest overlap of estimations from the individual methods.

The sample was also assessed using TA3 by the authors for all sites possible for each individual following the scoring guidelines (Milner et al. 2016a). Data was then analyzed using the TA3 software (Milner et al. 2016b) to produce an age estimation, which includes a mean age, standard error, 95% confidence range as well as a correlation coefficient to indicate the relative reliability.

Analysis of the efficacy of various aging methods was Tipu was challenging given there are no known ages for the individuals under consideration. Therefore, most of the statistical analysis was accomplished using mean ages, although age estimates for skeletal remains are most appropriately reported as a range. It should be noted that the ranges associated with the various estimates here varied extensively by method, especially with those produced using TA3.

Results

In the initial analysis (Table 4), the mean age of the adult sample using the composite estimation from traditional indicators was 28 years and that for TA3 was about seven years older with the difference being highly statistically significant ($t=9.68$, $df=96$, $p<.0001$). The mean ages and standard deviations for males and females within each method were not statistically different; therefore, the sexes were combined for all subsequent analyses. The TA3 age estimations, however, were not consistently seven years older than those from the traditional methods (Figure 4). The correlation coefficient between the two estimates for individuals was just 0.37, although still statistically significant at .001.

Next, we examined patterns of age estimations produced by individual traditional methods. As had been generally presumed at the study, tooth wear provided the youngest estimations. At 22.6 years, the dental wear mean is 10 years less than the one gained using the auricular surface and five years less than for symphyseal ages.

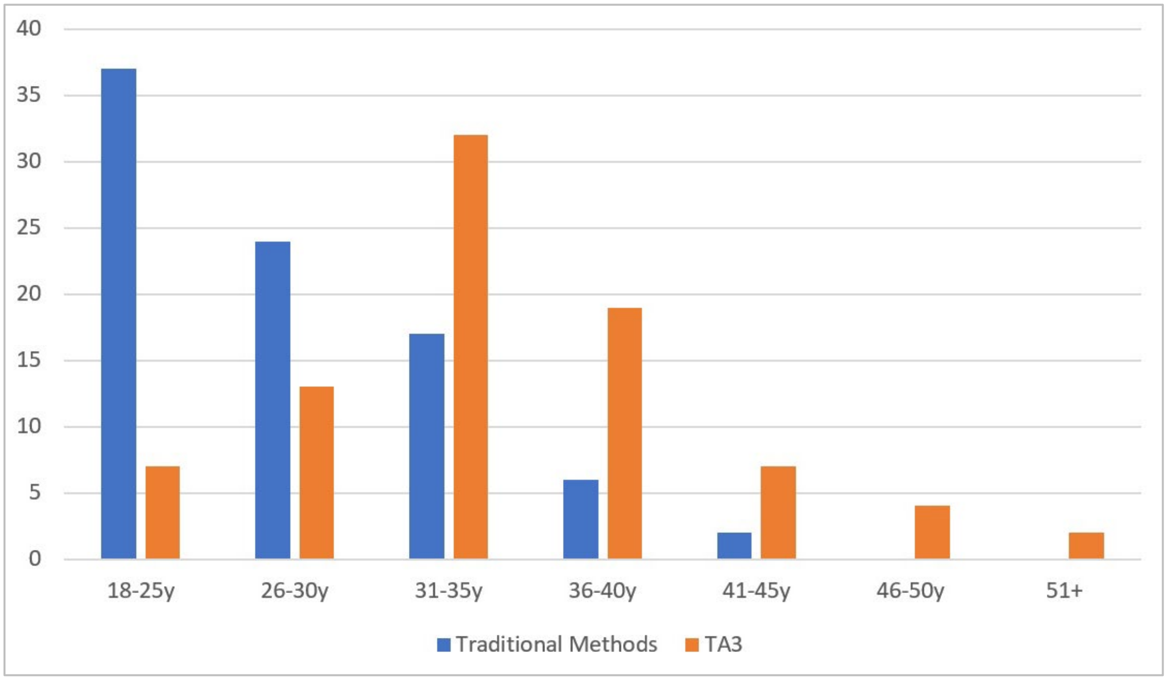

Figure 4. Percentage of sample by age decade using composite of traditional methods and TA3

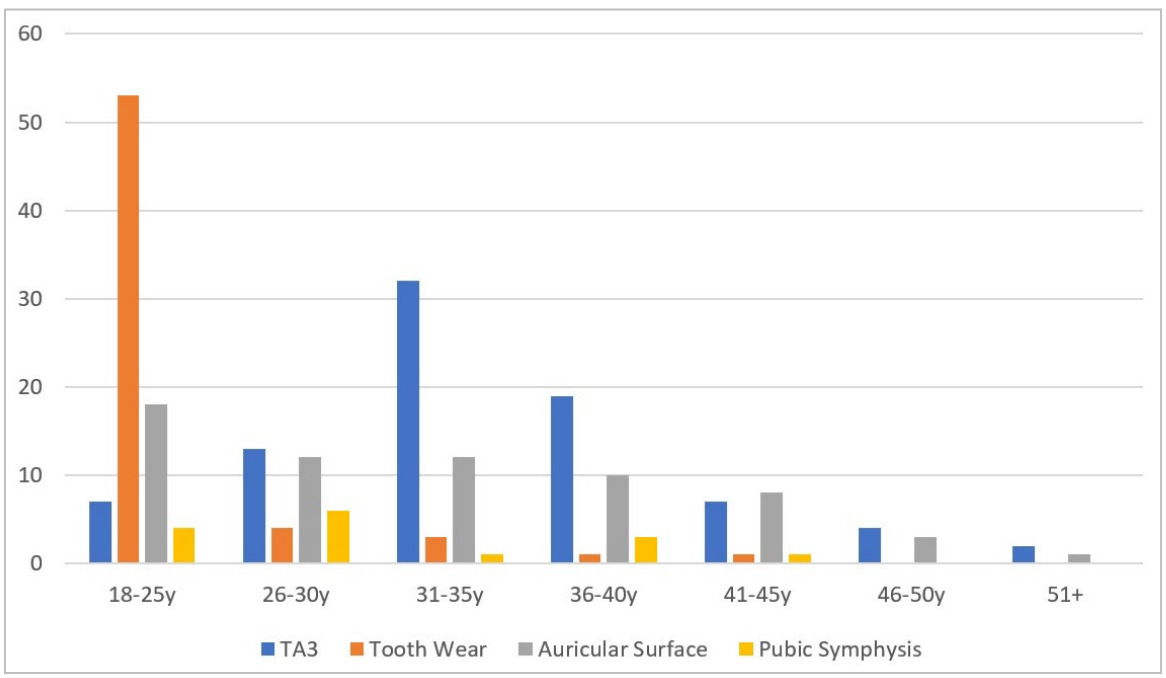

Figure 5. Percentage of sample by age decade using individual traditional methods and TA3

Figure 5 shows the distinctive tooth wear age profile compared to those of the other methods; not unexpectedly, tooth wear had the lowest correlation coefficients when its age estimates were compared to those of the other traditional aging methods (Table 5). However, even if the tooth wear estimates are removed entirely, the consequent profile is still not representative of a typical population of the time. Auricular area and pubic symphysis analysis did identify more individuals between ages 25 and 40 and the correlation of age estimates between them was very high at over 0.9. Nonetheless, very few burials older than age 40 were suggested by either method.

When the age estimations of TA3 were correlated with those of the traditional methods, variable patterns emerged. The coefficient with tooth wear was extremely low and only more moderate with pubic symphysis and auricular surface morphologies (Table 5). Even though the mean age estimates were on average older with TA3, there still was an underrepresentation of those over age 40 despite the fact that identification of older adults is suggested as one of the strengths of the method. To further explore this finding, George Milner (personal communication) kindly identified seven traits that he found to be especially diagnostic in distinguishing individuals between young and middle adulthood: lipping of lumbar vertebrae, sharp promontory edge of sacrum, glenoid fossa lipping of scapula, roughened lateral epicondyle of humerus, lesser tubercle bumps of humerus, fovea capitus lipping of femur, and greater trochanter exostosis of femur. In evaluating 19 individuals in the sample over 35 years of age using traditional methods, only three showed any of the TA3 traits associated with middle adulthood, and none had more than two of them. Thus it further reinforced the young age profile of the population, supporting the findings using the traditional methods.

Discussion

The age estimations in the Tipu population using all of methods evaluated were in strong agreement concerning the greater than expected number of young adults. Although the burials in the sample were evaluated using the traditional methods over 35 years ago, most of these individuals since have been looked at in multiple investigations, and no concerns over the quality of their demographic assessments has emerged. The original scoring forms for the most difficult method to apply, auricular aging, are still in the files, and the level of agreement between the observations made by O'Connor and Armstrong was quite impressive. Tooth wear, arguably the easiest method to apply, was even further accommodated by the generally complete dentitions seen with relatively low levels of dental pathology. The primary weakness among the traditional methods was the few individuals who had scorable pubic symphyses.

The most important finding of the analysis of the individual methods was the extremely young ages suggested by dental wear as compared to those from the auricular surface or pubic symphysis analysis. The impact of the method on the age profile of the Tipu population is enormous since a very large number of burials were only able to be aged using tooth wear. When the dental wear estimates are removed from consideration, the mean age of the population increases into the early 30s. Although not nearly as skewed as before, it suggests that the age profile for adults is still quite young, and this must be taken into account with site interpretation. The age pattern that resulted from tooth wear could be related to several factors, but the most likely relates to the fact that the standard used was ones based on a population in the northern U.S. still dependent in part on hunting and gathering (Meindl et al. 2008), which would have resulted in greater dental attrition. Therefore, the age estimations would likely be quite different if a standard based on Maya dietary practices were used.

In assessing the application of TA3 with Tipu, the general results might appear to suggest it was successful since the method did produce an older mean age for the population that was in greater accordance with estimates gained from other traditional age indicators with the exception of dental wear. However, such an interpretation needs to be somewhat tempered. TA3 identified five individuals as less than 23 years old at death, all of whom also exhibited well accepted indicators of young adulthood that were present, such as lack of complete fusion of the iliac crest, but there were also a number of other individuals it missed who also had convincing evidence of being late adolescents/early young adults. At times, however, these individuals were aged as 30 or older by TA3.

Another issue with the age estimations produced with TA3 is the large peak in the mid-30s. Upon greater consideration of these individuals, it was found that most had completed growth, as indicated by fully fused epiphyses, but they lacked any indicators suggestive of older adulthood, such as even slight arthritis. Without a perceivable upper end to the age range, TA3 in its statistical calculations placed them somewhere in an undefined middle, and to be fair, these age estimations usually also had lower rates of reliability as indicated by the associated correlation coefficient reported by the software. However, they do not inspire confidence when applied to interpretations of the Tipu demographic patterns.

Some of the more indecisive results using TA3 could be related to the fact that most traits indicating older age simply could not be scored on the Tipu burials. Many sites involved evaluating whether bone features had edges that were sharp or rounded or whether projections were present, but the relevant surfaces were all too often abraded by taphonomic processes. Still other traits were involved joint ends of bones and not the shafts, which of course are more likely to be broken off. Therefore, our hope of using TA3 to provide age estimates for the rest of the individuals at Tipu, especially for less complete sets of remains, was very dampened, and its application will be a challenge in many other Maya series as well.

TA3 does need additional testing in better preserved populations, and certainly will be taking place considering that it is a Beta version. Milner (personal communication) also reports it is currently undergoing further statistical revision, including some of the assumptions underlying the aging process. Although their machine-learning (AI) approaches were working well, they are continuing to develop a parallel route with an updated version of the TA logic, which so far is reportedly working better.

Throughout all of the various analyses, one thing that does appear to be consistently supported is that the Tipu population was comprised of a larger than expected number of young adults. Among the explanations offered to explain this age profile, two seem less likely to be in operation than others. Although introduced infectious diseases and the often-consequent famines unquestionably were present in the region and some researchers have even argued that they took a larger toll on young adults (Burnet and White 1972:97-100, Cox 2001, cf. Crosby 1975:29), there is no evidence of hurried burial or mass graves in the cemetery, as Cohen and colleagues (1994) have observed. Only one burial has been identified as having contained multiple individuals, and it includes two adult females very carefully placed in the grave holding hands (Hair et al. n.d.). Furthermore, it would seem unexpected for those dying from a horrific event as an epidemic to be interred in one of the most important public areas of the community. Another explanation for the lack of older adults that would seem to warrant less support is the suggestion that individuals grew more traditional in their beliefs as they aged and were thus buried outside the church cemetery. Such a tendency does not appear to be discussed in the Maya ethnohistorical literature (e.g., Graham 2011; Jones 1989), but the hypothesis could be further explored with more extensive excavation of the site.

If the accuracy of the aging methods is deemed acceptable, the most likely explanation for the young age profile at the site appears to be the ethnohistorical reports that Tipu experienced immigration to the site of large numbers of Maya fleeing Spanish domination as well as of those who were participating in rebellious operations as the Spanish tried to conquer the Petén (Graham 2011; Jones 1989). As discussed previously, those younger would theoretically have been more able to leave their home communities, both from a physical perspective as they negotiated traveling some challenging terrain but also socially in that they would seem to be less likely to have familial and other commitments that would be left behind. The excess of males at Tipu would also be consistent with such an interpretation. However, Cohen and others (1994) have correctly noted that the immigrant presence still does not explain why only a handful of individuals were over age 40 at death.

An additional line of evidence from more recent research also supports this explanation through identification of the extent of the immigrant segment at Tipu. Using Sr and O isotope levels in dental enamel, Trask (2018) identified 112 non-locals and 66 locals in the sample she tested at Tipu, suggesting that immigrants may have constituted nearly two-thirds of the site's burials. She ascertained several areas of origin for the non-locals, including the Maya Mountains, northern Yucatan, and the Petén, which very much corresponds with expectations based on ethnohistorical sources except possibly for the Maya Mountains (Jones 1989; Trask 2018). A similar situation also appears to potentially characterize another contact period Maya site, namely San Bernabé in the Petén region. San Bernabé was similarly the site of much rebellious activity against the Spanish, and there it appears that the largest demographic segment is comprised of young adults (Freiwald et al. 2020:Table 1).

Conclusions

The findings of this study supporting the presence of immigrants or refugees at Tipu only reinforces the unique position of the site in Maya contact period history. The youthful age profile of the series is consistent with their residence and then burial at the site, although the profile likely is not quite as young as has been earlier reported due to overreliance on dental wear as the primary aging method used. TA3 analysis did suggest the likelihood of a slightly older age profile than that produced using more traditional aging methods, but it still indicates most did not survive past age 40 or 45. However, application of the software in the rest of the Tipu population as well as in other Maya series is likely to be limited due to the challenges of preservation. Since the health patterns of those at Tipu have been well studied, future work will focus more on examining the role of the immigrant/local presence at the site, not only in light of DNA and isotope work that has been conducted at Tipu but also comparing with more recently discovered contact and colonial period cemeteries at sites such as San Bernabé (Freiwald et al. 2020; Pugh et al. 2012) and Campeche (Tiesler et al. 2010). It is hoped that such efforts will produce a more detailed and comprehensive view of life at these sites, especially in terms of rebellion, independence, negotiation, and resiliency.

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4 EXAMINING THE POLITICAL DYNAMICS UNDERLYING THE RISE OF THE LATE CLASSIC MAYA POLITY OF LOWER DOVER, BELIZE

John P. Walden, Rafael A. Guerra, Julie A. Hoggarth, and Jaime J. Awe

Our report overviews and summarizes our current understanding of the rise of the Late Classic (AD 600-900) Maya polity of Lower Dover in the Belize River Valley. We draw on settlement survey data and excavation data from commoner households, minor centers, and the civic-ceremonial center to distinguish between several hypothetical developmental trajectories for the Late Classic polity. While investigations are still ongoing, multiple lines of evidence overlap to suggest that Lower Dover likely emerged as a top-down imposition by an external regime with some degree of political power.

Introduction

The hinterlands of the Late Classic Maya polity of Lower Dover, situated in the Upper Belize River Valley, around modern day Unitedville, Cayo District, saw extensive archaeological investigation prior to the discovery of the civic-ceremonial center (Figure 1). Gordon Willey and colleagues (1965) famously pioneered household excavations at Barton Ramie, the northern hinterland of Lower Dover, and surveyed the minor center of Floral Park on the southwest periphery. Floral Park subsequently came to see extensive excavation under the Belize Valley Archaeological Project (BVAP) by Glassman, Conlon, and Garber (1995), and Brown and colleagues (1996). The civic-ceremonial center of Lower Dover was discovered at this time (and named Tres Rios; see Castelhano and Reeder 1996). The center was renamed Lower Dover and underwent survey and pilot excavation in 2009 (Wölfel et al. 2009). Following this work, the Belize Valley Archaeological Reconnaissance (BVAR) project began extensive investigation of Lower Dover in 2010 under the direction of Rafael Guerra (2011).

The discovery of a major center a mere 800 meters south of Barton Ramie seemingly answered long-standing questions about why settlement densities were so high in this region (see Chase and Garber 2004). Indeed, pilot survey of the southern Lower Dover periphery revealed dense clusters of commoner households extending southwest to Floral Park (Figure 2; Guerra 2011; Petrozza 2015; see also Walden, Biggie, and Ebert 2017). The position of the Lower Dover major center at the epicenter of several districts of commoner settlement

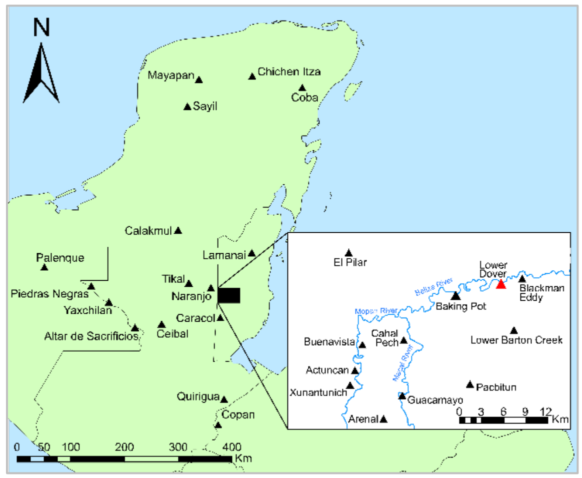

Figure 1: Map of the Maya Lowlands, with the Belize River Valley and Lower Dover inset.

aggregated around outlying minor centers seemingly made sense, as the polity resembled its nearby counterparts like Baking Pot and Cahal Pech (Awe 1992; Hoggarth 2012; see also Walden et al. 2019).

This simple picture was problematized by two complications. Firstly, the major center of Blackman Eddy, which rose in the Middle Preclassic (900-300 BC), is located just 3 km to the east of Lower Dover (Garber et al. 2004). While Classic Maya polities are more densely packed in the Belize River Valley than surrounding regions (Helmke and Awe 2012), the geographic proximity of Lower Dover to Blackman Eddy highlighted the possibility that the two civic-ceremonial cores formed at different times in a manner akin to the dynamic model (Marcus 1993). Still, some limited Late Classic monumental construction occurred at Blackman Eddy and a diminished royal court was

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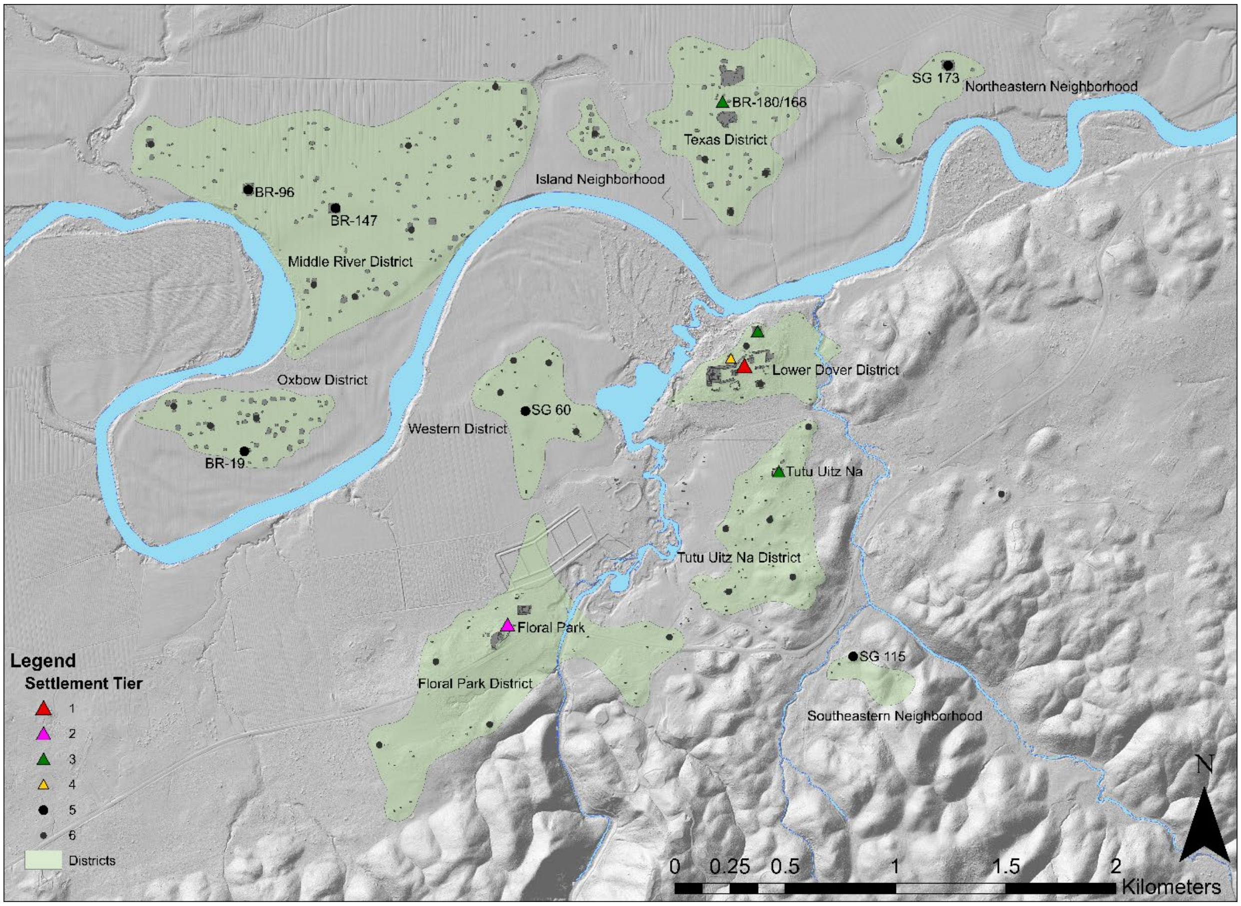

Figure 2: Map of the Lower Dover polity showing districts and major/minor centers.

Table 1: Chronology for the Belize River Valley.

Time Period	Date Range
Postclassic	CE 900/1000–1521
Terminal Classic	CE 800–900/1000
Late Classic	CE 600-800
Early Classic	CE 300-600
Terminal Preclassic	CE 150-300
Late Preclassic	300 BCE-CE 150
Middle Preclassic	900-300 BCE
Early Classic	1200/1100-900 BCE

likely still present there (Garber et al. 2004). Secondly, excavations at the Lower Dover civic-ceremonial center showed little Preclassic (1100 BC-AD 300) or Early Classic (AD 300-600) material, indicating that the center rose in the Late Classic (Table 1; Guerra 2019). This finding corroborated the idea that Lower Dover and Blackman Eddy followed different developmental trajectories, but problematized our understanding of the Lower Dover polity because earlier hinterland excavations revealed substantial Preclassic and Early Classic components at Barton Ramie (Willey et al. 1965; see also Gifford 1976), Floral Park (Driver and

Garber 2004:294; Garber et al. 2004:28; for BVAP ceramic analysis and radiocarbon see Walden 2021:234-235, 413-434), and Tutu Uitz Na (Petrozza 2015; Walden and Biggie 2017). Lidar assisted settlement survey revealed Preclassic and Early Classic ceramics on the surface of many commoner house mounds (Walden, Biggie, and Ebert 2017).

Excavation has revealed that Lower Dover developed along an understudied trajectory through which the polity capital (and associated apical elite regime) formed long after the surrounding settlement. The rise of Lower Dover saw the co-option of established local elites as intermediate elites (evident in a uniform decrease in intermediate elite wealth), and the incorporation of surrounding commoner labor for the construction of the monumental epicenter (Walden 2021; see also Guerra 2021; Guerra and Awe 2017). Traditional scholarship on the emergence of ancient polities considered hierarchical decision-making and socio-economic inequalities to arise in tandem with population growth. Recent research in the Maya lowlands (e.g. LeCount and Yaeger 2010) shows that disembedded capitals, which did not develop alongside surrounding populations (e.g. modern Belmopan, or Late Classic Xunantunich), were surprisingly common. As a late forming imposition on a densely settled landscape, Late Classic Lower Dover could hypothetically represent a: **(a)** top-down imposition by an external regime, **(b)** the arrival of a roving court of elites which had absconded from another polity, **(c)** the autochthonous paramountcy of a single local elite household, **(d)** a confederation of local elites, or **(e)** some combination of the above. We employ survey data of the hinterlands and excavation data from the civic-ceremonial core, three minor centers, and a 27% sample of households (*n*=96) to examine which of these trajectories best fits the current data. For the sake of brevity, we summarize the findings of previous statistical analyses in this report (for full analyses including ceramics and radiocarbon see Guerra 2021; Walden 2021). Based on multiple lines of evidence, we argue that the current data support the hypothesis that Lower Dover likely formed as **(a)** a top-down imposition by an external regime, or possibly through **(b)** an arrival of a roving court. This conclusion is tentative and we are in the process of combining new isotopic and genomic approaches with traditional archaeological methods to further examine this question.

Pathways to Power: The Emergence of Late Classic Polities in the Maya Lowlands

The five hypothetical pathways to power outlined above are based on general trends in Late Classic polity formation (Emery and Foias 2012; LeCount and Yaeger 2010; Peuramaki-Brown and Morton 2019; Schortman, Urban, and Ausec 2001). The first possibility is that Lower Dover rose as a top-down imposition by a more powerful external regime. This dynamic is evident at Dos Pilas which was founded on behalf of Tikal by Bajlaj Chan K'awiil in AD 648 (Martin and Grube 2008:56). Calakmul responded in AD 651 by dispatching their own vassal to found Cancuen (Kistler 2004:1–3). A second possibility involves the arrival of a roving "cadet lineage" of elites who successfully fissioned from an established polity to found their own capital (Guerra 2021:239). Examples of this dynamic include Minanha which was founded by elites who possibly broke away from Caracol (Iannone 2006:165; for other examples see de Montmollin 1995; Morton, Andres, and Wrobel 2019; Dunham, Jamison, and Leventhal 1989). The third pathway involves the possibility Lower Dover arose as an autochthonous development, with a single elite household rising to paramountcy over others and establishing itself as a regional suzerain (Guerra 2021:11). Caracol likely rose through this dynamic, as the center incorporated Hatzcaap Keel and Cahal Pichik to form the city of Caracol (Chase and Chase 2014:145). A fourth possibility, which also involves an autochthonous development, sees Lower Dover arising as a confederacy of local elites (Restall 2001). Instances of Classic confederacies are rare when compared to the Postclassic period, with examples like the K'iche' polity centered at Q'umarkaj (Carmack 1981:3-8), and the Mayapan confederacy (Roys 1967), although such dynamics remain possible especially in the Terminal Classic period when *popol nah* (council houses) became increasingly common (Fash et al. 1992). The last possibility is that Lower Dover formed through a combination of the four scenarios. An example

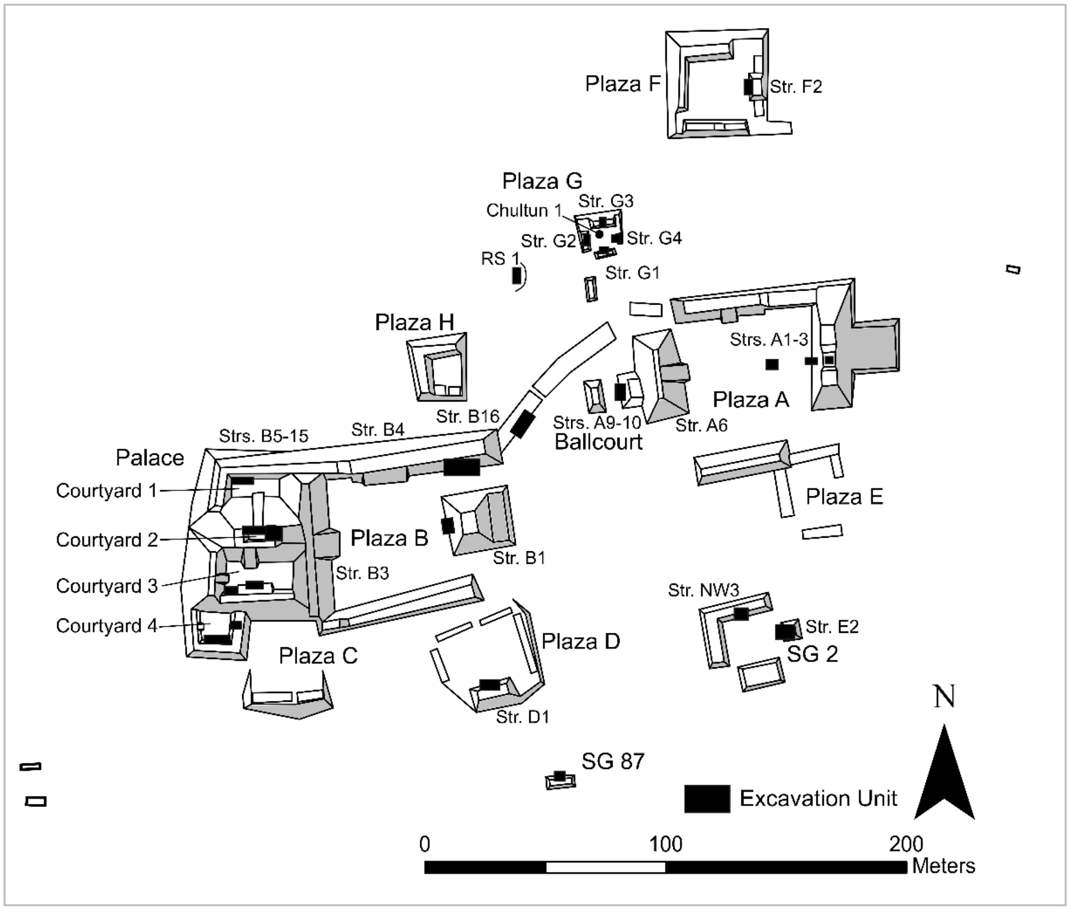

Figure 3: Map of the Lower Dover civic-ceremonial core showing excavation units (adapted from Guerra 2021:Fig. 3.3).

of this dynamic is Ceibal which grew as a satellite of Dos Pilas, but ascended to paramountcy as a regional suzerain in AD 830, but did so while being "overseen" by Kan Ek' Jo' Pet of Ucanal (Halperin et al. 2020:483; Schele and Mathews 1998:179–183).

The Emergence of Lower Dover-Core and Hinterland Perspectives

Vertical excavation units were placed on numerous structures and plazas in the civic-ceremonial core to understand its developmental trajectory (Figure 3; Guerra 2021). The Lower Dover civic-ceremonial center encompasses 148,800 m^3 of architecture, which was constructed in two main phases dating to the early Late Classic (AD 600-700) and the late facet of the Late Classic (AD 700-850). Most construction comprised dry laid boulder fill, which represented the most expedient way of constructing large imposing monuments (Guerra 2021:2). An estimate of construction labor costs using the method developed by Abrams (1994) and refined by McCurdy (2016) suggests that Lower Dover required roughly 1,746,000 person-days (Walden 2021:254-260). Given a polity population (and labor pool) of 2400 people (with a 20% dependency ratio based on McCurdy 2016:552), construction of the major center and intermediate elite minor centers would require ~18-28 days a year per person for the early Late Classic, and ~15-20 days a year per person for the late facet of the Late Classic (Figure 4). These estimated tax rates are consistent with a corvée labor system (Walden 2021:510-514; see also Abrams 1994:101). A sizeable proportion of this total construction was invested in the elite pyramidal palace and its associated courtyards (Watkins et al. 2017). The presence of this large palace, which housed a royal court, similar to those located in other centers in the region (Helmke and Awe 2012), is one line of evidence

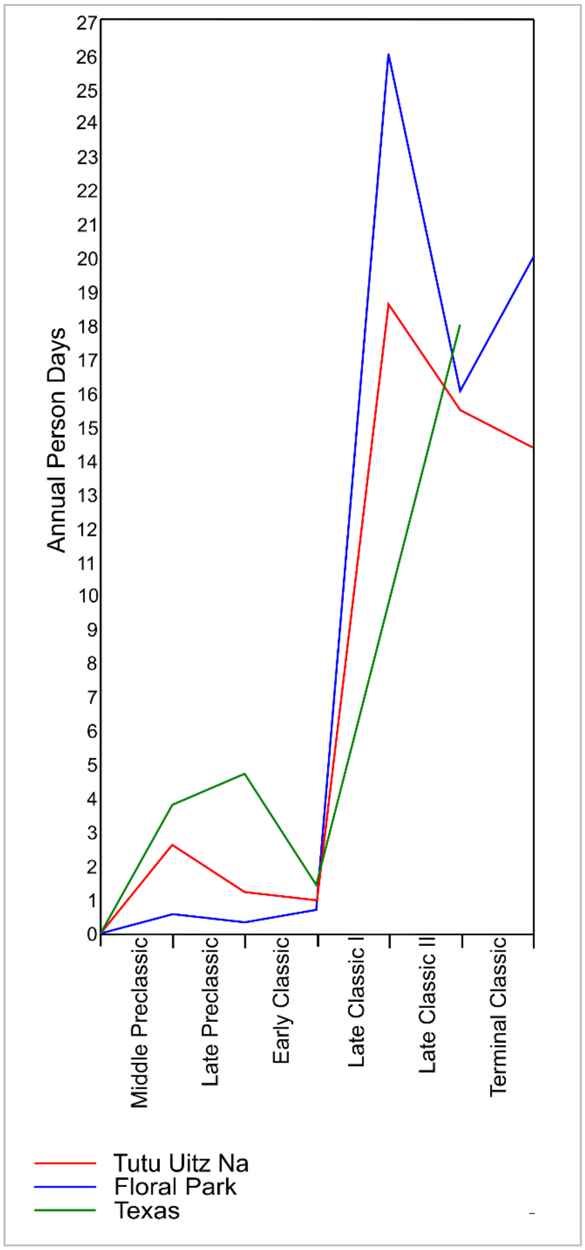

Figure 4: Graph showing estimated labor costs associated with monumental construction over through time.

which supports the idea that a system of kingship, not a confederacy, was present at Lower Dover.

There are several lines of evidence which point to the possibility that external actors played a role in the emergence of Lower Dover. For instance, the layout of the civic-ceremonial center is very similar to Cahal Pech and specific structures have clear analogs at Cahal Pech. The royal palace (Structure B3 and its internal courtyards) are laid out in a manner alike to Plaza A, the royal palace at Cahal Pech. Moreover, the eastern "audiencia" facing Plaza B is similar in size to Str. A2 at Cahal Pech, and probably had the same number of doorways (Guerra 2021:111, 238). Figure 5 shows similarities between the layouts of the two civic-ceremonial centers. It remains unclear whether these architectural similarities are indicative of emulation, whereby emergent royals based their civic plan on a long-standing and powerful neighbor, or if the similarities reflect top-down imposition, whereby the Cahal Pech rulers founded Lower Dover in the image of their own core.

Excavation of Structure B1 on the eastern side of Plaza B, revealed a small corbelled vaulted room flanked by two staircases (Guerra and Romih 2017:125-126). A bench inside this room contained two lip-to-lip bowls (one with spikes similar to a Miseria Appliquéd incensario) with a distal human phalanx inside (Guerra and Awe 2017:246). Similar lip-to-lip finger bowl caches are common at Caracol (Chase and Chase 2017), and have been found at Baking Pot and Cahal Pech (Cheetham 2004:137). These finger bowl caches were once considered evidence of overarching Caracol hegemonic control because these caches seemingly first appeared there in the Late Preclassic and remain common over the following centuries (Chase and Chase 1998). Although more recent studies have shown that these caches have been found far beyond the Caracol zone of influence (McCauley 2019:83). The presence of a Caracol style lip-to-lip cache could plausibly be interpreted as indicating that Caracol played some role in the rise of Lower Dover. Indeed, Caracol hegemony over the region around AD 600-700 seems plausible given the size of Caracol, and its distance from Lower Dover. However, the Miseria style of one of the vessels, and the architectural sequence suggests a Terminal Classic date for the placement of this cache, well after the apogee of Caracol dominance.

The civic-ceremonial core itself was demographically disembedded and the apical elite did not possess their own retinue or faction of followers, instead control of their commoner subjects was likely contingent on intermediate elite brokerage. Commoner households did not cluster around the civic-ceremonial center like at other well established polity capitals in the region (Hoggarth 2012). The central district around the

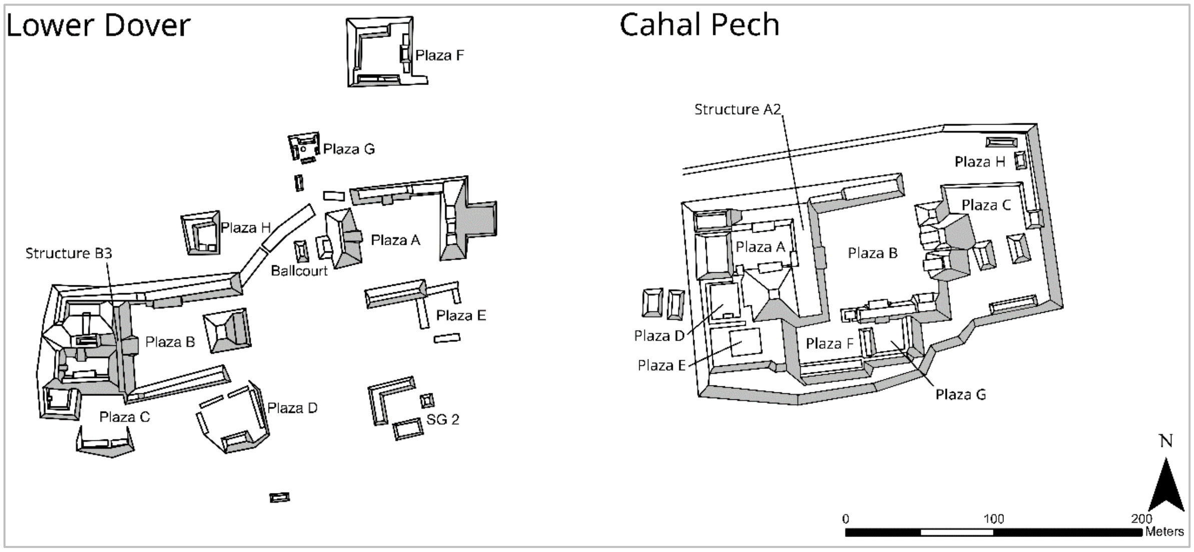

Figure 5: Maps of the Cahal Pech and Lower Dover civic-ceremonial cores.

Table 2. Polity and district populations compared with those modeled using a 0.1% per year birth rate increase.

Context	***Period***	***Population (based on survey and excavation)***	***Expected Population (0.1% per year)***	***Interpretation***
Lower Dover	Late/Terminal Classic	2400	2240	In-migration
Polity	Early Classic	1500	745	Heavy in-migration
	Late Preclassic	500	905	Out-migration
	Middle Preclassic	550	N/A	N/A
Tutu Uitz Na	Late/Terminal Classic	300	150	Heavy in-migration
District	Early Classic	100	60	Some in-migration
	Late Preclassic	40	65	Stasis
	Middle Preclassic	40	N/A	N/A
Floral Park	Late/Terminal Classic	200	185	Stasis
District	Early Classic	125	110	Stasis
	Late Preclassic	75	80	Stasis
	Middle Preclassic	50	N/A	N/A
Texas	Late/Terminal Classic	240	280	Some out-migration
District	Early Classic	185	80	Some in-migration
	Late Preclassic	55	90	Out-migration
	Middle Preclassic	55	N/A	N/A

civic-ceremonial core had just nine households, and a population of 180 people (Walden 2021:165, Table 6.2), all of which dated to the Late Classic (Guerra 2021:75; Walden, Guerra, and Qiu 2020). While a number of new households appeared on the landscape in the Late Classic, there is no reason to suspect large scale immigration into the polity. To gauge the extent to which population grew from migration, the expected maximum population estimate (with a growth rate of 0.1% per year based on Sanders 1974; see also Hassan 1978:68-69) was calculated for each period based on the previous period's population estimate (based on survey and household excavations). Table 2 shows diachronic population estimates at the polity and district scales and the modeled expected population estimate. Birth rate modeling shows that the majority of new Late Classic households could have emerged through internal growth without external migration, given internal population increases following the dramatic Terminal Preclassic population influx noted by Willey and colleagues (1965; see also Walden 2021:213, 309-310). The exception being new households in the Tutu Uitz Na District, although it is possible that some of these migrants moved from other districts like the Texas District (around the minor center of BR-180/168). The decision of incoming migrants to settle in an intermediate elite headed district, and subsequently contribute labor to its construction, and not situate themselves in the vicinity of the civic-ceremonial core is politically meaningful. Yaeger (2010) describes a similar pattern at Xunantunich, another late forming capital which imposed itself on an already settled landscape. The fact the apical elite did not bring a large entourage to Lower Dover suggests they were confident their power and authority would not be questioned.

Excavation data from commoner house mounds reveals that, with the exception of commoners situated in the Floral Park District, the rise of Lower Dover had a negligible impact on most households (Walden 2021:521-531). The Floral Park monumental center increased dramatically in architectural scale in the early Late Classic (Figure 4). Moreover, this shift occurred at exactly the same time that most surrounding commoners became increasingly impoverished in terms of portable wealth and ceased any substantial renovations on their own homes (Walden 2021:522-531, 539-541, Figs. 7.6, 7.7, 7.8). This decline in investment in household architecture at the commoner scale was likely tied to the more onerous Late Classic labor tax burdens imposed on them by the Floral Park elite (Figure 4). Commoners in the districts of Barton Ramie and Tutu Uitz Na generally show little change however, and it appears that aside from extracting commoner labor for the construction of the monumental capital, the rise of the Lower Dover center had little tangible impact on commoner lifeways.

More complex patterns appear at the intermediate elite level than the commoner level. All three intermediate elite regimes underwent a statistically significant decrease in portable wealth, this was most apparent at BR-180/168 and Tutu Uitz Na. Conversely, all three elites simultaneously saw their ability to extract commoner labor increase dramatically (Walden 2021:539-541, 621-636). The intermediate elites pursued different political strategies following the rise of Lower Dover. The BR-180/168 and Tutu Uitz Na elites modified their eastern shrines into large eastern triadic structures and began hosting increasingly theatrical mortuary interments and ancestor veneration ceremonies, which given the size of the plazas, likely included most commoners in their respective districts (Walden 2021:639-641; for eastern triadic structures see Awe et al. 2017). The Lower Dover apical elite were engaged in similar practices of ancestor veneration, this involved the construction of a large eastern triadic structure (Strs. A1-3) at the center. It seems plausible that the BR-180/168 and Tutu Uitz Na intermediate elites were countering top-down apical elite ancestral ideologies and legitimizing their own authority in the wake of their political eclipse by Lower Dover.

While the BR-180/168 and Tutu Uitz Na elites intensified their pre-existing ritual practices, their peers at Floral Park completely changed their ceremonial activities. The Floral Park elite constructed new forms of monumental ceremonial architecture including a *sacbe* (causeway) and terminus group. Plaza A shifted from a ritual and residential function to solely ceremonial space following the creation of Group 2, a new elite residence to the north (Walden 2021:413-434; see also Brown et al. 1996). The original eastern structure on Plaza A (Structure A1) was extensively modified and reoriented on its axis (Glassman, Conlon, and Garber 1995:61). These modifications probably saw the structure shift from having a mortuary function to a purely ceremonial one (Walden 2021:649-650). A newly constructed small mortuary shrine (Str. 2A) in Group 2 formed the nexus of Late Classic intermediate elite ancestor veneration at Floral Park. In direct contrast to the increasingly theatrical displays of ancestor veneration at BR-180/168 and Tutu Uitz Na, the Floral Park elite performed smaller, politically innocuous mortuary rituals at their private residential plaza (Figure 6). Many interments in Structure 2A were secondary burials that may represent

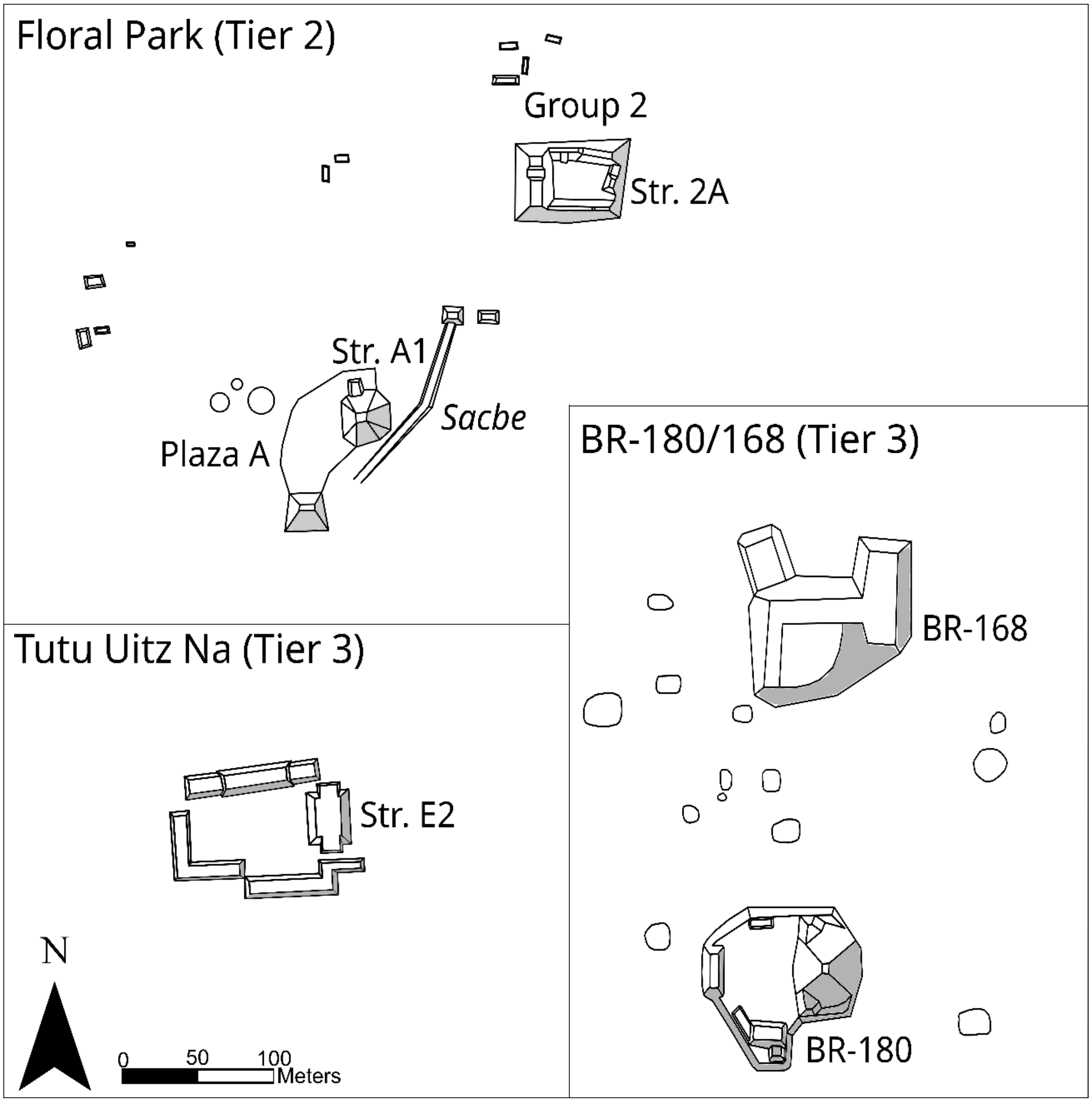

Figure 6: Maps of the minor centers of BR-180/186, Floral Park, and Tutu Uitz Na.

Table 3. Plaza capacities in the Lower Dover Polity.

Center	*District Population*	*Plaza Size (m²)*	*0.46m²/ person*	*1m²/ person*	*3.4m²/ person*	*3.6m²/ person*
Lower Dover	2400	8740	19000	8740	2571	2428
BR-180	240	1850	4022	1850	544	514
Floral Park Plaza A	200	1700	3696	1700	500	472
Floral Park Ceremonial	200	2700	5870	2700	794	750
Floral Park Group 2	200	400	870	400	118	111
Tutu Uitz Na Late Classic	300	1000	2174	1000	294	278
Tutu Uitz Na Early Classic	100	600	1522	700	206	194

individuals originally interred in Structure A1 who were relocated following the aforementioned early Late Classic structural modifications (Walden 2021:643-644).

Instead of ancestor veneration, the Floral Park elite hosted larger processional rituals associated with the *sacbe*. These ceremonies potentially attracted commoners from across the polity because, unlike the smaller district scale plazas at BR-180/168 and Tutu Uitz Na, the large plaza at Floral Park could accommodate the polity population (Table 3; Walden 2021:593-594). While intermediate elite district labor tax rates at BR-180/168 and Tutu Uitz Na increased during the Late Classic, this increase is less overt than at Floral Park, where the elite commanded unprecedented levels of commoner labor. These trends suggest the different elites adopted different political strategies following their eclipse by Lower Dover. While BR-180/168 and Tutu Uitz Na maintained older strategies and augmented the scale of ancestor veneration to legitimate their status and access to resources in the face of the emerging polity of Lower Dover, the Floral Park elites seem to have engaged in very different ceremonies and were able to extract increasingly higher amounts of labor from their subordinates (Walden et al. 2020). It seems probable that Floral Park was more closely affiliated with, or even annexed by Lower Dover. This relationship is suggested by the performance of larger polity-wide integrative ritual events at Floral Park, the less dramatic decrease in elite wealth, and their ability to seemingly coerce greater degrees of labor from their commoner subordinates.

The Political Dynamics Underpinning the Rise of Lower Dover

Of the five hypothetical scenarios through which Lower Dover could have formed, the idea of a top-down imposition best fits the current data for several reasons. The confederacy idea is problematized by the discovery of a single apical elite palace (Guerra and Awe 2017; Watkins et al. 2017). While the founding of a new dynasty through intermarriage or a union between intermediate elite households could result in a single apical elite palace, correlates of other council-based arrangements, like a *popol nah*, are absent. Moreover, the Late Classic decline in wealth at the intermediate elite centers renders a confederacy unlikely as none of the obvious partners in such an endeavor effectively gained in any tangible way. Likewise, if Lower Dover represented the paramountcy of a single elite household, then we may expect to see either the elevation of a single elite center, or possibly the abandonment of one elite center as the occupants moved to the core. Neither of these scenarios seems at all likely given continued occupations at all three elites centers, and the aforementioned decrease in intermediate elite wealth.

Apical elite power was sufficiently extensive to construct the core, incorporate Floral Park, but not dramatically alter commoner lifeways, or annex BR-180/168 or Tutu Uitz Na. The settlement data corroborates the idea that Lower Dover represents some type of external imposition because of the aforementioned lack of commoner clustering around the core and the absence of a Late Classic influx of commoners into the polity. All the commoners, including the small number of Late Classic arrivals, were situated in intermediate elite headed districts, not the core, meaning that the emergent apical elite founders did not possess a clear retinue (and associated labor pool, tax base, and military faction). This lack of a retinue implies that the apical elite had confidence that their power was not going to be questioned and implies this power was mandated through external connections, in turn hinting towards the polity representing a top-down imposition by an external power more so than the arrival of a roving court of elites. This being because a roving court (lacking external ties) would require their own retinue to ensure the compliancy of the hinterland populace. Possible local candidates who played a role in the formation of Lower Dover include the courts based at Blackman Eddy (based on geographic proximity) or Cahal Pech (based on architectural similarities). In terms of external hegemons, Caracol, or possibly Naranjo may have played some role in the formation of Lower Dover (Guerra 2021:65).

Conclusions and Future Directions

We have compared existing data on the Late Classic rise of Lower Dover to the expectations associated with several developmental models. Currently, these data suggest that fairly powerful external actors were likely involved in the formation of Lower Dover. This finding remains somewhat speculative however, and research is currently underway to better understand the developmental processes. Future directions involve more excavation of the Lower Dover civic-ceremonial center alongside a mobility isotope ($^{87}Sr/^{86}Sr$ and $\delta^{18}O$) and ancient DNA program to establish the geographic origin of individuals interred at the core and how they were biologically related to surrounding apical and intermediate elites. These novel genomic and isotopic approaches combined with traditional methods will open new doors to understand how Lower Dover formed and move us closer to reconstructing political history through archaeology.

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5 *NEW EVIDENCE OF ANCESTOR VENERATION AT THE SITE OF LAS RUINAS DE ARENAL*

M. Kathryn Brown and Dr. Rachel A. Horowitz

Recent investigations of a Preclassic E Group at Las Ruinas de Arenal have shed light on transformations in ritual practices from the Middle Preclassic to the Late Preclassic period. Our excavations at the site to date have uncovered a series of offerings and three burials on centerline of the E Group architectural assemblage suggesting a complex history of ritual practice at the heart of the Arenal community. The Preclassic burials are of particular importance as they illustrate a pattern of reentry and bone retrieval, thus, indicating early ancestor veneration practices by at least the Middle Preclassic. In this paper, we discuss the burial data and highlight patterns that are suggestive of venerative practices. By tracing the ritual history at this sacred location, we gain a better understanding of major transformations that occurred in Maya society.

Introduction

Ritual practices centering on ancestor veneration have a long history in the Maya lowlands and were an important component in the development and continued maintenance of a hierarchical social organization. The veneration of important individuals also played a fundamental role in the development of Maya divine kingship (Brown 2017; Schele and Miller 1986). Evidence for ancestor veneration takes several forms and includes the placement of important individuals within public/ceremonial spaces as well as the dedication of buildings and other features such as altars and stelae. Additionally, venerative practices can also include the manipulation, removal and re-deposition of the bones of important ancestors (Fitzsimmons 2009; Houston et al. 2006; McAnany 1995, 2001). McAnany (2001:133) argues that by the Late Preclassic, "emphasis on ancestors culminated in the collection and reinterment of select ancestral bones at focal locales prior to building a nonresidential, monumental structure." Later, in the Classic period, rulership and political authority were legitimized through strategic ties to deities and important ancestors. Because these ties were reinforced through rituals that commemorated key ancestors, ceremonial buildings were built to honor important ancestors, house their bones, and serve as venues for venerative rituals (Brown 2017). This is particularly evident in the built environment of Classic period cities, where these practices enhanced the power and political authority of rulers over centuries.

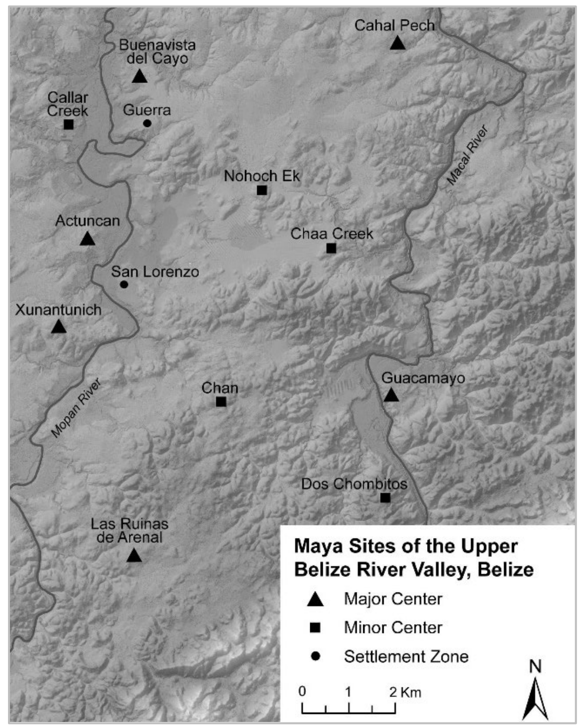

Figure 1. Map of Belize River Valley

Evidence suggests that the origin of these traditions, however, lies in the Middle Preclassic with ritual practices that centered on early public/ceremonial buildings (Brown 2017; Brown et al. 2018; Brown and Yaeger 2020; Estrada-Belli 2011). In particular, the interment of important individuals and the reentry, manipulation, and bone retrieval practice was common in E Group complexes in the Belize River valley beginning in the Middle Preclassic (Brown 2013; Brown et al. 2018). In this article, we highlight new evidence of ancestor veneration, at the site of Las Ruinas de Arenal (Arenal) within the E Group Plaza.

Recent Investigations at Las Ruinas de Arenal

The medium-sized polity of Las Ruinas de Arenal (Arenal) is situated on the edge of the Mopan River valley near the base of the Vaca Plateau. The site is located approximately 5.5 km south of the larger polity of Xunantunich (Figure 1). The east/west site layout and presence of an E Group with an attached ballcourt suggest that the site of Arenal may have played an important role in the Preclassic landscape of the Mopan River valley (Figure 2). Arenal was first investigated by Joseph Ball and Jennifer Taschek (1999), and it consists of three main architectural groups connected by elevated sacbeob. Group A, the ceremonial core of the site, was built on top of an enormous flat-topped platform that boasts an E Group complex on the eastern side. Group B appears to be an elite residential complex, presumably the palace zone, that housed the royal family during the Late Classic (Taschek and Ball1999). Group C may have also served as an elite residential unit with an eastern ancestor shrine, although this location needs investigation in order to determine its function.

The Mopan Valley Preclassic Project (MVPP) began pilot investigations at the site in 2015 and undertook more intensive excavation programs during the summer field seasons of 2018, 2019, and 2022. Our research goals include documenting the E Group complex and ballcourt in Group A, as well as investigating the Classic elite residence in Group B and settlement elsewhere at the site. In Group A, we have focused our investigations on uncovering the construction sequence of the E Group Plaza area and its use as a ritual space to shed light on transformations in ritual practices from the Middle Preclassic to the Late Preclassic period. Our excavations to date have uncovered a series of offerings and burials on centerline of the E Group Plaza suggesting a complex history of ritual practice at the heart of the Arenal community. The Preclassic burials are of particular importance as they illustrate a pattern of reentry, bone manipulation, and retrieval beginning by at least the Middle Preclassic, thus, indicating early ancestor veneration practices.

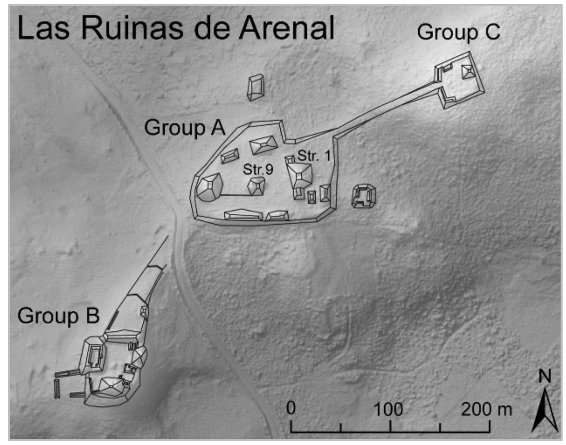

Figure 2. Site Map of Las Ruinas de Arenal

Below we discuss three Preclassic burials from Arenal to illustrate a pattern of venerative practices and provide comparative examples from other sites in the Belize River valley.

E Group Plaza Burial Sequence at Arenal

The MVPP excavations focused on the central axis of the E Group Plaza have uncovered a series of floors and fill layers that indicate multiple rebuilding cycles of the E Group complex, beginning in the early Middle Preclassic. Our excavations have documented approximately 50 postholes cut into bedrock, some of which included jade offerings. These Middle Preclassic offerings are some of the first ritual activity documented at the site, and although modest in comparison to more elaborate jade caches in the early E Group plazas of Cival (Estrada-Belli 2011) and Ceibal (Inomata et al. 2013), the presence of these greenstone offerings suggests that the early occupants at Arenal were practicing similar foundational rituals to sanctify their communal ceremonial space. We have suggested elsewhere (see Horowitz et al. this volume) that these jade caches symbolize the planting of maize. Excavations also uncovered a cache located at the approximate center of the E Group Plaza between the eastern and western architectural buildings. This cache, placed within a larger posthole feature, contained a partial ceramic jar and two greenstone fragments. Above the partial vessel was a concentration of 21 fragments of unpolished greenstone pieces.

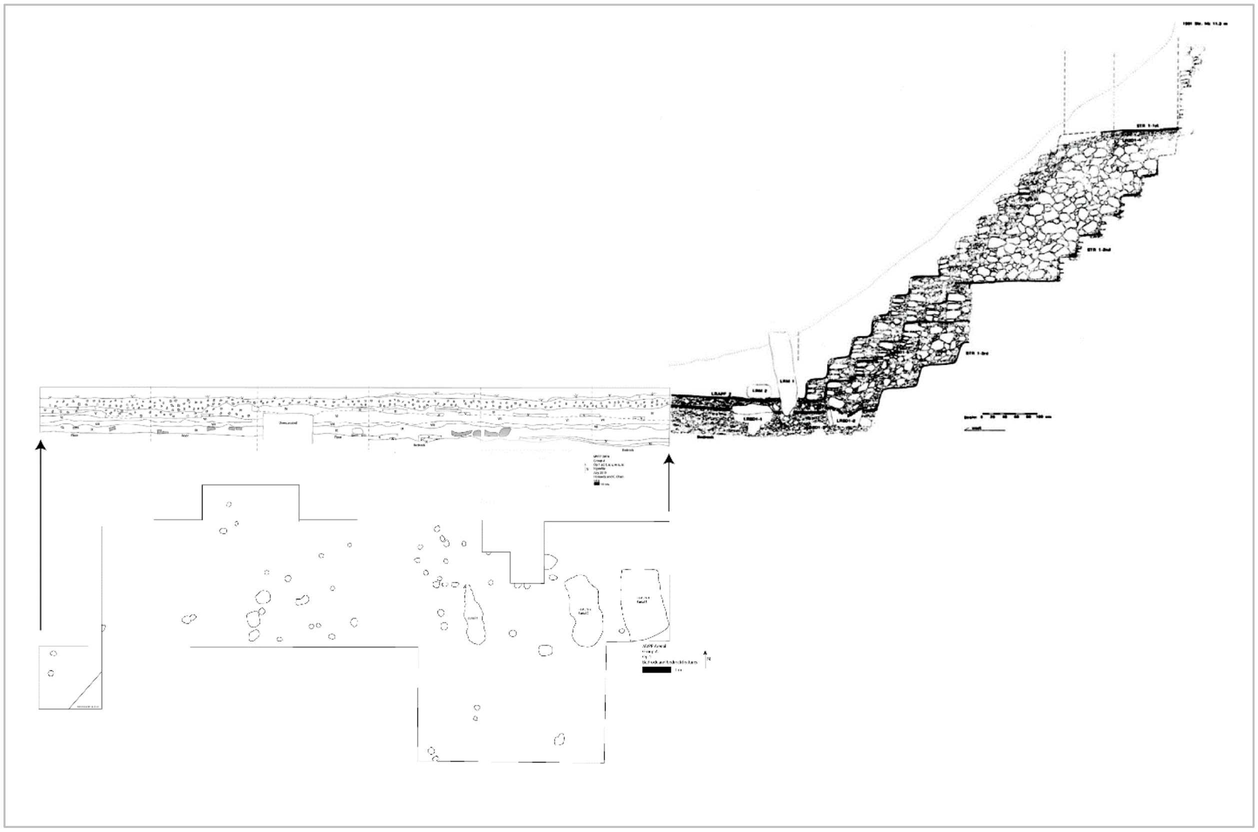

Figure 3. Plan and Section Maps of Burials in E Group Plaza (Section of Structure 1 adapted from Taschek and Ball 1999)

Although this Middle Preclassic cache is modest in scope, its placement within a larger posthole at the center of the E Group Plaza, coupled with its layered contents, suggests a purposeful reference to the vertical layers of the cosmos and the world tree as axis mundi at the center of the universe.

These early jade dedicatory offerings sanctified this public/ceremonial location within the community. Consequently, burials within this space were likely limited to key community members. Here, we focus on three Preclassic burials that were interred within the E Group Plaza near the eastern architectural complex on the centerline axis of the E Group (Figure 3). Although, the pandemic has delayed osteological analysis of the skeletal materials by project bioarchaeologist, Dr. Carolyn Friewald, we describe the stratigraphic context and preliminary observations of the burials to highlight evidence of reentry, bone manipulation, and retrieval practices that relate to veneration practices. Full reporting on the skeletal analysis will be forthcoming.

Burial 1

The earliest of the three plaza burials discovered to date (referred to as Burial 1) was placed in a cut in bedrock, below the earliest plaza floor surface. Although the floor was poorly preserved in places, eroded patches of floor and subfloor fill in the area above the burial suggest that the burial was placed prior to the floor surface. Dating of a wood charcoal fragment from the ballast below this floor returned a Middle Preclassic date (PSUAMS-5578, 748-685BC [24.6%], 666-643BC [7.4%], 586-581BC [.5%], 556-409BC [62.9%]). This floor covered the postholes and jade and ceramic offerings discussed above, thus, we were able to place these offerings and Burial 1 firmly within the Middle Preclassic, likely early Middle Preclassic. We plan to confirm this through AMS dating of the bones in 2023.

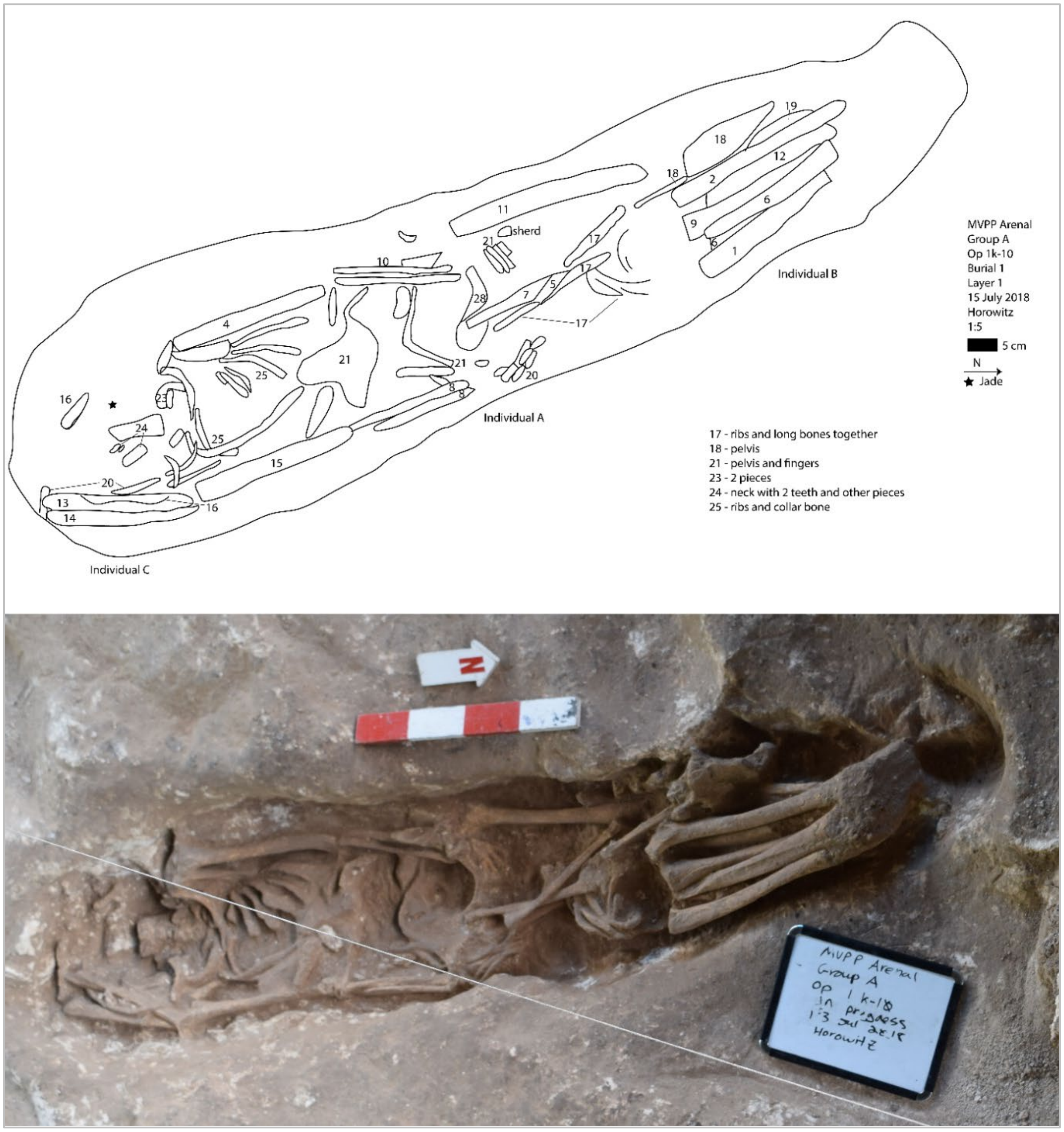

Figure 4. Plan Map and Photograph of Burial 1

Bedrock was carved to create a crypt-like feature for the interment. The cut into bedrock measured 100 cm by 175 cm and was 25 cm in depth (Horowitz and Brown 2019). The cut was oriented in a north-south direction, with the orientation slightly to the west of the true north-south line. This same orientation is maintained in the two Late Preclassic burials discussed below (see Figure 3). Excavations revealed that at least three individuals had been placed in this bedrock crypt (Figure 4). The main individual was a primary, extended, burial with the head placement to the south (designated Individual A). However, the skull of this individual was not present. Since there were no obvious cut marks on the vertebrae, we believe that the head was removed after the individual had been placed in the ground for some time. Moreover, we encountered two teeth within the vicinity of the head region, further supporting the notion that the head was removed later in time, likely for ancestor venerative purposes (Horowitz and Brown 2019).

In association with this primary individual and placed near the location of the missing head and along the east side of the upper torso, there were fragments of a secondary interment (Individual C), which included long bones. To the north of the internment we encountered what appeared to be a bundle burial of a third individual (Individual B). Although it is unclear if this individual was a primary or secondary interment, the lower limbs, including a pelvis, as well as some ribs were present (Horowitz and Brown 2019). There were no cranial fragments present, suggesting that the head of this individual was also missing. Full osteological analysis of the bones is necessary prior to further interpretation of Individual B.

The interments present in this burial were all placed directly on bedrock, and the crypt was filled with white marl, which had solidified, making excavation very difficult. While contemporaneity of these individuals and their deposition sequence is still unclear, we make some initial interpretations based on observations of the superimposition of skeletal elements. Based on the superimposition of the bones, Individuals A and B were likely placed into the crypt at or near the same time, although Individual B could have been deposited first, as some of the ribs from this individual were under the long bones from Individual A. The association between Individual C and A is less clear, as the bones were not superimposed in any way. However, since the head of Individual A appears to have been removed during a reentry event in antiquity, it is possible that Individual C was placed into the crypt at this time (Horowitz and Brown 2019). Since there was no clear cut and/or disturbance of the subfloor fill above Burial 1, we believe that the reentry happened prior to the construction of this Middle Preclassic floor. AMS dating of bones from these three individuals and from architectural contexts in the associated stratigraphy will, no doubt, further refine the chronology, adding to our understanding of the sequence of events.

In association with the burial, we found two pieces of greenstone. A single piece of greenstone was recovered from the location of the missing head of Individual A. Jade objects are often placed in the mouths of deceased individuals of high status, and this lone piece of jade may represent an early example of this practice. The second piece of greenstone was found on the surface of bedrock outside the bedrock crypt, but near the northwest edge, thus we believe it was associated.

As mentioned above, the earliest floor in the plaza sequence overlies Burial 1. Above this floor, we encountered a thick deposit of chert flakes, *jute* snail shells, and hundreds marine shell beads that we believe date to the Middle Preclassic as well (Horowitz et al. 2022). This lens appears to extend over the entire eastern half of the plaza. We have interpreted this unusual deposit as symbolically marking the eastern side of the E-Group as a watery place, with underworld references (see Horowitz et al. this volume). This is consistent with offerings and the sunken nature of the eastern side of an E Group at Early Xunantunich (Brown 2017) suggesting an association of east and water symbolism during the Middle Preclassic period.

Burial 2

The next burial, designated Burial 2, was encountered approximately 3 m to the east of Burial 1 (see Figure 3). This interment was also placed in a cut into bedrock, but an intrusion through the lithic and shell layer and a cut in the Middle Preclassic floor indicate that this burial postdates these features and is later than Burial 1. As in Burial 1, bedrock was cut to create a crypt-like feature, in this case measuring 215 cm north/south by 90 cm east/west, and was approximately 74 cm deep (Horowitz and Brown 2019). Also like Burial 1, Burial 2 is oriented roughly north/south. After the interment, the crypt was infilled and covered with capstones. White limestone slabs were found *in situ* covering the northern half of the crypt, albeit slumped in some places. The southern half of the burial, however, exhibited evidence of disturbance and reentry in antiquity (Figure 5). Slate fragments, lithics, ceramics, and *jute* shells were found within the disturbed matrix in the southern half of the burial, likely an admixture of materials displaced during reentry, including some of the dense lithic and shell deposit discussed above.

Figure 5. Photograph of Top of Burial 2 Showing Disturbed Area on South Side

One small slate capstone standing on its edge was encountered at the southern end of the burial crypt, providing further evidence of reentry in this location. This, combined with the slate fragments found within the disturbed zone suggests to us that one or more slate capstones may have covered the southernmost portion of the burial (see Figure 5), as this pattern was observed in the capstones of Burial 3.

The pairing of white limestone capstones on the northern half of the burial with black slate capstones on the southern half is intriguing and may represent cosmological color references to light and darkness. The symbolism of black slate may relate to the underworld, and its use in burial rites may represent the symbolic act of placing the deceased individual into the watery underworld realm. Slate capstones have been found at other sites in the Belize River valley including an incised slate slab that was placed on a reentered Late Preclassic chamber burial in the eastern structure of the E Group at Early Xunantunich (Brown 2013). The white limestone may relate to north, the heavens, and sacred ancestors (Ashmore 1991).

A single adult individual was placed on bedrock in the crypt of Burial 2. The individual was in an extended supine position, head to the south (Figure 6). A large Late Preclassic red-slipped bowl was placed in the location of the head, and cranial bones were located within the bowl. The bowl was slightly higher in elevation than the clavicle and spine. The fact that the capstones and matrix above the location of the bowl was heavily disturbed, indicates that the burial was reentered, presumably to retrieve the skull for veneration. Other than the bowl, the only artifact in association with the skeletal material was a single burnt sherd near the feet of the individual (Horowitz and Brown 2019). The AMS analysis of a fragment of bone from Burial 2 returned a Late Preclassic date (PSUAMS-6239, 106 BC - 24 AD [95.4%]). This date is consistent with the stratigraphy and chronological assessment of the red-slipped bowl.

Burial 3

The third burial that we highlight in this article, Burial 3, was located 1 m east of Burial 2 (see Figure 3) and at the base of Structure 1, the central, eastern structure of the E Group. Like Burials 1 and 2, this burial was placed within a crypt carved out of bedrock. In this case, however, the edges were lined with stones, forming a chamber-like feature and indicating a greater labor investment.

Figure 6. Plan Map and Photograph of Burial 2

Figure 7. Photograph of Burial 3 Showing Intact Lower Limbs of Individual

Figure 8. Photograph of Two Possible Slate Stelae and White Limestone Altars above Burial 3

The burial chamber was approximately 212 cm north/south by 110 cm east/west and 42 cm in deep. Burial 3 has been tentatively dated to the Late Preclassic, based on three AMS assays from a lip-to-lip cache that is stratigraphically later than the burial, which returned dates in the Late Preclassic to Terminal Preclassic range.

Our excavations revealed that Burial 3 was reentered in antiquity, with that reentry restricted to the southern half of the chamber, just like Burial 2 (Horowitz and Brown 2019). Capstones were not present above the southern half of the burial, and the matrix in that area included jumbled stones, some turned on their edges; slate fragments; white marl matrix; and bone fragments. The white marl matrix was extremely compacted, likely from water seeping into the fill where the original capstones had been removed. This compacted marl proved quite difficult to excavate. One of the more interesting findings was a speleothem fragment within the disturbed zone of the chamber. Identified bone fragments included a few fragmentary long bones, ribs, cranial bones, teeth, and a fragment of a human jaw bone.

In sharp contrast, the northern half of the burial did exhibit evidence of disturbance, and at the base of the chamber, we uncovered the intact lower limbs of a primary interment resting in an extended position (Figure 7). Between the lower limb bones of the individual we uncovered a circular, worked, slate object (Horowitz and Brown 2020). Osteological analysis of the bones by Carolyn Friewald is planned for 2023. Although our field observations suggest that at least one primary individual was present, it is possible that a secondary interment may have been present as well. The reentry to the burial above the location of the upper body and head, fits the pattern from venerative practices that were documented with Burial 1 and 2.

Above the disturbed southern half of Burial 3, we encountered two large slate slabs oriented east/west (Horowitz and Brown 2020). The slate slabs were tapered at one end, suggesting to us that they originally functioned as small stelae prior to being placed above the crypt. The northernmost slate slab measured 120 cm long, 41 cm wide, and 19 cm thick, while the slate placed on the southern edge of the crypt was 115 cm long, 45 cm wide, and 9 cm thick. Two large, roughly shaped, circular stones made of white limestone were placed directly on top of the slate slabs (Figure 8). These stones likely represent small altars that were intentionally paired with the slate stelae. The color contrast of white and black is reminiscent of the capstones seen above Burial 2 discussed above, thus representing a continuation of the symbolic dualism of light and dark.

Conclusion

Investigations of the Arenal E Group Plaza have uncovered a sequence of offerings and burials on centerline that document a complex ritual history at the focal point of the Arenal community. By the Middle Preclassic, important individuals were buried in this sacred communal space, likely as a way of commemorating them, celebrating their accomplishments, and creating generational links between them and their descendants through ancestor veneration practices. Perhaps the most important element of the process of creating hereditary social differences is to find effective ways to assert inherent status differences that endure across generations, and this is often accomplished by creating links between living people and important ancestors.

At Arenal, links between the living and the dead were established and reproduced over generations by the ritual reentry of burials, the removal of some skeletal remains, and curation and manipulation of key skeletal elements, particularly skulls. All three burials discussed above exhibit clear evidence of reentry in the vicinity of the head. The earliest, Burial 1, was missing the cranium. In Burial 2, the head of the individual was placed in a bowl. Brown et al. (2018) suggest that the pattern of placing heads within bowls in burials may have emerged in the Late Preclassic as a way to facilitate manipulation of the skull more easily for removal for ritual purposes, and in some cases, replacement in the burial as we see in the case of Burial 2. Moreover, the focus on skulls may symbolically reference the decapitation and resurrection of the Maize God (Brown et al. 2018).

Another important observation within the burial sequence at Arenal is the increasing elaboration of the burials as they are placed closer to the formal architectural features on the eastern side of the E Group complex. This elaboration culminates with the placement of burials within the pyramid shrines themselves beginning in the Late to Terminal Preclassic period as documented by Taschek and Ball (1999). This pattern is noted at many other sites including at Early Xunantunich (Brown 2017) and suggests that by the Late to Terminal Preclassic period, certain individuals were afforded the honor of being placed within temple shrines that were likely dedicated to deities. Burials within pyramidal shrines more broadly coincides with established social hierarchies and the institution of kingship.

Similar practices of ancestor veneration have been documented at other early E Groups within the Upper Belize River valley. At the center of the Early Xunantunich E Group Plaza, MVPP uncovered the remains of an adult male interred in an extended position. Evidence of reentry was present and the skull of the individual had been removed in antiquity. As in the case of Burial 1, discussed above, two teeth were present within head location suggesting that the head was present then removed. Brown (2017; see also Brown et al. 2018) suggests that the placement of this Preclassic individual at the heart of the early communities' ceremonial space, coupled with the removal of the skull, is indicative of ancestor veneration practices. Another example of this type of practice can be seen at the nearby site of Chan. Cynthia Robin and her colleagues (2012) uncovered a Middle Preclassic burial crypt cut into bedrock within the center of the E Group Plaza that they believe exhibits evidence for ancestor veneration. Careful documentation of this burial indicated that the crypt had been reentered at least twice and some bones had been retrieved and repositioned and the skull had been removed (Robin et al. 2012:128). Another example comes from the site of Cahal Pech. At the approximate center of Plaza B, a Late Preclassic crypt burial was uncovered that had a separate crypt for the skull that was placed within a bowl (Garber and Awe 2008). This Late Preclassic Classic burial is similar to Burial 2 at Arenal. The head in bowl practice may have originated to facilitate easier retrieval of an ancestor skulls for ritual purposes, and through this tradition, the head and bowl symbolism was linked to the severed head of the maize god, First Father (Brown et al. 2018).

It is clear that ancestor venerative practices were important to the process of establishing a hierarchical social order and maintaining these social distinctions. In order to understand the origin of these traditions and how they transformed through time, it is essential to trace the ritual history within ceremonial spaces, such as E Groups, at sites. We believe the new burial data from Arenal expands our understanding of important burial rituals centering on ancestor veneration and fits a broader pattern of venerative practices seen elsewhere in the region.

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6 NOBODY PUTS GRANDMA IN THE CORNER: PLACEMAKING AT EARLY CLASSIC CHAN CHICH, BELIZE

Anna C. Novotny, Tomás Gallareta Cervera, and Brett A. Houk

Mortuary evidence of the Early Classic period (AD 250–600) at the Chan Chich acropolis suggests the consolidation of power by the local ruling elite. Located in the northeastern corner of the Upper Plaza, Burial CC-B20 contained the exceptionally well-preserved remains of an elderly adult female within a stone-lined crypt (Crypt 2; cal AD 257–387). The excellent skeletal preservation allowed a comprehensive osteobiography; cranial modification, stable isotopes, and pathological changes to the vertebrae and long bones tell a story of a long and active life. The Early Classic was a transformational era at the city. During the Preclassic period, the Chan Chich rulers consolidated power by manipulating the built environment to create a political place in the Upper Plaza. In the Early Classic, they constructed a vaulted crypt in the Upper Plaza, partially dismantling a Late Preclassic platform in the process. Crypt 1 contained multiple male individuals and markers of rulership, including spondylus shell earflares and a jade bib-helmet pendant. In contrast, the coeval Burial CCB-20 lacked artifacts, but the construction of the crypt was labor intensive. The interment of the woman in Burial CCB-20 marks a change in the location and body treatment of the ruling lineage interred in this exclusive location. Osteological data are interpreted in concert with contextual information to gain insight into local ideas concerning power and gender, as well as into elite life at Early Classic Chan Chich.

Introduction

Throughout the ancient Maya realm, the Early Classic saw the transition of political power from lords of the Late Preclassic to the divine kingships of the Classic period. During the Early Classic at Chan Chich, the southernmost city of the Belizean portion of the Three Rivers adaptive region (Figure 1), two elite graves at the site's central precinct, the Upper Plaza, contained the material insignia of divine kingship. These insignia indicate their attempts to tap into this newly consolidated political model of ideological power (Friedel and Schele 1988; Gallareta Cervera et al. 2017; Houk et al. 2010). A number of individuals were interred in the Upper Plaza over the course of the Early Classic period, including an elderly female, Burial CC-B20. Our main question here is, *how did this transitional era, the social context of the early part of the Early Classic, mold the body of the individual interred in Burial CC-B20?* To address this question, we present a detailed osteobiography of this elite female. We conclude by contextualizing the osteobiography of Burial CC-B20 within the broader scope of placemaking through mortuary activity in the Upper Plaza during the Early Classic.

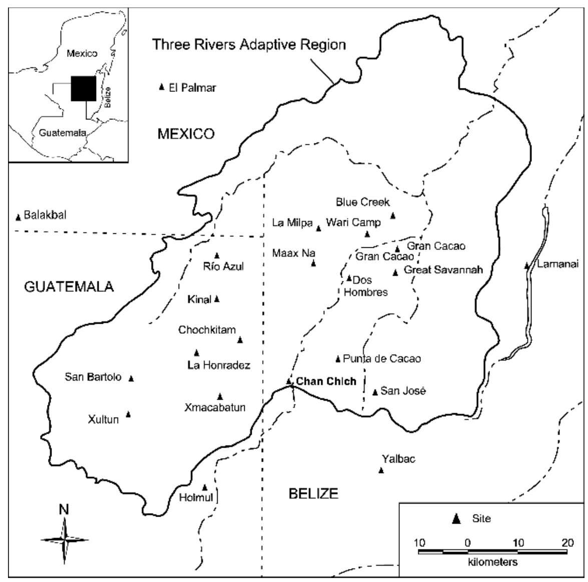

Figure 1. Map of the Three Rivers adaptive region.

An osteobiography takes a close look at the skeletal remains of one individual, tracking moments of life history from birth to death, and contextualizes the results within broader culture and historical context. The present study is positioned within embodiment theory, described by Schrader and Torres-Rouff (2020) as a conduit linking the human body with the social world. Historical approaches see a duality of body/culture in which the two are fundamentally opposed. Embodiment theory proposes that the body is not only an object to study but the subject of culture. There is plasticity and mutability inherent in the human body that culture molds and shapes. Bioarchaeological research is perfectly positioned to implement this theoretical perspective, as the discipline's prime goal is to answer questions about the past and past lives through the skeletonized body (Schrader and Torres-Rouff 2020).

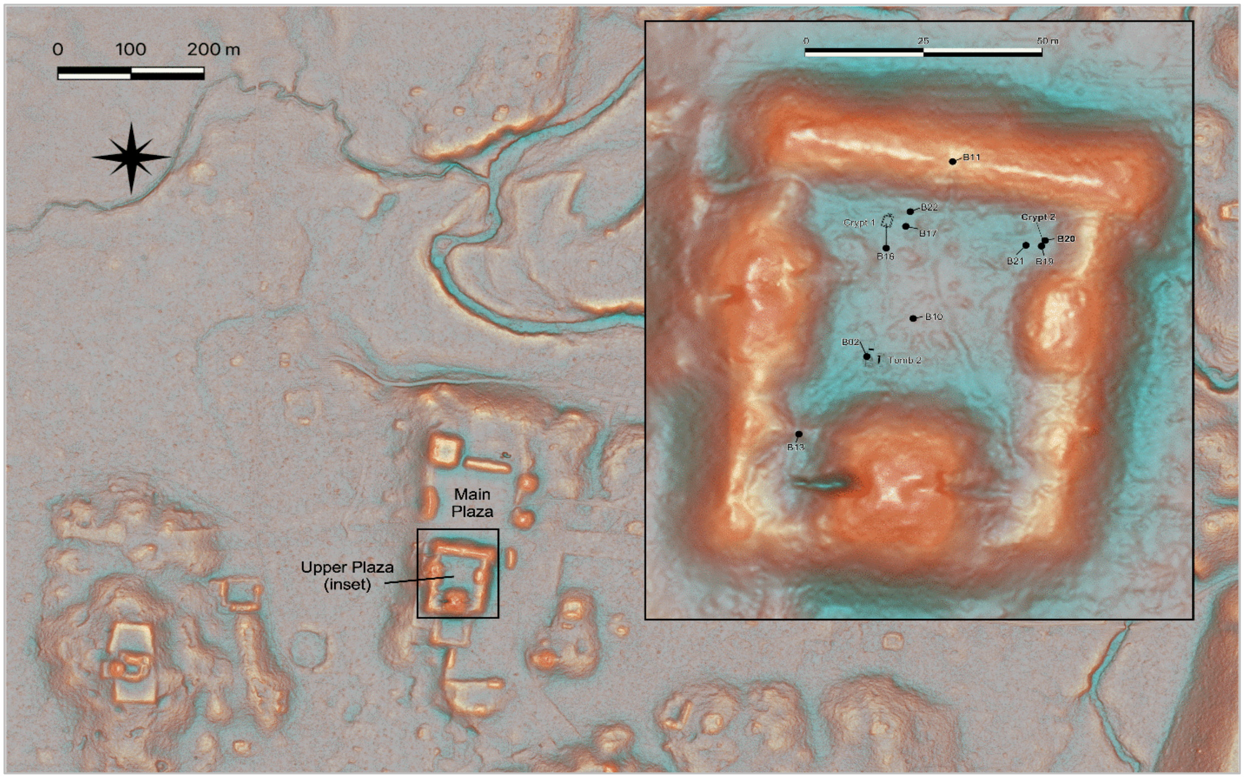

Figure 2. Red Relief Image Map of Chan Chich's site core, with an inset of the Upper Plaza showing the locations of excavated burials.

Our theoretical approach aligns with current interpretations of ancient Maya worldview concerning the body and sociality. We draw on several key tenets from ethnographic, ethnohistoric, and linguistic sources from a range of Maya groups throughout Mexico, Guatemala, and Belize (see Scherer 2015 for summary). Movement/action/behavior of the body affects the stability of the animating life essences, our Western understanding of the "soul." Infants, in particular, must be cared for in a manner that secures the newly attached animating essences, as they can lose vitality, "heat," or detach. Among adults, proper behavior, such as participating in rituals, maintaining your household, and not giving in to drunkenness, all build the heat of the *ch'ulel* and anchor it firmly to the body. This is the link between anthropological theory and the body—the belief that shaping bodies also is proper treatment of the *ch'ulel*. We can see the process of social identity formation in the body.

The architectural context of this osteobiography is the monumental core of Chan Chich, which is centered on a 350-m long, north-south line of contiguous plazas, multiple vaulted residences, two internal *sacbeob*, a ball court, and an acropolis group (Figure 2). Excavations from 2016–2018 focused on the Upper Plaza, an acropolis group elevated 7 m above the main plaza with two large temple-pyramids, attached lateral courtyards, and a formal entry through the central landing on Structure A-1 (Houk 2021). During the Middle Preclassic period, the first settlers of the site occupied the hilltop where the Upper Plaza would later be built.

Recent excavations into the Upper Plaza revealed several large buildings originally constructed around 400 BC that were dismantled and their foundations buried beneath the Upper Plaza in the later Late Preclassic (~400 BC–150 AD). Several Late Preclassic burials have been found in the Upper Plaza indicating its importance as a ritual locale. From then on, the Upper Plaza remained the heart of the community for several centuries. The architectural modifications and the mortuary activity, including Burial CC-B20, were part of the

Figure 3. Orthophoto of Burial CC-B20 created using Photoscan.

placemaking of the Upper Plaza—the creation of a socially meaningful locale, "… produced by ongoing human social practices and experiences with the material world" (Halperin 2014:111; see also Nieves Zedeño and Bowser 2009). There is ample archaeological evidence in the Maya lowlands that ancestor veneration and placemaking went hand in hand (McAnany 1998). We will return to the significance of Burial CC-B20's interment for placemaking in the Upper Plaza. In the following section we describe the osteological data from Burial CC-B20.

Burial CC-B20

Burial CC-B20 was excavated in 2018 at the northeastern corner of the Upper Plaza (Gallareta Cervera et al. 2019). Burial CC-B20 consisted of a single individual, encapsulated by a capped cist placed directly on the Upper Plaza's Middle Preclassic floor surface. Creating the grave required its builders to cut through approximately 2 m of Late Preclassic floors and fill to reach the Middle Preclassic floor. An AMS radiocarbon date from a bone fragment dates the body to cal A.D. 257–387 (Gallareta Cervera et al. 2019: Table 2.2).

The bones of the individual interred in Burial CC-B20 were extremely well preserved (Figure 3). Overall, about 75% of the bones in the body and four teeth were available for study. The individual's pelvis and cranium suggest a biological sex of female and indicate that she probably died in her early 70s (Novotny et al. 2019).

Skeletal indicators of immune response suggesting illness or poor nutrition include growth arrest lines called linear enamel hypoplasias on the teeth and inflammation on skeletal elements indicative of infection (Buikstra 2019). Burial CC-B20 was recovered with only four teeth, three of which were in occlusion. Recovered teeth include mandibular premolar, incisor, and canine, and one maxillary second molar. All were unmarked by hypoplasia and nearly free of dental calculus, or calcified plaque, which can lead to dental caries. She did suffer from extreme antemortem tooth loss, which is not unexpected for an ancient Maya individual, as their corn-based diet is highly cariogenic. The mandibular bone was particularly well healed, which suggests that she lived without her dentition for years before her death. Several long bones showed minor periostitis, an inflammatory bone reaction possibly indicative of infection. Periostitis suggests a low-grade, possibly systemic, infection.

As a child, her caregivers had modified her cranial vault in the tabular erect form, resulting in a sloping forehead and flattening to the posterior aspect of the cranium (Tiesler 2014). This shape is created by applying a compression device on the frontal bone, creating a sloping forehead, and a device higher up on the occipital, at lambda. Although difficult to discern in photos, the impression of these two circular pads is visible on the frontal bone. A furrow is also discernible posterior to the coronal suture and the occipital bone bulges slightly inferior to lambda.

Two ways we can see the life experience of Burial CC-B20 is through the markings of muscle attachments on the bones and osteoarthritic changes to joints. In short, tendons and ligaments attach muscle to bone and repetitive, habitual use of a muscle will promote bone proliferation at the attachment site (Benjamin et al. 2006). Well-developed musculoskeletal stress markers, or MSMs, are not necessarily pathological, and their frequency increases with age (Godde et al. 2018).

The deltoid tuberosity, a bone feature on the right humerus, was noticeably large, while the left side did not have the same robust shape. The deltoid muscle engages in raising the arm away from the body and rotating it anteriorly and posteriorly. The stronger expression of the MSM suggests a specific task that required just the right arm. The attachment for the teres major was also robust. The teres major is a muscle that adducts the arm, bringing it towards the body from a raised position. The conoid ligament, which attaches to the clavicle, was robust as well. This ligament functions to maintain shoulder stability when the arm is raised. The proximal ulna was not very well preserved, but the attachments for the muscles that rotate the forearm medially were pronounced, and there was evidence of osteoarthritis in the proximal epiphysis (elbow joint). Osteoarthritis was present on other elements, as well.

Osteoarthritis is a joint disease affecting the synovial, freely moving, joints of the body. The pathology begins in soft tissue, the joint's articular cartilage, which progressively degenerates. Skeletal involvement includes reactive bone formation on and within the joint surface, osteophyte formation at margins of the joint, and eventually eburnation, or polishing, of the joint surface due to bone-on-bone contact. Osteoarthritis is one of the most common diseases among living and past populations and is identified in two types—primary and secondary. Primary osteoarthritis is of unknown cause and is the result of biomechanical stress or trauma and tends to occur as age progresses. Secondary osteoarthritis occurs as the result of another condition and can happen at any point in life (Buikstra 2019). The osteoarthritis at the elbow joint, mentioned above, included porosity on the joint surface. In addition, lumbar vertebrae 4 and 5 showed signs of osteoarthritis in the form of porosity on the superior and inferior aspects of the bodies. There are osteophytes, curved spicules, on the anterior aspect of both bodies. Spicule formation suggests habitual anterior flexion of the spine.

Bone chemistry reflects the isotopic components of food and water consumed over the course of an individual's life (Price and Burton 2012). In particular, the isotopes of carbon and nitrogen reflect the nature of the plants and animals, respectively. In brief, more negative values suggest a diet of plants using the C_3 photosynthetic pathway, while less negative values indicated more reliance on C_4 plants, such as corn, and/or marine resources. Bone collagen values of $\delta^{15}N$ speak to the trophic level of the consumer; that is, they show the amount of terrestrial meat consumed. The carbon and nitrogen values speak to her diet for approximately 5–7 years prior to death.

Bone collagen was extracted from a fragment of humerus. The ratio of carbon to nitrogen isotope values is shown in Figure 4 for all Chan Chich Upper Plaza burials. The carbon value from bone collagen is -11.8 which suggests she consumed a fair amount of C_4 foods supplemented by foods with a C_3 photosynthetic pathway. Her nitrogen value was 8.6 indicating terrestrial meat was part of her diet. Her values are consistent with other ancient Maya

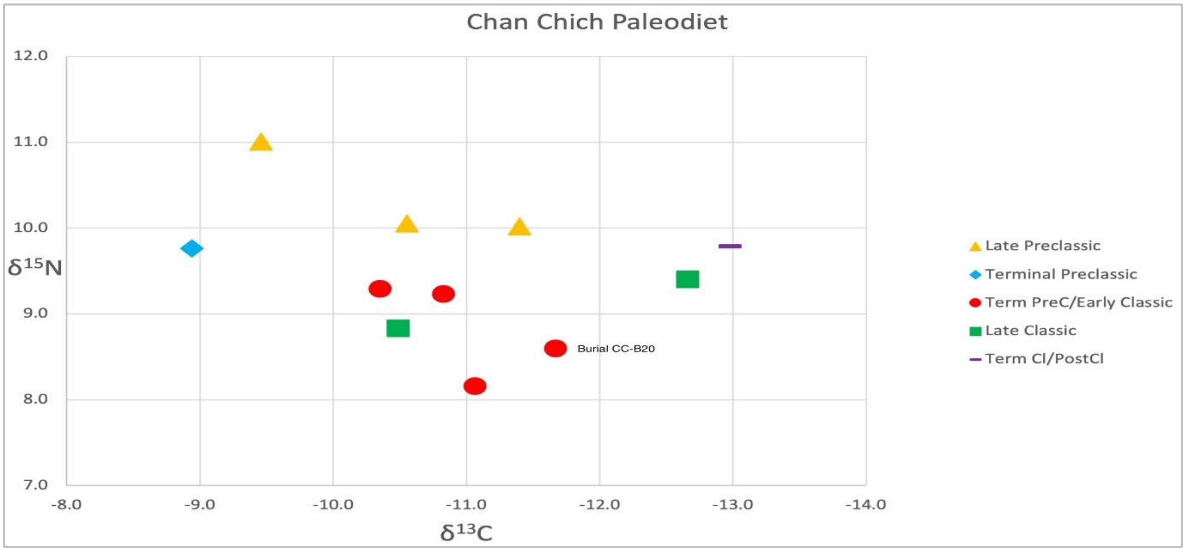

Figure 4. Carbon and Nitrogen isotope ratios from the Upper Plaza burials at Chan Chich.

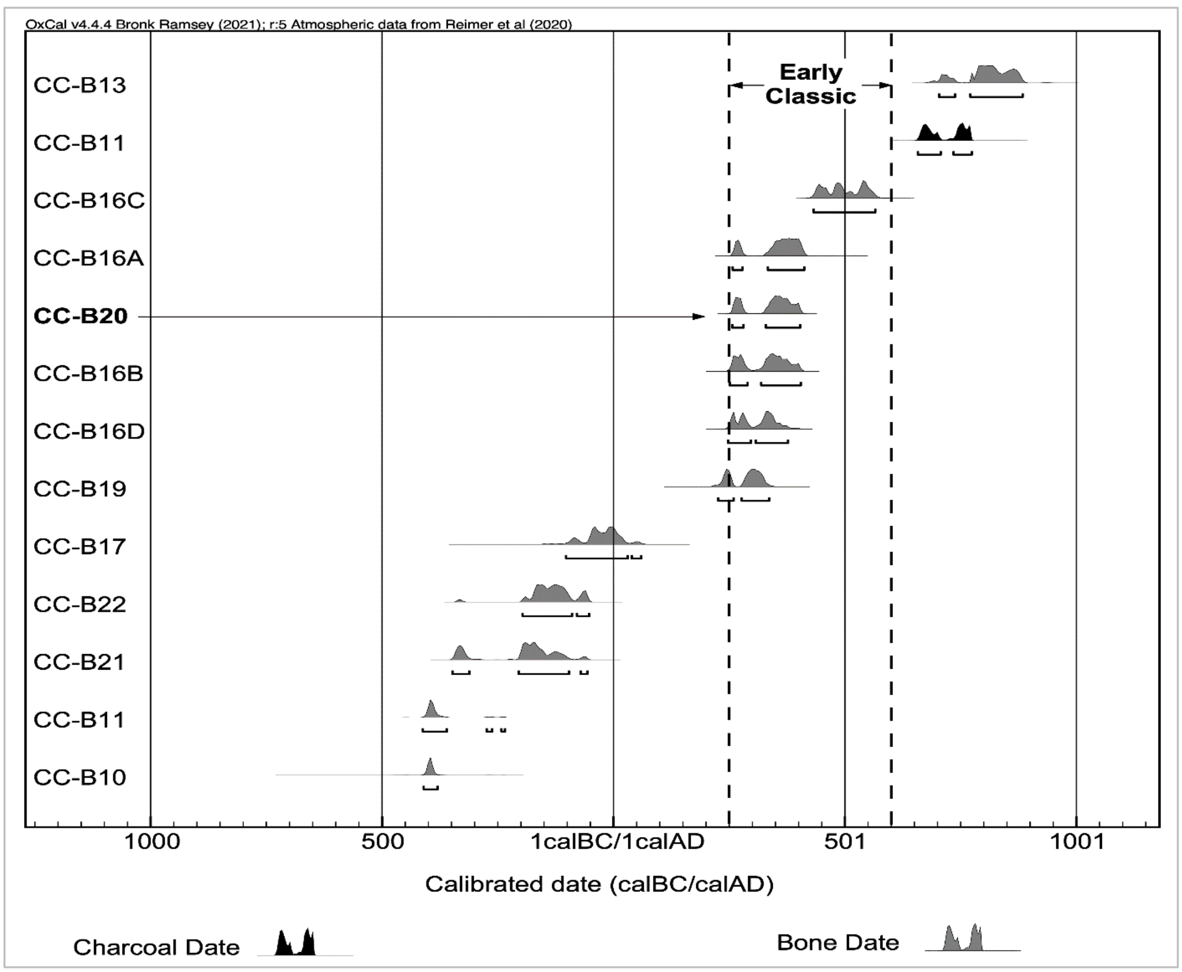

Figure 5. Sequence of radiocarbon dates from the Upper Plaza burials at Chan Chich.

individuals living in the Early Classic period (Sommerville et al. 2013).

Strontium isotope values reflect the ratio of ^{86}Sr to ^{87}Sr in bedrock. Humans consume plants and water that take on the strontium bedrock signature. Analysis of samples of human teeth and bone relate the strontium values of the location where the individual was consuming food and water while those tissues were formed—as a child when the teeth were forming or as an adult as bone remodeling occurred (Bentley 2006). Burial CC-B20's strontium ratio in dental enamel is $^{86}Sr/^{87}Sr$ =0.70820 and $^{86}Sr/^{87}Sr$ =0.70834 in bone. Local individuals are typically identified as those that fall within two standard deviations of the faunal mean for a strontium zone. There are no baseline faunal values for Chan Chich, but the range of baseline values from water, rock, and plants of the southern lowlands, $^{86}Sr/^{87}Sr$ =0.7071-0.7082 (Hodell et al. 2004), and the mean strontium value for the nearby site of Holmul, $^{86}Sr/^{87}Sr$ =0.70825 (Cormier 2018:206), suggest that Burial CC-B20 spent her childhood and adulthood in the vicinity of Chan Chich.

A radiocarbon date places Burial CC-B20 at cal A.D. 257–387, suggesting that her life began as early as A.D. 200 during the transition from the Late Preclassic to Early Classic (Figure 5). She was likely a member of an elite family at Chan Chich based on the location of her interment. In the following section, we interpret these biological data within the context of Early Classic Chan Chich and describe one possible trajectory for the life history of Burial CC-B20.

Osteobiography

The woman in Burial CC-B20 was likely born at Chan Chich. Within the first months of her life her caregivers, courtiers of the Chan Chich royal family, such as midwives, began the process of molding her cranium (Figure 6). The minor bulging at the occipital and the groove posterior to the coronal suture suggests the compression devices being extremely tight or being used longer than needed, after closure of the fontanelles, which typically occurs between 18–24 months (Tiesler 2014:43). As the modification is not particularly extreme, we suggest they were applied up to or beyond 18 months. Observations made by Fray Diego de

Figure 6. Orthophoto showing Burial CC-B20 cranial modification. Image courtesy of Gabriel Wrobel.

Landa (cited in Tiesler 2014) about infant head shaping suggest the practice lasted for several months to a few years, which is consistent with the marks seen on Burial CC-B20.

Tiesler's (2014) thorough study of head shaping throughout Mesoamerica suggests that, generally speaking, shaping the head emphasized the process instead of the resulting shape. Ethnographic and ethnohistoric data from multiple Mesoamerican cultures describe the top of the head and the occipital region as places where the newly attached life essence, *ch'ulel*, resides and that it can detach easily through the fontanelles. The caregiver's duty is to manage the body of the infant so that the soul remains attached and the newly born can accrue vitality, or heat, to secure the life essences. Growth and development, thus, is about caretakers' facilitating the accumulation of strength and vitality through the malleability of the body.

Although comparative sample sizes are small due to poor preservation, the type of cranial modification we see in Burial CC-B20 is also common for this region. Tabular erect makes up 80% of the modification in the Central Lowlands according to Tiesler's study, which is supported by Hannah Plummer's (2017) observations of crania from northwest Belize.

Childhood wellness is indicated by the lack of hypoplasias on the recovered teeth. The recovered teeth would have been completed formation by age 7 or 8. The absence of these lesions does not mean that Burial CC-B20 did not experience any illness, trauma, or metabolic stress, but that she was buffered from the most extreme consequences.

We do not want to overinterpret these MSMs and evidence for osteoarthritis. We cautiously suggest that Burial CC-B20 was engaged in activities related to craft production, perhaps spinning or another aspect of cloth production, a craft typically carried out by women in Mesoamerica. In fact, her training may have begun not long after the head shaping devices were removed. An image from the Codex Mendoza shows that Aztec girls as young as 3 years were taught to spin and were competent weavers by age 8 (Nielsen 2017). She may have continued to spin and or weave throughout her adult life. The osteoarthritis in her lower back suggests flexion of the spine in a motion consistent with movement while sitting. Bioarchaeologists studying movements of modern-day weavers in Peru and India, who also use backstrap looms like the ones used by the Maya, suggest that the positioning of the loom and movements during weaving may contribute to osteoarthritis in the lower back (Becker 2016).

Scholars of Aztec weaving suggest that older weavers began to spin more than weave as they aged and their eyesight diminished (Nielsen 2017). It is possible that the unilateral robusticity of the attachments associated with raising one arm and stabilizing the shoulder could be indicative of time spent spinning. As she aged, she may have taught younger women to weave and spin, as represented in the Aztec images.

Her long life likely affected her dental health. The well-healed alveolar bone of the mandible and general lack of dental calculus on recovered dentition suggest some degree of dental care. We propose that a health practitioner may have extracted carious teeth. A recent study by Schnell and Scherer (2021) identified carious and broken human teeth associated with a marketplace at Piedras Negras, indicating that dental care may have been available to certain parts of the ancient Maya population. Our own excavations at Chan Chich in the proposed marketplace recovered one human tooth (Degnan et al. 2022).

The lack of teeth would certainly have affected which foods she was able to consume, which would have influenced her bone collagen isotopic values. The isotopes are similar to other Early Classic elites in the Maya lowlands, but they are exactly on point with Early Classic non-elites from Sommerville and colleague's (2013) comparison of elite and non-elite diets. This might suggest that the Chan Chich elite were not consuming a diet on par with elites at other sites. A second interesting aspect of these isotope values is that the Early Classic burials, the red dots in Figure 4, indicate a slight shift in diet from the Late Preclassic period, shown in yellow. Further isotopic analysis should clarify her diet and those of the other Chan Chich residents, including what she ate as a child when her teeth were forming.

The woman in Burial CC-B20 spent her life at, or in the vicinity of Chan Chich and passed at an advanced age, likely living into her 70s. Her mourners decided that the Upper Plaza, a private and long used ritual locale at the site, was the best place for her interment. She was among at least four other people already interred there at or near the time of her interment, including two individuals likely of royal status. Two secondary burials dating to the Preclassic period were found in close association with the grave of Burial CC-B20, suggesting a gathering of remains in this corner of the plaza (Gallareta Cervera et al. 2019).

Her grave showed particular investment in construction, beginning with the excavation of a 2 m deep shaft. Her body was laid in a semi-flexed position on a Middle Preclassic floor. Seven large roughly shaped limestone slabs held back the construction fill, and three enormous chert boulders capped her crypt. The grave was not filled with sediment, as others in the Upper Plaza were, but was left open. Her body position and orientation are consistent with the rest of the Three Rivers adaptive region. Around 65% of primary burials are flexed and 58% are oriented with head to the south (Novotny 2022).

Even though Burial CC-B20 was placed in the corner of the Upper Plaza, well below the plaza floor, she was included in a centuries' old tradition of interment in this exclusive architectural group. The tradition of interment there was a critical source of social memory that the Chan Chich nobility relied on for consolidating power in the Early Classic. They were claiming divine kingship evidenced by the jade bib helmet diadems in Tomb 2 and Crypt 1 (Friedel and Schele 1988; Gallareta Cervera et al. 2017; Houk et al. 2010). The institution of divine kingship drew on the traditions of ancestor veneration to legitimate power during the Classic period, including interment of the dead in special locations to facilitate care and communication. Placemaking at the Upper Plaza created the appropriate stage for the theatre of divine kingship, including all those who were no longer visible. Long after her death, Burial CC-B20 remained integral to the placemaking of the Upper Plaza.

Conclusion

We began by asking *how did the social context of the early part of the Early Classic mold the body of the individual interred in Burial CC-B20?* The individual in Burial CC-B20 embodies the biocultural traditions of cranial modification, eating, and crafting. She was cared for and guided towards becoming a vital and contributing member of her group. She likely passed on these skills and traditions, important social knowledge, as she aged. Her cranial modification and body treatment at death were all in line with the general population of Early Classic Maya in the Three Rivers adaptive region.

After her death, the living chose her to include in a cohort of dead who were gathered together as part of the placemaking of the Upper Plaza. Some had material status markers, while she did not have any that survived the millennia since her burial. Her placement and the construction effort put forward to inter her speak to the purposeful inclusion of her body. Early Classic period placemaking marked the Upper Plaza as an important locale to be through the Classic period.

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7 TWO LATE CLASSIC ROYAL BURIALS FROM BUENAVISTA DEL CAYO, BELIZE

Jason Yaeger, Bernadette Cap, and M. Kathryn Brown

We describe two Late Classic royal tombs excavated by the Mopan Valley Archaeological Project at Buenavista del Cayo. Feature 385-6, excavated in 2018, was located in Structure 3c and dates to around AD 600. The large masonry tomb contained an individual laid to rest on an elevated wooden bier, accompanied by 19 ceramic vessels, obsidian and stingray spine bloodletters, a mirrored headdress, and a jade bead. Among the more remarkable findings in the tomb were hundreds of desiccated popcorn kernels and two pyrite mirrors, one with Teotihuacan style painting. Feature 385-30 is another masonry tomb, excavated in 2019 in Structure 3b. Dating to the late 7th century AD, this tomb contained an adult individual wrapped in textiles, accompanied by two jade artifacts and 27 ceramic vessels, some of which were elaborately painted. Of particular note, two parallel rows of chert lithics were found immediately under the body: a row of five very fine, large bifacial axes, and a row of nine eccentrics. Three additional eccentrics were found near the head. These tombs indicate that the line of kings that was established at Buenavista by at least ca. AD 450 reigned for at least two centuries.

Introduction

Since the inception of the Mopan Valley Archaeological Project (MVAP) in 2005, one of the project's primary goals has been to create a more robust understanding of the succession of political centers in the Mopan River valley (Figure 1), as originally proposed by Ashmore and Leventhal (2004; see Brown and Yaeger 2020, Yaeger and Brown 2019 for the most recent syntheses). Research by MVAP, the Mopan Valley Preclassic Project (MVPP), and the Actuncan Archaeological Project have demonstrated that this sequence of centers begins with Early Xunantunich, the valley's earliest known ceremonial center and first E-Group, dating to ca. 700 BC (Brown and Yaeger 2020). Early Xunantunich was occupied throughout the course of the Middle Preclassic period (900 – 300 BC), and toward the end of the Late Preclassic period (300 BC – AD 300) it was likely replaced as the valley's political center by Actuncan, located 1.5 km to the north (Brown and Yaeger 2020). Actuncan declined in the Early Classic period (AD 300 – 600) and was largely abandoned by perhaps AD 400 (Fulton and Mixter 2022; Mixter 2017), just as nearby Buenavista apparently became the valley's dominant power (Brown and Yaeger 2020; LeCount et al. n.d.). Located 2 km north of Actuncan, Buenavista was powerful both politically and economically during the Early Classic and into the Late Classic (AD 600 – 780). It was then eclipsed by Xunantunich later in the the Late Classic period, as Xunantunich experienced rapid growth, labor investment in monumental architecture, and a series of royal burials (Audet 2006; Awe et al. 2019; LeCount and Yaeger 2010).

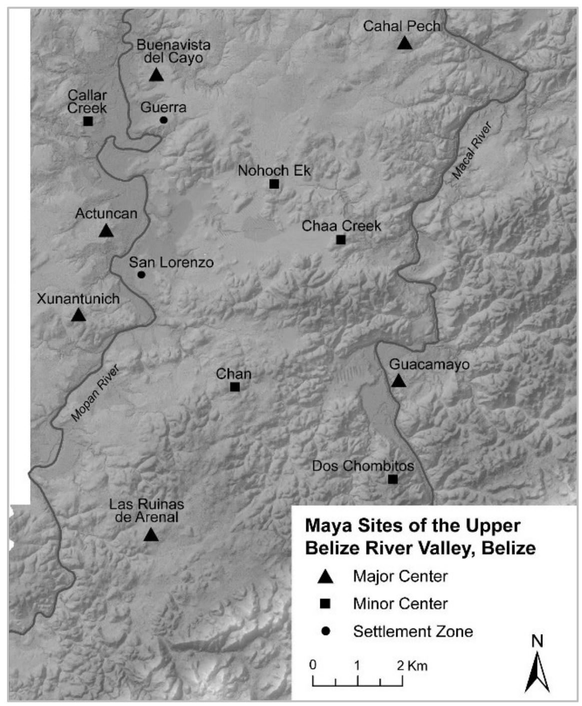

Figure 1. Map of the Mopan and Macal Valleys showing sites mentioned in text.

The documented pattern of shifting political centers in the Mopan Valley raises many interesting questions about the nature of political cycling within a region and the factors that played a role in the rise and fall (or more precisely, the successes and failures) of these polities. These shifts relate in part to ideological shifts and changing economic systems, as well as conflict within the region (Brown and Yaeger 2020). One facet of MVAP's research has been understanding the establishment of a royal lineage at Buenavista and the role that the introduction of divine kingship into the Mopan valley played in the region's political dynamics. To that end, since 2014, we have excavated four royal burials, two dating to the Early Classic and two dating to the Late Classic.

The Early Classic burials were described in volume 12 of *Research Reports in Belizean Archaeology* (Yaeger et al. 2015). Both burials (Feature 384-1 and Feature 384-2) were placed in the site's Central Plaza along the central axis of Structure 3 (Figure 2). These two royal burials date to the 5th century AD, and we hypothesize they held the first kings of the royal house of Buenavista. A large marine shell gorget found on the chest of the individual in the earlier burial (Feature 384-2) bears a "name-tag" inscription labelling it as the pendant of the divine king (*k'uhul ajaw*) of the polity of Komkom (Yaeger et al. 2015). This important finding led us to conclude that Buenavista was the capital of the ancient capital of Komkom, which was ruled by its own royal dynasty by AD 450, if not earlier. The gorget as an instrument of power and element of royal regalia also indicates a link between the founder of the Komkom royal dynasty and the great Early Classic power of Tikal and, by extension, the Central Mexican city of Teotihuacan (Yaeger et al. 2023).

Buenavista Structure 3

In 2017 and 2018, we shifted our attention from the Central Plaza to Structure 3, the second tallest structure at the site, where we discovered two Late Classic royal burials. In its final form, Structure 3 was composed of a pyramidal substructure with a rectangular footprint. The final summit of this substructure (Structure 3-1st and Structure 3-2nd) sat roughly 14 m above the surface of the Central Plaza and was accessed by an axial stairway. The substructure was topped by three masonry shrines, each facing west. The two lateral shrines (Structures 3a and 3c) were smaller and simpler; the central shrine (Structure 3b) was taller and more elaborate. Thanks to our excavations on the structure's summit and an axial trench in the western stairway placed by Joseph Ball and Jennifer Taschek (2016), we have a firm understanding of the structure's architectural history, which we argue mirrors changes in the nature of political authority at the site.

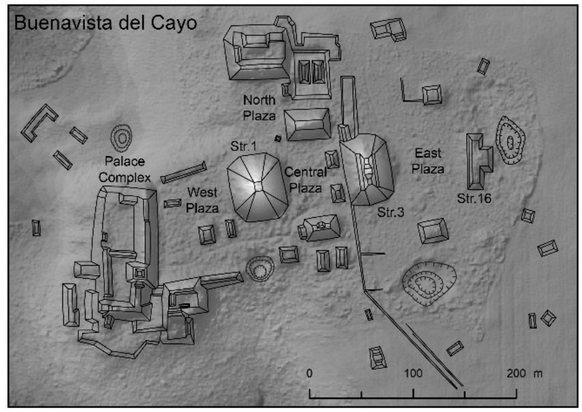

Figure 2. Map of Buenavista del Cayo.

The earliest known phase of the substructure, Structure 3-4th, is a stairway in Ball and Taschek's axial trench. They date its construction to Late Preclassic period (Ball and Taschek 2016). We believe that Structure 3-4th was a radial pyramid that served as the western structure of an E-Group complex focused around the East Plaza, with Structure 16 as its eastern complex (Yaeger et al. 2015). Structure 3-4th was capped by Structure 3-3rd, which was built near the close of the Late Preclassic period (Ball and Taschek 2016) and may have had a form and function similar to its predecessor, Structure 3-4th. Ball and Taschek (2016) also identified the stairway of Structure 3-2nd, which was built in the Early Classic period. Structure 3-2nd is coeval with earliest known construction phase of Structure 1, Structure 1-3rd (also identified by Ball and Taschek [2016]), located on the west side of the Central Plaza. We hypothesize that by this time, the Maya had reconfigured Structure 3 from a radial pyramid to a western-facing platform, which became the eastern complex of an E Group of the configuration that Awe et al. (2017) label the eastern triadic architectural assemblage. Ball and Taschek (2004) also noted the solar alignment of Structures 1 and 3.

Our excavations demonstrate that the three shrines that crown Structure 3 were placed on the summit of Structure 3-2nd, the Early Classic version of the substructure. While we

Figure 3. Overview of Feature 385-6 in Structure 3c.

recovered a variety of ritual offerings in the three shrines, including some with infant remains, this paper focusses on the two Late Classic tombs we discovered, one in 2018 in Structure 3c and one in 2019, deep within Structure 3b. Below, we describe each of these in turn.

Buenavista Feature 385-6 in Structure 3c

Our excavations in 2018 revealed a royal tomb placed in a pit cut deep into the heart of Structure 3c's substructure platform (Figure 3). The tomb was capped with three layers containing tens of thousands of chert flakes (Horowitz et al. 2020), which are widely recognized as a hallmark of royal tombs (Coe 1988). The lowest layer also included obsidian blades and production debitage. Directly beneath the layers, we encountered the capstones of the tomb, designated Feature 385-6.

Feature 385-6 was a masonry chamber measuring 1.2m wide and 2.1m long, covered with a roughly vaulted roof. Bioarchaeological analysis by Carolyn Freiwald determined that the tomb was the resting place of a single adult individual whose sex could not be determined due to the fragmented nature of the skeletal remains. The individual was buried with its head to the south, a common pattern in the Mopan River valley (Friewald 2011).

Radiocarbon dates from the tomb suggest the interment took place sometime around AD 600. A date from one of the desiccated corn kernels placed in the tomb (see below) yielded a date of AD 546 – 599 (PSUAMS-5906, 1510 +/- 15, AD 546 – 599 at 95.4% probability, calibrated using OxCal 4.4). An assay from a fragment of pine charcoal associated with the clay plaster that coated the sides of the tomb yielded slightly later date, AD 592 – 647 (PSUAMS-5548, 1450 +/- 15, AD 592 – 647 at 95.4% probability, calibrated using OxCal 4.4). Taken together, these suggest an interment at the end of the 6th century or early in the 7th century. This accords well with the ceramic assemblage, which has modes consistent with the transition from Tzakol III to Tepeu I.

The individual in Feature 385-6 was laid to rest on a raised wooden bier. The body was wrapped with fabric and perhaps matting, as indicated by impressions preserved on small fragments of mortar that had dripped from the tomb's roof onto the enshrouded body and dried in place, preserving the impressions of the textiles and mats after those perishable objects had decomposed. Taschek and Ball (1992; also Ball and Taschek 2018) also observed the practice of shrouding a royal corpse and covering the burial in layers of leather and textiles. When the bier decomposed, the body and associated objects, as well as planks from the bier itself, fell to the floor of the tomb and into three large, bichrome dishes that were placed beneath the bier, under the lower half of the body. Project conservator Griselda Pérez Robles recovered and conserved the bier's boards when excavating these vessels.

While the skeleton and objects on the bier were displaced with its collapse, we infer that the individual wore a jade bead around the neck and a headdress made mostly of perishable elements that included four small, round hematite mosaic mirror rondels. Near the pelvis we found bloodletting implements, one stringray spine and two obsidian blades.

We also recovered a large mass of slate, shell, and oxidized pyrite originally placed on the bier near small of the person's back. The Maya polished fragments of pyrite and fit them together in discs on wooden or slate backings to make brilliant shiny mirrors (Healy and Blainey 2011). Pyrite oxidizes readily, however, and most pyrite mirrors recovered in the Maya lowlands are found only as crumbly oxidized pyrite associated with the backing.

When we found this mass in 2018, it was obvious that it required careful conservation, so we block-lifted the entire mass, wrapped it tightly, and transported it to our curation facility. In 2019, Pérez Robles undertook its conservation, carefully "excavating" it layer by layer, documenting each fragment with photographs and drawings. The individual pieces were numbered and recorded; removed, cleaned, conserved, and labelled; and then reassembled to recreate the objects that originally comprised the mass. Pérez Robles found that there were in fact two mirrors, stacked one atop the next. The lower mirror, Mirror 2, is 21cm in diameter and consists of pyrite affixed to a slate backing. The reverse was originally painted with red hematite. Mirror 1 measured 19cm in diameter, and was more complex than Mirror 2. It's backing consisted of a central slate circle surrounded by a disk, half of which was stucco and half of which was pyrite. On its upper surface, the mirror had a complex mosaic of shell and stone (Figure 4). Although it is difficult to reconstruct the iconography due to missing tesserae, a series of greenstone butterflies encircle the inner disk (Griselda Pérez Robles, personal communication, 2019). On the reverse side of the object, the central slate disk was covered by pyrite to form a small mirror, while the surrounding disk of pyrite and stucco was painted in Teotihuacan style (Christophe Helmke, personal communication, 2020).

Figure 4. Mirror 1, showing central mosaic and surrounding disc of pyrite and stucco encrusted with shell and stone mosaic tesserae. Photograph by Griselda Pérez Robles.

Maya rulers were often buried with pyrite mirrors, which were important components of a ritual divinatory-scrying complex in Classic Maya civilization (Blainey 2016). They were also prized objects, made by highly skilled artisans using rare and imported materials

Figure 5. Desiccated popcorn kernels from Feature 385-6.

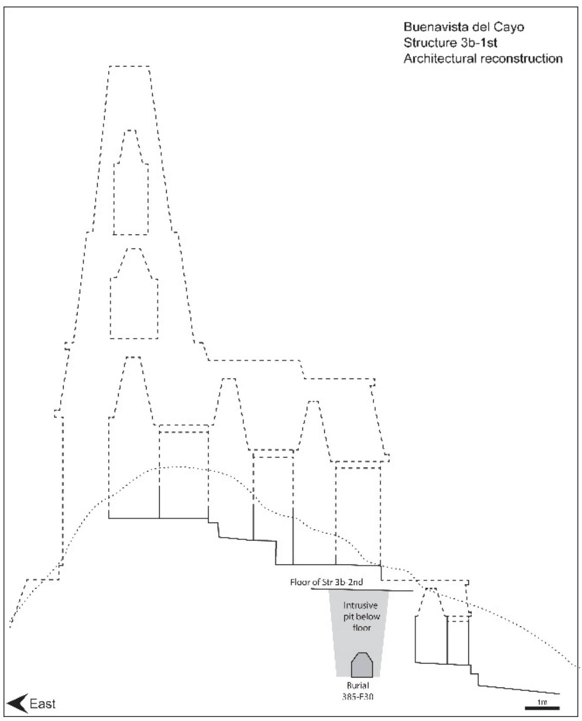

Figure 6. Profile of Structure 3b-1st showing location of Feature 385-30 and associated pit. Solid lines show *in situ* architecture; dashed lines are reconstructions.

(Gallaga 2016). Maya art shows rulers using mirrors in courtly activities, and rulers often wore mirrors affixed to their costume near the small of their backs (Blainey 2007).

Above, we had noted that the shell gorget buried with Buenavista's earliest known king was an instrument of power that linked the founding of the Buenavista royal dynasty to Tikal (Yaeger et al. 2023), at a time when that kingdom was expanding its influence across the Maya lowlands, likely due in part its connections to Teotihuacan (Canuto et al. 2020). Mirrors are also closely associated with Teotihuacan, and Mirror 1 is particularly salient in that regard. One side bears painted designs that are clearly in the Teotihuacan style and color palette, while the other bears butterflies. Mirrors are associated with the sun and fire because of their brilliant reflective qualities (Taube 1992), and at Teotihuacan, butterflies represented the spirts of apotheosized warriors who had fallen in battle, who upon death were cremated, turning into divine butterflies (Nielsen and Helmke 2018). Thus, the iconography of Mirror 1 is closely related to Teotihuacan.

As noted above, three bichrome dishes sat under the bier, and 16 additional vessels were arrayed around the sides of the chamber. Most of these are monochrome, including a number of black slipped vases with pre-fire incised geometric designs. The tomb had remarkable preservation, including hundreds of popcorn kernels (Rebecca Friedel Juan, personal communication 2018). Unlike most preserved corn kernels, the popcorn was desiccated rather than carbonized (Figure 5), which should allow us to undertake DNA, starch, and Sr isotope analyses, with the goal of better understanding the spread and selective breeding of maize and the trade of corn and other staples across the Maya lowlands.

Buenavista Feature 385-30 in Structure 3b

In 2018, we also began excavations of the larger, central shrine, Structure 3b. We removed the fill from a deep trench that looters had dug along the central axis of Structure 3b in the 1960s or 1970s, which Ball and Taschek had refilled in the late 1980s. In clearing the looters trench, we also expanded it and extended it downward. We discovered a small room set into the stairway of the Structure 3b platform, which contained scores of incense burner fragments, clearly a place of ritual, likely veneration of sacred ancestors buried within the shrine.

Structure 3b's stairway rose in two segments, one on either side of the room, to give access to the main shrine, which sat on a substructure taller than the adjacent Structures 3a and 3c. This masonry building consisted of three rooms arranged in tandem with central doorways (Figure 6). The narrow width of the rooms and the building's thick walls are consistent with the presence of a large masonry roof comb, which is also suggested by the fragments of modeled stucco we recovered in the alleyway between Structure 3b and Structure 3c.

South of the southern stairway, our 2018 excavations revealed a large mask depicting the deity Chahk (Christophe Helmke, personal communication, 2018; Figure 7). Chahk was associated with rain, needed to sustain crops that were essential to the economy of this ancient agrarian society (Doyle 2022). This five-foot tall portrait was made with a mosaic armature of carved limestone blocks, covered with a thin coat of modelled stucco. In 2019, our excavations revealed a matching mask just north of the northern stairway. It had the same form, size, and construction methods as the southern mask, but it was not as well preserved. The duplication of the image of Chahk reiterates the importance of this deity to royal political authority at Buenavista.

Farther back in the looters trench, in the interior of Structure 3b's platform, we found a dense layer of chert flakes at the base of the trench. The trench followed the top of the layer of flakes but did not penetrate the layer. Inspection of the stratigraphy above the layer of flakes revealed that they were placed in a pit that had been cut through the penultimate version of the central shrine, Structure 3b-2nd. As we began excavating the undisturbed material at the base of the looters trench, we found that there was only one lithic layer and that it sat directly on the capstones of a tomb, dubbed Feature 385-30. Initial observations by Rachel Horowitz indicate that most of the flakes are large bifacial thinning flakes, similar to the lithics placed over Feature 385-6 in Structure 3c (Horowitz et al. 2020, this volume).

The tomb capstones were large, cut limestone blocks with their long axes oriented east-west. A few blocks were blackened from burning, but the absence of any associated ash or charcoal suggests either the burning happened elsewhere—perhaps the capstones were re-purposed architectural elements from a structure where burning had occurred—or the area was cleaned very well after a burning event.

Figure 7. Southern mask on Structure 3b. Photograph by Neil Dixon.

We removed most of the capstones and exposed the cavity of Feature 385-30. Although the tomb was partially collapsed, it still presented as an air-filled chamber that measured roughly 2.5m by 1m (Figure 8). It seems that the tomb's masonry was assembled quickly, as the mortar was not allowed to dry fully. As a result, the weight of the capstones and fill in the burial pit above them compressed the wet mortar, some of which was extruded into the tomb chamber. Where this wet mortar came to rest on the enshrouded body, it dried and created impressions of cloth, twisted cordage, and woven matting (Figure 9). In places, dried mortar with impressions still adhered to the walls of the tomb chambers, precisely revealing the original position of the shrouded corpse. Some of the cloth impressions retained a red color suggesting that the textiles were dyed or that a red mineral was sprinkled over the wrapped corpse as part of the burial process. The red coloration was only found in the southern portion of the tomb, however. A radiocarbon assay of organic material adhering to one of the fabric impressions returned a calibrated date of AD 605 – 665 (PSUAMS-8606, 1395 +/- 20, AD 605-665 at 95.4% probability; calibrated with OxCal 4.4). A series of radiocarbon dates from other contexts in the central trench suggest the interment occurred toward the latter half of the 95.4% interval, in the second half of the 7th century AD.

The skeleton of the individual buried in Feature 385-30 was highly fragmented, even more than the skeleton in Feature 385-6. The

Figure 8. Overview of Feature 385-30 in Structure 3b.

Figure 9. Impressions of fabric and cordage from Feature 385-30; detail on right. Photographs by Neil Dixon.

analysis of the remains by Carolyn Freiwald indicates that a single adult was buried in the tomb, placed with their head to the south. The individual's sex could not be determined.

As noted above, the body was wrapped in textiles secured with twisted cords. A line of five very long (up to 40cm long), very thin chert bifaces were placed end-to-end under the body, extending roughly from the feet to the head (Figure 8). All have an axe-like form, but they are thin in comparison to general utility bifacial axes. Their size, fine craftsmanship, and sharp edges suggest they were ritual or decorative objects, rather than utilitarian tools. Running parallel to the line of bifaces was a row of nine chert eccentrics of typical Belize valley forms common at Buenavista (Iannone 1993; Ramos-Ponciano 2018). Three eccentrics, including a larger, thicker crescent and a thin, round disc were found near the individual's head.

The bifaces and eccentrics were found below the body. We recovered organic material and small animal bones (mice perhaps) below the bifaces and eccentrics, and one biface had a delicate fabric impression on its upper surface. These observations suggest that the body was clothed or wrapped with textiles when placed on the lithics, and that the lithics were either placed on matting or other organic material on the floor of the tomb or wrapped along with the body in a larger, layered bundle.

Placed near the head or neck of the individual were two jade objects. One is a small ear flare. We did not recover a second ear flare, but we believe it may have been displaced in antiquity into a nearby crack in the tomb floor. The other object is a reworked fragment of a larger carved jade object that had been broken. It has several drilled holes on one face, but their arrangement is unusual, leaving it unclear how it would have been worn or attached.

The shrouded body was surrounded by 27 ceramic vessels, placed along the four edges of the tomb. The stones that had fallen into the chamber had broken nearly all of the vessels, but through careful excavation, we recovered nearly all of their fragments. The assemblage includes monochrome, dichrome, and polychrome vessels, all of which are serving forms (plates, dishes, bowls, and vases). Patterning in color schemes and decorative motifs suggests that the assemblage contains several distinct sets of vessels.

The most elaborate vessels are a pair of vases that share the same color scheme and similar iconographic motifs, and the same pseudo-glyphs on their rim bands. These were conserved by Pérez Robles and displayed in an exhibit at the San Antonio Museum of Art, entitled “Nature, Power, and Maya Royals,” curated by Bernadette Cap. The complex and rich iconography of these vessels cannot be fully elucidated in this short report, but we will describe them briefly.

One vessel, Vessel 3 (Figure 10), depicts a ruler wearing a Teotihuacan-style headdress seated on a cushion or covered with jaguar pelt, facing another lord, presumably a vassal. On the opposite side is a cartouche with two animals—a rattlesnake and an owl—with supernatural elements that are likely wahyob (Christophe Helmke, personal communication, 2020). The second vessel, Vessel 6 (Figure 11), has three distinct panels, separated by bands with half-quatrefoils, symbols of the entrance to the underworld. The three panels depict a dog and spotted feline, perhaps also wahyob, engaged in what appears to be combat; what appears to be the same headdress as the ruler wears on Vessel 3, but shown in frontal view and including the Central Mexican “ray and trapeze” year sign in its mouth; and a coiled serpent with an old underworld god, perhaps the Jaguar God of the Night Sun, emerging from its open maw.

We believe these vessels were made as a set specifically for the individual interred in Feature 385-30. Their beauty and fine execution certainly make them suitable for the royal court. More specifically, however, we believe their iconographic program was meant to emphasize the legitimizing relationship between the divine kings of Buenavista and powerful forces, particularly the wahyob, feared creatures associated with disease and supernatural power (Helmke and Nielsen 2009; Stuart 2020). The iconographic allusions to Teotihuacan, while not unusual in Maya art of the 7th and 8th centuries (e.g., Stone 1989), are particularly interesting given the more specific links to Teotihuacan materially expressed by the Buenavista rulers over the course of the royal house’s history, including the shell gorget in Feature 384-2 and the mirror in Feature 385-6, as discussed above.

Concluding Remarks

The analysis of the two Late Classic tombs described above has just begun, with additional material, osteological, iconographic, and paleobotanical analyses already underway. The results of these multiple analyses promise to provide us with rich insight into the nature of political authority at Buenavista deal Cayo, the history of the kingdom and its relationships to other polities in the valley and across the central lowlands, and the ideology and pragmatics of Maya divine kingship more broadly.

From the data presented above and the analyses already completed, we can assert that Buenavista was ruled by a line of divine kings for at least two centuries, from at least ca. AD 450 (the approximate date of Feature 384-2) through ca. AD 675 (the approximate date of Feature 385-30). We have argued that the royal house was founded in conjunction with Tikal (Yaeger et al. 2023), whose ambitious kings were expanding their political hegemony over the Central Maya

Figure 10. Rollout photograph of Vessel 3 from Feature 385-30. Photo by Anson Searle.

Figure 11. Rollout photograph of Vessel 6 from Feature 385-30. Photo by Anson Searle.

lowlands at that time, in part due to the kingdom's close relationship with Teotihuacan (Canuto et al. 2020). The fact that an early king of nearby Pacbitun acceded to the throne in the late 5th century under the supervision of a powerful overlord, likely the king of Tikal (Helmke 2019; Helmke et al. 2006), suggests the possibility that the kings of Tikal were enacting a concerted strategy to expand their influence in the Upper Belize River valley, an agriculturally rich region and the head of a waterborne trade route connecting the landlocked interior of the Central Lowlands to the Caribbean Coast.

Tikal's influence in the Mopan valley likely waned after the defeat of Tikal at the hands of Caanul AD 562. A diverse array of data indicate that the large and powerful kingdom of Naranjo took advantage of that political vacuum. A discussion of the complex and shifting relationships between the lords of Naranjo and the various polities of the Mopan River valley are beyond the scope of this paper (see Ashmore and Leventhal 2002; Helmke 2019; Helmke and Awe 2012, 2016; LeCount and Yaeger 2010; Taschek and Ball 1992). For the purposes of this paper, suffice to say that Buenavista had a close relationship with Naranjo, and the individuals buried in the tombs described above played key roles in those relationships.

Buenavista's relationship with Naranjo was also volatile, including periods of alliance and episodes of violent conflict, including the sacking and burning of the site in AD 696 (Helmke and Kettunen 2011; Yaeger et al. 2015). This event was likely related to the growing preeminence of another polity within Naranjo's hegemony, Xunantunich (Awe et al. 2020; LeCount and Yaeger 2010), but it did not spell the end of Buenavista. Ball of Taschek (2018) have argued that several large construction projects and a sequence of noble burials suggest a resurgence of political power at the site in the mid-8th century. It remains unknown who was responsible for this resurgence, although Ball and Taschek suggest they may have been related to the royal house that ruled the site prior to AD 696. Further research at Buenavista promises to help address that question and allow us better understand the last phase of the site's complex political history.

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8 MAPS AND IMAGERY: A HYBRID MODEL FOR ANALYSES AND INTERPRETATION OF ARCHAEOLOGICAL CAVE SITES

Holley Moyes, Dominique Rissolo, Hilda Lozano Bravo, Shane Montgomery, and Amy Newsam

Mapping is one of the most fundamental and important enterprises for cave archaeologists not only for research, but integral to cave management and heritage preservation. Using traditional cartography techniques is often a tedious and long-term project involving numerous field seasons and thousands of measurements. Capturing 3D spaces using these 2D techniques is clunky and often unsatisfying when recording features or chambers that align and overlap vertically. Due to the complexity of the spaces, accuracy is often sacrificed in the interest of time and traditionally cave features are "sketched" even in the best-case scenarios when measurements are collected from stations or physical baselines. New technologies allow archaeologists to rapidly collect 3-dimensional spatial data at an unprecedented level of accuracy. Employing a case study from Belize, we illustrate a methodological advancement in map making using LiDAR imagery.

Introduction

Unlike man-made architectural features, caves present special challenges for survey and mapping. They are complex 3-dimensional spaces with high sinuosity and rough complicated surfaces that do not lend themselves to traditional 2-dimensional mapping techniques (Moyes 2002:9). In fact, they are so difficult to map that the error rate in cave mapping is far greater than in any other field (Tarsoly 2006). Additionally, cave mapping requires geographic literacy for the numerous conventions and symbols that are not always intuitive to the viewer. For instance, one of the most difficult challenges occurs when spaces vertically align and overlap. To render these spaces intelligible in 2D, our projects use the convention of callouts as illustrated in the map of Yax Moch (Green Frog) Cave in Belize (Figure 1). Footprints of overlapping areas are shown on the map and callouts are used to render areas either above the cave floor or subterranean spaces below, depending on locations and concentrations of cultural materials.

Given the inherent challenges in cave survey, why would we continue to produce maps when technological advancements such as LiDAR (Light Detection and Ranging) enable us to create digital twins that can be viewed and experienced in 3 dimensions? One criticism of digital recording techniques is that they increase the distance of the archaeologist from what is being recorded, which suggests a different, less intimate relationship with the object of record (Huggett 2015:89-90; Rissolo 2019: xvi). In this paper, we will argue that maps continue to be a viable source of knowledge, discuss the challenges in traditional hand-mapping techniques, and demonstrate a new method to leverage LiDAR scanning technology to enhance map accuracy and precision while retaining the humanistic qualities and capabilities of more traditional mapping techniques.

Maps and Images

There is a great deal of difference between a map and a digital image. LiDAR scanning produces 3D images that are geometrically accurate renderings of the real world, but like the real world, do not inherently organize space that is anthropocentric. Here, we refer to these as "images" as opposed to maps because of the geometric accuracy and close approximation in rendering of real-world. These 3D images only have a home in the digital spaces where they can be viewed using specialized software designed for that purpose, though screenshots may be generated from the models that are useful for print copy or other traditional forms of dissemination.

On the other hand, maps are abstract renderings of the real world that are necessarily a selective incomplete view of reality with a heavily anthropogenic component requisite in their design (Monmonier 1991:1). The world is full of information from the tallest mountain to the smallest insect but for us to understand, explore, and describe our experience requires the reduction and categorization of sensory inputs into comprehendible pieces (Tversky 1993). In this sense, maps are analogical to our basic cognitive functions in that they are abstractions of the real world that provide symbolic

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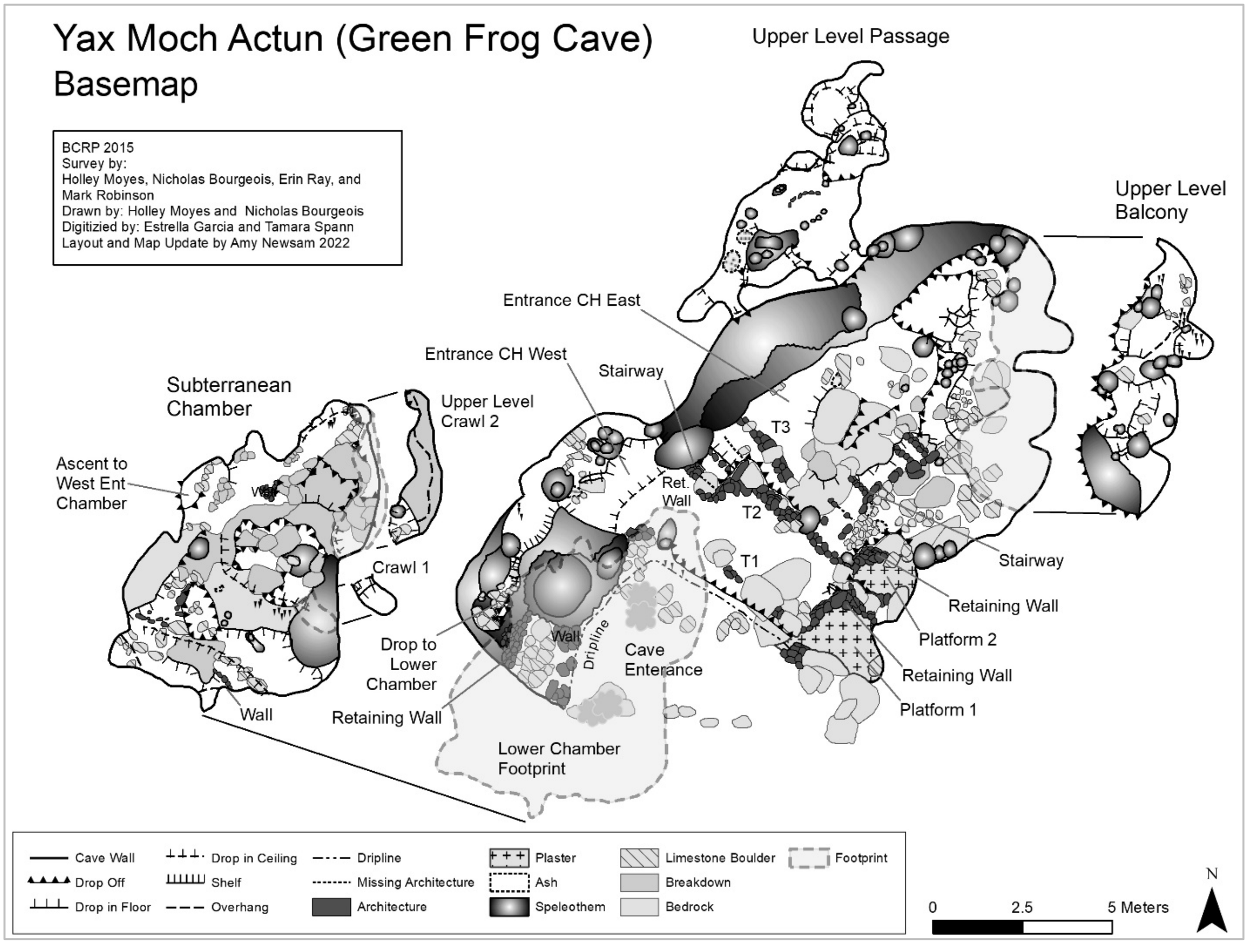

Figure 1. Basemap of Yax Moch (Green Frog) Cave illustrating map convention for overlapping spaces. Footprints show where the callouts fit on the map.

representations, in this case of space. The beauty of maps is that they are a subjective abstraction of reality and an argument for a particular view of a space. In terms of research, maps have the ability to encode data, answer questions, and artistically illustrate elements of interest to users and viewers.

Maps may represent multiple arguments (or agendas) and an infinite number of renditions may exist for a particular space depending on the interests and concerns of the mapper and the acceptable margin of error between the real-world and its abstract representation. Because of this quality, we argue that scanning and other digital techniques will never fully replace mapping. It is because they are representations that maps will always have a place in research programs. In his provocative work *How to Lie with Maps*, Mark Monmonier (1991:130-138) points out that, in the wrong hands, maps have the ability to "lie" in order to advance an agenda or argument. While this is a dark side of map-making, as with any other data tool including supposedly unbiased scientific laboratory analyses, credibility relies on the integrity of the researcher, revealing biases, and agenda transparency.

One of the critical issues in mapping any space is deciding what to map and what not to map. Because there is this a human element in these decisions, no map of a complex environment will ever be identical to another, even in the case of mapping the same space by the same person. Therefore, no cave map will be identical to another. As representations for particular viewpoints and specific intentions, cave surveys conducted by archaeologists and those of spelunkers will necessarily be different from one another. Cavers typically map for navigation, cave formations, morphology, hydrology, etc. (Dasher 1994), while archaeologists are typically interested in representing human and animal activity areas, artifact placement relationships between cave morphology and artifacts, and how humans move through the space from a phenomenological perspective.

Problems with Paper

For the last 25 years, archaeologists have been hand mapping caves in Belize using methods adapted from speleology (Dasher 1997). One of first major efforts in Belize that focused on mapping archaeological cave sites in Belize was the Western Belize Cave Project (WBRCP) initiated by Jaime Awe in 1996. Project members Christophe Helmke and Cameron Griffith developed mapping techniques and symbol systems for the project in which they added details of artifacts and cave features to their maps. To save time and improve accuracy, whenever possible the project method was to use offset baselines (or central routing method) rather than the typical station to station mapping employed by cavers (Figure 2). In this method, a string is run through the central area and wall points and other features are measured in by moving along the string or baseline.

The Main Chamber of Actun Tunichil Muknal (Moyes 2001, 2005), was the first cave in which the project made a fine-grained record and inventory of artifacts and features, which required rendering the hand-drawn maps at a small scale, thus greatly increasing their physical size. The final map of the 183m long Main Chamber measured 11ft. in length (Figure. 3). Though this set the bar for future projects, this sort of detailed mapping was hugely time consuming and tedious. As an example, in 1996 a partial map of the Main Chamber was drawn by Christophe Helmke assisted by Cameron Griffith and for Moyes and her team to complete the map and record the Chamber's many artifacts required an entire 3-month field season.

Physically large maps can only be published and shared if rendered into digital formats. While some archaeologists have opted for using software such Illustrator, because of its many capabilities Moyes has elected to digitize

Figure 2. In field cave mapping using baseline offset method (Holley Moyes and Erin Ray pictured) Photo courtesy of the BCRP.

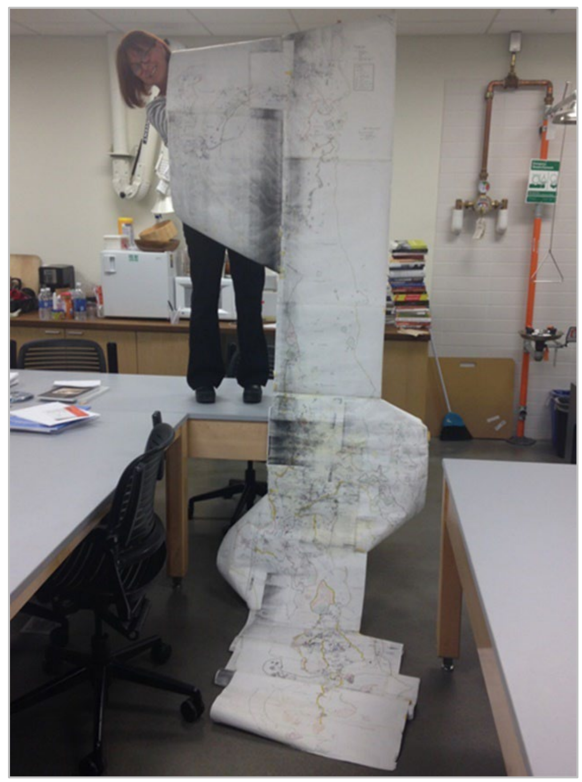

Figure 3. Map of the Main Chamber of Actun Tunichil Muknal is 11 ft. in length (Holley Moyes pictured) Photo courtesy of the BCRP.

paper maps in Geographic Information Systems (GIS). A GIS can not only display spatial data at different scales, but functions as a database management system for artifacts and cave features essential for spatial and comparative analyses. It is relatively easy to generate least cost paths and viewsheds of the space and to do nearest neighbor and other analyses of artifacts that can be visually displayed. However, although based on standard cartographic techniques and conventions, the system itself has been criticized for its "spatial determinism," a convention and limitation that necessarily reproduces the world as points, lines, and polygons (Lock and Harris 2000).

Despite technological innovations we have continued to produce hand-drawn paper maps because they are cheap and relatively easy to produce and are able to capture the largest amount of data in the least amount of field time. Admittedly they are fraught with error and can be imprecise. As an example, maps are rendered on graph paper marked with squares that are assigned numeric designations dependent on scale. Typically, paper will be printed with larger squares 1-inch squares divided into 10x10 smaller squares. For a large cave map a large square may represent 1m. and the smaller 10cm. each, on for very large caves the large squares may represent 2m. and the smaller 20cm. This allows for a fine-grained mapping, yet still limits resolution. Additionally, for most caves, multiple sheets of paper are needed, therefore requiring individual area maps to be joined. Even when done meticulously, these may slightly alter the map's magnetic north orientation, especially when the paper itself is slightly warped due to the cave's humidity. This is exacerbated by rolling and unrolling the document. Not only this, but mapping areas on steep slopes can be problematic. To represent the sloping floor on paper, mapping and marking of the baseline must account for the cosine ($\cos(\theta)$. In this exercise, even the width of a #2 pencil can make a difference in precision.

Another consideration is that because caves are so complex, one must strategically collect data. Typically, measured data points are only collected from walls and large features due to time constraints, therefore other features require sketching, which introduces additional error. Human error also occurs in the data collection itself. In measuring for baseline mapping, to ensure maximum accuracy the data collection instrument is necessarily held perpendicular to the baseline and measurements should be level. Years ago, this was extremely difficult due to the limitations of instruments, but the DistoX, a digital measuring tool developed by B. Heeb, has greatly improved methodology (Heeb 2014). The DistoX is a hand-held integrated electronic device that accurately measures azimuth, inclination, and distance. It is small, lightweight, portable, and has become indispensable for cave mapping because it is so easy to determine and maintain its position while taking a measurement (Trimmis 2018).

Finally, another challenge is the cave's morphology. Cave walls are usually concave, convex, or obstructed by flowstone, so *where* one collects a data point on a wall influences the final product, thus leading to further error. Best efforts are made to collect data points at 50cm. above the cave floor, but this is not always possible. Therefore, any cave mapping is at best an informed estimate of the actual space.

One may wonder why geodectic stations (total stations) are not employed more frequently in caves (See Trimmis 2018:1 for discussion). Mapping with a total station does provide a method for accurate point data collection, and some units may even collect point sweeps, but the equipment was designed for recording simple anthropogenic spaces such as rooms, lots, roads, or other structures, not complex topologies. Total stations can be used for shooting specific points and may be integrated into mapping protocols to increase accuracy, but the equipment is bulky and heavy, impeding portability. Because the device must be mounted on a tripod and leveled for each use, and because it can only collect data within its line of sight, the equipment must be moved frequently. Additionally, it is difficult or impossible to set up in small spaces or to carry it through tight squeezes common caves. A trade-off for the accuracy of the total station is that traditional cave survey techniques such as baseline mapping are much faster, and many more points can be collected in a shorter time.

For the Cave at Las Cuevas, the Las Cuevas Archaeological Reconnaissance developed a hybrid method to increase accuracy using hand-drawn maps, limited total station survey, and ArcGIS 10.1 (Phillips et al. 2014). In this method control targets were positioned on cave walls, which were measured in on the hand-drawn map. A total station was then brought in to map the targets as well as the datum points of baselines. Scanned paper maps along with the total station data were then brought into the GIS. The total station data for the targets and datums were used to georeference the paper maps, thus warping them (rubber sheeting) slightly to the more accurate points. This served to average out any error in the hand-drawn map over the entire 280m cave system and allowed researchers to establish the level of accuracy for the final product by computing how far off the hand-mapped targets were from those collected by the total station. When rectifying the hand map to the total station points, the project noted that there was an average error of approximately 7cm., with only one point off by 30cm., which skewed the estimate upward. Researchers concluded that the method increased the global accuracy within the site and reduced propagated error in the resulting digital map. While these interventions improved accuracy, the overall error remained in the final product, though it was deemed acceptable for research questions, heritage management and dissemination purposes.

A New Process for Producing Cave Maps

In 2021, the University of California, Merced (UCM) and Principal Investigator Moyes was awarded a National Science Foundation Major Instrumentation Grant to purchase a Hovermap system. The Hovermap (by Emesent) pairs a Velodyne LiDAR with a proprietary SLAM (simultaneous localization and mapping) algorithm and processing system that can be used in two modes: a handheld device that scans while walking or one in which the scanner is mounted on a customized multirotor UAV. This allows for progressive scanning while walking through constricted or confined spaces with the unit in hand (Figure 4), with plug-and-play transition to drone-based scanning as terrain and environments require (https://www.emesent.io/hovermap/). To go from landscape to interior space or subterranean chambers within a single seamless scanning project is game-changing.

The recently acquired system was deployed and in the summer of 2022, our team field tested cave sites in the Chiquibul Forest Preserve in western Belize. In only 10 days we were able to scan and collect the geometry and detailed photogrammetry of rock art and cultural

Figure 4. Scanning with the Hovermap (Gonzalo Pleitez and Shane Montgomery pictured) Photo courtesy of the LCAR.

features of four cave sites, two of which were large cave systems each with over 300m of tunnels. Here, we present data collected from Bird Tower Cave as a test case for creating a hybrid model illustrating how LiDAR scans can be used to produce highly accurate and precise images as the basis for the creation of more traditional 2D basemaps.

Bird Tower cave is located southeast of the Las Cuevas site core on a hill 678masl (Moyes and Awe 2013). It was mapped by the Belize Cave Research Project (BCRP) in June of 2012 (Figure 5) and entered into a GIS (ArcGIS 10.1 and later updated to ArcGIS 10.8) for management and display (Figure 6). Although the cave is relatively small, it is architecturally complex containing a number of architectural features of interest including terraces, 2 constructed walls, 6 plastered platforms and floors. Additionally, there is a carved speleothem column in the back of the cave. Damage to the

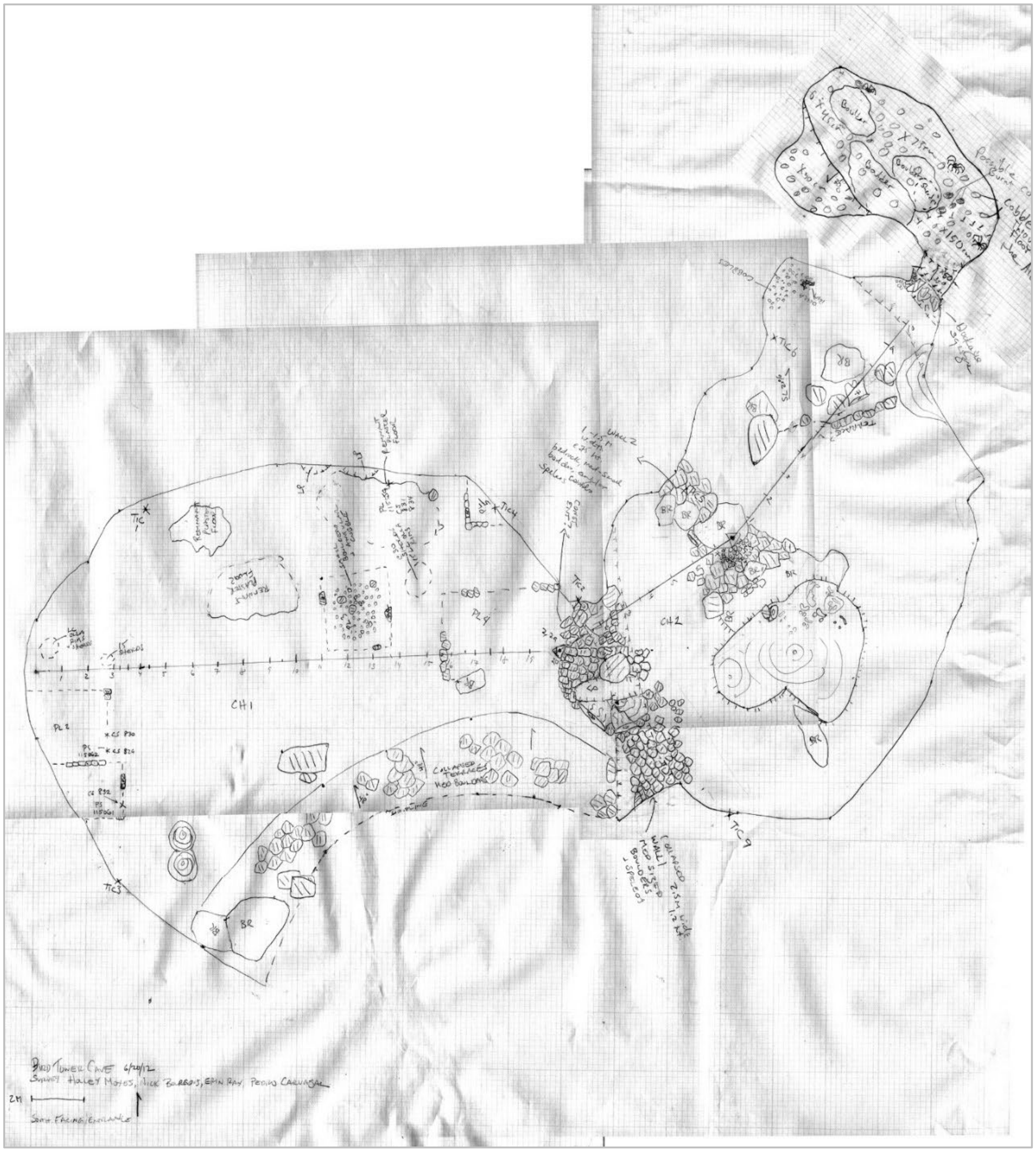

Figure 5. Scanned paper map of Bird Tower Cave. Note the wrinkles in the map. Courtesy of the BCRP.

architecture and the lack of artifacts suggests that in the past, the cave was heavily looted.

The wide south-facing cave opening is located at the base of a small sink hole with a 14.8m. dripline. The site is composed of two designated areas separated by a constructed wall. Upon entering the cave, the floor descends at a 48° slope into Chamber 1 below. Spanning the entrance are at least two badly collapsed remnant terraces constructed of dry-laid boulders. Chamber 1 is a rock shelter measuring 22m on its east west axis with a ceiling height of 3m, 14.5m north south axis. The chamber contains at least six damaged plaster platforms or floors constructed with a single course of dried laid boulders filled with loose dirt, a cobble layer, and a layer of mud topped with thick plaster. In the case of Platform 6, the exterior boulders lining the platform have fallen away leaving only the remnant plaster and fill. Platform 3 standing .3m in height appears to have had two levels with a smaller tier sitting on top of a larger platform.

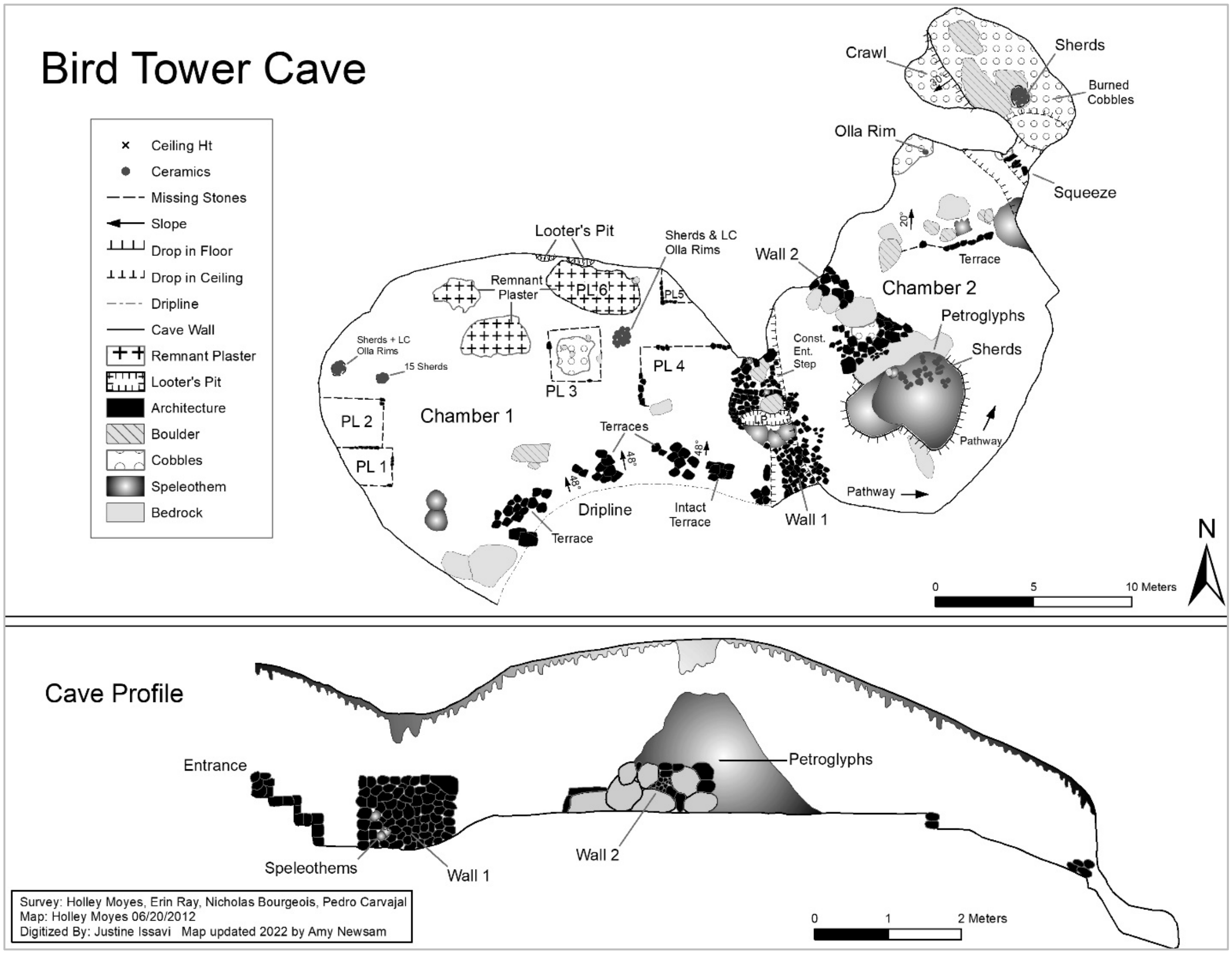

Figure 6. Map of GIS digitized map of Bird Tower Cave. Courtesy of the BCRP.

Chamber 1 contained a few jar rims dating to the Late Classic period (700-900 BCE).

Separating Chamber 1 from Chamber 2 is a thick wall (Wall 1) constructed of dry laid boulders spanning a natural constriction in the outer cave walls. It is in fairly good condition and measures 7m across and 2.5m in width. Wall 1 stands only 1.2m in height, therefore does not extend to the ceiling. A doorway or entrance was constructed at the north side measuring approximately .75m in width, enough room for one person to enter at a time using series of steps (now badly collapsed) into Chamber 2. A looters pit cut through the center of Wall 1 revealing that both broken speleothems and limestone boulders were used in its construction.

Chamber 2 measures 22m on its east west axis, 14.5m north south, with a maximum ceiling height of 2.6m. It is divided into two areas by Wall 2 that runs east to west, abutting the northwest wall of the chamber and ending at a speleothem column in the chamber's center. Wall 2 measures 5m. in length and between 1.8m and 4m. in width. A large boulder is opportunistically incorporated into the wall's construction. Placement of the wall across the chamber forces a person to move to the east of a centrally-located large speleothem column to reach the back of the cave. The northwest (interior) side of the speleothem is carved with petroglyphs, which include faces and at least one human figure. They are deeply hewn into the rock and appear to have been carved into the calcite surface before it hardened.

Most of Chamber 2 is in twilight, though the speleothem creates a dark shadow in the rear of the chamber. Moving further toward the back of the chamber is a remnant terrace that descends

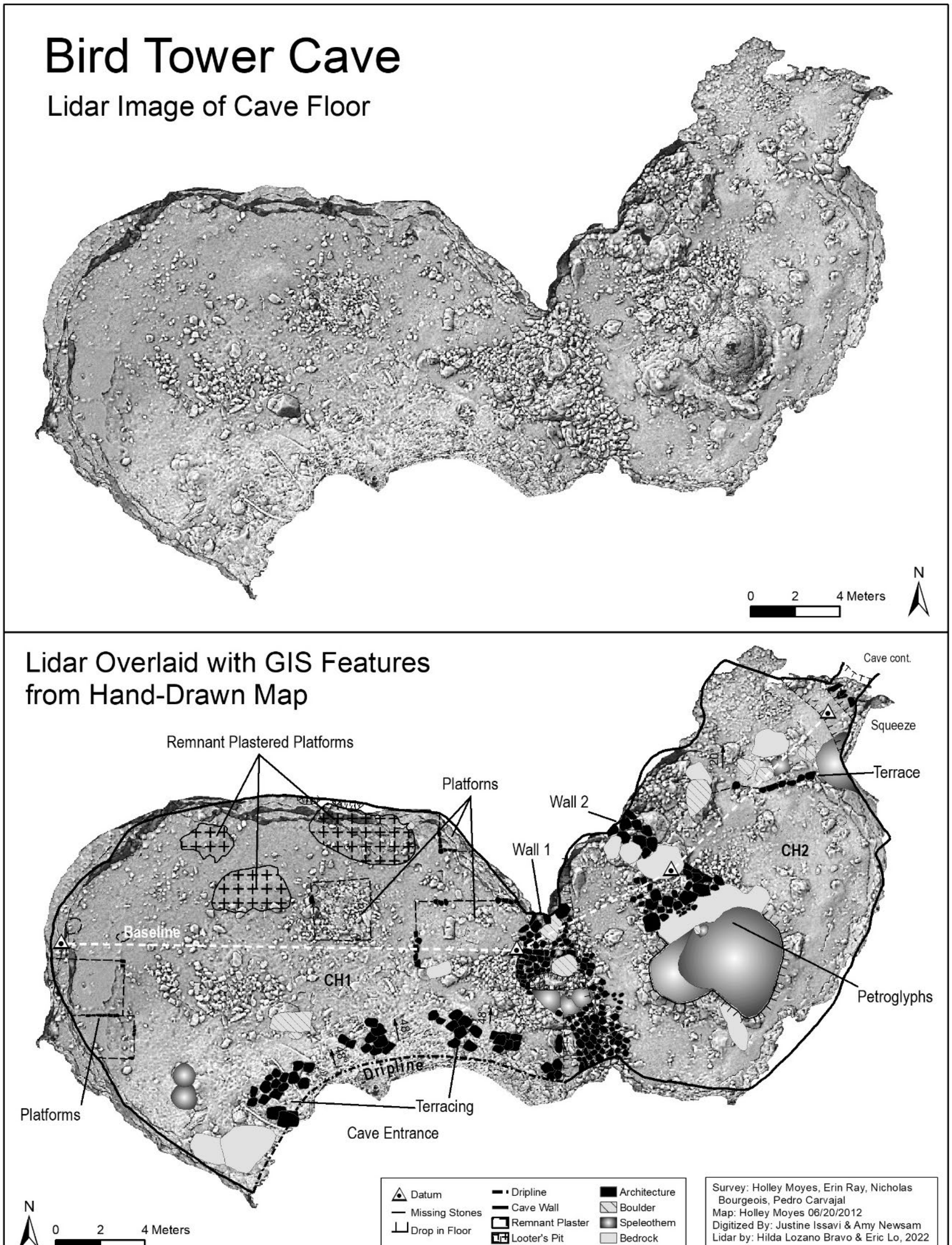

Figure 7. LiDAR generated basemap of the floor of Bird Tower Cave (top). LiDAR basemap with digital features generated in GIS from the hand-drawn map made by the BCRP in 2012 (bottom). The bottom map illustrates how a hybrid-style map could look. Courtesy of the LCAR.

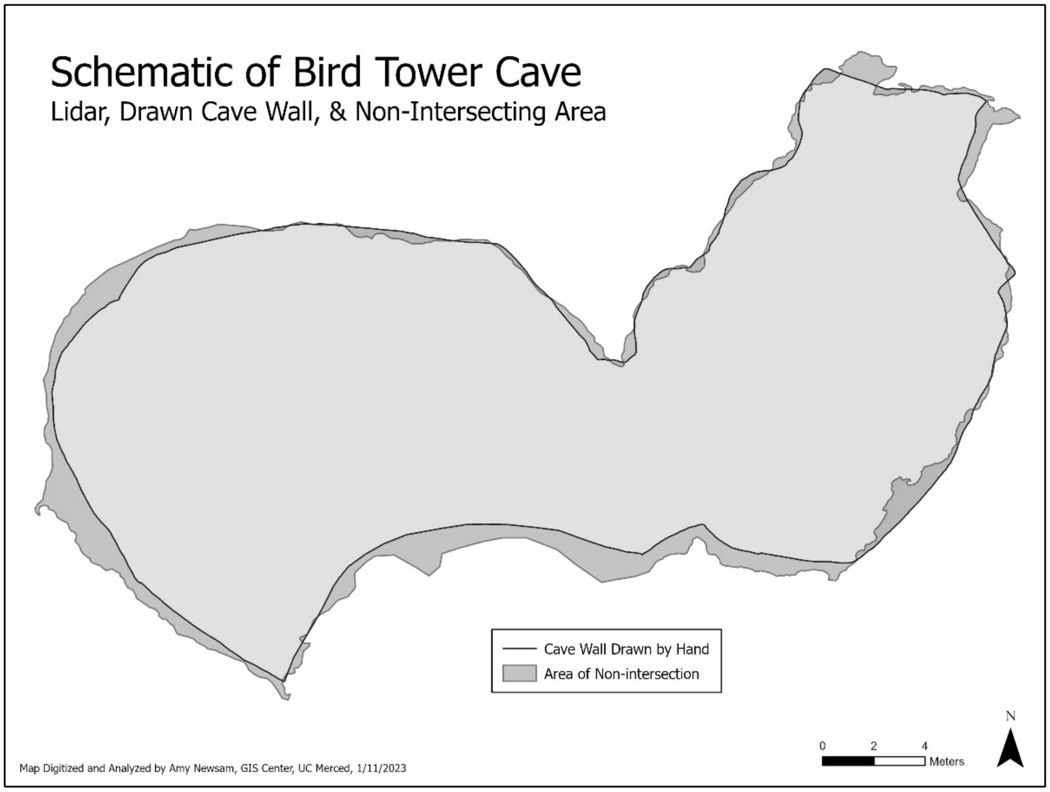

Figure 8. Overlaid polygons of Bird Tower Cave illustrating the cave wall overlap between the BRCP GIS map of the site and the LiDAR generated image. The polygon derived from the hand-drawn map is on top. Courtesy of the LCAR.

to the back wall where there is an entrance to a crawl space, which descends approximately .5m. The crawl measures 10m in length x 4.2m in maximum width and has a ceiling height that goes from 1.5m to .3m at the end. This is the only true dark zone of the cave and was likely to have been used by the ancient Maya as evidenced by a small scatter of non-diagnostic sherds and burnt cobbles. Our team was not able to scan this area during our 2022 field season due to the presence of a bat colony, therefore it is not covered in our analyses or discussion.

We chose this cave to pilot our study because of its small size, relatively simple geometry, and primarily horizontal floor surfaces, therefore it does not present the challenges one might face in a more complex system. The 3D geometry from Bird Tower Cave was collected in a single scan walking the cave with the Hovermap. The raw data from the Hovermap was processed in the Emesent Processor 1.6.2 using the standard profile to produce a 3D point cloud of the cave in .las format. The initial point cloud captured the overall cave morphology, but small-scale geometry was obscured by noisy points. To address this issue, the point cloud was denoised using CloudCompare 2.13 software's noise filter setting a radius of 5 cm. To create a plan view image of the cave illustrating features on the ground, the ceiling and walls were removed. To achieve this, we used Leica Register 360 2022.1.0 to interactively view the point cloud from different angles and manually delete those points. The resulting point cloud consisting of only the cave floor was imported into Agisoft Metashape Pro 1.8.3 to create a DEM (digital elevation model), which was exported as a GeoTIFF raster image with embedded scale information. Finally, both a color and a grayscale multidirectional hillshade were created in ArcGIS Pro 2.9.0 to highlight details in the cave floor DEM, providing the base for tracing the 2D maps (Figure 7, top). Using this raster image as the map base, it is then possible to produce either a portable digital or hardcopy version to use in the

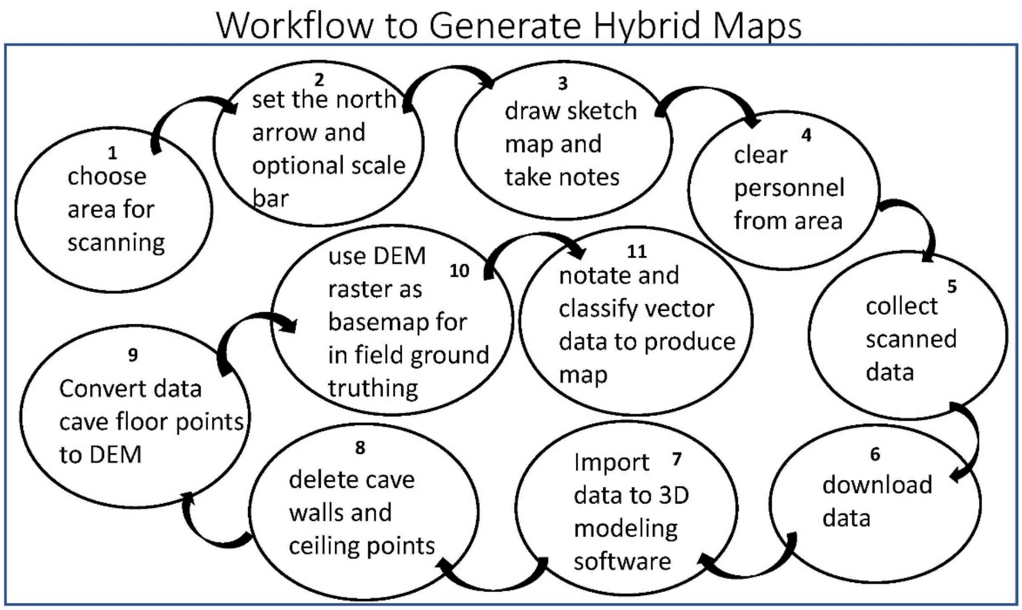

Figure 9. Workflow to generate hybrid maps.

field for ground-truthing, thus avoiding ever having to measure in cave features, one of the most time-consuming practices in recording sites.

A comparison between the LiDAR-generated image and the GIS map generated from the hand-drawn paper map is illustrative (Figure 7, bottom). The bottom image in Figure 7 displays the hand-drawn map with the baselines laid over the digital image. A few observations demonstrate the advantages and disadvantages of each recording method. First, note that the cave walls in the LiDAR image have more sinuosity and detail, hence are more accurate and precise. There is a considerable discrepancy between the two data sets in Chamber 2 west of the large speleothem located in the center of the chamber. Note that the baseline ran to the east of the image so that the speleothem occluded the direct line of site to the wall. We suspect that in this case, the wall points were estimated and sketched in. Using ArcGIS Pro 2.9.0, we created polygons using the cave wall geometry, and by overlaying the two polygons (Figure 8), we computed the difference in overlap by calculating the ratio of the non-intersecting area to the LiDAR area (assuming that the LiDAR was the more accurate).

The resulting ratio was 1:10, which represents a 10% error in the hand-drawn map. Considering the inherent problems in hand-mapping, this was less than we might have expected. However, we must also bear in mind that this particular cave was a best-case scenario in terms of hand-mapping because the cave was small, requiring only 3 horizontal baselines, and only one area of site line occlusion. In other more complex sites, we might expect a greater margin of error.

Some cultural features of interest in the LiDAR are discernable and some are not. For instance, Walls 1 and 2 are distinct. From the LiDAR image alone, one might suspect that these are walls based on the spatial distribution of the rock, but this could only be confirmed by ground truthing. The terracing at the cave's entrance could not be discerned in the LiDAR image, nor could Platforms 3, 4, and 5 or the remnant plaster floors in the northern areas of Chamber 1. Platforms 1 and 2 abutting the west wall were quite obvious. Artifacts did not show up and the petroglyphs on the carved speleothem were not evident on the LiDAR alone, though incorporating photogrammetric renderings would highlight such features. In terms of initial LiDAR data collection, this suggests that the process should include a rough sketch map of the scanned area noting important features. Ground truthing requiring field investigations is still integral to the process, though it would be possible to digitize some features in advance, resulting in field time savings. Cave wall lines and polygons could be drawn in advance of field work, and by viewing the LiDAR image in GIS or other 3D software, sloping floors and drops in ceiling could be calculated and entered onto a working basemap, further decreasing the need for measurements or field observation.

Putting It All Together

Our pilot study suggests a basic workflow for future data collection and map production that will help to guide future work (Figure 9). In the field, once an area has been selected for scanning a reflective north arrow should be placed in a flat, relatively empty area of the cave floor. If the LiDAR scanner is properly calibrated, a scale bar should not be necessary. At this point a quick sketch map (that does not require measurements or scale) is drawn and notes describing special features such as architecture, art, artifacts, and phenomenological observations can be collected. This can be useful if the team choses to add any obvious features to the basemap prior to ground truthing. Before scanning, all unnecessary personnel should be cleared of the area. People create "noise" in the data showing up in the image as "ghosts" that later need to be scrubbed increasing the time used in post-processing.

Small topographically simple caves (such as Bird Tower) may be scanned in one file, whereas more complex systems require many scans that can be "daisy-chained" or compiled to create an overall image of the site. Once the scan is complete, the image or images are downloaded either at the site or in a lab, and processed and displayed in 3D software such as the open-source CloudCompare, Blender, or other software. In the computer lab, using these 3D models it is then possible to generate a map of the floor surface. We anticipate that in complex caves with sloping floors, this process will require refinement. Depending on the data plan and amount of field time, this step could occur in the field. Using this image as the map base, it is then possible to produce either a portable digital image to be used on a tablet or laptop for infield data enhancement or collection, or a hardcopy version could be printed so that in-field notations could be made and later entered on whatever digital platform (such as Illustrator or GIS) is used to produce a 2D hybrid map. An example of how such a map would look is found in Figure 7 (bottom).

Conclusion: What we Gain from a Hybrid Model

The suggested hybrid method of site recording incorporates the greater precision and accuracy of LiDAR data, while not sacrificing the more humanistic qualities of cave mapping. It has many advantages. First and foremost, it avoids ever having to measure cave features, one of the most time-consuming practices in recording sites, thus saving valuable field time. This allows archaeologists to quickly record endangered caves sites at a more rapid rate, contributing to their digital preservation. From a humanistic perspective, archaeologists are still able to determine *what* to highlight on a map but using a scanned image as background for the basemap, this method reveals more detail than could possibly be captured by traditional cave survey with a hand-drawn map. It avoids spatial determinism by presenting a more realistic and continuous image of the floor space, but also enables the archaeologist to generate a narrative of the site by categorizing and labeling features, notating the map and including phenomenological information. Numerous platforms could be used to produce the 2D maps, but this method is compatible with GIS, so that the advantages of the system such as database management and analyses are insured. Additionally, the method increases map accuracy and precision, therefore analyses from these data will yield more rigorous results. In sum, this method solves a number of issues with map-making by creating better baseline data while maintaining much of the humanistic perspective that makes a map a map.

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9 LEVIATHAN WAKES: THE EMERGENCE OF EL PILAR AS A MAJOR CENTER AT THE ONSET OF THE LATE PRECLASSIC

Sherman Horn III, Anabel Ford, Paulino Morales, and Andrew Kinkella

The scale and extent of monumental construction at El Pilar – over 150 hectares spread across two kilometers – attest to its position as a dominant Classic-period center in the upper Belize River area. Like several nearby sites in the Belize Valley, El Pilar was founded in the early Middle Preclassic as the focus of a burgeoning agricultural community. Major architectural expansion at El Pilar accompanied population growth across the area during the transition from Middle to Late Preclassic times. This paper explores the transformation of El Pilar from village ceremonial center to political capital at the onset of the Late Preclassic. New radiocarbon dates, stratigraphic reconstructions, and ceramic analyses reveal the massive scale of architectural investment in the ceremonial core of El Pilar – Plaza Copal – during this important transitional phase. We discuss these new data and their implications for understanding the increasingly complex sociopolitical landscape of the Late Preclassic upper Belize River area. The scale of this construction boom at El Pilar demonstrates the deep roots of power its ruling elites continued to wield until the close of the Classic period.

Introduction

El Pilar was the largest Classic-period Maya city in the upper Belize River area, encompassing more than 150 hectares of monumental architecture and an extensive zone of residential settlement. Located approximately 15 km from the major Petén cities Naranjo and Holmul – and about the same distance from smaller centers in the Belize River valley – El Pilar occupied a strategic environmental position at an ecotone, where the Petén escarpments, Belize River, and low-lying northern plains converge (Figure 1). Recent analyses of excavation data, associated ceramics, and new radiocarbon dates indicate El Pilar began its trajectory toward dominance of the upper Belize River area at the Middle-to-Late Preclassic transition, around 400 BCE. The timing of this development fits well with patterns of social change documented in the Belize River area and the southern Maya Lowlands more broadly, which suggests the establishment of institutionalized social hierarchies and hereditary rulership at El Pilar early in the Late Preclassic.

Background: The Middle-To-Late Preclassic Transition in The Southern Maya Lowlands

The transition from Middle to Late Preclassic times is critical to understanding the origins of ancient Maya social complexity (see recent summary in Horn 2020). Here, we focus on major regional trends to contextualize the data from El Pilar. Settlement surveys in central Petén and adjacent areas of Belize reveal increasing populations across the region as time progressed through the Preclassic (Fedick and Ford 1990; Ford and Fedick 1992; Puleston and Puleston 1972; Rice 1976). Families continued to occupy Middle Preclassic farmsteads in most cases, and new residential groups began to fill in the Maya Forest landscape. Middle Preclassic community centers, many already possessing some form of public ceremonial architecture, expanded in size as populations around them grew.

Early public architecture – especially in the form of E-Groups (e.g., Inomata et al. 2015, 2020) – was elaborated and expanded during Late Preclassic times, as exemplified by the Petén sites Cival (Estrada-Belli 2011) and El Palmar (Doyle 2012). The scale of construction dramatically increased at Tikal (Coe 1990), Guatemala, and contemporaneous pyramid construction at Lamanai, Belize, made it one of the largest Late Preclassic centers east of the central lowlands (Pendergast 1981). A regional pattern involving the covering of Middle Preclassic residential structures by plazas has been documented at Cahal Pech (Awe 1992; Horn 2020), Cerros (Cliff 1988), Cuello (Hammond et al. 1991), Pacbitun (Healy et al. 2004), and San Estevan (Rosenswig and Kennet 2008) in Belize, reflecting the transformation of these small community centers into formalized seats of authority.

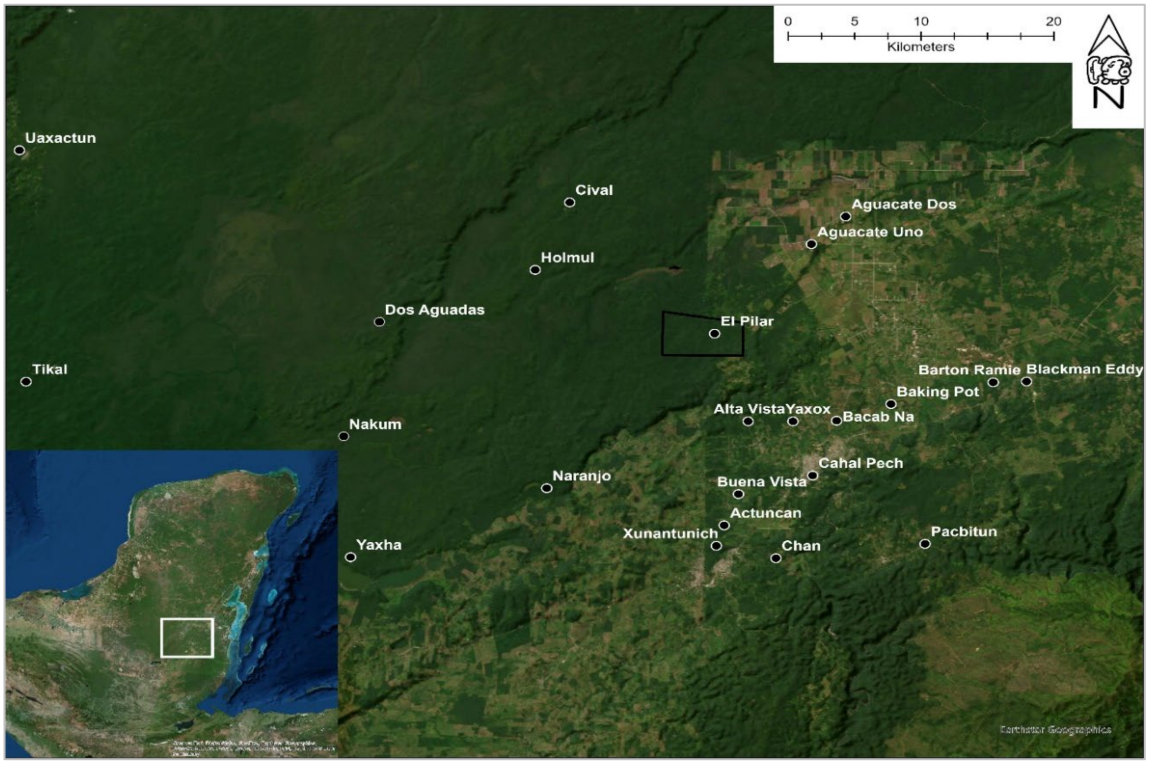

Figure 1: Location of El Pilar in the eastern Maya lowlands.

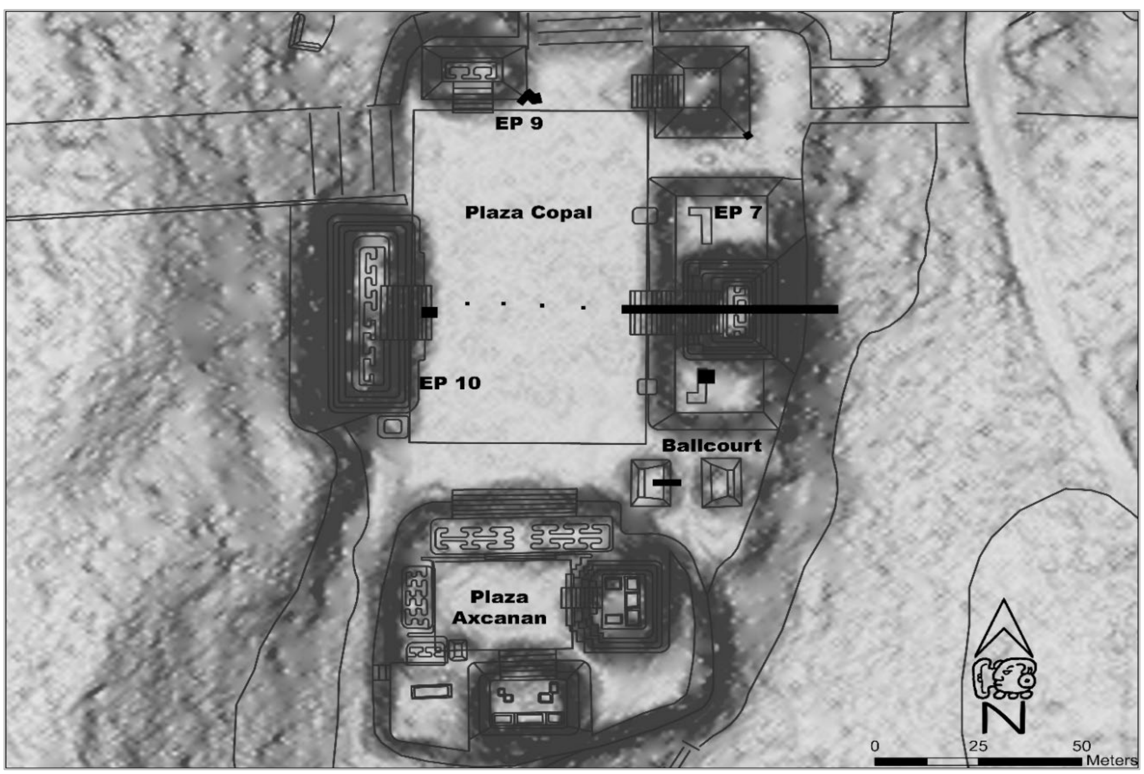

Figure 2: Nohol Pilar, showing locations of structures and excavations discussed in the text.

The increased emphasis on large-scale monument building, the more formalized use of space, and the flourishing of elite symbols at Late Preclassic centers likely reflect the entrenchment of hierarchical leadership structures that were beginning to emerge in Middle Preclassic times (Freidel and Schele 1988). Architectural sculpture flourished, building on Middle Preclassic traditions (Garber et al. 2004) to create a program of stucco deity masks that became widespread across the lowlands (e.g., Hansen 1992; Pendergast 1981).

This study places El Pilar into the chaotic milieu of increasing social complexity that characterized the transition from Middle to Late Preclassic across the Maya Lowlands. The nature and extent of interactions between the sites mentioned and El Pilar are not currently known, but the patterns described above provide a framework for interpreting new data.

Investigating Preclassic Developments at El Pilar: Materials and Methods

We base our recent analyses on materials excavated at Nohol Pilar, the large southern architectural complex in the eastern monumental group of the El Pilar epicenter. The El Pilar Project excavated this area between 1993 and 2004 and produced detailed records of architectural development in the form of profiles and plan drawings, which we revisit here to focus on Preclassic architectural developments. We review the large numbers of recovered pottery fragments for chronological information and evaluate selected sherd lots related to early construction phases for greater precision in our temporal assessments. New information comes from a suite of 20 AMS radiocarbon assays from charcoal collected in the excavations, which were processed and analyzed by the Keck-Carbon Cycle AMS facility at the University of California, Irvine. We use the OxCal program and the IntCal20 calibration curve to calibrate and present the dates in this paper (Reimer et al. 2020).

Excavations at El Pilar focused on defining major Classic-period architecture and establishing a site chronology. Investigating deeply buried Preclassic occupations was not a primary goal of the project, and thus our window into the earliest settlement is narrower than at other sites. The most direct evidence for Preclassic developments comes from a series of excavations in and around Plaza Copal, the largest plaza and ritual center of El Pilar for much of its history (Figure 2). The excavations most relevant to our study of Preclassic developments comprise:

1. Deep soundings into the southern platform or "wing" of EP 7, the primary temple of Plaza Copal and eastern structure of its E-Group.
2. Excavation of the southeast corner of EP 9, a pyramid marking the northwest corner of Plaza Copal, and the adjacent plaza floor.
3. A test unit through the playing alley of the ballcourt south of EP 7 and the cleaning of a looter's trench in the western structure.
4. A tunnel through the centerline of EP 7, beginning in Plaza Copal and continuing 42 meters to the eastern side of the structure.
5. An axial trench in EP 10, the massive structure enclosing the western end of Plaza Copal and the counterpart of EP 7 in the central E-Group.

Radiocarbon dates (Table 1; Figure 3) and associated ceramics from these excavations provide a history of Preclassic settlement and construction in the El Pilar epicenter. These data anchor chronological interpretations of building episodes elsewhere at the site and allow us to cautiously extrapolate the scale of Preclassic construction to areas outside Plaza Copal. We discuss these examples after presenting chronological data from the excavations listed above.

Middle Preclassic El Pilar: Founding of A Community Center

To understand social changes that occurred at El Pilar at the beginning of Late Preclassic times, we must know something about the existing community that experienced those changes. Evidence from sites across the Maya Lowlands suggests increasingly complex social relationships characterized burgeoning Middle Preclassic agricultural communities, which appear to be focused on central places with public architecture built at varying scales.

Table 1: Radiocarbon date ranges for samples discussed in the text. All dates are calibrated BCE.

Sample Number	Calibrated 2-sigma date ranges All dates BCE	
	Early	***Late***
R_Date 7108	1050	920
R_Date 936	785	565
R_Date 933	765	540
R_Date 7183	755	420
R_Date 7156	750	415
R_Date 941	750	415
R_Date 7123	395	205
R_Date 7176	390	205
R_Date 784	380	205
R_Date 1048	380	205
R_Date 7170	370	200
R_Date 7173	360	170
R_Date 7131/132/133	355	170
R_Date 7180	355	170
R_Date 7130	355	170
R_Date 7119	355	160
R_Date 750	355	150
R_Date 7140	355	115
R_Date 7115	350	110
R_Date 7116	355	100

What we know of Middle Preclassic El Pilar fits well with the model of a modest-sized community center, with the area beneath Plaza Copal likely functioning as the ceremonial heart of a growing village.

Our knowledge of the initial settlement at El Pilar is limited, and we cannot report with any certainty on its size or configuration. Two lines of evidence, however, suggest El Pilar was founded around the same time as other early centers in Petén and the Belize Valley. The first is a single radiocarbon date (R_Date 7108) from a deep fill deposit excavated from the Southern Platform of EP 7 (Lavarreda 1995; Figure 4). The stratigraphic position of this deposit above several substantial building episodes suggests the dated material is redeposited midden.

The validity of this early date as an indicator of permanent human presence at El Pilar by at least 1000 BCE is supported by the recovery of pre-Mamom pottery fragments from Plaza Copal excavations. Small numbers of sherds from everted rim dishes and rounded bowls displayed dull red slips and post-slip incised designs, which were similar to Cunil complex vessels from the Belize Valley and other comparably early ceramics from across Petén (e.g., Nievens 2018; Sullivan and Awe 2013). These early sherds were found in deposits mixed with later materials, but their presence in the assemblage provides corroboration for placing the initial settlement of El Pilar around 1000 BCE, at the very beginning of the Middle Preclassic.

Evidence for slightly later occupation, with dates spanning the Middle Preclassic (800-400 BCE) but clustering in the first half of this range, comes from beneath the southeast corner of EP 9 and the tunnel through EP 7 (see Figure 2). The EP 9 corner excavation revealed a series

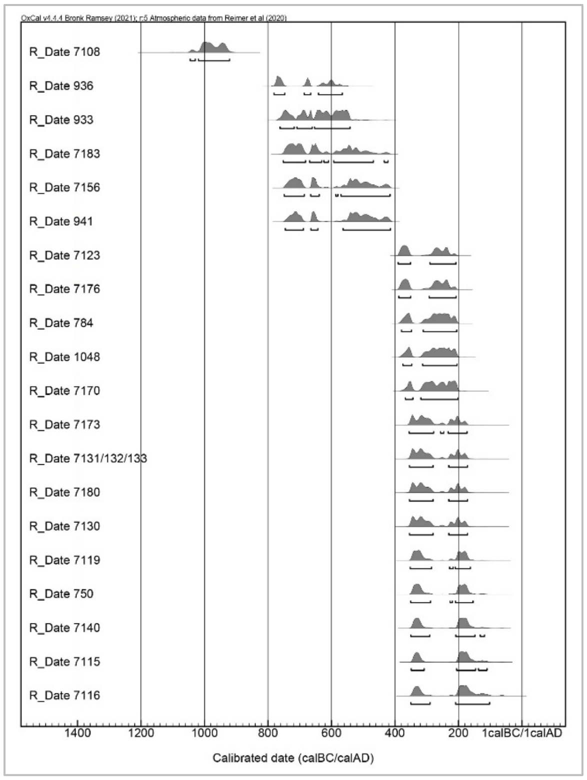

Figure 3: Graphic representation of calibrated radiocarbon presented in Table 1.

of stone alignments beneath the adjacent plaza floor that were likely related to the elevation of the northwest corner of Plaza Copal. Buried beneath this later construction was a small round platform with a thick plaster surface, only part of which could be exposed due to its location under EP 9 (Figure 5). We estimate the diameter of this platform to be about 4.5 m based on the curvature of the exposure, and it was raised 30 cm over the surrounding plastered surface.

No postholes were discovered on the exposed surface of this platform, suggesting a potential function as an oratory or stage for the performance of small-scale rites. Three radiocarbon dates (R_Date 936, R_Date 933, R_Date 941) associated with this structure place it squarely in the Middle Preclassic.A shallow, red-slipped, outcurving dish – provisionally assigned to the Joventud ceramic group – was cached at the base of a wall outside the round platform and may mark the beginning of plaza construction that raised and covered this area.

Tunneling through the center of EP 7 (Orrego 1995) revealed an extensive construction history centered on that location with origins in the Middle Preclassic (Figure 6). A plaster plaza floor, exposed for more than 30 m from west to east, was the clearest manifestation of Middle Preclassic public architecture at El Pilar. Associated with small, stone-faced structures to the west that were demolished by later construction, this floor created a paved, open surface to the east and was oriented away from the later Plaza Copal. A radiocarbon date (R_Date 7183) from a deposit beneath this floor aligns with the Middle Preclassic round structure under EP 9, suggesting the constructions were roughly contemporaneous. Ceramic lots from beneath the plaza floor contained fewer sherds than those from overlying architectural phases, but all diagnostic sherds reflected Middle Preclassic types of the Savana, Jocote, and Joventud groups, which accord well with the radiocarbon dates.

Additional evidence for Middle Preclassic construction in the vicinity of Plaza Copal comes from a test excavation in the ballcourt south of EP 7. This unit was placed in the playing alley adjacent to a looter's trench in the ballcourt's western structure to expand the profile obtained from cleaning the trench. Excavation revealed a buried stone alignment oriented east-west beneath the ballcourt, and associated ceramics indicated this structure was built in Middle Preclassic times. No radiocarbon assays have yet been run on materials associated with this structure.

Summary of the Middle Preclassic at El Pilar

Combining this somewhat limited dataset, we can develop a picture of an emergent Middle Preclassic ceremonial center located beneath Plaza Copal at El Pilar. The original configuration of the built environment has yet to be revealed, but ceramic and radiocarbon data suggest El Pilar was settled at roughly the same time as other early centers in Petén and the Belize Valley, likely around 1000 BCE. In the centuries that followed this initial occupation, the residents of the growing village built more durable structures of stone and plaster. Round structures resembling the platform buried beneath EP 9 have been documented across the Preclassic Maya Lowlands and appear to have served various functions related to ritual performance (Aimers et al. 2000). The construction of a

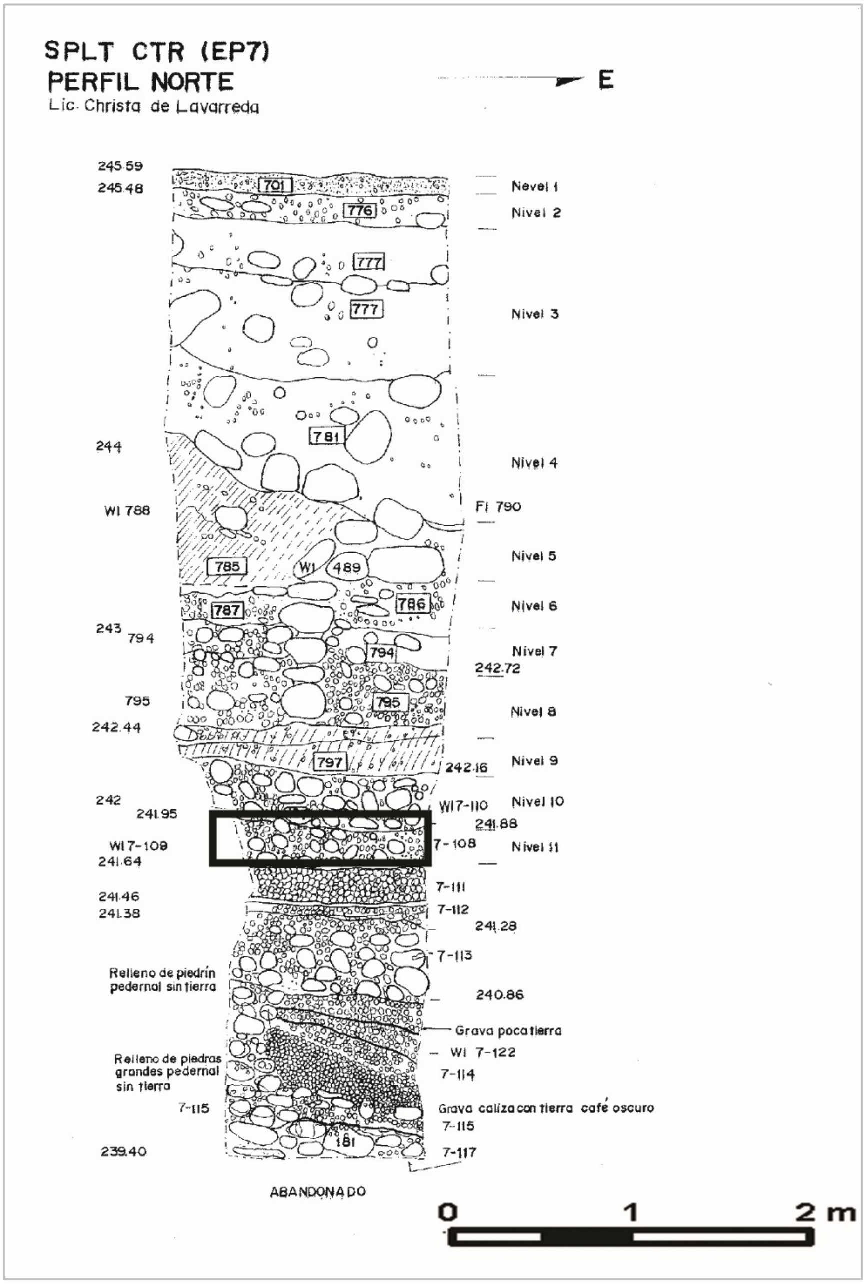

Figure 4. North profile of EP 7 South Platform excavation, showing deposit that produced early date R_Date 7108.

nearby plaza created open space for people to gather and participate in a wide range of public activities. The size of this plaza represented a significant investment in public architecture for what was presumably a small-scale, yet growing, agricultural village. Based on the architectural evidence at hand, Middle Preclassic El Pilar appears to fit the pattern – documented at several sites in nearby areas of the southern Maya Lowlands – of an early community center showing signs of increasingly complex social organization.

Late Preclassic El Pilar: The Emergence of a Major Power

At the end of the Middle Preclassic, around 400 BCE, the community center beneath Plaza Copal was rapidly transformed by a flurry of construction activity. Mirroring events at sites across the southern Lowlands, Middle Preclassic

Figure 5. Photograph of round structure and overlying construction beneath corner of EP 9.

architecture at El Pilar was engulfed by larger and more formalized Late Preclassic structures and plazas. Data from the Plaza Copal excavations reveal the large-scale building program in the ceremonial heart of El Pilar and provide a foundation for interpreting Late Preclassic construction in other areas around the site.

EP 7 Tunnel Sequence

The largest dataset of Late Preclassic construction activities derives from the tunnel through EP 7, which revealed an unbroken sequence of Preclassic-to-Classic buildings. AMS dates and associated ceramics place five construction episodes in the relatively short timeframe of 400-100 BCE, corresponding to the onset and early facet of the Late Preclassic period (Figure 7). The scale of these structures, partially revealed in tunnel stratigraphy, dwarfed all previous construction, and the short span of the AMS dates indicates a rapid building tempo.

The Late Preclassic monumental program beneath EP 7 began with the construction of a large, black clay platform over the remains of earlier stone wall foundations at the western end of the Middle Preclassic plaza floor (Orrego 1995). This platform measured approximately 8 m east-west, with a ramp-like surface sloping downward to the level of the earlier plaza floor in the east. In the west, excavations revealed a step leading down to an elevated plaster plaza floor that continued beneath Plaza Copal. We estimate the height of this platform to be at least two meters, although the summit protruded above the roof of the tunnel. The congruence of the eastern ramp edge with the plaza floor indicates this earlier floor was still in use at the time of platform construction. The step and later plaza floor in the west, however, suggest a reoriented focus for activities that reflected the later configuration of Plaza Copal.

Initial ceramic assessments indicated a Middle Preclassic date for the construction of this large clay platform, and Middle Preclassic Mars Orange and Jocote-group sherds were indeed numerous in its associated lots. The sherd lots also contained high frequencies of Chicanel-sphere, Sierra-group everted rim plates and bowls, which are diagnostic markers of the Late Preclassic period. This temporal mixing of pottery accords well with both the stratigraphic position of the platform and its associated AMS date (R_Date 784) at the early end of the Late Preclassic sequence, placing construction of the platform near the Middle/Late Preclassic transition. The proportion of Middle Preclassic sherds in the assemblages of later constructions was also notably less than in this early, transitional manifestation of EP 7.

As impressive as the black clay platform must have been to the inhabitants of the growing center of El Pilar, what their leaders built next was even larger, and larger still after that. Using a mixture of cobble and sediment fill, the Late Preclassic builders of EP 7 expanded the structure upwards and primarily to the east, where roughly hewn masonry blocks marked the faces of two apparent terraces in the tunnel sequence. A single stone wall three courses high probably marked the first riser of a staircase in the west, which was set about 50 cm in front of the early clay platform. We estimate this structure – likely a flat-topped platform – to have been about 11.5 m in the east-west dimension and to have risen 2.5 m above the plaza floor in the west. It stood an even more impressive 3.5 m over the older plaza floor to the east, on which surface its rear terraces were built. Two AMS assays (R_Date 7123, R_Date 7119) are somewhat spread out over the early end of the Late Preclassic, but an age of around 350 BCE seems likely. Pottery from the various fill deposits contained within this structure was dominated by Late Preclassic Chicanel-sphere sherds, according well with the radiocarbon age.

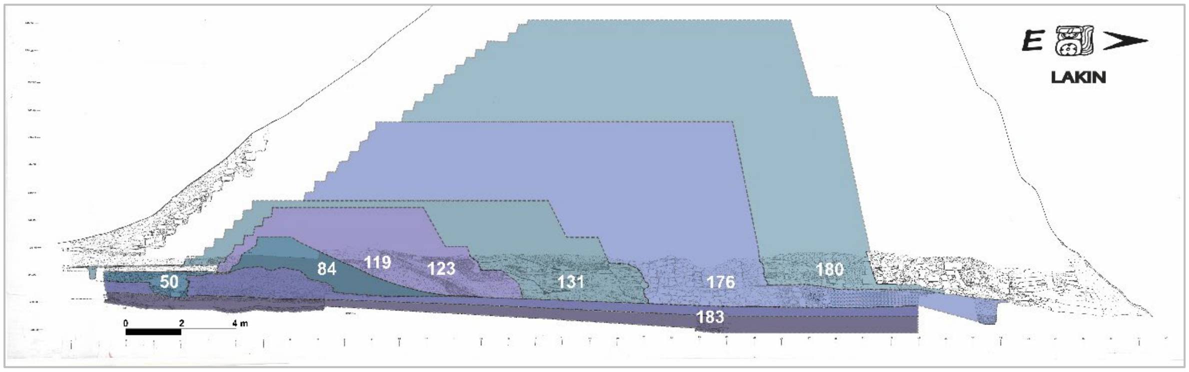

Figure 6. North profile of EP 7 tunnel with Preclassic construction phases highlighted. Numbers correspond to radiocarbon samples that date each phase.

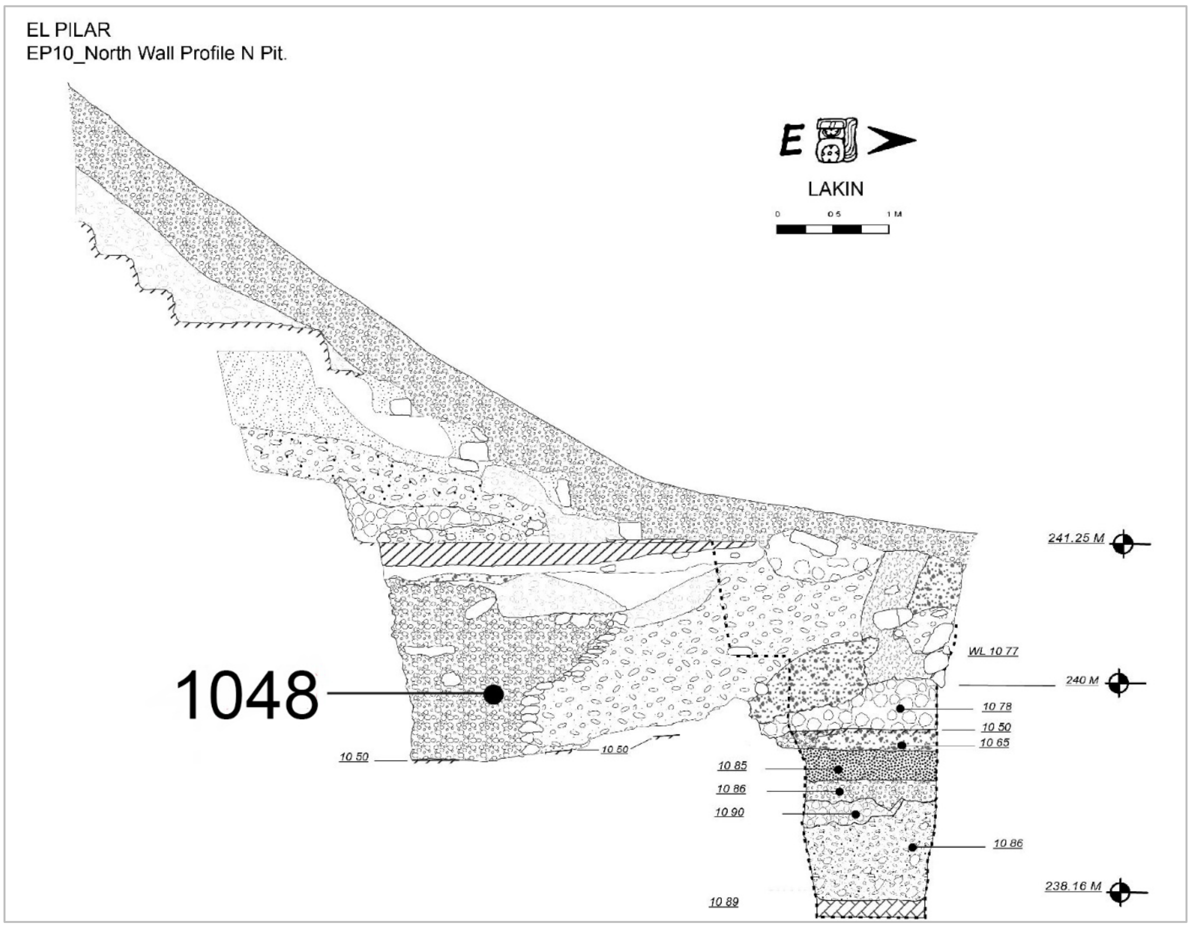

Figure 7. North profile of EP 10 axial trench, highlighting clean cobble fill deposit.

The succeeding building phase provides the last evidence of westward expansion of EP 7 during Late Preclassic times. A two-course stone wall, set about one meter west of the previous building's staircase, likely represents the basal riser of a new stair. This step was built on a new floor that raised the level of the western plaza by about 20 cm. The major expansion of this structure was again to the east, increasing its size in that direction by 4.5 m over the preceding platform and appearing to end in two terraces across its eastern face, just as its predecessor had. Our estimates suggest that for all this addition of depth to the platform – it now measured a full

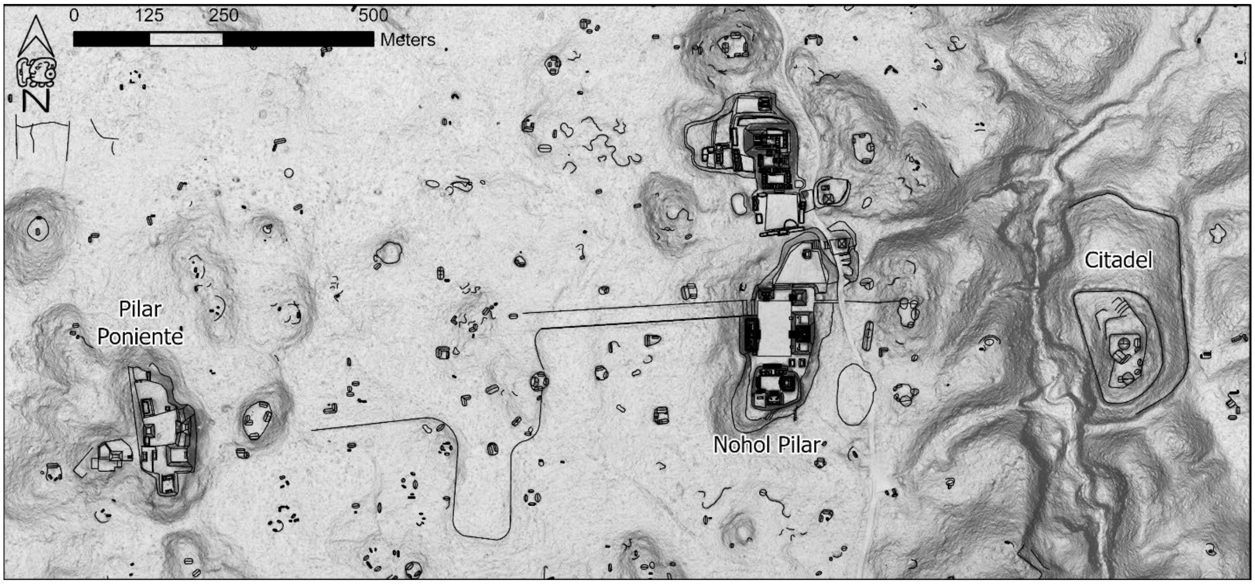

Figure 8. El Pilar city center showing monumental groups discussed in the text.

17 m east-west – its height was only minimally increased, perhaps reaching 20 cm higher than the structure it covered. This may reflect a north-south expansion of the structure along an axis perpendicular to the direction of the tunnel. One radiocarbon assay (R_Date 7131) again yielded a date range of in the early half of the Late Preclassic, suggesting another short interval of time elapsed between building episodes.

The final two Late Preclassic building phases of EP 7 present a sharp change in both construction techniques and the probable shape of the building. No remnants of the plaza-facing stairways of either structure were encountered in the tunnel, suggesting two possibilities: 1) these later buildings completely covered their predecessors but were partially dismantled by Classic-period construction, or 2) the stairs of these last Preclassic buildings did not reach plaza level, but instead used the surface of the preceding platform as a landing to create a stepped effect. The level of demolition that would be required to remove all traces of such monumental structures from the centerline seems too substantial to have been likely, so we prefer the second possibility in our reconstruction.

The partially rounded or sloping terraces that marked the eastern face of the previous constructions were replaced by steeply angled facades with walls of masonry blocks at their base. This change created taller, more imposing buildings that began to approximate the shape of their Classic-period successors. An innovation that may have allowed this change in building form was the use of cut-stone construction bins to contain "clean cobble" fill, which replaced the mixed fills used in earlier versions of EP 7. We note the use of similar deposits of dry-laid chert cobbles in other Late Preclassic constructions at El Pilar below.

We estimate the first steep-sided pyramid in this sequence measured 22 m east-west, including the stairs from its predecessor, and stood approximately five meters over the western plaza floor. AMS assay R_Date 7176 again falls in the range 400-200 BCE, fitting well with its position in the stratigraphic sequence. The final Preclassic manifestation of EP 7 measured about 25.5 m east-west and must have towered an impressive 15 m above Plaza Copal in the west. The AMS assay associated with this construction (R_Date 7180) produced a slightly later date range of 355-170 BCE, shifted toward more recent times than the dates of its immediate predecessor.

EP 10 Axial Trench

Additional evidence for large-scale Late Preclassic construction in Plaza Copal comes from an axial trench placed in EP 10 (Figure 8), the large structure framing the western edge of the plaza. After penetrating the base of the central stairway, this trench revealed a complex construction sequence including multiple fill episodes that raised Plaza Copal to its present elevation. Buried beneath the basal steps were the remains of an eastward-sloping wall or terrace, reminiscent of the back terraces of earlier manifestations of EP 7 across the plaza. Overlying part of this potentially earlier building was a large deposit of "clean cobble" fill, whose unstable nature forced excavation in the trench to cease. One AMS assay (R_Date 1048) places this deposit in the early Late Preclassic range of 400-200 BCE, indicating construction of large buildings was not limited to the area of EP 7 during this period of rapid growth. The additional Late Preclassic radiocarbon age associated with clean cobble fill adds confidence to chronological interpretations of this construction technology where dates have yet to be obtained.

Ballcourt, The Citadel, Plaza Axcanan, and Pilar Poniente

With the Late Preclassic construction sequences in Plaza Copal firmly anchored by radiocarbon dates and associated ceramics, we turn our attention to areas of El Pilar where dating relies on ceramics and/or construction technology. Cleaning of a large looter's trench in the western structure of the ballcourt south of EP 7 revealed its construction sequence and yielded diagnostic ceramics of the Chicanel sphere. The temporal relationship of the ballcourt's construction to the massive investments in EP 7 are not clear, but all major building phases were datable to the Late Preclassic by associated ceramics. Major construction was therefore begun and completed in the Late Preclassic, with only minor maintenance activities carried out through the centuries of the Classic period.

Late Preclassic construction with no Classic-period architectural overlay also characterized the largest buildings atop the Citadel, a monumental hilltop group of eight mounds located to the east and across a steep ravine from El Pilar. The most recognizable features of the Citadel are the ramparts that encircle the cluster of buildings on the summit, which have been mapped but not yet investigated to determine their construction chronology. Cleaning of looter's trenches into the two largest structures once again produced pottery fragments diagnostic of the Late Preclassic, with the inclusion of trickle- or resist-ware sherds suggesting construction continued until later in the period. Whatever the function of this enigmatic group, it appears to have been part of the same Late Preclassic building program that produced many monumental structures in the site epicenter.

Clean cobble fill was encountered in plaza test units in Plaza Axcanan, a 30-x-25-m plaza raised above Plaza Copal to the south. Access to Plaza Axcanan from Plaza Copal was restricted by a large range structure, and the palaces and pyramids that enclose it may represent a Classic-period royal residence. The principal structures of Plaza Axcanan await more detailed investigation, but the probability that construction of this monumental group began in the Late Preclassic is intriguing, especially if the interpretation of a royal residence is borne out by evidence. Clean cobble fill was also noted as a major architectural component in the largest structure at Pilar Poniente during salvage excavations by IDAEH (Ramirez Baldizón and Montejo Diaz 2008). A massive looter's trench that effectively split the structure in two and exposed large, dry-laid core deposits caused much of the earlier construction phases to collapse and threatened the integrity of the entire pyramid. Conditions recorded during operations to stabilize and consolidate this structure suggest this was the same Late Preclassic construction technology documented in the eastern monumental groups.

Summary of the Late Preclassic at El Pilar

New AMS dates and associated ceramics reveal a large-scale Late Preclassic building program at Plaza Copal that transformed the earlier community center into a colossus of monumental temple pyramids. The relatively tight range and overlap of the dates indicate the rapid tempo of monument construction at EP 7, with newer and larger versions completed every other generation. Late Preclassic monumental building was not confined to Plaza Copal but appears to have been undertaken in several areas across the site, from the Citadel in the east to Pilar Poniente in the west.

Discussion And Conclusion: Preclassic Transitions At El Pilar

The picture emerging from this study suggests El Pilar followed a trajectory comparable to that of other sites in the Maya Lowlands during Preclassic times. This began with an early foundation by people using pre-Mamom pottery, likely around 1000 BCE, and saw the growth of El Pilar into a community center with public architecture in the succeeding centuries of the Middle Preclassic. There was an explosion of monumental construction and a reordering of the ceremonial environment at El Pilar sometime after 400 BCE, followed by rapid change and expansion over the course of the Late Preclassic. Tunnel excavations in EP 7 indicate monument building continued in that area until the Terminal Classic, representing an unbroken construction sequence in the ceremonial core of nearly 2000 years (Ford 2004; Ford and Horn 2017).

Late Preclassic sociopolitical relationships remain largely obscured by the mists of time and building habits of the Maya, but the data from El Pilar suggest a major transformation took place at the onset of this period. Changes in political organization, likely representing the development of institutionalized hierarchies characteristic of later Maya civilization, allowed leaders to embark on a massive building program that vaulted El Pilar to the highest rungs of the settlement system in the upper Belize River area. Direct evidence for the emergence of kings during Late Preclassic times remains elusive at El Pilar, but the scale and tempo of monument construction – and the control of labor needed to accomplish those feats – strongly suggest the centralization of political power occurred during this period.

The results of our study document the emergence of El Pilar as a major local power at the onset of the Late Preclassic. Understanding the factors underlying this transformation is the focus of ongoing research. Whether the answer lies in population increases, intensifying interactions between developing polities at the local and regional scales, increasing control over productive lands, or other potential factors, more directed research into the Preclassic at El Pilar has the potential to illuminate the essential processes that created complex Maya societies.

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10 ADAPTING THE FOREST: A SPATIAL MODEL OF SUSTAINABLE MAYA PRODUCTION AT EL PILAR

Justin Tran and Anabel Ford

If one considers the Maya forest as a domesticated landscape, as an alternative to what prevailing views of "shifting agriculture" have posited, a new view of the Classic Maya landscape is envisioned. The milpa cycle is a land use system first encountered during the Spanish conquest that ensures consistent availability of resources when envisioned over a 20-year cycle. The cycle includes open fields emphasizing annual crops, perennial succession focused on products used in home and maintenance, and closed-canopy forests for fruits and products used in construction. Recognizing that land use is dependent on knowledge, skill, and labor, we consider the whole production cycle in providing sustenance and shelter, as well as a habitat for wildlife. Modeling the milpa cycle presents an example of the Maya transformation and adaptation of their landscape to provide for burgeoning populations amidst the tropical woodlands. To test the limits of the cycle and its viability in a real-world context, we create a spatial model of land use covering an 18 square kilometer settlement area at El Pilar using ArcGIS and knowledge of Maya dietary requirements. The results guide a discussion of the sustainability and sufficiency of the milpa cycle within the Maya forest.

Introduction

The Maya civilization arose in the tropical forests of southern Mesoamerica and maintained a presence there for millennia, leaving an ecological footprint on the landscape that echoes to the present day. In the context of the Maya forest, the Maya developed hand-cultivation practices clearly attuned to the tropical environs in which their civilization flourished. Discussion persists on whether these techniques could sufficiently provision the burgeoning populations of the Maya—such questions are at the crux of the debate surrounding the reasons for the Classic Maya collapse (Turner and Sabloff 2012). Determining whether the Maya were capable of controlling deforestation and overpopulation warrants a greater exploration of Maya land use and their ability to extract resources without damaging the environment from which they derived their wealth. In order to test the Maya agricultural system known as the milpa cycle and its viability on a settlement scale, we conduct land use modeling at the Maya center of El Pilar through the use of Geographic Information Systems (GIS).

El Pilar is a major Maya city center on the divide of modern-day Belize and Guatemala. The settlement straddles an ecotone of limestone ridgelands characteristic of the greater Petén to the west and the alluvium of the Belize River Valley to the south and east (Ford et al. 2009). Lidar scans of the area, initially conducted in 2012 and extensively ground-truthed over the following years, reveal a complex topographic mosaic within the 20 km^2 boundaries of the El Pilar Reserve for Maya Flora and Fauna that includes numerous hills, stream beds, and flat areas (Horn III et al. 2019; Figure 1). The local area comprises well-drained ridge lands, wetlands, poorly drained lowlands, as well as limited alluvium (Ford et al. 2009), reflecting a varied microcosm of the Maya landscape. These conditions at El Pilar, in conjunction with Lidar scans and settlement survey data, constitute an appropriate study area for land use modeling.

The Milpa Cycle: Forests and Fields

The milpa forest-garden cycle is a traditional swidden cultivation system that produces over 90 types of annual crops in both forest and field environments. The milpa system plays out in an approximately 20-year cycle, progressing from annual crop production in fields opened through controlled burns, to perennial succession providing domestic goods, to managed closed-canopy forests and back again (Ford and Nigh 2015:43; Figure 2). The polyculture cycle provides a skillfully curated range of foodstuffs and domestic goods, including resources for home maintenance (Ford 2020). Plots are staggered to operate asynchronously in varying stages of the cycle at any given time according to need and location (Ford and Nigh 2015:60). The maintenance of closed-canopy forest integrates the milpa cycle with the natural woodland ecology, conserving water, replenishing the soil, and reducing erosion

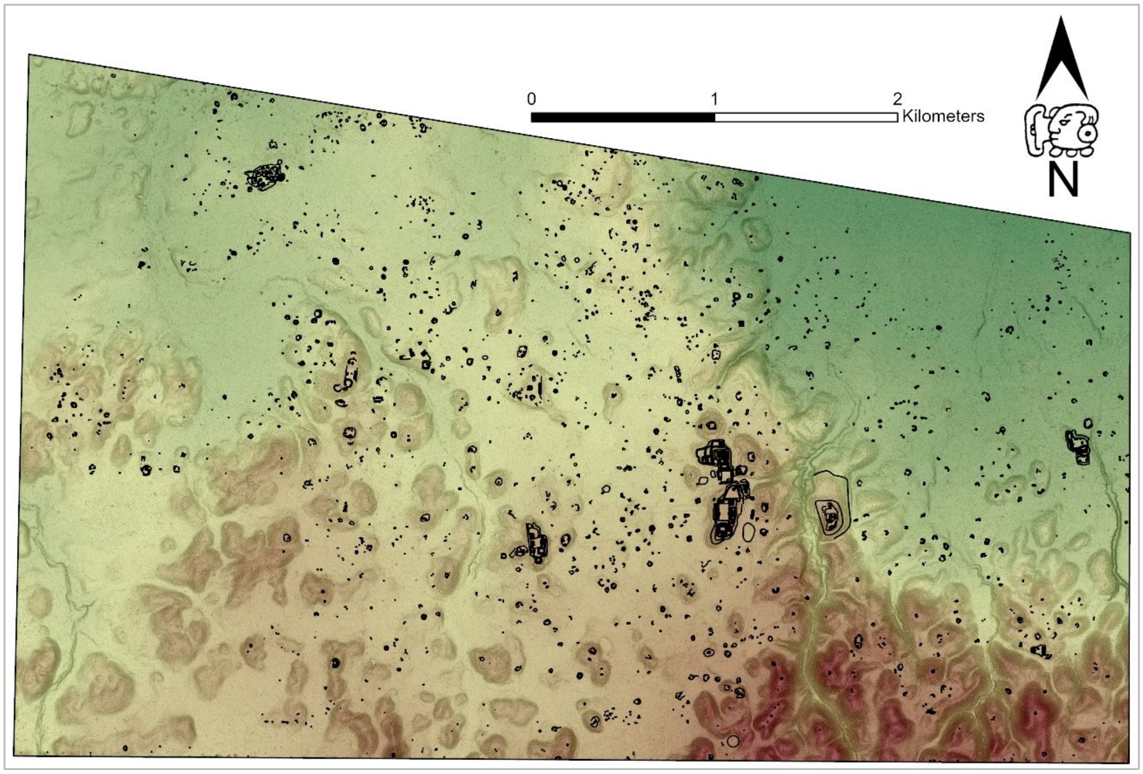

Figure 1. Map of El Pilar showing 2022 settlement survey against a Lidar-produced digital elevation model (DEM).

Figure 2. The stages of the milpa cycle (Credit: MesoAmerican Research Center).

while encouraging the propagation of useful plants and trees (Campbell et al. 2006; Ford et al. 2021; Ford and Nigh 2015:57; 98). Such practices also maintained a biodiverse habitat for wildlife like deer, birds, and bees which could be hunted and relied on for ecological functions like pollination and seed dispersal (Everton 2012; Ford 2008; Greenberg 1992; Hernández Xolocotzi et al. 1995:63-64).

As Terminal Classic populations grew and economic pressures mounted, it is suggested that the woodlands were widely cleared in successive shortenings of the 'fallow' period (a term incorrectly applied to the managed succession phase). Such practices supposedly resulted in destructive environmental consequences and the climate-induced collapse of Maya societies (Diamond 2005; Turner and Sabloff 2012, Webster 2002). Modern pasture-and-plow techniques, traced to the imposition of European-style agriculture on the Maya lowlands in what can be termed "ecological imperialism," have only inflamed perspectives of the traditional milpa system as contrary to agricultural efficiency (Crosby 1986). However, the pre-contact Maya had no conception of pasture-and-plow, and both forest and field were tapped for their value, resulting in a visible legacy of resource production in the Maya forest (Ford 2022; Ford and Nigh 2015:38).

Thus, a paradox arises: if the traditional Maya agricultural system relied upon the forest as a replenishing stock of goods, why then would they have destroyed the forest in an attempt to simply feed themselves? With growing populations, agricultural intensification was necessary, but would it necessarily translate to environmental exhaustion or excessive deforestation? An alternative perspective on the Maya ability to provide resources of food and shelter from the landscape in a sustainable manner must be entertained. Our analysis begins with determining whether the milpa cycle could indeed be viable in feeding an urban Maya population, and this is the viewpoint from which we create the milpa cycle model.

The Milpa Cycle Model

In visualizing the milpa cycle against the geographic conditions of El Pilar, we estimate the area of land optimal for agricultural activity. Using ArcGIS Pro software, the model was constructed over an 18.50 km^2 study area at El Pilar containing verified archaeological features. Three 'ineligibility factors' make up the foundation of the agricultural model. The first ineligibility factor concerns slope, serving as a primary determinant of cultivable land. This involves a map visualizing steep land that would be affected by erosion. The second ineligibility factor is defined by areas that contain architectural features, thus limiting cultivation. The third ineligibility factor is defined by areas surrounding 'primary residential units' (PRU) to reflect the presence of infield home gardens identified in traditional Maya land use systems. By combining these components, we derive an estimate of land ineligible for the milpa cycle, which can be inversely used to approximate eligible land for milpa cycle cultivation at El Pilar.

Using Ground Slope as a Representation of Erosion

Erosion is identified as a major limiting factor in agriculture, where soils affected by wind or water exposure become increasingly non-negotiable for cultivation due to the reduction of the topsoil. Ground slope presents a proxy for representing erosion hazards in our model; the steeper the slope, the more soil erosion (Montgomery 2007). To identify the slope characteristics at El Pilar, we first produce a raster map of ground slopes at El Pilar measured in percentages. Minimum and maximum slope limits, 7% slope and 15% slope, were identified based on Scott Fedick's (1995) work in applying United States Department of Agriculture (USDA) land classification systems to the agricultural landscape of the Maya.

The process for identifying and isolating all land above a 7% and 15% slope limit follows these successive steps. A three-meter resolution slope raster was generated from a Lidar-derived Digital Elevation Model (DEM) of El Pilar using geoprocessing tools. The slope raster underwent conditional evaluations, where cells of the raster with a value above the designated percentage were given a value of zero, and cells with a value below were given a value of one. The rasters were then converted into polygons, each retaining the assigned values; we then isolate the zero-value polygon, which represents areas at El Pilar considered ineligible for milpa cycle cultivation based on erosion susceptibility (Figure 3). It should be noted that, perhaps due to the resolutions involved, areas with identified terraces were at times classified as having ineligible slopes, despite assumptions that such features were constructed to accommodate agricultural activity. Manual editing was required to reclassify this land as potentially cultivable.

Defining Architecture and Cultural Features as Obstructions to Cultivation

It is logical that milpa cultivation would not occur where there are spatial impediments to the agricultural process. These manifest as architecture and other cultural features where the space would have been occupied by physical obstructions. In the existing GIS framework at El Pilar, these features are drawn as polylines representing their location and spatial extent. All cultural features at El Pilar are represented by these polylines, including house mounds, *plazuelas*, terraces, berms, quarries, *chultunes*, and water-retaining depressions or *aguadas*.

We converted the polylines into more exact planar representations of area using geoprocessing tools. We generated a six-meter resolution raster grid covering the extent of the

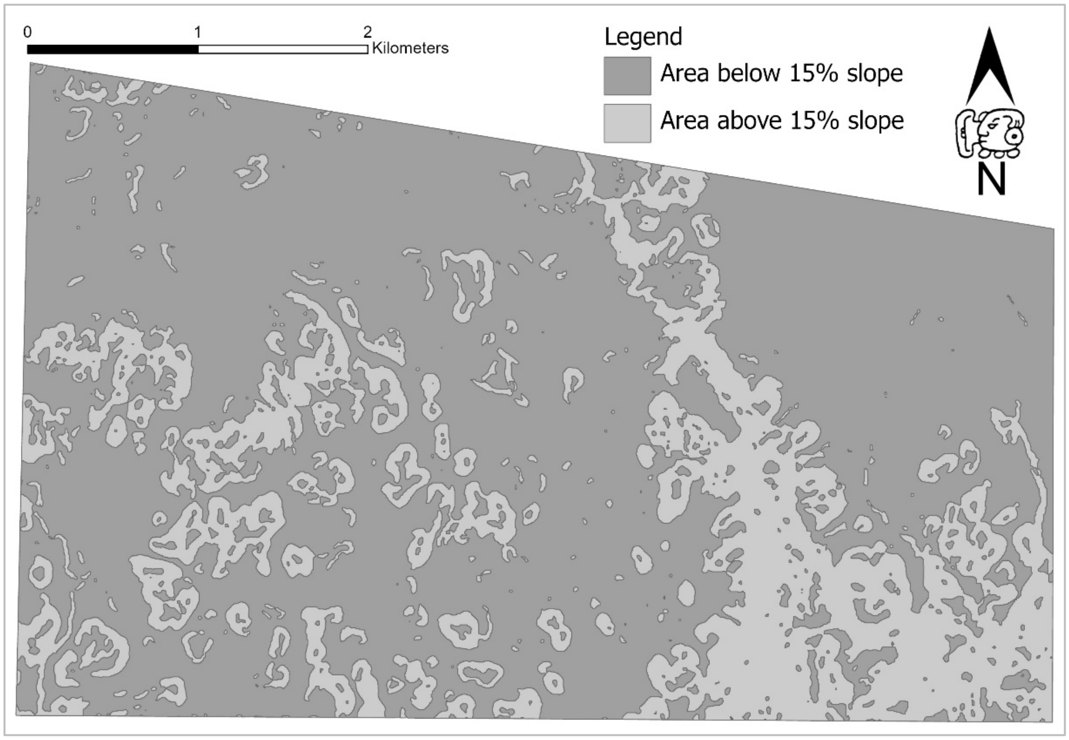

Figure 3. Map of ground slope at El Pilar delineated by the 15% cutoff point.

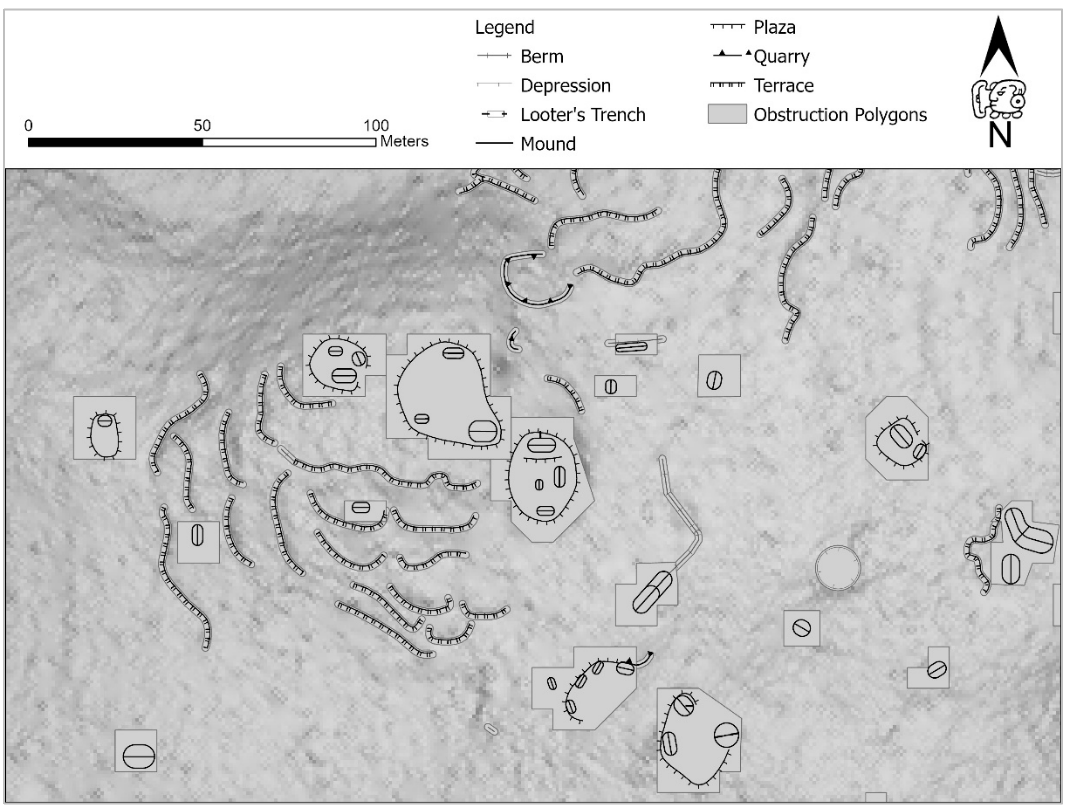

Figure 4. Obstruction polygons covering cultural features at El Pilar.

polylines and converted this to polygon format as a direct conversion proved ineffective for the El Pilar data. Some corrections were required in cases where areas were incorrectly classed as eligible for cultivation due to the inability of ArcGIS to recognize the nuances of some cultural features. In these instances, manual editing was applied to delineate architectural areas. For linear features such as terraces and berms, a 1-meter circular buffer was generated around them to reflect their linearity. This process resulted in polygons denoting the area containing cultural features at El Pilar ineligible for milpa cycle cultivation (Figure 4).

Creating Infields around Primary Residential Units and Unifying the Model

We next establish which residential units at El Pilar constitute a primary residential unit (PRU) or a secondary residential unit (SRU). The classification of PRUs and SRUs impacts both the location of infields and population estimates. Infields are home forest gardens that consist of the personal orchards and crops that Maya families would cultivate in an average 4,000 m^2 area around their primary residence (Fedick 1992). The household-based infields would have been supplemented by outfield agriculture, represented in our milpa cycle model, occurring beyond the residential unit (Ford and Nigh 2015:119-121). Infield polygons were generated by creating a circular Euclidean buffer around PRU polygons. As ArcGIS lacks the functionality to create buffers of a specified area based on varying input polygons, we instead inputted a variable distance value (in this case, 24 m) which generated areas that averaged approximately 4,000 m^2 across all buffer polygons. This creates visual approximations of infield area at El Pilar and thus land that would not be undergoing outfield milpa cycle cultivation (Figure 5).

This process results in the three constituent parts of the model: 1) polygons representing areas above 7% and 15% slope, 2) cultural feature obstruction polygons, and 3) PRU-infield polygons. These elements are then merged to create a unified polygon representing all land considered ineligible for milpa cycle cultivation at El Pilar. By taking this polygon and subtracting it from a polygon representing the full extent of the study area, the remainder represents the total eligible area for agricultural cultivation at El Pilar.

Calculating Population Estimates and Maize Crop Yields

We use the derived cultivable area in conjunction with accounts of traditional Maya maize yields and population estimates for the El Pilar area to determine the viability of the milpa cycle in sustaining a population. Determining population counts is the subject of much debate and speculation, but common methods count observed structures as representing houses for estimating population (see Culbert and Rice 1990; Healy et al. 2007:30; Robin 2012). When considering the residential patterns of contemporary Maya farmers, however, a distinction must be made as to what may represent a household. At El Pilar, residential units are classified into two types to represent this distinction: PRUs and SRUs. PRUs are defined as household groups often comprising at least two structures as per traditional farming household dynamics (Everton 2012:58; Hanks 1990:95-96; 333). SRUs represent secondary residences that may have served as ancillary structures and agricultural storage in peripheral areas (Zetina Gutiérrez 2007).

Residential unit types are classified by evaluating several criteria: structure dimensions (diagonal length and height), structure counts within a group, *plazuela* (raised platform) presence, and labor investment (LI) values (Ford and Clarke 2016). Labor investment, measured in labor-days, represents time devoted to gathering resources for and constructing perishable structures (Ford and Clarke 2016; accord Arnold and Ford 1980; Erasmus 1965). PRUs in the model were identified as single or multiple structure units with an LI value of greater than or equal to 500 labor-days or any group with a *plazuela.* SRUs are not included in the population.

We consider PRUs as the source of population estimates and assign a commonly applied value of 5.5 people per PRU (see Haviland 1972; Healy et al. 2007:31; Robin 2012:41; Turner 1990). Though not all residential groups at El Pilar can be assumed to have been inhabited concurrently, we assume

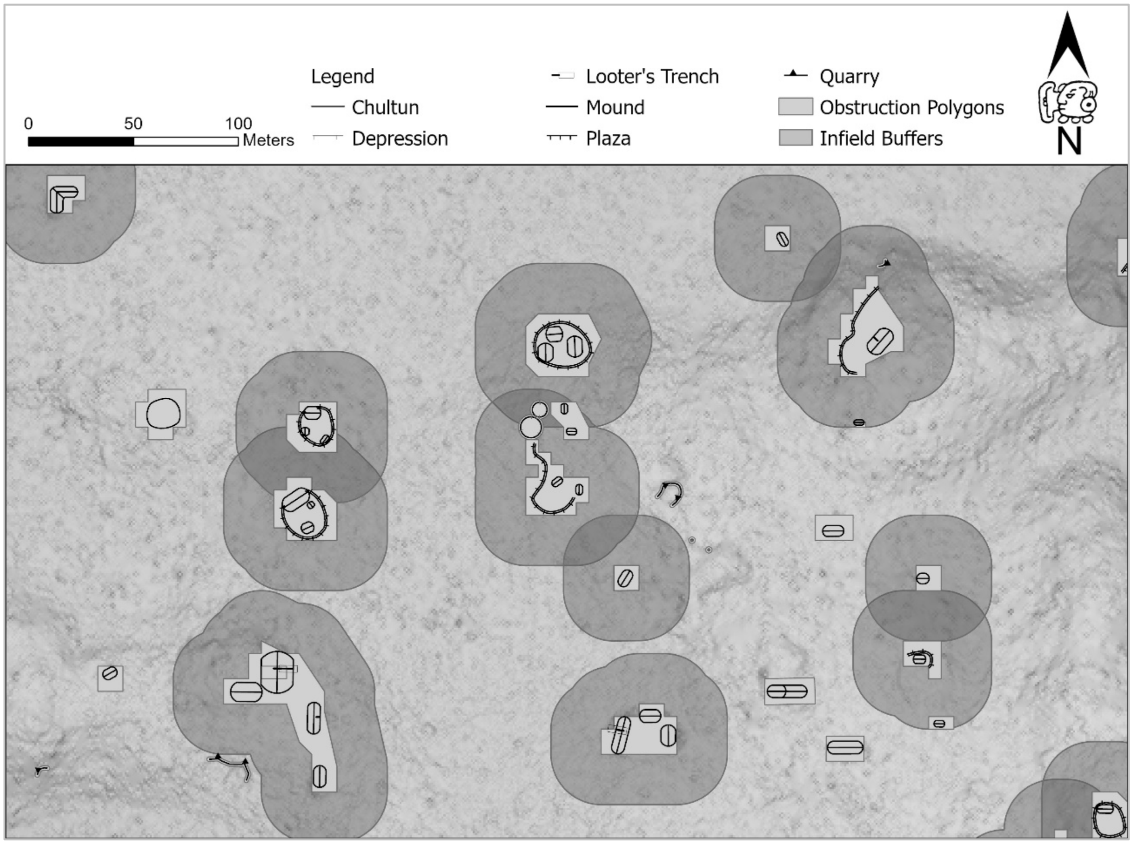

Figure 5. Infield buffer polygons surrounding primary residential units at El Pilar.

Table 1. Population calculations for El Pilar and caloric requirements of the established population using maize as a proxy.

PRU Count	692
Population	3,806
Daily energy intake of average human in kcal (Anriquez et al. 2010; Basset and Winter-Nelson 2010:21; Shapouri et al. 2009)	2,100
Annual caloric requirement of El Pilar (kcal)	989,843,547
Energy output of maize in kcal (Leung and Flores 1961)	3,551
Annual requirement of maize (kg)	278,750.65

100% occupation for the purposes of the model. We then calculate the annual caloric intake required by the estimated population. In discussing food requirements, we acknowledge maize as a major component of the diet and use it as a proxy for caloric input. It is important to remember, however, that the polyculture milpa cycle would have provided a wider variety of foodstuffs. Knowing caloric requirements, thus, it becomes possible to identify how much maize would have been needed to feed the population (Table 1).

Next, we identify how much land would be needed to produce the required amount of maize. There are a number of sources providing approximated maize outputs amongst Maya communities, but for the purposes of this exercise, we assume a productive range of 1,144 to 1,642 kilograms per hectare (Redfield and Villa Rojas 1962; Schwartz and Corzo 2015;

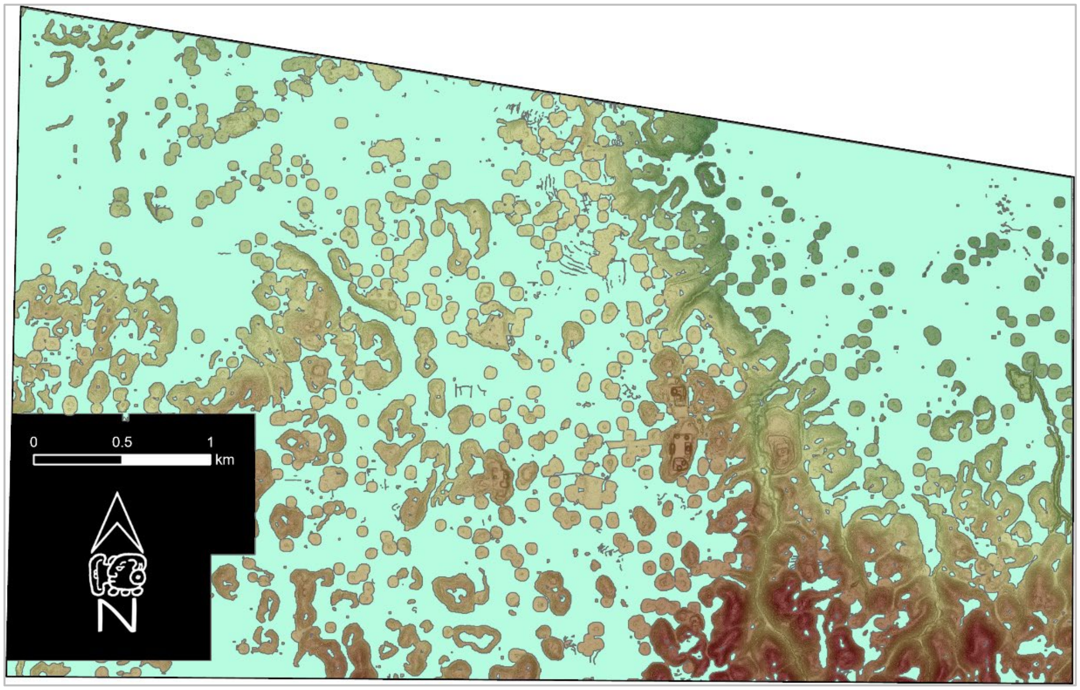

Figure 6. Cultivable area within the study area at El Pilar using the 15% slope model.

Table 2. Derived areas from the milpa cycle model, including cultivable outfield land and values derived from the constituent parts of the model.

Study Area (km^2)	18.5
Total Cultivable Outfield Land - 15% (km^2)	11.24
Total Cultivable Outfield Land - 7% (km^2)	7.19
Total Infield Area (km^2)	0.83
Total Architectural Area (km^2)	0.78
Total PRU Area/Percentage of Architecture (km^2)	0.37/47%
15% Very Steep Area (km^2)	4.97
7% Moderately Steep Area (km^2)	10.38

Steggerda 1941; Villa Rojas 1945), with higher outputs scaling with greater agricultural intensity. We use these values in conjunction with the annual maize requirements of El Pilar to determine how many hectares or square kilometers are necessary to produce that range. The outfield land required for producing 278,750.65 kg of maize at production rates of 1,144 kg to 1,642 kg/ha is identified as 2.44 km^2 to 1.70 km^2 respectively. This number is multiplied by five to reflect the fact that one-fifth of the approximately 20-year milpa cycle would be producing maize at any given time (Ford and Nigh 2015:121), giving us the land required to accommodate the entire cycle. This value comes out to 12.18 km^2 to 8.49 km^2, respectively.

Results

Products of the Model

We derive a range of measurements from the milpa cycle model including the area of land available for cultivation under the established ineligibility conditions (Figure 6). Additional area measurements can be derived from the model when evaluating the components used in its creation (Table 2).

Ability of the Area to Fulfill Land and Maize Requirements

The results of the model are applied in the context of approximated maize yields and population estimates to determine the sufficiency of the land at El Pilar to adequately support the population through the milpa cycle. It is important to recognize that the amount of land required for the milpa cycle and the land required to produce enough maize for the estimated population are not the same; home infields produce a supplemental portion of maize annually that is not represented in the outfield production cycle. Thus, two fulfillment standards are evaluated: whether there is enough land available for the whole outfield milpa cycle, and whether the maize needs of the population are met given both outfield and infield maize production.

As it stands, land available within the 7% model is insufficient to support the entire population through the whole outfield milpa cycle given the range of approximate maize yields. Within the 15% range, the land available falls just short, fulfilling 92% of the land required if yields were 1,144 kg of maize/ha yet 132% of the amount needed if yields were 1,642 kg/ha (Table 3.1).

Acknowledging that 30% of infield land is dedicated to producing maize annually (Everton 2012:57-72; Ford and Nigh 2015:120; Lopez Morales 1993:222), we use the value of infield land derived from the model and multiply it by 0.3 to determine how much infield land is dedicated to maize. This infield value contributes to the value of outfield maize land determined in the steps prior to gain an approximation of all maize cultivation land. The addition of the infield maize value makes a marked distinction in the overall maize production. In the 7% model, the range nearly meets the land required if yields were 1,144 kg of maize/ha and exceeds it for 1,642 kg/ha. The addition of the infield maize value for the 15% model provides sufficient maize yields that provide 128% to 184% of needed maize, far in excess of the basic requirements for the population (Table 3.2). These results influence our analysis of the sufficiency of the milpa cycle and its implications for agricultural intensification and environmental impacts.

Discussion

It is observed that, even within the narrowest thresholds for cultivability with the 7% model, the maize needs of El Pilar can be fulfilled when infield-outfield agriculture is conducted with intensity to produce yields between 1,144 kg to 1,642 kg of maize/ha. If reliance is only on the outfield milpa cycle, this is only feasible at the 15% slope threshold and with maize production of 1,642 kg/ha. While the needs of the population are fulfilled under these circumstances, El Pilar appears situated on a threshold where further intensification of agriculture may have been necessary to assure food sovereignty. Methods of intensification take forms both evident and imperceptible, manifesting visibly in the form of landesque capital and invisibly in adjustments to agricultural practices. In the case of El Pilar, there is reason to believe the milpa cycle was intensified via adjustments to agricultural practices more so than landesque capital, even with the presence of some terracing and berms at the settlement.

Terraces and berms, noted in specific sectors of El Pilar (Ford 2014), present evidence of visible land use intensification at El Pilar. Terraces are interpreted in the Maya lowlands to have provided agricultural benefits, expanding steep areas to slow water movement and preventing soil erosion and retaining water by reducing surface runoff (Chase and Weishampel 2016; Johnston 2003). Areas that are waterlogged may have been managed through landesque investments to drain the water, as seen with the raised and drained fields in the north of Belize (Beach et al. 2009; Turner and Harrison 1983). These are not noted at El Pilar.

The relative proximity of berms to terraces in the north of El Pilar hint at related purposes; it is observed, however, that the presence of berms with irregular orientations and shapes at El Pilar indicates that a portion of these land modification features may have served non-agricultural functions (Horn and Ford 2019). In addition, when observing the area taken up by such investments through the model, we note that they only represent approximately less than one km^2 or 4% of the land within the study area. In other words, a large amount of cultivable land does not have evident land modification constructed by the Maya. This is true even in

Table 3.1. Land required for the entire milpa cycle to take place over 20 years and how it compares to available land at El Pilar.

Slope Model	Land Available for Entire Cycle (km^2)	Land Required for the Entire Cycle from Minimum-Maximum Yield (km^2)	Percentage Fulfilled at Minimum-Maximum Yield
7%	7.19	12.18-8.49	59%-85%
15%	11.24	12.18-8.49	92%-132%

Table 3.2. Land available for cultivating maize at El Pilar and how it compares to available maize land at El Pilar.

Slope Model	Maize Land in Outfields	Maize Land in Infields	Maximum Maize Land Including Infields (km^2)	Land Required for Maize from Minimum-Maximum Yield (km^2)	Percentage Fulfilled at Minimum-Maximum Yield
7%	1.44	0.88	2.32	2.44-1.70	95%-136%
15%	2.25	0.88	3.13	2.44-1.70	128%-184%

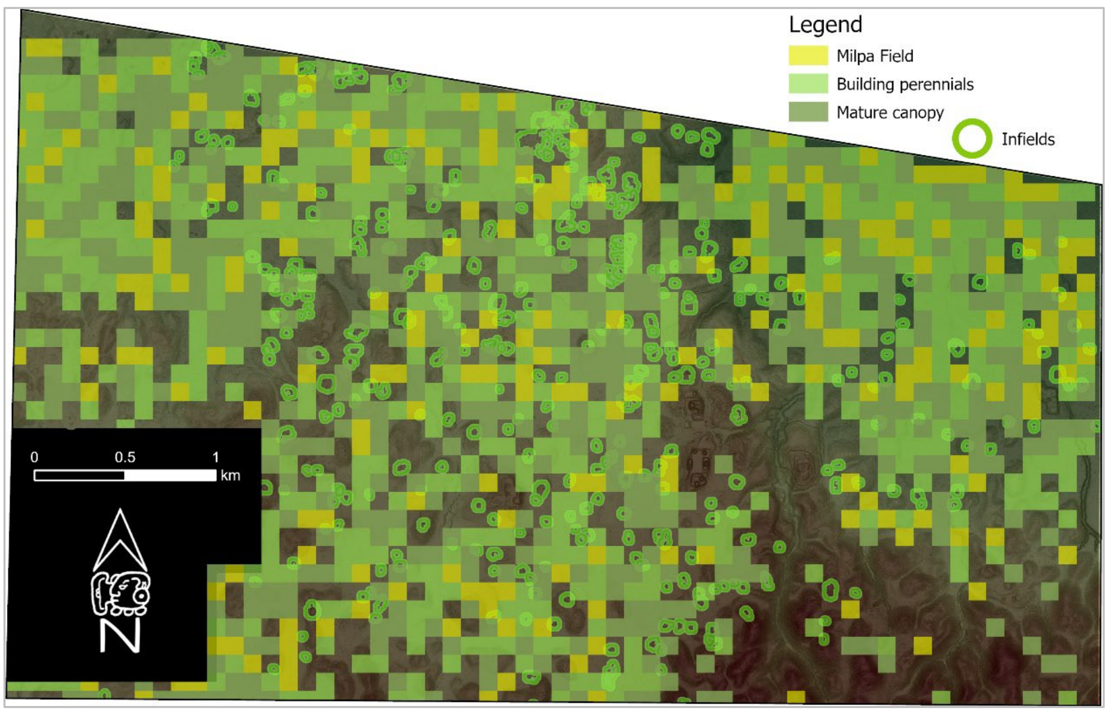

Figure 7. The stages of the 20-year milpa cycle overlaid against the 15% slope model of cultivable land. Each square represents one hectare.

areas of existing terrace-berm complexes such as ‘Berma’ (see generally Horn and Ford 2019). A level of invisible labor intensification was evidently occurring to a greater degree than that of landesque capital investment at El Pilar.

Invisible production multipliers manifest primarily as adjustments in labor, skill, and scheduling practices. Labor investments may involve increased time, effort, and maintenance devoted to soil enrichment practices and cultivation phases (Ford and Nigh 2015:76; see Boserup 1965; Johnston 2003). As a ‘skill-oriented’ agricultural system, the milpa cycle is similar to those described by Bray (1986), where production is increased by improving the quality of the labor force, specializing skillsets or training workers in matters such as crop selection, managing biochar and organic inputs, and water control (see also Scarborough 2003:13-16). Schedule adjustments include modifications in the timing of planting and reaping, in accordance with intensification strategies observed in other pre-industrial agricultural systems (see Stone et al. 1990). Such strategies are present in Maya agricultural examples, as the high, 2,800 kg/ha maize yields of the Lacandon Maya were brought primarily through adjustments to labor, skill, and scheduling (Ford and Nigh 2015:64-67; Nations and Nigh 1980). These production multipliers leave no mark on the archaeological landscape which accords with the absence of widespread landesque capital at El Pilar as well as other centers such as Tikal.

What invisible intensification does not entail, thus, is a compromise of the milpa cycle or a need to overuse the landscape by, for example, reducing forest cover for the proliferation of maize fields. Rather, it is a negotiation of the existing methods to ensure all the daily needs are met with minimal disruption to the landscape that served the populace. As seen by the results of the model, the land within the study area of El Pilar can be sufficient to sustain the needs of the population relying on the milpa cycle, with adjustments to labor, skill, and scheduling as the strategy for agricultural intensification. Indeed, while the model guides an approximation of the area of cultivable land, what should not be ignored is *how* the area involved is managed by farmers to extract resources from the entire landscape of forests and fields (Figure 7; see also Figure 11 in Ford et al. 2021). The milpa cycle model provides a spatial context for further investigations into these capabilities and encourages the incorporation of real-world environmental contexts in the exploration of Maya sustenance and resource sustainability.

Conclusion

The milpa cycle model presents a method of visualizing land use by evaluating empirical conditions of topography, cultural and architectural remains, and traditional land use systems based on local ecological knowledge. Consideration is placed on the practical elements that affect resource production. Such conditions are represented through ArcGIS to derive an approximation of cultivable land within the confines of a Maya settlement. From the derivation of cultivable land, we use population estimates and observed traditional crop yields to determine the sufficiency of the land in sustaining an urban Maya population. In the course of our analysis at El Pilar, we have determined that the land is sufficient to support maize production at a medium-to-high level of yield, which translates into the need for Maya farmers to develop land use adaptations relying first on labor, skill, and scheduling followed by land modifications.

Future elaboration of our model will refine and improve the understanding of potential Maya land use. Development of the GIS model will focus on reducing the manual input involved and creating a more direct reflection of cultivable land. Such improvements will make the model easily applicable to other Maya settlements, with inputs adjustable depending on topographic conditions and architecture at other archaeological sites. We also intend to include additional factors of agrarian landscapes such as soil conditions, recognizing that the model in its current form is driven primarily by slope whereas a variety of other conditions can affect the cultivability of land. We recognize too that the model is constrained to the boundaries of the El Pilar Reserve - questions remain on the degree to which the model captures the full historical extent of the settlement, as well as the degree to which certain resources would be externally sourced.

As modern landscapes grow to be dominated by intensive monocultural agriculture and cattle pasturage, the perception of the traditional milpa system as ineffective when compared to such strategies persists. The milpa cycle, however, should not be evaluated on the basis of mechanized agricultural techniques, nor should we assume that the cycle's management of forests could be so easily compromised in the name of increased agricultural production. Millennia of forest-dwelling, the legacy of which lives on in the modern Maya forest, charts the success that sustained the ancient Maya. To suggest that the Maya engineered the destruction of their environment is a viewpoint that demands scrutiny. The milpa cycle represents an agricultural symbiosis of field and forest, a system that can be intensified to meet needs without compromising the environment from which the Maya managed food, domestic resources, and wildlife habitats. The creation of our model serves to test the limits of the milpa system in order to better entertain alternative perspectives on ancient Maya resource production and the development of sustainable practices in the context of the tropics.

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11 ARCHITECTURE AND RITUAL PRACTICE IN THE ACTUNCAN E-GROUP

Borislava S. Simova

Situated on a ridge overlooking the Mopan River, the Plaza F complex of Actuncan forms one of the key early ceremonial spaces within the Preclassic Maya landscape of the Upper Belize River Valley. Its architectural configuration, consisting of a plaza flanked by an elongated eastern platform and western pyramid, defines it as an E-Group. E-Group complexes were some of the first public ceremonial structures constructed in many Middle Preclassic Maya sites (1100 – 900 BCE) and served important ritual and community-integrative functions. In examining the central structures of the Actuncan Plaza F complex, we can evaluate how the distinct constructed components of the complex were integrated over time to fulfil these functions, despite variations in construction materials, labor, and patterning of ritual deposits. Changes occurring during the development of the complex in the Middle Preclassic to Terminal Preclassic period (1100 BCE – 250 CE) indicate transitions in the way the public space was conceived and used, with implications for developing social practices. However, continued investment in the public ritual space and continuity in certain ritual elements indicate it retained its overarching communal functions.

Introduction

The lifecycles of ancient Maya structures were often marked through ritual observances, consecrating new constructions and commemorating the burial or termination of old ones (Kunen et al. 2002; Mock 1998). These ritual observances demonstrate a world-view that "relates the natural forces of death and rebirth to the cultural processes embedded in the landscape of the human body and its life cycles," (Mock 1998:4). In giving life to the spaces where the most important activities of life occur, such as houses and places of worship and governance, the ancient Maya often left material traces of the things held most valuable, from food and sustenance to symbols of their belief systems. Analyzing the association of architecture and material offerings is one of the key methods through which archaeologists are able to not only reconstruct the uses of structures built by the Maya, but also the complexities of their religious, political, and social practices. In this paper, I explore the complicated architectural history of the Preclassic Plaza F architectural complex at the site of Actuncan, Belize, and how changes in its architectural development relate to changes in the ritual observations and deposition within it. Together, architecture and ritual deposits weave a history of how the local community viewed and engaged with a prominent ritual space at the core of the site.

An architectural complex consists of multiple structures associated based on proximity, position on a single platform, and/or other bounding architectural elements, is understood to have an overarching function. As such, its structures would be expected to have a shared lifecycle, growing in clear stages of ritual deposit placement and construction. However, the history of construction for any one structure is often messy, with modifications, repairs, and rebuilding marked in different ways. For a complex, individual structures may be maintained, modified, and replaced as the materials, labor and needs of the local community fluctuate over time.

In its final configuration, the Plaza F complex forms an E-Group, a well-defined architectural complex in the Maya area. E-Groups consist of a plaza defined by an elongated eastern platform and a western pyramid. The repeated forms and associations of the E-Group structures across Maya sites mark it as a special-function complex. Furthermore, excavations in E-Groups have demonstrated a deep history and common trends in their use as spaces for communal ritual (Chase and Chase 1995; Estrada-Belli 2011; Freidel 2017). E-Groups were some of the earliest constructed public spaces in the Maya region. They were venues for public communal ritual practices and as such, they served community integrative functions, helping anchor dispersed populations and provide shared cultural models of practice (Inomata et al. 2015; Joyce 2004). In later time periods, E-Groups were also appropriated in political displays, reflecting shifts from public to exclusionary models of political power (Aimers

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and Rice 2006; Freidel and Schele 1988). With these broad trends in mind, I now aim to evaluate the specific development of Actuncan's Plaza F complex and how its architecture and ritual deposits reflect the interests of the local community.

Actuncan's Plaza F Complex

Actuncan is a ridge-top site located on the western bank of the Mopan river, in western Belize. It has a long history of occupation, beginning at around 1100 BCE and continuing to about 1000 CE. In the Late to Terminal Preclassic periods (400 BCE – 250 CE), Actuncan was one of the key early ceremonial cores within the Preclassic Maya landscape of the Upper Belize River Valley. The site core was constructed over adjacent ridgetops, with residences clustered in the northern area and civic-ceremonial architecture in the south (Figure 1).

The Plaza F complex was the northern-most public ritual space in the site core. Its eastern platform, measuring 130 m in length, overlooks the Mopan River. The various components of the complex fluctuated over the span of its occupation, but its primary configuration follows the layout of a Cenote style E-Group. This style consists of a plaza flanked by an elongated eastern platform, with an off-set central superstructure, and a western radial pyramid, seen at sites such as Cenote, in Belize, and Tikal and Yaxha, in Guatemala (Chase 1983; Chase and Chase 1995).

Excavations to date have focused on the western pyramid (Structure 23), eastern platform (Structure 26) and its central superstructure (Structure 27), and the plaza space between them (Plaza F) (Figure 2). Two more structures flank the plaza space to the north and south (Structures 31 and 44) and a low wall further encloses the space in its later occupation. Through excavations, we have further identified low platforms within the plaza, which may have defined activity areas.

Excavations reveal changes in construction materials, architectural configuration, and ritual deposition patterns across the space. Collectively, these indicate changing community relationships with the complex.

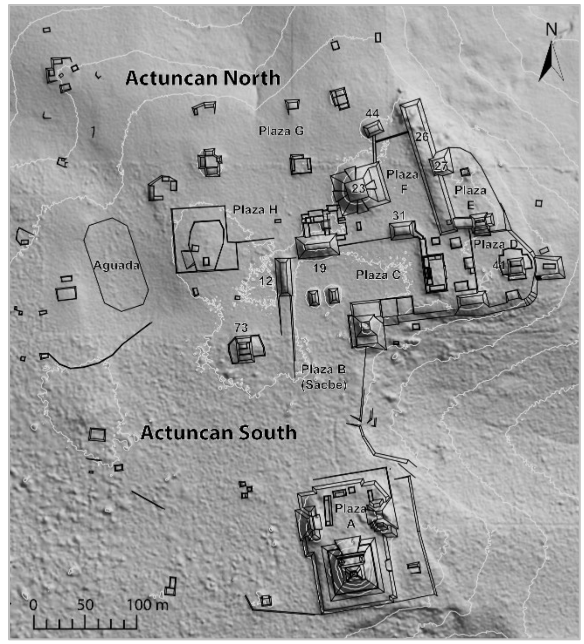

Figure 1. Actuncan site core. Map by B. Simova and D. Mixter, after D. Salberg (2012), D. Perex (2011) and J. McGovern (1993).

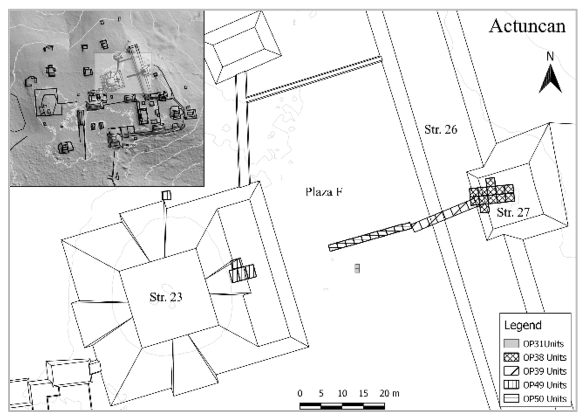

Figure 2. Map of Plaza F excavations.

The distribution of labor and incorporation of new building materials across the three investigated spaces, speak to increased investment as well as a changing focus from the low, wide expanse of the plaza to the broadening of the eastern ridge, and eventually to the vertical growth of the western pyramid. At the same time, ritual deposits incorporated into the architecture mark continued interest in intervisibility. The patterns of ritual deposits indicate a consistent ritual engagement with the space but shifting emphasis between ephemeral and permanent offerings and paraphernalia.

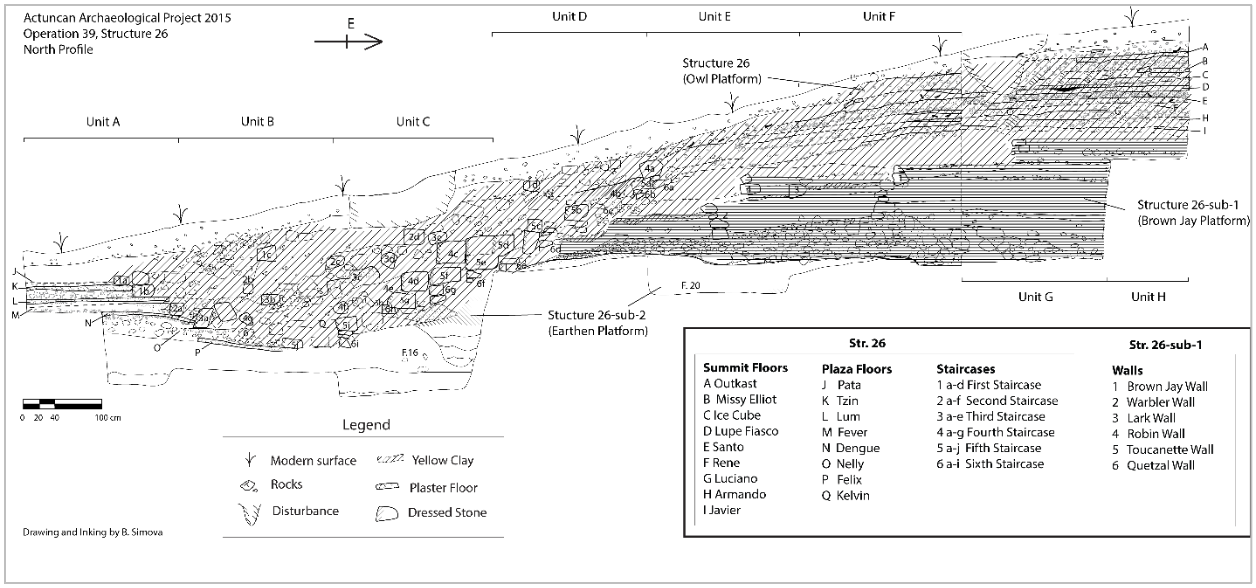

Figure 3. Profile of Structure 26, Operation 39, highlighting major construction phases.

Some patterns also emerge in the spatial organization of ritual within the complex, as deposits and offerings on the eastern platform reference water and storage to a greater degree than deposits in the plaza. Despite observed variability in the materials and uses of the Plaza F complex, it continued to serve as a central place for public gathering and ritual observation throughout its history.

In the following sections, I first describe the architectural developments within the three main areas of the complex (the eastern structures, western pyramid, and plaza) and then parse out the architectural lifecycle of the complex in relation to the ritual deposits encountered in our excavations.

Architectural Stages of the E-Group Complex

Eastern Structures

In the eastern section of the plaza complex, the first construction (Structure 26-sub-2) consists of mounded brown clay, rising about a meter above the surrounding ridgetop (Figure 3). Here, the Actuncan E-Group complex differs from other Maya E-Groups whose initial constructions consist of modified bedrock (e.g., Brown 2017; Estrada-Belli 2011; Inomata et al. 2013). The clay ridge-top, with its much more deeply buried bedrock, presented a limitation on available materials. While there were likely symbolic differences between exposing white limestone and mounding brown soil, the resulting augmented landscape could have been understood in similar terms, as a space cleared for specific public use.

This low earthen mound was covered over by a dense limestone fill, containing occasional large, dressed stones. Construction bins identified in excavations to the east of the clay mound indicate the ridgetop was extended to support subsequent, larger structures. The use of limestone in this fill evokes bedrock, and yet the subsequent structure, Structure 26-sub-2, also called Brown Jay platform, consists of earthen terraces faced with cobbles, more consistent with the clay and river cobbles available in the immediate site. The platform fill is generally dark brown clay loam, but surfaces were capped with a yellowish silty clay, indicating an intentional selection and layering of materials.

Brown Jay platform was expanded at least once, raising the structure summit and medial terrace and adding low terraces along the western façade. The summit and wide medial terrace were elaborated with small-cobble architectural features, defining low platforms or paths (Simova and Mixter 2016).

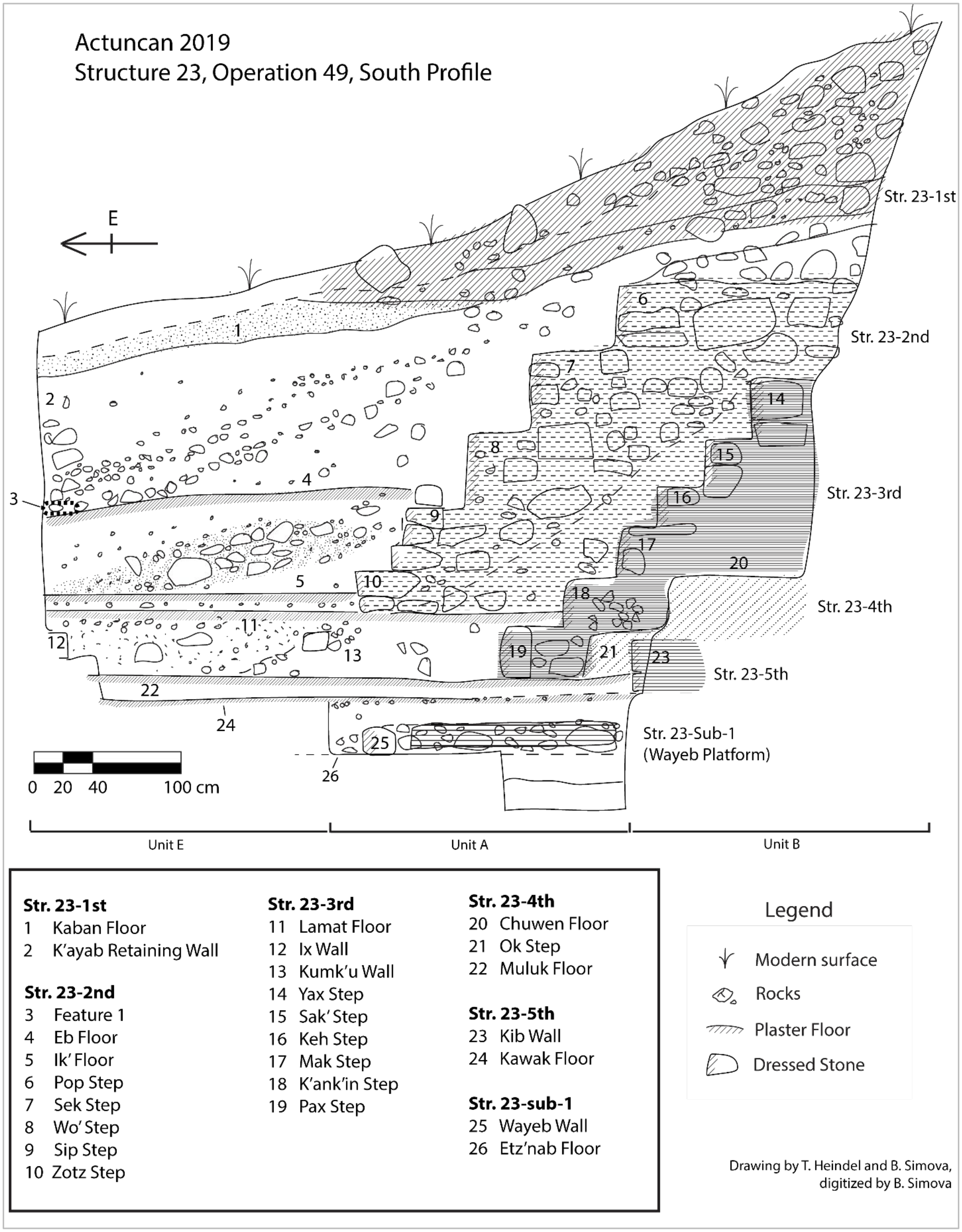

Figure 4. Profile of Structure 23, Operation 49, highlighting major construction phases.

The majority of Brown Jay platform was covered in dark clay and a new phase of dressed stone and plaster construction began with the construction of Structure 26 proper. Also called Owl Platform, Structure 26 was reworked multiple times, growing in size. Our excavations exposed six staircases and nine platform floors (Donohue 2014; Simova and Mixter 2016). Although we observed changes to the materials and construction techniques, the basic layout of the staircase leading to the top of the platform remained consistent.

The first staircase was faced with small limestone cobbles, while subsequent versions tended to use large, dressed stones and occasionally plaster to construct the step raisers. Interestingly, rather than terminating and fully covering older staircases, new staircase constructions often reworked or reused steps from older versions, creating a complicated history of construction. The final staircase construction was largely collapsed, with many of the stones from the steps and platform face robbed.

On the summit of Owl Platform, the first two floors consisted of thin ballast and plaster. The first, Javier Floor, was built directly on the silty clay capping Brown Jay platform and the next floor, named Armando Floor, was built directly on top of it, making them hard to distinguish. Later floors become thicker, but remained closely spaced, with little fill in between. The sixth floor in this sequence, Lupe Fiasco, was capped with a yellow silty clay layer, similar to the surfaces encountered in Brown Jay Platform. The remaining three floors encountered in excavations differed from the earlier floors because of their deeper fills.

The summit superstructure structure (Structure 27) on the eastern platform, which places the complex in the Cenote-style type of E-Group, had an interesting construction history despite exhibiting fewer architectural modifications. The earliest excavated stages of construction consisted of clay fill layers with some small-stone alignments, consistent with the construction of Brown Jay Platform. Due to the limitations of excavations, it is unclear if these construction fills formed the summit of the broad eastern platform or the foundations to a distinct central superstructure. Small stone lines suggest a potential foundation to a platform or perishable structure, but these could have been more extensive throughout the eastern platform, as indicated by similar small-stone alignments on the medial terrace of Brown Jay.

Brown Jay Platform's summit appear to have remained exposed through most of the Owl Platform phases, perhaps serving as a clay and cobble superstructure on the plaster and dressed-stone eastern platform. Eventually, it was covered in a thick, but uneven cobble fill containing stone bifaces, and a layer of brown clay loam and replaced with a plaster construction (Donohue 2014). Structure 27 had only two phases, associated with plaster floors and low steps leading down to the Structure 26 platform. The latter phase of construction included an alter feature (Feature 3) constructed out of large limestone slabs over a cobble fill.

Western Structures

In the west end of the Plaza F complex, the first construction, Structure 23-sub-1, named Wayeb platform, consisted of a low cobble platform, with large cobble fill, built on top of a prepared earthen surface (Figure 4). Notably, the eastern wall of Wayeb platform is oriented more to the northeast than subsequent structures in this location. The earthen floor around it was covered in a cobble and marl fill before the whole area was covered with a brown clay loam and a thin plaster floor.

We uncovered five phases of Structure 23 with five terrace additions, all consisting of dressed stone and plaster (Heindel 2016; Simova 2020a). The earliest two phases of Structure 23 were only exposed in small parts, but appear to consists of low platforms (Figure 4). In the next two phases, the pyramid was enlarged, and formal staircases were added to the eastern façade. Two of the staircases were well-preserved, while the final phase was extensively collapsed after many of its facing stones were removed in antiquity. In terms of construction, the western pyramid modifications differ from the eastern platform in that later constructions appear to neatly cover older versions.

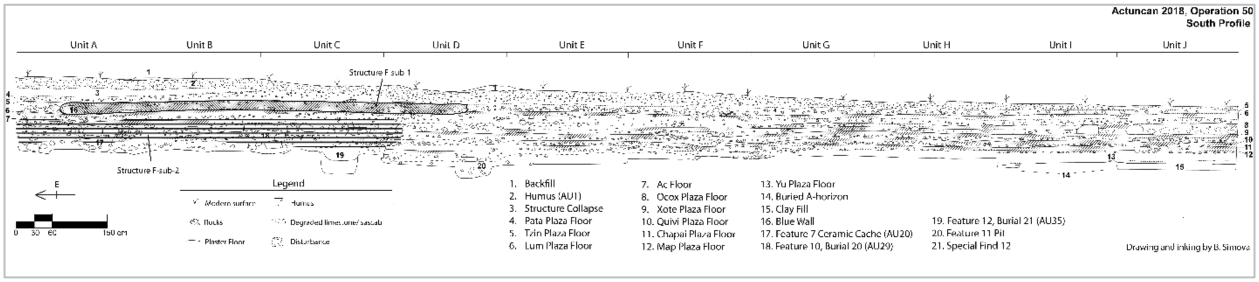

Figure 5. Profile of Plaza F, Operation 50, highlighting major construction phases.

We identified a mix of construction techniques, with some versions having large, exposed limestone blocks while in others thick plaster covers over the construction materials, consisting mostly of limestone of variable quality.

The eastern side of the pyramid was also elaborated with a series of terraces, which were appended to the base of staircases. These appear to provide an activity area closer to the plaza. The initial terrace, appended to 23-3rd, was approximately half a meter in size and was resurfaced and extended to the east twice. The next major terrace construction raised the level of the surface by nearly a meter and was appended to 23-2nd. The final phase of the terrace represented the largest expansion, raising the surface by a meter and a half, providing increasing vertical separation from the plaza.

The Plaza

The early plaza space, or Yu plaza floor, consists of a dark clay loam with sparse cobbles. From coring, we know the clay was deposited in such a way as to even out a 30 by 40 m area in the central portion of Plaza F (Simova 2020b). We recovered fragments of daub within Yu floor which indicate the presence of perishable structures over the long use of the earther surface.

Yu plaza floor was eventually covered by 20 to 30 cm of soil and the construction of Map Floor. Map floor is a soft plater floor built on a shallow ballast of large cobbles placed over the clay fill. The next three floors were built almost directly on top of each other, with cobbles infilling only some areas of the plaza. This set of early floors is associated with a low platform, Structure F-sub-2, constructed in the eastern end of the plaza, at the base of Structure 26 (Figure 5). This platform was modified at least four times, marked by thin, deteriorated plaster resurfacings. Its western façade was highly disturbed by the placement and manipulation of a burial, discussed below.

Following the series of four closely spaced plaster floors, the next three floors in the plaza become more spaced out, separated by deeper cobble fills, and had thicker plaster surfaces. The more deteriorated state of these floors indicates they were in use for longer periods of time. One of these floors, Lum Floor, covered over the F-sub-2 platform and supported the construction of another low platform, Structure F-sub-1. This platform had a single phase and was covered by the next floor construction (Tzin Floor). The final floor of the plaza, Pata Floor, did not have any preserved plaster. It was highly eroded and deflated, except for a small limestone pebble ballast found under Structure 26 collapse.

Unfortunately, I am not able to place all architectural elements across the Plaza F complex in direct order, but a few associations and dates parse out major architectural transitions. In the following sections, I describe these transitions as well as the features and ritual deposits that characterize their use.

Ritual Lifecycle of the Plaza F Complex

The Plaza F complex began as an earthen plaza and mound. The construction of the Structure 26-sub-2 mound was commemorated with a foundational cache of Cunil vessels containing burned organic material. Central in the deposit was a wide-mouthed Arghda jar rim with loop handle although fragments of other vessels were also present (Simova and Mixter 2016). The burned material dates between 1125 and 1015 BCE (LeCount et al. 2017). Carbon from the Yu Floor fill is roughly contemporary in date to the foundation cache of Structure 26-sub-2 (1115-930 BCE), indicating the plaza and mound were likely built as a set.

The foundation cache is simple in comparison to finds from Ceibal and Cival featuring extensive deposits and full vessels (Aoyama et al. 2017; Estrada-Belli 2012; Inomata et al. 2017). There are no exotic items such as marine shell, obsidian, or jade, and no indication of ritual layering. As Garber and colleagues (1998:128) note, the value of the contents of the cache are less important than the symbolic act of birthing or ensouling new constructions. And yet, the use of a utilitarian jar to mark the ritual burning location, at a time when ceramic technologies were first appearing in Maya Lowlands, speaks to the needs and interest of the population constructing this public space at Actuncan.

Other likely contemporary deposits and features from the earthen complex include a small stack of limestone cobbles and an empty pit feature near the base of the mound (Figure 3). These deposits were aligned with the foundation cache, establishing the centerline of the complex from this early period. These earthen components of the Plaza F complex remained in use for approximately 600 years with some indication of perishable structures augmenting the activity areas throughout that time. It is possible the Wayeb cobble platform on the eastern side of the plaza was constructed within that time as well, bounding the extent of the plaza, and serving as an early example of changing construction materials. However, from its diverging orientation, it is unclear if Wayeb platform was conceived as part of the platform-plaza complex.

The earthen platform was replaced with the initial version of Brown Jay platform around 330 BCE (365-300BCE), while the plaza remained unchanged. The architectural transformation did not appear to be marked through ritual dedications or terminations using durable artifacts, although a small deposit consisting a greenstone and shell beads within the limestone fill at the base of Brown Jay Platform may have served as an offering to the new construction. Instead, the preparation of the foundation with quarried limestone and marl may have served as the central indication of renewal. During this phase of the complex, we again see a pit in the plaza, dug into Yu Floor. In this instance, the pit contained burned material and a single shell. The pit was topped with cobbles and likely remaining exposed for some time prior to the next phase of construction within the complex. This feature indicates a continued interest in storage and ritual burning. It also points to the use of perishable materials in ritual observances, which were likely more prevalent than we can see archeologically.

The next construction shift in the complex involved the introduction of plaster in the plaza, in the construction of Map Floor, at around 280 BCE. The floor extended the western edge of the plaza, covering over Wayeb platform. While Brown Jay platform was modified around the same time, it did not incorporate the more labor-intensive material. Unfortunately, we lack dates or artifacts to help delineate if the first version of Structure 23 was added at this time as well. The plaza and eastern platform constructions were not marked by any artifact deposits on the centerline of the complex. The transition was not an insignificant one, as the new plaza involved a substantially greater investment in procuring materials, preparing, and applying plaster. It also altered the appearance of the complex, providing a bright, clean surface for gathering. The construction was likely marked by ritual observances and use of perishable offerings, but the more substantial offering to the structure in this case was the labor and time.

At about 200 BCE, we see a transition to the plaster and masonry Owl Platform and the addition the F-sub-2 platform in the plaza. Although once more the construction was not marked with dedicatory deposits of durable materials, over the next period of approximately 250 years, the structures saw frequent modification (three staircase versions, six summit floors, and five stages of the sub-plaza platform) and deposition of ritual materials.

On the summit, the first plaster floor construction contained a limestone alter feature with a cached, overturned plate, and a pile of jute (freshwater river snails). The floor also featured a deep pit containing several large jars (Simova and Mixter 2016).

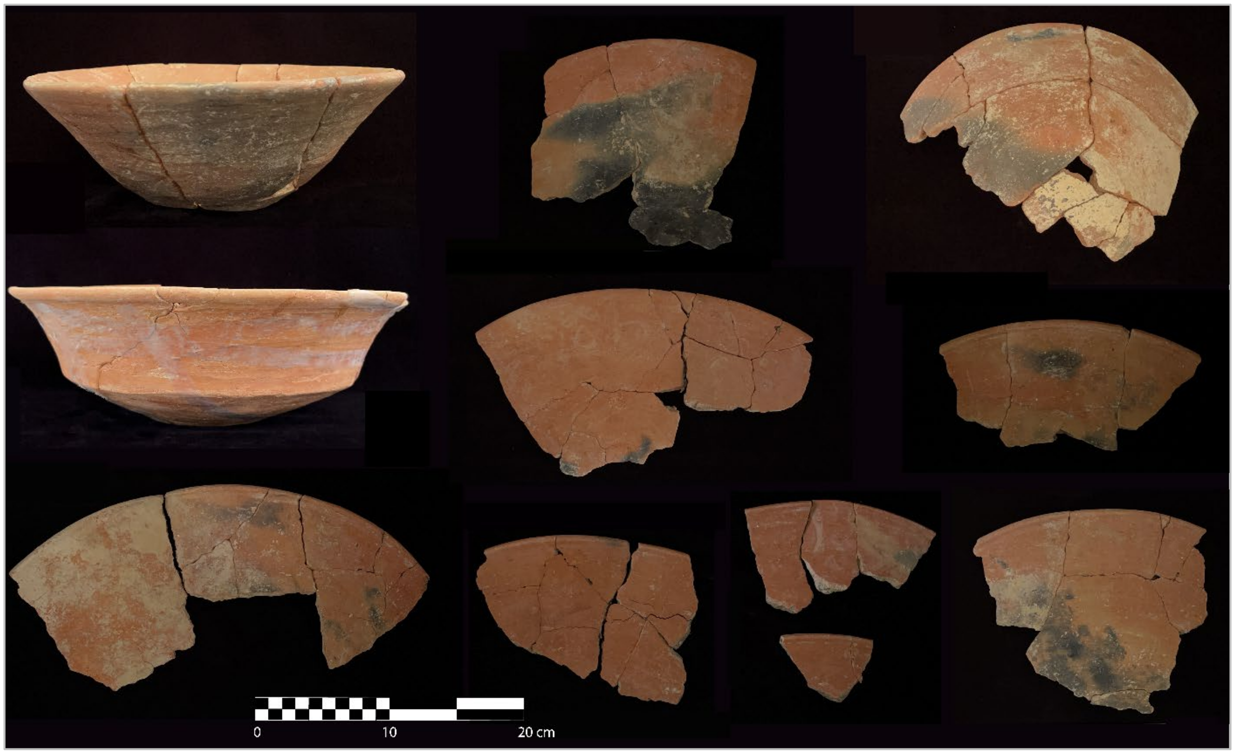

Figure 6. Selection of ceramics from Structure F-sub-2 Feature 7 deposit.

The subsequent four floors contained few durable markers of activities, but geochemical studies of three of the preserved surfaces revealed continued deposition of organic materials, likely in the form of food and drink (Simova et al. 2018). The ritual deposits on these floors continue to emphasize ceramic technologies used in storage while offerings of food become more archaeologically visible, through preserved residues in the plaster floors.

The sixth plaster floor of Owl Platform contained more extensive features, including a deep posthole and a cyst burial (Burial 18). The burial was capped by four limestone slabs and lined with a combination of limestone slabs and cobbles. Associated artifacts include worked chert (Feature 3) placed on either side of the hips, obsidian, and a stingray spine next to the legs, and scatters of sherds and lithics in the burial fill (Donohue 2014; Freiwald 2015).

In the plaza, the F-sub-2 platform formed an even more active stage for ritual deposition, but here the patterns were slightly different. An early platform stage contained a feature with three overturned, stacked plates with evidence of burning. One of the final construction phases contained a pit feature (Feature 7) with several bowls dated to between 50 BCE and 10 CE (Figure 6). Broken ceramics littered the platform near the feature and a cobble retaining wall passes directly over it, indicating this deposit may have served as a termination and dedication to the new phase of the platform.

The platform also contained two burials (Burial 20 and 21), one of which (Burial 20) was associated with the downturned plates. Burial 20 was dug into the fill and the body was placed among the cobbles, with its legs bent to fit the constrained space (Simova 2019). A large Savannah Bank Usulután Bowl with true resist decorations bore the head and two more vessels, a small bowl and well-polished pot, were deposited next to the body as burial offerings (Figure 7).

An additional crypt burial, Burial 21, was placed near the edge of the platform. The limestone slabs of the crypt were disturbed and the body lacked many skeletal elements, indicating reentry of the burial in antiquity (Simova 2019).

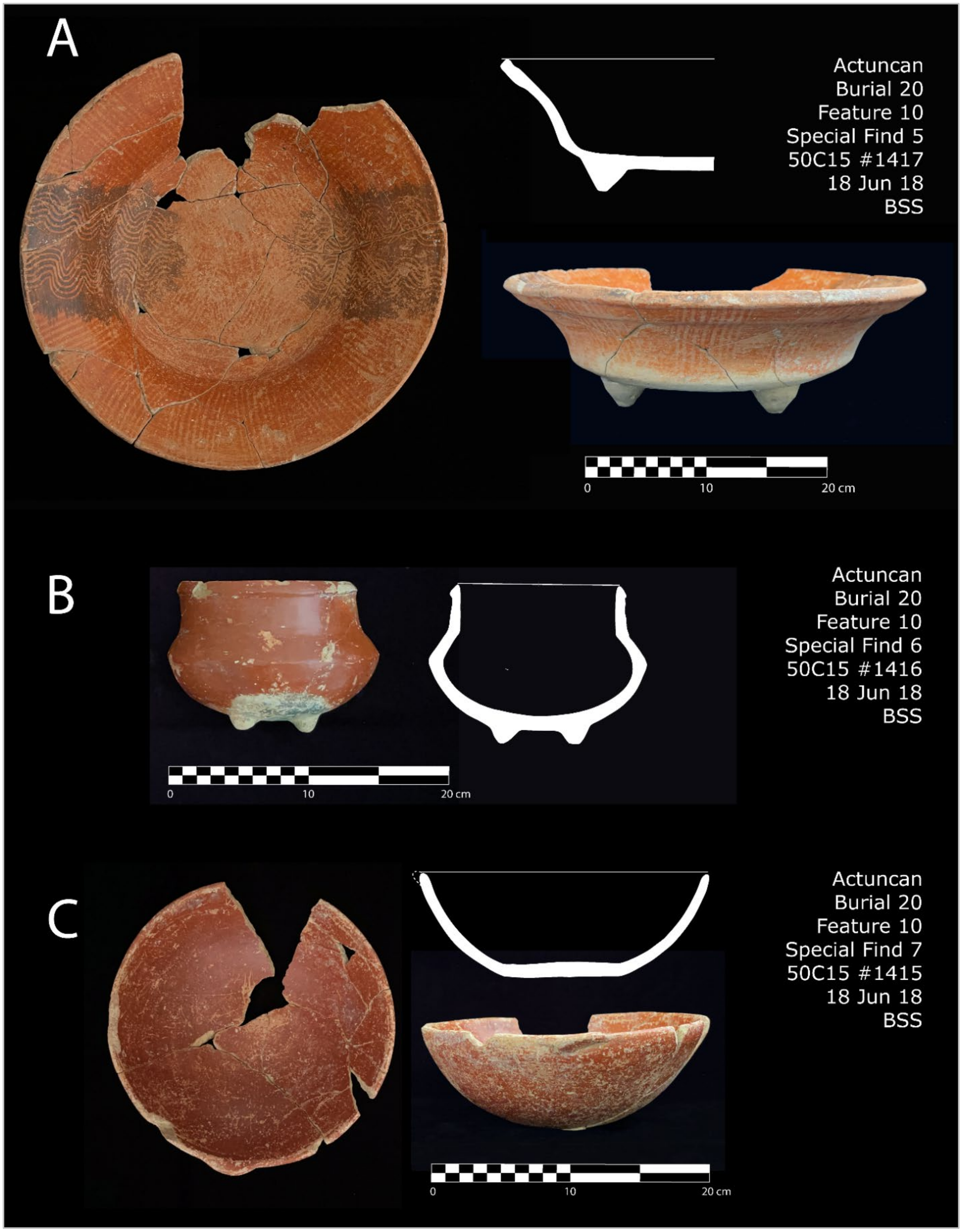

Figure 7. Ceramics deposited with Burial 20, Feature 10. (a) Savanah Bank Usulután tetrapod dish (S.F. 5), (b) possible Cabro Red tetrapod pot (S.F. 6), and (c) Vaquero Creek Red bowl (S.F. 7).

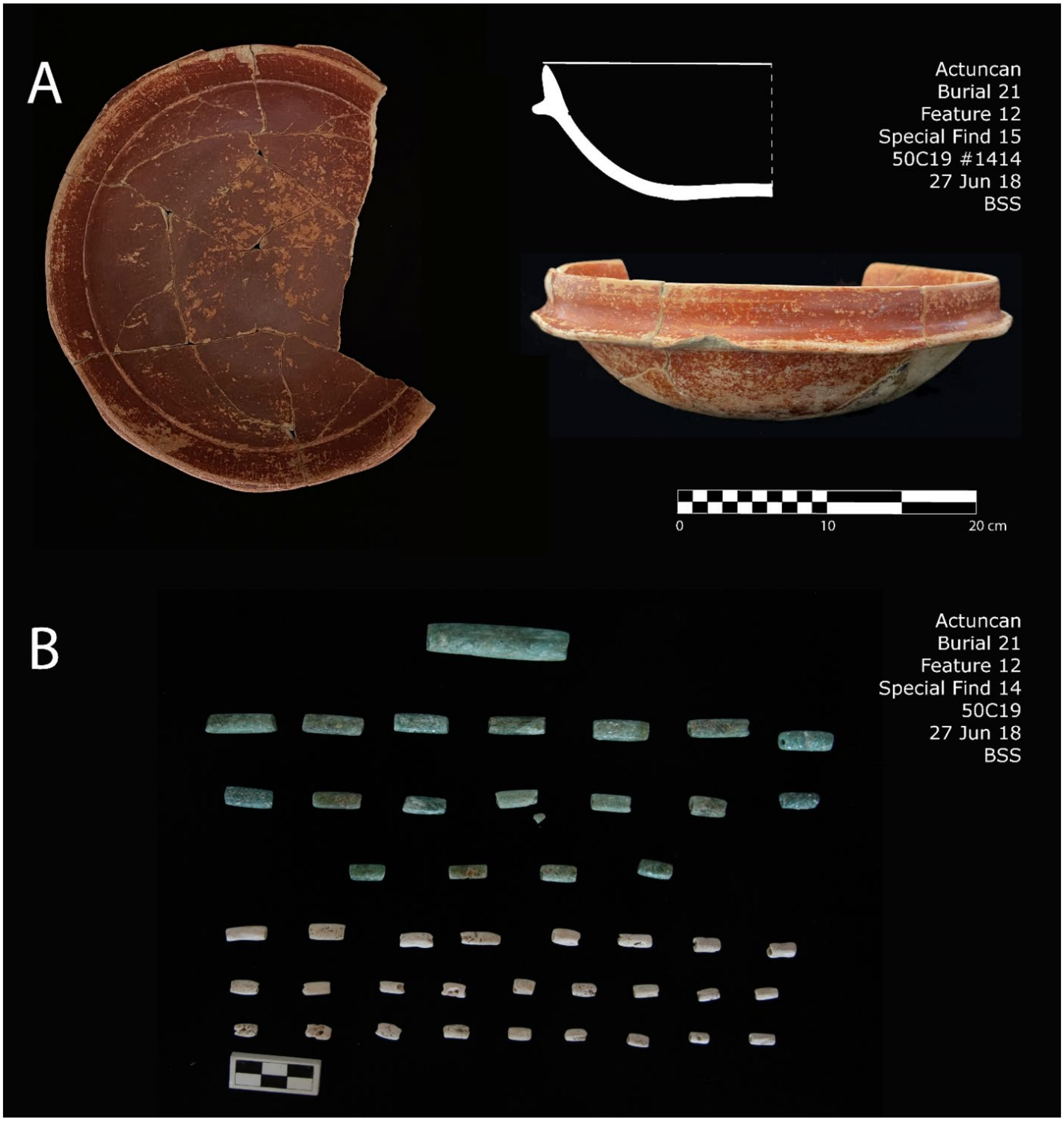

Figure 8. (a) Correlo Incised-dichrome bowl (S.F. 15) and (b) jadite and shell beads (S.F. 14) deposited with Burial 21, Feature 12.

What we recovered were portions of the lower legs with a jar and the cranium deposited in a flanged bowl with shell and jadite beads (Figure 8). Because of later reentries and disturbances to the crypt and fill layers above it, it is difficult to place the burial within the phases of the F-sub-2-platfrom, but it is clear that the burial was part of multiple ritual observances during the use of the Structure F-sub-2 platform.

Within this plaza platform, the ritual deposits emphasize serving vessels, in comparison to the storage vessels used in deposits on the eastern platform. The vessels incorporated in the cache and pit are largely unslipped, while the vessels used in the burials are more decorative. The burials themselves incorporate more durable goods than the burial atop the Owl Platform, perhaps placed, - and reentered in the case of Burials 21, - with more extensive ritual displays in the more readily visible, low platform.

From ceramic dating, it appears the first three phases of Structure 23 were built during this phase of durable ritual displays in the complex's history. The structures formed a substantial investment of plaster and masonry. They lacked low terraces at this time, so ritual uses were likely centered on their platform summits, which were not exposed in excavations.

When this phase of the complex drew to an end, Owl Platform was capped with a layer of orange clay, recalling the earthen surfaces of the Brown Jay cobble platforms, ahead of a new floor construction, the plaza was resurfaced with Lum floor, covering over the F-sub-2 platform, and the western pyramid was expanded with a new phase.

In Owl Platform, the new set of constructions began around 150 CE and consisted of the last two staircase modifications and four summit floors, as well as the plaster modification of the central superstructure, Structure 27. In Structure 23, we see the last two phases of the pyramid and their associated terraces. In the plaza, the construction of Lum Floor and Structure F-sub-1 briefly defined a new activity space, but the platform was quickly covered by the subsequent and final two plaza surfaces.

Ritual deposits during this phase of the complex include vessel fragments deposited on staircases (39 F 1 SF 9, F4 38B10), a ceramic termination deposit of Owl Platform (F10), a lithic scatter on a terrace of Structure 23 (F1), and a smattering of shallow pits and posts throughout the complex (Donohue 2014; Simova 2019, 2020a; Simova and Mixter 2016). The new low plaza platform of F-sub-1 lacked artifacts from ritual deposits. The practices that led to the depositions of abundant ceramic vessels and burials within the Plaza F complex in the previous phase were no longer represented. However, there was no ritually marked break in the function of the space. We do not find evidence of extensive termination deposits or dedicatory offerings. Rather, the construction materials create a clean start across some of the spaces (e.g, the clay cap on the summit, new plaza surface). The materials we do encounter in this phase are simple. The lithic scatter references production in a way we do not encounter in previous stages, but ceramics, pits and posts indicate a continued use of perishable materials and storage/serving vessels in ritual observances within the complex.

There are no constructions in the main structures and plaza beyond the Terminal Preclassic period. Valuable building materials, such as dressed limestone blocks and large stones in general, are relatively absent from the collapsed terminal phases of the eastern and western structures, leaving heaps of earthen and cobble fills. Although labor was no longer invested in the maintenance of the complex, it remained as a monument within Actuncan's core. This is reflected in the evidence of later use and occupation, including Late Classic materials surrounding a deposit of eight chert eccentrics in collapse on top of Owl platform (Donohue 2014; Simova et al. 2015).

Conclusion

In tracing the lifecycle of the Plaza F complex, we not only gain understanding of the early development of Actuncan's E-Group, but also the changing engagement of the local community with the public ritual space. From its early earthen construction, the complex embodied communal labor. As the community grew over time, the labor became more extensive, requiring procurement and preparation of materials like plaster and limestone blocks. Changes in the materials and appearance of the complex could potentially mark a reconfiguration of the space, remaking it to serve new functions. However, these transitions were not marked with ritual dedication or termination through artifact deposits. The early plastering of the plaza surface with continued use of cobble architecture, and later the combination of plaster and masonry with a cobble summit in the eastern platform reinforce the idea that the complex was not reconceptualized with the introduction of new materials, even as the architecture changed.

The ritual deposits we encountered throughout the complex, starting with the dedication of the earthen platform, mark the practical concerns of the community. Ceramic containers were central in many deposits. They represent remnants of festive activities, as in the case of the storage jar deposit on Owl Platform and the bowl deposit (Figure 6) on the low plaza platform, as well as offering containers in two of the three burials within the complex.

Throughout the history of the complex, however, we begin to note changes in the rate and type of ritual deposit placements that indicate some shifts occurring in the organization of the community. For over a century, Structure F-sub-2, despite its small size, formed a relatively active space for deposition, containing two burials and two ceramic deposits. In the same time frame, Lupe Fiasco Floor on the Owl platform showed an increase of ritual observances as well, with the placement of a burial, use of perishable structures, and more pronounced chemical signatures of organic deposits (Simova et al. 2018). In this period of increased ritual deposition, we see a distinction in the ritual importance of the plaza platform and eastern platform. In the plaza, deposits contain more serving vessels, including the decorative vessels used in burials. On the eastern platform, the burial offerings appear to reference production activities (chert, obsidian) as well as water (stingray spine), as was the case in earlier deposits of jars.

The placement of burials within the Plaza F complex could have served a few different ritual functions. The placement of individuals in prominent public spaces is an indicator of growing social inequality (Awe 2013; Brown et al. 2018). Evidence of reentry in Burial 21 is consistent with rituals calling on powerful ancestors. The intrusion of burials in a space largely seen as serving communal functions, particularly in E-Groups during the Terminal Preclassic, is seen as a political strategy of ruling elite to garner more power. In this way, the more elaborate ceramic offerings Burial 20 and 21 could be seen as displays of wealth and status. The association of burials with construction episodes, however, can also be interpreted as a powerful offering to the structure or complex itself and an increased effort to promote renewal (Becker 1992:193). The placement of human remains in serving vessels, in this case heads laid in bowls within the context of burials, certainly suggests an element of ritual offering. Ultimately, these interpretations may not be mutually exclusive, with individuals or lineages attempting to coopt power through manipulation of existing customs of construction and renewal in times when more powerful offerings were sought by the community. What is noteworthy within the Actuncan E-Group, is the limited temporal extent of this practice. An orange clay cap and new plaza floor draw a sharp distinction with the new phase of the complex and their more space deposits. While the locations of Burial 18 and earlier deposits appear to have been referenced in subsequent ritual deposits on the eastern platform, the placement of the plaza platform burials was no longer physically marked. The change may reflect a decline in the importance of the E-Group, as other ritual spaces at the site drew more focus. Alternatively, the change could have reflected a rejection of more exclusive forms of ritual performance within this particular public space.

The variation in the architecture and type and placement of ritual deposits across the Plaza F complex evidence a shifting social landscape at the site of Actuncan. However, throughout these shifts, the community continued to invest labor in the space, building structures to new heights, and marking practical concerns through ritual deposits. The essential communal functions continued to define the overarching function of the complex through the Preclassic.

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12 WATERY UNDERWORLD SYMBOLISM AND THE DEVELOPMENT OF POLITICAL AUTHORITY IN THE MOPAN VALLEY, BELIZE

Rachel A. Horowitz, M. Kathryn Brown, Jason Yaeger, and Bernadette Cap

Shifts between the Preclassic and Classic periods involved transitions in many aspects of Maya society, including the role of ritual activities as sources of power for and markers of political authority. During the Classic period, royal individuals were often buried in crypts or tombs marked with water symbolism that symbolically placed the individual within the watery underworld. Layers of lithics overlying these important interments were part of this symbolism. Water symbolism of this nature has deep roots in Maya ideology, beginning as early as the Middle Preclassic, prior to institutionalized political authority. In this article, we explore the relationships between large lithic deposits and underworld and water symbolism at Las Ruinas de Arenal and Buenavista del Cayo to shed light on diachronic transformations of ritual practices involving lithics and other objects reflecting the watery underworld. The deposits at Arenal suggest that during the Preclassic period, watery underworld symbolism was part of communal ritual activities that occurred in public ritual locations. At Buenavista, large lithic deposits reflecting underworld symbolism are more restricted and individualized in nature. We believe this reflects elite incorporation of communal practices to legitimize their privileged position in society and reinforce their political authority.

Introduction

The intersection of ritual and political authority can be examined through materials deposited as part of ritual activities. In this article, we examine deposits with watery underworld symbolism, specifically layers of lithics and other objects, through a diachronic lens to better understand transformations in ritual practices involving these important cosmological references. In particular, we are interested in tracing Middle Preclassic period communal rituals involving cosmological references to the watery underworld to Classic-period burial practices of elite personages that reflect concepts of water, the underworld, and themes of life, death, and rebirth. Although there is much information pertaining to ideological transformations associated with the institution of divine kingship and the establishment of political authority rooted within this system, for the purpose of this article we limit our discussion to cosmological references reflecting water symbolism that have recently been uncovered from the Preclassic E Group at Las Ruinas de Arenal, hereafter Arenal, and Classic period royal burials discovered at Buenavista del Cayo, hereafter Buenavista (Figure 1). Through these two datasets, we have identified preliminary patterns that suggest that Middle Preclassic communities purposefully created spaces that referenced the layered cosmos, including the watery underworld, within the heart of their centers, such as early E Groups.

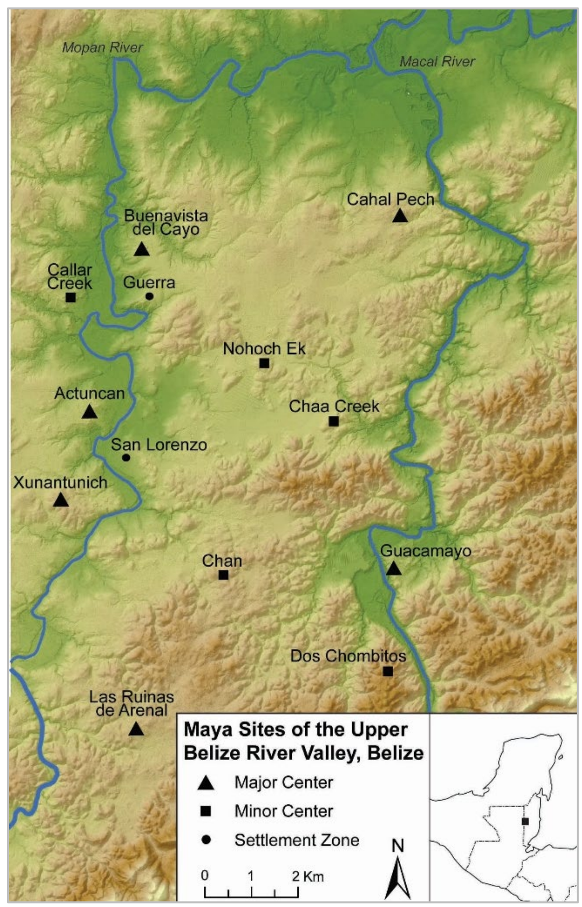

Figure 1. Map of sites mentioned in the text. Map by B. Cap, used with permission of the Mopan Valley Archaeological Project and Mopan Valley Preclassic Project.

By the Classic period, references to the watery underworld featured heavily in royal burials, emphasizing the importance of certain individuals and a shift away from the collective focus. To address these transitions, we first discuss the symbolic importance of the different types of materials found in ritual deposits indicative of the watery underworld, specifically jade, flaked stone lithics, and shell, followed by a discussion of the ritual deposits from Arenal and Buenavista and their relationships with political changes.

Within Maya cosmology, the underworld was conceived of as a watery place. Within architectural constructions in the Preclassic and Classic periods, the watery underworld was symbolically constructed through a combination of architectural features and deposits of different materials (see Brown 2017; Brown et al. 2018; Coggins 1988; Freidel 2017; Horowitz et al. 2020; Zralka et al. 2017; see Lucero and Kinkella 2015 for a discussion of underworld/water symbolism). For example, a Middle Preclassic E Group plaza at Early Xunantunich was sloped to the east and contained ramp features that likely functioned both as pathways for ritual processions and as mechanisms for funneling water towards the eastern architectural complex when it rained. This led Brown (2017) to suggest that the eastern side of the plaza was symbolically linked to the watery underworld. Another intriguing example of water symbolism on the eastern side of an E Group comes from the site of Cival in Guatemala. In the plaza in front of the eastern building of the Cival E Group, an elaborate cache was encountered that contained five Middle Preclassic water jars that were arranged in a quatrefoil pattern with four greenstone celts surrounding the central water jar and over a hundred jade pebbles placed beneath the central vessel (Estrada-Belli 2011). Greenstone celts were likely symbolic of maize (Taube 2000), while the water jars link this offering to the watery underworld. Estrada-Belli (2011: 82) interpreted this cache as the remains of an elaborate ritual dedicated to the ordering of the cosmos.

During both the Preclassic and Classic periods, jadeite (commonly referred to as jade), was associated with both maize and water, among other things (Taube 2005). For example, Preclassic triangular jade objects have been suggested to represent maize kernels. Taube (2005) also links jade to wind because wind often brings rainstorms, thus connecting jade to water. The symbolic links between jade, maize, and water made this material important both ritually and economically. Thus, it is not a coincidence that early rulers utilized jade for carved diadems that served as kingly jewels beginning in the Late Preclassic period (Freidel and Schele 1988). While the maize and water symbolism of jade has deep roots, by the Classic period, jade was connected to rulership and political power and was often an important offering within royal and elite burials.

Flaked stone lithics, specifically chert, are also related to the underworld and political rulership, as based on ethnographic, epigraphic, and ethnohistoric research (e.g., Agurcia et al. 2016; Clarke 2020; Doyle 2022; Houston 2014; Houston et al. 2006; Stone and Zender 2011; Stuart 2010; Taube 1992). Chahk, the rain god who was also important in the ideology of Classic period divine kingship, is often depicted carrying an eccentric lithic and/or a hafted stone axe. Furthermore, lithic raw material, including chert and obsidian, was associated with K'awiil, a god associated with lightning and supernatural power (Doyle 2022; Stone and Zender 2011). Chahk's axe is often depicted as a personification of K'awiil, and these two powerful deities were closely associated with divine kingship (Doyle 2022; Stone and Zender 2011).

Jade and lithics are common components of ritual deposits throughout the Maya region. Large ritual deposits of lithics have been found across the lowlands, particularly above Classic period royal burials (e.g., Andrieu 2020; Audet 2006; Barron 2016; Coe 1998; Hall 1989; Horowitz et al. 2020; Hruby and Rich 2014; Johnson and Martindale Johnson 2021; Zralka et al. 2016; see Andrieu 2011, 2020; Coe 1998; Hall 1989; Moholy Nagy 1997 for overviews), while jade objects are often found placed within the burials. Other types of ritual contexts, including caches, also often contain large quantities of lithics (e.g., Demarest et al. 2014), particularly eccentric flints (e.g., Iannone 1993; Lytle 2020; Ramos-Ponciano 2018), but such deposits are outside the scope of this article. Here we discuss Preclassic period ritual deposits at Arenal related to the watery underworld symbolism, and then provide examples of Classic royal burials from

Buenavista that share that symbolism. We close by arguing that the differences between these deposits relate to the changing nature of political authority between the Preclassic and Classic periods.

Preclassic Deposits at the E Group Plaza at Arenal

Arenal is located in the Mopan River valley and was occupied from the Middle Preclassic to Terminal Classic periods (Figures 1, 2; Taschek and Ball 1999; Horowitz and Brown 2019, 2020). The Mopan Valley Preclassic Project (MVPP) investigations at the site began in 2015 and have focused heavily on the E Group, located in Group A (see Chase et al. 2017 for an overview of E Groups). Our investigations suggest that the Arenal E Group was first constructed during the Middle Preclassic period as a space for public communal ritual activities and it was remodeled and rebuilt over centuries as it continued to be one of the site's primary sacred spaces.

Below we briefly highlight a series of offerings and deposits that relate to water symbolism. Excavations in the E Group plaza in front of Str. 1, the central structure of the eastern complex of the E Group (Figure 2), uncovered a series of deposits placed on and, in some cases, cut into bedrock. These included multiple burials, caches, and postholes (Figure 3), mostly placed along the central axis of the E Group. A total of 50 postholes and three internments have been identified to date. The stratigraphy and a suite of radiocarbon dates indicate that the postholes and one burial date to the Middle Preclassic period, while two other internments that were intrusive through earlier floors and deposits date to the Late Preclassic and Terminal Preclassic periods. For a more detailed discussion of the burials at Arenal, see Brown and Horowitz (this volume). The postholes range from 15-45 cm in diameter, suggesting multiple functions for the posts. Some of the posts (see Figure 3) appear to have been supports for a perishable altar feature, like that identified in front of the eastern structure of the E Group at Early Xunantunich (Brown 2017; Brown et al. 2018).

Nine postholes and bedrock divots contained ritual deposits, three of which contained jade (or greenstone) offerings, three contained both jade and ceramic fragments, and three contained only ceramics (Figures 3, 4). The jades uncovered from the bedrock postholes and divots are mostly small triangular pieces; most are rough, although some exhibit polish. As mentioned above, triangular jade pieces have been suggested to represent maize kernels (Taube 2005), and we believe that the jade pieces placed in bedrock deposits at Arenal were linked symbolically to maize, regardless of their form. We further suggest that their purposeful placement on bedrock and in postholes was symbolic of planting of maize and referenced the first birth of the maize god within the watery underworld (Salazar Lama 2022). The rituals associated with these early offerings were likely communal activities that established the E Group plaza as an important ritual space tied to agricultural fertility, as was the case at other E Groups (see Brown 2017; Chase et al. Chase et al. 2017; Chase and Chase 2017; Estrada-Belli 2016; Inomata et al. 2013). Spatially, the Middle Preclassic jade offerings were spread across the plaza, with most located on the eastern half of the plaza or near the center (Figure 3). However, we have not yet excavated the entire extent of the plaza, and we may locate other offerings closer to the western structure of the E Group.

Just above bedrock, we encountered the earliest E Group plaza floor surface, which dates to the Middle Preclassic. Overlying the floor was a Middle Preclassic ritual deposit that consisted of a dense layer of chert lithics, marine shell beads, and freshwater *jute* shells (*Pachychilus* ssp.). A low-lying stone wall atop the plastered floor surface divided the plaza into eastern and western zones, and the lithic deposit was placed only on the eastern side of this low wall (Figure 3). Our excavations only focused on central axis of the plaza, and we expect that the deposit extends to the north and south and likely covered the entire eastern half of the E Group plaza.

To date we have excavated 59 m^2 of the plaza zone that contained the deposit. The volume of materials from the deposit was quite large, containing freshwater shells (n = ~115,000), marine shell beads (n = 761), and lithics (n = ~100,000; Horowitz et al. 2020).

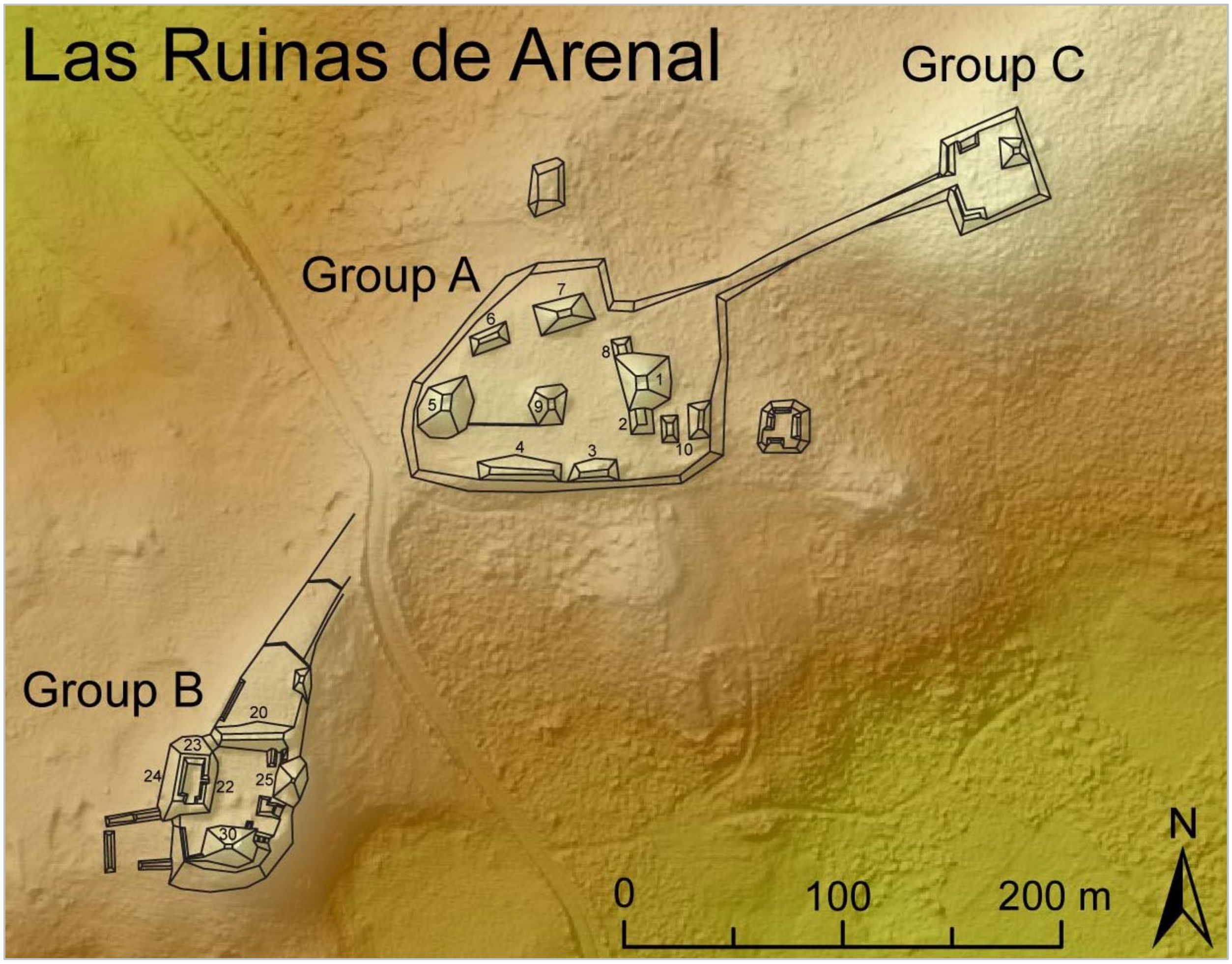

Figure 2: Map of Arenal showing the location of the lithic deposit. Map by B. Cap, used with permission of the Mopan Valley Archaeological Project and Mopan Valley Preclassic Project.

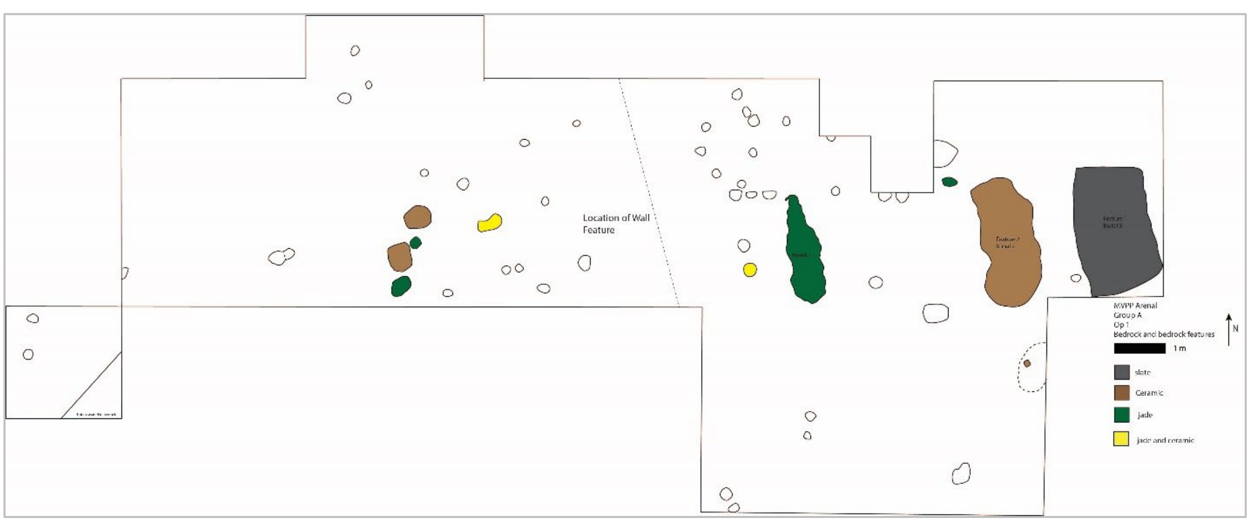

Figure 3: Map of bedrock deposits identified in excavations at Arenal. Map by R. Horowitz.

The marine shell beads were counted individually, while the total quantity of freshwater shells was estimated based on the quantity from a single 4 m^2 area multiplied by the total excavated area of the deposit.

The quantity of lithic materials was also estimated based on the analysis of a portion of the materials from a 12 m^2 excavated area (n = 15,716). When multiplied by the total excavated area covered in the deposit, we estimate more than 100,000 lithics in the excavated area. The lithic assemblage is predominately debitage, with a few bifaces, hammerstones, and other tools (Horowitz et al. 2020). The debitage within the assemblage consists predominately of bifacial thinning flakes (n = 5,162, 74% of classifiable debitage), which derive from the production of large bifaces. Despite the presence of large quantities of small marine shell beads associated with the lithics, the lithic assemblage is unrelated to the production of the beads, as only a single chert drill was documented in the analyzed portion of the assemblage. More broadly, we have encountered no evidence of marine shell production at the site to date.

We argue that this unusual Middle Preclassic lithic and shell layer represents the watery underworld due to the linkages between chert and underworld symbolism and the more direct linkages of both freshwater jute and marine shell objects to water and, by extension, the watery underworld (see Coggins 1988; Freidel 2017; Horowitz et al. 2020; Zralka et al. 2017; see Lucero and Kinkella 2015 for a discussion of underworld/water symbolism). Additionally, the lithics within the dense deposit may also reflect vertical transitions between the levels of the universe. Although the foundational bedrock caches were placed much earlier in the Middle Preclassic, it seems highly probable that the social memory of the consecration of the community's ceremonial space would have endured for centuries. Thus, we believe that the lithic and shell deposit was a coordinated communal ritual that reinforced the cosmological significance of this important place by tying together the foundational planting of symbolic maize kernels (jade) with a ritual deposit related to watering, nurturing, and remembering those symbolic kernels. This corresponded with an important rebuilding cycle of the E Group.

Figure 4: Examples of caches from bedrock deposits at Arenal. A. In situ image of vessel cache which had jade above the vessel (no jade visible in image); B. In situ image of vessel cache; C. In situ image of posthole cache of jade and ceramic sherds; D. Jade cache; E. Jade and tooth deposited on bedrock; F. Greenstone and redstone posthole cache. Photographs by R. Horowitz.

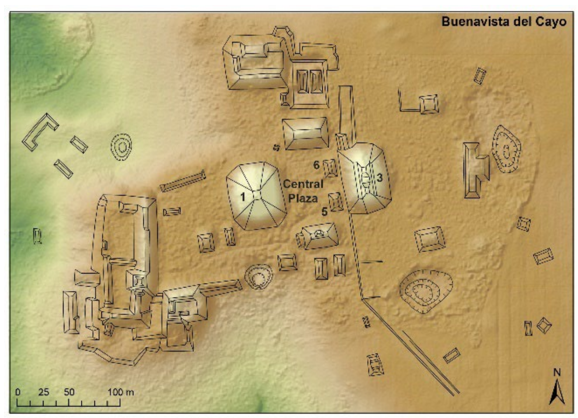

Figure 5: Map of Buenavista showing the locations discussed in the text. Map by B. Cap, used with permission of the Mopan Valley Archaeological Project and Mopan Valley Preclassic Project.

In both density and morphological characteristics, the lithics in this plaza deposit are strikingly similar to the dense layers of lithic flakes and debitage that cap royal tombs in Classic period Maya sites, including Buenavista. Below we describe these layers at Buenavista and argue that they represent a symbolic continuity with Arenal's Middle Preclassic deposit, but transformed through the institutionalization of divine kingship and its ideology.

Classic Royal Burials in the Central Plaza and Str. 3 at Buenavista

Buenavista is a Classic period Maya center in the Mopan River valley, located 10.5 km north of Arenal (Figures 1 and 5; Ball and Taschek 2004; LeCount and Yaeger 2010; Yaeger et al. 2015, 2019, 2022). Excavations at the site by the Mopan Valley Archaeological Project (MVAP) have discovered two Early Classic royal burials (Yaeger et al. 2015) and two Late Classic royal burials (Yaeger et al. this volume). Of these, three were capped with dense lithic layers. Here we discuss two examples, an Early Classic tomb in the Central Plaza that was re-entered during the Early Classic period (Burial 384-F1) and a Late Classic royal burial in Str. 3c (Burial 385-F6; Figure 5).

Our excavations identified two royal burials in the Central Plaza in front of Str. 3, one above the other. The earliest, Burial 384-F2, was a crypt burial with a marine shell pectoral bearing a text naming it as the pendant of the *ajaw* of the polity of *Komkom* (Yaeger et al. 2015). A second burial was placed immediately above the crypt's capstones. It was a large masonry chamber that had been re-entered in antiquity, with scattered broken vessels and fragments of objects that Yaeger and colleagues (2015) inferred to be the remains of a royal burial assemblage that had been largely removed in antiquity. The chamber was then refilled, and the matrix of the fill contained a high concentration of lithics. While not as dense as an intact layer, we believe that the 12,844 chert and limestone flakes that were recovered were originally placed above the tomb (Horowitz et al. 2020). It is likely that only one layer was present, given that the tomb's roof was not far from the plaza surface.

The pattern of capping royal interments with lithic layers is also documented in the shrines that were built atop Str. 3. Burial 385-F6 in the southern shrine (Str. 3c) was capped by three distinct lithic layers, described below. Burial 385-F30 in the central shrine (Str. 3b) was capped by a single lithic layer, which has not yet been analyzed. The lithic layers capping Burial 385-F6 were comprised of chert debitage, complemented by an obsidian concentration in the lowest layer (Yaeger et al. 2019, this volume). Due to the large quantity of materials, an aggregate analysis was performed of an opportunistic sample from each of the three chert layers (see Horowitz et al. 2020). The weight of the entire assemblage and the weight of the analyzed portion of the assemblage were used to estimate the quantity of material that comprised the three layers (estimated total = 32,222).

In the lithic assemblages associated with both Burial 384-F1 and Burial 385-F6, the chert artifacts consisted predominately of bifacial thinning flakes (Horowitz et al. 2020). Thus, these deposits were very similar in composition to the Middle Preclassic lithic assemblage discussed above. We suggest that the deposition of chert and obsidian over the burials reflects the association between lithics, the underworld, and the transitions between worlds—in this case, specifically the earthly realm of the living and the watery underworld of the dead—and also references the connections between chert and K'awiil, whose powerful lightning was related to the sacred basis of the authority of Classic divine kings.

Concluding Thoughts

Ritual deposits consisting predominantly of large numbers of chert flakes and debitage are present at both Arenal and Buenavista, dating to the Middle Preclassic and the Classic periods, respectively. While scholars have defined capping layers of lithic debitage as one of the hallmarks of Classic period royal tombs (Coe 1988), we argue that this Classic period phenomenon has its origins in ritual practices that occurred over a millennium earlier, as exemplified by the Middle Preclassic period deposit at Arenal.

In both cases, the deposits symbolically refer to water and the underworld, even though the materials that were used differed somewhat. The differences, however, between the locations of these deposits and their contexts speak to the development of political authority over the long course of Maya history. Although the water and underworld symbolism endured, the nature of the rituals that led to their placement shifted. At Arenal in the Middle Preclassic, the deposition of jade pieces in postholes—symbolically planting a field of maize—was one of the foundational events in the E Group, the site's sacred center and ritual focus. Although sometime later, this was followed by the deposition of the extensive layer of chert artifacts, jute shells, and marine shell beads across the open, public plaza, symbolically watering the jade maize kernels below. We see this ritual as a collective activity undertaken by the Arenal community to sanctify the most important ceremonial space in their sacred landscape and ensure the fertility of their fields.

In contrast, the Classic period lithic deposits are much smaller in extent, restricted to layers immediately above royal tombs that were placed first in Buenavista's Central Plaza and subsequently in the more restricted space of the adjacent pyramid. Relatively few people could have participated in the placement of these deposits, and they focused not on the community's symbolic maize fields, but on the individual rulers buried in the tombs beneath these layers. The connections of these rituals to fertility and community well-being remain, given the close association between Maya divine kings and the maize god; the rain god, Chahk; and the lightning god, K'awiil. After death, Maya divine kings followed the archetypical path of the maize god, reborn first from a seed in the watery underworld and then reborn again as a sprouting maize plant breaking the ground surface, bringing agricultural bounty while reaching up toward the heavens (Salazar Lama 2022).

Brown and colleagues (2018; see also Brown and Yaeger 2020) have argued that religious rituals in western Belize shifted from communal activities in public spaces in the Middle Preclassic, to more restricted rituals in the Late Preclassic that were tied to the institution of kingship. Similarly, the differences in the extent and location of the ritual deposits discussed in this paper reflect a transformation from communal rituals focused on agricultural fertility and community prosperity to restrictive rituals that celebrated the supernatural power of individual divine kings and the promise of their rebirth, thus both legitimizing and reinforcing the social distinctions and political authority of the Classic period.

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13 CREATING ANCESTORS TO GUIDE US: HINTERLAND LIFE AT EARLY CLASSIC SAN LORENZO

Victoria Ingalls and Tiffany M. Lindley

During periods of transition in the Maya region, the importance of ancestors becomes increasingly central to both political legitimation and ritual expressions. From the Preclassic to Early Classic periods, the role of individual ancestors not only transformed civic-ceremonial centers and political legitimation, but also hinterland household and community ties to the land and landscape. At the community of Rancho San Lorenzo, near the larger centers of Actuncan and Xunantunich, broad Early Classic social transformations are reflected at both the household and community levels. Here, we examine this transition through Early Classic interments at two distinct settlement clusters: the San Lorenzo ritual center, SL-13, and in the largest household complex of Floodplain North (FPN), SL-63. We explore how the rituals of daily life bound ancestors to the landscape, the community, and created enduring places. Burials were used to construct sacred space, and through this ritual behavior families and lineages actively laid sacred claim to the land. At SL-13, multiple Early Classic burials create a communal ritual-religious connection between the living and the dead, sustaining political and economic rights within the community. At FPN the Early Classic burial is the only one of its kind in the entire settlement, suggesting it helped to establish the SL-63 household as the first family in the area. This household was also the wealthiest and had the most diverse temporal occupation history, likely due to the Early Classic establishment of a sacred landscape. The burials at these specific locations established enduring personal ties to the land anchored by ancestors.

Introduction

During periods of transition in the Maya region, the importance of ancestors becomes increasingly central to both political power and ritual expressions. Especially from the Preclassic to Early Classic periods, the role of individual ancestors not only transformed civic-ceremonial centers and political legitimation, but also hinterland household and community ties to the land and landscape. At the community of Rancho San Lorenzo, near the larger centers of Actuncan and Xunantunich (Figures 1, 2), these broad Early Classic social transformations are reflected at both the household and community levels. Here, we examine this transition through Early Classic interments at two distinct settlement clusters: the San Lorenzo ritual center, SL-13, and in the largest household complex of San Lorenzo Floodplain North, SL-63.

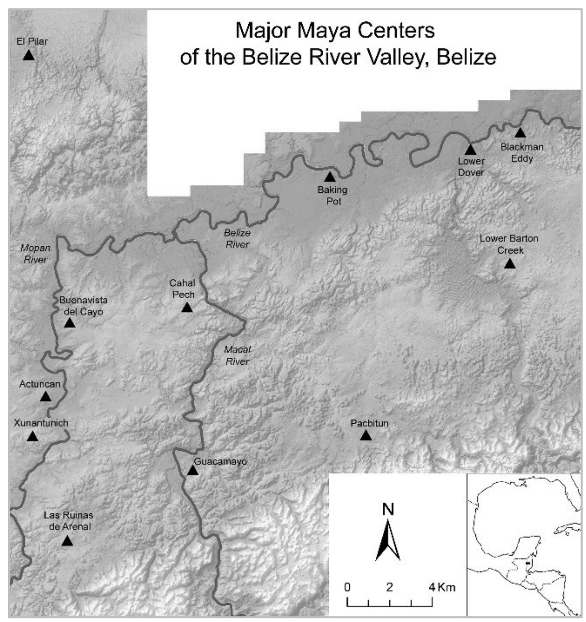

Figure 1. Belize Valley Region. Image courtesy of the MVPP/MVAP projects.

The earliest expressions of ancestor worship in the Maya region are typically ascribed to burials and iconography from the Middle to Late Preclassic period. For example, at large centers, including the Belize River Valley sites of Xunantunich, Cahal Pech, and Chan, burials placed at the summit of E-Group structures signifies a shift in association from communal rituals celebrating celestial events and deities to a specific emphasis on semi-deified individuals in the form of ancestor veneration (Brown 2013; Chase and Chase 1995, 1998; McAnany 2001; Robin et al. 2012; also see Źrałka et al. 2017). Additionally, evidence from the Late Preclassic shows increasingly frequent reentry of burials, elaborate practices of bone manipulation, and the development of long-term patterns of reverential caching and the placement of offerings (Brown 2017; Źrałka et al. 2017).

Ancestor veneration has long been recognized for its role in facilitating the rise of early kingship (Brown 2017; Brown et al. 2018;

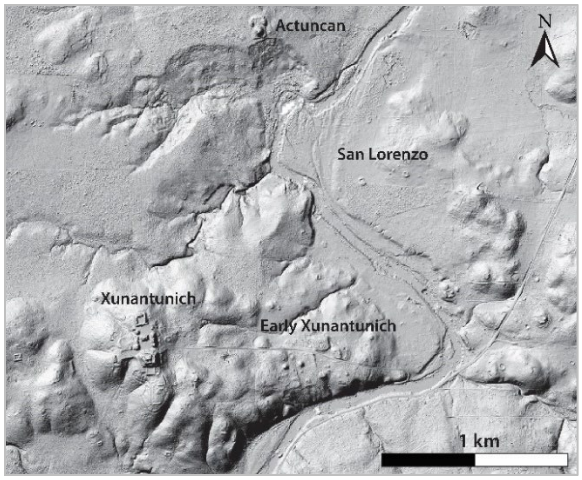

Figure 2: LiDAR image of San Lorenzo and surrounding sites. Image courtesy of the MVPP/MVAP projects.

Lucero 2003; McAnany 1995; Schele and Miller 1986; Źrałka et al. 2017). However, we must also look at how changing ideas of individual prestige and power may have been expressed at a local, non-elite level.

Outside of monumental centers, some ancient Maya commoners buried their revered dead below the floors of houses or household shrine structures (e.g., Chase and Chase 1998, 2011). At the same time, archaeologists have acknowledged that these burials represent a small subset of the total population, and therefore other practices surrounding death must have been practiced. Thus, it is reasonable to assume that the individuals selected for interment below house floors were special within their lineage, or perhaps their burial was linked to specific ritual or calendrical events, and they were therefore selected for a different type of remembrance tied to the ongoing life of the household and/or community (McAnany et al. 1999). Through this ritual behavior families and lineages actively laid sacred claim to the land, literally tying themselves to a place through their ancestral connections. Ancestors remained active figures in the lives of their descendants and could be called upon in times of crisis or dispute, helping their descendants weather social transformations in both spiritual and practical terms.

Rancho San Lorenzo

The ancient hinterland settlement of Rancho San Lorenzo (Figures 2, 3) sits on the eastern bank of the Mopan River and is the most studied settlement zone in the broader Xunantunich/Actuncan hinterlands (Chase 1992; Donn 2018; Ingalls 2020; Ingalls and Yaeger 2022; LeCount 1996; Lindley 2021; VandenBosch 1992; Villarreal 2018; Whitaker 2014; Yaeger 2000). In the Mopan Valley, accumulated data suggests that four major cities, Early Xunantunich, Actuncan, Buenavista del Cayo, and Classic Xunantunich experienced alternating periods of growth and decline (Brown and Yaeger 2020). These significant shifts were the result of economic and political competition among these cities and their allies (Ashmore 2010; Brown and Yaeger 2020; Garber 2004). While it is clear that surrounding households and communities, including Rancho San Lorenzo, were tied to these polities at various times, people in the hinterlands continued the ritual practices and traditions that elites at large centers had amplified, including ancestor veneration.

The ancient Rancho San Lorenzo hinterland community consists of five spatially discrete settlement clusters of domestic groups and a single ritual-administrative group (Figure 3). The latter group, SL-13, is not spatially integrated into any of the settlement clusters and evidence shows it was a gathering place for the broader community. Floodplain North is the northernmost settlement cluster and has a minimum of ten household groups, although recent research by Lindley (2021) suggests there might be additional mound groups that were either disturbed via modern farming or are so low they were not detected by mapping methods.

Multiple research projects at Rancho San Lorenzo have documented a long history of occupation from the Preclassic through the Postclassic. Cunil and early Middle Preclassic ceramics indicate settlement in the area began as early as 1000 BC (Donn 2018; Sullivan and Awe 2013; Villarreal 2018; Whitaker 2014), although materials dating to this early period remain rare and ephemeral. By the Early Classic (AD 250-600) the community was expanding, evidenced by the increased investment in permanent structures at SL-13, as well as in the Floodplain North and San Lorenzo settlement clusters (Ingalls 2020; Lindley 2021; Yaeger 2000). Population peaked in the Late Classic (AD 600-810) when the majority of documented house structures across the community were occupied.

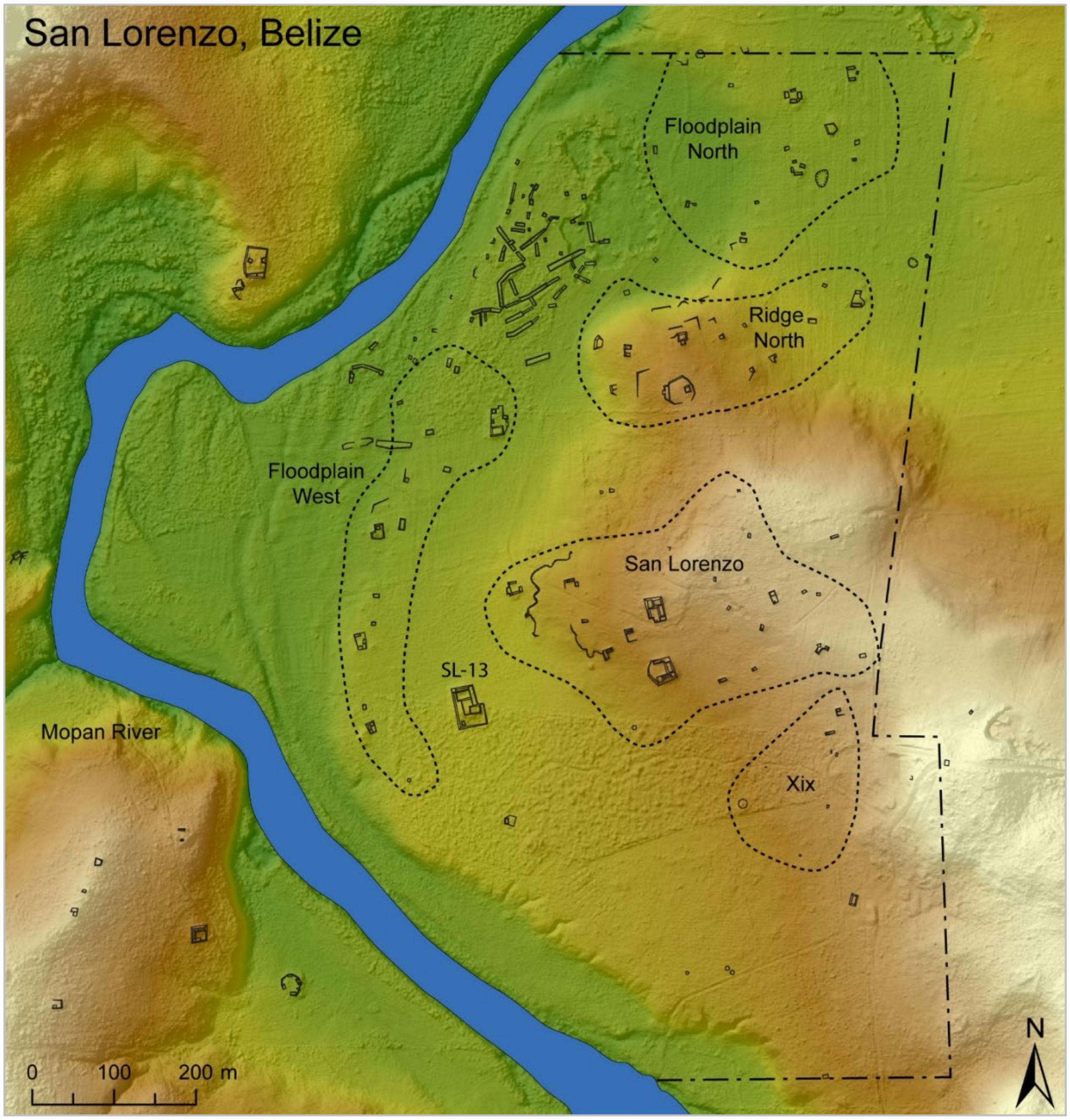

Figure 3: Rancho San Lorenzo settlement zone with settlement clusters indicated. Image courtesy of the MVPP/MVAP projects

The settlement was largely abandoned by the end of the Late Classic (c. AD 810), although diffuse evidence suggests a small population remained into the Postclassic period. Broadly, these settlement data indicate that the history of the Rancho San Lorenzo settlement mirrored larger sociopolitical trends in the Mopan Valley.

Floodplain North

The Floodplain North (FPN) settlement cluster (Figure 4) was established in the Early Classic Ak'ab phase (AD 300-600) and reached its peak in the Late Classic Hats' Chaak (AD 670-780) (Lindley 2021). FPN remained active through the Late to Terminal Classic Tsak phase (AD 780-890), with evidence of a continuing but ephemeral early Postclassic occupation (c. AD 900). Inhabitants of the FPN settlement utilized social ties within and outside the community to identify and exploit resources that enabled them to persist longer than neighboring settlement clusters.

Most of the house groups within this local FPN community had short occupation periods in the Late Classic Samal (AD 600-670) or Hats' Chaak phases before they were abandoned. However, one group, SL-63, had multiple construction phases dating from the

Early Classic through the Terminal Classic (Figure 4). SL-63 was the first household group established at FPN, had the longest occupation history, as well as the most construction phases within a single house group. Additionally, this group displayed material culture indicating that the members of this household were wealthier than the rest of FPN and, perhaps as the founding family or lineage, acted as local leaders. Due to its prime location on a ridge at the southern periphery of the community, SL-63 had the advantage of physically overseeing the rest of the community and likely had access to the best farming lands across the Mopan River floodplains below.

Even though SL-63 was a wealthy household within FPN, it still lacked formal stone masonry - a notable difference from the wealthy groups at the San Lorenzo settlement cluster to the south. However, the investment put into the group (e.g., the substantial amount of construction fill used in the platform construction and the physical labor needed to build) versus the low investment of most groups throughout the rest of FPN indicates SL-63 was distinct within the settlement cluster.

There is a distinct difference between the early (Ak'ab and Samal phases, AD 300-670) and later (Hats Chaak and Tsak phases, AD 670-890) structures throughout the FPN community. The SL-63 household had at least three structures, represented by raised cobble platforms upon which the perishable structures would have been placed. The Early Classic structures at SL-63 were built using cut limestone blocks of similar size and a large amount of cobble and debris construction fill to create a substructure upon which a perishable structure sat. Cut limestone was brought to FPN from outside of the community, thus necessitating high labor input than gathering locally available river cobbles. Additionally, the most striking feature of this construction phase is the presence of a thin (1-3 cm) plaster floor, the only plaster floor in the entire FPN settlement cluster. However, later construction heavily modified and removed sections of this early building. All that remains of the Early Classic building is associated with an Early Classic burial.

In the Late Classic, construction methods are modified due to either 1) a building boom in

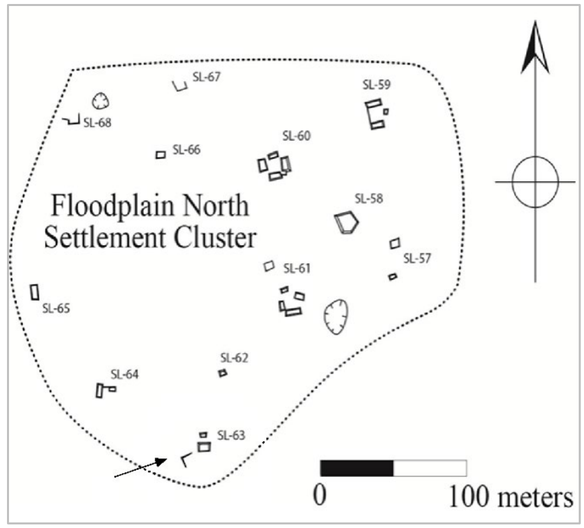

Figure 4: Floodplain North settlement cluster map highlighting SL-63. Image courtesy of Lindley.

the larger community that required a different distribution of labor and resources, or 2) changes in behaviors and attitudes related to visible wealth. Late Classic SL-63 residents still utilized limestone for substructure platforms, however the blocks vary in size and are likely secondhand stones scavenged from earlier construction. Additionally, large river cobbles become prevalent construction materials in later structures. The changes in construction at FPN demonstrate how broader shifts in socioeconomic ideology seen throughout the Mopan Valley shaped daily behaviors and choices of non-elite communities. These behavioral changes are also reflected in the burial record at FPN SL-63.

SL-63 Burials

In total, there are three burials at SL-63. These burials date to successive periods – the Early, Late, and Terminal Classic periods – and temporal changes in grave preparation mirror those seen in house construction practices. The graveshaft for the Early Classic burial utilizes cut limestone and is covered by a plaster surface; the Late Classic burial was placed under a platform that used a combination of cut limestone and rounded limestone cobbles, possibly pulled from previous construction; and the Terminal Classic burial was placed under mounded river cobbles of varying sizes.

The SL-63 Early Classic burial comprised two individuals within a partial cist

Figure 5: Terminal Classic construction above the Early Classic cist at SL-63. Image courtesy of Lindley.

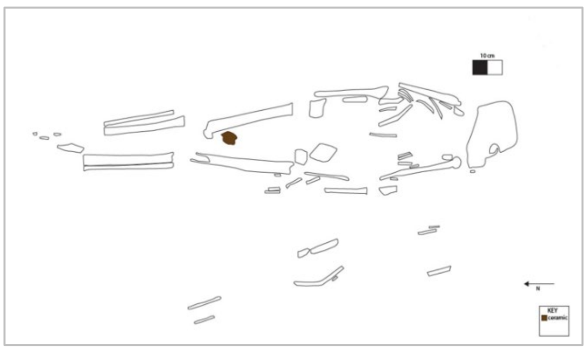

Figure 6: SL-63 Early Classic burial, Individual 2. Image courtesy of Lindley.

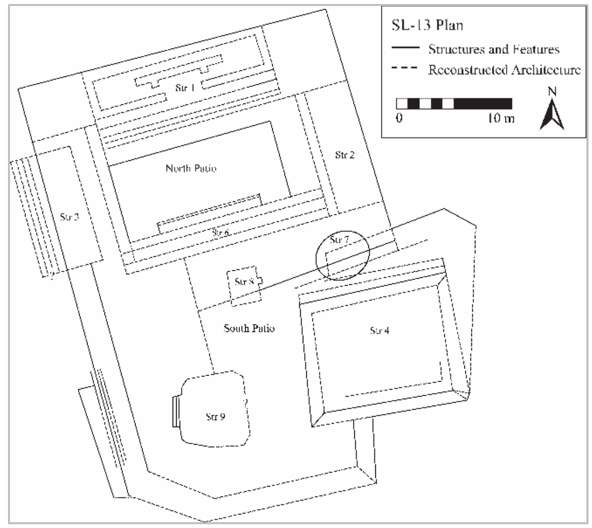

Figure 7: Structures comprising SL-13. Image courtesy of Ingalls.

capped by a plaster floor (Figure 5). The burial abuts a Terminal Classic construction that incorporated the Early Classic construction into the new structure. This suggests the Terminal Classic residents were aware of the earlier burials and either 1) did not want to disturb them, 2) wanted to actively integrate their ancestors into their household, 3) or both. The plaster floor capping the Early Classic cist was lined with a ring of river cobbles, but the floor extends below the cobbles slightly, perhaps 2-3 cm; the floor and cobbles are not articulated in a manner that would indicate they were installed simultaneously. It appears that during Late or Terminal Classic modifications, the plaster floor was impacted but residents knew the significance of this particular location and demarcated the burial with the river cobbles.

This Early Classic cist contained the remains of two individuals, but apart from a partial barkbeater, the only associated artifacts were undiagnostic sherds and lithics. Individual 1 was articulated, but only partially intact, and was directly under the plaster floor. Based on preliminary skeletal analysis, Individual 1 was likely an adult. There were no immediate grave goods associated with Individual 1.

Radiocarbon dating for Individual 1 returned a date of AD 250- 393 (cal. AD 241-380 [92%] and cal. AD 366-393 [3.4%]), indicating the individual died in either the Terminal Preclassic Pek'kat or Early Classic Ak'ab phase.

Individual 2 (Figure 6) had evidence of heavy disturbance and was not covered by the plaster floor, possibly through construction or a later re-entry into the graveshaft. Buried with their head to the south, Individual 2 only had partial long bones remaining. However, both right and left femora and tibia were present and articulated, indicating a primary burial. Based on the gracile nature and the approximate length of the diaphyses, Individual 2 was likely a subadult. There was a single undiagnostic ceramic sherd placed between the legs of Individual 2, but it is possible this sherd was introduced post-interment. No radiocarbon dating has occurred for Individual 2, but the placement and the possible disturbance during the interment of Individual 1 suggests it was an earlier burial.

SL-13

At the southwestern edge of the Rancho San Lorenzo settlement zone, SL-13 is located in an open space between two settlement clusters and is unique in size and architectural features within this hinterland community (Figure 7). Throughout its use life, SL-13 remained a focal node for community members, facilitating community gatherings and social interactions, increasing the strength of social ties and integrating this hinterland community into the larger sociopolitical landscape (Ingalls and Yaeger 2022). It is also unusual as excavations have revealed a total of 10 individuals buried there. There are four major construction phases that date from the Preclassic through the Terminal Classic periods that show the changing nature of community organization across time. The Preclassic to Early Classic transition is the most dramatic of these architectural changes and represents the shifting nature of authority and community organization.

During the Late Preclassic, SL-13 was the location of an open patio and small round platform, Structure 7. Many similar circular platforms have been found across the Maya lowlands, and these are typically interpreted as open ceremonial platforms that reflect a less hierarchical, more community focused social organization during the Preclassic (Aimers et al. 2000; Hendon 2000; Peniche May 2016). While the size, organization, and precise location of Preclassic households is not known, the data from SL-13 Structure 7 suggest that this was a focal point for the local community, a gathering place for various types of rituals and celebrations (Ingalls 2020; Ingalls and Yaeger 2022; Yaeger 2000).

Moving into the Early Classic period, the architectural sequence shows that the small, open Structure 7 was covered over with a much larger and rectangular platform, Structure 4-5th and 4-4th. These platforms were constructed out of large river cobbles capped with a series of marl and plaster floors. As there is currently no evidence of a superstructure present during this period, it may be that Structure 4 was also an open platform. Materials from the floor surfaces were relatively limited. However, at the summit, excavations uncovered a deposit of unifacial tools. Detailed usewear and starch grain analysis of similar tools from Xunantunich (Chapman 2013; Devio 2016) indicate that this type of tool was used to grate organic materials including tubers, chiles, and corn. Along with the absence of other production debris (like shell or slate) and primarily open form ceramic vessel fragments from this context, these data suggest periodic feasting was taking place here (Ingalls and Yaeger 2022). Therefore, Structure 4 may have functioned much like the preceding round structure and contemporaneous monumental structures at Xunantunich and Actuncan (albeit at a much smaller scale) – as a setting for feasting and various communal practices of affiliation.

SL-13 Burials

Just as we see at monumental centers in the region, the role ancestors play becomes increasingly central to both religious and political expressions at Rancho San Lorenzo from the Preclassic through the Early Classic. At SL-13, multiple Early Classic burials create a communal ritual-religious connection between the living and the dead, sustaining political and economic rights within the community. These practices were then expanded and amplified during the Late and Terminal Classic periods.

Within the construction fill of the Early Classic iteration of Structure 4 (Str. 4-4th) and just outside of Structure 7 excavations uncovered Interment 1, the remains of one or possibly two small children within the same burial context. Formal analysis by Carolyn Freiwald is ongoing, but Ingalls (2020) initially interpreted this burial as two individuals based on the number of deciduous teeth present. Bone preservation was very poor, but these children were buried along with 41 pieces of obsidian, 3 marine shell tinklers, slate pieces, faunal bone, and petrified wood. These objects, while not placed in a formal cache, suggest that these individuals may have been part of a dedicatory offering that commemorated the death of one structure (Structure 7), while giving life to the new building above. Radiocarbon dating indicates that these individuals died between AD 256 and 396, at the very beginning of the Early Classic period (Ingalls 2020).

While these individuals may have commemorated the ‘birth’ of Structure 4, the later Interment 2 was cut into the floor surface of the structure. This burial comprised an adult individual placed in a stone lined cist near the center of the structure (Figure 8). Radiocarbon dates indicate this individual died between AD

180 and 338 (Ingalls 2020). However, given the dates from the individual(s) in SL-13 Interment 1, this burial likely dates to the end of this range, at the start of the Early Classic period. Combining these data lets us date the construction and termination of this Early Classic phase of architecture between AD 256 and 338.

The cist itself was made out of river cobbles and roughly shaped limestone blocks placed standing on end arranged in a narrow oval around the individual's body. The cist was then covered with several successive floors that were very thin and heavily eroded. The individual's remains were very fragmented, likely due to the very thin buffer between the deceased and those walking on the floor above. During the Late Classic period, a line of cobbles delineating the edge of a new phase of construction was built over the individual's feet. As at FPN SL-63, this suggests that later people remembered the location of the Early Classic burial and purposely continued to incorporate them into their new buildings and practices.

The individual in Interment 2 was buried face down with their head to the south, and excavators found a large animal claw near the individual's upper thigh or pelvis, as well as a small Chan Pond group jar placed at their head.

Additionally, a maize kernel-shaped greenstone bead was found near the chin, suggesting it was either strung on a necklace or possibly placed in the mouth of the deceased. The placement is intriguing, as jade objects placed in or near the mouth have been interpreted to represent breath or one's life essence (Coe 1988). Similar jade triangulates have been interpreted to represent maize kernels offered to feed the individual on their way through the underworld and prepare them for rebirth as ancestors, like the Maize God (Awe 2021; Miller and Martin 2004:57). By placing this individual near the center of Structure 4, the community may have emphasized this new ancestor's place in the physical and spiritual center of the community. The inclusion of the jade triangulates tying them to the resurrected Maize God suggests that this burial fits a rising pattern of individual ancestor veneration during this period. These burials also mirror transformations seen at early E-Groups throughout the region – where previously

Figure 8: SL-13 Early Classic cist burial. Image courtesy of Ingalls.

communal ritual structures become associated with semi-divine ancestors.

Excavations at SL-13 have so far identified seven individuals, five adults and two children, buried during the Late Classic period. Possible signs of venerative practices include one adult individual whose grave was reentered, and their skull and long bones removed (Ingalls 2020). The grave of a second adult was reentered, their leg bones removed, and a child buried in their place. The adult's leg bones were then bundled and cached above the grave. On the southeast side of Structure 4, investigators documented an adult individual who had an upturned bowl on their lap containing the remains of a skull (Ingalls 2020). Again, this symbolism references beliefs surrounding the Maize God, resurrection, and practices associated with ancestor veneration (Brown et al. 2018:109; Chase and Chase 2005; Garber and Awe 2008; Garber et al. 2007). Thus, as seen at surrounding cities, the venerative practices established in the Late Preclassic and Early Classic periods are continued and amplified by the community during the Late Classic.

Discussion

The rites and rituals associated with death are practices of affiliation central to community identity and memory (Ingalls and Yaeger 2022). Both ancient and modern Maya peoples live in an animate world where agency and personhood extend beyond living individuals and where objects, animals, and places possess a spirit that is fully alive and with their own agency (Astor-Aguilera 2020; Chase and Chase 2011; Gillespie 2001; Hendon 2010; McAnany 1995). The ancient Maya lived with their dead who retained their personhood, and who continued to commune with descendants and kin. Additionally, ancestors continued to confer rights and privileges to their descendants by structuring inheritance and access to certain land, resources, rituals or ritual spaces, and other exclusionary rights. These important individuals were repeatedly used and referenced as part of ongoing rituals that ensured the link between the past and present was maintained through the shared memories of the household and community. While not all individuals were likely to have been revered as ancestors, the knowledge of the dead's presence physically within the household or community shrine would have influenced the actions of the living.

In such an animate world, there is no clear distinction between the religious and the secular. Ritual activities are undertaken as part of daily life in order to achieve certain outcomes through maintaining relationships with otherworldly beings, including ancestors. Burial within domestic spaces like SL-63 is one way to ensure continued veneration and proper treatment of ancestors. At Floodplain North, the Early Classic burial is the only one of its kind in the entire settlement cluster, suggesting it helped to establish the SL-63 household as the first or founding family in the community. This household was also the wealthiest and had the longest occupation history, likely due to the Early Classic ancestor figures who established sustained ties to the land, as well as the political and economic rights of the household or lineage. This deep history allowed this lineage to physically distinguish themselves from the rest of the community through access to prime farming land and status items, as well as an elevated household complex built into the ridge that could literally oversee the entire FPN settlement. The location and positioning of the SL-63 group is significant because it enabled the ancestors to watch over FPN. These ancestral ties could also explain how the people who lived at SL-63 were able to maintain their local authority during times of sociopolitical change from the Early Classic through the Terminal Classic periods.

At SL-13, multiple Early Classic burials created an animate ritual space and communal connections between the living and the dead during a period of great social transition. These burials also shifted the association of the structure from an open communal space to one associated with specific individuals, possibly deified ancestor(s). This tradition continued into the Late Classic, when at least seven more individuals were buried here. If future aDNA studies show a biological relationship between these individuals, it could indicate that there was a leading lineage within the community attached to the specialized ritual and political expressions seen at SL-13. If this is the case, SL-13 could be a localized example of the same processes taking place at large monumental centers. The prominent burial of this Early Classic individual elevated them to the status of an ancestral figure and simultaneously established the spiritual and political center of the community at SL-13.

Thus, the patterns seen at major centers of the increasing importance of individual leaders turned ancestors mirror those documented at Rancho San Lorenzo at both the household and community levels. The establishment of burials at the transition from the Preclassic to the Early Classic created an enduring link to the land and helped households and the community adapt to and endure social transitions and transformations through time.

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14 UNDERSTANDING LATE PRECLASSIC MAYA POLITICS: PRELIMINARY INVESTIGATIONS INTO THE TRIADIC GROUP AT ACTUNCAN, BELIZE

David W. Mixter, Scott R. Ferrara, and Thomas R. Jamison

For the Maya, the Late Preclassic period was a time of growth and consolidation; populations boomed and a common set of cultural ideas spread across the Maya Lowlands. This process is evident in the widespread presence of Chicanel Horizon ceramics, the dispersal of a unified Late Preclassic figural style found on mural and carved monuments, and the construction of a common set of architectural forms including canonical Triadic Groups. In the lower Mopan River Valley, the adoption of these ideas is evident in the rapid growth of the major center of Actuncan, Belize, which contains each of these cultural forms. This presentation reports on several years of preliminary research by the Actuncan Archaeological Project into the site's triadic temple group. The authors have undertaken original documentation of the site's extensive looters' tunnels and trenches, two seasons of original excavations, and archival work to recover original notes and drawings from research by James McGovern under the auspices of the Xunantunich Archaeological Project during the 1990s. Drawing on these data, we present initial interpretations of the sequence of construction of Structure 4, the largest and central pyramid of Actuncan's Triadic Group. This includes evidence for eleven major construction phases, which are described in detail. We contextualize these findings by explaining our observations of regional trends in Triadic Group construction, which drive our ongoing research.

Introduction

Since 2013, the Actuncan Archaeological Project (AAP) has renewed investigations into Actuncan South, the site's largest monumental architectural complex. Initial research by James McGovern (2004) during the 1990s as part of the Xunantunich Archaeological Project determined that this group of pyramids was a Triadic Group similar to those that appeared across the central Maya Lowlands during the Late Preclassic period (Hansen 1998). Drawing on test pitting and documentation of the group's large looters' trenches and tunnels, he determined that Actuncan South as seen today was indeed largely built during the Late Preclassic period with some evidence of Early and Late Classic construction and Terminal Classic ritual reuse. His reconstruction of Actuncan South, identification of monumental stucco masks, and discovery of Stela 1, a carved stone monument in Late Preclassic style, established the importance of Actuncan as a Preclassic center. It has also provided a starting point for AAP to situate this architecture within our work in the Actuncan North monumental complex and the site's households.

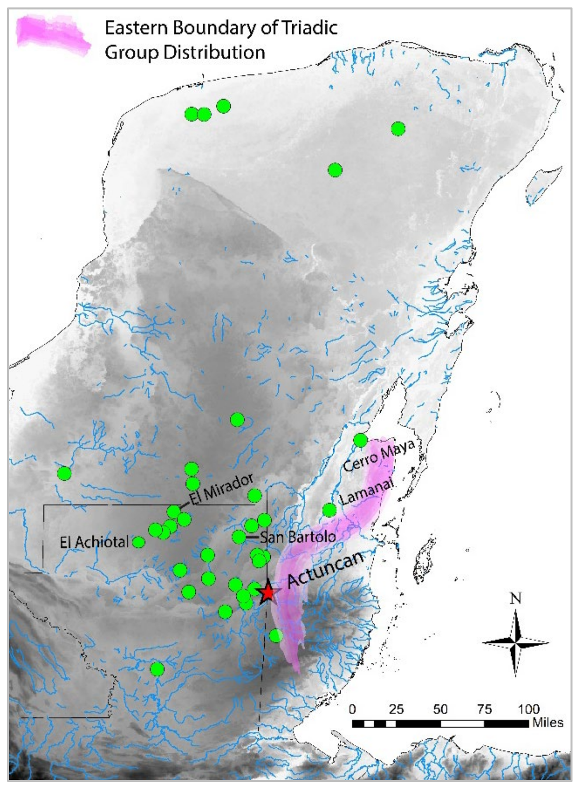

Figure 1. Map showing the location of Late Preclassic Triadic Groups based on the inventory by Szymański (2014). Sites mentioned in the text are labeled.

While AAP's initial project design developed by Lisa LeCount (2004) aimed to understand the origins of Maya rulership at Actuncan through a study of household development, the current phase focuses on the site's Preclassic monumental architecture to understand the emergence of hierarchical rulership at Actuncan. This research began with investigations into the site's E Group, led by

Borislava Simova (this volume), and continues with our work within the Triadic Group. This paper has two purposes. The first part of the paper presents the theoretical context that drives our current research agenda. Consistent with this volume's theme of transformations and transitional expressions, our research aims to understand the political transformations that underpinned the spread of Triadic Group architecture. The second part of the paper presents a summary of the research that has taken place to date, with a focus on providing an up to date reconstruction of Actuncan Structure 4, the largest structure at the site, by combining our findings with McGovern's.

What of Late Preclassic Politics?

With sustained epigraphic and archaeological research in recent decades, models for the political systems of the Classic period (AD 250 to 780) Maya have become increasingly nuanced and historicized narratives, documenting city-states using military might and diplomacy to create complex hierarchical alliance networks (Martin and Grube 1995, 2008). These models provide us with a solid understanding of regional political dynamics as well as the rulership principles within some individual polities. In the absence of hieroglyphic writing, no such scholarly consensus exists for the politics of the Late (400 to 150 BC) and Terminal (150 BC to AD 250) Preclassic periods. While significant work has been dedicated to the instruments and ideology of Preclassic rulership (e.g. Freidel and Schele 1988; McAnany 1995), scholarship that has accelerated with the publication of west wall of the San Bartolo Murals (Taube et al. 2010), the practical nuances of who Preclassic Maya rulers were and how they were selected remain poorly understood (Martin 2016). Furthermore, the regional political dynamics of the Late Preclassic period have been rarely addressed until recently (but see Doyle 2012, 2017; Freidel 2018). Yet, understanding the nature of regional political relationships may be key to answering questions regarding the rule of individual Preclassic cities and polities.

The Late Preclassic period was long viewed as a developmental period that saw the slow evolution of Maya society from small village life to the states of the Classic period.

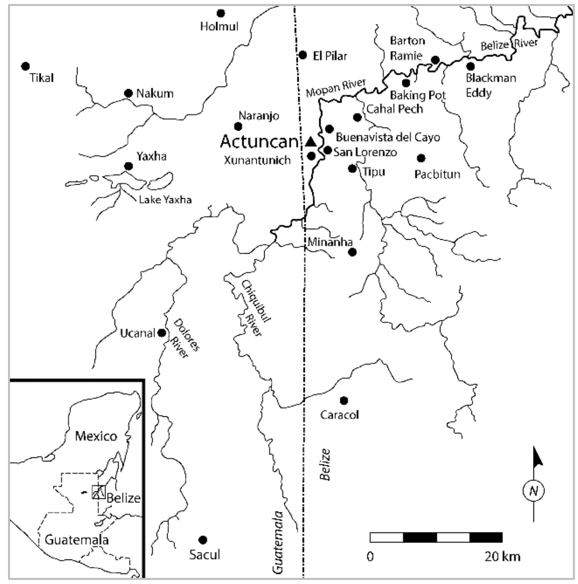

Figure 2. Map showing the location of Actuncan in relation to nearby centers and rivers (based on LeCount 2004:Figure 1).

Publications on the massive Late Preclassic cities of El Mirador, Guatemala and its neighbors since the 1980s (e.g. Matheny 1980) and more recently of the massive Middle Preclassic sites of the Usumacinta River valley (Inomata et al. 2021) have transformed this view. We now view the Late Preclassic period as a monumental urban apogee in its own right (Estrada-Belli 2011; Hansen 1998), with its own consequent collapse that laid the ground for the rise of Classic period politics.

Two kinds of public architecture dominated Late Preclassic Maya cities, E Groups and Triadic Groups. E Groups consist of a long linear eastern platform and a taller western pyramid separated by a plaza and have been the subject of significant scholarship (e.g. Freidel et al. 2017). However, E Groups are actually an old architectural form by the Late Preclassic period. Many E Groups were built during the Middle Preclassic period and some were founded before 1000 B.C. While some E Groups were elaborated in the Late Preclassic period, they are not a distinctively Late Preclassic cultural manifestation, but rather one that was inherited. Indeed, at the site of San Bartolo, Guatemala, the E Group was entirely buried in a monumental Triadic Group during the Late Preclassic period suggesting that the E Group form had fallen out of favor there (Saturno et al. 2018).

Triadic Groups are triadic arrangements of terraced pyramids located on three sides of a large, elevated rectangular platform. In some cases, the central pyramid is actually a platform with a nested arrangement of pyramids on its summit. They often served as canvases for monumental public art programs, particularly stucco god masks affixed to terrace faces flanking staircases. Generally, Triadic Groups are monumental in height, particularly in comparison to the relatively low E Groups. In contrast to E Groups, Triadic Groups are distinctive to the Late Preclassic period. Though the first examples may date to the end of the Middle Preclassic period, Triadic Groups became widespread in the central Maya Lowlands during the Late Preclassic period (Hansen 1998).

Triadic Groups do not appear in all parts of the Maya world. James Doyle (2017:16–18) divides the Lowland Maya world into five regional Preclassic cultural traditions, of which the Central Lowlands cultural tradition is particularly marked by its monumentality during the Late Preclassic period. Using Jan Szymański's (2014) inventory of Maya Triadic Groups, we can see that the distribution of Late Preclassic Triadic Groups is concentrated in the Central and Northern Lowlands (Figure 1). As important, mapping known Triadic Groups produces clear frontiers outside of which Triadic Groups have not been identified in the Late Preclassic period. This exercise suggests regional cultural diversity in the Late Preclassic period with a central zone marked by monumental Triadic architecture and surrounding zones in which this architecture is absent. Does this difference in monumentality reflect differing political arrangements in these areas? What caused the spread of Triadic Groups during the Late Preclassic period?

In a recent article, David Freidel (2018) has hypothesized that the spread of Late Preclassic monumental traditions may have been part of an effort by El Mirador to establish a territorial empire that controlled strategic trade routes. Sites with Triadic Groups may represent nodes of this empire. Cerro Maya at the mouth of the New River in Belize may have been a Preclassic trading outpost of El Mirador (Reese-Taylor and Walker 2002), and El Achiotal was an inland port with hybrid Maya-Olmec iconography at the western edge of the Central Karstic Uplands dominated by El Mirador (Acuña 2018). The construction of Triadic Groups near the northern coast of the Yucatan peninsula (e.g. Anderson 2011) and at Lamanai on the New River (Pendergast 1981) also suggest the construction of overland and canoe-based trade networks radiating from the El Mirador zone. This evidence certainly suggests some intentional political mechanism behind the spread of Triadic Groups, even if the empire hypothesis remains one of several possible models.

Similarly, Actuncan, Belize is located strategically on the Mopan River at a location that could regulate trade along the Belize River into the interior of the Petén (Figure 2). Actuncan is the furthest downriver location of a Late Preclassic Triadic Group along the Belize River drainage. Sites further downstream, including nearby Cahal Pech, do not have Triadic Groups. Instead, they transformed their E Groups into something fundamentally different, inline Eastern Triadic Assemblages, through the burial of the western structure and vertical elaboration of a group's eastern range (Awe et al. 2017; Ebert et al. 2021). In contrast, the E Group at Actuncan retains an archetypical Cenote-style layout (cf. Chase and Chase 1995) as the nearby Triadic Group grew in size. This difference in monumental trajectory suggests a political or cultural frontier may have existed between these two sites, perhaps reflecting the limits of El Mirador's influence. However, further research within Actuncan's Triadic Group is required to establish its sequence of construction and to anchor this construction sequence to a fine grained chronology that may be compared to broader local and regional trends in monumental construction. Research begun at Actuncan's Triadic Group aims to better understand the nature of Late Preclassic politics through the lens of monumentality at the frontier. The remainder of this paper reports on research to date at Actuncan's Triadic Group.

Actuncan

Located on an alluvial terrace overlooking the Mopan River, Actuncan was a major center in western Belize. The site's core was constructed as two monumental complexes separated by a natural ravine and connected by a

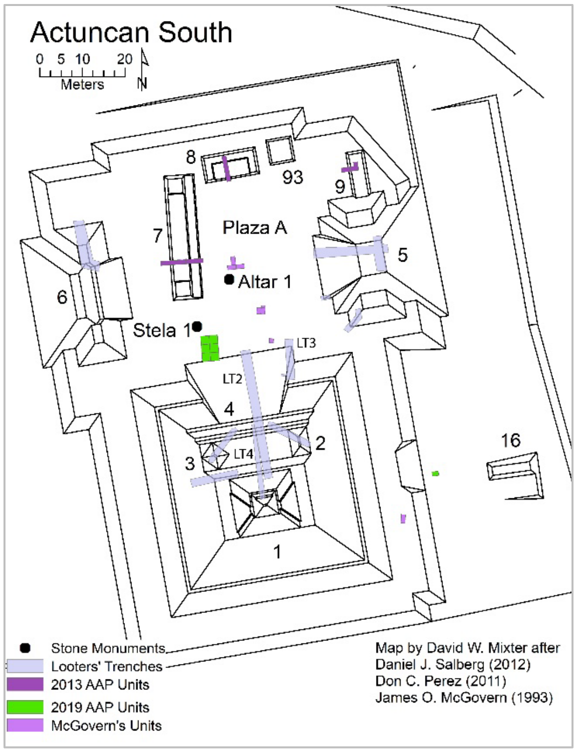

Figure 3. Map of Actuncan South showing the location of excavations and looters' trenches.

Figure 4. Photograph of the entrance to Looters' Tunnel 2 on the centerline of Actuncan Structure 4.

wide paved processional causeway (*sacbe*). Actuncan North, the larger of these complexes by area, is composed of five public plazas which are bounded by civic and ritual monumental architecture and urban residences. In contrast, Actuncan South consists of a single architectural group: the site's Triadic Group (Figure 3).

Actuncan South was built on a 4.5 m tall platform with a monumental staircase on its north side connecting to the *sacbe*. The group itself is a "fractal-type" Triadic Group (following Szymański 2014) which features a U-shaped arrangement of pyramidal substructures, with the central substructure (Structure 4) featuring an additional U-shaped arrangement of structures on its summit. At 15 m tall, the central structure, Structure 4, is substantially taller than the 8 m tall Structure 5 and 7 m tall Structure 6, which flank it on the east and west sides of Plaza A. This is augmented by the 11 m tall Structure 1 on its summit, which brings the total height of the central temple pyramid to approximately 26 m. On the summit of Structure 4's platform, Structure 1 is flanked by the low Structures 2 and 3. Finally, four low structures (Structures 7, 8, 9, and 93) were built in Plaza A as part of a Terminal Classic period reuse of the group (Mixter 2022), but were not part of the Triadic Group's original design.

Actuncan South seems likely to have been a place of public ritual and political performance. It contains the tallest buildings at Actuncan, all of which have the potential to be used as monumental stages. Additionally, McGovern discovered that at least some phases of Structures 4 and 5 had polychrome painted monumental stucco masks flanking the central staircases and that the plaza contained both carved and plain stone monuments. These features suggest that Actuncan South was the center of Actuncan's Late Preclassic development as a political center.

History of Research at Actuncan's Triadic Group

Actuncan South has been the subject of archaeological research for over a century; however, research using modern archaeological methods only began in the 1990s. Thomas Gann

(1925:48–93) worked at Actuncan in December 1924 during his two-week excavation at Xunantunich. He named the archaeological site based on a large snake that he spotted entering a hole in Structure 1 and briefly reported on his excavations there. He was the first to identify uncarved stela fragments in the plaza and a whole uncarved altar. He also left craters in a few buildings from his trademark excavation techniques. During Gordon Willey's Barton Ramie project, Michael Stewart visited Actuncan in 1954. He was not aware of Gann's previous visit and gave the site a new name, Cahal Xux (Willey et al. 1965:316). He was the first to identify fragments of a carved stela in the plaza, likely the monument now known as Stela 1. Looting took place at Actuncan prior to 1977 and likely during the 1980s (McGovern 2004:64). These efforts left large trenches or tunnels in all the structures that make up Actuncan's Triadic Group.

From 1992-1994, McGovern (1992, 1993, 1994, 2004) began the first large-scale scientific research at the site for his Ph.D. dissertation as part of Richard Leventhal's Xunantunich Archaeological Project. He mapped the mounded architecture, mapped most of the site's looters' trenches, collected ceramics from looters' trench profiles to assign relative ages to construction phases, and strategically placed excavations to aid his volumetric analysis of Actuncan's architecture. Within Actuncan South, McGovern cleared Plaza A, drew the substantial looter's trenches and tunnels in Structures 1, 4, 5, and 6, and placed test excavations into Plaza A to better understand the depth of its construction. He provided a preliminary chronology of these buildings through the assessment of small samples of ceramics collected from the looters' trench profiles. In Plaza A, he recovered Actuncan Stela 1, which dates stylistically to the Late Preclassic period. He also identified painted stucco masks adorning architectural terraces on Structures 4 and 5. During March 2019, Jamison and Mixter visited the Xunantunich Archaeological Project archives held by Richard M. Leventhal at the University of Pennsylvania. They were able to acquire copies of many of McGovern's notes, photographs, and detailed original drawings. McGovern was a meticulous documentor who produced lovely hand-drawn architectural profiles that provide a rich resource for reconstructing Actuncan South's architectural history.

The Actuncan Archaeological Project (AAP), directed by Lisa LeCount, began work at the site in 2001; however, the project didn't begin investigations in Actuncan South until 2013. That year, Mixter (2016, 2022) directed excavations focused on the Terminal Classic (A.D. 780 - 1000) reoccupation of Actuncan South as part of this dissertation research. He tested three small structures in Plaza A, determining that each date to this later time period.

In 2015, AAP personnel arrived at Actuncan to find renewed looting activity at Actuncan South from 2014 to 2015. Most dramatically, this included the extension of the centerline looters' tunnel into Structure 4 to 32 m in length. During 2018, Mixter returned to Actuncan South to record the new looting activity. In 2019, excavations supervised by Mixter and Ferrara were located in the plaza in front of Structure 4. Their 6 m long trench clipped the final version of Structure 4's staircase and then continued down through a sequence of plaza floors, ultimately terminating within a deep, dense clay construction fill before reaching culturally sterile layers.

The section that follows reports on our current architectural reconstruction of Structure 4 and its relationship to Plaza A based on these diverse data sources. Like McGovern, our excavations have not yet reached the earliest construction phases. Future research will aim to identify the group's foundational architecture.

Actuncan Structure 4: Accumulating Architecture Over Time

To understand Actuncan's place in Late Preclassic Maya political geography, our research must focus on Structure 4. The reconstruction of Structure 4 that follows is based on cross referencing McGovern's plaza test excavations, his recording of Looters' Tunnels 2, 3, and 4 (LT2, LT3, LT4), our 2018 remapping of LT2 (Figure 4), and our 2019 excavations along the north side of the structure at the western end of the terminal staircase. Though excavations do not connect these different efforts, many architectural features are consistent across the

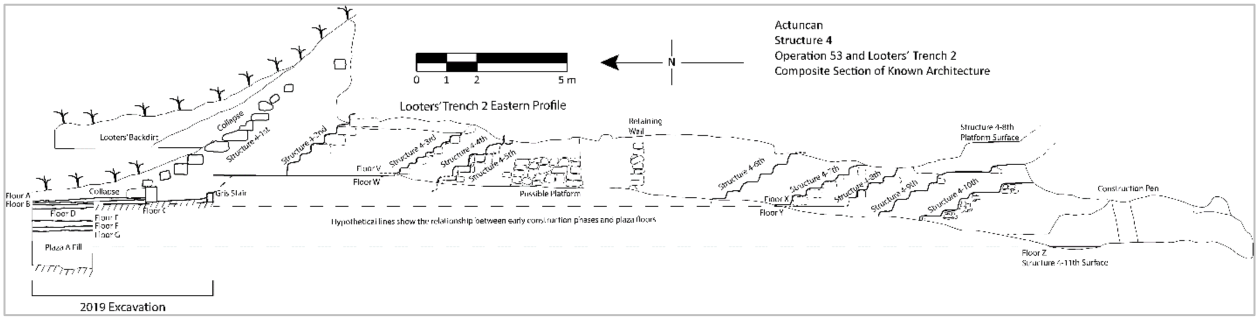

Figure 5. Composite section of Structure 4 based on the drawings of Looters' Trench 2 and AAP's 2019 excavations. This reconstruction shows the known extent of the architecture along Structure 4's centerline for all eleven construction phases.

plaza, as noted by McGovern (2004:115).

Structure 4's architectural history is represented in the composite profile in Figure 5. This reconstruction combines the profile drawing from our 2019 excavation with the 2018 drawing of LT2's profile. These were placed relative to one another using datum elevations as recorded using a Total Station in 2019 and by reconstructing the location of our excavation relative to the final staircase in the Looters' Trench using GIS software. Additional details outside the mouth of the looters' tunnel were filled in using McGovern's drawings, which were made before some areas were filled in with looters' backdirt in 2015. His drawings were aligned to ours using common architectural features present in both drawings.

Structure 4 consists of 11 known major construction phases. Earlier construction phases may remain to be discovered. I will describe what is known of each phase from earliest to latest.

The earliest phase, Structure 4-11th is only known from a small patch of plaster floor (Floor Z) identified deep within LT2. Because of the limited size of the exposed floor, we can't say much about this early construction phase; however, we would like to make two observations. First, the floor does not appear to continue at the identified level to the back of the tunnel where the tunnel dips down. This suggests that the floor was likely a platform surface of some kind. Second, this floor appears to represent a construction that was distinctly different from the phases that followed. The next five phases are represented by sequential staircases. Structure 4-11th was buried well below the earliest of these.

Structure 4-10th is the earliest identified staircase. We also identified this phase's platform surface. The platform was at least 1.2 m tall, though the lowest step is below the exposed portion of the stair. Construction of this phase buried Structure 4-11th under a fill of packed sascab with chert river cobble inclusions of varying sizes and densities organized into stacked chert cobble construction pens. The stairs were made of packed sascab, not proper lime plaster. This structure seems to have served as a template for the four phases that followed.

The four structures that followed, Structures 4-9th through 4-6th, are all structurally similar. Structure 4-9th expanded the structure by at least 1.3 m to the north and was at least 1.7 m tall based on the measurement from the summit of this platform to the lowest visible stair. Its staircase was constructed of polished plaster that was burned at the end of its use.

Structure 4-8th expanded the structure to the north an additional 1.0 m. A possible plaza or terrace floor (Floor Y) was mapped at the base of this version of the structure and the platform surface formed part of the tunnel's ceiling. We estimate that Structure 4-8th was a 2.2 m tall platform. Its staircase was also built of polished plaster. This platform was filled with a mix of packed sascab and large chert river cobbles. Both the staircase and plaza floor were heavily burned during the construction of the next phase.

It seems likely that Structures 4-7th and 4-6th were associated with plaza floors at similar elevations to Floor Y. Floor X runs from the foot of Structure 4-7th and seems to have directly replaced Floor Y, which may have been partially

Figure 6. Photograph of the lowest five steps of Structure 4-1st staircase in AAP's 2019 excavations.

destroyed at that time. Structure 4-7th expanded the platform approximately 1.9 m to the north. While it was likely larger than its predecessor, we do not have a clear estimate of its height because its summit is well above the limits of the looters' tunnel. The stairs of this phase are nicely rounded over individual cut limestone blocks. This staircase was also a uniform gray, suggesting an even burning prior to burial.

Similarly, Structure 4-6th expanded the structure at least 2.6 m to the north and was presumably taller than its predecessors, though we do not know where the platform's surface was located. This staircase was also constructed of smoothed plaster.

These early platforms provide evidence of early monumental construction, though we do not know if these were part of triadic arrangements. Each is constructed out of lime with the quality of the construction and plaster improving over time. The earliest structure in this set, Structure 4-10th, may have been constructed from tamped sascab rather than proper slaked lime plaster. All following versions were made from proper lime plaster, backed variously by large cut limestone blocks or small stacks of flat limestone. Additionally, each of these structures were extensively burned across their staircase surfaces prior to being covered by the fill of the next construction phase. This practice likely reflects a termination ritual of some kind and brings to mind a similar practice documented at nearby Pacbitun (Powis et al. 2019). This burning treatment is not apparent on later versions of the structure.

We do not have a clear understanding of how each of these staircases related to the plaza floors uncovered in McGovern's work or our excavations. While Structure 4-11th could not have been associated with any known plaza floors, Structures 4-10th to 4-6th are each high enough for them to possibly be associated with a sequence of three relatively tightly stacked plaster plaza floors previously identified in Plaza A. In the drawings of his plaza excavations, McGovern names these Plaza Floors 2, 3, and 4; however, I have renamed them Plaza Floors E, F, and G reflecting the greater number of plaza floors that we encountered in our excavations and some inconsistency in the elevations of plaza floors given the same names by McGovern in both his excavations and in LT2. Under one scenario, Structures 4-8th through 4-6th may have been associated with Plaza Floors C and D, which are roughly the same elevation as Floors X and Y.

Regardless, it is apparent that the lowest of these plaza floors, Plaza Floor G, is associated with a massive plaza expansion, likely to the dimensions of the final Triadic Group plaza. Our excavations along the front of Structure 4 excavated 1 m of compact chert cobble and clay fill below this layer with no evidence of another plaza surface. Near the center of Plaza A, McGovern excavated 2.7 m below these floors without identifying an occupation surface. Structure 4-11th is clearly associated with an earlier deeply buried organization of this space. Some of the following five architectural phases may have been as well. But one of these structures likely represents the establishment of the layout of Actuncan South as it is seen today.

Following the burning of Structure 4-6th, Structure 4 was massively expanded. The Staircase for Structure 4-5th is 9 m to the north of its predecessor. This phase fully encased all earlier versions of the structure. McGovern's architectural correlations and elevations in LT2 and LT4, at the summit of Structure 4, suggest that this phase may have been approximately 13 m tall, though we would like additional confirmation of the association between the phases at the foot and summit of the structure. We also do not know how this phase is associated with plaza floors. This staircase was built of rounded plaster steps with upright stones providing backing.

Structure 4-4th represents a minimal renovation to Structure 4-5th's staircase. Its construction partially dismantled the previous phase. This staircase was built through the placement of vertical stones directly on the steps of Structure 4-5th, which were then covered by a thick layer of plaster to create nicely rounded stairs.

Structure 4-3rd expanded the structure 1.5 m to the north. The fill of this structure consists of compact clay broken up by evenly spaced cut limestone block inclusions. This structure's staircase was built using a distinctive method in which every other stair was backed by a limestone block. These stones and the intervening spaces were covered in a thin layer of plaster to create nicely shaped rounded stairs. The staircase ends at Floors V and W, which are likely the same as McGovern's Plaza Floor 2 from his drawing of LT2. Importantly, these do not seem to be plaza floors. Instead, they form the surface of a broad terrace that extends to the south from the northern edge of the staircase during this and the subsequent construction phases. During this phase, this broad terrace may connect to the plaza with a staircase that terminates at Gris Stair, a single block found at the edge of our 2019 excavations that we believed represented an earlier construction phase. If this is the case, then this phase is likely associated with Plaza Floors B and C. Further research is needed to confirm this possibility.

McGovern's (2004:190–191) drawing of the western profile of LT3, located at the east end of Structure 4's central staircase, indicates that Structure 4-3rd is associated with polychrome plaster masks flanking the central staircase. Furthermore, the eastern profile of the trench includes stairs, indicating that the structure had three staircases on its northern face during this time period in a way that is reminiscent of the Late Preclassic form of N10-43 at Lamanai (Pendergast 1981:41). The masks would have decorated terraces between each of the staircases.

The staircase of Structure 4-2nd expanded the building 3.75 m to the north. This staircase was constructed of large limestone blocks laid flat in an overlapping pattern that were covered with rounded plaster surfaces. Like the previous phase, the staircase terminates at the broad terrace formed by Floor W. Similarly, the profiles of LT3 indicate that this structure also had a triad of staircases on its northern facade with terraced façades in between. It is not clear if the terraces of this version featured stucco masks. Thus, Structures 4-2nd and 4-3rd seem to follow similar stylistic principles.

Structure 4-1st is the final known construction phase and would have brought Structure 4 to its full 15 m height. Its staircase was identified in both LT2 and our 2019 excavations (Figure 6). The staircase is made of large limestone blocks set in an interlocking fashion. Because Floor W runs into the back of this staircase, it is possible that the lower portion of the staircase reused stairs from the northern end of Structure 4-2nd's broad terrace or destroyed that staircase in its process of construction. Our excavations indicate that the final two plaza floors, Plaza Floors A and B, are associated with the Structure 4-1st. The staircase seems to have been built into the earlier of these floors, Plaza Floor B. A final broken up step may have been added to the foot of the staircase at the end of its use, but this step was poorly preserved.

In sum, Structure 4's large mass was assembled over a sequence of at least 11 major construction phases. Continuing research will aim to solidify this sequence, associate these basal construction episodes with construction on Structure 4's summit, and establish the association of these construction episodes with monumental art projects. You may have noticed that we did not say when these different phases were built. McGovern (2004) concluded that all the plaza floors and three of the architectural phases he saw were largely Late Preclassic. He dated Structure 4-2nd perhaps to the Early Classic and Structure 4-1st to the Late Classic. Unfortunately, his dating program was based on very small samples of ceramic sherds pulled from the looters' trench profiles. Our ongoing program of ceramic analysis from our plaza excavation and extensive program of radiocarbon dating of materials collected from both the excavation and looters' trench walls will aim to produce a high-resolution chronological sequence for this building. Preliminary findings from this program indicate that all phases from Structure 4-9th to 4-2nd date to the Late and Terminal Preclassic periods, with Structure 4-1st perhaps dating to the Early Classic with later Late and Terminal Classic modifications. Broken Terminal Classic period ceramics found at the base of the final staircase speak to later ritual reuse consistent with Mixter's (2016, 2022) findings elsewhere in the plaza. On the other side of the temporal spectrum, we do not yet have good datable material from the earliest construction phases or know if we have identified the earliest construction phases. However, M. Kathryn Brown's model for Middle Preclassic regional sacred landscape centered on Early Xunantunich suggests that Actuncan forms the northern shrine of that site's early sacred axis (Brown and Yaeger 2020:297–300). If so, we are likely to find earlier Middle Preclassic levels deeply buried under the architecture discussed here.

Concluding Thoughts

The research presented in this paper provides a preliminary synthesis of Structure 4's construction sequence as well as the theoretical background for our continued work. A regional comparison of Preclassic architecture in the Belize River drainage suggests that Actuncan is different from its neighbors in the Late Preclassic period. Its massive Triadic Group and Cenote-style E Group are different from the compact E Groups and emergent Eastern Triadic Assemblages that are more common in the region. Our work at Actuncan aims to test why this location is different and what that difference might tell us about local and regional political models at this time. The reconstruction of Structure 4 presented here is a first step towards these broader historical aims. Determining what Actuncan's monumental architecture looks like, evaluating why it is different from other local forms, and finely controlling when it was built are key steps to bringing the site's Late Preclassic political past to life.

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15 *RENEWING THE BELIZE ARCHAIC PROJECT IN 2019*

Robert M. Rosenswig

The Archaic period in the Maya region represents six millennia (7000-1000 BCE) when non-ceramic-using peoples began to experiment with domesticates and reduce their settlement ranges. The single longest epoch of the Mesoamerican chronology, these early millennia are often overshadowed by the investigation of more recent peoples who built cities and have left evidence of elaborate artistic traditions. The Belize Archaic Project (BAP) began work over 20 years ago after the fortuitous discovery of aceramic deposits containing heavily patinated lithic tools and debitage under Postclassic settlements in the Freshwater Creek drainage of northern Belize. The 2019 field season marks a renewed phase of this project and initiates a program of systematic settlement survey and test excavations. This paper presents initial results of a systematic program of auguring that documented 87 Archaic-period sites and excavations at four of these locales during the summer of 2019. The renewed BAP investigates local land use patterns and foraging adaptation as well as the dynamic manner in which they affect (and are impacted by) climate change and evolving local forest and lacustrine ecology.

Introduction

The Belize Archaic Project (BAP) renewed a program of documenting evidence of Archaic-period settlement in the Freshwater Creek drainage of northern Belize (Figure 1). After fortuitously encountering aceramic deposits under Postclassic island settlements at Laguna de On and Caye Coco (Masson 1999, 2000; Masson and Rosenswig 2005; Rosenswig and Masson 2020), initial excavation of Archaic period remains were undertaken between 1997 and 2001 (Rosenswig 2004; Rosenswig and Masson 2001). In the intervening years, new and exciting finds continue to increase our knowledge of the Archaic period occupation of Belize from what was known two decades ago (e.g., Lohse et al. 2006). Investigations in the Belize Valley have continuously generated new results (e.g., Awe et al. 2021; Brown et al 2011; Stemp et al. 2016). Work by Keith Prufer and colleagues at cave sites in southern Belize have recently expanded the geographic range from where Archaic and earlier evidence is known (e.g., Prufer et al. 2017; 2021). Further, new finds in the Crooked Tree region are expanding the geographic range of the Archaic-period occupation in northern Belize (Stemp and Harrison-Buck 2019).

More than twenty years after first investigating the Archaic period, seven weeks of fieldwork were undertaken by the BAP on the west shore of Progresso Lagoon in the Corozal District (Figure 2) during the summer of 2019 (Rosenswig 2022). The project's overall objectives are to systematically document Archaic remains from a regional context through settlement survey, document and date regional

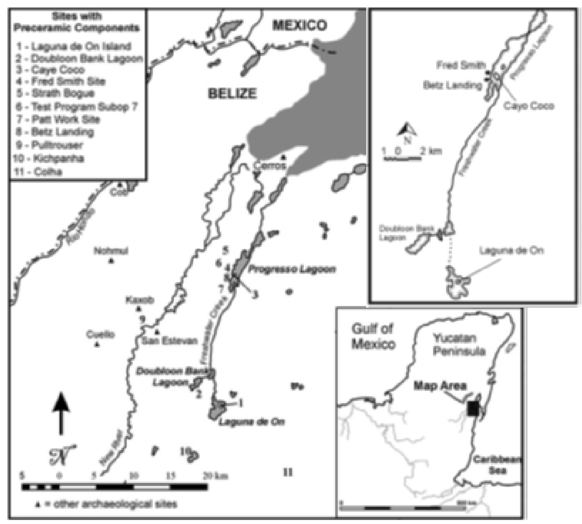

Figure 1. Freshwater Creek drainage with previously known Archaic-period sites.

adaptation through excavation as well as the reconstruction of forest ecology and climate change through sediment cores documenting pollen and charcoal. I present preliminary fieldwork results from the 2019 season in the pages that follow and explain our survey methodology. Before doing so, I contextualize the research by briefly reviewing what is known of the Archaic period in northern Belize.

Previous Evidence of the Archaic Period in Northern Belize

Following up on his work in the highlands, MacNeish started the Belize Archaic Archaeological Reconnaissance (BAAR) project in the early 1980s (Zeitlin 1984). BAAR undertook excavations at a number of sites in the northern half of the country, including Betz

Research Reports in Belizean Archaeology, Vol 18, 2023, pp. 177-184.

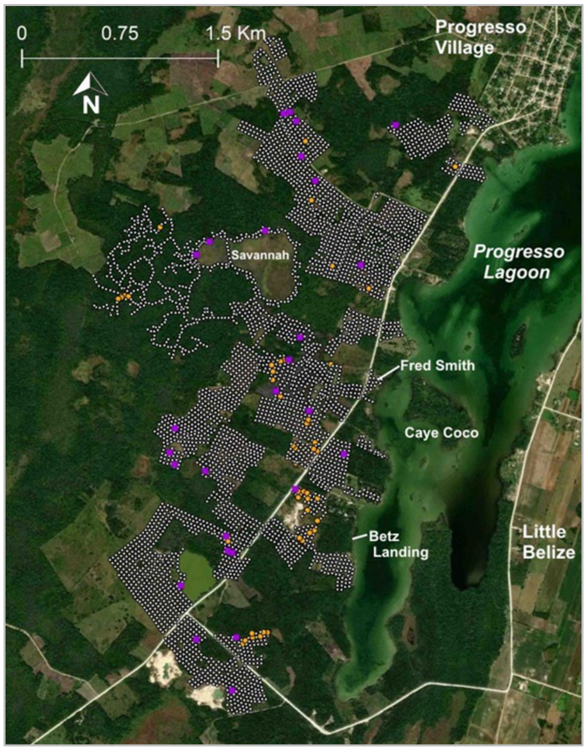

Figure 2. Location of 96 augur holes with orange soil (orange circles) and location of 33 recorded Archaic surface finds (purple circles).

Landing on the west shore of Progresso Lagoon (Figure 1). No archaeological features were reported from the excavations but a "reddish-brown soil" located 20-40 cm below the surface was documented with dates between the 1600-1200 BCE (Zeitlin 1984:364-365).

The best-defined cultural sequence in the Maya area from the Late Archaic period still comes from the site of Colha (Hester 1994; Hester et al. 1980; 1996; Iceland 1997, 2005; Iceland and Hester 1996; Shafer and Hester 1983). Colha is located at the north end of an extremely high-quality chert-bearing zone that was extensively utilized from Archaic times up to Spanish contact to make stone tools. Colha is approximately 15 km from Honey Camp Lagoon and 25 km from the south end of Progresso Lagoon (see Figure 1). Two superimposed lithic production areas were defined at Colha and dated by ten radiocarbon assays—the lower surface with evidence of unifacial tool production was dated to the Archaic; the upper, prepared surface had diagnostic Middle Formative lithic production debris (Hester 1994:3; Hester et al. 1996:47). At nearby Cobweb swamp, Jones (1994) and Jacob (1995) document forest modification as well as maize and manioc pollen by 2400 BCE.

Pohl et al. (1996) undertook a paleoecological program of coring and excavation at Pulltrouser Swamp, west of the New River in northern Belize. They documented maize and manioc pollen at Cob swamp before 3000 BCE (possibly as early as 3400 BCE). Yet pollen of tree species indicates that these cultigens were grown in high tropical forest with minor disturbance (Pohl et al. 1996: 363). After 2500 BCE, significant forest disturbance is documented from the pollen and charcoal records at Cob Swamp (Pohl et al. 1996:Fig. 4). The lithic assemblage recovered from the Pulltrouser Swamp excavations is reported as being similar to that at Colha.

The discovery of Archaic-period occupation in the Freshwater Creek drainage (Rosenswig and Masson 2001) led us to undertake preliminary excavations at two sites on the western side of Progresso Lagoon (Rosenswig 2004, 2006, 2021; Rosenswig et al. 2014; Stemp and Rosenswig 2022). At Caye Coco, approximately 150 m^2 of distinctive orange-colored soils containing Archaic-period stone tools were documented near two pit features and a single posthole. Radiocarbon assays of carbon from the orange soils at Caye Coco date to the Middle and Late Archaic (5464 ± 20 and 3885 ± 20 BCE). Excavations from similarly distinct orange soils at the nearby Fred Smith site, also produced distinctive stone tools, including a variety of expedient and formal bifaces, and unifacial tools made from macroflakes. As we have seen, two dates reported by Zeitlin (1984) from a "reddish-brown" soil stratum at Betz Landing, 500 m south of the Fred Smith site, are dated to the second millennium BCE. The age of these deposits are definitively, but not precisely, dated to the Archaic period.

Seven Archaic-period sites were identified along the Freshwater Creek drainage in northern Belize by our investigations (Rosenswig and Masson 2001; Rosenswig 2004). Initial analysis produced evidence of early domesticates (including maize, squash, manioc and chili peppers), stone tool assemblages from different site locations BCE (Rosenswig et al. 2014). Northern Belize also has numerous closed-basin ponds that preserve paleoecological records stretching back to these millennia (Pohl et al. 1996). Both hard-to-find datasets exist together in the project area – a rarity in Mesoamerica (Rosenswig 2015). We collected sediment cores from in and around Progresso Lagoon for environmental reconstruction during the 2022 season and analysis is in process. The groundwork is thus set to make a significant contribution to understanding the interplay of climate change, tropical forest ecology and human food production by documenting the relationship between them. The 2019 field season was our first attempt to document Archaic period sites systematically at Progresso Lagoon.

Survey and Excavation of Progresso Lagoon's West Shore

Orange Soils

The basis of our survey methodology is the correspondence between orange soils and patinated lithic tools made from macro-flakes that are distinctive of the Archaic period. We have not yet determined the causal relationship for the empirical observation that orange soils on the west shore of Progresso Lagoon contain Archaic tools. My working hypothesis is that some geological process (possibly Sahara Desert sands blown over the Atlantic Ocean) is responsible for the orange soil formation and that then Archaic-age peoples inhabited the area. This means that we do not necessarily expect all orange soils to always contain Archaic period remains. The alternate interpretation would be that some aspect of the Archaic occupation caused the orange soils and, if this were the case, Archaic tools and orange soils would necessarily co-occur. Rosenswig and others (Rosenswig and Masson 2001; Rosenswig et al. 2014) report that Archaic tools are documented in white clays at Laguna de On (aka Honey Camp Lagoon) and Doubloon Bank Lagoon – both upstream of Progresso Lagoo in the Freshwater Creek drainage (see Figure 1). Different depositional matrices could date to different time periods but we do not yet have enough dated contexts to evaluate this possibility. Further, north of Progresso the quantity of orange soils increases without any documented increase in Archaic period sites. In fact, during the early 2000s when highways

Figure 3. Heavily patinated lithic tools surface collected in 2019, ventral (A) and dorsal (B) sides.

Figure 4. Western edge of the "savannah" on west shore of Progresso Lagoon (see Figure 2 for location).

around Chetumal in Quintana Roo were being expanded, kilometers and kilometers of orange soils were exposed by construction machinery. On a number of occasions, inspections by Marilyn Masson and I never encountered a single Archaic tool or patinated flake. Therefore, the co-occurrence on which this methodology is based, works for the west shore of Progresso Lagoon but its applicability elsewhere would need to be established. The “orange soils” documented through excavation in 2019 range from orange (7.5YR 5/6) to dark reddish brown (5YR 3/1; 3/2; 3/3 and 3/4) to reddish brown (5YR 4/4; 4/3; 3/3) to red (2.5YR 3/6; 4/6; 4/8) so could have been called red or red-brown (or “reddish-brown” as MacNeish originally did). However, as I have long referred to these soils as orange, the BAP continues to do so.

Survey Methodology

Based on the observation that orange soils and Archaic-period deposits co-occur our survey methodology documents the presence and absence of orange soil in a systematic manner. During the first weeks of fieldwork in July 2019, we fine-tuned the methodology that combined opportunistically investigating land that is open of secondary growth vegetation and auguring at a systematic interval of 30 m. Auguring was undertaken with a 2 cm bit forced into the ground by hand which produced soil plugs that allowed soil strata to be described and measured. Orange soils could thus be documented in terms of their depth below current ground surface and thickness of the deposits. Following previous survey methodologies developed in Chiapas, Mexico (Rosenswig 2008), the 30 m spacing interval over a region results in each collection point representing an area of approximately 0.1 ha. Therefore, the resolution of our survey sampling captures all sites lager than 0.1 ha but misses an undeterminable number of smaller sites. This “know unknown” was not significant when documenting sedentary villages in Chiapas. However, when documenting the remains of mobile foragers with more ephemeral and smaller sites, we accept that a more significant error is built into our recovery methodology.

Results

In all, we survey about half of the land on the west side of Progresso Lagoon that was not forested during the 2019 field season and dug a total of 4424 augur holes (Figure 2). Of these, 96 had orange soil in them and we identified 87 potential Archaic-period sites. An Archaic period site was defined as the total number of augur probes with orange soils that were adjacent (i.e., 30 m apart) to each other. The majority of sites were defined by a single augur hole.

A strength of our survey auguring methodology is that the identification of orange soils is not dependent the type of land cover. Secondary growth forest and abandoned sugar cane fields were harder to move through and to acquire GPS reading, and so, require more time to survey each hectare of land. In contrast, newly burned and harvested sugar cane fields with no tree cover were surveyed much more quickly and provided easy visibility of artifacts on the ground surface. Household yards of mowed grass were also surveyed quickly but provided limited visibility of surface artifacts. However, regardless of land cover, the documentation of soil profiles through equivalently spaced augur holes provides directly comparable results.

Archaic surface finds were also encountered during our program of systematically auguring. In all, 33 heavily patinated tools were recovered during the 2019 season. We cannot claim that this recovery was systematic as different land-cover conditions greatly affected surface visibility. In addition, rain, excessive heat and the time of day also affected how many surface finds were noticed and collected. However, as is exemplified with Figure 3, large, complete lithic tools covered with white patina are evident when ground cover is not too thick. The six examples presented in Figure 3 give a sense of the range of patinated tools recovered, including unifaces, bifaces and large expedient utilized macro-flakes. When heavily patinated tools (many of which were unifacially worked macro-flakes) were noticed on the ground surface, a GPS point was recorded and they were entered onto a surface finds log. As is evident on Figure 2, surface finds (purple dots) and auguring holes with orange soil (orange dots) sometimes occur in the same area but sometimes they do not. Lithic tools making their way up to the surface depends on many things, most importantly of which is the disturbance that the area has experienced since the Archaic occupation. Therefore, surface finds reflect post-depositional processes more than a simple presence of Archaic deposits.

The area labelled “savannah” in Figure 2 (and see Figure 4), and forested lands to the west, did not allow us to follow the standard BAP survey methodology as described above. Savannah is the term locales use for seasonally inundated land where trees do not grow and so are commonly in high grass. The etymology of this term is likely from the colonial period when words used by British administrators from Africa and India were are (mis)applied, like the common Belizean practice of calling jaguars tigers and howler monkey baboons. The area of savannah and land to the west was part of a single large property measuring 500 acres with no agricultural activities. Instead, the owners were logging the land and this resulted in a network of access roads with smaller paths off the roads. To provide a sub-surface sample of this area, we augured along each of the roads and paths and this accounts for the meandering appearance of the augur hole locations. For the savannah itself, we augured only the higher ground around the edges of the grass. As can be seen in Figure 2, patinated tools were encountered on the ground surface around the edges of the savannah and orange soils documented below some roads within the area being logged.

As noted, 96 augur holes had evidence of orange soil and 33 heavily patinated lithics tools were recovered during the BAP survey season in 2019. These data spread across most of the survey area south of Progresso Village and north of the road to Little Belize that skirts the south of end of Progresso Lagoon (Figure 2). Therefore, our survey generated 129 indicators of Archaic-period occupation rvey to guide our placement of excavations. These newly documented sites add to those already excavated on the island of Caye Coco and two sites on the shore: Fred Smith (Rosenswig et al. 2014) and Betz Landing (Zeitlin 1984). The new locales also expand the range of excavated contexts toward the ultimate goal of documenting regional land use practices of peoples who left scant traces on the local landscape compared to subsequent sedentary villagers.

Figure 5. Location of four excavation Operations where excavations were undertaken in 2019.

Figure 6. Excavation unit of Operation 1, Suboperation 1 with to a limestone marl quarry in the background (see Figure 5 for location). Note the ploughed-up orange soils on the right (image faces south).

Excavation Locales

Based on survey results we selected four areas for text excavations (Figure 5). Operations 1 and 3 were both less than 1 km from Progresso Lagoon and both were areas with the highest concentrations of augur holes that document orange soils (see Figure 2). Each of these sites was also located east of the San Estevan-Progresso Road. The presence of orange soil in the augur holes at Operation 1 along with patinated lithics on the ground surface made this a very promising locale. Further, this area is 350 m from Progresso Lagoon shore and directly north of a large quarry pit where heavy machinery has been excavating limestone marl (see Figure 5). Five 2 x 1 m units were excavated adjacent to augur holes with orange soil. Figure 6 shows the Suboperation 1 excavation unit with the marl quarry in the background (visible as the white

Figure 7. Constricted uniface document in Operation 1, Suboperation 2, Level 4.

Figure 8. Orange soil and bedrock in excavation unit at Operation 4, with suboperation 2 in the foreground (image faces west).

Figure 9. Patinated lithic tools and debitage from Operation 4, Suboperation 2, Level 3.

area south of Operation 1 on Figure 5). Suboperation 1 at Operation 1 was 40 cm deep and contained a 20 cm thick layer of orange soil from which patinated flakes were recovered. At Suboperation 2, a complete constricted uniface was recovered from within the orange soil horizon (Figure 7). Note that through the patination banding visible. Such banding is characteristic of the chert from the Northern Chert Bearing Zone that includes Colha. This tool was smaller (~9 cm long) than most constricted unifaces and so may have been used for woodworking rather than digging soil or felling trees as the larger versions of this tool type are interpreted as fulfilling (see Stemp and Rosenswig 2022).

Operation 3 was selected for excavations as many heavily patinated tools were encountered on the ground surface in the area. This location is over 1 km from the lagoon shore, directly west of Caye Coco and the Fred Smith site. Unfortunately, Maya period occupation of the area significantly impacted the integrity of the underlying Archaic-period deposits. The four 1 x 2 units excavated for Operation 3 were placed between a series of Maya mounds to the south and a bajo to the north. The area was covered in tall grass, with the site being identified by two separate loci each containing concentrations of patinated chert flakes. We encountered no intact orange soils or patinated lithics in these excavation units. The lesson learned was that later Maya villagers disturb Archaic deposits so that we should not rely on tools fond on the ground surface in the vicinity of mounds as an indicator of Archaic period occupation.

Our systematic auguring program did not find any orange soils on the property in which Operation 4 units were excavated. However, the landowner was in the process of putting up a fence along the north side of his land and post holes had been opened with a post-hole digger at 5-m intervals just prior to our arrival (see fence posts along the tree line on right side of Figure 8). All seven 1 x 2 m units excavated at Operation 4 encountered orange soil within 20 cm of the ground surface. The fact that none of our augur probes in this region documented orange soil emphasizes that the survey methodology under-estimates the presence of these deposits. The site documented from Operation 4 excavations was on a bluff overlooking the lagoon 1 km away. All excavated units contained patinated lithic remains, the densest document at Suboperation 2 with over 200 flakes, shatter and broken tool fragments (Figure 9). This is a significant area of occupation and we will likely return in a future season to expose more of this site.

Path Forward

The 2019 BAP field season began a new phase of research on the Archaic period occupation of the Freshwater Creek drainage. With funds now secured for five seasons of fieldwork, the 2019 season began the research effort by systematically documenting Archaic period forager occupation at Progresso Lagoon in order to reconstruct land use patterns and economic organization with data from excavated deposits. The 2022 season saw the survey completed, excavations at another six locales undertaken as well as the collection of five sediment cores from Progresso Lagoon and two closed-basin ponds to the east. With three more field seasons of work, we are well on the way to achieve the BAP research goals of documenting forager adaptation and how it was impacted by climate change.

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16 TRANSFORMATIONS AND ADAPTATIONS: THE TERMINAL CLASSIC TO POSTCLASSIC IN NORTHERN BELIZE

Manda Adam, Iyaxel Cojit Ren, Fred Valdez Jr.

Northern Belize was an active and interactive region of the ancient Maya during the Terminal Classic and Postclassic periods. Data concerning the Terminal Classic Maya and episodes of the period are discussed in the context of several northern Belize communities, particularly Colha and Lamanai. The Terminal Classic events witnessed at Colha seem to be different and in contrast to developments at Lamanai. The transition or transformation to Postclassic life at both Colha and Lamanai are also reviewed as a means of understanding continuity as well as discontinuity in occupation, settlement, and cultural tradition(s) in northern Belize. Changes among the ancient Maya from the Terminal Classic into the Postclassic are focused on data from material remains including lithics, ceramics, and faunal resources. Specific details for the chronology at each site are compared and contrasted. The pattern of adaptation(s) in northern Belize, for the two periods under discussion, may be seen as developmentally similar in other regions of the ancient lowland Maya.

Introduction

At 660 CE a drying trend began in the Maya Lowlands that persisted through 1100 CE (Kennett et al 2015). Ancient Maya cities, some occupied over a millennium, were abandoned during the Terminal Classis period or the Classic Maya collapse (800-1000 CE). Kings and queens who once ruled the cities fell from power. The Classic Maya collapse is a point of fascination and mystery for academic and public audiences alike.

At some sites there appears to be a slow deterioration and abandonment, where garbage built up in sites and sites become polluted leading to the site's abandonment (Aimers et al 2020, Lentz et al 2020). While at other sites there was a rapid abandonment event accompanied with violence (Barrett and Scherer 2005; Chase and Chase 2020; Massey and Steele 2006). At Colha 55 individuals were killed then the site was abandoned (Massey and Steele 2006). At Caracol evidence of burials deposited in trash or left unburied and the burning of buildings indicates that the site experienced a rapid and violent abandonment (Chase and Chase 2020). Burning events have been reported for Becan, Tonina, and Palenque during the Terminal Classic (Buttles and Valdez 2016; González 2021; Harrison-Buck 2016). At Tonina burning events in relation to human sacrifice begin in the Terminal Classic and continue into the Early Postclassic, over 15,000 human bones have been recovered from these deposits (González 2021).

When discussing what occurred during the collapse, these abandoned sites give us insight into what may have occurred during the Terminal Classic. Researchers throughout the southern Lowlands have identified "problematic deposits" that date to the Terminal Classic (Aimers et al 2020; Chase and Chase 2020; Harrison-Buck et al 2008; Houk 2020). These deposits could reflect the purposeful destruction of elite through the removal of burials from tombs, burials deposited in trash or left unburied, sheet refuse, artifacts removed tombs, artifacts smashed in abundance in passageways, and the defacement of monuments and stelae (Chase and Chase 2020; Harrison-Buck 2016; Harrison-Buck et al 2008; Helmke 2021; Houk 2020). During a drought, it would have been the elite's responsibility to use their claimed ancestry to the gods to remedy the situation. When the drought persisted, the elite's authority may have been questioned and lead to their undoing. There is not one distinct cause of the Classic Maya collapse (or transformation) it is clear that various factors i.e., polluted cities, a long and prolonged drought, dissatisfaction with the elite, among other concerns, proved to be disastrous for the Classic Maya of the southern Lowlands.

After the Terminal Classic is the Postclassic period (1000-1500 CE). Northern Belize was an active and interactive region of the ancient Maya during the Terminal Classic and Postclassic periods. In northern Belize, most ancient Maya sites were not reoccupied after the Terminal Classic. There are, however, a few notable exemptions. Sites along Progresso Lagoon and Laguna Seca, and the site of Honey Camp/Laguna de On were established during the

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Postclassic in the 11th century (Masson 1999; Valdez and Masson 1992). The sites of Colha and Nohmul were abandoned in the Terminal Classic then reoccupied during the Postclassic (Buttles 2002; Hammond 1987 et al; Hammond 1982; Valdez and Mock 1985). Santa Rita Corozal experienced a population decline at the Terminal Classic, but persisted into the Postclassic, becoming an important site during the Late Postclassic (1350 - 1500 CE) (Chase and Chase 2008). Santa Rita Corozal is also noteworthy for its Late Postclassic murals (Chase and Chase 1988). Lastly, the site of Lamanai, never experienced an abandonment event (Aimers 2008; Graham 2004; Ting 2015; Wrobel and Graham 2015).

The Postclassic in the broader Mesoamerica is viewed as a dynamic period with the proliferation of states and the rise and fall of these states (Helms 1975). There is an expansion of trade networks by the Maya to Mexico, Panama, Costa Rica, and Nicaragua (Lange 1996). Maritime trade is expanded via the Caribbean Sea through the trading interests of Chichen Itza and Mayapan (Masson and Chaya 2020). The period is also marked by the appearance of metallurgy. Cast metal becomes a heavily traded good with gold coming from southern Central America and copper from West Mexico (Lange 1996; Simmons and Graham 2016). Turquoise arrives into Mesoamerica from the American Southwest around 1000 CE. Chocolate pots and feathers from neotropical birds appear in the Southwest (Carpentar 2020; Rosenwig and Vaquez-Leiva 2021).

Data concerning the Terminal Classic Maya in Belize and episodes of the period are discussed in the context of several northern Belize communities, particularly Colha. The Terminal Classic events witnessed at Colha seem to be different and in contrast to developments at Lamanai. The transition or transformation to Postclassic life at both Colha are reviewed as a means of understanding continuity as well as discontinuity in occupation, settlement, political relationships, and cultural tradition(s) in northern Belize. A broader theoretical potential will be presented before the data from northern Belize sites.

Theoretical Background

Drawing on current research by Adam (in progress), the Postclassic period in Northern Belize may contribute to three primary areas of interest. First, is research on conceptualizing and understanding the aftermath of societal collapse. Second, is research on memory and its role in social change and transformation. Third, interests concerning on daily life and its effects on social change and transformation.

Conceptualizing Collapse and its Aftermath

Myths and stigmas of the Postclassic persist, including that the Maya completely disappeared and that the Postclassic Maya were declining, decaying, decadent, and depopulated (Chase, Chase, and Morris 2008; Chase and Chase 1988). Ideas and narratives of progressive deterioration like these ignores the long-term resiliency of Maya culture after the Terminal Classic and their endurance for centuries (Masson and Hare 2020). Furthermore, links between collapse and failure enables a negative and discriminatory view of descendant communities and erases the history of these groups (Meehan 2019). Researchers have emphasized the importance of shifting narratives of collapse. The Maya collapse should be understood as a time of change and transformation with new social, economic, and political circumstances and opportunities (Aimers 2007; Chase, Chase and Morris, Clayton 2020; Meehan 2019).

Furthermore, when conceptualizing and understanding the Postclassic, the changes that take place should be understood as a mosaic pattern of change (Aimers 2007; Joyce et al 2014; Schwarz 2009). The various social classes and families within Maya culture would have been affected differently by the collapse or transformation (Meehan 2019; Schwarz 2009; Yaeger 2008). There would have been varying degrees of engagement (and experienced effects) between and within urban and rural populations (Schwarz 2009). Yaeger (2008) suggests that the urban, wealthy, founding families would have stayed at sites for longer periods of time after the collapse and were least likely to abandon due to their family's ancestral connection to the site. Other wealthy and elite families, however, may have faced violence and were even killed during the Terminal Classic (Barret and Scherer 2005; Massey and Steele 2006).

Due to these varying responses and engagement with collapse, it is important that collapse research includes a diversity of sites and that the investigations move away from only examining large sites and regional capitals such as Mayapan and Chichen Itza to a focus on smaller households and communities for a more complete dynamic understanding (Clayton 2020).

Memory

An emerging area of research is the effect of the legacy of the collapsed state on the development of culture after collapse, and how the collapsed state is remembered and engaged (Clayton 2020; Johnson 2019; Johnston et al 2001; Joyce et al 2014; Manahan and Canuto 2009; Meehan 2019). Maya sites during the Terminal Classic experienced violent, and traumatic abandonment events. These events likely had a profound impact on how people engaged and remembered these spaces following the Terminal Classic. Through ritual activities, settlement choice, and material culture, the Early Postclassic Maya appear to try to disconnect from the Classic Maya state and connect to times before the Classic Maya.

Brown (2011) argues at Xunantunich that Early Postclassic peoples intentionally chose spaces for ritual activity for the place's antiquity and suggests that people would have known and remembered the antiquity of these areas. The Peten in Guatemala, Oaxaca, Mexico, and northern Belize experience similar phenomena. Early Postclassic ritual activity and settlement is occurring in spaces that were not occupied by the Classic Maya (Johnston et al 2001; Meehan 2019; Valdez and Masson 1992). Furthermore, the Postclassic Maya dismantled Classic buildings, stelae, and altars and incorporated them into the walls of Postclassic structures (Cecil and Pugh 2018). Attempts to connect to the time before the Classic Maya can further be seen through the cultural similarities between the Preclassic (350 BCE – 50 CE) and the Early Postclassic. At Copan, Honduras Early Postclassic material culture is more similar to the Late Preclassic material culture (Manahan and Canuto 2009). Similarities are reflected in the architecture organization i.e. linear arrangement of structures around a plaza, lack of plaster floors, and the presence of earthen floors, and an emphasis on perishable structures (Chase and Chase 1988).

Daily Life

After cultural transformation people will make, acquire, and use new kinds of materials as new relationships and opportunities arise. This shift in materials results in changes in foodways, rituals, and economic networks. Additionally, people will make decisions such as moving, reorientating social and economic networks, and innovating new forms of leadership (Clayton 2020). While everyday practices in households may appear to be inconsequential for understanding political transformations, without considering the agency of all people and the impact of everyday household practices, understandings of social change will be incomplete (Joyce et al 2014). Thus, daily life is essential to understand how people navigate the shifting social, economic, and political circumstances after the Classic Maya collapse.

During the Early Postclassic, one change in daily life observed is more access to trade networks and prestige goods to rural communities. It is suggested that rural actors could take independent actions no longer being constrained by elites (Chase and Chase 1988; Joyce et al 2014; Manahan and Canuto 2009; Meehan 2019). For instance, obsidian becomes more widely available during the Early Postclassic, it is transformed from a luxury good to a utilitarian item (Masson and Chaya 2000; McKillop 1996). Having more access to goods and materials would have had a profound change on the daily life of Postclassic Maya.

In addition to more accessibility to good and materials, another profound change occurs with religion in the Postclassic. In the Postclassic a wider sector of the population is involved with the religious systems -- this can be seen through the increased use of incensarios in the Postclassic to contact ancestors (Chase and Chase 1988; McAnany 1995; Schwarz 2009). Incense burners or incensarios were used in the Maya Region from the Preclassic period through the Colonial period. In basic form, an incensario is a vase, small cup, or bowl that was used to burn incense materials such as resins, gums, or copal (Cecil and Pugh 2018).).

These changes that occur during Postclassic are a result of changes in daily life, thus daily life is essential to understanding the changes that occur after the Classic Maya collapse. Changes among the ancient Maya from the Terminal Classic into the Postclassic are focused on data from material remains including lithics, ceramics, and faunal resources. Specific details for the chronology at each site may be compared and contrasted. The pattern of adaptation(s) in northern Belize, for the two periods under discussion, may be seen as developmentally similar in other regions of the ancient lowland Maya.

Methods

To investigate the ancient Maya Postclassic period, three distinct methodological approaches are implemented: 1) the utilization of previously excavated materials from sites located in the RBCMA (Rio Bravo Conservation Management Aera) 2) archaeological excavation data from the site of Colha, and 3) lidar analyses. In tandem these methods will build off one another to give insight to the ancient Maya Postclassic period in northern Belize.

Within the RBCMA, Postclassic materials have been found by various researchers (Houk 2008; Hyde 2008; Padilla 2007; Sagebiel 2008). The Postclassic record for this area is, however, highly fragmentary in that the individual data points of Postclassic evidence has not been brought together into conversation with one another. Postclassic materials have been found at various sites in the RBCMA (La Milpa, Mulch'en Witz, Akab Mucil, Medicinal Trail, Dos Hombres, Chawak But'o'ob, Bird of Paradise Fields, Gateway, Chan Chich and Gran Cacao) (Figure 1). Culminating data from multiple sites in the area will be very illuminating to understand site interactions within the RBCMA, how the RBCMA is interacting with other sites in the region of northern Belize, and how Northern Belize is interacting with other regions.

Another aspect of utilizing previously excavated materials will be a reanalysis of the Colha Postclassic ceramics (Valdez 1987).

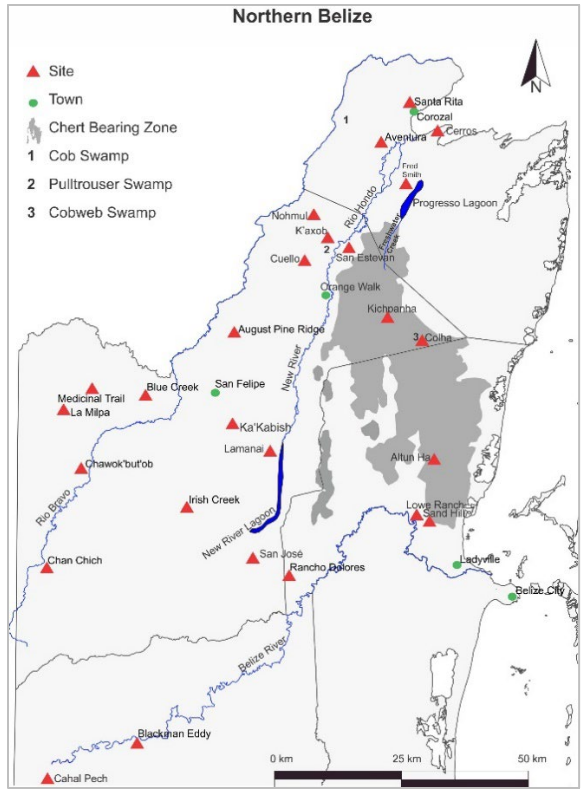

Figure 1. Map of Research Area (Northern Belize).

While the entirety of the prehistoric Colha ceramic collection was originally analyzed decades ago, the Postclassic part of the Colha ceramic collection needs to be reanalyzed and updated to include current type names of Postclassic ceramics. Updated ceramic classifications of the Colha Postclassic ceramics will be helpful to make cross site comparisons and to understand Colha's interactions in the region and beyond.

Another aspect of interest is locating and excavating Postclassic architecture. At Colha as at other Maya sites, Postclassic architecture often reuses Classic period buildings through re-purposed stones from Classic buildings to build rooms next to Classic structures (Manahan and Canuto 2009). Architecture from the Postclassic in northern Belize has been minimally investigated and the architecture is not well defined and a missing point in the literature.

The use of airborne lidar derives 3D maps of sites and settlements. For over a decade lidar has proven to be a powerful tool in helping archaeologists detect new archaeological remains, pose new and innovative research questions and expand our knowledge of past cultures (Beach et al, 2019; Chase et al 2020; Garrison et al 2018; Thompson et al 2018; Yaegar et al 2016). The various GIS methods will help to model Postclassic interactions and settlement.

Site And Samples

Colha

Colha is one of the earliest occupied Maya sites in the Maya Lowlands the first short-term occupation of Colha occurred in the Early Archaic (6000 BCE). At 3,400 BCE there is evidence for part time occupation, then around 1000 BCE there is full time occupation and settlement at Colha with clear evidence of Maya culture (Valdez et al 2021). It is hypothesized that Colha would have been a desirable area to reside at due to its proximity to Cobweb Swamp and its water resources and Colha's position in the chert bearing zone of northern Belize. Chert from this area would have been highly desirable for making stone tools (Buttles 2002; Barrett and Scherer 2005; Reid 2012).

Due to Colha's position in the chert bearing zone, until the Early Classic (250 CE) Colha controlled lithic production, with no evidence of other lithic workshops in the area. There was a brief hiatus of lithic workshop production in the Early Classic and production resumed during the Late Classic Period (600 CE) (Reid 2002). During the Late Classic, it is possible that Colha was under the control of the nearby polity Altun Ha.

Colha was then abandoned in the Terminal Classic period (900 CE), the abandonment of the site is most notably marked by an event resulting in the death of at least 55 individuals in two separate deposits (Barrett and Scherer 2005). One deposit contained the decapitated skulls of 30 people (10 adult females, 10 adult males, and 10 young children) (Massey and Steele 2006). Osteological analyses suggest that these individuals were part of the elite class of Colha due to individuals having elongated skulls and the filed teeth amongst the older adults. The second deposit contained highly fragmented remains of at least 25 individuals aging from 12-18 years of age. The site was abandoned for 50-100 years and reoccupied during the Middle Postclassic (1000 CE) then abandoned permanently during the Late Postclassic (1350 CE) (Barrett and Scherer 2005; Massey and Steele 2006).

The relationship and shared culture between Colha and the large Maya center of Lamanai is highly curious. While Lamanai did not seem to suffer the same consequences witnessed in the Terminal Classic at Colha, it large site continued into the Early Postclassic seemingly without any abandonment. The ceramics, lithics, and other artifacts recovered at Colha for the Middle and Late Postclassic are identical to those from the same periods at Colha. The exact nature of the relationship between Colha and Lamanai remains a subject of study, but carries many implications for the nature of Maya polities in northern Belize.

Rio Bravo Conservation and Management Area

Another research area for the Postclassic of northern Belize is the RBCMA. The RBCMA encompasses an area of about 250,000 acres and is managed by the Programme for Belize (PfB). The Programme or Belize Archaeological Project (PfBAP) area has approximately 70 ancient Maya site that range from urban centers, towns, and villages to hamlets (Valdez 2008; Figure 2). Initial human occupation started in the Paleoindian Period and continued into the Historical period.

When describing the nature of the Postclassic period in the RBCMA it falls into two categories: visitation and occupation (Houk et al 2008). Visitation in the Postclassic is classified as small groups visiting for a short amount of time i.e., pilgrimages or hunting parties, while occupation is classified as groups of people permanently living in an area (Houk et al 2008).

Occupation in the Postclassic period is evidenced at the sites of La Milpa, Gran Cacao, Akab Muclil, and Birds of Paradise. The site of La Milpa, one of the largest sites in Belize, has limited Early Postclassic occupation. It is argued that the site was reoccupied after abandonment by small groups by the Early Postclassic (Sagebiel 2005). Evidence for occupation comes from Structure 86, a Yuctacen style house, it contained Early Postclassic ceramics in the structure's floor and subfloor fill (Sagebiel 2005). It is speculated that further Early Postclassic activities occurred

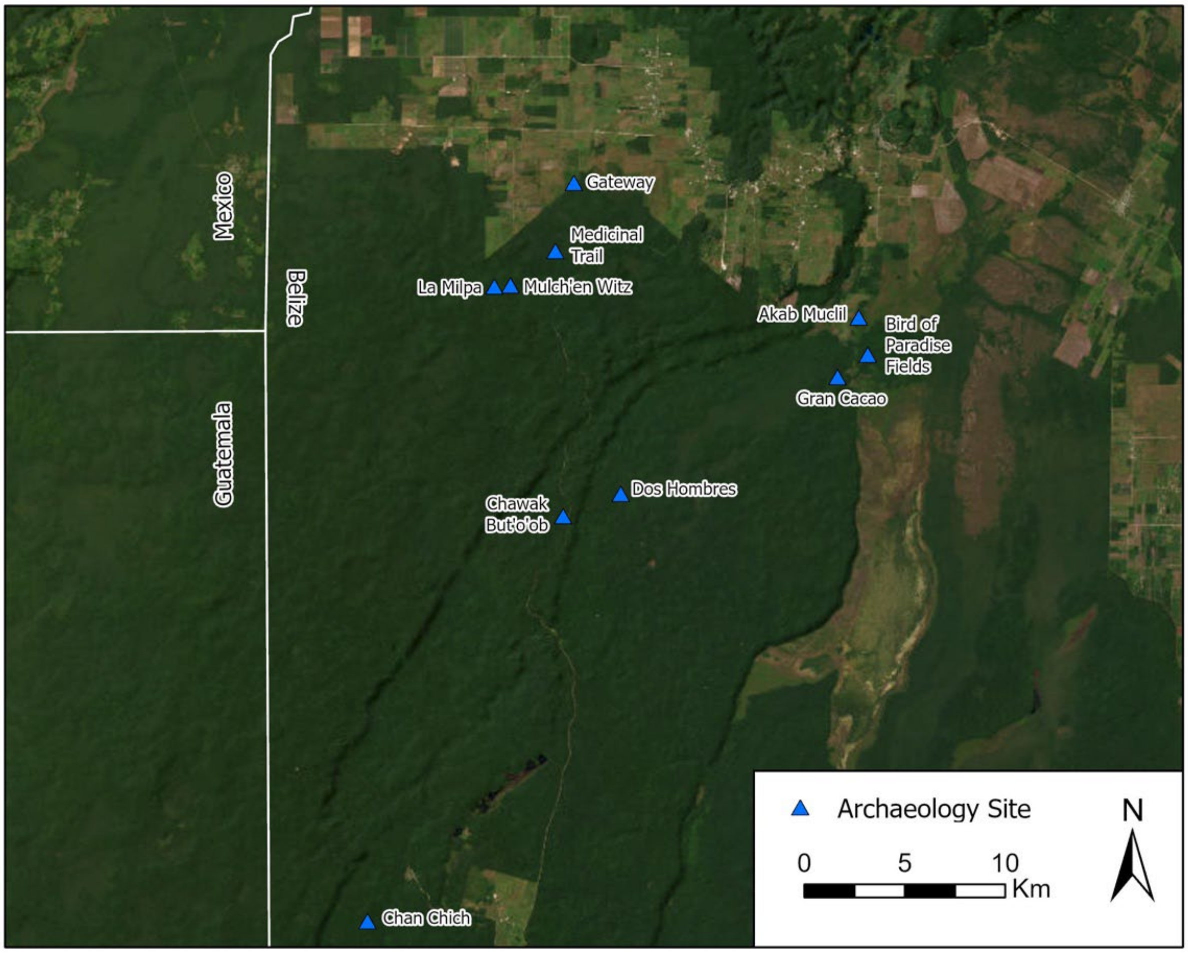

Figure 2. Sites with Postclassic Evidence in the Rio Bravo Conservation and Management Area.

in the site's core and to the east and west of the site core (Sagebiel 2005).

At Gran Cacao, Durst was able to identify two households outside of the civic ceremonial center that contained Early Postclassic pottery (Durst 1997). The architecture from these two households were not constructed in the Postclassic, but where single phase Late Preclassic structures (Durst 1997). Adam (2019) designed a survey with lidar data to test for Postclassic evidence at Gran Cacao in an area Durst found Postclassic remains. In total three households were excavated as part of the survey. The majority of the ceramics from the three households were Tepeu II (Late Classic 700-850 CE). However, the recovered ceramics were highly eroded and there may be Postclassic ceramics mixed in but were not preserved well enough to identify.

One of the best sites (in NW Belize) with Postclassic evidence is the site of Akab Mucil. The site is unique due to its Postclassic architecture. Structure 1 was remodeled on top of an earlier building in the Early Postclassic and Structure 6 was built entirely in the Early Postclassic (Krause et al 2018; Padilla 2007). In addition, a thin sheet midden of Postclassic sherds seemed to cover the entire site (Padilla 2007).

To the west of Akab Muclil and north of Gran Cacao lies the massive wetland complex Birds of Paradise fields. In these wetland fields there is evidence of canal usage during the Early Postclassic evidenced by carbon collected and dated from the canals, and environmental proxies collected by core samples (Beach et al 2019; Krause et al 2020). In the Postclassic the use of these wetlands continued to a lesser extent, but hunting, fishing and resource extraction is likely to have occurred (Krause et al 2020). *Zea mays* pollen has been identified, suggesting maize agriculture continued into the Postclassic in some form (Krause et al 2018). Additionally, a small platform has been identified and excavated in the fields, containing Early Postclassic ceramics and a jaguar head incensario (personal communication Timothy Beach).

Evidence for visitation in the RBCMA is more frequent than occupation and occurs at a range of sites from rural hinterland sites to large sites with monumental architecture. Postclassic arrow points have been found at the larger sites of Dos Hombres, La Milpa, and Chan Chich, these points have been hypothesized to be from hunting parties or pilgrim groups (Houk et al 2008). Evidence for visitation by pilgrimage groups or hunting groups performing ritual activities is seen through the depositing of incensarios throughout RCBMA.

At La Milpa there is evidence of ritual activities throughout the Postclassic, Middle Postclassic Cheac Hunancti censers and a Late Postclassic Chen Mul Modeled censer were found in the site center (Sagebiel 2008). Even into the Historic time period, items continued to be left at La Milpa, a glass bottle was found, dating to 1804-1834 CE (Sagebiel 2008). In the outskirts of La Milpa, at the site of Mulch'en Witz, a copper bell was found in chultun burial (personal communication Toni Gonzalez).

Incensarios have also been found at the sites of Chan Chich, Dos Hombres, Gateway, Chawak But'o'ob, Medicinal Trail, and Bird of Paradise. There is little information about the incensarios found at the larger sites of Chan Chich and Dos Hombres, besides that they were found in the civic ceremonial centers of both sites (Houk et al 2008). Additionally, at the rural sites of Gateway, Chawak But'o'ob, Medicinal Trail, and Birds of Paradise there is little information about the incensario found at each site other than it recovered. The incensario found at Chawak But'o'ob was fragmentary and described as a "jaguar-shaped" plumbate foot (Houk et al 2008; Hyde and Martin 2009). At Medicinal Trail two Postclassic incensarios were recovered at a Preclassic structure. The incensarios were fragmentary, but were decorated with Maya blue paint, matte red paint, and small pieces of applique (Hyde and Martin 2009). Lastly, as mentioned previously a jaguar head incensario was found at the Bird of Paradise site. Furthermore, it is unclear if these incensarios represent religious pilgrimages, hunting parties asking for ancestral approval of hunting or a mixture of both (Houk et al 2008).

Conclusion

The Postclassic period is one of the least understood time periods of the ancient Maya cultural history in the broader Maya Region and in northern Belize in particular. The concentration of Postclassic research has been conducted in larger sites with monumental architecture in the Yucatan region of Mexico at the sites of Mayapan and Chichen Izta (Chase 1988, Durst 1996, Schwarz 2009). Notable Postclassic studies that have been conducted in Guatemala, Mexico, and Belize (Brown 2011; Kingsley 2008; Meehan 2019; Schwarz 2009). By using novel approaches and methods, northern Belize is an opportune location for clarity of political and social structure of the Postclassic.

Research is focused on what causes collapse and what happens during the collapse but neglects what to understand what occurs after the collapse and what effect collapse events have on the transformation of culture (Clayton 2020). In the Maya region, this is true, the causes of the Classic Maya collapse are very well studied, but the aftereffects are not (Aimers 2008; Schwarz 2009). Specifically, how the memories of the collapse and Classic Maya are remembered and how these memories shaped cultural transformations. Studying the sites of Colha and Lamanai, among others in northern Belize, aims to understand how the memories of the Classic Maya and the Classic Period collapse would have transformed culture in northern Belize for the following generations.

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17 CLASSIC PERIOD CERAMICS OF NIM LI PUNIT: CHANGES IN COMMUNITIES OF PRACTICE AT A SOUTHERN BELIZE POLITICAL CAPITAL

Luke R. Stroth, Mario R. Borrero, and Geoffrey E. Braswell

Pottery recovered from 2012 to 2019 at Nim li Punit, Toledo District, demonstrates that it was occupied from AD 150/250 to AD 830+. We identify long-term changes in the kinds of material produced, used, and discarded over the 600- to 700-year occupation of the site. During the last century of the Classic period, Nim li Punit witnessed a decline in the diversity of ceramic practice. This could reflect a shift in feasting behavior, perhaps due to the political and demographic instability experienced throughout Maya lowlands during the eighth century. Alternatively, this could be the result of new networks of alliance and exchange that arose during this turbulent time. A third possibility is that distinct communities of potters occupied Nim li Punit at different times. To test these different interpretations, we track changes in the ceramic collection at the type: variety level. We discuss similarities and differences seen in the pottery of Nim li Punit and that of other political centers of the Southern Belize Region, and note design and style elements that are shared with other parts of the Maya world.

Introduction

Nim li Punit is a Classic Maya site located in the Southern Belize Region (SBR) of Toledo District (Figure 1a). The five principal centers of the SBR are Pusilha, Lubaantun, Nim li Punit, Uxbenka, and Xnaheb. Since 2000, Braswell has conducted archaeological survey and intensive excavation at the first three of these sites under the Pusilha Archaeological Project and its successor, the Toledo Regional Interactional Project (or TRIP). Since 2009, TRIP investigators have focused on Nim li Punit (Figure 1b).

Important questions that motivate our research include: (1) Were all the sites occupied at the same time?; (2) From where did the people of the SBR come and when? (2) Were each of the large sites independent capitals or were at least some of them part of the same polity?; (3) To what extent were the economies of each site connected?; and (4) How did interaction with larger and more powerful polities outside the region shape southern Belize? (Braswell 2020).

A Brief History of Classic Period Southern Belize

Studies of pottery, obsidian, hieroglyphic texts, human teeth, and other material remains have allowed us to answer some of these questions. First—and thanks to parallel research directed by Keith Prufer (Braswell and Prufer 2009; Jordan and Prufer 2017; Thompson et al. 2018)—we know that the first two substantial sites in the region were Uxbenka and Nim li Punit. Neither site has yet yielded any pure Preclassic contexts (Braswell 2022a; Jordan 2019:109, 208). The oldest ceramic artifacts at both Uxbenka and Nim li Punit date to the dawn of the Classic period, ca. A.D. 150-250, and are assigned to the Peripheral Chicanel sphere (Jordan 2019:429-430). The earliest pottery of Nim li Punit and Uxbenka is sufficiently similar to suggest that the first settlers of both sites came from the same general area, perhaps the other side of the Maya Mountain in southeastern Petén. Hieroglyphic texts and ceramics indicate that Pusilha was established roughly 400 years later, and is essentially a Late to Terminal Classic site. Although ceramics evince the closest ties with southwestern Petén (Bill et al. 2005), isotope analysis reveals that the royal family of Pusilha had marriage ties with Copán (Somerville et al. 2016). As construction activity at Uxbenka declined during the eighth century, settlers from that site established Lubaantun on the Río Grande. The Late Classic ceramics of these two sites are virtually indistinguishable (Jordan 2019:450; Braswell 2022b).

Although significant research has yet to be conducted at Xnaheb, our working hypothesis is that it was established by colonists from Nim li Punit, perhaps to guard the frontier from encroachment. Given that rulers raised stelae at Xnaheb during a 50-year period of epigraphic silence at Nim li Punit, we wonder if Xnaheb was the capital of the polity during the middle to late

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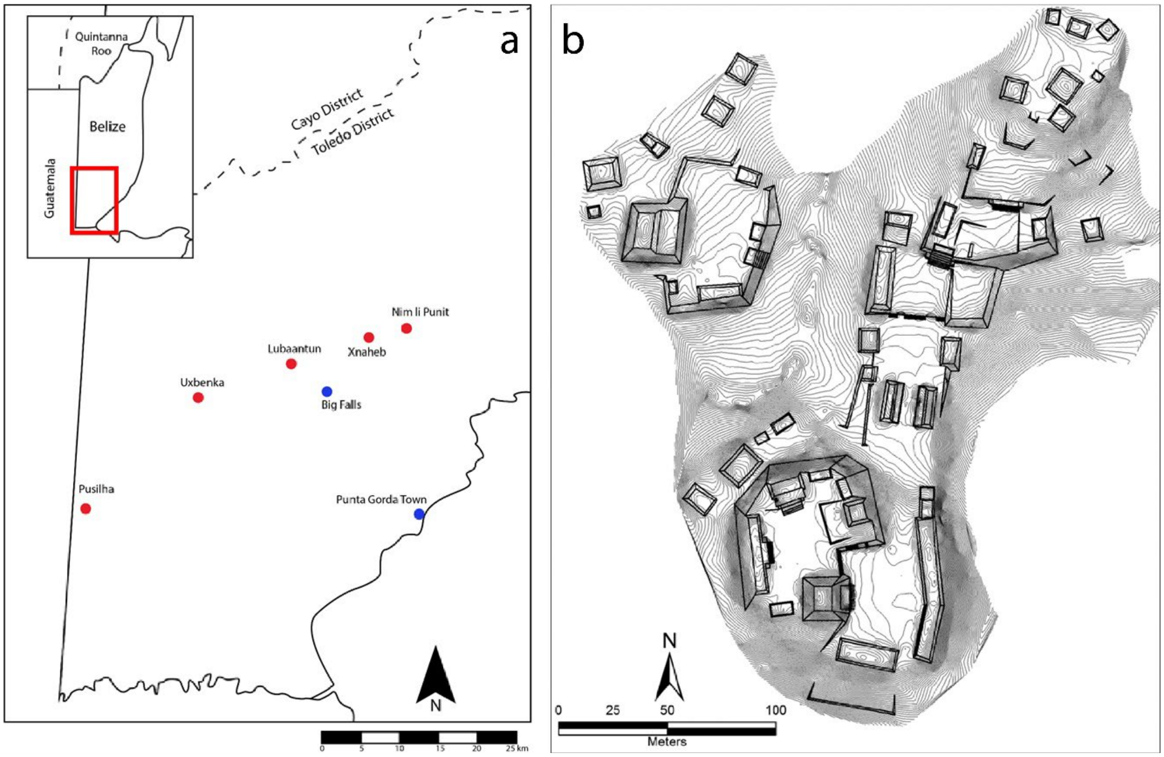

Figure 1a. The Southern Belize Region: (a) sites mentioned in the paper; (b) Map of Nim li Punit (surveyed by James T. Daniels, Jr. and Geoffrey E. Braswell).

eighth century. Finally, collapse and political fragmentation began at the two sites furthest from the coast: Pusilha and Uxbenka. In contrast, Nim li Punit and Lubaantun were able to persevere later because of their easy access to marine resources. Late to Terminal Classic Lubaantun, in particular, evinces strong ceramic ties to the coastal and island sites long-studied by Heather McKillop and E. Cory Sills (McKillop 2002, McKillop and Sills 2021:5-6). These include unit stamped red-slipped monochromes and mold-made figurines.

Although founded at different times, we interpret the five Toledo sites as forming three independent and contemporary Late Classic polities centered at Pusilha, Uxbenka/ Lubaantun, and Nim li Punit/Xnaheb. Our ceramic studies, as well as those conducted by Jillian Jordan at Uxbenka (2019) and Norman Hammond (1975) at Lubaantun, support this conclusion. The three Late Classic kingdoms of the SBR do not clearly mention each other in any hieroglyphic text, and pottery suggests that economic interaction among them was quite limited. A single stela at Uxbenka suggests artistic and perhaps political connections with Tikal at about AD 400, but later material culture paints a picture of building isolation. As noted, the royal family of Pusilha had marriage ties with the Copán region during the seventh century and fought and lost at least one important battle against the Water Scroll site, most likely Altun Ha (Helmke et al. 2018; Prager et al. 2014). The strongest evidence for distant political and economic ties, however, is found at the small site of Nim li Punit. There, ceramics indicate indirect ties to or knowledge of Teotihuacan at about AD 400. The famous jade Wind Jewel implies dynastic ties to Cahal Pech and probably Caracol in the seventh century, and several eighth-century hieroglyphic texts mention *ek' xukpi'* lords, a title later used at Quirigua, as well as the Water Scroll site. Throughout its history, the pottery of Nim li Punit reflects its wider ceramic connections, but all of the sites seem to have developed ceramic ties with western Belize during the period of contraction and collapse ca. AD 780-850.

Excavations at Nim Li Punit

Braswell began excavations in 2010 at Nim li Punit with a series of test pits, and followed this from 2012 to 2018 with horizontally extensive excavations in the South Group. In 2019, we began excavations in the West Group. To date, five structures have been excavated and consolidated to protect them for the future (Figure 2). These are Structure 8 (the council house), Structure 7 (the administrative palace), Structure 7A (a low entrance platform at the top of a set of stairs leading up to the group), Structure 6 (a platform of uncertain function), and Structure 50 (an elite residential platform). As at most Maya sites, evidence for the earliest occupation of Nim li Punit was found below architectural fill at the site epicenter. The earliest occupational level in the South Group, found on top a buried A-horizon soil sandwiched between architectural fill and bedrock, yielded resist-decorated Usulután sherds, mammiform supports, sherds with thickly-slipped and waxy slips, all found in association with polychrome sherds. This indicates a Terminal Preclassic to Early Classic beginning for the site, conceivably as early as AD 150 but probably closer to AD 250. About 2 m above this early surface and cut into Structure 7-sub, we found Tomb IV. It contains solidly Early Classic vessels dating to around AD 400, including Teotihuacan-related, direct-rim tripod vases and orange-slipped polychrome bowls. Another meter higher in Structure 7 we found Tomb V, a cenotaph dedicated to an anthropomorphic eccentric. Tomb V contained the Wind Jewel, 25 ceramic vessels, and other objects. Among the pottery are a Belize Red pyriform vase and Fine Orange supersystem vessels, implying a date of around AD 830. Thus, six to seven centuries of construction and occupation are represented in the South Group. In contrast, the West Group and Structure 50 are entirely Terminal Classic, based on the presence of Belize Red sherds found both in plaza fill and on top a deeply buried A horizon above bedrock. Structures in both plaza groups were modified in their last phases, roughly dated to AD 800+, seemingly due to earthquake damage.

The Ceramics of Nim Li Punit

Based on our excavations in the South and West Groups, we have a six-phase ceramic chronology, starting with the Preclassic to Early Classic transition (provisionally called EC1), two solidly Early Classic phases (EC2 and EC3), a yet

Figure 2. Structures excavated and consolidated at Nim li Punit from 2010 to 2019: (a) Structure 6; (b) Structure 7; (c) Structure 7a; (d) Structure 50.

undifferentiated Late Classic phase (LC), and one or two Terminal Classic ceramic phases (TC1 and possibly TC2). The 2021 laboratory season entailed processing ceramic material recovered from 2012-2019, focusing on temporally secure contexts. The ceramic analysis was conducted at three levels of granularity each with distinct goals. First, Stroth identified the paste-wares in the collection by examining the fabric of the sherds. Second, he conducted a more common type:variety study so as to have data comparable with other sites in the SBR and beyond. Finally, Stroth carried out a detailed modal (or attribute) analysis in order to refine our chronology, differentiate among sites in the region, and possibly to identify distinct workshops within the Nim li Punit polity. Comparison of our pottery with material from other sites allows us to better understand the economic role of Nim li Punit within the larger course of the development of the Southern Belize region, and the Maya lowlands.

Paste-Wares

Ceramic classification creates hierarchically organized sets of attributes that are used to construct meaning from a collection of

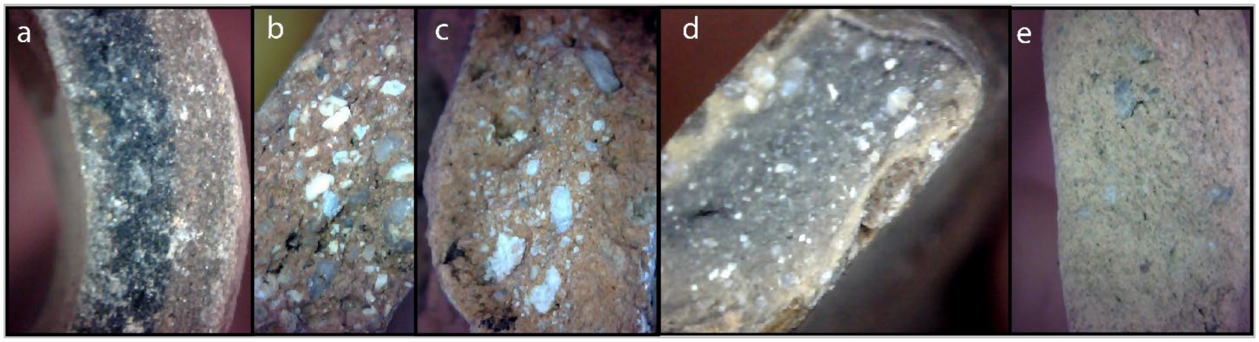

Figure 3. Photos of fresh breaks on sherd profiles taken with a Dinolite microscope: (a) Remate Redux paste-ware group; (b) Toledo Coarse paste-ware group; (c) Punta Gorda Orange paste-ware group; (d) Eggshell Gray paste-ware group; (e) Belize Ash paste-ware group (photos are not to scale).

sherds. The system is flexible and, based on the research question, archaeologists can choose different attributes to define each level of classification. We follow Prudence Rice (1976) and James Aimers' (2007) methods of classification in which paste-ware is a large and primary organizing principle.

Paste-ware refers to the physical properties of the ceramic fabric, including hardness, color, characteristics and kind of inclusions, and porosity. It is a recipe for pottery manufacture emphasizing how it looks inside rather than its external appearance. I have identified seven major paste-ware groups at Nim li Punit. Most locally produced vessels are assigned to the paste-ware Remate Redux (Figure 3a), which includes our local variations of the slipped and unslipped Remate and Turneffe groups identified first at Lubaantun by Hammond (1975). Less common, but second in overall frequency, is a locally produced paste-ware called Toledo Coarse (Figure 3b), containing large inclusions of quartzite or similar minerals. Coarse tempered pottery increases in frequency over time but never dominates the collection.

A relatively common paste-ware that we suspect was locally produced at Nim li Punit is Iron Hondo, our name for the Hondo Group defined by Hammond (1975) at Lubaantun based on just 14 sherds. Another interesting paste-ware group is Punta Gorda Orange (Figure 3c), limited to the earliest contexts at Nim li Punit. Some sherds of this paste-ware group evoke pottery from northern Belize and the Petén region. It is not yet clear if these are imports or locally made imitations, and if the latter, they may hint at the origin of the first Classic period inhabitants of Nim li Punit. Less common paste-wares are more likely imported. Eggshell Gray is a fine-grained, gray-fired paste often used to build thin-walled vessels with painted designs (Figure 3d). A resist-ware decorated sherd found in a near-bedrock context dating to the EC1 phase is assigned to the Eggshell Gray group. From the latest contexts is Belize Ash, a paste-ware group that includes ash-tempered Belize Red pottery (Figure 3e). This material is present only in architectural contexts dating to about AD 780 and later, especially during the TC1 phase.

Type-Varieties

After Stroth classified the collection from Nim li Punit into paste-ware groups, he then assigned each sherd to a specific type based on vessel form and surface treatment. He further divided types are then divided into varieties, based on decoration. This follows Culbert and Rands's (2007) system of multiple classifications that joins the type: variety system to paste-ware analysis. It is likely that similar forms and decorations appear across multiple paste-ware groups which may help distinguish between imported and locally produced material.

Early Classic Type-Varieties

The earliest contexts of Nim li Punit include a wide variety of material. Types present in these contexts include unslipped bowl forms assigned to the Remate Redux paste-ware group, Toledo Coarse red-slipped bowl forms, and Punta Gorda Orange red-slipped bowl forms. At Uxbenka, Jordan and Prufer (2014) characterize

Early Classic I by, among other things, sharply everted rim forms on Santa Cruz Red vessels. At Nim li Punit, he has found everted rim sherds in the earliest contexts. These may be unelaborated or decorated with interior grooves (Figure 4a).

Several interesting pieces suggest connections to the larger Maya world. These include single a mammiform support body decorated using the resist-ware Usulután technique (Figure 4b). The well-fired matrix, dark paste, thin wall, and fine parallel lines visible on this sherd indicate a refinement of Usulutan style seen during the Caynac period dating to between 100 BC and AD 250 (Demerest and Sharer 1982). Stroth assigns this sherd to the Eggshell Gray paste-ware group, and to the Red-slipped unspecified type: resist-ware variety.

Also present in these contexts are a number of Punta Gorda Orange sherds and strap-handles that are red-slipped and punctated, and have stud appliques and overlapping or nested v-shaped incisions (Figure 5). These pieces closely resemble members of the Sapote Striated type corresponding to the Barton Creek ceramic complex at Barton Ramie and thin-walled varieties identified in Preclassic complexes at Tikal. Although low in overall frequency, these sherds have high ubiquity in early contexts. These vessels were locally produced in low quantities, or widely-available imports.

Plates were the primary vessel form used to display polychrome designs in the Early Classic. These vessels are red- or orange-slipped, and typically have basal flanges. Member sherds of the Remate Redux paste-ware group exhibit decorative elements of Dos Arroyos polychromes, and in few cases the E-shaped painted designs reminiscent of Actuncan polychromes, suggesting an affiliation to the Tzakol 1 sphere circa AD 250. An orange-slipped, incised, and painted basal flange belonging to the Remate Redux paste-ware group (Figure 6) shows that local paste recipes and were used to produce elaborate vessels with polychrome designs.

Late Classic and Terminal Classic Type-Varieties

During the Late Classic period, vases and bowls became the primary media for displaying polychrome designs at Nim li Punit. Plates made during these centuries are assigned to the Toledo

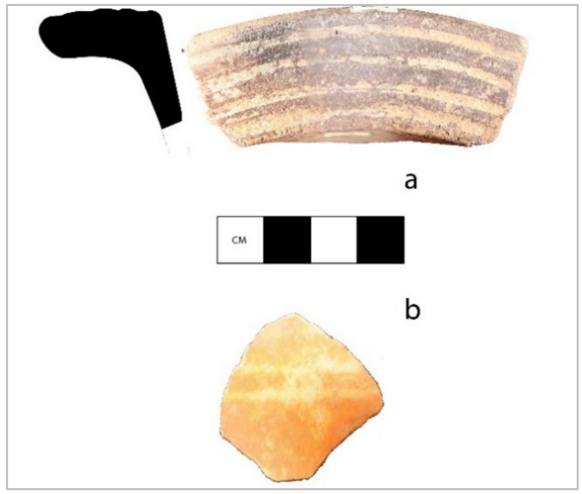

Figure 4. Sherds belonging to Early Classic 1 contexts from Nim li Punit: (a) Everted and grooved rim (Remate Redux paste-ware group, Black-slipped everted vessel type: grooved variety); (b) Usultan-style sherd (Eggshell Gray paste-ware group, Orange slipped unspecified vessel type: resist-ware variety).

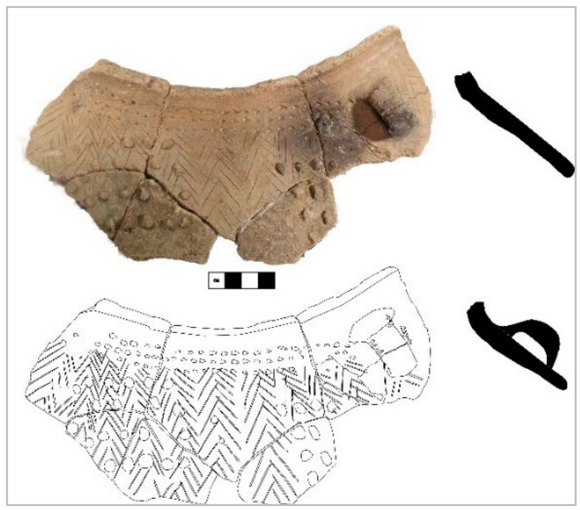

Figure 5. Sapote-style sherd recovered from Early Classic 1 context, assigned to the Punta Gorda Orange paste-ware group, Red-slipped restricted bowl type: Incised, punctuated, and applique variety.

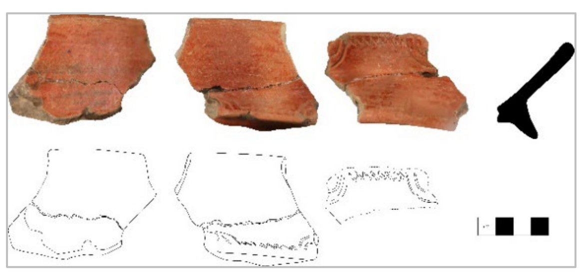

Figure 6. Elaborate flange from an Early Classic vessel, assigned to the Remate Redux paste-ware group, Red-slipped plate type: incised and painted variety.

Figure 7. Two Puluacax-style sherds assigned to the Toledo Coarse paste-ware group, Puluacax type: variety unspecified.

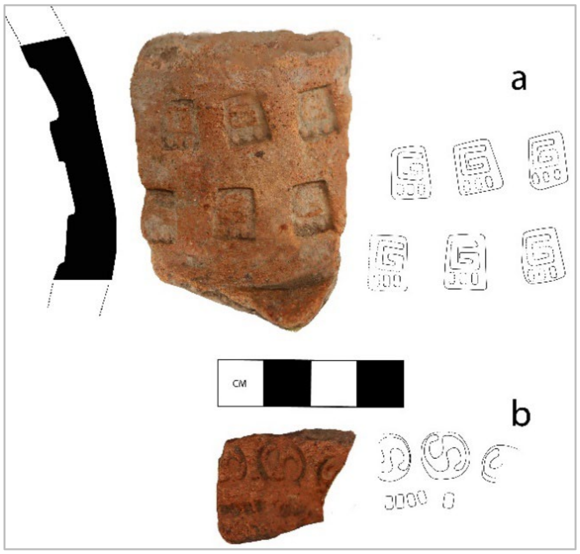

Figure 8. Two unit-stamped sherds showing meander (a) and circular (b) motifs. Both sherds are assigned to the Remate Redux paste-ware group, Red-slipped jars: stamped variety.

Figure 9. Two modeled-carved sherds, resembling members of the Ahk'utu modeled-carved complex. Both are assigned to the Belize Ash paste-ware group, Red-slipped vase type: modeled-carved variety.

Coarse and Temash Pebbled paste-wares, and frequently have micaceous flakes mixed into their paste. Flanged vessels are less common and less elaborate. A new paste-ware, Sandy Yellow, appeared during the Late Classic. Vessels are typically unslipped or striated, and often decorated by punctated designs reminiscent of Triunfo Striated. The Late Classic is difficult to distinguish entirely from the Early Classic period, but may be characterized by the appearance of polychrome vases and Puluacax sherds. Unlike the later Terminal Classic, the Late Classic collection lacks Belize Red pottery.

The Puluacax Group was first defined at Lubaantun in 1975 based on its coarse fabric dominated by inclusions, z-angled restricted jars and vases, and thick rims that taper to thin vessel walls (Figure 7). Coarse-tempered fabrics with sand- and quartzite inclusions are present in the earliest context at Nim li Punit and Uxbenka, and the development of the Puluacax bowls and jars is consistent with the long-term pottery traditions of the southern Belize region. We redefine Puluacax as a type within the Toledo Coarse paste-ware group.

The Terminal Classic at Nim li Punit is marked by the arrival of Belize Red pottery, which we assign to the Belize Ash paste-ware group. Stamped designs on Remate Redux and Sandy Yellow vessels are also diagnostic of this period. Coarse tempered paste-wares such as Toledo Coarse and Temash Pebbled were more common than in earlier periods, although the well-sorted, medium grained, and incompletely oxidized Remate Redux remained the most common paste-ware of the Terminal Classic. Remate Redux red-slipped jar types: stamped varieties are decorated with geometric designs including meander (Figure 8a) and circular (Figure 8b) motifs, usually accompanied by regular punctations. These are part of a shared southern Belize stamped tradition described by Cassandra Bill (2013), but differ from the animal motifs common of Lubaantun (Hammond 1975) and the triangular and s-shaped stamps from Uxbenka (Jordan 2019:449).

The earliest modeled pottery at Nim li Punit dates to the Early Classic period, but this decorative technique became much more common during the Terminal Classic. Apparently absent from our collections are the mass-produced vessels belonging to the Pabellon Modeled-Carved and Sahcaba Modeled-Carved systems that display "mexicanized" designs within the Maya region during the Terminal Classic periods. Instead, Terminal Classic modeled vessels from Nim li Punit appear more similar to the Ahk'utu modeled-carved complex described by Helmke and Reets-Budet (2008). This conclusion is based on the inclusion of Classic Maya iconography, a barrel-shaped profile with restricted orifice, and construction using British Honduras Ash ware (Figure 9).

Conclusions

We have discussed the presence of certain decorative techniques, paste-wares, and vessel forms that are similar to those reported from throughout the Maya lowlands. Some vessels are very likely to have been imported, including ash-tempered Belize Red. Others may be locally produced imitations of pottery produced elsewhere, such as the Sapote-style type:varieties within the Punta Gorda Orange paste-ware group. We may posit a Petén origin for the inhabitants of Nim li Punit, but subsequent generations developed a local ceramic tradition in dialogue with contemporary Toledo centers, northern Belize, and the southeast periphery. The potters of Nim li Punit incorporated techniques from the larger Maya region as interpreted through the southern Belize pottery tradition. Doing so, they created site-specific varieties of regional paste recipes and decorative techniques. Future analyses and the application of radiometric dating may help us better determine the absolute chronology of each ceramic phase, and to better define and perhaps split the Late Classic into more than one phase.

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18 FOCUSING ON INDIVIDUAL WOODEN BUILDINGS REVEALS CHANGES IN THE LATE TO TERMINAL CLASSIC ECONOMY AT THE PAYNES CREEK SALT WORKS

Heather McKillop and E. Cory Sills

Preservation of wooden building posts in red mangrove (Rhizophora mangle) peat below the sea floor at the Paynes Creek Salt Works in southern Belize provides a rare opportunity to study pole and thatch buildings that were likely the dominant construction in the Maya area in prehistory. In 2020 and 2021, when field research at the salt works was not possible due to the covid pandemic, individual wooden buildings at two of the largest sites, Ek Way Nal and Ta'ab Nuk Na, were radiocarbon dated. The dates indicate that the buildings were constructed at different times. Associated artifacts reveal both residences and salt kitchens at both sites and that production began earlier at Ta'ab Nuk Na and ended later at Ek Way Nal. Identification of tree species used in building construction at Ek Way Nal indicates the salt workers selected useful trees and did not overuse the environment.

How did the Classic Maya Obtain Dietary Salt?

Although we know from where the Classic Maya obtained salt, the organization of production and distribution from various sources has been subject to debate. Salt was available from solar evaporation along the arid Yucatan coast of Mexico and the Pacific coasts of Guatemala, Mexico, and El Salvador. Boiling brine in pots over fires in salt kitchens was practiced at inland salt springs and along the coasts of Belize and the Pacific where rainfall precluded solar evaporation. Solar evaporation remains visible on the modern landscape along the Yucatan, with historic records of use underscoring long-term use for producing salt (Andrews 1983). By way of contrast, salt production sites along the coast of Belize are less visible in the modern landscape due to sea-level rise submerging coastal sites and growth of red mangroves in the shallow coastal shorelines. Brine boiling to make salt is clear at sites since it leaves briquetage—broken ceramic vessels and associated supports used to hold the pots over the fire to evaporate the brine. Typically, a dozen or more vessels are supported over a fire, with constant re-filling with brine until only salt remains in the pot (Reina and Monaghan 1981).

The view that brine-boiling is inferior as a production technique to solar evaporation is outdated, since the methods are suitable to rainy and arid environments, respectively. In rainy settings such as southern Belize, the use of salt kitchens for brine-boiling extends the seasonal use of this method beyond the dry season and provides a place to store fuel, brine, pots of loose salt, salt cakes, and pots broken to remove the salt cakes. Salt kitchens also protect the brine-boiling fires from wind and other weather. Tree species selection for building construction at Ek Way Nal from the Late to Terminal Classic periods is examined to investigate whether wood resources were being depleted over time, as suggested for Tikal (Lentz and Hocaday 2009).

Figure 1. Map of the Maya area Showing Sites mentioned in the text. (Map by Mary Lee Eggart, LSU).

In the Maya area, salt kitchens are known historically from inland salt springs at Sacapulas and other communities focused on salt production in the Maya highlands of Guatemala and Mexico (Reina and Monaghan 1981) and prehistorically from the Paynes Creek Salt Works (Figure 1; McKillop 2002, 2005, 2019, 2022; McKillop and Sills 2016, 2021, 2022a; Sills and McKillop 2018; Watson and McKillop 2019). Pole and thatch buildings also were likely used at salt production sites elsewhere along the coast of Belize but the wood has not preserved, making the Paynes Creek Salt Works a valuable model for interpreting brine-boiling at other sites (Figure 1; McKillop 2019, 2020). The Belize salt sites include Cerros, Northern River Lagoon and other lagoon sites north of Belize City, Marco Gonzalez and other sites on Ambergris Cay, Moho Cay, Watson's Island, and the Placencia Lagoon Salt Works.

Regional Trade of Salt

A model of regional production and distribution of salt would have fulfilled the needs of the Classic Maya (McKillop 2019). Daily consumption rates for salt vary depending on a person's level of physical activity, the heat and humidity, and the amount of salt in food (McKillop 2002). The addictive quality of salt may have served to ensure the ancient Maya consumed enough of this biological necessity. Using an estimate of 6 grams/ person/ day of dietary salt, a total of 15,000 tons of salt was needed for five million Maya during the Classic period (McKillop 2019). Salt yields from historic records from solar evaporation on the Yucatan coast indicate 20,000 tons were produced per year (Andrews 1983). Reina and Monaghan's ethnographic study of a salt-making family at Sacapulas documented that they produced an estimated six tons per year of salt. Using the Sacapulas data as a model, estimates were made that the Paynes Creek salt kitchens produced from 60 to 600 tons of salt per year, based on 10 to 100 salt kitchens under use. Extending the salt yields the brine-boiling from Sacapulas to other salt works along the coast of Belize indicates 480 to 4800 tons of salt was produced at just seven of the salt works. Together with the inland salt springs at Salinas de los Nueve Cerros, Sacapulas, and elsewhere in the highlands, production and trade of salt within regions in the Maya area was possible (McKillop 2019).

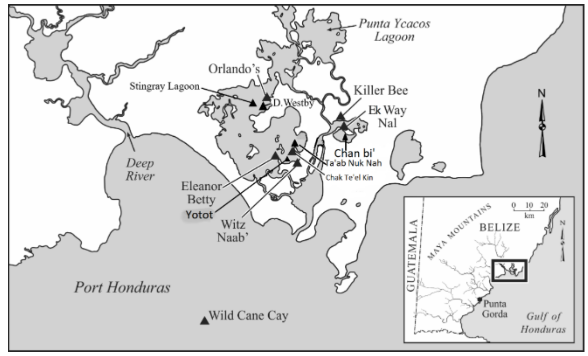

Figure 2. Map of Punta Ycacos Lagoon showing sites mentioned in the text, with insert showing location in southern Belize (Map by Mary Lee Eggart, LSU).

How was Salt Production Organized?

A new field project was initiated in 2019 by the authors to excavate large underwater sites at the Paynes Creek Salt Works to look for variability in activities, in order to evaluate how salt production was organized to meet inland salt needs. Two large underwater sites, Ek Way Nal and Ta'ab Nuk Na, were selected for excavations of each of the 10 pole and thatch buildings (Figure 2). Research was focused on determining if production was controlled by local salt workers or by inland elite who controlled seasonal workers, perhaps with inland overseers to manage the production and/or distribution of salt. The two contrasting explanations would produce different archaeological correlates: Residences would be expected for local workers living at the salt works who produced salt as part of surplus household production, similar to families at the Sacapulas salt works. In contrast, overseers' residences and storage facilities might be expected for inland control of production or distribution of the coastal salt.

A variety of different activities associated directly or indirectly with salt making, were expected in the pole and thatch buildings and the open areas at the salt works (McKillop and Sills 2021: Table 4). Salt kitchens were excavated previously at Site 74 (Potok Site), providing a template for archaeological correlates of activities (McKillop and Sills 2016). High abundance of briquetage was expected inside and along the exterior walls of the salt kitchen, as at Sacapulas, where broken pots were stored along the inside walls and later discarded outside the buildings. Briquetage comprised 98% of the artifacts at Site 74, with a few distinctive Warrie Red water jar sherds and Belize Red serving bowl sherds. Manos and metates may be expected at salt kitchens or salt workers' nearby residences, since corn meal was used in the salt production process. At Sacapulas, the interior of pottery vessels is coated with corn meal before the brine is added and boiling begins, in order to prevent the salt from adhering to the pot. Earlier in the production process at Sacapulas, when salty water is poured over raised containers of salty soil to catch the enriched, saltier water in a jar below, the brine is judged to be salty enough when a small ball of corn meal floats in the enriched brine.

Enriching the salt content of brine before it is boiled is common worldwide where the brine-boiling method is used, in order to reduce the evaporation time and amount of wood fuel used. Evidence for brine enrichment is found at the Eleanor Betty and Witz Naab' sites at the Paynes Creek Salt Works. A wooden canoe was found between two lines of palmetto palm posts, raised by wooden stakes, at the Eleanor Betty site (McKillop et al. 2014). A large clay funnel was found below the canoe, evidently used to channel enriched brine into a container below the canoe (Figure 3). Excavations at one of the earthen mounds at Witz Naab' revealed it consisted mainly of soil that was interpreted as a slag heap for brine enrichment (Watson et al. 2018; Watson and McKillop 2019). Earthen mounds are a common feature on the salt production landscape at the Placencia Lagoon Salt Works farther north (Sills 2016).

Referring again to Sacapulas, once the brine was evaporated and the pots were full of loose salt, it was either stored in large jars along the wall or further hardened over the fire to make salt cakes for trade at regional markets. The pots were broken to remove the salt cakes at Sacupulas, with the broken pots stored along the inside walls of the salt kitchen and then periodically discarded outside the salt kitchen along the exterior of the building. Abundant broken pots at Ek Way Nal and other Paynes Creek Salt Works would be an archaeological correlate of breaking pots to remove the salt cakes. This practice was also typical of other salt works by salt springs in the

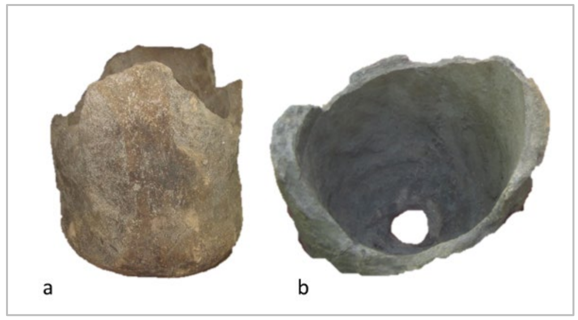

Figure 3. Side and interior views of clay funnel from under the canoe used to hold salty soil for brine enrichment at the Eleanor Betty Site. (Photo by H. McKillop).

Maya highlands of Guatemala and Mexico and forms a model for the Paynes Creek Salt Works (McKillop 2021). In contrast, Andrea Yankowski's (2010) ethnoarchaeological field research at traditional salt works in the Philippines revealed that the salt cakes remained in their pots for transport and trade inland.

The expectations at the Paynes Creek Salt Works for trade of salt cakes in their pots would be a shortage of vessels in comparison to the vessel supports and other briquetage at the salt kitchens and the presence of discarded salt-making pots at consumer sites. Cynthia Robin and colleagues (2019) interpret thousands of tiny sherds near the main plaza at Aventura in northern Belize as the remains of pots broken on site after the transport of salt cakes in the pots from coastal production sites.

Trade of salted fish is common world-wide associated with salt production and was likely undertaken at the Paynes Creek Salt Works as well. Marilyn Masson (2004) suggested that catfish were salted and transported inland from the salt works at Northern River Lagoon. She found an excess of catfish head bones in contrast to fewer post-cranial elements in middens at the site. On the central coast of Belize, Elizabeth Graham (1994) interpreted cut tuna vertebrae as evidence of cutting and spaying fish to dry for inland trade. The absence of bone at the Paynes Creek Salt Works may be attributed to the acidic red mangrove peat that destroys material composed of calcium carbonate, including bone and temper in the pottery.

Archaeological correlates of residences would include a diversity of pottery shapes suitable for cooking, eating, and serving, storing water, and other uses, as well as a variety of other

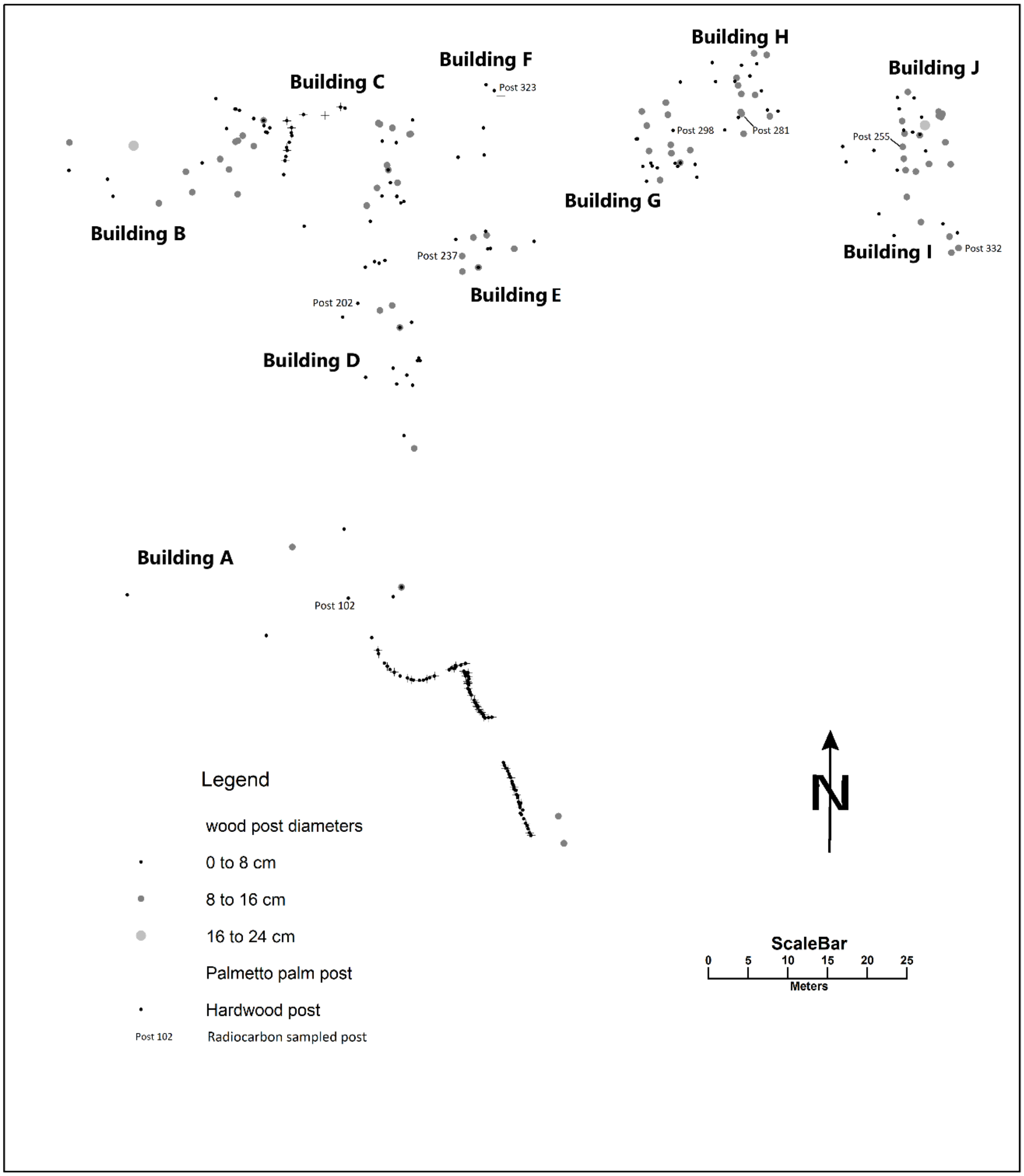

Figure 4. Map of wooden building posts at Ek Way Nal. (map by H. McKillop).

goods and food for a household. Briquetage would not be expected at residences, except in limited quantities if the pots were made at home for use in the salt kitchens. At Sacapulas, the brine boiling pots were made outside the salt workers' homes and carried to the salt kitchens. The pots were dried in the sun and not in a kiln.

Woodworking was a common activity at the Paynes Creek Salt Works. Pottery making paddles such as the one found at Chac Te'el Kin (McKillop 2019: Figure 6.5), the rosewood handle for the jadeite gouge at Ek Way Nal (McKillop 2019: Figure 6.11), canoe paddles from Ka'ak' Naab (McKillop 2005) and other sites (McKillop 2019: Figures 6.14-6.15); McKillop and Sills 2016), and the canoe from the Eleanor Betty site (McKillop et al. 2014), indicate wood working was a common activity.

Chert stone tools, including one from Ek Way Nal, were identified as cutting and whittling wood (McKillop and Aoyama 2018). Stone tools were also needed for cutting building posts, beams, and other wood and for sharpening the ends of posts that were driven into the ground during building construction. Black and white mangrove wood was selected from the immediate environs of Ek Way Nal, but other trees were selected from farther away, including the deciduous forest on the south side of the Deep River (McKillop and Sills 2022b). Some of the stone tools were made from high-quality northern Belize chert with styles similar to those made at the chert tool-manufacturing site of Colha. The Colha stone tools were distributed to sites in northern Belize, but water transport along the Caribbean likely facilitated their transport to southern Belize to Wild Cane Cay and to the Paynes Creek Salt Works.

The Pole and Thatch Buildings at Ek Way Nal: Their Ages and Uses

Wooden posts were discovered at Ek Way Nal during flotation survey by a team systematically traversing back and forth on Research Flotation Devices (RFDs) and marking the location of posts on the sea floor. The post locations were marked by survey flags in shallow water and in deeper water by fishing floats tied to fishing line held in the sea floor with wire. The posts were individually mapped using a total station from a datum of poured concrete with a 2" PVC pipe embedded in the cement (Figure 4).

Associated artifacts also were individually flagged and mapped in order to identify activities associated with buildings and outdoor spaces (McKillop and Sills 2021). A date on the rosewood handle from the jadeite gouge (McKillop et al. 2019) found beside post 252 which also was dated, indicate a Late Classic age.

Although the footprint of some of the buildings was obscured by mangrove accretion since the time the site was abandoned, several buildings reveal a rectangular shape, notably Buildings G, H, I, and J (Figure 2; McKillop and Sills 2021: Figure 6). Posts included palmetto palm (*Acoelorraphae wrightii*) and various species of hardwoods. Some palmetto palm posts were found as isolated posts in buildings with the majority forming a long line of posts at the south end of the site near Building A.

Figure 5. Wooden post with sharpened base and worm-eaten top where the post protruded above the sea floor, Building C (N 3 M, E 0 M) at Ek Way Nal. (Photo by H. McKillop).

The wooden posts protruding from the sea floor form the walls of buildings that appear to be contemporaneous, but that observation derives from the even deposition of mangrove peat as sea-level rose after the salt works were abandoned. The wooden building posts were spectacularly preserved below the sea floor in the mangrove peat, but not in the water above. The jagged top of worm-eaten posts barely protruded, if at all, above the sea floor. Few complete posts were excavated during survey or excavation, so their depth below the sea floor is unknown. However, in some cases, the posts were buried over a meter below the sea floor.

This depth resembles the depth posts for modern pole and thatch buildings in traditional Maya villages are driven into the ground (Wauchope 1938). In some cases, the complete posts less than 50 cm in length were excavated, showing the sharpened base (Figure 5).

Radiocarbon Dating Building Construction

Radiocarbon dating a wooden post from each of the 10 buildings at Ek Way Nal indicated that they were not contemporaneous. The posts were driven into the ground during building construction. Studies of modern Maya pole and thatch buildings indicate posts were driven into the ground to various depths (Wauchope 1938). However, only the lower portions of the posts were preserved in the mangrove peat that formed the sea floor and extended to over 4 M below (McKillop et al. 2010). The peat was deposited as sea-level rose, creating a level sea floor and obscuring the different construction dates for the buildings. Wood above the sea floor at Ek Way Nal decayed, leaving worm-eaten tops of posts barely protruding from the sea floor.

The Ek Way Nal buildings were constructed over four phases (Figures 6-7; McKillop and Sills 2021). Buildings B and G were constructed first, in Phase 1, dated from A.D. 650 to 700, during the early part of the Late Classic or Tepeu 1. Building J has a radiocarbon date ranging from A.D. 680 to 980, with the A.D. 680 to 770 referred to as Phase 2, in the Late Classic Tepeu 2. Buildings A, C, D-F, and H date to the end of the Late Classic and through the Terminal Classic Phase 3, from A.D. 770 to 900. Building I dates to the early part of the Early Postclassic period, from A.D. 900 to 1000.

Building Use Over Time

The spatial patterning of artifacts mapped on the sea floor indicates that some buildings were salt kitchens, but others were residences, or were used for fish and/or meat processing (Figure 8; McKillop and Sills 2021). Buildings B, E, and G were identified as salt kitchens by the abundance of briquetage. Fish and/or meat was processed at Buildings A and C as identified by use-wear on the edges of chert tools (McKillop and Aoyama 2018). The diversity of pottery and other artifacts associated with Buildings F and J suggested they were residences. Buildings D and H were not assigned functions since few artifacts were recovered from the sea-floor survey in those areas.

Combining building use and dates indicates the earliest buildings at Ek Way Nal were used for salt production in Phase 1 during the Late Classic. Processing fish and/or meat was added to salt production sometime from the end of the Late Classic through the Terminal Classic. The salt workers had residences at the salt works at that time. The earliest construction at Ek Way Nal included salt kitchens at Buildings B and G in Phase 1 at the beginning of the Late Classic. Most of the buildings were constructed in Phase 3, sometime from the end of the Late Classic

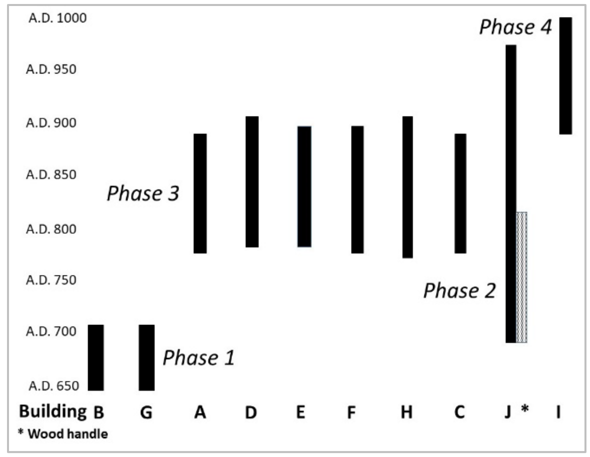

Figure 6. Graph showing four phases of building construction at Ek Way Nal from radiocarbon dated building posts and the rosewood handle from the jadeite gouge. (Figure by H. McKillop).

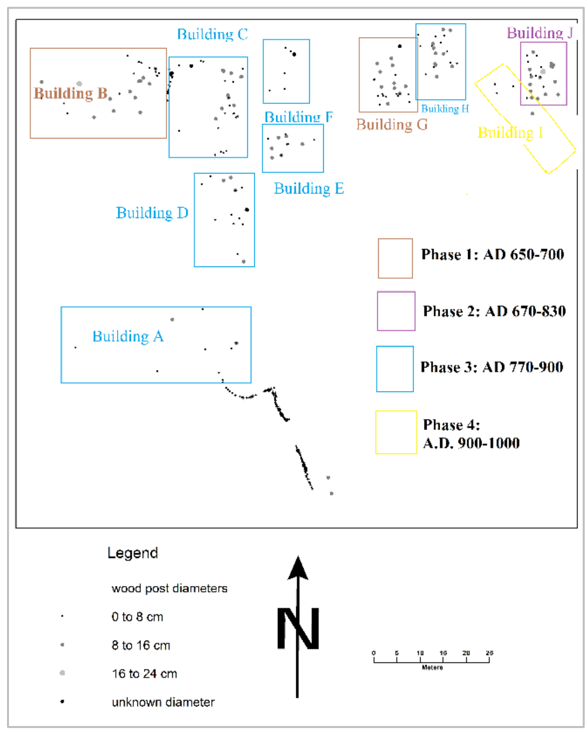

Figure 7. Map of posts at Ek Way Nal showing buildings by construction phase. (Map by H. McKillop).

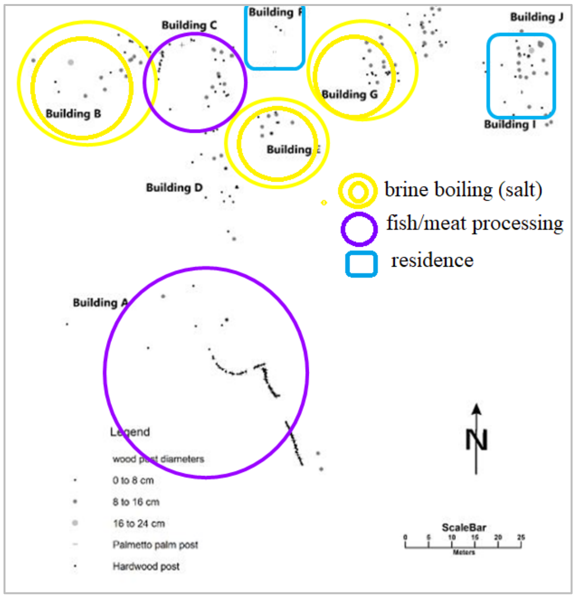

Figure 8. Map of wooden posts at Ek Way Nal showing building uses suggested by artifacts mapped on the sea floor. (Figure by H. McKillop).

through the Terminal Classic periods. Phase 2 included Building J as a residence. The jadeite gouge with a rosewood handle was found by post 252 in the southwest corner of the building. Use-wear analysis was inconclusive to the function of the gouge, although the tightly-woven grains (which gave the translucent green appearance) indicate it was a durable material (McKillop et al. 2019). Phase 3 included processing fish and/or meat in Buildings A and C, as well as salt production in Building E. Phase 4 includes Building I of unknown function from the sea-floor material.

Dating Individual Buildings at Ta'ab Nuk Na

After radiocarbon dating individual pole and thatch buildings at Ek Way Nal, the same process was carried out for Ta'ab' Nuk Na, idincating it too was a multicomponent site. The site has 10 pole and thatch buildings indicated by 500 mapped wooden posts. Pottery, stone tools, and wooden artifacts were individually mapped using a total station, following sea-floor survey and flagging of posts and artifacts embedded in the sea floor (McKillop and Sills 2022a). Radiocarbon dating indicated the first construction was Buildings H and F in Phase 1, from the end of the Early Classic to the beginning

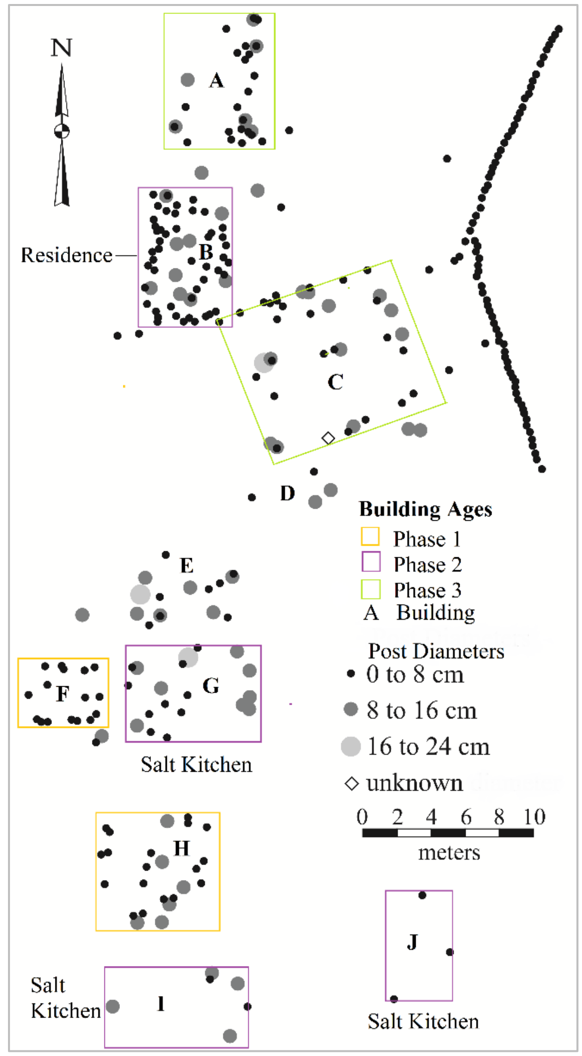

Figure 9. Map of wooden posts at Ta'ab Nuk Na showing age and use of buildings. (Map by H. McKillop).

of the Late Classic. Building H was interpreted as a salt kitchen on the basis of briquetage.

Most of the buildings were constructed in Phase 2, during the Late Classic, between A.D. 650 and 780. Three salt kitchens were identified by briquetage, including Buildings G, I, and J. Building B was identified as a residence on the basis of a diversity of pottery, stone tools, and wood objects. Buildings A and C were constructed in Phase 3, between A.D. 760 and 900, which includes the later part of the Late Classic.

Tree Selection for Late to Terminal Classic Maya Buildings

Tree species from the radiocarbon-dated buildings at Ek Way Nal were evaluated to discover whether tree species and habitat selection of trees for building construction changed from the Late to the Terminal Classic, when inland cities were abandoned. Species identification has not yet been carried out for the Ta'ab Nuk Na posts. Overuse of the forest is suggested at Tikal, where wooden lintels from temple buildings indicated a change to less desirable wood overtime (Lentz and Hockaday 2009). Clearing rainforest to expand slash and burn farming in order to provide sufficient food for the increasing populations in the Late Classic (A.D. 600-800) may have increased soil erosion and depleted soil nutrients, resulting in a reduction of productive land, as explained by a pollen core at Copan (Abrams and Rue 1988). However, other cores indicate a continuity of forest cover from the Late to Terminal Classic at Copan, including Copan (McNeil 2012; McNeil et al. 2012).

Wood post samples from Ek Way Nal were kept in water, first to desalinate them, and subsequently to maintain the wood structure which would deteriorate if the wood was allowed to air dry. Identification of wood species was aided by modern comparative wood collections, wood slides, and by digital images and descriptions of diagnostic traits of wood structure. A variety of tree species were selected for building construction, including palmetto palms and hard woods.

Ancient Landscape and Habitat Selection of Trees for Buildings

The landscape of the salt works was a mangrove ecosystem comprised of red mangroves (*R. mangle*), black mangroves (*Avicennia germinans*), white mangrove (*Laguncularia racemose*), and buttonwood (*Conocarpus erectus*) in the Late and Terminal Classic periods (McKillop et al. 2010). Ek Way Nal and the other salt works were on dry land along the low-lying margins of the salt water lagoon system. The sites were submerged by sea-level rise and are currently underwater from depths ranging from a few cm to over 2 m in various arms of the lagoon system (McKillop 2019: Figure 4.7). Red mangroves grow along the shoreline of the lagoon and in the water, since they are adapted to high salinity. Black mangroves are on mudflats inland from the shoreline, also in areas of high salinity. White mangroves and buttonwood are farther inland. Palmetto palms grow in dense stands on dry land farther back from the lagoon as well as in scattered clumps on the savanna. All three mangrove species are prolific and grow in large stands in the lagoon system, although high salinity at Ek Way Nal in particular has dwarfed the height of the red mangroves (McKillop 2019: Figure 5.1). Buttonwood is an isolated tree scattered along the shoreline. Tropical broadleaf rainforest trees are available nearby, south of the Deep River, as well as in isolated locations on dry land near the salt works (McKillop and Sills 2022b; Robinson and McKillop 2013: Figure 4).

The ancient Maya at Ek Way Nal selected trees from the mangrove ecosystem surrounding Ek Way Nal, from the dry land on the coast, and from the broadleaf forest west of the nearby Deep River (Figure 2). These habitats were easily accessible from Ek Way Nal by boat. The extensive savannah, dominated by grass, with scattered clumps of pine, oak, and sandpaper trees, was not used for extraction of wood for building construction, despite its proximity to the salt works. Trees were cut and transported to Ek Way Nal for building posts, with the ends each sharpened to a point to dig into the ground. Recovery of a wooden canoe from the Eleanor Betty Site (McKillop et al. 2014), a complete canoe paddle from Ka'ak Naab' site (McKillop 2005), and paddle blade pieces from the Potok and Elon sites (McKillop 2019), document canoe transport was available, not only for transporting salt cakes, but also for moving building posts, palm thatch, and other goods and resources.

Wood carving tools

Tools were needed both to fell trees and to chip the ends of each post before they were driven into the ground during construction of the pole and thatch buildings. Tools also were needed for making small objects including the rosewood handle of the jadeite tool from Building J (McKillop et al. 2019). Use-wear analysis by Kazuo Aoyama indicated some chert stone tools from the Paynes Creek Salt Works were used for

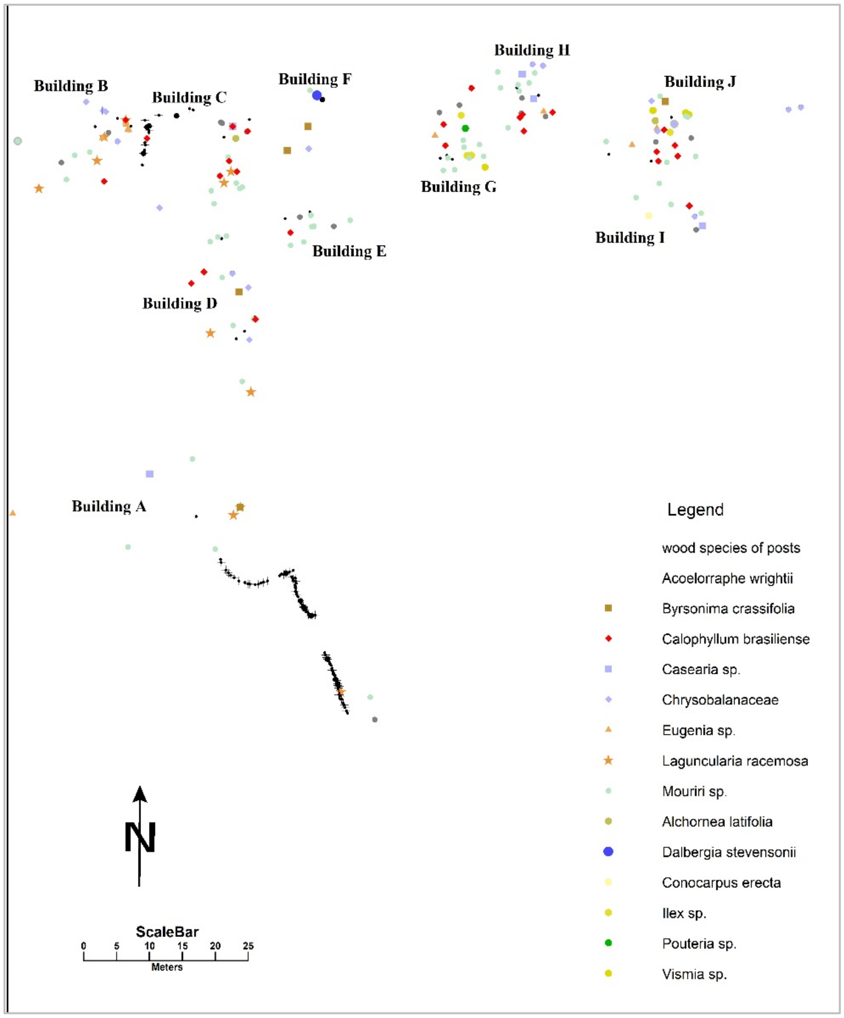

Figure 10. Number of trees by habitat for each phase at Ek Way Nal. (Figure by H. McKillop).

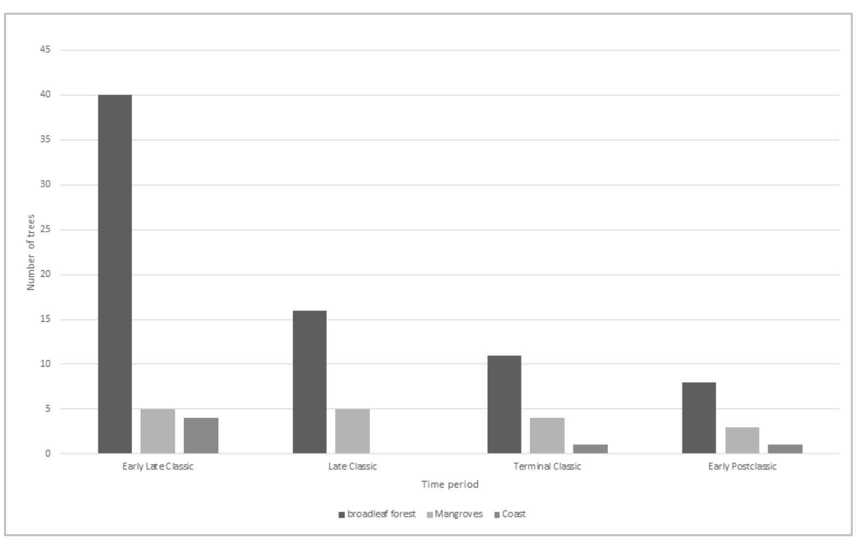

Figure 11. Tree species of wooden posts identified from Ek Way Nal. (Map by H. McKillop).

Table 1. Number of posts of different species for pole and thatch building construction by Phase at Ek Way Nal. Late Classic Phase 1 (A.D. 650-720); Late Classic Phase 2 (A.D. 680-880); Terminal Classic Phase 3 (A.D. 780-920); Early Postclassic Phase 4 (900-1000). (Chronology from McKillop and Sills 2021: Table 1 and Figure 7).

		Phase and Building										
		1	1	2	3	3	3	3	3	3	4	
		B	G	J	A	C	D	E	F	H	I	
Tree Species	**Habitat**											Total #
Concarpus erectus	Mangrove ecosystem										1	1
Laguncularia racemosa	Mangrove ecosystem	4			3	2	2					11
Avicennia germinans	Mangrove ecosystem		1							1		2
Calophyllum brasiliense	Tropical broadleaf forest	2	3	5		6	3	1		3	1	24
Dalbergia sp.	Tropical broadleaf forest								1			1
Pouteria sp.	Tropical broadleaf forest		1									1
Ilex sp.	Tropical broadleaf forest		3	1								4
Vismia sp.	Tropical broadleaf forest		1	3								4
Eugenia sp.	Tropical broadleaf forest	3	1	1	2					1	1	9
Aceoloraphea wrightii	Coastal woodland and tropical broadleaf forest	1			55	11			1			68
Byrsonima crassifolia	Coastal woodlands			1			1		2			4
Caesaria sp.	Coastal woodlands				1	1				2	1	5
CHRYSOBALANCEAE	Coastal woodlands	4								2	1	7
Total		14	10	11	61	20	5	1	4	9	5	140

woodworking, including one chert tool from Ek Way Nal (McKillop and Aoyama 2018). A lenticular biface from Late Classic Building B at Ek Way Nal was used for whittling and cutting wood (McKillop and Aoyama 2018: Figure 4 a).

Temporal Changes in Tree Species Selection

There were changes in the tree species selected over time, but there is no evidence of overexploitation of the rainforest or selection of lower quality species over time (Figures 10-11; Table 1). Red mangrove wood was not used for building construction at Ek Way Nal, perhaps due to high salinity limiting growth as occurs today. White mangrove wood was used for buildings in Phases 1 and 3, whereas black mangrove wood was used for buildings in phase 1 (Table 1; Figures 3-5). One buttonwood post was identified from Phase 4. Most of the palmetto palm posts are associated with the phase 3 Building A. Hardwood species from the broadleaf forest south of the Deep River were common, with Santa Maria (*Calophyllum brasiliense*) used throughout the sequence. One rosewood post (*Dalbergia sp.*) from Phase 3 and one sapote (*Pouteria sp.*) from Phase 1 were used for building. Mouriri sp. is popular throughout the building sequence, being the dominant tree species selected for building construction at Ek Way Nal. The coastal woodland of dry land along the sea includes crabbo (*Byrsonima crassifolia*), and plums (*Caesaria sp.* and CHRYSOBALANCEAE) over the course of construction.

Tree species for building posts from each of the 10 pole and thatch buildings reported here, shows that wood selection by the householders at Ek Way Nal was similar during the Late to Terminal Classic periods, indicating the Maya managed the forest resources well. Some nearby trees in the mangrove ecosystem, notably black and white mangroves and buttonwood, were cut for building posts. Red mangrove was not selected, despite its ubiquity in the immediate mangrove landscape, which may be due to the high salinity limiting growth. White mangrove was used in the Late and Terminal Classic whereas black mangrove was used in the Late Classic and buttonwood in the Early Postclassic. Hardwood species were cut and hauled from the rainforest west of the Deep River, including Santa Maria, rosewood, and others. Rosewood was used for carving small objects, including the handle for the jadeite gouge from Building J (McKillop et al. 2019), as well as objects from other sites at the Paynes Creek Salt Works. Evidence from wood selection at Ek Way Nal indicates little variation or no overuse of the resources over time in the availability of resources—negating the idea of a generalized view of over exploitation as a causal reason for the abandonment of southern lowland cities.

Chronology of Salt Production

Radiocarbon dating individual buildings at Ek Way Nal and Ta'ab Nuk Na indicates both sites are multi-component, with the peak of salt production earlier at Ta'ab Nuk Na. Most of the buildings at Ta'ab Nuk Na were constructed during Phase 2 in the Late Classic. In contrast, most of the buildings at Ek Way Nal were constructed during Phase 3 in the Terminal Classic. Salt production took place from the end of the Early Classic, throughout the Late and Terminal Classic and during the first part of the Early Postclassic (Figure 12).

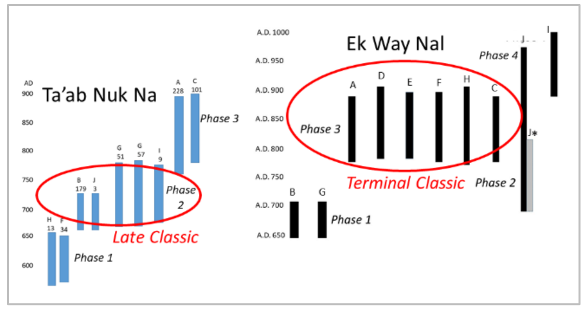

Figure 12. Comparison of the Radiocarbon Chronology of Building Construction at Ta'ab Nuk Na and Ek Way Nal. (Figure by H. McKillop).

This research underscores the importance of radiocarbon dating each pole and thatch building at the salt works in order to evaluate production capacity of this dietary necessity. The research also shows the value of individually mapping artifacts and posts on the sea floor at the underwater sites in order to interpret building use. Using Sacapulas salt works as a model from which to develop archaeological correlates fits with Ta'ab Nuk Na and suggests the Maya living permanently at the community were engaged in surplus household production of salt that was well integrated in the regional economy, allowing them to acquire a variety of nonlocal goods. Although the salt industry at the Paynes Creek Salt Works depended on wood fuel, species identification of wooden building posts from Ek Way Nal from the Late to Terminal Classic periods indicates the salt workers managed the forest and did not overuse these resources.

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19 CHANGING SPHERES OF INTERACTION IN TERMINAL CLASSIC WESTERN BELIZE

Jaime J. Awe, Christophe Helmke, Julie A. Hoggarth, and Claire E. Ebert

Archaeological investigations in western Belize have recorded a growing body of evidence that is indicative of non-central lowland Maya influences in this Maya sub-region during the Terminal Classic period. Evidence for Yucatec and non-Maya influence in the Belize River Valley is manifested by the presence of new architectural styles and programs, and by the introduction of "foreign" artifacts and ideologically charged symbols. These cultural changes represent a departure from the previous Late Classic cultural tradition which reflects closer ties with central Peten sites. Besides providing evidence for Yucatecan style architecture and artifacts in western Belize, we suggest that these non-local traits were likely associated with the waning influence of Peten sites during a period of economic and political decline in the central Maya lowlands, and with the concurrent rise of Terminal Classic polities in the northern lowlands of the Yucatan Peninsula and the Gulf Coast of Mexico.

"*What significant "external" or "foreign" influences affected Lowland Maya cultural development? This has long been a major question in Maya research, and it continues to be so today, so that an occasional review, or "stock-taking", of the subject seems in order. What progress has been made*?" (Gordon R. Willey 1977:57)

Introduction

In the opening sentence of an article published more than 45 years ago, Gordon Willey (1977) asked the foregoing question which we believe was as relevant in the 1970s as it is now in 2023. The focus of Willey's 1970s article, titled "External Influences on the Lowland Maya", was to compare what was known of this topic 35 years after Hay et al. (1940) published their seminal volume on "The Maya and Their Neighbors". In retrospect, Willey really did not have much information to work with in the 1970s, for what was known then about the Terminal Classic in the Belize Valley was limited to his own work at Barton Ramie, and on evidence recovered in the 1930s by Eric Thompson at San Jose and Xunantunich (known as Benque Viejo at the time). In the case of San Jose, Thompson (1939:153, 231-232) reported the discovery of spindle whorls painted with asphaltum, slate ware ceramic vessels, and fine orange pottery which he identified as clear indicators of Gulf Coastal and Yucatecan influences in west central Belize. In contrast to central Belize, non-local cultural remains at Altar and Ceibal in western Peten were more considerable, and included architectural, artifactual, and iconographic evidence for what Willey termed "foreign impingements" in the western lowlands, and for which his colleagues suggested was clear evidence of "foreign" intrusions and/or invasions into that lowland Maya sub-region (Adams 1973, Sabloff 1973, Willey and Shimkin 1973). The latter perspective became a central theme of the 1970s Santa Fe symposium that led to the publication of the volume on the Maya Collapse (Culbert and Adams 1973), and it was again an important topic of discussion in the volume on the Terminal Classic Maya Lowlands edited by Demarest et al. in 2004. Importantly, one of the key differences between the latter two volumes is that whereas several contributors to the first (1973) tome interpreted foreign influences as the result of invasion or migration of "Mexicanized" groups into the region, contributors to the more recent (2004) volume credited Terminal Classic cultural changes in the western lowlands as the product of emulation and trade, and of elite use of foreign symbols for legitimizing their statuses during a period of societal stress and political disintegration (Demarest et al. 2004; Tourtellot and Gonzales 2004).

Of particular significance to this present paper is that neither of the aforementioned volumes incorporated much data from the Belize River Valley (BRV). Each volume, in fact, had only one article focusing on the Belize Valley and both articles were primarily site specific. Willey's (1973) article in the first volume, for example, was based solely on his investigations at Barton Ramie where he noted no evidence of foreign influences in the Terminal Classic

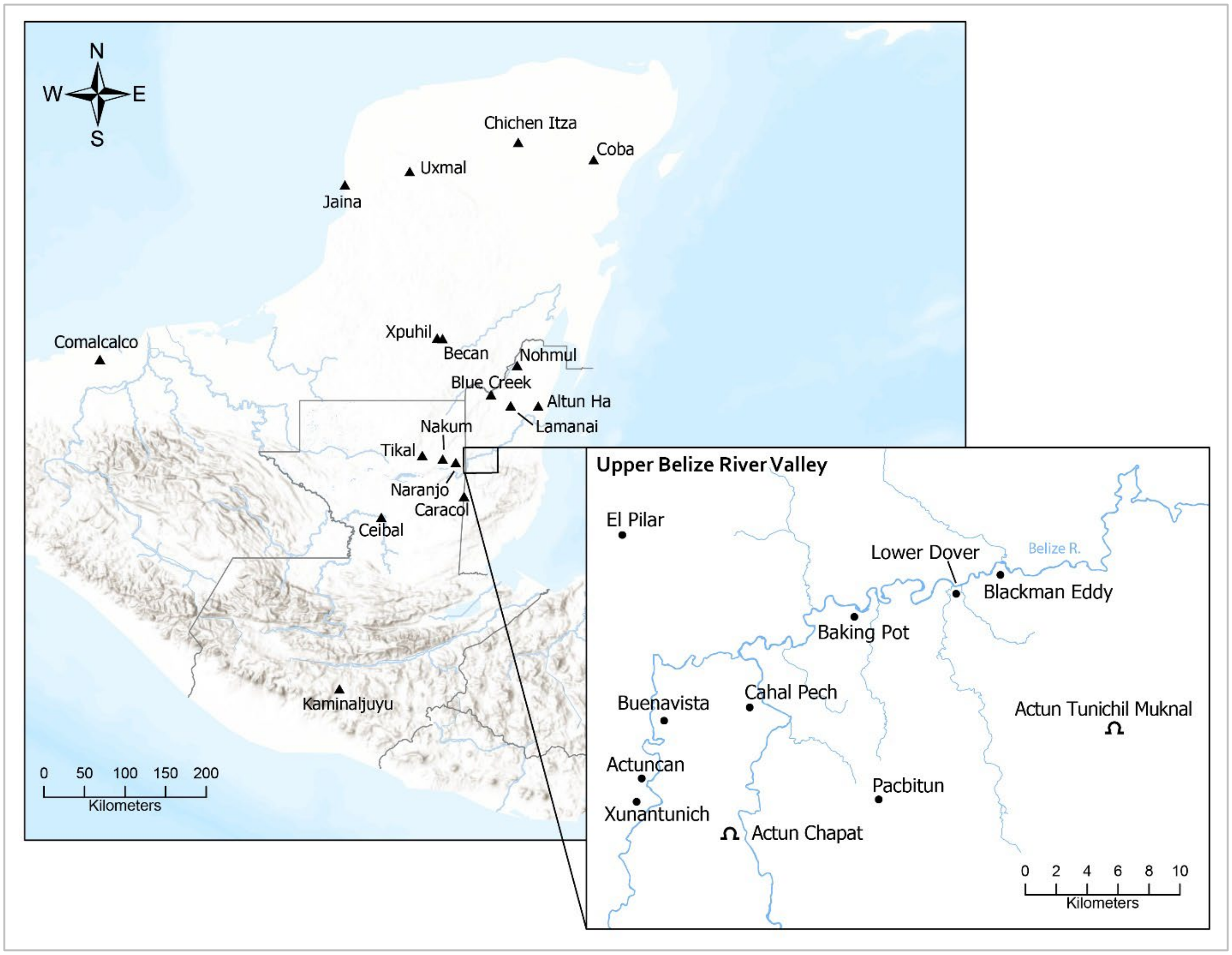

Fig. 1. Map of the Maya Area with Belize River Valley inset.

cultural assemblage of that site. Likewise, an article by Ashmore et al. (2004) in the 2004 volume provided an excellent overview of the Terminal Classic strategies of Xunantunich and its hinterlands but mentioned no evidence of external influences in the architecture, iconography, or artifact assemblage of that site. A major focus of this paper is to address this omission and to provide a regional perspective on this topic based on significant new data collected during the last 20 plus years. Our purpose here is threefold. First, we begin by presenting the considerable and diverse types of archaeological evidence for external influences in the Belize Valley sub-region (Fig. 1) during the Late Classic period. Second, we explore the origins and timing for the introduction of these influences. Third, we examine whether there were specific socio-political and economic factors that may have contributed to the increase of "foreign influences in the BRV during this time. In addressing these questions, we would like to underscore that unlike the previous efforts of our former colleagues, we are in a much better position to provide a more informed assessment of cultural changes in the BRV for the simple fact that we benefit from a significant increase in archaeological activity in this area during the last twenty years.

Archaeological Evidence for Yucatec and Gulf Coast Influences in the Belize River Valley

Long-term investigations by the Belize Valley Archaeological Reconnaissance (BVAR) Project, the Western Belize Regional Cave Project, as well as the research conducted by several of our colleagues in western Belize indicate that there is considerable archaeological evidence for Terminal Classic Yucatec and Gulf Coast influences in this lowland Maya sub-region. The extant evidence is also diverse and manifested by new architectural styles and programs, the introduction of "foreign made" or "foreign" inspired material culture, and by the increasing use of "Mexicanized" ideological symbols. Below, we describe these various types of evidence under the three categories of architecture, artifacts, and ideology.

Architectural Evidence

In a paper describing their research at Nohmul, Belize, Diane and Arlen Chase (1982:596) commented that architecture is especially important for determining "foreign" influences because, unlike portable objects that are easily traded, similar architectural features and programs in widely separated cultural sub-regions provide clear examples of "shared ideological and/or functional concepts". We concur with the Chases observation and note that during the last 23 years, the Belize Valley Archaeological Reconnaissance (BVAR) and the Tourism Development Projects recorded several architectural features in western Belize that clearly reflect foreign influence. These architectural features include a Puuc-style ballcourt with vertical hoops or ballcourt rings, a small shrine with a portico entrance, circular structures, radial platforms, structures with decorative or non-functional stairways, albaradas, and possibly the re-introduction of balustrades flanking the central stairways of elite-related architecture.

Puuc Style Ballcourt with Ballcourt Rings or Vertical Hoops

Ballcourt 1 at Xunantunich (Str. A18 and Str. A19) provides an excellent and unique example of a Puuc style ballcourt in western Belize. In addition to having ballcourt rings (Fig. 2), the angles of the benches, the form of the ballcourt buildings, and the T-shaped or half enclosed playing alley of Ballcourt 1 (Fig. 3), are reminiscent of the ballcourt at Uxmal and other courts in Yucatán. We should also note that while Xunantunich Ballcourt 1 is the only known ballcourt that incorporates Puuc style ballcourt rings in Belize, it is not the only ballcourt of this type known in the central Maya lowlands.

Fig. 2. Ballcourt Rings at Xunantunich.

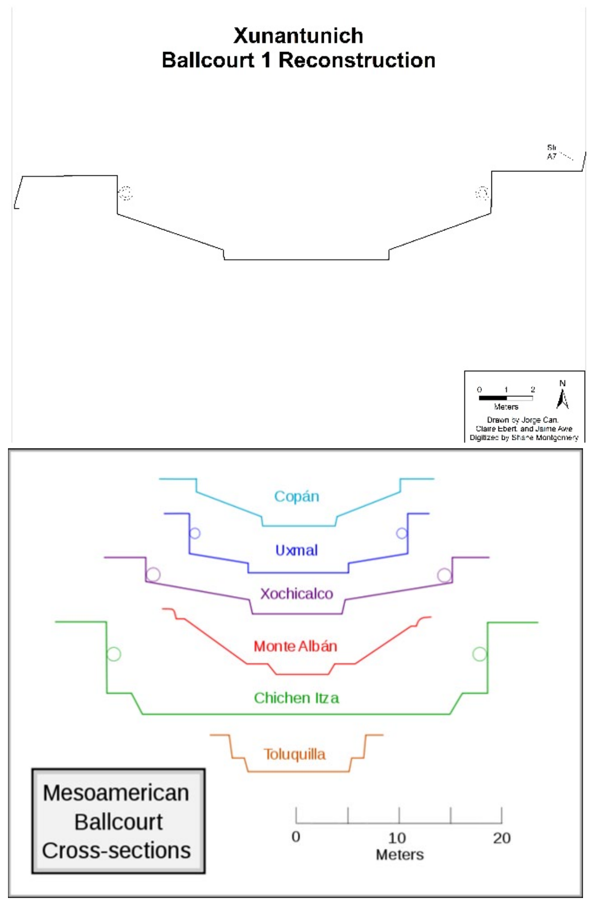

Fig. 3a-b. Profile of Ballcourt 1 at Xunantunich and of Ballcourts across Mesoamerica.

Ballcourt rings have also been found at Naranjo (Graham 1980:187) and Xultun in Peten, Guatemala. The Naranjo specimen, represented by a large (one third) fragment of the complete ballcourt ring, is designated as Ballcourt Sculpture 1 and is inscribed with two glyphs (Graham 1980; also see, Helmke et al 2015:18, Fig. 15). This ballcourt ring was first reported by

Fig. 4. Str. 20 at Xunantunich with a Portico Entrance.

Ian Graham (1980:187) in the Corpus of Maya Hieroglyphic Inscriptions. According to Graham, Naranjo site guards discovered the hoop or ring laying on the surface next to Structures B-32 and B-33 in 1979. Structures B-32 and B- 33 form one of the two ballcourts in the Naranjo site core. Another ballcourt ring was recorded by vonEuw (1978) at Xultun, a site located approximately 10 kilometers from Naranjo. The Xultun ballcourt ring, which is missing its tenon, was found just to the north of Structures A-16 and A-17, the Late Classic period ballcourt at the site.

Buildings with Portico Entrances

Structures with portico entrances should not be confused with portico gallery or colonnaded buildings. Gendrop (1998:150) defines structures with portico entrances as buildings with wide doorways that are flanked by two columns, and he notes that they are a common architectural form of the Puuc region (see also Mayer 1981). In contrast, portico gallery or colonnaded buildings have multiple or several columns and are also typical of Terminal Classic Puuc architecture.

Str. 20 at Xunantunich (Fig. 4) is presently the only known Terminal Classic period structure with a portico entrance in western Belize. This small temple or shrine is located on the upper western flank of the Castillo. Dating between the end of the 9th and start of the 10th centuries, Str. 20 is also one of the last buildings constructed at the site. The two circular columns flanking the entrance or doorway into the building are uncommon architectural elements within the central Maya lowlands but are typical of shrines at Chichen Itza (e.g., Templo de los Buhos), and later at Mayapan. The only other possible structures with portico entrances in the central lowlands are at Lamanai, Aguateca, and possibly Uxactun and Nakum. Other buildings with rounded columns have been reported at Blue Creek, Belize (Driver 2002), Copan (the "Chorcha" structure, Fash et al. 1992), Tikal (the East Plaza ballcourt, Structures 5D-42 and 5E-3 1; Jones 1996), and Yaxha (Structure 90; Hellmuth 1972), but these structures are colonnaded buildings rather than shrines with portico entrances. Another structure with rounded columns was discovered at Buena Vista in summer 2023 by Jason Yaeger (personal communication) but, like the Blue Creek structure, the Buena Vista building is likely Early Classic in date. Tikal Group G, also known as the Palace of Grooves or Channelled Walls, has pseudo columns that serve as a façade of the building, and DesMeules and Foias (2016) note that carved columns at Piedras Negras and the Puuc region provide evidence of connections between the northern and southern Maya lowlands during the Late Classic period.

At Lamanai, Pendergast (1986:232) noted that Structure N10-2 "yielded reasonably secure evidence of a columned entryway" and that the use of colonnades at the site was an "apparent innovation early in the Terminal

Fig. 5. Str. 5D-43 at Tikal with Tajin-style Architecture.

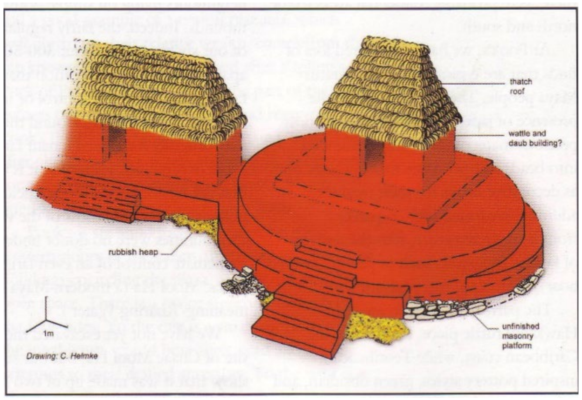

Fig. 6. Circular Structure A4-1st at Pook's Hill.

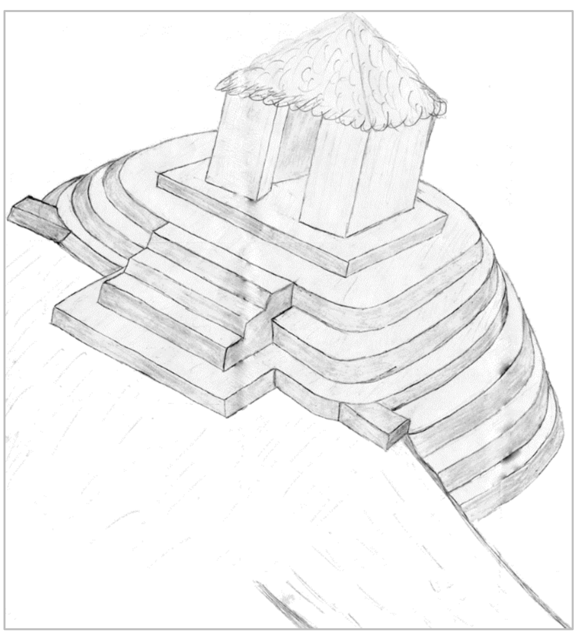

Fig. 7. Artistic Reconstruction of Circular Structure 209 at Baking Pot (drawing by Gustavo Valenzuela).

Classic". Graham (2004:236) also noted that Str. N10-77 at Lamanai reminded her of a structure in the Nunnery Quadrangle at Uxmal, and Aimers (2007:349) added that "architectural similarities to Uxmal and Champoton are evident" in the Ottawa Group at the site. In spite of these reported architectural similarities with the Puuc region, it is important to note that Graham (personal communication 2023) recently informed us that the columns on N10-2 are assumed to have been wooden. Given this new information, we are not completely certain if Structure N10-2 was a colonnaded building or whether it had a portico entrance.

In Peten, Guatemala, Smith (1950:47-48) reported that Strs. A2 and A4 at Uaxactun incorporated pillars in their façades. Valdes and Fahsen (2004:154) also note that rounded columns were discovered on Str. M8-37 at Aguateca, and that the Terminal Classic date of these buildings reflect foreign influences in the Peten. At Nakum, Zralka & Hermes (2012:164, 179) mention "the use of stone pillars and the construction of round and tandem structures (Structures 12 and 63A respectively)" and that this architecture suggests influences from Chichen and Puuc sites. Zralka and Hermes (2012:179) also report that Str. E at Nakum has "talud-tablero-reverse talud motif" which is "especially characteristic of the Epiclassic period centers of Veracruz and central Mexico (e.g., El Tajín and Xochicalco)." These connections remind us of Str. 5D-43 at Tikal which has talud-tablero terraces but with added flaring cornices that are reminiscent of the architecture of El Tajin (Fig. 5), Xochicalco, and Cacaxtla (see Jones 1996; Sharer 1977:547; Schele and Mathews 1998:72).

Circular Structures

Circular structures have a long, but episodic, history in the Belize Valley (Aimers et al. 1995; Awe 1992). They first appear in the Middle Preclassic period, disappear from the archaeological record between the Early Classic and Late Classic periods, and are then reintroduced in the Terminal Classic. The circular platforms of the Middle Preclassic are also very different from the later structures which share greater similarities with coeval architecture in the Gulf Coast, Yucatán, and western Peten.

Terminal Classic circular structures in western Belize include Str. A4-1st at Pook's Hill (Fig. 6), and Str. 209 at Baking Pot (Fig. 7). Str. A4-1st at Pook's Hill has two circular terraces that are capped by a rectangular platform at its summit and an outset stairway facing west. Str. A4-1st was also constructed above an earlier rectilinear building that served as the eastern shrine of the main plaza at Pook's Hill. Helmke (2003:125) who excavated Str. A4-1st at Pook's Hill structure, concluded that the circular structure appears to be associated with socio-political restructuring, population movement and changes in ritual practices occurring under the influence of so-called 'Mexicanised' Maya neighbours. The round structure at Baking Pot is located along a short causeway that links the two major architectural complexes in the site core. The structure has three circular terraces, a west facing outset stairway, and a small rectangular platform at its summit (Audet 2006: 222-252). Like at Pook's Hill, the latter likely supported a perishable building.

Similar structures, with circular terraces and rectangular upper platforms, have been reported at several sites in Yucatán, including Calera, Chichen Itza, and Quiengola (Andrews and Andrews 1975; Pollock 1936). Closer to western Belize, Harrison-Buck and McAnany (2006, 2013:303) describe circular structures at the Sibun Valley sites of Pechtun Ha, Oshon, and Obispo, and D. Chase and A. Chase (1982) previously reported on a circular structure (Str. 9) at Nohmul. Just northwest of the Belize - Mexico border, there is an excellent example of this type of architecture at Becan, and Folan (1987:317-348) describes a similar structure at Calakmul. To the west, in Peten, Terminal Classic circular structures are present at Ceibal (Str, C-79; Smith 1982; Tourtellot and Gonzalez 2004:72; Szymański 2010) and at Nakum (Str. 12, Źrałka and Hermes 2012). Interestingly, the Ceibal circular platform (Str. 79), like Baking Pot's circular Str. 209, is also located along a causeway terminus (Tourtellot and Gonzalez 2004:72).

Źrałka and Hermes (2012: 171) note that Ringle and his colleagues (1998:299-22) "associate Terminal Classic round structures with feathered serpent symbolism" while "in central Mexico circular constructions are associated with Ehecatl-Quetzalcoatl, a wind aspect of Quetzalcoatl." They (Źrałka and Hermes 2012: 171) further propose that "Terminal Classic-Postclassic round structures in the Maya area may bear a closer relationship with the wind god (Ik' k'uh in Classic Mayan) than the feathered serpent" and that they do reflect interaction between the central lowland Maya and their northern and western neighbors. This position was previously suggested by D. Chase and A. Chase (1982) who commented that the circular structure at Nohmul provided strong evidence of interaction between the Terminal Classic Maya of northern Belize and Gulf Coastal and Yucatecan people to the north. In contrast, Harrison-Buck and McAnany (2013:302-303) suggested that the presence of circular architecture "at strategic points along the coast and rivers of the Caribbean Watershed" suggest that "small groups of Chontal-Itza [migrants] may have entered places like the Sibun Valley [in Belize] and become permanent or semipermanent residents" and that this could explain the presence of circular shrines in this area. As we caution below, one should not assume that cultural changes are always the result of migrations without sound scientific evidence to support these assumptions. Bioarchaeological research on Terminal Classic skeletal remains in the Belize Valley, for example, has yet to yield any evidence of immigrants originating in either the Gulf Coast or northern Yucatán, thus supporting the argument for interaction and emulation rather than immigration.

Structures with Decorative or Non/functional Stairways

Structures with decorative, or non-functional, stairways are typical of Rio Bec architecture. Structure 1 at Xpuhil, which is beautifully illustrated on the cover of Proskouriakoff's (1963) "Album of Maya Architecture", is probably the best example of this architectural form. Sharer and Traxler (2006:114, 531) note that classic Rio Bec architecture is primarily a product of the Terminal Classic period when sites (e.g., Becan, Xpuhil and Rio Bec) in this subregion become heavily influenced by Puuc culture from northern Yucatán.

Our investigations in western Belize recorded two structures with non-functional/decorative stairways, these include

Str. B 9 at Caracol (Fig. 8) and Str. A2 at Lower Dover. Structure B9 at Caracol is the eastern building of Ballcourt B and its decorative stairway faces Plaza B (Caana Plaza) to the east. The west side of the structure faces the other ballcourt building to the west. We believe that the east side of Str. B9 was purposely decorated with the non-functional stairway to disguise the back side of the ballcourt building by creating a façade that looked like a temple facing Plaza B. Another interesting aspect of the architecture within Caracol's Plaza B is that several of its perimeter structures incorporate foreign-inspired features. These include the decorative stairway on Str. B9, balustrades flanking the midsection of the stairway leading to the summit of Caana, low-lying rectangular platforms in front of all the major structures in the plaza, and stucco masks in the form of the Storm Gods (Tlaloc) on the stair sides of Str. B5 (described below). The decorative stairway on Lower Dover Str. A2 was only partially excavated so beside the fact that the stairway faces Plaza A to the west, there is not much we can presently say of this feature at that site.

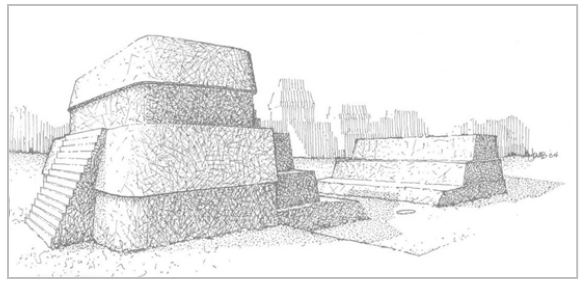

Fig. 8. Str. B9 at Caracol with Non-Functional Stairway (after Joseph Balay).

Fig. 9. Radial Platforms at Lubaantun.

Radial Platforms

George Andrews (1975) and Marvin Cohodas (1980) previously noted that there are two types of radial structures in the Maya lowlands, the radial pyramid and the "altar platform". The former is typically represented by the western structures of E-Group complexes. The latter is defined by Cohodas (1980:209) as "a small radial structure that functions as a secondary element in its architectural complex and is usually placed on axis with a larger structure." Instead of applying the very functional "altar platform" designation to these structures, we prefer to identify them as radial platforms. We also define them as low structures or platforms which, like most radial pyramids, often, but not always, have steps on all four sides and are often centrally located in epicentral courtyards. Two of the best-known examples of these radial platforms are the Pillory Shrine and Jaguar Throne structures that are axially located east of the central stairway of the Governor's Palace at Uxmal. Radial platforms are also common architectural features of other Puuc sites and are present to the west and south of Yucatán during the Terminal Classic period (e.g., the radial platform in the courtyard of the Cross Group at Palenque).

Radial platforms, which appear as late additions to the architectural assemblage of western Belize sites, are present at Baking Pot, the Benque Site, Caracol, and possibly at Xunantunich (Str. A1). In southern Belize, Structure 32 at Lubaantun (Fig. 9) is another very good example of this architectural type. Braswell (2022:156) notes that Postclassic sherds were found around Structure 32 at Lubaantun, but that this pottery is indicative of Post abandonment ritual pilgrimages to the site. The radial platform at Baking Pot, Str. N, is one course high, it is in the center of Plaza 2 in Group 1 and is axially located between the E-Group assemblage at the site (Aimers 2002:429, 2003:159). In contrast, the radial platforms at the Benque Site (Str. 7) and at Caracol are located on the side of their respective courtyards. The radial platform at the Benque Site, like that of Lubaantun, has steps on all four sides of the platform. The Caracol platform, which is located just southwest of the Barrio Group, has a single stairway on the south side, while the Baking Pot platform has no steps. Aimers (2002:429) previously observed that the Baking Pot form of the radial platform is "sometimes used as a marker of the Terminal Classic-Postclassic" period, and that ceramics recovered "from Mound N date to this era." He also commented that previous researchers suggested that this type of radial platform was Central Mexican in origin, and that it was introduced into the Maya area by foreign invaders or immigrants.

Above, we suggested that Str. A1 at Xunantunich could be considered a type of radial platform. This structure, which has stairways on its north and south sides, was constructed in the latter part of the 9th century at the center of what was originally a large open plaza in the heart of the city. Its construction served to cut the large courtyard in two thereby creating Plazas A-1 and A-II. The major difference between Str. A1 and other radial platforms in the Belize Valley is its size. Whereas all other radial structures in the valley are low-lying platforms, the size of Str. A1 is more in line with what Cahodas (1980) defined as radial pyramids. Unlike radial pyramids that are associated with Preclassic E-Group Complexes, however, Str. A1 at Xunantunich is not associated with an E-Group and neither does it date to the Preclassic period.

Albarradas

Our investigations in western Belize have recorded low stone walls at several sites across this lowland Maya subregion. Too often, in our opinion, these low stone walls are automatically assumed to be defensive in nature (Awe and Morton 2023; Demarest 2004) with little effort expended to discriminate between defensive and non-defensive functions. From our point of view, and based on our examination of their contexts, mode of construction, and chronology, these features more likely represent a*lbarradas*, that is, low stone walls that serve to demarcate "property" or to enclose household spaces. *Albarradas* have a long history of use in Yucatán, where they became prominent during the Terminal Classic and Postclassic periods, and where they continue to be used and modified today. In the greater Belize Valley, these low stone walls are present at Cahal Pech, Lower Dover, Tipan Chen Uitz, and Xunantunich, and they are all associated with the final, Terminal Classic, phase of occupation at all four sites. South of the valley, there is also an *albarrada* at Caracol that originally enclosed a large area to the east and south of the Barrio Group and Plaza B. Like those of the Belize Valley, the Caracol *albarrada* also dates to the Terminal Classic period and is in a location that provides no defensive advantages to the site's core area.

Foreign-made or Foreign-inspired Objects

Spindle whorls

Eric Thompson was one of the first archaeologist to identify foreign-made or foreign-inspired artifacts in western Belize. In his San Jose report, published in 1939, Thompson observed that spindle whorls at the site were painted in what he identified as asphaltum (black asphalt/resin). He added that the asphaltum and incised designs on the spindle whorls were very similar to "spindle whorls from the Huaxtec region of northern and north central Veracruz" (Thompson 1939:153). Thompson's observations are supported by Patel (2012:240-241) who recently reported that figurines in Veracruz were "often accented with a black asphalt/resin – a convention unique to this coastal region." Patel added that more than 500 spindle whorls were discovered in the Pyramid of the Flowers at Xochitécatl in Tlaxcala, that the Carnegie Institution of Washington recovered more than 100 from ritual contexts at Chichen Itza, and that some 200 plus specimens were found at the Isla de Sacrificios in Veracruz. Many of the latter were decorated with isthmian symbols and motifs (Patel 2012, Fig. 7.41 c-g) that are akin to those from San Jose, Belize.

Hachas

Ballgame paraphernalia are another type of artifact that is closely linked to Gulf Coast cultures, and particularly with the site of El Tajin in Veracruz. This makes the discovery of an hacha at the Belize Valley site of Buenavista significant for it provides another example of late influences originating from the Gulf Coast region. According to Helmke et al. (2018:11) the Buena Vista hacha was found on a mound just outside of the site core, about "300 meters west of the royal palace." Helmke and his colleagues

(2018:11) add that nine yokes were found at Copan, that two fragments of yolks are known from Ceibal, and that ballgame paraphernalia have also been discovered at Altun Ha and Caracol in Belize, and at Palenque, Tonina, and Bolomkin in the western Maya area. In regard to the Palenque ballgame paraphernalia, Rands (1973:196) previously reported that the "[t]hin stone heads and fragments of yokes" were considered by Alberto Ruz Lhuillier "to indicate intrusions from the Veracruz Gulf Coast."

Quadruple Ceramic Flutes

During our investigations of the circular Str. A9 at Baking Pot (see above), we discovered two quadruple flutes in Burial 2 (see Audet 2006:239). The Baking Pot flutes (Fig. 10) are very similar to four-chambered or quadruple flutes that Martí (1968, 1978) previously assigned to Gulf Coast origins. A more recent study of these musical instruments by Arndt (2O14) indicates that quadruple flutes have been found in Tabasco, Jaina, Oaxaca, and the Pacific Coast of Guatemala, and especially at Teotihuacan (Arndt 2014) where several fragmented specimens have been discovered in diverse contexts. The Teotihuacan versions of these flutes, however, are generally smaller than that those that were produced later in the Gulf Coast, and the anthropomorphic figures on their mouthpiece differ in style from the Baking Pot specimen. Neutron-activation analysis of the Baking Pot flutes (BVAV026) by Reents-Budet and Ron Bishop (see Reents-Budet et al. 2005:367, 370, 381) noted that their chemical composition is not local to the Belize Valley thus indicating an undetermined place of origin, but likely from the Gulf Coast or possibly the Motagua River Valley. Based on their form and style, it is much more likely that the Belize Valley quadruple flutes were imported from the Gulf Coast region rather than from Central Mexico or the Motagua region. A recent study of Terminal Classic three-chambered flutes from Jaina and Copan by Zalaquett Rock and Espino Ortiz (2019) noted that except for the number of chambers, the three chambered flutes from the latter sites are shaped similar to the quadruple specimens from Baking Pot, and that they also reflect close similarities with three-chambered flutes from the Gulf Coast.

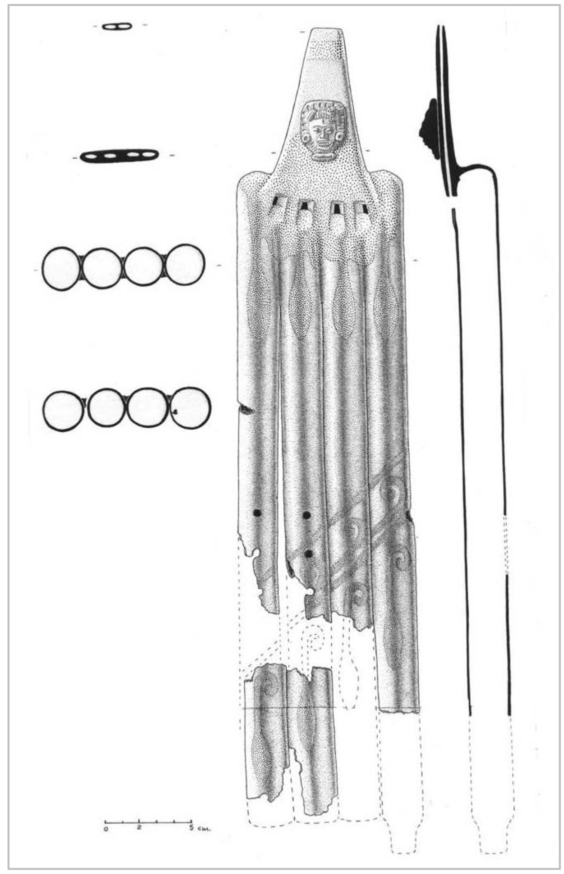

Fig. 10. Quadruple Flute from Baking Pot (drawing by Gustavo Valenquela).

Fig. 11. Fine Orange Vase from Pook's Hill.

Pottery

Ceramic remains, including fine paste pottery, slate ware, comales, and frying pan censers are among the most common cultural materials that reflect non-local influences in the greater Belize Valley during the Terminal Classic period. Fine Orange pottery (Fig. 11) is almost ubiquitous at Belize Valley sites (see Helmke 2001; Helmke and Reents-Budet 2008; Ting et al. 2015), and fine orange moulded-carved vases are consistently recovered in caves and surface site contexts. Another significant feature of fine orange pottery in the Belize Valley is that most of it appears to be locally, or regionally, produced, with only a few specimens of the Usumacinta-related Pabellon Modelled-carved type present. The most common of two locally/regionally produced types is Ahk'utu' moulded-carved vases (see Helmke and Reents-Budet 2008; Ting et al. 2015) with diagnostic, bulbous, tripod supports. The fact that the latter are predominantly produced in the region suggests that most fine orange pottery in the Belize Valley represent emulation or foreign inspiration of a non-local ceramic tradition.

Slate ware was first identified at San Jose by Thompson (1930), who accurately noted that it reflected ties with sites in northern Yucatán. More recently, slate ware has been identified at several other sites in central Belize, including Cahal Pech, Caracol, Altun Ha, and the Sibun Valley (Aimers 2002; Awe et al. 2020a; Chase and Chase 2007; Harrison-Buck and McAnany 2006). Aimers (2003:380-381) previously suggested that affinities between the Central Belize slate ware with that of the Sotuta complex at Chichen Itza likely suggests that this ceramic type was introduced by immigrants from northern Yucatán. Harrison-Buck and McAnany (2006), in contrast, propose that the large quantity of northern-style pottery at Sibun sites is more in line with local production, thus imitation, rather than direct imports. Because we have yet to conduct petrographic or iNAA studies of the Cahal Pech slate ware vessels, we cannot, at present, state whether they represent imports or the product of emulation. We should also note that slate ware ceramics, and comales, are common in northern Belize, especially along coastal sites. Mason and Boteler-Mock (2004:383, 393) suggest that the distribution of these materials was associated with a Terminal Classic interaction sphere that was dominated by Chichen Itza.

Ceramic, Jaina-like, Mould-made Figurines/Ocarinas

The production of figurines and ocarinas in the Belize Valley began at the end of the Early Formative period (Awe 1992). By the end of the Late Formative, however, figurine production was discontinued, and following a hiatus that lasted for most of the Classic period, they were eventually re-introduced during the Terminal Classic. Besides their date of production, there are several other significant differences between the early and late figurine traditions in the valley. Whereas Formative period figurines are solid, hand-modelled, unslipped, and stylistically unsophisticated, the Terminal Classic specimen are hollow, mould-made, and have facial and dress features executed in great detail. The latter figurines are also often painted with red and orange slips, and occasionally with Maya blue pigment.

In the Belize Valley, Terminal Classic mould-made figurines and ocarinas have been recovered at Cahal Pech, Xunantunich, Baking Pot, and Pacbitun (Awe et al. 2020a,b; Cheong et al. 2014; Healy 1988). Petrographic analysis of a sample of the Pacbitun assemblage indicated that there were both locally made and foreign specimens in the collection. While we have yet to conduct source analysis of the Cahal Pech, Baking Pot, and Xunantunich specimen, similarities with the Pacbitun foreign-made figurines suggests that a similar distribution can be reasonably expected at the former sites. What we are uncertain of is the exact place of origin for the foreign-made figurines. Stylistically, several of them display similarities with figurines and ocarinas from Jaina where some specimens are also painted with various colors, including Maya blue.

Maya Blue Pigment

Although the use of Maya blue extends into the Late Preclassic in the Maya lowlands, there is a clear increase in the use of this pigment, on pottery, murals, and sculpture, during the Terminal Classic period (Arnold 2005). Arnold (2005) has also identified Terminal Classic mines

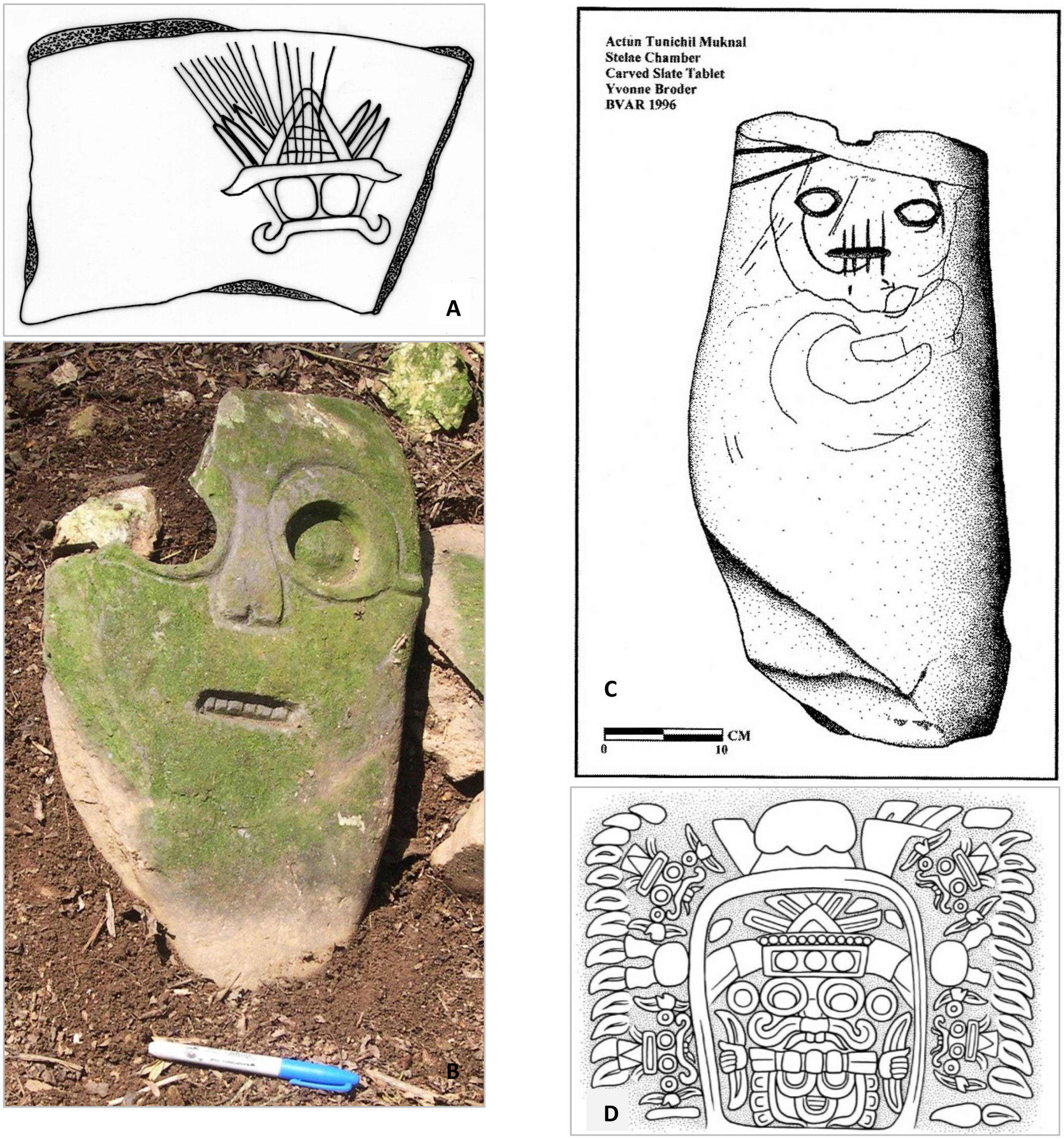

Fig. 12a-d. Mexican Storm god incised on Belize Red Sherd at Cahal Pech, carved out of Slate at Bajo del Lago, incised on Slate Slab at Actun Tunichil Muknal, and on a moulded tripod vessel from Esquintla Guatemala (after Anderson and Helmke 2013), drawing by N. Latsanoupoulos.

for the extraction of palygorskite, a major component of Maya blue pigment, near Sacalum and Ticul, Yucatán. Given the discovery of these palygorskite mines, we can deduce that Maya blue was most likely produced in Yucatán, and that the pigment was exported to cities in the central and southern lowlands. The use of Maya blue in the Belize Valley during the Terminal Classic would also suggest that this pigment was imported from the northern lowlands at this time.

Ceramic Griddles or Comales, Grater Bowls, and Frying Pan Censers

Frying pan censers, flat ceramic griddles, or comales and, to a lesser extent, grater bowls, are present in the Terminal Classic ceramic assemblages of Baking Pot, Cahal Pech, Xunantunich, and Caledonia, and they have also been found at Altun Ha, Caracol, and several cave sites in central Belize (Aimers 2002; Awe 1985, 2008; A. Chase and D. Chase 2007:16, 23; Pendergast 1979). Halperin (2017:16) notes that the earliest evidence for the use of flat ceramic griddles is in Central Mexico and Oaxaca, although they are also known from late Early Classic contexts at Quirigua and Copan. In the Belize Valley comales and grater bowls first appear in Terminal Classic times and, along with frying pan censers, are generally found in the same contexts as fine orange vessels. This pattern is also evident at Caracol where, in addition to frying pan censers and fine orange pottery, there are also "Mixtec-style" incense burners (A. Chase and D. Chase 2007:16, 23). At Xunantunich, LeCount (2010: 147) suggests that *comales* were used in elite palace kitchens. Ardren (2020:280-281) indicates that "grater bowls and griddles [comales] presented radically new methods of food preparation" in Yucatán and that they do not show up at Chichen Itza, and by extension the northern lowlands, until during the Terminal Classic period. She adds that from Yucatán their use for making tortillas likely spread southward.

Terminal Classic, "Mexicanized", Ideological Symbols and Yucatec-inspired(?) Rituals in the Belize Valley

In the Belize Valley, "Mexicanized" ideological symbols are manifested by images of the Mexican Storm god (Tlaloc), the Mexican Year Sign, and by pecked crosses and patollis. Other "foreign" ideologies that were likely introduced during the Terminal Classic period are rituals associated with round structures and radial platforms, an increase of child sacrifices in caves, and the introduction of frying pan and Mixtec-style censers.

Mexican Storm god (Tlaloc) images in the BRV are depicted on a Terminal Classic, Belize Red, ceramic sherd from Cahal Pech (Fig. 12a), and they are carved on slate at Bajo del Lago in the upper Macal (Fig. 12b), and at Actun Tunichil Muknal (Fig. 12c) along Roaring Creek. They are also featured on two large stucco masks that flank the central stairway of the terminal architectural phase of Structure B5 at Caracol

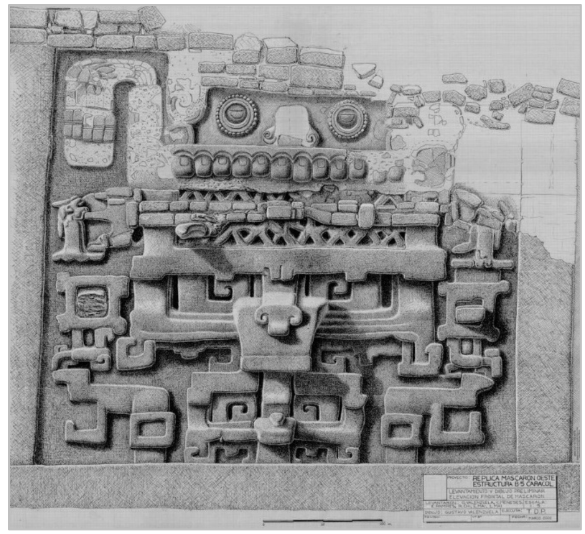

Fig. 13. Mexican Storm god depicted on Mask Flanking the stairway of Str. B5 at Caracol.

(Fig. 13). The incised image on the Cahal Pech sherd represents a frontal depiction of the Central Mexican Storm god wearing a headdress that includes the trapeze and ray element in the middle (aka. the Mexican Year Sign). The Storm god on the Cahal Pech sherd can be identified by the goggles as well as the pronounced and curving upper lip (usually referred to as a "*bigote*" in the literature concerning this deity). Rice (1983) and Aimers (2003:408) argue that reptilian motifs on Terminal Classic and Postlcassic period art in the central lowlands, including western Belize, "represent the movement of Mexicanized Maya people from the Gulf Coast and Yucatán into the Belize Valley during and after the Terminal Classic or at least some sort of unspecified "influence" of Mexicanized groups from the Gulf Coast or Yucatán".

The Mexican Year sign is evident on a polychrome vase from Actun Chapa (Fig. 14), a cave located about six kilometres south of Cahal Pech (Awe et al. 2019:44, Fig. 13). At the center of the iconographic field, the vase is adorned with two Mexican Year Signs. Awe et al. (2019:44) previously noted that Mexican Year Signs are typically associated with central Mexican cultures and with Teotihuacan in particular. What is significant about the Actun Chapat vase, however, is that it was produced long after Teotihuacan had collapsed and following the depopulation of this central Mexican metropolis. This situation led Awe and his colleagues

Fig. 14. Mexican Year Sign painted on Vase from Actun Chapat, Macal River Valley.

(2019:44) to suggest that the late manifestation of the Mexican Year Sign in the BRV was likely associated with "a Late Classic revivalist movement wherein motifs of central Mexican origin and especially those tied to and associated with Teotihuacan saw renewed vigor in their use and application." They further added that "The pairing of this symbol with the simplified Maya glyph for *ajaw* "king" along the rim" of the vase is interesting for the Mexican Year Sign often decorates the headdresses of rulers at Teotihuacan (see Nielsen and Helmke 2017). When considered in tandem, these iconographic features confirm and support Ringle et al. (1998) previous suggestion that a cult of Quetzalcoatl was partly responsible for the Terminal Classic spread of symbolic elements and mythology to the Maya lowlands.

Pecked crosses and patollis are both present in Terminal Classic architectural contexts at Xunantunich. The Xunantunich pecked cross (Fig. 15a) was carved or pecked into the floor of a small room in Structure A20, the small shrine with the portico entrance described above. This pecked cross consists of some 40 small circular depressions, and two larger ones at the north and south end of the cross. Wanyerka (1999:109) and Woodfill (2014) report that pecked crosses are predominantly found in Central Mexico, particularly at Teotihuacan where Aveni associates them with "astronomical sighting devices". Aveni et al. (1978:278) also note that pecked crosses are often associated with patolli boards at Aztec sites. This association is certainly the case on Structure 20 at Xunantunich, and at

Fig. 15a-b. Pecked Cross and Patolli incised on the floor of Str. A20, Xunantunich.

the site of Lagarto in southern Belize where both features have been found near to each other (Wanyerka 1999).

In the case of *patollis*, Watkins et al. (2023; also, Fitzmaurice et al. 2021 and Saldana et al. 2023) note that Xunantunich (Fig. 15b) contains the second most *patollis* recorded in the central Maya lowlands. Structure 13, in particular, contains about a dozen of these game boards carved into the floor of rooms in this elite residential building. Zralka's (2014:70) study of *patollis* indicates that some of the earliest patollis known are from Teotihuacan. Other examples are known from El Tajin and later at Tula, Hidalgo, and at Aztec sites in Central Mexico. Zralka notes that the Teotihuacan *patollis* are generally quadrangular with a cross-like pattern at their center. The Aztec boards are more typically X-shaped. The Xunantunich *patollis* share greater similarities with the Teotihuacan types rather than with the later Aztec types. In the Belize Valley, *patollis* are also almost always found in association with graffiti. Zralka (2014:193-196) notes that some graffiti, particularly those of Terminal Classic date, reflect "foreign" or "Mexicanized' influence and that they are likely linked to the "International Style" typical of this period.

To the southeast of the BRV, several *patollis* have been discovered in the Stan Creek (Graham 1994) and Toledo Districts (Wanyerka 1999). The Lagarto Ruins in southern Belize has several monuments, Monuments 5, 10, and 12, that are all decorated with *patolli* designs and also Wanyerka 1999, Figs. 3, 4, 5). These Lagarto monuments share close similarities with altars that were found paired with Stela 10 and Stela 22 in Group A at Ceibal (Smith 1977: Figs. 4-7). Significantly, Stelae 10 and 22 at Ceibal are both decorated with what Smith suggests are non-local rulers, and Group A was the primary courtyard of Ceibal during the Terminal Classic period (Smith 1977:360-361). Smith (1977:361) also argues that the presences of *patollis* at Ceibal, Belize, and Uxmal represent influences from Tula. Stresser-Péan (1971:599), in contrast, notes that *patollis* are very common among the Huasteca of Veracruz, but that the earliest examples appear to be at Teotihuacan.

Concurrent with the introduction of these non-local ideological symbols in the BRV is an increase in cave rituals, and new styles of incense burners. Frying pan censers, in particular, were introduced during the Terminal Classic period at Baking Pot, Cahal Pech, Caledonia, and Xunantunich (Aimers 2002, 2003; Audet 2006; Awe 1985; Awe et al. 2020b). A. Chase and D. Chase (2007:16, 23) also report "frying pan" and "Mixtec-style" incensarios at Caracol where they represent foreign influences during the Terminal Classic period.

Our investigations also reflect coeval changes in cave rituals at this time. Cultural remains in caves along the Roaring Creek, Barton Creek, and Macal River, for example, indicate that there was a significant increase in cave ritual activity during the Terminal Classic period (Awe et al. 2019, 2020b, Helmke 2009; Moyes 2006; Moyes et al. 2009). An important aspect of ritual intensification in subterranean sites at this time was human sacrifice, particularly that of children (Ardren 2011; Awe et al. 2020b; But 2020; Owens 2005). Given the widespread evidence for child sacrifice in caves and cenotes in Yucatán (Ardren 2011), it is possible that this practice in the BRV was a result of influences deriving in the northern lowlands.

Origin of Influences

More than 80 years ago, Thompson (1939) suggested that slate ware pottery, fine orange ceramics, and spindle whorls painted with asphaltum at San Jose provided strong evidence of Gulf Coastal and Yucatecan influences in western Belize. Several years later, Richard Adams (1973) and Jeremy Sabloff (1973; see also, Willey and Shimkin 1973) argued that new architectural styles, the introduction of fine orange pottery, and iconographic representations on monuments at Altar de Sacrificios and Ceibal indicated that foreign "Mexicanized" groups invaded and conquered the western Maya lowlands via the Usumacinta River. Thompson (1975) subsequently noted similar changes in the iconography of stelae at Ucanal and suggested that these influences were likely associated with Putun or Chontal Maya incursions into the central Maya lowlands. Willey (1977:69) later supported Thompson's view and noted that "Late Classic foreign influences on the Lowland Maya [may have derived from] Chollula or Xochicalco, or sites in Veracruz" and that "these ideas may have been mediated by Chontal or Putun Maya groups, on the western edge of the Maya Lowlands." Ball (1974) also noted that the late florescence of Usumacinta sites was likely a result of Yucatecan groups who moved into the area during the Terminal Classic period. More recently Laporte (2004:229) suggested that foreign influences at Ucanal may be associated with Mopan immigrants from the Yucatan.

Following the discovery of foreign influences at Nohmul in northern Belize, and at Terminal Classic sites along the eastern seaboard of the Maya area, Arlen Chase (1985) questioned the "single vector, west to east" origins of foreign influences that had been proposed by Adams, Sabloff, Thompson, and Willey. In contrast to the latter, he suggested a two-pronged intrusion for the influences, one deriving from the west via the Usumacinta drainage around 9.16.0.0.0 (ca 750 AD), and the other emanating from Chichen Itza around 9.19.0.0.0 (ca 810 AD) and following an easterly coastal direction then inland via riverine routes. Another significant difference of Chase's model is that rather than explicitly crediting invaders for changes in the Terminal Classic assemblages of central lowland Maya sites, he hypothesized that changes in the iconography of centers like Caracol likely resulted when the city's last two rulers "entered into some sort of alliance with individuals foreign to the site" and that these individuals "may have come from somewhere to the north" (Chase 1985:106).

In the volume on the Terminal Classic in the Maya lowlands, Tourtellot and Gonzalez (2004:78) questioned the migration/invasion model previously proposed for the Usumacinta region. They commented that many of the theories regarding military conquest of, or migration into, Ceibal during the Terminal Classic "smack of unexamined biological determinism, as if Classic and non-Classic Maya cultures were carried by the biology of their origins." They further supported Ringle et al's. (1998) suggestion that foreign influences were more likely introduced because of the spread of "a new Epiclassic world-religion", the cult of Quetzalcoatl, which strongly recognized "that new ideas also moved by means other than conquest and migration." Tourtellot and Gonzalez (2004:74) further note that, "Rather than seeing late invasions as disrupting Classic Maya civilization, serious trouble may already have developed in the Late Classic from internal processes, producing conditions under which people eventually sought and developed alternatives for rule and worship that offered them hope."

For the Belize River Valley, Aimers (2007:345-46) recently observed that sites in this region have yet to provide evidence of invasion in spite of the fact that "stylistic change [in the Terminal Classic] was great compared to earlier periods". Aimers added that "[c]eramic styles related to northern Belize, Yucatán, and the Gulf Coast do not definitely indicate foreign presence, but they show that the people of the Belize Valley were familiar with exotic styles and did not hesitate to adopt them." A similar case has been made by Harrison-Buck and McAnany (2006, 2013) for the Sibun River Valley, where they recorded architecture and cultural remains that reflect connections and interaction with Terminal Classic centers in Yucatan.

The biggest problem with previous studies that have argued for invasion/migration as the causal factor for Terminal Classic foreign influences in the central Maya lowlands is that almost none of these studies have applied biological data for addressing this critical question. Fortunately, this sin of omission is changing, and new and ongoing research has begun to provide interesting insights regarding migrations during and after the decline of the central lowlands. Recent studies of population dynamics in the BRV, for example, indicate that there was considerable migration (between 10% and 40%) of people into the area around this time (Freiwald 2021, Freiwald et al. 2014; Hoggarth et al. 2021, 2022). Most immigrants into the Belize Valley, however, appear to have come from adjacent regions to the south (Maya Mountains), and from Peten in the west. Another recent analysis of the dental morphology of a sample of 676 individuals from 11 sites in central Belize, Peten, and Yucatan also indicate that some Terminal Classic members of the central Belize population were non-local (Wrobel et al. 2022). When the central Belize samples were compared with the small representative sample from sites in Yucatan and Peten, differences between the two groups suggest that the origin of the central Belize "foreigners" likely lies outside of the northern lowlands, or at least not from the sites analysed in the study. It is hoped that a planned future analysis of samples from a larger number of sites may yet help to determine the diverse regions of origin for the Terminal Classic immigrants in central Belize. Despite these

Table 1. Sources of Terminal Classic Foreign Influences in the Belize River Valley.

Sources of TC Foreign Influences in Western Belize			
Yucatan	**Gulf Coast**	**Central Mexico**	**Usumacinta**
Slate ware	Hachas	Storm god	Fine orange
Maya blue	Asphaltum	Mexican Year sign	
Jaina figurines	Quadruple flutes	Pecked crosses	
Frying pan censers	Circular platforms	Patolli	
Ballcourt rings	Comales	Comales	
Portico entrances	Patolli??	Arrow points??	
Radial platforms	Arrow points??		
Decorative stairs			
Child sacrifices in caves?			

limitations, our study of non-local architectural styles, ideological symbols, and artifacts in the Belize Valley (see Table 1) suggests that most of the influences derived from Yucatan, followed by the Gulf Coast, and then central Mexico. The one exception was fine orange pottery which likely originated in the Usumacinta region, and either introduced overland across the Peten, or via the Caribbean coast or by inland trade routes that connected the Rio Bec region with the northern and southern regions of the lowlands. The latter route has been suggested by Rice and Rice (2004:281) who noted that "Becan seems to have enjoyed a brief tenure as an important trading port in the late ninth and early tenth centuries, as the main transpeninsular trading route from the Gulf to the Caribbean." Whatever the actual route of foreign influences into the BRV may be, the widespread geographic origins and diversity of these cultural influences lend support to the development and dissemination of international styles across Mesoamerica during the Terminal Classic period.

Dating the Introduction of Foreign Influences into the Belize River Valley

Arlen Chase (1985) previously suggested that Yucatecan influences manifested in northern and central Belize around the start of the 9th century (9.19.0.0.0 ca. 810 AD). Data from the Belize Valley roughly supports this time frame, but also indicates that it may have begun as early as the last few decades of the 8th century. We propose this earlier time frame for a couple of reasons. First, our 14C dates of cultural remains in caves with evidence of Terminal Classic foreign influences generally tend to cluster between 750-900 AD. This is especially true of Actun Tunichil Muknal which contains fine orange and plumbate pottery, the image of a Mexican Storm God carved onto a slate slab, and considerable evidence for child sacrifice (Awe et al. 2005; 2020b).

Our second reason for suggesting a slightly earlier date for the introduction of Terminal Classic influences in western Belize is based on observations by colleagues working in several other neighboring sub-regions. Robles and Andrews (1986), for example, argue that data from the East Coast of Yucatán reflect a decline of Peten influences by about 750 AD and to the start of Puuc florescence in Yucatán around this same time. This situation, they claim, is quite evident at Coba, and at other sites in Quintana Roo. Further south in Honduras, Fash et al. (2004:283) note that beginning in Terminal Classic times, Copan's previous links to the central lowlands began to dissipate, and that they "show [greater] contact with central Honduras and influence from lower Central America that is absent at other southern Maya lowland sites during this turbulent time period."

Closer to the Belize Valley, Mason and Mock (2004:367) argue that the "burgeoning network of circum-peninsular maritime trade that formed around the Yucatán [stimulated by Chichen Itza]… directly undermined the economic foundations of older, inland regional capitals in the Belize subregion." This perspective conforms with Sabloff and Rathje's (1975) previous observation which suggested that trade with inland sites dissipated as their political systems disintegrated. Because this disintegration is now known to have begun by the middle of the 8th century (Kennett et al. 2012), it appears prudent to suggest that the introduction of foreign influences from Yucatan and the Gulf Coast was a coeval development in the Belize Valley.

As to the factors that led to the introduction of foreign influences from the north and northwest, we suggest two main factors. First and foremost, archaeological data strongly suggest that the disintegration of political and economic systems in the central lowlands, that is, to the west in Peten, led to decreasing interaction between cities in western Belize and their contemporaries in the eastern Peten. This void was eventually filled by interactions with the rising polities of the north, particularly with the booming economies of Chichen Itza and other cities in the Puuc region of Yucatan. A second factor that influenced these changes was the spread and adoption of international Mesoamerican styles and ideologies that was on the rise during this time of socio-political, economical, and environmental stress in the central Maya lowlands. The spread of both Maya and non-Maya goods, ideas and concepts at this time was undoubtedly facilitated by an increase in maritime trade across greater Mesoamerica, and cities that lay along the new trade routes quickly became the recipients of this broader interaction network.

Conclusion

In this paper we noted that our long-term research in western Belize has recorded considerable evidence for the introduction of non-central lowland Maya influences into this Maya sub-region during the Terminal Classic period. These influences, which originated in the Puuc region of Yucatan, the Gulf Coast, and central Mexico, are manifested by the presence of new architectural styles and programs, and by the introduction of "foreign" artifacts and ideologically charged symbols. The introduction of these cultural materials and traits in the Belize Valley during the Terminal Classic period represents a significant departure from the previous Late Classic cultural tradition which reflected much closer ties with large polities in central Peten such as Tikal, Calakmul, and Naranjo. But what is it that led to these changing spheres of cultural interaction? From our point of view, and based on considerable archaeological evidence, we posit that the introduction of northern and northwestern traits was likely associated with the waning influence of Peten sites during a period of economic and political decline in the central Maya lowlands, and with the concurrent rise of Terminal Classic polities in the northern lowlands of the Yucatan Peninsula, the Gulf Coast, and the central valley of Mexico.

Another important observation of our research is that while scholars have traditionally touted the influences of Teotihuacan on the lowland Maya during the Early Classic period, we think it is important to underscore that Teotihuacan's influence pales considerably when compared with the influences from Yucatan and the Gulf Coast during the Terminal Classic period. When perceived through a comparative lens, we find that Teotihuacan's influence was predominantly elite centric, that it included a few material objects (primarily green Pachuca obsidian and a small number of ceramic types/forms), and, to a very limited degree, talud-tablero architecture. Equally telling is the fact that Teotihuacan's influences are mostly manifested at a few major Maya capitals such as at Copan, Kaminaljuyu, and Tikal. In contrast, Yucatecan and Gulf Coastal influences during the Terminal Classic period are geographically more widespread, they transcend social classes, and ideologically they were considerably more impactful.

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SECTION TWO: *GENERAL RESEARCH REPORTS*

Colorized Digital Elevation Model (DEM) of the Aventura LiDAR survey area

20 SETTLEMENT, AGRICULTURE, AND ENVIRONMENT AT AVENTURA, BELIZE: RESULTS OF NEW LIDAR RESEARCH

Cynthia Robin

In 2009, the first LiDAR (Light Detection and Ranging) was flown over Caracol, Belize, transforming our understanding of Maya settlement, agriculture, and environment, and positioning the country of Belize as a leader in this transformation. Flown a decade later in 2019, this article reports on an 18 square kilometer LiDAR survey at Aventura, northern Belize. The National Center for Airborne Laser Mapping at the University of Houston used an Optech Titan sensor, the world's first multispectral airborne LiDAR sensor, in the Aventura LiDAR survey. With approximately 25 points per square meter, we were able to maximize our detection of smaller features, as documented in ground truthing. LiDAR has two primary uses: (1) locating previously unidentified sites and (2) providing a complex human geography of ancient places that link people and land. This paper highlights how LiDAR facilitates the development of a human geography of ancient places. At Aventura, LiDAR research illustrates a human geography that links people, settlement, agricultural, and environment. Raised field agricultural systems at Aventura along the New River, and systems of bajos and pocket bajos, provide a window into understanding Aventura's environmental positioning, wetland resources, and agrarian roots and insight into a broader New River agricultural-environmental system.

Introduction

LiDAR (Light Detection and Ranging) remote sensing methods provide a macroscopic lens on settlement and society allowing archaeologists to view whole ancient cities, communities, and even regions in ways that were never previously possible. In Maya archaeology LiDAR research has had a particularly transformative effect given that the contemporary tropical forest canopy has long obscured our ability to attain extensive full-coverage surveys. The country of Belize has been a leader in this transformation.

This paper presents the results of the 2019 Aventura LiDAR survey, flown just at the cusp of the global Covid-19 pandemic, that was part of the National Center for Airborne Laser Mapping at the University of Houston's Belize Small Projects Campaign. The Aventura LiDAR survey spanned an 18 square kilometer area around the Maya city of Aventura, Corozal district, northern Belize. The survey allows us to see the extent of the ancient city of Aventura, for the first time, and examine its landscape positioning.

With approximately 25 points per square meter, the Aventura LiDAR was able to maximize our detection of smaller features. LiDAR results were ground truthed based on a 1 square kilometer pedestrian survey at Aventura that was completed between 2015 and 2017 (Fitzgerald 2017; Grauer 2017; Nissen 2016; Robin, Grauer, and Nissen 2015; Robin et. al. 2017; Robin et. al. 2019). LiDAR has two primary uses in Maya archaeology: (1) locating previously unidentified sites and (2) providing a complex human geography of ancient places that link people and land. While locating previously unidentified sites and features is certainly and always a key aspect of LiDAR research, this article highlights how LiDAR research facilitates the development of a human geography of ancient places.

I begin my discussion by briefly situating Belize's historic role in LiDAR research which began at Caracol in 2009 (Chase et al. 2010, 2011a, b, 2012, 2013). I then turn to the Aventura case study, flown a decade later, to illustrate the complex relationships between settlement, agriculture, and environment that LiDAR entails.

Belize's Transformative Roll in LiDAR Research: The 2009 Caracol Flight

You can hardly find an article that doesn't use the term "revolutionize" to describe the roll of LiDAR research in archaeology, and much of that revolution happened in Belize. The first LiDAR campaign across a 200 square kilometer area, was undertaken at Caracol, Belize in 2009, by Arlen and Diane Chase (Chase et al. 2010, 2011a, b, 2012, 2013). The Caracol research established the utility of the LiDAR method for archaeology. It demonstrated that LiDAR could map vaster areas than traditional pedestrian survey could ever cover. It could provide detailed data at the level of archaeological features, and importantly, it could

Table 1. LiDAR projects in Belize in the first decade of LiDAR research. Table 1 is adapted from Chase and Chase 2017, Figure 22.1, which provides LiDAR coverage information up to 2015.

Location	Year	Area (km2)	Points (m2)
Caracol	2009	200	20
Uxbenka	2011	99	20
El Pilar	2012	20	20
Western Belize	2013	1057	15
Northwestern Belize	2016	257	23.7
Belize Small Projects*	2019	76	15-25
*Aventura, Lamanai, Las Cuevas, Mukelbal Tzul/ Ek Xux Valleys, & Pearce Ruins			

bring detailed environmental and settlement data into unison.

Not only was a robust new areal mapping methodology established through the Caracol research, but persistent questions in Maya archaeology, such as were Maya settlements indeed urban centers, were put to rest once and for all as Caracol's vast settlement was revealed (Chase and Chase 2017). LiDAR is not just a method; it is a means to address persistent archaeological questions.

Extensive systems of agricultural terraces were identified and mapped at Caracol prior to the use of LiDAR, however the LiDAR data revealed an unprecedented view of the scale and extent of terrace agriculture at Caracol and its integration within other aspects of settlement (Chase et. al. 2011a, b; Chase and Weishampel 2016). By bringing together environmental, agricultural, and settlement data, LiDAR at Caracol produced a human geography of a Maya place that illustrated how people and the land were inextricably tied to one another.

In just over a decade that has transpired since the original Caracol LiDAR flight, LiDAR research has expanded in Belize and across the Maya area. Table 1 presents the LiDAR research conducted in Belize between 2009 and 2022. This burgeoning research has resolved a wide range of questions such as: the extent of agricultural production and the physical organization of houselots in the Rio Bravo region (Beach et. al. 2019; Kwoka 2021; Luzzader-Beach, Beach, and Dunning 2021), the nature of anthropogenic landscape modification at Uxbenka (Prufer, Thompson, and Kennett 2015; Thompson 2020), the ditched water management systems at Baking Pot (Ebert, Hoggarth, and Awe 2016), the nature of ancient, historic, and contemporary land use around El Pilar (Ford and Horn 2019), the areal extent of a Preclassic center to the east of and as sizeable as Xuantunich (Brown, Yaeger, and Cap 2016), and the identification of caves used to model ritual landscapes around Las Cuevas (Moyes and Montgomery 2016). LiDAR enhances archaeologists' and heritage managers' abilities to preserve and protect archaeological remains due to the expansive and precise locational knowledge that LiDAR provides.

Aventura LiDAR Research

Aventura is situated in a populated area in the Corozal district between the contemporary communities of San Joaquin, Conception, San Pedro, and Cristo Rey. An 18 square kilometer area was chosen for the Aventura LiDAR survey to provide the most continuous swath of settlement associated with Aventura's central precincts situated between the modern communities to the north, south, and west and the New River to the east (Figure 1).

Issues in LiDAR Research

For all of its value, nobody would say that LiDAR is a deux-ex-machina. Forest cover can affect the quality of LiDAR results. The best LiDAR results are produced in areas of high forest cover, such as found at Caracol. In areas of low and disturbed vegetation, and variable vegetation types, LiDAR results can be more variable. This is of particular concern at

Figure 1. Colorized Digital Elevation Model (DEM) of the Aventura LiDAR survey area.

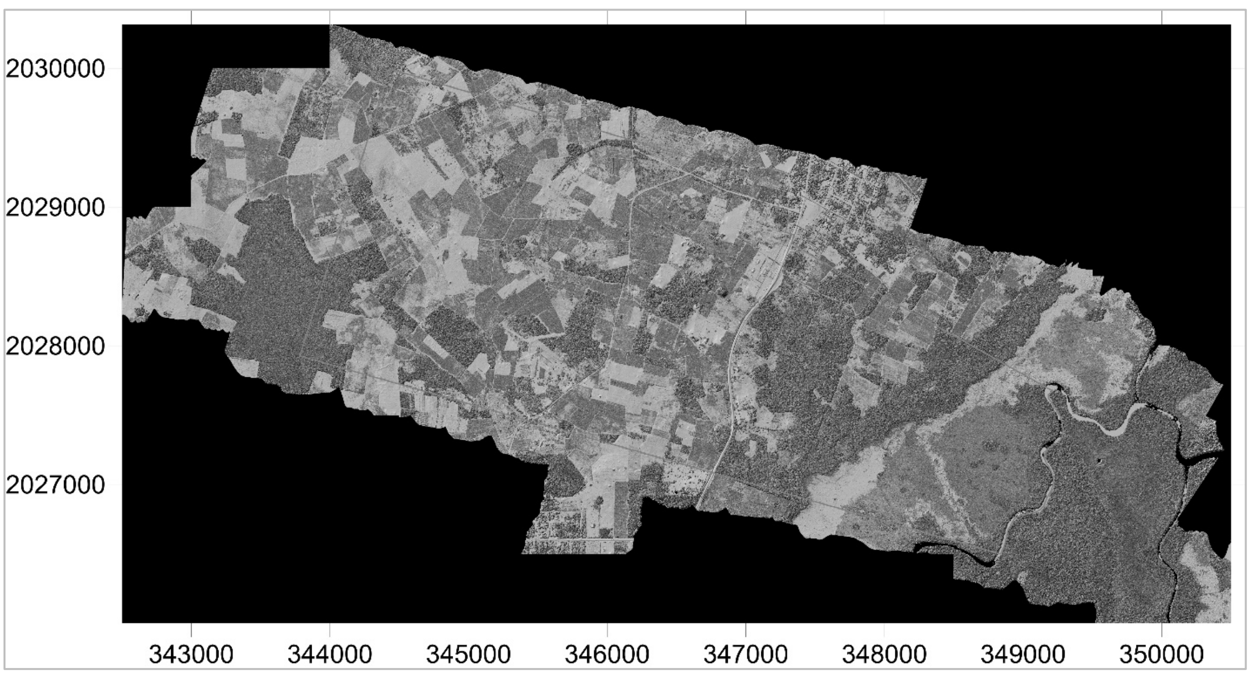

Figure 2. Hillshade Digital Surface Model (DSM) of the Aventura LiDAR survey area.

Aventura as the majority of the Aventura area consists of low, disturbed, and variable vegetation.

Keith Prufer, Amy Thompson, and Douglass Kennett's (2015) evaluation of 2011 LiDAR flight results around Uxbenka in areas of disturbed vegetation found that 90% of small residential structures between 1 and 3 meters high could not be detected in the LiDAR. Their LiDAR survey utilized 20 laser points per square meter, comparable to the Caracol flight. Bernadette Cap, Jason Yaeger, and Kat Brown's (2018) evaluation of the LiDAR survey around Xunantunich that utilized 15 laser points per square meter, identified only 40% of features mapped during pedestrian survey, with small residential structures lower than 2 meters in height being the least detected. Similarly, Scott Hutson, working in in the coastal plains of Yucatan, Mexico and examining LiDAR survey that averaged 15 laser points per square meter, found that 61.6% of archaeological features identified through pedestrian survey that were under 1 meter in height were not detected by LiDAR, however 87.9% of pedestrian-survey-identified features that were 1 meter in height or higher, were visible on LiDAR (Hutson et. al. 2016).

Increasing the average points per square meter, enhancing algorithms and visualization techniques, such as the use of Topographic Position Index, and advances in LiDAR sensor technology are methods that can help address the issues that LiDAR research can have in areas of low, disturbed, and variable vegetation (e.g., Ebert, Hoggarth, and Awe 2016; Huston 2016: Thompson 2020). Timothy Hare, Marilyn Masson, and Bradley Russell (2014) used a high-density LiDAR method, that included a laser point density of 40 laser points per square meter, to map the site of Mayapan, Yucatan, Mexico. This significantly improved the LiDAR detection of small features, however, even this approach still didn't facilitate the visualization of small mounds in settlement areas that are often no more than 10 centimeters in height.

To maximize the detection of small features at Aventura and balance cost considerations, as cost increases with increasing laser point density, I worked with Ramesh Shreatha and Juan Fernandez-Diaz at the National Center for Airborne Laser Mapping at the University of Houston to develop a methodology that would couple their new third generation sensor, the Optech Titan sensor, the world's first multispectral airborne LiDAR sensor, with a laser point density of 25 points per square meter.

Figure 2 shows a Hillshade Digital Surface Model (DSM) of the Aventura LiDAR study area. The Hillshade DSM captures the highest natural (ie., trees, shrub, sugar cane, ground surface) and cultural (ancient and modern buildings, etc.) features on the earth's surface. Visible in the Aventura Hillshade DSM is a patchwork of vegetation types that characterizes the contemporary region. The primary vegetation type in the Aventura region is sugar cane, the primary industry in northern Belize where Aventura is located. Due to the thick, dense nature of sugar cane, pedestrian survey is not possible when sugar cane is present. This resulted in a patchwork style pedestrian survey, which will be discussed further below. Full coverage pedestrian survey would only have been possible at Aventura were the project able to conduct survey year-round and access fields after they had been burned and cut. This pedestrian survey issue provided one of the impetuses for conducting LiDAR research.

The patchwork of vegetation types that make up the Aventura LiDAR survey area also include cattle pastures, manicured grass lawns, highly disturbed areas of grass and shrub, and forest canopy. Cattle pastures are present in limited numbers. Manicured grass lawns are found across the modern communities that adjoin Aventura and on the former Fruta Bomba factory property that is currently the site of the Aventura Construction Supplies & Block factory. Highly disturbed areas of grass and shrub are located in former sugar cane fields that are no longer in use and have not been converted to another use, as sugar cane production today in northern Belize is decreased from its production peak in the 1960s and 1970s. Forest canopy still shrouds Aventura's central precincts and large buildings where plowing, and agriculture is not feasible due to structure height and stone density. Given its patchwork, low, and disturbed vegetation types the Aventura area is suboptimal for LiDAR data acquisition, requiring extra attention to methodological considerations.

Small Feature Recovery with the Optech Titan Sensor and a 25 Points/m^2 Laser Point Density

From 2015 to 2017, the Aventura Archaeology Project, completed a pedestrian survey of a central 1 square kilometer are around Aventura's site core (Fitzgerald 2017; Grauer 2017; Nissen 2016; Robin, Grauer, and Nissen 2015; Robin et. al. 2017; Robin et. al. 2019). The pedestrian surveys were directed by Kacey Grauer, Zachary Nissen, and Kat Fitzgerald. The shape of the pedestrian survey area was a patchwork, as we had to survey around active sugar cane fields. There were parts of the Aventura region that were always inaccessible to pedestrian survey during the summer months of our research and would only have been accessible had we been able to conduct a year-long survey.

The Aventura pedestrian survey drew upon Global Positioning System (GPS), Total Station, and Geographical Information System (GIS) technology, to develop 2D and 3D georeferenced digital imagery of cultural and natural features. Systematic field walking enabled full-coverage pedestrian survey in an area outside of active sugar cane production. We collected information on natural features (land formations, vegetation, environment), cultural features (architecture, agricultural fields, other human constructions), and chronology (relative dating of archaeological features through surface ceramic analysis). The pedestrian survey combined three survey techniques to achieve its goals: (1) topographic mapping, (2) archaeological reconnaissance, and (3) surface ceramic analysis. The survey team walked the cut cane fields, forests, and other vegetation types of the Aventura area. All cultural and natural features and topography encountered on survey were recorded using a combination of a Topcon GTS-605 Total Station and a Trimble Juno GPS to produce an accurate and georeferenced map in a GIS.

The Aventura pedestrian survey work provided a baseline data set to ground truth the LiDAR data. Figure 3 shows the LiDAR survey results visualized as a Digital Elevation Model (DEM) with the pedestrian survey area superimposed. Comparing the mounds identified in pedestrian survey and the LiDAR DEM documents that all mounds greater than 40 centimeters in height that were identified in the pedestrian survey were identified in the LiDAR DEM. The LiDAR DEM also visualized 40% of mounds between 29 and 39 centimeters in height. No mounds under 29 centimeters in height were visualized. Ground truthing LiDAR results is important to determine the extent of settlement loss, for proposing population estimates, assessing social organization, and especially in understanding the humblest commoner Maya houses. The Aventura LiDAR research methods that combined the Optech Titan sensor and a 25 points/m^2 laser point density produced improved visualization of small features. However, we were still unable to visualize 7% of our smallest mounds, or 19% of mounds under 1 meter, which will affect what we can say about commoner settlement at Aventura based on LiDAR data. Given that our ground truthing occurred within the central 1 square kilometer of the city center of Aventura, additional ground truthing further in Aventura's hinterlands is needed before we can provide reliable population estimates based on the LiDAR data, as the percentage of small mounds in hinterland areas is likely to be greater than in the central area.

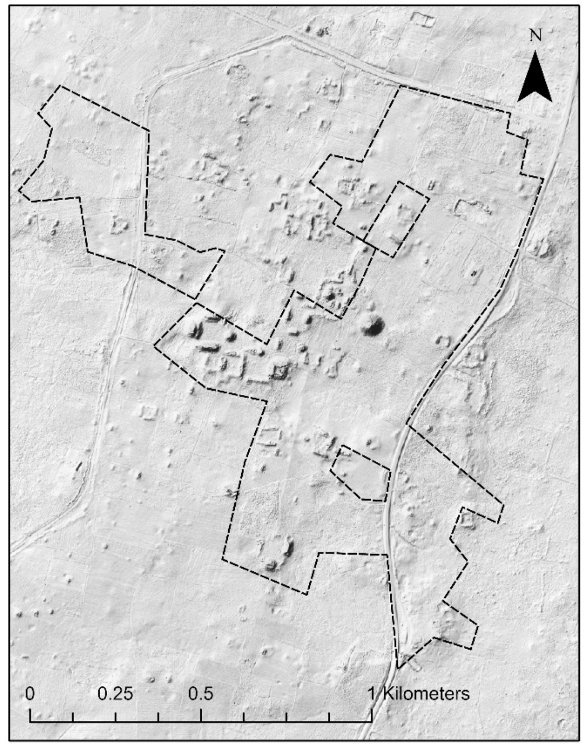

Figure 3. Aventura pedestrian survey area superimposed on the LiDAR Digital Elevation Model (DEM). The pedestrian survey area is shown with dashed lines.

Aventura LiDAR Results

One of the most notable aspects of the LiDAR data at Aventura is the abundance of its raised agricultural fields along the New River (Figure 4). The raised fields are found along the first elevated area along the river course – just west and above a wide marshy area that

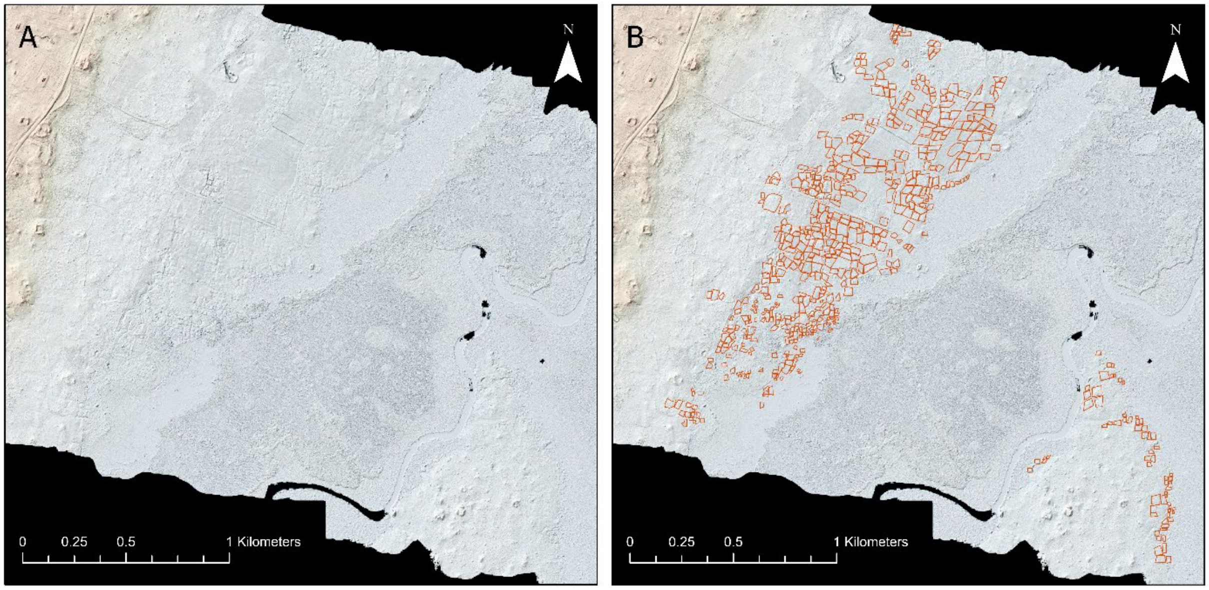

Figure 4. Raised fields adjacent to Aventura. (a) LiDAR model of raised fields. (b) GIS line drawing of raised fields superimposed on the LiDAR model.

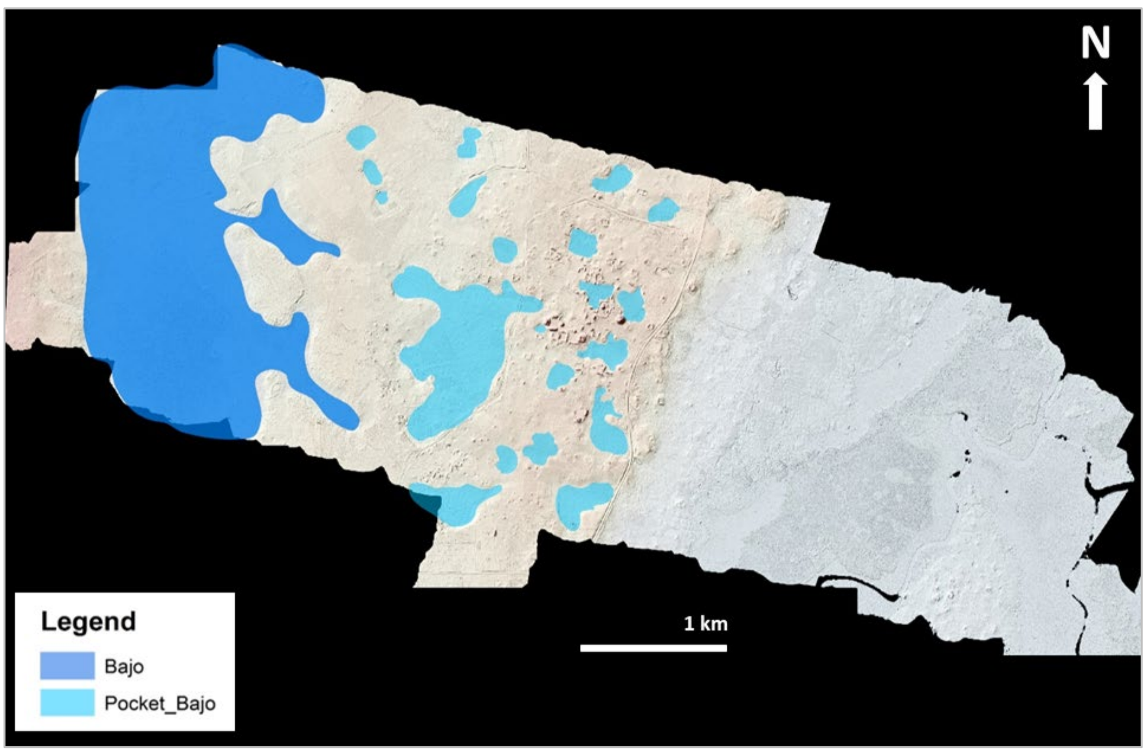

Figure 5. *Bajos* and Pocket *Bajos* at Aventura.

immediately surrounds the river. Additional raised fields are located along the edges of an elevated island delta to the east where the New River splits and then rejoins. There is also a small settlement cluster on the island delta as well.

Raised fields at Aventura were visualized for the first time through LiDAR research and their identification is transformative to our understanding of Aventura as well as the human geography of the New River region of Northern

Belize. Since the work of Raymond Sidrys (1984) in the 1970's Aventura has been identified as the probable production center for the Buyuk Striated Double Mouth Jars. Geographically, Aventura has been described as located between the New River and Rio Hondo, which certainly is the case. The LiDAR data resituates our attention to Aventura being a city located along the New River, situated on the second elevated area along the river course, an area of sufficient elevation to support habitation. The broad first area of elevation, between the settlement and the marshy area immediately along the river, which had as larger or larger of a footprint as the city itself, supported a vast extent of raised field agriculture.

This evidence situates Aventra as a breadbasket for food production. Raised fields were not just significant areas of agricultural production, but they could have been used for aquaculture and hunting as well. Scholars such as Vernon Scarborough (1986), and Billie Lee Turner and Peter Harrison (1983) have postulated about the existence of raised fields all long the New River. In the 1980s Vern Scarborough (1986) attempted to use SLAR, side-looking airborne readout, to identify raised fields along the New River and Fresh Water Creek region between Aventura and Cerro Maya, however the technology at the time was not sufficient, and he was unable to gather evidence to document their existence.

The Aventura LiDAR results demonstrate the existence of a previously only posited, lower New River raised field system, that supports the idea of Northern Belize being a breadbasket region for food production. Furthermore, it greatly expands our understanding of settlement and agricultural organization in the Maya area as a whole. In contrast to the central Peten area of Guatemala with its sizeable and more centralized urban centers, in Northern Belize we see a greater abundance of smaller sized sites, like Aventura, each associated with fertile agricultural zones, indicating a different, and perhaps less hierarchical social order. The real significance of LiDAR research is not just its identification of new ancient features, such as the raised fields at Aventura, but the interpretive potential that LiDAR's broad understanding of human-land relations reveals.

Expanding beyond the New River and the Aventura LiDAR research area, recent LiDAR research along the Rio Bravo which joins with the Rio Hondo on Belize's northwestern boarder, by Tim Beach, Sheryl Luzzadder-Beach, Tom Guderjan, Fred Valdez and colleagues documents raised field agriculture along the Rio Bravo (Beach et. al. 2019; Luzzader-Beach, Beach, and Dunning 2021). The new LiDAR documentation of raised fields in Northern Belize along the Rio Bravo and at Aventura complements and expands Billie Lee Turner and Peter Harrison's (1983) identification and excavation of raised fields in the 1970s and 1980s around Pulltrouser Swamp and both early aerial reconnaissance by Siemens (1982) along parts of the Rio Hondo and more recent aerial reconnaissance and by Eleanor Harrison-Buck (2014) in the Crooked Tree Wildlife Sanctuary. Taken together new LiDAR research along the New River and Rio Bravo illustrate a wide distribution of wetland agroecological systems across Northern Belize and identify Northern Belize as a key breadbasket in the Maya region.

When we dive deeper into the Aventura LiDAR, at a site-focused level, we can identify local agroecological infrastructures that related people and land. This notable aspect of the Aventura LiDAR research allows us to develop a complex human geography. By human geography, I am referring to the complex relationships that link people, settlement, agricultural, and environment.

Across the Aventura 1 sq km pedestrian survey area surveyors identified five pocket *bajos* (Grauer 2017; Nissen 2016; Robin, Grauer, and Nissen 2015; Robin et. al. 2017; Robin et. al. 2019). Kacey Grauer (2020, 2021a) describes pocket *bajos* as karstic depressions less than 2 square kilometers in area and her excavation and phytolith research has documented that pocket *bajos* at Aventura were water sources for the ancient community, although many are dry today. Grauer (2021b) additionally identified that pocket *bajos* were located adjacent to areas of commoner architecture as well as elite and civic architecture.

LiDAR has expanded our view of pocket *bajos* at Aventura and indicates they comprised a significant part of the square footage of the city and were important parts of the infrastructure of

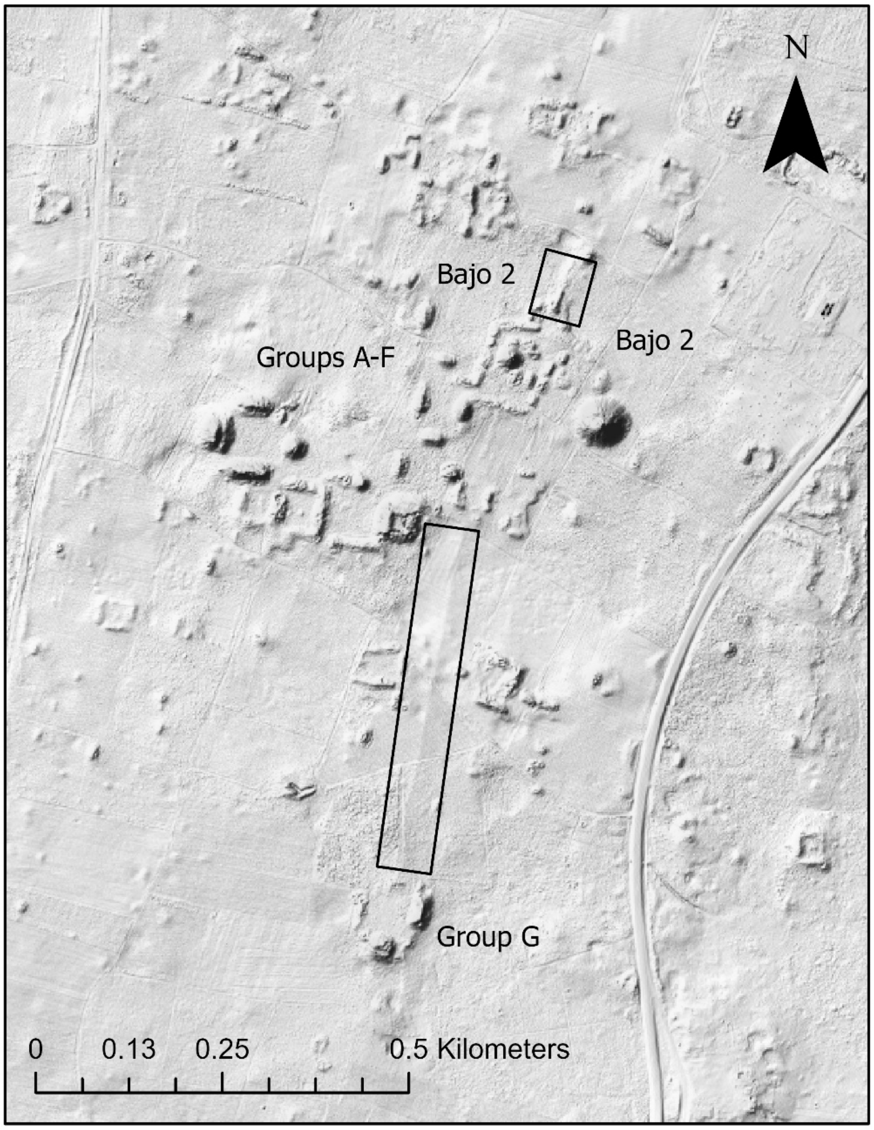

Figure 6. Close up of LiDAR visualization of Aventura's central area. Black rectangles surrounded causeways. The larger southern causeway connects site core Groups A-F and Group G and crosses Pocket *Bajo* 1. The smaller northern causeway crosses Pocket *Bajo* 2.

the city (Figure 5). Aventura was a city built surrounding pocket *bajos*. The LiDAR data expands our identification of pocket *bajos* associated with commoner settlement, a finding that is even more significant given the previous discussion of the limitations of the LiDAR work in identifying Aventura's smallest mounds.

Grauer (2020, 2021a, b) excavated three of the pocket *bajos* identified in the Aventura pedestrian survey and associated commoner and elite households. As just noted, Grauer's micro studies of phytoliths from pocket *bajos* identified that they were water features for the city in the past. Her household excavations indicated that commoners and elites alike at Aventura had access to water from pocket *bajos* to meet biophysical and spiritual needs (Grauer 2021b). Bringing the LiDAR data into the picture we can see how multiple lines of evidence from LiDAR's macro lens, to a household lens, to the micro lens of phytolith studies come together to paint a picture of water access that cross-cuts hierarchical division at Aventra, as Grauer's research has identified.

Aventura was not alone in terms of its decentralized access to water resources. Drawing upon Caracol's LiDAR data, Adrian Chase (2016) documented 1590 reservoirs across the city's urban settlement of civic architecture, elite architecture, and commoner architecture.

The Aventura LiDAR survey covers a smaller area than most LiDAR surveys due to the proximity of the site to modern communities. This smaller area draws our attention to the interior features that make up the infrastructure of the city (Figure 6).

During the pedestrian survey, Zachary Nissen (2016) painstakingly mapped an ephemeral causeway at Aventura that was barely visible on the ground surface. The causeway led from Aventura's main ceremonial complex, Groups A-F, to a secondary ceremonial complex, Group G. The LiDAR survey elevates Nissen's careful ground research, by visualizing the full extent of the causeway. An intriguing aspect of the causeway is that it crosses Pocket *Bajo* 1. A second elevation divides the eastern and western portions of Pocket *Bajo* 2. The exact significance and use of these roadways, particularly as they cross pocket *bajos*, pends future excavations, however they do indicate another way pocket *bajos* were incorporated into the fabric of the city.

Conclusion

At Aventura, LiDAR research illustrates a human geography that links people, settlement, agricultural, and environment. Raised field agricultural systems at Aventura along the New River, and systems of *bajos* and pocket *bajos*, provide a window into understanding Aventura's environmental positioning, wetland resources, and agrarian roots as well as insight into a broader New River agricultural-environmental system.

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21 SITUATING HOUSEHOLDS WITHIN AN URBAN COMMUNITY: RECENT RESEARCH AT AVENTURA, AN ANCIENT MAYA CITY

Zachary A. Nissen, Kacey C. Grauer, Gabriela Dziki, Hannah Hoover, Erin Niles, Debra S. Walker, Anna Moles, and Cynthia Robin

Recent excavations at the Maya site of Aventura, Belize provide insights into the social, economic, and environmental resources available to the residents of its ancient urban community. In 2019, the Aventura Archaeology Project (AAP) horizontally excavated three households and continued vertical test-pit investigations across commoner and elite domestic groups. The horizontal excavations, comparable to previous excavations of households in 2018, provided new insights into the similarities and differences between structures, features, burials, and middens across status groups at Aventura. One household excavation, Group 54, elucidated commoners' access and relationships to a nearby water management feature. Commoner household excavations at Group 24, one of the smallest mound features identified by the AAP survey, revealed that even the smallest of Aventura's households had access, though limited, to cut limestone blocks for domestic architecture. Excavations of an elite patio group, Group 38, to the north of the site core provided architectural data which complicate distinctions between elite and non-elite households. These excavations of households across the site also revealed a pattern of primary and secondary subfloor-burial deposits across elite and non-elite groups, which may indicate an attempt to socially integrate households of all statuses into Aventura's urban community. Vertical test excavations further support Aventura's community was inhabited over the long-term, with multiple households revealing Early and Middle Classic materials, and all households revealing occupation during the Late to Terminal Classic transition. Together, household excavations provide insights into the social, economic, and environmental forces that shaped the lives of Aventura's urban community, bringing better focus to heterogenous and enduring urban populations during dynamic periods of Maya society.

Introduction

Prior to the onset of the Covid-19 pandemic, the Aventura Archaeology Project (AAP) conducted its second year of household excavations at the Maya site of Aventura, Belize, in 2019. These excavations provided insights into the social, economic, and environmental resources available to residents of an ancient city. During our 2019 season, the AAP team horizontally excavated three households and continued vertical test-pit investigations across domestic groups at the site. The horizontal excavations, comparable to previous excavations of households in 2018, provided new insights into the similarities and differences between structures, features, burials, and refuse deposits across status groups at Aventura. Together, these investigations elucidated the forces that shaped the lives of Aventura's residents, bringing better focus to heterogeneous and enduring urban populations during dynamic periods of ancient Maya society.

The site of Aventura is a medium-sized ancient Maya city, located in the contemporary district of Corozal, Belize (Figure 1). Since the AAP's inception in 2015, under the supervision of Dr. Cynthia Robin, the project has surveyed the site and documented 246 archaeological features within a 1 km sq area (Fitzgerald 2018). And in 2018 we began conducting excavations of households to assess the diversity of settlement at

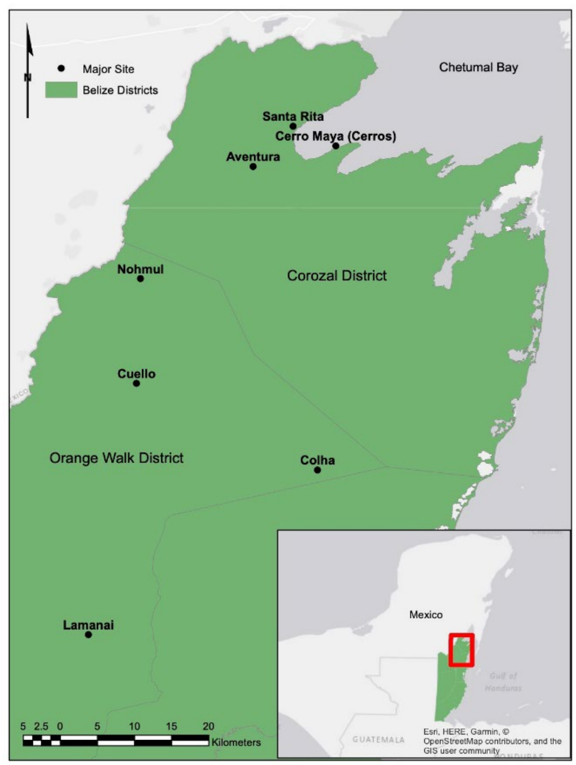

Figure 1. Map of Belize showing location of Aventura and other key ancient Maya sites (generated by Nissen).

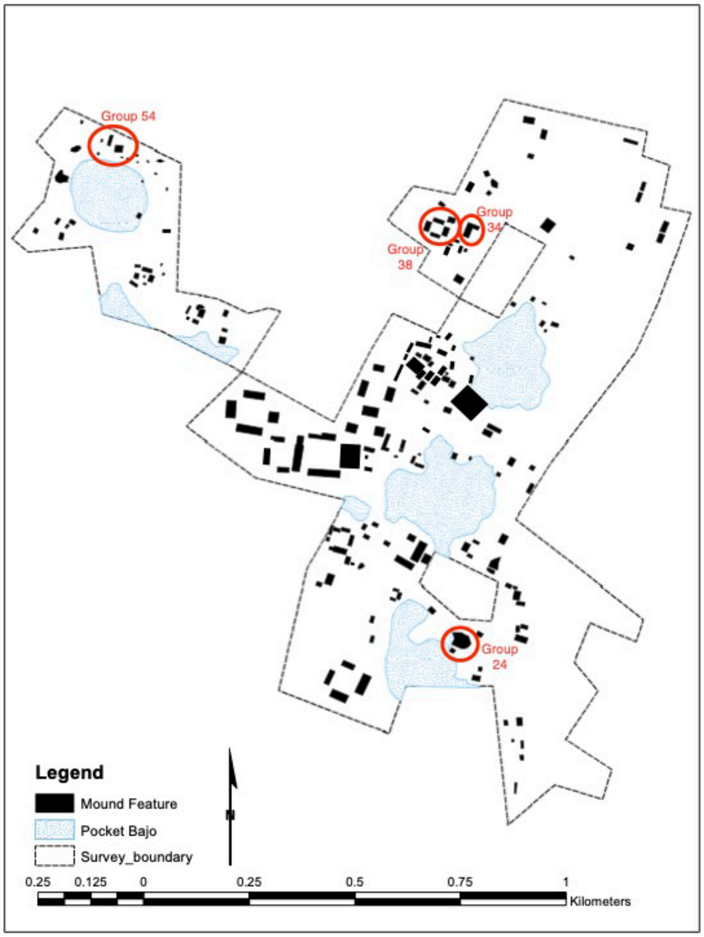

Figure 2. Survey map of Aventura depicting groups excavated in 2019 (generated by Nissen).

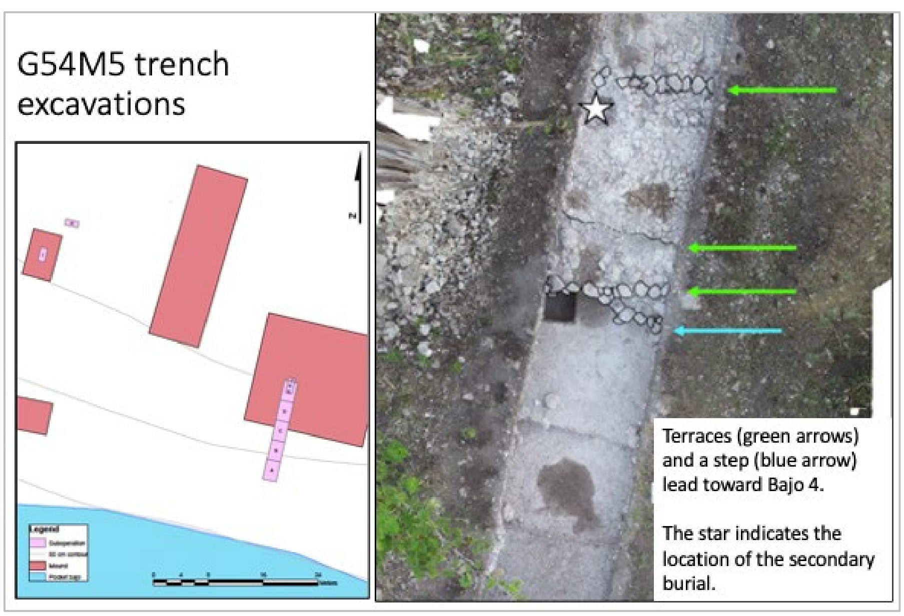

Figure 3. Group 54 and Op 14 Trench (Generated by Grauer).

the site and examine the lives of the city's residents, from unassuming commoner households to the impressive masonry residences of elites (Grauer *et al*. 2020).

Our work prior to the 2019 season, through the ceramic analysis of Laura Kosakowsky, indicates that Aventura was initially settled in the Late Preclassic and grew to its maximal population during the extended terminal classic from 750 – 1100 CE (Kosakowsky 2018). Understanding Aventura's growth and persistence during this period has been central to the investigations of our project, as this was also a period where cities in the Peten region were experiencing dramatic social, environmental, and economic changes that resulted in the depopulation of many classic period centers and the decline of divine rulership.

At Aventura, we define households as groups of mounds located around a patio, or when a central patio is absent, as groups of mounds within a 20m distance of one another (Nissen 2018). Household groups at the site contain mounds that are all less than 5m in height and radiate out from the monumental and civic-ceremonial core of the city. Looking at the settlement data, two groups of non-monumental architecture emerge that comprise three different types of residential architecture: low-lying substructures that supported perishable domestic superstructures, part-masonry superstructures with thatch roofs, and fully masonry superstructures with corbel vaulted roofs (Nissen 2022). In this paper, we delve into the 2019 household excavations to flesh out similarities and differences across two commoner and two elite household at Aventura (Figure 2).

Operation 14, Commoner Household excavations at Group 54

The first excavations we will discuss were directed by Kacey Grauer, who conducted a trench excavation, four test units and a posthole program at Group 54, as part of her dissertation research (Grauer 2021). Group 54 is a commoner household group composed of 5 mound features located approximately 1 km west of the site core along the edge of pocket *Bajo* 4 (Figure 3). Designated as Op.14, Grauer's excavations sought to assess the household's relationship to pocket *Bajo* 4, and to determine the function of an ancillary structure near the main house mounds.

To investigate the household's relationship to the nearby pocket *bajo*, a trench excavation was conducted along the mound running from the top of the structure down toward *Bajo* 4. It revealed that G54M5 consisted of a platform supporting two substructures that would have supported perishable superstructures. The platform was constructed in sixteen phases of alternating fills and ballasts, with a total of four floors. The platform consisted of three levels and exhibits evidence of a small step from the lowest level leading from the top of G54M5 toward *Bajo* 4.

The recovery of a high variety of artifact types from Operation 14 excavations, along with the presence of a primary burial underneath floors, suggests that G22M3 was indeed a household. Artifact types uncovered include ceramics, obsidian, chert, ground stone, and shell. Ceramics ranged from utilitarian to ritual in function.

At least three interred individuals were encountered during excavation. A secondary burial was encountered just south of the second terrace of the platform. The burial consisted of a smashed black slipped bowl containing human teeth and a fragment of a bone, possibly mandibular or cranial. A primary burial of an adult individual associated with a subadult secondary burial was encountered in a cut in the platform of G54M5 in between the two substructures, radiocarbon dated to 693-967 CE. An upturned Corona Red hemispherical bowl was placed on top of the cranium of the adult individual. Human teeth lacking roots were encountered upon fine screen soil from an upturned Unnamed red-on-red deep bowl.

The trench excavation also demonstrated the importance of *Bajo* 4 to the Group 54 household, as they revealed a terraced platform of the structure, as well as the small step, that would have facilitated movement between the dwelling area and the pocket *bajo*. This suggests the commoners living here had the ability to physically access *Bajo* 4. Additionally, the presence of the secondary burial on the backside of the structure facing the pocket *bajo* points toward the ideological significance of pocket *bajos*. It is possible that this secondary burial is the remains of ancestor veneration, suggesting people living here were accessing nonhuman worlds in association with *Bajo* 4.

In addition to the trench excavation in G54M5, Grauer conducted a test excavation at G54M3, a small ancillary structure measuring 0.29 meters high. Due to its size and location, she posited that this structure may be the remains of a kitchen. The features encountered during excavation, including a possible hearth, confirm this. The structure was built in three phases from the Early to Middle Classic. However, its collapse has a *Terminus Post Quem* of the Middle to Late Classic, indicating there may have been a final later construction phase that has not preserved.

Along the western edge of the excavation, we encountered a burn feature on top of a sascab surface. This was a 10cm thick area of loose, gravely sediment with layers of ash. Additionally, a large amount of burning was evident in the profile, and there was a line of burned stones encountered to the west. Directly in the center of the structure, there was a cut in the sascab with a near perfect east-west orientation, which contained refuse. Refuse 2 contained a wide variety of artifacts consisting of ceramics, lithics, ground stone, and shell. It also contained a significant amount of ash and burned material. The *Terminus Post Quem* for this midden is the Early Classic, indicating it was deposited at the same time the earliest phase of the structure was built. Phytolith and starch grain analysis are currently underway in the hopes of elucidating what plant materials may have been prepared and disposed at G54M3.

In her efforts to assess the function of the pocket *bajo*s at Aventura, Grauer also conducted a test excavation in the center of *Bajo* 4. The excavations in *Bajo* 4 revealed interesting data that contributes to the notion that the pocket *bajo* may have been filled with water during ancient Maya occupation. Elsewhere in the Maya region, archaeologists have demonstrated that the ancient Maya maintained water management features by clearing sediment out of them (Dunning *et al.* 2015). This corroborates oral histories that indicate pocket *bajos* at Aventura held water as recently as the War of Castes in Mexico (1847-1901) when the historic village of *San Jose de los Abanes* was founded (R. Aban, personal communication date). This is further complemented by Grauer's more recent phytolith analysis that demonstrates *Bajo* 2 at Aventura was much wetter in the past than it is today (Grauer 2021).

In sum, Excavations in Operation 14 demonstrate that the commoners living at G54 had access to *Bajo* 4 and the water contained therein. They had access to both the physical aspects of water, as demonstrated by the presence of steps, and metaphysical access, as demonstrated by the evidence of ancestor veneration in between the dwelling and the pocket *bajo*. Interestingly, both these types of access were also implicated in excavations of an elite household on a pocket *bajo* edge in the site core (Grauer et al 2020; Grauer 2021). This suggests elites and commoners alike had access to multiple important aspects of water at Aventura.

Operation 15, Commoner Household excavations at Group 24

The second household we present here was excavated by Zachary Nissen, as part of his doctoral research, at Group 24 (Nissen 2022). Composed of a single mound, standing a mere 20 centimeters tall, G24 represents one of the smallest households identified by the AAP. Here, we credit the project's meticulous pedestrian survey, because G24 was not documented by Sidrys and colleagues survey of northern Belize in the 1970s (Sidrys 1983). Furthermore, Cynthia Robin discusses how small mounds (less than 1m in height) were too small to identify in recent LiDAR imagery of the site, leaving their discovery up to traditional pedestrian survey techniques (see Robin, this volume). Despite the difficulty of identifying small mounds, G24 is identifiable as a surface as a scatter of limestone rubble and artifacts (ceramics, chert, and groundstone) along the edge of *Bajo* 3, about a half a kilometer from the site core.

In 2018, Nissen conducted test excavations at the group which revealed it to be the remains of a single-phase residential building composed of a limestone rubble filled substructure, covered by a single plaster floor that would likely have supported a perishable superstructure, likely pole-and thatch, that has since decomposed (Nissen 2019b). Artifacts from the fill and a nearby refuse deposit indicate the structure was occupied during the Late Classic.

Nissen returned in 2019 to conduct a horizontal exposure of the domestic structure, which revealed a low, but impressive substructure facing Pocket *Bajo* 3 (Figure 4). The substructure was composed of a limestone rubble fill with a single plaster floor and a low-lying basal wall. The basal was constructed with two courses of parallel cut stones outlining the edge of the substructure, which would have likely supported a superstructure constructed with perishable materials such as pole-and-thatch. The Op.15 exposure confirmed at least one phase of occupation, as well as a secondary burial placed in the rubble fill under Floor 1. The secondary burial consisted of an upturned tripod bowl, which AAP Ceramicist, Debra Walker, preliminarily typed as Kik Red. Upon removing the bowl, excavators discovered four and a half very poorly preserved tooth crowns, which were identified by Anna Moles as representing those of a young adult individual.

Following the exposure of the G24M1, Nissen opened a series of interior units designed to excavate the front centerline of the structure. The interior excavations consisted of a trench utilizing 2 x 3m units along the front center of the structure, which revealed the mound's stratigraphy down to the limestone bedrock. An additional unit was placed outside of the trench to excavate the area below the secondary burial, which revealed a primary burial. Primary Burial 9, like the secondary burial, was poorly preserved and consisted primarily of long bones. However, Nissen's team did find a metatarsal shaft, vertebral fragments, and 5 teeth from another young adult individual. Along the front/center of the structure we discovered a second upturned ceramic vessel, a smashed jar. There were no human remains associated with this deposit, but Nissen found a single chert flake underneath the jar. As this deposit was found within the fill beneath the front step of the G24 substructure, we interpret this deposit as some kind of cache or dedicatory deposit.

Outside of the special finds, the Op.15 excavations collected a diverse array of artifact types, from utilitarian ceramics to those of finer quality likely procured through trade like slate

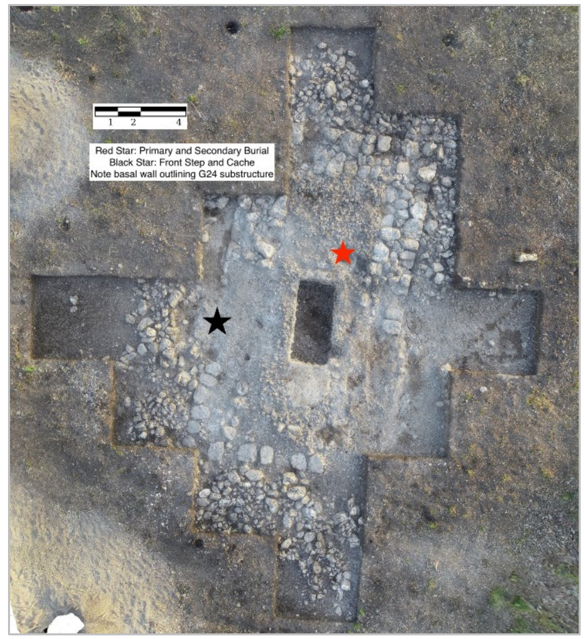

Figure 4. Drone Image of Op.15 Horizontal Excavations (Photo by Nissen).

wares, a ceramic figurine, and a couple spindle whorls, as well as two carved shell beads, obsidian blades and points, and a diverse array of chert types. The only material type not identified by the Op.15 excavations was jade or greenstone, which has been found at other, predominantly elite, households at Aventura.

Together, the Op.15 excavations provided key insights into the architecture, activities, and ritual practices of one the smallest households identified at Aventura. While G24 is one of the smallest groups mapped by the Aventura Project, the 2019 excavations revealed significant architectural features: including a plaster floor, a basal wall, and a step along the front-center line of the substructure. These features along with the ritual evidence of primary and secondary burials indicate that even low-status residents at Aventura could be active participants in the social and economic networks of the city.

Operations 16 and 17: Elite Household Excavations at Group 38

The third group excavated in 2019 was was subject to excavations directed by Gabriela Dziki of UCL and Hanna Hoover of the University of Michigan. Group 38 consists of six mounds, four of which are tightly and cardinally

Figure 5. Group 38 Mound 2 (Photo by Dziki).

arranged around a patio area. The fifth mound is adjacent to the northern mound while another, low-lying mound in the center of the plaza was observed after the area had been cleared of brush in advance of the 2019 field season. Dziki's Operation 16 focused on the largest mound (G38M2) of Group 38. Hoover's Operation 17 sampled the smallest of the group's residential mounds, as well as the central plaza structure. Together, Operations 16 and 17 provide an insight into the architecture of Aventura's residential complex Group 38 and the incorporation of burials into the structures.

The purpose of Operation 16 was to investigate the northern mound of Group 38, G38M2 (Group 38 Mound 2). During her initial exposure of the mound, Dziki documented that G38M2 was actually two separate superstructures on what seemed to be one substructure, which have been subcategorized as the western and eastern buildings of G38-M2.

The eastern building was a masonry structure with a vaulted roof and had only one doorway facing south. The western building, on the other hand, was likely a part masonry part perishable structure with low masonry walls, with few cut stones found in the collapse. Vertical excavations under the floors of the western building uncovered three burials, identified as Primary Burials 6, 7, and 8. Burial 6 was found in the eastern room containing two individuals placed along the length of the building, the EW axis, while Burials 7 and 8 were found under the floor of the western room, each with one individual along the NS axis.

Dziki's excavation provide insight into how one large structure can offer at least two different types of architectural construction: the eastern building is a large, masonry, corbel vaulted building, while the western building a part perishable, part masonry wall building. The architects of G38M2 were able to connect the two buildings through a step design that links both into one structure (Figure 5).

Moreover, the burials found in the western building run on a different axis, with burial 8 in the western room running on the north-south axis and Burial 6 in the eastern room running on the east-west axis. Even within the same building, excavations revealed differences in how the burials and therefore, the ancestors, were incorporated into the construction process.

Operation 17, directed by Hoover, sought to examine G38M4, the western mound of Group 38, which identified typical residential architecture with a single level substructure (Figure 6). Hoover's excavations revealed two to three courses of cut limestone that likely supported walls and a roof made of perishable materials unlike the full masonry walls of

Figure 6. Group 38 Mound 4 (Photo by Hoover).

Figure 7. Group 34, Mound 1 (Photo by Niles).

G38M2. Excavations exposed a doorjamb along the centerline of the mound and subsequent excavations focused on what was likely the central room of the structure. Given the size of the room relative to the length of the mound, there may have been an additional room to its north.

G38M6 is a mound located just west of the geometric center of the Group 38 plaza. It consisted only of a low lying, single level substructure with no evidence of a masonry superstructure. An interior room, measuring 3.2m by 2.3m, was identified in the northeast corner of the structure and is likely the earliest construction phase of the structure. It sits atop the penultimate plaza floor that unites all of the G38 mounds. Hoover's excavation of this plaza center structure revealed one and maybe two floors of G38M6, three plaza floors, a Crypt, as well as a primary and secondary burial, in addition to ceramics, obsidian, marine shell, and chert. The central location of G38M6 as well as the layering of Crypt 1, Secondary Burial 11, and Primary Burial 5 below the Group 38 plaza floors suggests that G38M6 was a plaza center shrine structure for the residents of Group 38.

Operation 18, Elite Household Text Excavations

The final set of excavations we present here were directed by Erin Niles. Designed as test excavations to assess the construction history of elite house mounds, Operation 18 exposed one room of an L-shaped residential structure G34M1, a household to the east of Group 38 (Figure 7).

From the excavation of one room in the 'L' shaped elite structure of G34M1, Niles establish that this was an elite vaulted masonry structure. Burning was an important feature in the structure's construction process, as there were several layers of burning, especially in connection to both plaster floors and sascab construction floors. Niles also identified 4 secondary burials under the final-phase building floor in the fill, revealing an emerging pattern of secondary burials found underneath plaster floors at household groups across the city.

Through Operation 18's excavations, Niles also determined that G34M1 had two construction phases. The top 'L' shaped one being from the Late Terminal Classic period, and a second structure being uncovered underneath this one dating to the Early Classic period. Little was discerned of this earlier structure, as only a small portion of it was uncovered. What is known from this investigation is that the structure has basal molding on its exterior, which connects to a plaster plaza floor.

Conclusion

Household excavations reveal the city of Aventura to have had a relatively heterogeneous urban community. From large masonry elite residences, to smaller pole-and-thatch commoner residences, or those that mixed masonry and perishable forms of architecture, residents of all statuses were distributed across the city's landscape. Yet, despite these differences in construction, the 2019 excavations reveal a series of patterns that extend across groups of all statuses. Excavations of both commoner and elite households have revealed domestic assemblages of diverse material types, with goods like obsidian and fine ceramics having been procured through long-distance trade networks. We are also seeing a pattern of upturned ceramic vessels being interred with primary burials or even with collections of teeth underneath plaster floors. Here, we suggest that Aventura offers important insights into the ways residents of all statuses were integrated into thriving social and economic networks, shedding new light on why the city thrived during the terminal classic, when many other cities were undergoing population decline and political turmoil.

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22 THE ROLE, FUNCTION, AND APPLICATION OF TECHNOLOGIES IN ARCHAEOLOGY: DATA FROM NW BELIZE

Patricia Neuhoff-Malorzo, Angelina Locker, Timothy Beach, and Fred Valdez Jr.

The Programme for Belize Archaeological Project (PfBAP), in NW Belize, has recently benefitted from the application of several technologies not often available to archaeology research programs. The use of non-destructive geo-physical and related technologies at several sites has provided the PfBAP with data concerning community structure. These data also inform the interest for future excavations. The developments in isotope research have also benefitted the PfBAP in providing measures for understanding population movement and possible interaction across the NW Belize region. The local variation of strontium and oxygen isotopes in NW Belize is now better understood. The isotope data, from the PfBAP, demonstrates the presence and consistency of immigrants within ancient Maya settlements from NW Belize through time. A third technology that has modified the PfBAP understanding of ancient settlement and activity is the use of LiDAR. Ancient Maya settlements not previously recorded are now more evident as are features from ancient activities including reservoirs, sacbeob, and agricultural fields. The rapid changes in certain technologies and their application to archaeology are seen as beneficial in NW Belize.

Introduction

The Programme for Belize Archaeological Project (PfBAP), in NW Belize, has recently benefitted from the application of several technologies not often available to archaeology research programs. While the PfBAP (Figure 1) has always been open to the testing of technological and methodological innovations, the quality of the potential findings has varied. Among some technological applications have been geo-physical techniques, bio-archaeology related isotope studies, and settlement-and-feature identification through LiDAR.

Geo-Physical Research

Non-destructive geo-physical and related technologies at several sites has provided the PfBAP with data concerning community structure. These data also inform the interest for future excavations. The use of geophysical survey techniques has a long history with archaeology, and has been used with at a varying rate both across the globe and in Belize overall. Use of these techniques has typically been dependent on the region in which they are employed, access to the equipment, and cost. So, while such techniques have been utilized regularly in other locations and regions, such as Europe or the UK, they were sporadically employed elsewhere. This is changing. In the past fifteen to twenty years these non-invasive methods have been more regularly employed in connection with archaeological endeavors. This increase in use is due to a host of factors including but not limited to overall technological advances, decreasing costs, and increased reliability of the data generated. These combined factors have made the application of non-invasive geophysical techniques a reality for a wider scope of archaeological programs and investigations, especially as more and more programs call for conservation rather than destruction of cultural heritage (Gaffney et al. 2002). It is with the addition of geophysical data-sets that is enabling archaeologists to more fully evaluate various attributes of past cultures (McKinnon and Haley 2017). The use of these techniques enables researchers to assist in understanding aspects of the built (but buried) environment that can be known in no other way (Aspinall et al. 2008).

Turning the focus towards the application of non-destructive techniques more locally employed, there are a number of non-destructive geophysical techniques that have been applied across Belize and more specifically during recent seasons at several locations in connection with sites and projects within the purview of the Programme for Belize Archaeology Project in NW Belize(Aitken 2008; Aitken and Stewart 2004; Aitken et al. 2005; Daniels Jr 2014; Haley 2006; Keller 2012; LeCount et al. 2016; McAnany et al. 2004; Micheletti et al. 2016; Neuhoff-Malorzo 2022, in press-a, in press-b; Neuhoff-Malorzo and Stanley in press; Powis et al. 2017; Sweely 2005; Walker 2012; Xu and Stewart 2002; Yaeger et al. 2009). The use of these techniques is providing a wealth

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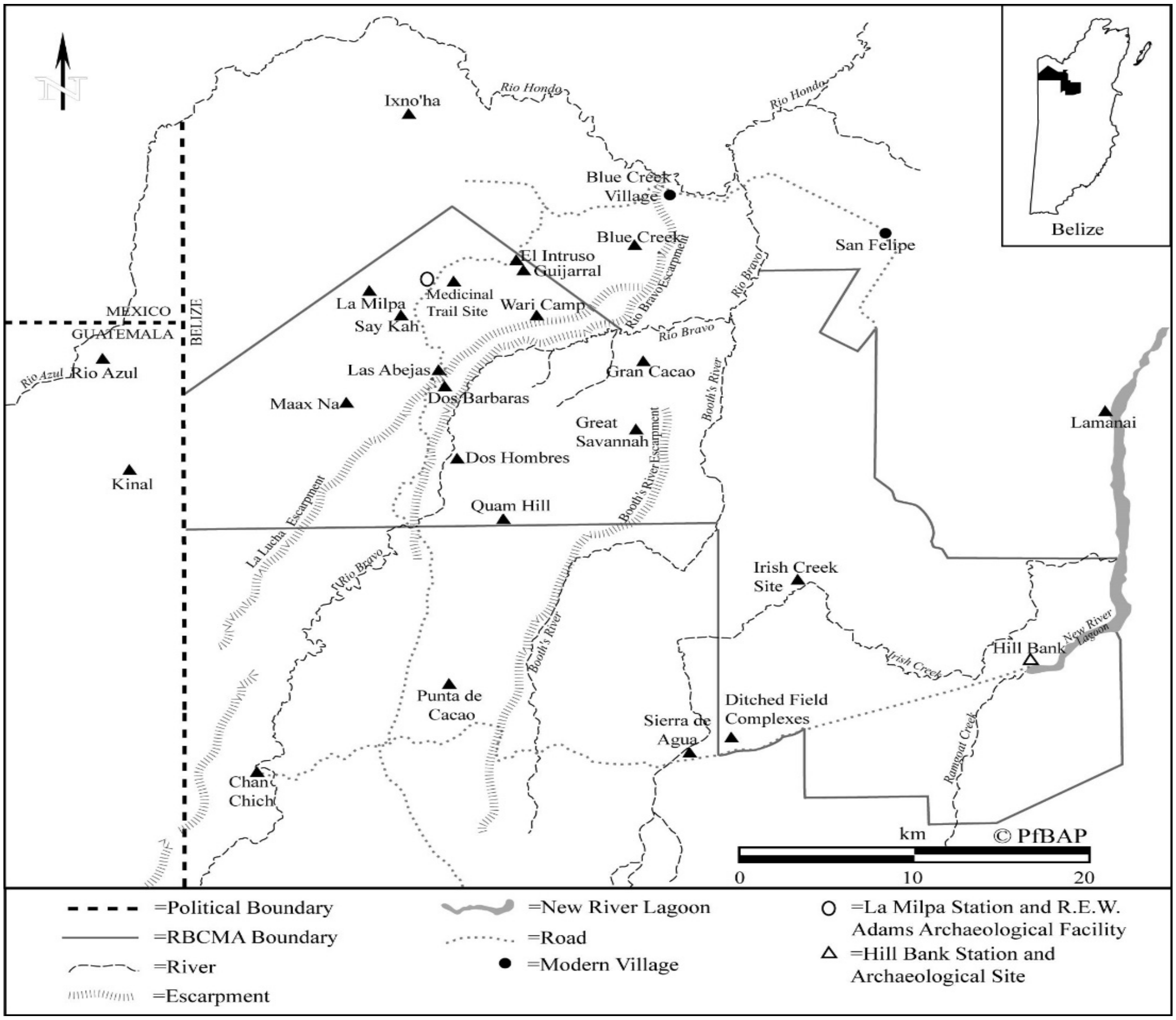

Figure 1. Map of the Rio Bravo Region, Programme for Belize Archaeological Project.

of data that is being used in a number of ways, including analysis of stratigraphic levels at individual settlements, analysis of settlement layout, identification of architectural footprints, and identification of areas of potential for excavation and investigation. The identification of buried remains and stratigraphy through near-surface or surface-based techniques allows for more complete analysis of changes in the environment reflective of human habitation and related anthropogenic activities and alterations.

The techniques most recently applied at PfBAP sites include Ground Penetrating Radar, MASW (multichannel analysis of surface waves or seismic survey), and magnetometry. These techniques have been used to conduct non-invasive investigations at Chawak But'o'ob, Mulch'en Witz, and Tzak Naab. These methods have been used signally and in concert with one another. Single survey applications of GPR have been conducted at La Milpa and Mulch'en Witz respectively. Complementary surveys of GPR and MASW have been used in conjunction at the site of Chawak But'o'ob, and Magnetometry and GPR have been used in concert at Tzak Naab. These applications have shown that geophysical survey data can be used to analyze and compare settlement layout and community structure through the identification of buried remains and surface architectural remnants and for targeting potential areas for excavation that could contribute to a better understanding of community structure, habitation and activity areas, and occupational timelines.

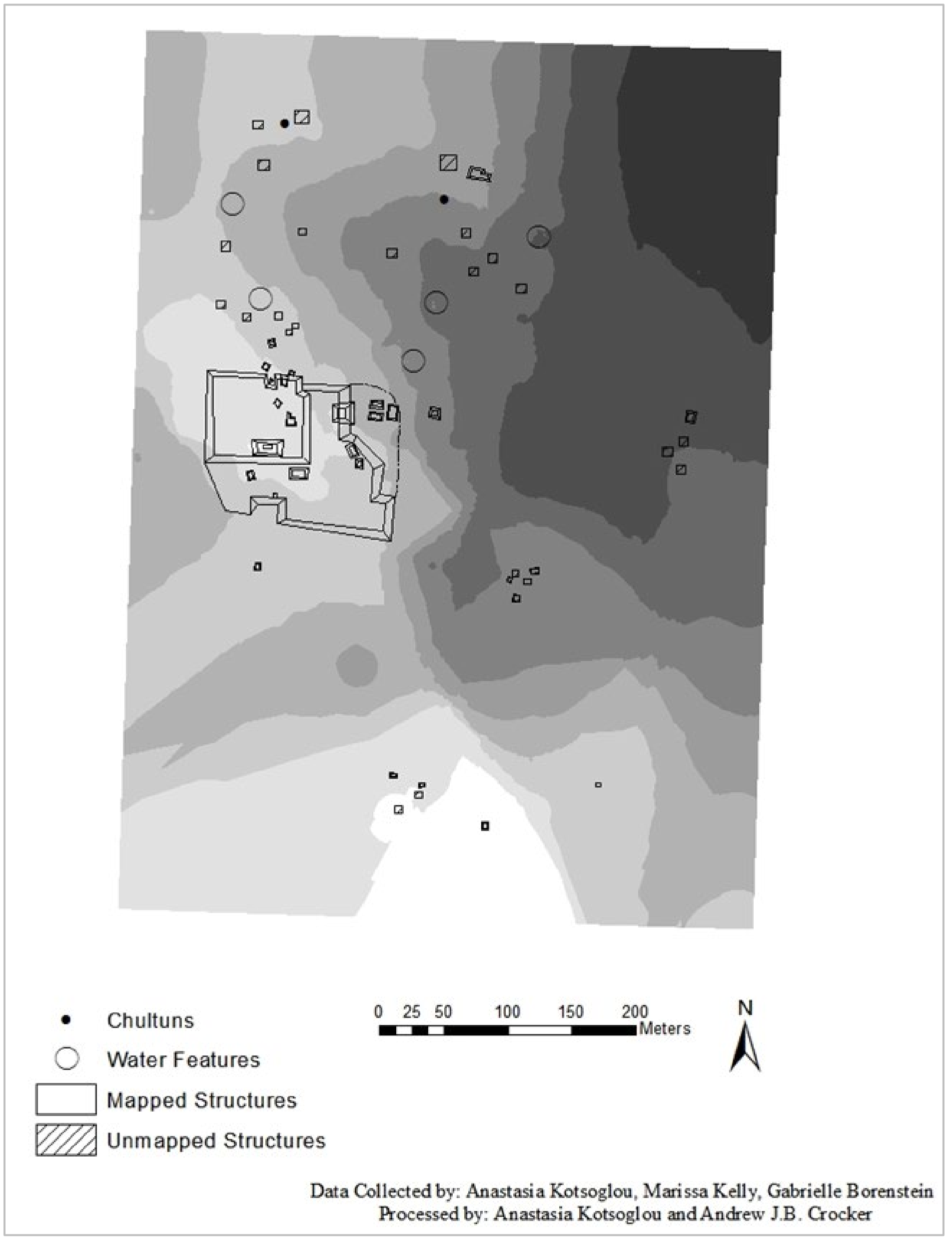

Figure 2. Map of Tzak Naab.

Recent study at the settlement of Tzak Naab (Figure 2) utilized the technique of Magnetometry over a large area combined with targeted GPR survey to generate complementary data sets for the analysis of the southern portion of this site. These survey results have revealed datasets that inform as to these exact aspects: social organization, habitation and activity areas, and possibly redefined the timeline for this particular settlement. The inclusion of geophysical survey, specifically at this site, has allowed for more in-depth analysis and expansion of the available datasets for identification of spatial patterns. This research analyzed buried architectural features to consider how that architecture clarifies, dictates, and reinforces the established traditional social roles, relations, and hierarchy in the creation of spaces and activity areas at ancient Maya hinterland settlements.

The use of geophysical techniques can provide a wealth of information at sites where there has been little or incomplete investigation.

These techniques can enable meaningful analytical insight through non-invasive techniques that are repeatable and that can be replicated at any number of locations.

Isotope studies

The developments in isotope research have also benefitted the PfBAP in providing measures for understanding population movement and possible interaction across the NW Belize region. The local variation of strontium and oxygen isotopes in NW Belize is now better understood. The isotope data, from the PfBAP, demonstrates the presence and consistency of immigrants within ancient Maya settlements from NW Belize through time.

Over the last 30 years, research has shown that the ancient Maya were a mobile group, with fluid landscapes. Non-local individuals have been identified in nearly every isotope study completed on individuals recovered from ancient Maya sites (see for example Cucina et al. 2011, 2015, 2017; Ebert et al. 2021; Freiwald et al. 2014, 2019, 2020; Negrete et al. 2020; Ortega-Muñoz et al. 2018, 2019, 2020, 2021; Ortega-Muñoz and Cucina 2021; Price et al. 2006, 2008, 2010, 2012, 2014, 2018a, 2018b, 2019; Rand et al. 2015, 2020, 2021; Sharpe et et al. 2016, 2022; Somerville et al. 2013, 2016; Sosa et al. 2014; Suzuki et al. 2020; Trask et al. 2012; Wright 2005, 2012; Wright et al. 2010; Wrobel et al. 2017). Attempts have been made to understand the relationship between ancient Maya major centers and Teotihuacan (Price et al. 2010; White et al. 1998, 2000, 2001, 2002, 2004a, 2004b; Wright 2005; Wright et al. 2010) and to identify immigrants related to potential diaspora events of the Late and Terminal Classic when the ancient Maya underwent a political and economic restructuring (Aimers 2007; Rice and Rice 2004; Rice et al. 2004;).

Research utilizing PfBAP data show how an examination of bodies helps explain regional population settlement and abandonment episodes by showcasing how systems of mobility set in place by a non-elite population shaped ancient Maya settlement and the archaeologically visible landscape. We might also argue bodies were used as a mnemonic for the legitimization of place and authority within households and communities where living groups, both elite and non-elite, manipulated and controlled narratives centered around lineage, descent, and ancestry.

Locker (2020) described how ebbs and flows of population density that occur in various places and times throughout occupation history in the region correspond with a Dynamic Model for social organization and state power (Marcus 1993, 1998). Populations have the ability to shift across landscapes based upon alliances and networks established through horizontal dimensions of heterarchy. Long-distance, external migration decreases through time and does not fully support the hypothesis that long-distance immigrants played a key role in the population growth the region experienced during the Late Classic. Out of the 47 individuals analyzed, eight were identified as long-distance immigrants; three of these were secondary burials and may represent ancestral and placemaking events from Late Preclassic and Early Classic contexts. Importantly, drinking water reservoirs vary considerably between sites located on the escarpment and sites located off the escarpment, such that an additional three individuals were identified as being short-distance immigrants – meaning, they were local to the region, but not local to the site in which they were recovered. These intra-regional migrations seem to be steady in the Late Preclassic and Early Classic and then drop significantly in the Late Classic before regional abandonment.

The ancient Maya were able to reconfigure their sociopolitical landscapes in ways that may have been more suitable to sustain growing populations. The physical undulations of these spaces would have allowed for cyclical mobilities, encompassing both long-distance and short-distance migrations of bodies. The modification of centralized political powers may explain the patterns present in the observed isotope data, which show the Late Preclassic had the most non-local individuals represented. This undoubtedly coincides with an expansion into the region, most likely from the Petén Core area. Intraregional immigration is evident in rural communities as well and likely relates to the first settling of those spaces.

The Early Classic was originally characterized as a period of abandonment. Locker (2020) suggests that the major centers were depopulated while minor centers were more intensely settled. This is supported by isotope evidence which shows the only non-local individual was a secondary burial from an elite tomb, while intraregional migration is restricted to minor centers.

The Late-to-Terminal Classic period supports the idea that PfBAP sites attempted to gain and maintain independence from the Petén Core. This is made evident by the production and predominant use of local utilitarian ceramic wares by elite populations. Isotope evidence suggests two distinct geographic locations for non-local individuals. Long-distance immigrants who moved to major centers likely came from the Petén Core. Long-distance immigrants who settled in minor centers were likely from the Belize Coast or the Yucatán, potentially from Calakmul. These isotope values in conjunction with "gigantism" of jars and bowls and the presence of imitation slate wares may indicate growing alliances with sites and polities to the north.

In sum, external immigration to the region decreases through time. Internal immigration is consistent during the Late Preclassic and Early Classic before it decreases in the Late-to-Terminal Classic. The reduction in movement during this time may be indicative of growing internal populations which reduces the spaces into which people had to expand. The identification of both external and internal immigrants, however, indicates that mobility was fundamental to ancient Maya cultural practices and organization throughout time.

Locker (2020) has also turned her focus to the secondary burials in the PfBAP burial population and discussed two specific burial events to show how body partibility provided an avenue for dividual persons to be interred as a means of creating and manipulating place, memory, and ancestry by linking living populations to external place and legitimizing power within a community. The use of dividual persons was not limited just to elite populations. Rather, it is more likely that elite populations appropriated several aspects of non-elite ancestral veneration practices put in place or first utilized during the Late Preclassic as a means of justifying social hierarchies and legitimating their right to govern.

An examination of the dead must also consider the beliefs and identities of the living. Bodies were used as mnemonics for memory and legitimization of place. Ancient Maya descendant communities used elements of real and imagined relations (both intimately within their personal familial narratives and more broadly within general societal practices) and incorporated elements of re-use of space and bodies to build place.

LiDAR

A third technology that has modified the PfBAP understanding of ancient settlement and activity is the use of LiDAR. Ancient Maya settlements not previously recorded are now more evident as are features from ancient activities including reservoirs, sacbeob, and agricultural fields.

As an active form of remote sensing, Lidar uses laser scanning to penetrate through forest gaps to map the ground. Lidar scanning may be conducted from a small plane or from the ground. It is capable of mapping cm high terrain changes, and can therefore 3D map ground features that range for ancient Maya canals to large monumental constructions. Although the utilization of lidar began with other interests, it has come to revolutionized archaeology and changed what we thought we knew about the human activity in tropical forests. Lidar has shown that the Maya built environment was far greater, more extensive than previously understood across the Maya lowlands including all of northwest Belize.

While archaeological survey and mapping has always been difficult in tropical forested regions, Lidar has opened a methodological approach that evades the difficulties of physical investigation(s). At the multi-national zone of Belize, Mexico, and Guatemala, a 200 square kilometer Lidar run collected in 2016 provides a wide area of tropical forests and wetlands of the Rio Bravo Conservation and Management Area (Beach et al. 2019). Numerous new features, including buildings, sacbeob, and agricultural systems were identified that exposes the Maya footprint of ancient populations and intensive farming systems.

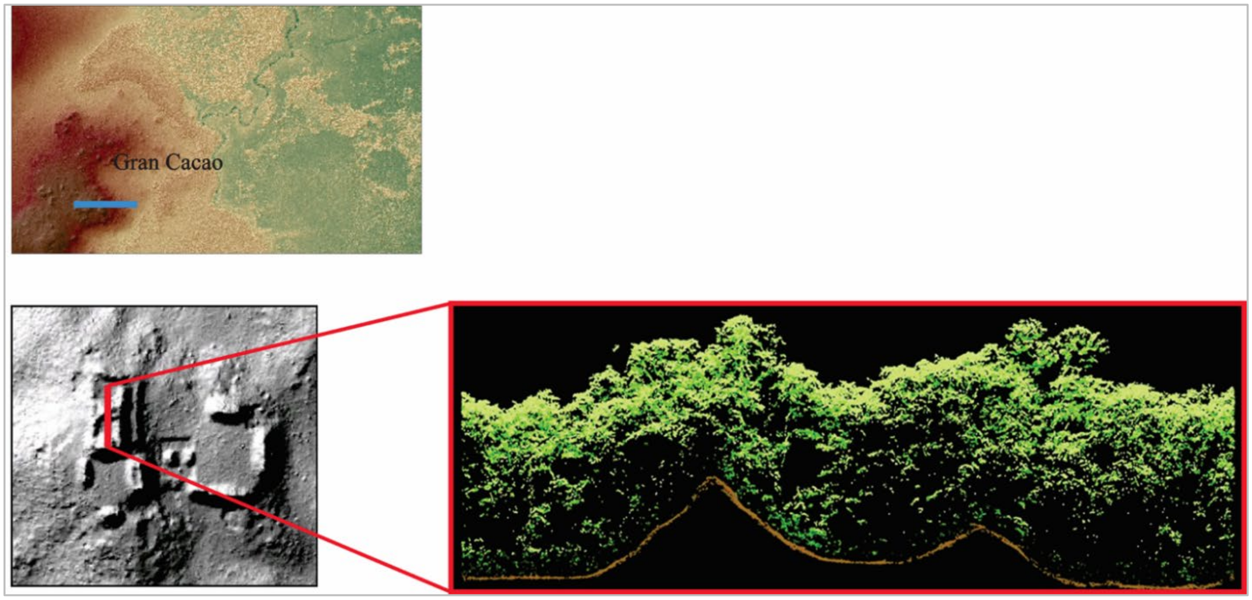

Figure 3. Lidar section of Gran Cacao (after Beach, et al. 2020).

After more than 25 years of traditional archaeological survey, about one square km of ancient Maya wetland fields and canals had been documented. Lidar imagery showed that there was far greater activity by the ancient Maya than the one km area. Recent Lidar research has allowed for more direct investigations – and while most agricultural features date to the Late Classic, many seem to have Late Preclassic origins, and several extend into the Postclassic.

The greatest surprise from Lidar in NW Belize was the rediscovery of the largest area of wetland fields in a region somewhat distant from known Maya centers. Information on ecology and many other geographical sciences is also greatly enhanced through Lidar imagery. Lidar also provides excellent topographic data that allows for defining courtyards as seen, for example, at Gan Cacao (Figure 3). A final consideration is that the fine-point imagery of Lidar can help define areas to excavate that may be a time and resource-saving aspect.

Comment

The three technologies discussed demonstrate the rapid changes in certain technologies; and their application to archaeology are seen as beneficial in NW Belize. We, at the PfBAP, have been privileged with the opportunities to utilize these varied technologies in archaeological interests.

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23 RAISING THE "BAAR" THROUGH IMPROVED METHOD AND THEORY: REINVIGORATING REGIONAL RESEARCH ON ARCHAIC OCCUPATIONS IN NORTHERN BELIZE

Marieka Brouwer Burg, Eleanor Harrison-Buck, and Samantha Krause

Although much research has explored the transition to early village life in the Maya Lowlands, comparatively less attention has focused on the ~6000-year period of Archaic occupation in the region. Initiatives like the Belize Archaic Archaeological Reconnaissance (BAAR) Project were ground-breaking forty years ago, and firmly established an Archaic presence in northern Belize. While the interpretations and lithic chronological sequences developed by the BAAR are problematic, the published results are still widely cited and support a growing body of new research on this period. Today, most BAAR sites fall within the boundaries of our project, the Belize River East Archaeology (BREA) Project, and we have recently reinvigorated regional research on the Archaic period in this area. Here we describe our work re-identifying and accurately geolocating some of the key Archaic sites established by the BAAR, and field strategies implemented to mitigate issues of stratigraphic sequencing and temporal anchoring. Hindsight and improved technological methods have helped us develop a multipronged, systematic surface and subsurface strategy for detecting, recording, and interpreting Archaic occupational scatters. Centered on the Crooked Tree Wildlife Sanctuary, our project resumes research on the successful and sustainable Archaic adaptations that preceded the earliest Maya in northern Belize.

Introduction

Preceramic Paleoindian and Archaic occupations (c. 11,500–2000/1000 cal BC) are few and far between in Belize (Prufer et al. 2019; Stemp et al. 2021; Lohse 2010; Lohse et al. 2006; Valdez and Aylesworth 2005). Many of the lithics that have come to represent the diagnostic tool kit of the Preceramic have been found by chance or in surficial scatters. To better anchor these lithic chronologies, sealed and stratified deposits containing specific tool forms in association with datable organics and/or sediments are needed. Research from other parts of the Americas suggests broad technological similarities throughout the late Paleoindian period, shifting to regional diversification with the onset of the Holocene climatic amelioration (Hodell et al. 2008), and the adaptation of tool kits to new and varied ecosystems (e.g., Loyola et al. 2018). Archaic foraging groups lived nomadically on the landscape, although sedentism began to increase in some areas (e.g., the Basin of Mexico and the Soconusco region) c. ~4000–2000 cal BC (Rosenswig 2015:115). These groups utilized a variety of environments throughout their seasonal rounds, and recent research in both northern and southern Belize has shown that many foragers incorporated horticultural practices to varying degrees throughout the period and region (Kennett et al. 2020; Rosenswig et al. 2014).

In this paper, we detail the aims and initial findings of a new research project focused on Archaic or Preceramic (c. 8000–2000/1000 cal BC) adaptive strategies in northern Belize—the Northern Belize Archaic Adaptive Strategies (NBAAS) Project. This project falls under the auspices and permit of the Belize River East Archaeology (BREA) project headed by Eleanor Harrison-Buck. The goal of this project is to explore the range of subsistence modalities and degree of mobility of Archaic peoples from a regional perspective. More specifically, the project aims to recover well-preserved stratified deposits, associated radiocarbon dates to secure litho-chronological sequences, and to compile data from long-term, widespread systematic survey campaigns. The project's scope encompasses the areas in and around Crooked Tree Island in northern Belize (Figure 1).

The NBAAS project's inception was marked by the chance finding of a Lowe point and other preceramic-looking formal tools during excavations at the site of Crawford Bank on Crooked Tree Island (Harrison-Buck et al. 2018; Stemp and Harrison-Buck 2019; Figure 2), located within the largest inland wetland system in Belize. The original Operation 35 strip trench at Crawford Bank was excavated in June of 2017 (see Stemp and Harrison-Buck 2019:Figure 3). Square J, nearest to the water, yielded the Lowe point close to the surface of the excavation. Importantly, this area can only be accessed during

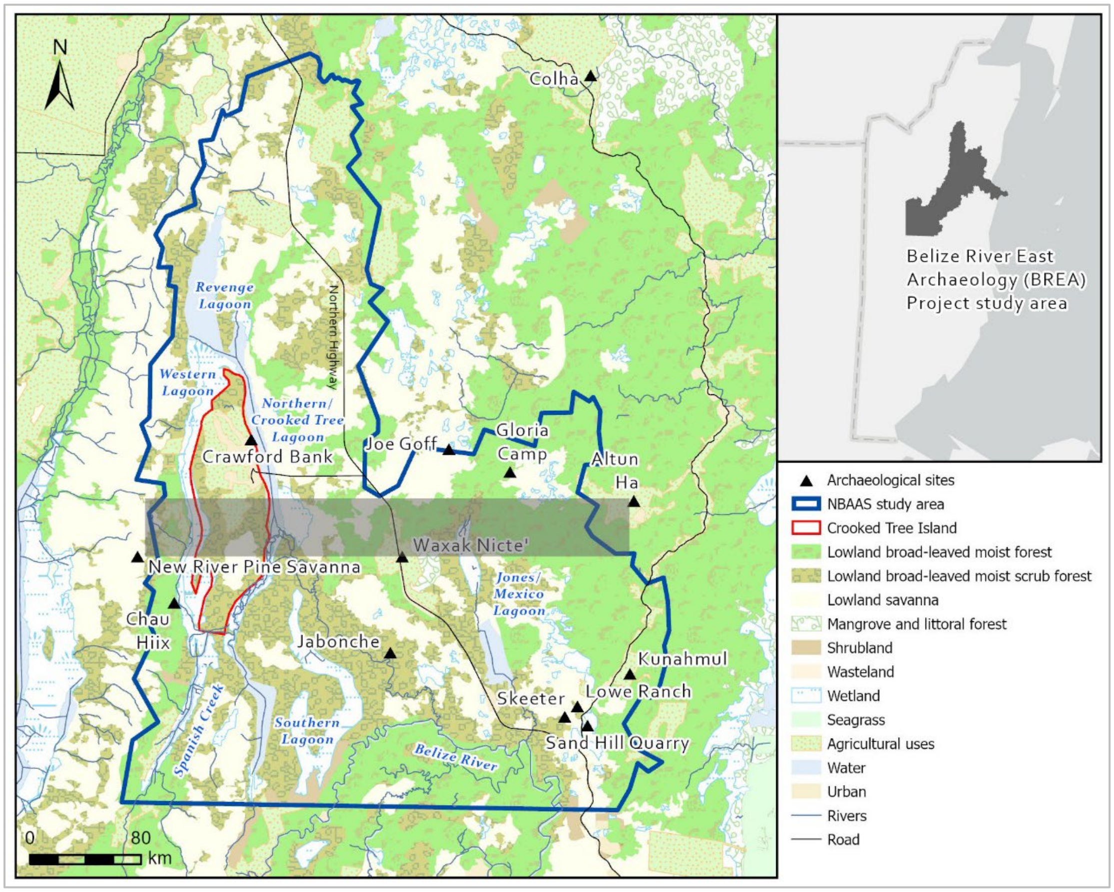

Figure 1. Overview of the Northern Belize Archaic Adaptive Strategies (NBAAS) and Belize River East Archaeology (BREA) project study areas with sites discussed in text.

Figure 2. Aerial view of 2017, 2020, and January 2022 excavations at the Crawford Bank site.

the height of the dry season; during the rest of the year, this elevation is typically submerged under the waters of Crooked Tree Lagoon. This excavation yielded over 1000 lithic tools and debitage, as well as retouched macroblades and blades, the distal end of a biface, the distal fragment of a constricted uniface/trimmed macroblade and, of course, the Lowe Point (Stemp and Harrison-Buck 2019:7). According to the assemblage of formal tool types known from the Late Archaic, the Crawford Bank occupation yielded almost all the forms known to span the early through late Preceramic periods defined for Belize (c. 2500–900 cal BC).

Use wear analysis revealed many of these lithic tools were used in woodworking activities (Stemp and Harrison-Buck 2019), which dovetails with the fact that valuable hardwoods (such as logwood or *Haematoxylon campechianum*) also flourish along this coastline. However, there is an inherent issue with the context of Operation 35: the Lowe point was found only 5 cm below ground surface, and most of the other tools were found within a small

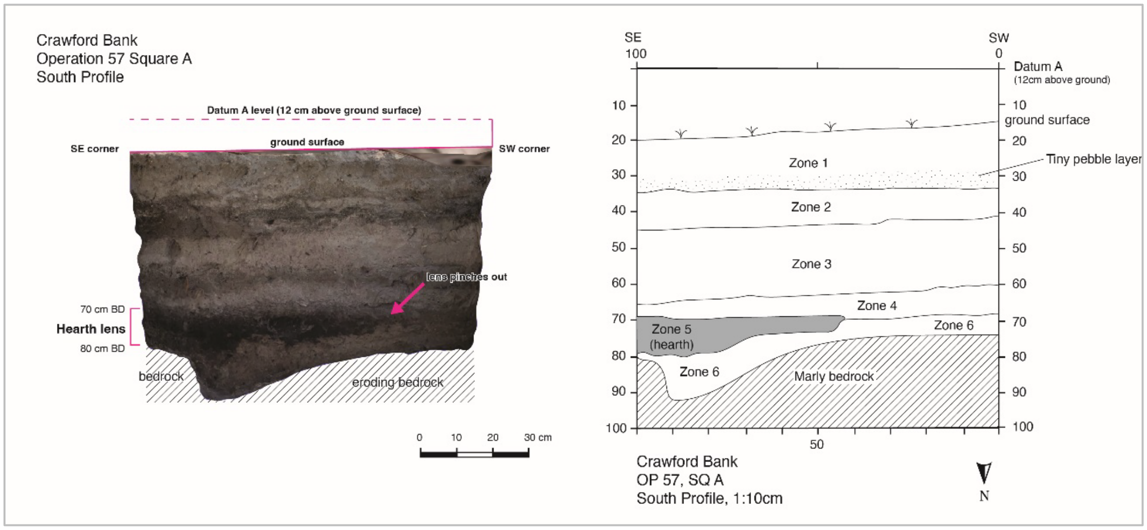

Figure 3. Possible hearth feature at Crawford Bank (Operation 57).

depression in the underlying bedrock, a mere 20 cm below ground surface. We know that the parcel of land where these artifacts were recovered has been routinely raked, scraped, and mowed over the last 20-odd years and thus they were likely not in a primary context. Furthermore, their find context was adjacent to the shoreline of Crooked Tree Lagoon, which rises and falls as much as 50 feet over the course of a year. Both wind and wave energy has undoubtedly displaced many of these lithic artifacts from their original contexts.

In January 2020 we opened another excavation unit (a strip trench, Operation 51) at Crawford Bank 20 m north of Operation 35 in search of stratified, in situ deposits and with the hope of finding organic materials in association with diagnostic tool forms. Below ~50 cm of intermingled historic material and what appeared to be Archaic lithics (on account of similarities with Op. 35), an aceramic lithic scatter (containing 286 pieces) was discovered beneath a sterile clay layer (Brouwer Burg 2021, 2022). A handful of charcoal samples were collected from the layers containing lithics. However, these samples did not survive the long Covid-driven hiatus in our storage lab. Thus, a 1 x 1 m unit was excavated just south of the Op. 51 trench in January 2022 in an attempt to recover datable organics (Operation 57). We recovered what appeared to be a sealed hearth pit beneath sterile layers of sandy clay, in association with chert debitage and a constricted unifacial preform, and notably aceramic (Figure 3). However, when analyzed, the radiocarbon samples from the hearth pit dated to the 1800s cal AD. There are two likely explanations for the recent dates of these samples: 1) a burning event occurred in or near this natural or anthropomorphic depression in the1800s and subsequently, the depression was filled and covered by more recent human-induced sedimentation, probably aided by machinery; or 2) the pit, ash, and charcoal deposit was the result of older burning event—perhaps Archaic—but the charcoal samples have been contaminated by more recent burning and soil leaching by biannual lagoonal infilling. Neither explanation can account for why we find what seem to be sealed aceramic layers with Archaic-like lithics beneath sterile layers of clay and sand. Whatever the case, we are now convinced that the shoreline of Crooked Tree Island is not likely to reveal stratified deposits, as both natural and cultural post-depositional processes have taken their toll on the archaeological record.

New Research Initiatives

These pilot investigations provided strong evidence that the area in and around Crooked Tree Island holds immense potential for unlocking further information about the Archaic period. During the Covid travel ban, we received a National Science Foundation Grant to continue pursuing our examinations of Archaic period human-landscape interactions. And while we knew that the Crawford Bank area still had much to tell us, we designed the current NBAAS research to be regional in nature. This was in part inspired by the groundbreaking work of Richard S. MacNeish, who pioneered regional survey on the Archaic with his Belize Archaic Archaeological Reconnaissance (or BAAR) project. Notwithstanding litho-chronological issues and a lack of anchored stratified sediments, the regional approach of the BAAR project was able to shed light on how different environments were used over time and for different activities (MacNeish 1981, 1982; MacNeish and Nelken-Terner 1983; MacNeish et al. 1980; Zeitlin 1984). From MacNeish's work, we learn that the types of environmental zones where Archaic occupations were most commonly encountered were estuarine island, stream and sand ridge, and sink hole and sand ridge (see MacNeish et al. 1980:22). This regional approach also seemed important for our purposes, given that Crawford Bank—located on Crooked Tree Island—is situated in an incredibly biodiverse area known as the Crooked Tree Wildlife Sanctuary. This extensive 16,400-acre network of shallow, seasonally inundated freshwater lagoons, rivers, creeks, swamps, and marshes is home to a wide range of food and other resources. To begin unraveling the range of Archaic behavioral processes conducted throughout this broad, biodiverse area, we set out to conduct our tests within a handful of microenvironments. Figure 1 shows the transect that has been guiding the sampling strategy of this research, and which cuts through five important microenvironments: broadleaf moist forest and scrub forest, lowland pine savanna, mangrove/littoral swamp, and wetland. Our methods have thus far entailed surface survey of the eastern shoreline of Crooked Tree Island, shovel test pitting campaigns in three of the microenvironments, and selective excavation.

Re-visiting and assessing the current state of BAAR sites

The NBAAS project area coincides in some places with areas formally investigated by the BAAR project 40 years ago (Figure 4). Despite its inherent issues, the BAAR project was instrumental in kickstarting Archaic research in

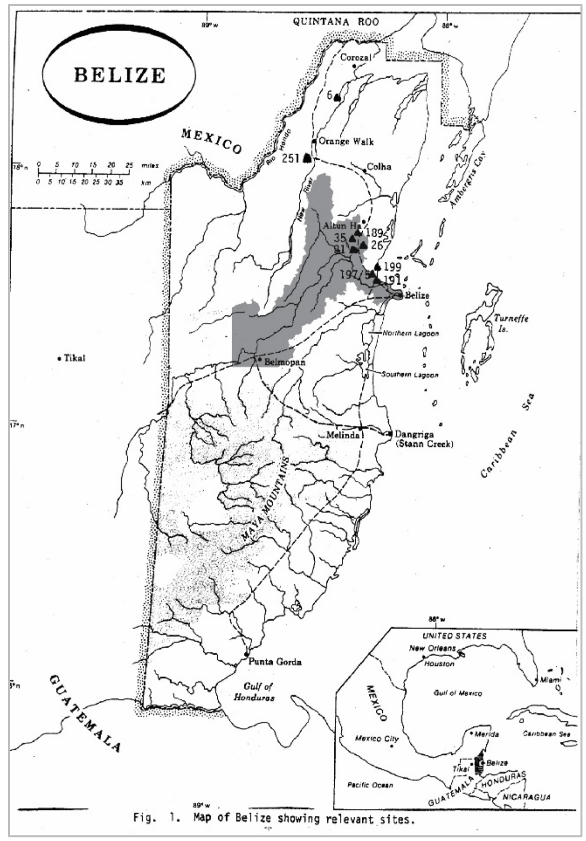

Figure 4. BREA project study area superimposed over a map depicting the occupations documented by the Belize Archaic Archaeological Reconnaissance (BAAR) project. Original image derives from MacNeish et al. (1980:vi).

Belize, and at the very least, we felt it was important to revisit as many of the original sites as possible, to assign precise GPS locations for each, as well as to ascertain their degree of preservation and their potential for containing stratified Preceramic deposits and organics for radiocarbon dating. We felt it was an auspicious way to reinvigorate regional research on the Archaic in this part of Belize.

The initial stage of this process involved combing back through the original BAAR reports, although the maps in these reports were neither accurate nor thorough (see e.g., MacNeish et al. 1980:25, 28; MacNeish 1983:23). We also spent time in the filing cabinets at the Belize Institute of Archaeology (IA), culling every site form making mention of a BAAR, Ladyville, or quarry site in northern Belize. While there were some gaps in the records, we were able to identify two remaining cards with BAAR sites listed. Paired with information from the BAAR reports, we determined that Sand Hill Quarry, Ladyville Quarry, and the Lowe Ranch sites would be the best to try to reidentify.

Sand Hill Quarry (BAAR 26) lies a quarter mile off the Old Northern Highway, as the original IA site card suggests; however, MacNeish and colleagues noted that the site was heavily disturbed by the construction of the highway in the 1930s and 1940s (MacNeish et al. 1980:14). Thus, they situated their excavations in a few isolated areas on the edge of the site proper. We characterized the area as deflated savanna sands with outcropping chert nodules interspersed with little pine and oak tree islands and wet *bajos*. Many of these bajos seem to be borrow pits from the public works highway activities. With the help of Mr. James Gibson of Sand Hill Village, who had worked on the BAAR project in the early 1980s, we were able to reconstruct the location of the test excavations carried out by that project. Mr. Gibson corroborated what we had suspected – that many centimeters of overlying sediment had been stripped away during the highway project to get at the underlying chert and limestone. Observation of lithics on the surface suggested mostly expedient tools, debitage, and tested nodules. Our shovel test pits revealed yellow-brown sandy clays with lithics throughout, becoming more heavily patinated with depth. We also encountered a number of chert nodules at the bottom of the shovel test pits (STPs) perhaps indicative of bedrock.

The next target area was the Ladyville Quarry area (BAAR 191, 195, 197, 199). Reidentifying this area proved a lot more challenging, as much of the land north of Ladyville has been repurposed for shrimp farming. The IA card instructions told us to "take road to wireless station near Ladyville to the east. Drive beyond into quarry area." These seemingly simple directions proved difficult to follow given all of the recent building and land transformation in the area. Using the IA card, an old site plan map, and satellite imagery of the vicinity from Kelly (1993), we attempted first to find BAAR 191/Ladyville 1. Targeting an area today owned by the Nova Shrimp Farm, we found a small scatter of worked chert on the top of one of the embankments, likely dredged in the creation of the shrimp ponds. We also identified a promising sandy spot seemingly untouched by recent development in the aerial photography. However, upon ground-truthing the location, it appears to have been the quarry for limestone to build up the embankments of the shrimp ponds. The area has been heavily impacted by sheet wash, and we found almost no chert, just heavily eroded limestone.

Several pieces of this limestone recovered from the surface appeared to be flaked, and some even seemed to have bulbs of percussion. However, when these specimens were more closely inspected, the cortex appeared to be more reminiscent of limestone than chert. We know from other parts of Belize that limestone is sometimes used for tool production, although it appears not to have been a favored material for knapping, given that its friable texture often leads to intense weathering (Dahlin et al. 2011; Hearth and Fedick 2011; Horowitz et al. 2019). This area is not directly within the Northern Belize Chert Bearing Zone but lies proximate to the zone. Some specimen looked chert-like, and could perhaps be composed of a crystalline, dolomitic limestone, or perhaps silicified limestone, as is found widely on the karstic landscape of the Northern Maya Lowlands (Dahlin et al. 2011). We are still unsure of the role of these possible artifacts and cannot exclude the possibility that these were spalls created by more recent mechanized activities that are documented in the area.

We tried again to reidentify some of the occupations in the Ladyville Quarry area, following the "Just north of the wireless station" direction more closely, which led us to yet another shrimp farm (Caribbean Shrimp). Here, in an old, bulldozed sand pit that had undergone extreme sheetwash, we found some Late Archaic-looking artifacts, such as a large, possibly "shoe-shaped" unifacial axe, measuring 21 cm long by 9 cm wide and weighting one kilogram (Figure 5a). Our STPs here indicated that under humic topsoil and a yellow sandy clay with gravel inclusions lies a compact sandy sediment with variable oxidation. It is this compact sandy sediment on which most of the lithics appear to have eroded out onto through various processes, suggesting that they were once deposited in the yellow sandy clay. Most of the chert tools and debitage we observed on the compact sandy

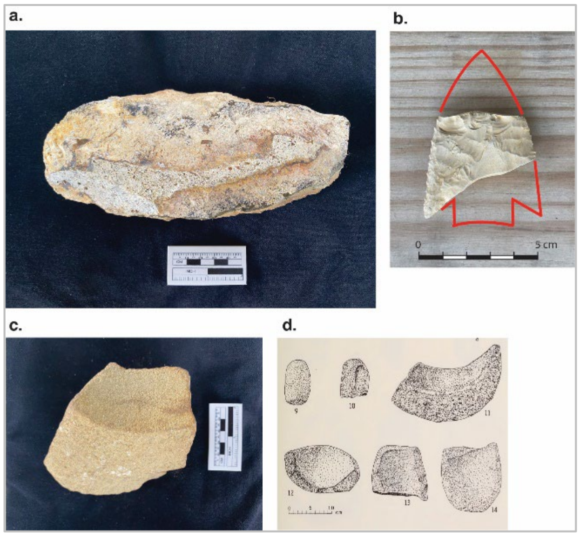

Figure 5. a. Unifacially worked "axe"; b. Lowe point fragment; c. Stone bowl fragment; d. images of similar stone bowl specimens from MacNeish et al. (1980:45).

surface were heavily patinated and some were very poorly preserved. As at many of these savanna sites, a number of the artifacts sat atop little pedestals, from the wind/rain action. We also uncovered a possible Lowe point fragment, heavily patinated, with serrated edges and an intact barb notch (Figure 5b). The last confirmation that this was likely a former BAAR site was the recovery of a stone bowl fragment (Figure 5c); MacNeish et al. (1980) reported finding various similar specimen during BAAR research (Figure 5d). Based on this data, we believe we reidentified a former BAAR site, although there is no telling which one it was. Additionally, the awful state of preservation of the occupation was certainly not encouraging for future research prospects (and made us rethink our purposes here – were we attempting to raise the BAAR, or were we documenting the razing of BAAR-identified occupations?).

During this time, we also made a visit to Lowe Ranch (BAAR 31, 35), the eponym for which the Lowe point was named. The property was sold 25 years ago in 1996, and we learned that the current landowner has not done much with the property other than cattle ranching, a bit of logging, and some sand extraction. Upon walking the property, we found lithics scattered on the ground surface as well as concentrated in the handful of sand pits. As with the Ladyville Quarry sites, the lithics appear to have been lying in the top 20–30 cm of light tan-grey quartz sand, underlain again by very compact clay. The artifacts were also pedestaled and patinated and they were eroding out of the pit edges. In some of the sand pit back dirt piles we found large quantities of debitage as well as some very chunky, expedient looking tools perhaps used for working wood.

In sum, we have not been able to relocate all of the BAAR sites that fall in the BREA area. Although we attempted to find the Kelly site—reportedly 40 km south of Colha and just north of the airport—we were not successful in identifying anything in the vicinity of where the site is purported to have been located, despite many hours scouring Google Earth images, driving the back roads of Ladyville, and walking different parcels. One of the primary aims of the NBAAS project is to identify Archaic occupations with stratified deposits and datable organic remains in association with diagnostic tools. In assessing these three BAAR sites that we have successfully reidentified, there was little evidence of any deeply stratified contexts, although Lowe Ranch may be the best candidate. In what follows, we briefly describe how the NBAAS project is attempting to raise (not raze) BAAR research initiatives.

New Approaches to Archaic Research in the Former BAAR Project Area

As it is now more than 40 years since the inception of the BAAR project, it is not surprising that many advances have been made in various technologies, geospatial technologies chief among them in terms of importance to this project. While NSF funding for this project was initially obtained in the summer of 2021, no field research was possible that year on account of Covid-related travel bans. Thus, from afar, we conducted a series of geospatial analyses using geographic information systems (GIS) software (ESRI ArcGIS and QGIS) to heuristically explore Archaic period land use and mobility patterns within a dynamic climatic and environmental setting, and to home in on target areas for future field work. The ability to harness varying spatial datasets using GIS is a tool that was certainly not available to BAAR researchers in the early 1980s. Instead, Archaic period sites were found (quite successfully, we might add) through expert knowledge about Archaic settlement preferences gleaned from other areas in the Americas, information from local informants, and many long hours of field reconnaissance and pedestrian survey. Nevertheless, the ephemeral nature of most Archaic period occupations—and the many post-depositional processes that have acted on such deposits over the intervening years—makes it very difficult to find such sites. We hoped to use GIS to approximate a number of areas of heightened potential of Archaic occupation, with as little post-depositional disturbance as possible. Borejsza et al. (2014:292) warn that the location of Preceramic open-air sites in central Mexico "is not something that can be 'predicted' by applying some geomorphological 'laws' to a set of maps and aerial images of sufficient resolution and handling them with sufficiently sophisticated GIS software". However, given the travel bans, we still felt that this was a useful exercise, not just to identify possible areas of higher Archaic potential, but also to help familiarize ourselves with the local environment.

Part of this modeling involved identifying areas within the landscape that might have served as important "high and dry" refugia to hunter-gatherer-fisher-emergent farmers, especially during very wet seasons, we consulted a modern floodwater interpolation model (floodmap.net). This model approximates how much land will be submerged given x meters of sea level rise; much of the low-lying coastal zone of Belize would be inundated by 15 m of sea level rise. These projections are useful for reasons beyond their alarming qualities, as they represent persistently elevated areas that were likely high and dry in antiquity. It is here in these locations that we might expect to find remains of Archaic behavior focused on hunting and settlement, especially during the wet season. When these interpolated floodmap surfaces are overlain on an ecosystem map layer, these areas all correlate with broadleaf moist/scrub forest, highlighting the important role that high and dry forests likely played as refugia in this area during extremely wet periods. We identified a number of key target areas to focus on upon resuming field work (Figure 6).

To explore the subsistence potentials of the area around Crooked Tree Island, a preliminary multicriteria geospatial analysis was

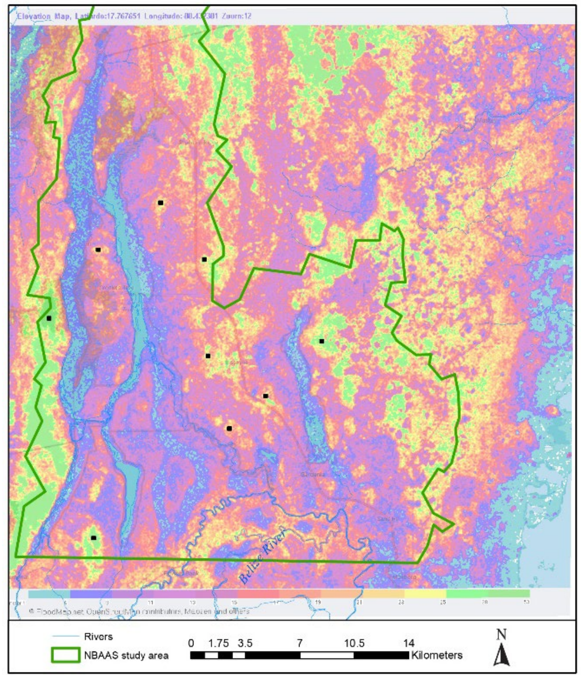

Figure 6. Elevation map of Crooked Tree Island and surrounds. Light green represents the highest elevations, blue represents the lowest elevations. Black squares represent potential target areas for future research.

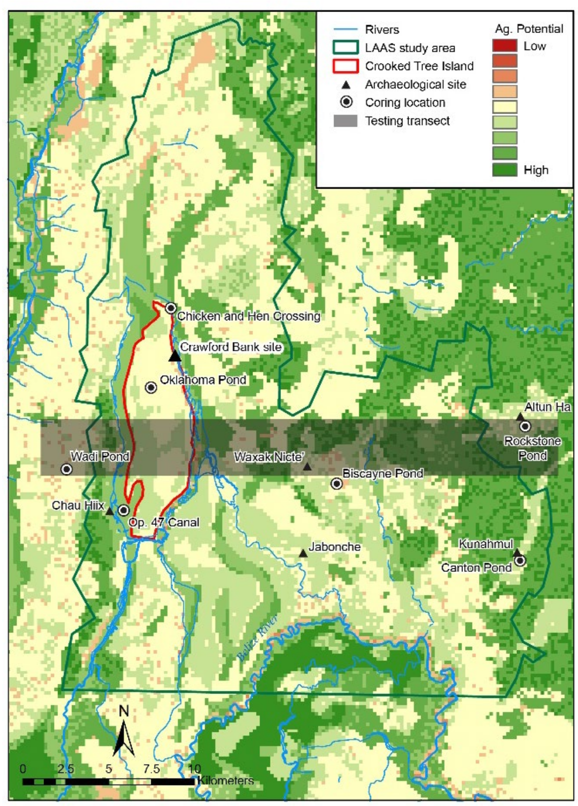

Figure 7. Map of agricultural potential in and around Crooked Tree Island.

conducted, executed on slope, soil drainage, and ecosystem type data layers. The resulting map indicates that areas highly conducive to agriculture lie within a short distance of the island (~5 km) to the southwest and east. Maya settlements (which were not included in the modeling) show an interesting pattern: Chau Hiix is located in an area highly conducive to agriculture; however, Jabonche and Altun Ha are located in less conducive marginal lands (see Pyburn 2003:123; Harrison-Buck 2015; Figure 7), a trend that has been noted in this area (Harrison-Buck 2014). While this mapping experiment provides only a preliminary understanding of agricultural potential, it will help guide future surface reconnaissance, shovel test survey, and excavation. We will focus in particular on a 20 km^2 E–W transect, which spans areas of varying agricultural potential and multiple biotic zones and is anchored on either end by dated core profiles and archaeological sites (Chau Hiix and Altun Ha) with long-term occupations beginning in the early Middle Preclassic when agriculture was well established as the primary subsistence strategy (Andres 2009; Pendergast 1982; Pyburn 2003).

Another new suite of technologies that have become essential to archaeological investigation since the early 1980s are global positioning systems (GPS), which today can provide sub-decimeter locational accuracy for a fraction of the price that such systems cost during their nascency in the late 1980s and early 1990s. Before such systems, it was difficult to establish the precise locations of archaeological sites without some kind of triangulation from a known survey marker. It appears that the BAAR project located sites primarily based on such survey triangulation and by using geographical features. This has compounded our efforts to revisit some of these sites, as exact UTM locations were never recorded and instead, narrative accounts and imprecise, hand-drawn maps have been our only recourse. Thus, one of the main thrusts of this phase of the project was not only to relocate, but also to document precise geolocations for these sites, regardless of their preservation status. We used an EOS Arrow 100 coupled with an open-source GIS software (Map Plus) loaded on an Apple iPhone 12 to collect this data. We were

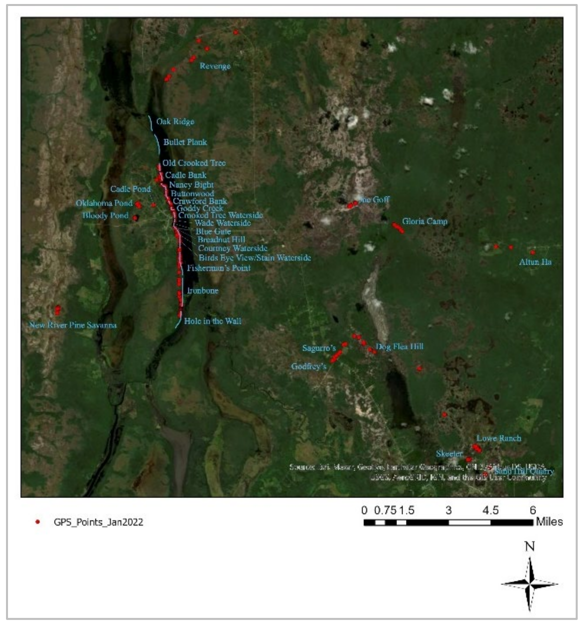

Figure 8. Map of all GPS points taken on artifact scatters.

consistently able to collect geospatial data with spatial accuracy of 5–20 cm.

Cutting edge GPS allowed us to record and visualize our on-the-ground findings in real time, which helped inform decisions about next steps for reconnaissance on the fly. During the January 2022 field season, our main goal was to walk the length of the eastern shoreline of Crooked Tree Island, and we succeeded in covering about 9 km, the limit permissible by lagoonal water levels at the time. Artifacts were observed almost everywhere on the ground surface and consisted of a mixture of historic and Preceramic-looking chert lithics. Only one location yielded Maya artifacts, at Crooked Tree Waterside (Figure 8). The northern and southern tips of the island were not accessible in January on foot and by May of 2022, most of the area surveyed in January was already submerged. We plan to revisit this surface survey in January 2023 when (hopefully) the lagoon waters have receded.

We also collected drone imagery and drone-equipped lidar imagery of some of the target areas of interest. However, while this technology is proving invaluable for identifying ancient Maya landscape modifications and structures, drone-equipped lidar is not an appropriate technology for identifying Archaic occupations, which are typically either buried below ground or the sum of a scatter of lithic artifacts. Instead, these techniques can be helpful for developing detailed digital elevation (DEM) models that can yield data about paleolandscapes and post-depositional processes.

To further our investigations of coupled human-landscape relations during the Archaic, and gain firmer understandings of paleoenvironment and climate, another main segment of the NBAAS project entails closed-basin coring of ponds and lakes. We identified seven bodies of water in January as potential coring targets. In Summer 2022, we used a modified piston coring device made of carbon fiber rods and polycarbonate tubes used with a locking piston to retrieve lacustrine sediment. This instrument is custom made by the Land Use Environmental Change Institute (LUECI) in the Department of Geological Sciences at the University of Florida by Dr. Jason Curtis.

Our most successful core attempt was conducted at Jones Lagoon, which lies ~10 km south-southwest of Crooked Tree Island and is also part of the Crooked Tree Wildlife Sanctuary. Here, we cored both near and far shore locations encountering a soft, muddy bottom. We used two boats for this excursion, first inserting a sized-up PVC pipe into the mud to guide our successive core holes. We found that staffing each boat with three people was necessary to undertake all the associated tasks: from stabilizing the boats while hammering PVC into the mud, pushing the corer into the subsurface, extracting the corer from the subsurface, taking notes and photographs, holding the piston line, and keeping the full core tubes upright during transportation. We collected three cores at Jones Lagoon that were then extruded, described, and bagged back at our field camp on Crooked Tree. Core 1, taken in deeper water, holds the most potential for reconstructing environmental change within the system (Figure 9). The upper portions of the sediment column are about 50+ cm of unconsolidated material comprised of organics and shells, which we describe as the sediment-water interface. We collected a few samples within the sediment-water interface to better capture the modern ecology surrounding the lagoon. Below the sediment water interface, the sediment transitions into a gyttja (or eutrophic mud), which forms due to suspension fallout and reflects the stagnant quality of the lagoon. The gyttja then transitions

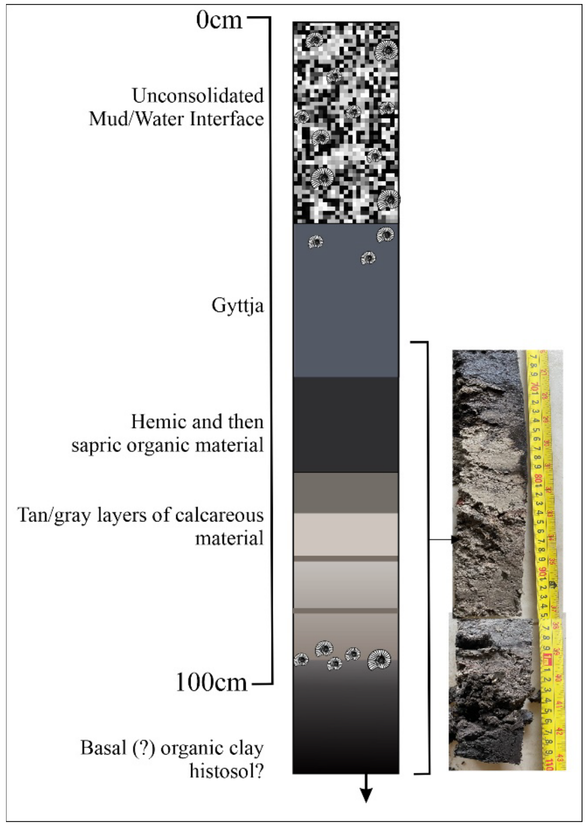

Figure 9. Core sample from core 1 attempt at Jones Lagoon.

at ~70 cm to a histic (less decomposed) to sapric (more decomposed) peat, which then transitions to calcareous sediment with faint layering by 80 cm, and then finally to an organic clay at 106 cm, which may represent a basal histosol, though deeper coring may confirm this in subsequent seasons.

These samples will be shipped back to the Beach Lab at University of Texas at Austin, where one of us (Krause) will conduct or prep for a number of analyses. The base of each core will be dated to determine age depth for each sequence. Soil types and morphological development will be identified to trace changing environmental conditions in these water bodies. Carbon isotope ratios (C3 versus C4) will approximate the mix of vegetation growing in each area. The sediment samples will be visually inspected for plant material that can be analyzed for macrobotanicals such as seeds, nuts, and wood fragments, revealing resource extraction and subsistence information. Pollen and phytolith samples from select cores will be prepared and sent for analysis to explore the vegetation succession of each pond.

Future Research and Conclusions

Our future research goals fall into three categories: 1) acquire additional paleolandscape and paleoclimate change data by using a vibracore device, which can more effectively punch through compacted sediments into older deposits; 2) continue the STP campaign in a wider range of microenvironments, looking for evidence of Archaic deposits; and 3) carry out excavation in areas identified in geospatial modeling and from the STP campaign as areas with high potential for stratified, in situ deposits of Archaic artifacts and good preservation for organics recovery. To conclude, we note that while the interpretations and lithic chronological sequences developed by the BAAR project are problematic, we still have them to thank for kickstarting regional research on the Archaic period in Belize, an approach that we feel is still incredibly important for understanding broadscale adaptive strategies. And thus, when we say we are attempting to raise the BAAR, these initiatives are intended to build and improve on the work begun by this project over 40 years ago.

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24 DENUDED LANDSCAPES AND EXPOSED NEIGHBORHOODS: RESULTS OF THE 2022 VALLEY OF PEACE ARCHAEOLOGY PROJECT

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Much of the Valley of Peace Archaeology (VOPA) project area, encompassing the center of Yalbac to the south, the pilgrimage destination of Cara Blanca to the north (owned by The Belize Maya Forest Trust as of late 2020) and rural areas in between that were home to farmsteads and elite residences, has recently been deforested for agricultural purposes exposing hundreds of mounds. Here we present the results of the 2022 VOPA salvage archaeology operations (excavations of 14 rural residences) in an area between Yalbac and Cara Blanca that yielded information on ancestral neighborhoods. One of the major benefits of this project is our contribution to recording ancestral Maya culture heritage one neighborhood at a time, which not only preserves their history, but also reveals lessons from the past. Even when Maya population peaked c. 600-800 CE in the Late Classic period, the Maya endured because of their diverse and sustainable practices.

Introduction

Gordon Willey and other pioneers of settlement archaeology followed more recently by LiDAR mapping have transformed Maya settlement studies. No method, however, can recover settlement data if history is being erased—as it is in various parts of Belize (Fedick 1996), including central Belize. After a destructive hurricane in 2010 and subsequent wildfires destroyed most hardwoods, Yalbac Ranch, a sustainable logging company, sold over 30,000 acres to the Spanish Lookout Community Corporation (SPLC) in 2014. SPLC has since clear-cut thousands of acres for agricultural purposes and continues to do so, including much of the Valley of Peace Archaeology (VOPA) project area encompassing the center of Yalbac to the south up to the pilgrimage destination of Cara Blanca to the north (owned by the Belize Maya Forest Trust as of late 2020), and rural areas in between. In the process, they have exposed hundreds of ancestral Maya farmsteads and elite residences with long occupation histories (c. 300 BCE-1100 CE) (Benson 2017). And since the Maya would ritually raze houses and rebuild in the same place about every 20 years and bury their deceased family members beneath house floors (Ashmore 1981), we lose 20 to 40 years of a family's history each time farmers plow. Our salvage operation is thus vital to collect as much information before additional history is erased.

One fact is clear. Even when Maya population peaked c. 600-800 CE in the Late Classic period, the Maya remained resilient because of their diverse and sustainable practices that did not result in extensive deforestation, as evident in their long occupation histories. In this paper we present the results of the first (2022) of three seasons of salvage archaeology in the VOPA area where we were able to excavate 14 ancestral Maya sites in three different areas or neighborhoods (MF1, MF5, and MF2).

2022 Salvage Operations

The sites selected for excavations over the three-year period (2022-2024) reflect the percentages of types surveyed in 2014 and 2016: 29% Type 1 (n=13); 41% Type 2 (n=19); 24% Type 3 (n=11); and 5% Type 4 (n=2) (Figure 1). As Table 1 shows, the site types are determined by size, construction materials, and layout. In 2022, we ran three concurrent salvage operations and excavated 14 of the 15 planned sites (Table 2).

Early on we realized that we could take the opportunity to excavate several structures of the same neighborhood or community. A neighborhood is defined as "a group of co-located residents with frequent, repeated face-to-face social interaction…of ~3-25 households (or under 500 people…)" (Thompson et al. 2022:6). That said, mounds still had to near roads so as not to interfere with growing crops.

Some mounds have become smaller since they were first classified in 2014 due to mechanized farming (Table 3). Given that ceramics dating up to 900 CE and arrow points dating to the Postclassic (c. 1100+CE) were recovered in 2016 (Benson 2017; Ferree and Benson 2017; Kosakowsky 2017), and that many

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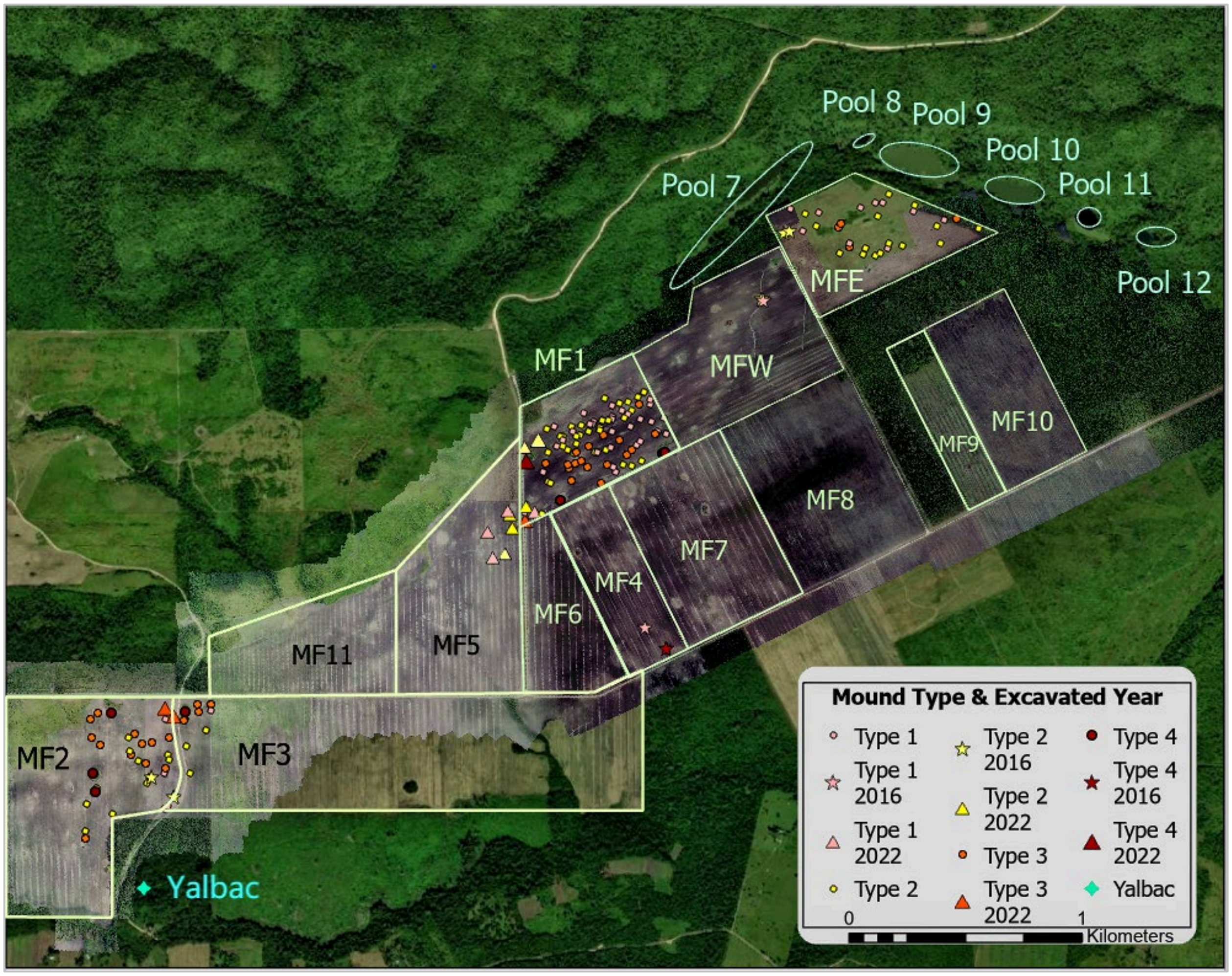

Figure 1. Drone and GIS Google with sites excavated in 2016 and 2022.

Table 1. Site types (revised from Benson 2015).

Type 1	Small, low scatters of cobbles, no cut stone; c. 0.5 m or less in height
Type 2	Mounds ranging from 0.5 to 1.5 m tall; cobbles, no obvious cut stone
Type 3	Mounds c. 1.5 m or taller; cut stone
Type 4	Large, multi-structure (3-4 structures) surrounding patio; similar to Type 3 but on raised platform

Table 2. 2022 excavated mounds.

	Type 1	**Type 2**	**Type 3**	**Type 4**	**Total**
Year 1- 2022	4	6	4	1	**15**
Achieved 2022	4	6	3	1	**14**

locations excavated in 2022 lacked a strong Terminal Classic component, we estimate that plowing has resulted in over 100 years of lost ancestral Maya history.

The land has been leveled by bulldozers with a giant chain attached between them (i.e., the chaining method), after which logs and debris were piled up and burned and then farmers

Table 3. 2022 excavated MF mounds, type, status, and occupation history

Site	Type/year classified	Current Type	Status	Occupation history
MF2-34	3/2022	3	Unplowed w/ piled flat boulders	Late Preclassic-Late Late Classic (300 BCE- post-700 CE)
MF2-35	3/2022	3	Unplowed w/ piled flat boulders	300 BCE- post-700 CE
MF1-1	3/2014	2	Plowed	300 BCE- post-700 CE
MF1-3	2/2014	2	Plowed	Late Preclassic-Terminal Classic (300 BCE-900 CE)
MF1-4	1/2014	1	Plowed	300 BCE- post-700 CE
MF1-22	4/2014	4	Unplowed	300 BCE-900 CE
MF1-86	2/2014	2 (barely)	Plowed	300 BCE- post-700 CE
MF1-92	2/2022	2 (barely)	Plowed	300 BCE-600 CE
MF5-1	2/2022	2	Plowed	300 BCE- 900 CE
MF5-2	2/2022	2 (barely)	Plowed	300 BCE- post-700 CE
MF5-3	1/2022	1	Plowed	300 BCE- post-700 CE
MF5-4	2/2022	2	Plowed	300BCE- post-700 CE
MF5-5	1/2022	1	Plowed	300 BCE- post-700 CE)
MF5-6	1/2022	1	Plowed	300 BCE- 900 CE

carried out heavy-duty mulcher crushing, spreading the remaining debris (see Brouwer Burg et al. 2016). Heavy machinery churned up soil, exposing and reconfiguring architectural features and artifacts.

We had to learn about plow archaeology and plow architecture (see Brouwer Burg et al. 2016)—roots, time, plowing (at least 20 cm deep), and the weight of the plow and other heavy machinery really churned up the sites. There was also lateral drag that spread out mounds that resulted in mixed deposits and mound shifting—for example, at MF5-2, a Type 2 site, we placed two trenches through what we thought was the mound center. As we excavated, we realized that the site center was several meters to the west. Plowing had transformed the mound's configuration. In another example, MF5-7 (not measured or excavated) has a 35.1 m plow drag. 'Below surface' measurements also took on an entirely new meaning—'below plowed surface' is more accurate. We also noted that farmers had sheared the edges of larger Type 3 mounds and Type 4 platforms.

Excavations

Excavations focused in three mound fields (MF1, MF2, and MF5) due to their proximity to each other and roads (see Figure 1). We also chose them because of their diversity in mound types. At each mound we usually excavated two c. 1 m-wide trenches, north-south and east-west through the center of each mound. We collected diagnostic ceramics (rims, flanges, bases, decorated sherds, etc.), obsidian, jade, fauna, and marine shell. We only counted and photographed chert flakes and cores, non-diagnostic body sherds and groundstone for grinding maize, after which we placed them in the backfill. We exposed six burials that date to c. 700-900 CE and removed all except Bu. 6 and part of Bu. 5 at MF1-22—a protected Type 4 site that is not in danger of being destroyed.

The earliest ceramics date to the Late Preclassic and Terminal Preclassic periods (Chicanel and Floral Park: 300 BCE to 250 CE). However, these earlier ceramics only appear in later mixed contexts, which may be the result of plowing in some cases. The first evidence of strong occupation occurs in the Early Classic (Tzakol: 250 CE) and continues uninterrupted through the Late Classic (Tepeu 1/Tiger Run) until sometime in the 9th century CE (Tepeu 2-3/Spanish Lookout 1-2). The Preclassic and Early Classic ceramics show linkages to the Petén, northern Belize and the Belize Valley, though by the Late Classic (post 700 CE) linkages to the Belize Valley appear stronger (Ball in Gifford 1976). Not all mounds have a strong Terminal Classic (Tepeu 3/Spanish Lookout 2) component, likely due to plowing.

MF1 excavations consisted of four Type 2 mounds, one Type 1 mound, and one Type 4 mound (see Table 3). MF1-1 (8.2 x 6.81 m, c. 1.46 m high), previously a Type 3 and now classified as a Type 2, showed several phases of architectural construction dating from 300 BCE to post-700 CE. We uncovered three identifiable plaster floors with small cobble fills (with artifacts) between them, an interior wall orienting east-west, a well-made, cut stone exterior wall orienting north-south, and lots of large boulders on the east exterior, suggesting fill for a large exterior platform. One of the top floors (c. 25 cm below ground surface) was initially not distinguishable from the surrounding matrix, though we did identify it in the profile. We found the cut stone interior wall when we followed out this first floor. Most of the artifacts are ceramic sherds, especially in the lower layers. From the topsoil, we noticed a greater variation in artifact types (e.g., flakes, cores, a broken biface, etc.).

MF1-3 (10.98 x 11 m, c. 1 m high) dates from c. 300 BCE-900 CE and did not appear to be as well-constructed as MF1-1. The cobble fill was much less uniform, and the walls and several plaster floors were much more degraded, less defined, and constructed with walls largely of uncut small and large boulders. Additionally, the artifacts were more varied and included several lithic tools, chert cores and flakes, some soft and sandy stones, and ceramic sherds. At c. 47 cm below the surface level on the south edge of the south trench, we came upon plastic wrapping and glass shards beneath what we thought was a floor or platform fill. This discovery made us reevaluate the extent of the damage caused by modern agricultural practices.

In contrast to the two previous mounds, MF1-4 (300 BCE to post-700 CE), a Type 1 mound (2.55 x 2.48 m, c. 0.10 m high), had less identifiable plaster floors and stone walls or features. The artifact density appeared to be higher, though we postulate that this could be due to their highly fragmentary nature and surface proximity as the result of plowing. Despite locating a single, degraded plaster floor, some cobble and pebble fill on what appears to be the exterior of the structure, and small burned patch of floor, we found no additional defining features like walls. It may be worth doing quantitative analyses as outlined in Thompson et al. (2022) to generate discussions about the spatial relationships between these structures. MF1-4 is close to the other two structures just described, but have no similar architectural features, which may indicate it served for storage, cooking, or some other non-residential function.

MF1-86 (barely a Type 2 at 5.4 x 5.7 m and 0.79 m high) and MF1-92 (also barely a Type 2 at 5.7 x 7.46 m and c. 0.67 m high) are probably the worst defined mounds and were severely damaged by mechanized farming. MF1-86 dates from c. 300 BCE to post-700 CE, and MF1-92 to c. 300 BCE to 600 CE. We collected an abundance of ceramics and other artifacts in deeply mixed contexts, but without any defining architectural features. This makes interpretation difficult, though their proximity to the Type 4 MF1-22 and other structures with more clearly defined architecture could suggest that these two mounds may have served as storage or kitchen structures. However, we did not find many faunal remains or other types of discarded material, so their use is currently unclear.

MF1-22 is the largest and most complex site we excavated, unsurprising since it is a Type 4 site—a platform (height, c. 0.57 m) on which the Maya built four structures (Figure 2). In the initial phases of excavation, we were only aware of three structures, but after a site visit from Josue Ramos, he informed us that there was a smaller fourth structure on the south side that had been bulldozed in the recent past. In addition to placing a center trench perpendicular to their length in each of the four structures (Strs. 1-4), we excavated a 2 x 1 m test unit in the plaza center for chronological purposes. We also noticed that there were steep slopes behind Strs. 2 and 3, perhaps exacerbated by plowing shearing off platform edges. Based on the diagnostic ceramics

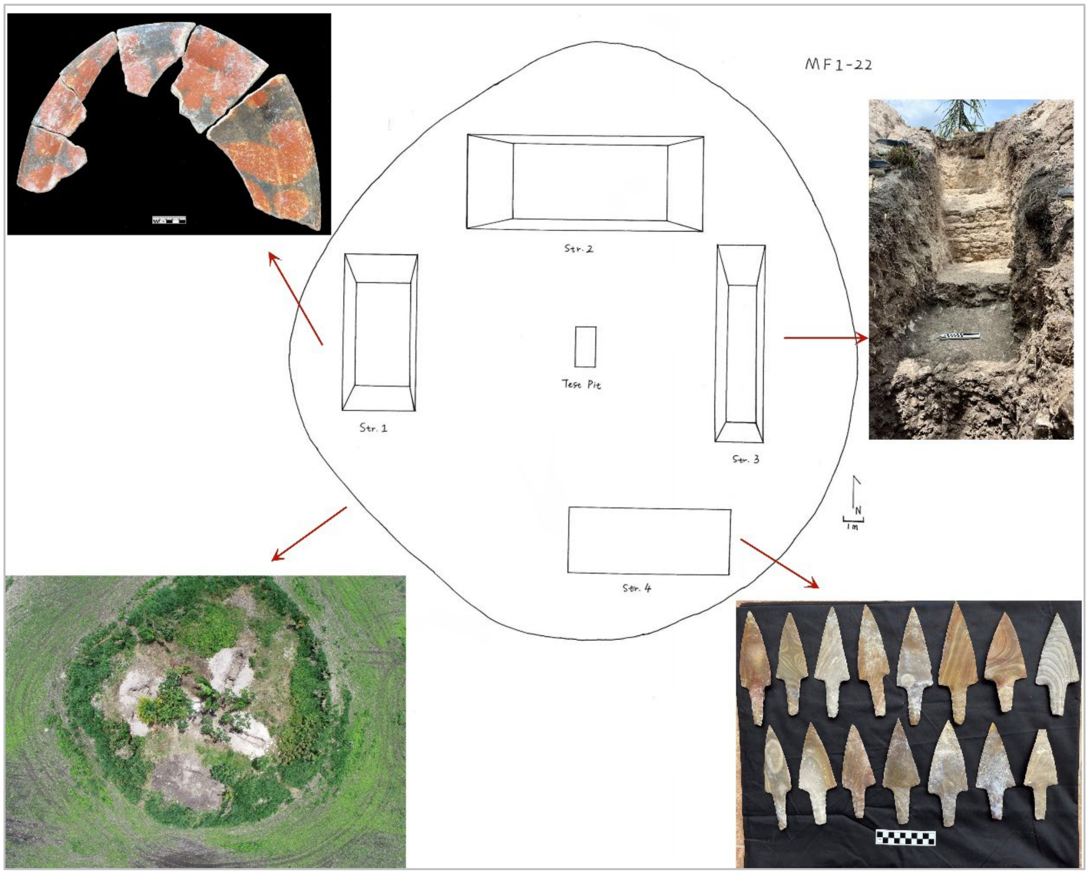

Figure 2. MF1-22 planview and drone photo, 'Daylight Orange' dish from Bu. 5 in Str. 1, Str. 3.

we recovered, the Maya occupied MF1-22 from c. 300 BCE to 900 CE.

Str. 1 (height, 1.16 m) is the next tallest after Str. 4 (height, 0.59 m) and sits on the west side of the platform. It appears to have an outset wall on the north and south edges, as well as a large ceramic deposit (over 300 sherds) on the exterior of the south outset wall. This dense concentration of sherds that covers the entire time range of occupation, and did not include complete vessels and may or may not have been purposeful. We excavated some of this ceramic deposit, but decided that since this site was protected, that we had no need to go any further. In the center of the structure we uncovered a burial (Bu. 5). The orientation of the individual was difficult to ascertain as the matrix was quite loose and defining the remains grew increasingly difficult the more we excavated. However, it did appear to be the best preserved of the burials we uncovered since we were able to see and recover smaller bones like phalanges and vertebrae. After removing a portion of the remains for analysis, we left the rest of the remains *in situ*. Associated with Bu. 5 is an almost complete Daylight Orange bowl.

Str. 2 (height, c. 1.97 m), which lies on the north side of the platform, had a series of floors and east-west walls that were uncovered along with what we think is a plastered bench near the bottom of the platform (c. 1.05 m below the surface) that appears to have been constructed before the walls. It continued to the south much farther than we had anticipated, and we were unable to determine its extent due to time constraints. Immediately below the bench lay another plaster floor (c. 1.18 m below surface), which we realized was probably an extension of the central plaza floor because of their similar color and texture. In the north wall profile on the trench, we noticed a plaster floor near the top and heavily degraded that we missed while excavating.

Str. 3 (height, c. 2.14 m) sits on the east side of the platform and is the tallest and best constructed. Strs. 3 and 2 are quite close to each other, and there may have been a covered walkway connecting them. There are minimally four plaster floors, as well as several walls of uniform cut stone. There were artifacts present within the structure fill, though nothing of note. At the trench bottom we recovered several small and currently unidentifiable faunal remains from the west wall.

Str. 4 on the south side of the platform, while barely perceptible on the surface, yielded the most unique deposits. On the north side we uncovered Bu. 6, which we ultimately decided to leave *in situ* for similar reasons to Bu. 5, though we did extract a few bone samples for isotopic analysis. Additionally, we recovered fifteen stemmed macroblades stacked on top of one another that essentially fell out of the south wall while excavating. They show no use wear and are made with fine chert; the Maya likely manufactured them specifically for caching. They did not appear to be associated with the burial, but we did find some fragmented faunal remains near the stemmed macroblades, which upon further analysis may end up being significant. On site, they appeared to be of to a large mammal, likely deer.

Finally, we excavated a 1 x 2 m test pit in the center of the MF1-22 plaza. The first floor we encountered was deeper than expected, suggesting that the bulldozer may have removed the most recent floor(s) and fills. Because this floor was so deep (c. 65 cm below surface), we decided to continue excavating a 1 x 1 m unit (north side) so we had some means of getting out of the test pit. Under the initial floor discovered, we found another floor 1.13 m below surface that had three replastering events in close sequence and with no fill between them (i.e., four floors starting at c. 1.13 m below surface). After the fourth replastering, we came upon a cobble fill with few artifacts and then what appeared to be topsoil c. 1.5 m below. After excavating into this 'topsoil' 15 cm without finding artifacts, we closed the plaza unit. The total depth of the plaza test pit was at 1.65 m below surface with ceramic dates ranging from c. 300 BCE to 900 CE.

The diversity in the construction of not only the four structures of MF1-22, but the other

Figure 3. Drone photo of MF5-1, 1 m scale north (right side)-south.

MF1 mounds, suggest that despite their geographic proximity, each of these households had differential access to or different preferences of construction materials, and different experiences in design and construction. The lack of uniformity across these structures paints a dynamic portrait of different lives in close proximity to both the pilgrimage destination of Cara Blanca and the urban center of Yalbac.

Separated from MF1 to the west by a 3 m wide dirt road is MF5 (see Figure 1). We excavated six mounds (three Type 1 and three Type 2) with four burials (see Table 3). The mounds in this area have been severely damaged by mechanized farming and upper architectural features have been destroyed. According to Google Earth, MF5 was still forested until 2017. MF5 mounds have not been mapped or classified in previous seasons, so we do not know their original dimensions and classification. However, on the 2018 Google Map, several mounds that no longer exist in 2022 appear to be Type 3. The soil of MF5 is black and clayey with poor drainage compared to the other fields. In general, there is a notable lack of architecture, which is more likely due to mechanized farming rather than natural formation processes.

MF5-1 (c. 8.35 x 10 m, .99 m high), a Type 2 mound, does not appear to be residential and dates from c. 300 BCE to 900 CE (Figure 3). It was exquisitely built with several well-made plaster floors and straight cut stone interior walls and rounded on the exterior. On the west side, we revealed two walls made of boulders separating an additional external "room" with a limestone cement and steps constructed of a row of three boulders oriented north-south. In addition, we collected several human skeletal fragments in the west interior wall but did not find additional remains below. The central room appears to be empty of features and is covered by a c. 4 x 4 m plaster floor rebuilt several times with only a few small sherds and chert chunks in the fill. On the south side, the Maya added two cobble walls to make the south corner more circular and included ceramics and lithics, including half of a hematite disk with a drilled center hole. On the north edge, a gibnut-sized animal bone was found. It is also worth noting that the soil of MF5-1 is consistent throughout: yellow (Munsell 10YR6/3), clean and loose—quite different from the black, MF5 clayey soil.

Based on its clean central room, its relatively few artifacts, its unique circularesque shape and pure yellow fill, we posit that MF5-1 served not as a typical residence but rather a public community center for ceremonies and other neighborhood events. The Maya likely used the west room with the most artifacts as storage for ceremonial paraphernalia.

To the north of MF5-1 c. 3.5 m distant is MF5-3, a Type 1 mound (c. 2.84 x 3.06 m, .20 m high), that dates from c. 300 BCE to 900 CE. Given its small size, we posit that MF5-3 did not serve as a residence, but rather an auxiliary structure for MF5-1. However, there was a noticeable number of artifacts on and near the surface. The non-plastered floor was compact and difficult to excavate, which may be the result of heavy-duty agricultural machinery. After removing the topsoil, which contained large amounts of household items and agricultural implements (e.g., ceramics, *manos* and *metates* fragments, bifaces, etc.), we exposed two burials, Bu. 1 in the south and Bu. 2 to the north.

Beneath two partial inverted ceramic bowls (one Rubber Camp Brown and the other Garbutt Creek Red), pebbles and freshwater shells in Bu. 1, we collected human skeletal remains oriented c. 20°. Exposed to plowing, the remains close to the surface were fragile and poorly preserved with barely identifiable parts. Based on the general layout of the human remains, we think Bu. 1 was of a flexed adult. Similarly, after removing several boulders in the north, we found a human tooth and several long bones (Bu. 2), followed by several obsidian blades. However, when we expanded excavations, we did not find additional human remains. We collected all human remains from both burials since they were at a risk of additional damage.

To the south of MF5-1 are two contemporary Type 2 (barely) mounds, MF5-2 (c. 5.64 x 4.25 m, .7 m high) and MF5-4 (c. 6.1 x 7 m, .5 m high). We exposed little obvious architecture at MF5-2—no walls or plaster floors despite using the same trenching techniques as the other structures. But we did recover a noticeable number of artifacts, including diagnostic ceramics that range from c. 300 BCE to 700 CE and lithics (e.g., a jade ax, chert hammerstones, bifaces, chert chunks and flakes, a chalcedony or alabaster fragment, etc.).

MF5-4 consists of a series of well-made plaster floors (the uppermost one was c. 5 cm thick) and linear exterior cobblestone walls including a double wall (a narrow porch?), also dating from c. 300 BCE to 700 CE. However, it has been severely altered by plowing: the original mound center was shifted further west over meter based on the layout and orientation of the plaster floor. Also, the exterior walls may have been shifted or damaged by plowing. On the south edge of the mound, we found several sherds from a highly eroded Portia Gouged Incised vessel (similar to Ahk'utu' molded-carved) with a human figure that mimics fine orange molded-carved ceramics from the Terminal Classic in the Petén (Ting 2018), as well as several marine shells.

While excavating below the top center lower plow fill and finding a green jade bead, we came upon a pale gray (Munsell 10YR3/2) plaster floor with a circular hole the Maya had cut to place a deceased individual (Bu. 3) that would have originally been in the center of the structure as far as we can tell (plow shifting resulted in Bu. 3's current location on the east side). Unlike the other burials, Bu. 3 was articulated and in good condition with few burial goods. This individual was placed on their left side, curled up with the right side of the body facing up (a flexed burial). The individual's hands appear to be tied behind their back. Due to time constraints, we only collected the exposed bones and a few teeth rather than expand excavations. We also collected two

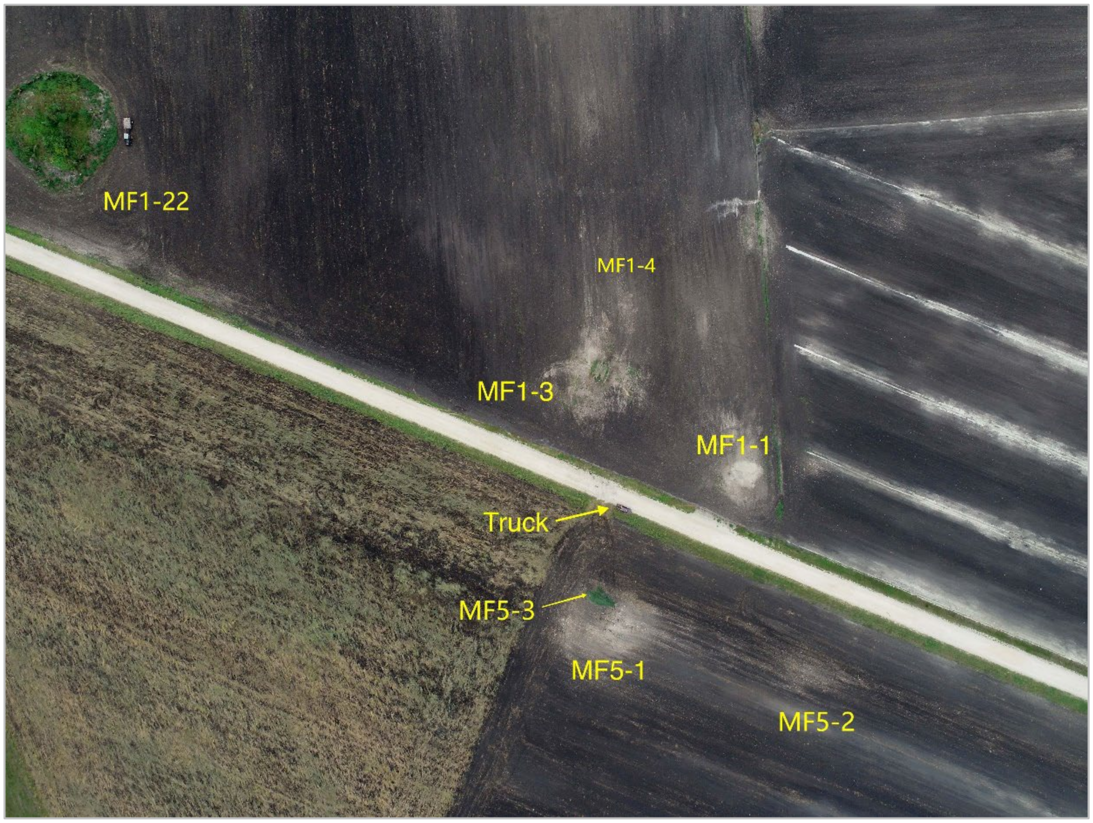

Figure 4. MF1 and MF5 'neighborhoods'.

Figure 5. Drone photo of MF2-24, MF2-34, MF2-35, MF2-36, and the cave system

bags of screened soils from Bu. 3 for paleobotanical and humic acid analysis.

MF5-5 and MF5-6 are both Type 1 mounds near MF5-4. They were both quite rocky, with pebble fills and a large number of ceramics and chert agricultural tools indicating that farmers had lived in them (i.e., farmsteads). We found few architectural features, likely because of plow damage, especially at MF5-6. At MF5-5 (c. 4.97 x 4.58 m, .05 m high), we exposed three plaster floors; the middle one was not clearly defined. After removing the top floor, we came upon a concentration of ceramics on the northwest side. In the north floor profile, we also found a few fragments of large mammal bones, possibly deer. The Maya cut a circular hole in the plaster floor and placed an adult person (Bu. 4) beneath the cobble fill above the third floor in the mound center. The skeleton is oriented c. 300° with the skull to the south. The individual is in a flexed position, on their back, with their legs curling up on the upper body. We collected the humerus, left and right radius and ulna, and the pelvis. Due to the poor preservation, the remainder of the skeleton was too fragile to remove. Although we excavated deeper near the skull and screened the soil, no teeth were found. We think the ceramic concentration was associated with Bu. 4, but was displaced by plowing. Diagnostic ceramics date MF5-5 from c. 300 BCE to 700 CE.

At MF5-6 (c. 3.49 x 4.24 m, .07 m high), in addition to ceramics, groundstone and chert lithics, we recovered four crystalized stones, likely from a cave or water system. According to a landowner of MF5, there is a spring nearby to the northwest. It reminded us of the dry, collapsed cave system we found in MF2 (see below), which could indicate interaction between these neighborhoods. Ceramics show that the ancestral Maya continuously resided at MF5-6 from c. 300 BCE to 900 CE.

MF5 mounds certainly beg the question as to whether the features we excavated were shaped intentionally by the ancestral Maya, damaged and shifted by modern agriculture, or a combination of the two.

A neighborhood or community is created when residential groups in close proximity establish social identities through kinship, religion, and administration and subsistence cooperation (Smith 2010; Thompson et al. 2022). The Maya may have conducted public rituals or administrative affairs at the possible community building (MF5-1) that connected local families in the area (Figure 4). Furthermore, MF5-1 and its neighboring sites (MF5-2, MF5-3, MF1-1, MF1-3) formed a "face-block," which can be defined as a "small neighborhood based on community layout where households facing each other across a street form a social unit" (Thompson et al. 2022:6).

While MF2 is further away from both MF1 and MF5 areas (see Figure 1), these mounds were chosen based on their type (Type 3), their proximity to the road, and their being unplowed. We were hoping to reveal a complete building construction history to compare to plowed mounds to see how much of the latter's history has been plowed away. We excavated portions of two mounds (MF2-34 and MF2-35), surface collected one (MF2-24), and also noted a collapsed cave system nearby (Figure 5).

Abutting the south side of MF2-34 (7.44 x 8.0 m, 2.3 m high) is a pile of large flat boulders. Farmers bulldozed them against the structure to clear the surrounding area for farming, which has slightly obscured the mound size and configuration making it appear larger (the dimensions do not include the boulder pile—they would add an additional 11 m to its north-south measurement). After removing the topsoil on to the mound summit, we revealed a massive flat stone similar to the stacked boulders, but much larger; in fact, the flat stone appeared to cover the entire summit (c. 4 x 4 m). Where necessary the Maya had added plaster c. 6-7 cm thick manufactured from tufa (10YR84) from the cave system to even out the surface—it could have served as another community building. Artifacts are predominantly ceramics, ranging from c. 300 BCE to 900 CE.

MF2-35 (3.69 x 8.8 m, 1.52 m high) has an odd shape—it almost looks like two mounds conjoined in the center. There is also boulder pile to the east (c. 3.46 x 4.43 m). We decided to excavate an east-west trench along the longest part of the mound to expose as many architectural features as possible. We came upon a wall almost immediately that was oriented north-south near the center of the structure that appeared to be placed haphazardly on top of a nicer wall oriented to the east-west. We also found an east-west 'path' that the Maya appeared to have cut through a plaster floor c. 50 cm below surface. Artifacts consisted primarily of ceramics that date from c. 300 BCE to 900 CE, some in clusters near the walls and above the floor.

Near to the collapsed cave system, the Maya built a Type 1 mound (MF2-36) beside and over one of the smaller cave entrances. We do not know its original size. We suspect that plowing and bulldozing caused the collapse of the surrounding area, including the cave system and what likely was a spring that is now dry. Most of the tufa and large flat boulders we found at MF2 sites likely came from this cave system.

Concluding Remarks

The fact that we still find so many mounds despite all the plowing is a testament to their longevity—and the positive relations the ancestral Maya had with their nonhuman neighbors—soils, water, forest, fauna, etc. The lack of any obvious agricultural features in drone images and from ground checking highlights two things: 1) there was plentiful fertile soils that did not require intensified agricultural strategies (e.g., ditches, terraces, etc.); and 2) the Maya maintained soil fertility through a different kind of collaboration than we see presently, which is not sustainable in the long run.

One of the major benefits of the VOPA salvage operation is our contribution to recording ancestral Maya culture heritage one neighborhood at a time, which not only preserves their history, but also reveals lessons from the past (see Coningham and Lucero 2021). The past embodies practices, challenges, strategies, successes, and failures from which to devise sustainable solutions to address current problems of, for example, deforestation (Lucero and Gonzalez Cruz 2020). Diversity is key, at all scales; thus, identifying and evaluating diverse strategies considering current and future needs are critical.

Ancestral settlements are at the mercy of looting, urban sprawl, and increasingly the need to feed growing populations by expanding agricultural fields and grazing lands (Fedick 1996). "The slash-and-burn cultivation practiced by most farmers in Belize does little damage to archaeological sites. In contrast, mechanical cultivation rapidly destroys the mounds that contain otherwise well-preserved remains…" (Fedick 1996:2). In the face of this growing threat, all we can do as archaeologists is to collect information as quickly and comprehensively as possible. Salvage archaeology programs will become increasingly critical in this endeavor. As Brouwer Burg and colleagues note (2016:21), that once mechanized machinery begins, "there is a limited window of 10-15 years for archaeological discovery, documentation, and investigation." Ironically, most non-Maya mechanized farmers only buy or lease land with lots of Maya mounds because they know that ancestral Maya were expert farmers who knew how to select the best soils for agriculture.

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25 THE BRITISH IN THE BAY: OCCUPATIONAL STRESS AND BIOLOGICAL DISPARITIES

Lauren C. Springs and James F. Garber

Bioarchaeological and paleodemographic analyses conducted at St. George's Caye have revealed diverse expressions of osteological stress among individuals interred in the island's colonial cemetery. Dental pathologies, skeletal infections, and traumas are particularly common among a subset of individuals that also displayed evidence of significant enthesopathy development. The combination of depressed health, numerous traumas, and entheseal stress has been documented in similar frequencies in other bioarchaeological studies of working class and enslaved cemeteries of the eighteenth and nineteenth centuries in North America. Previous historic and archaeological research on St. George's Caye has demonstrated that the island was populated by British colonists and free and enslaved people of African descent, and that the colonial population was primarily occupied with timber extraction economies during the eighteenth and nineteenth centuries. In this paper we explore how patterns of demographic structure, disease, and trauma found at St. George's Caye reflect participation in the logwood and mahogany economies in the Bay. We discuss how pathological variation within the cemetery may reflect patterns of social stratification and/or inequality that are prevalent in colonial discourses but have otherwise been absent from existing archaeological analyses at St. George's Caye.

Introduction

For the British hoping to gain a foothold in the Bay of Honduras during the 16th-18th centuries, piracy proved an effective method for disrupting Spanish economic and political ambitions in the Caribbean and Central America (Thomson, 2004). In the 17th century, a fledgling population of British colonists, or "Baymen", established a permanent occupation along contemporary Belize City's coastlines that became known simply as the "Settlement" or the "Bay Settlement". These colonists abandoned their privateering efforts and established settlements from which they could labor in the thriving timber industry (Campbell, 2003).

Located approximately nine miles northeast of the Belize City coast, the small island of St. George's Caye (SGC) was an early community of importance within the broader Bay Settlement. It was the location of the signing of Burnaby's Code and the famous Battle of St. George's Caye, which culminated in Spain abandoning it's efforts to maintain control over the settlement. A permanent British settlement was established on SGC as early as the 1670s (Thomson, 2004), and the island served as a main residential center and the seat of government for the Bay Settlement during the 18th century (Campbell, 2003; Thomson, 2004).

Although the early demographic make-up of SGC is largely unknown, community statistics began appearing in colonial documents in the mid-18th century. An island map dated to 1764 notes not only the presence of British families' homesteads, but also a plot of land on the northwestern margin of the caye described as "negro quarters" (Craig, 1969). At this time, there were at least 17 residences, a blacksmith's shop, and a gallows on the caye. Fifteen years later, a 1779 Spanish raid on the island documented the capture of nearly 300 settlers (101 whites, 40 people of 'mixed color', and approximately 250 slaves) who were imprisoned in Jamaica for three years before being allowed to return to the island (Gibbs, 1883; Thomson, 2004). An additional 50 white men and a few hundred slaves escaped captivity and fled to nearby Roatan. The island remained abandoned during the settlers' imprisonment in Jamaica, but upon release, it is believed that some of the prisoners returned to repopulate the island (Anon, 1829). Currently, SGC is sparsely populated but contains numerous summer homes, a resort, and a small historic cemetery located near the center of the caye. It is the oldest historic, non-Maya cemetery known in Belize (Campbell, 2003; Garber, 2010) and is believed to have housed the graves of some of the earliest and most influential European colonists in the Bay Settlement.

The St. George's Caye Archaeology Project

The cemetery at St. George's Caye largely fell out of use by the early 1900s, although it remained reasonably well maintained during this time. Few formal records of the cemetery's history have been located and almost all visible

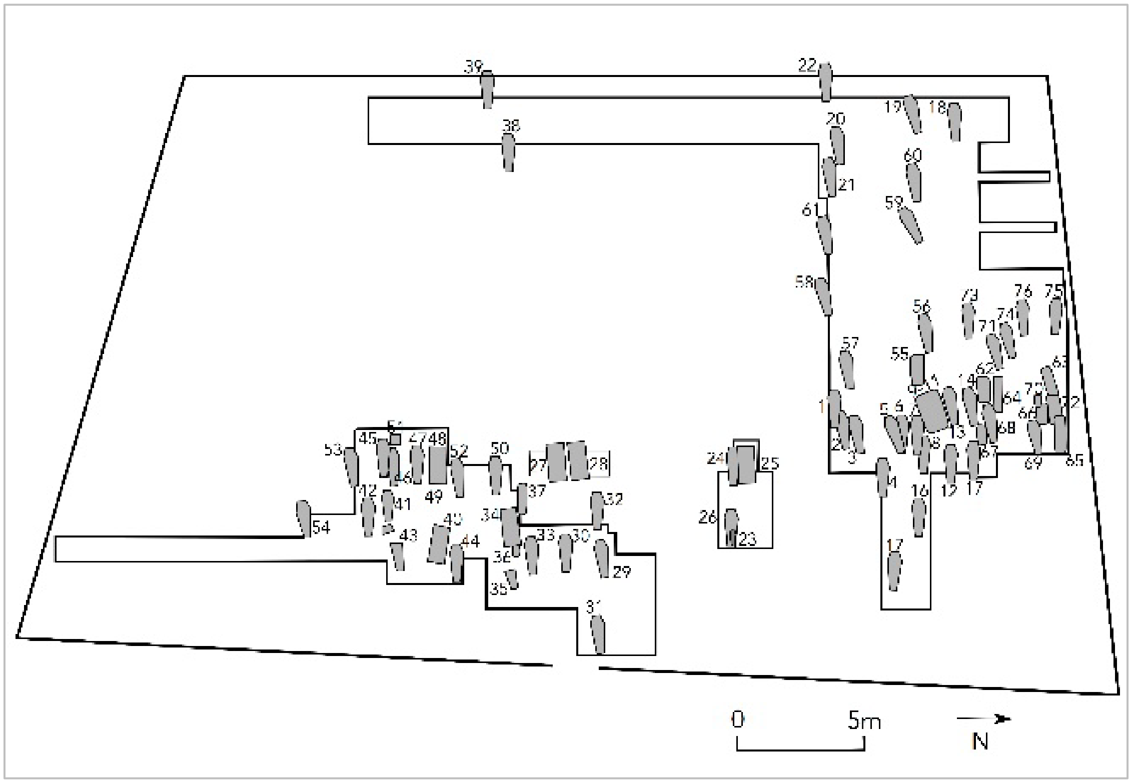

Figure 1. The cemetery at St. George's Caye showing the locations and positioning of burials recovered from 2010-2018.

signs of its existence have been obliterated by storm surges, vandalism, and the consequences of disuse (Garber, 2010). The St. George's Caye Archaeology Project (SGCAP) was initiated in 2009 to investigate the archaeological deposits left by the earliest members of the British colonial project at the Bay Settlement. A primary goal of the SGCAP was to document the current state of the cemetery and recover any archaeological assemblages located within its grounds. The stratigraphy of the cemetery has been heavily disturbed by storm surges, plant and animal activity, and human use. Crab burrows, root growth, and modern refuse were regularly encountered, and recovered cultural materials varied greatly in preservation due to the effects of a high and seasonally fluctuating water table. Throughout the cemetery, an assemblage of historic period artifacts has been recovered in a primarily diffuse deposit with few distinct concentrations and a small number of artifacts directly associated with individual burials. Artifacts chiefly consist of glassware, ceramic vessel fragments, ceramic pipe bowls and stems, metal fragments, coffin hardware, clothing buttons and animal bone.

Although few formal records of the cemetery exist, an 1872 map by Rob Hume documents the locations for twenty burials in the cemetery. Hume's map notes the surnames and partial given names for sixteen of the mapped burials. Additional information about the individual's names and dates of interment are known from epitaphs recorded in 1907 (Usher), and information about another nine burials were recorded by Gann (1926) and Check-Pennel (1989). These records indicate that the cemetery included burials of both foreign and locally born individuals, some of whom were directly involved in the mahogany trade, and most of whom were buried between 1787 and 1894. Local residents suggested that additional and earlier unmarked graves were also present within the cemetery walls, and this was confirmed during subsequent excavations. To date, a total of 76 burials have been identified. While a handful of individuals were buried in brick box tombs or stone sarcophagi, the majority were placed in hexagonal hardwood coffins, in supine position, and oriented with their feet to the east

(Figure 1). A subset of the mapped stone or brick burials overlap with the locations of coffin burials, which were found beneath the remains of the brick tombs. It is likely that the coffins were interred sometime in the 18th-19th centuries, after the island was heavily populated but before the installation of the brick and stone tombs. Very few personal possessions or grave goods were recovered and no observable patterns have emerged among the mapped or early coffin burials to suggest that individuals were buried according to differences in social status or cultural affiliation, although one familial group has been identified.

Bioarchaeological Findings

Osteological profiles

Seventy-six burials were located in the cemetery during the 2010-2018 field seasons. Skeletal preservation varied considerably, and in many cases precluded full osteological evaluations of age, sex, and pathology. From the 76 burials at SGC, partial osteodemographic data could be inferred for 52 individuals (see Table 1). Those excluded from these analyses were either located but unable to be excavated or lacked the degree of preservation required to complete osteological analysis.

Thirteen of the 52 individuals were adults of indeterminate age, and the remainder were grouped into the following age categories: infant (0-2 years), child (3-11 years), adolescent (12-19 years), young adult (20-34), middle adult (35-49), and older adult (50+). Excluding the thirteen adults of indeterminate age, those under 35 years of age made up almost one-half (n=19) of the burial population. Ten burials were of subadults, nine of young adults, 18 of middle adults, and two of older adults. Of the 42 adults in the burial population, skeletal sex was determined for 37 individuals, while the remaining five lacked sexually diagnostic features. A total of eight females and 29 males were observed.

Activity markers

Schmorl's nodes, degenerative joint changes, and osseous development at humeral entheseal sites (where tendons or ligaments attach to bone) were commonly encountered. We scored the development of entheseal lesions for 31 individuals over age 12 to infer activity patterns in the population. Sites located on the shaft of the humerus were best preserved while proximal entheseal sites were frequently damaged or unobservable. As a result, only entheseal sites located on the shaft and distal portion of the humerus are reported in this paper. Seventy-seven percent (n=24) of individuals had at least one well-developed humeral enthesopathy. This includes 18 adult males, two adult females, one adult of unknown sex, and four adolescents. Spinal joint pathologies, which can form as a result of mechanical loading stress, were also prevalent. Forty percent of individuals aged 12 and above were affected by at least one form of joint pathology. Spinal osteophytosis was observed in 10 individuals, Schmorl's nodes in seven, and two individuals were affected by both. Joint pathologies most frequently occurred in males and among individuals with humeral enthesopathies.

Disease and pathology

Numerous dental and skeletal pathologies, including caries, antemortem tooth loss, linear enamel hypoplasia (LEH), periostitis, porotic hyperostosis (PH), and trauma were identified. Thirty-eight individuals at SGC were recovered with permanent dentition, but due to a high degree of postmortem tooth loss there are significant gaps in the reported data. Not a single individual was recovered with their full set of dentition, and approximately one third (n=13) retained less than half of their dental arcade. Nonetheless, 89% (n=34) of individuals had at least one visible dental pathology, and the majority had multiple carious lesions and/or experienced antemortem tooth loss. Over half (n=22) had one or more visible LEH.

Nonspecific periostitis—an inflammatory condition often used as an indicator of generalized infectious disease (Ortner, 2003)—occurred in 33% (n=17) of the burial population. Porotic hyperostosis, which can indicate periods of stress experienced during childhood, was observed in 15 individuals. Other disease pathologies identified in the population include one probable case of osteomyelitis, three probable cases of rickets, and one case of otitis media.

Table 1: Osteodemographic Data. Abbreviations: LEH-linear enamel hypoplasia, CAR-caries, ATL-antemortem tooth loss, PER-periostitis, PH- porotic hyperostosis, DIS-other disease, ENT-enthesopathy, SCH-schmorl's nodes, JPS/O- joint pathology spinal/other, TR-trauma.

Burial	*Sex*	*Age Group*	*Pathologies*	
			Dental	*Skeletal*
1	M	Young Adult	LEH, ATL	
2	M	Middle Adult	N/A	ENT
3	M	Older Adult	CAR, LEH, ATL	PH, ENT, TR
5	M	Adult	CAR, ATL	DIS, ENT, SCH
6	M	Young Adult	CAR, LEH, ATL	PH, PER, ENT, SCH
7	-	Adolescent	CAR, LEH	ENT, TR
8	M	Adult	N/A	SCH
9	M	Young Adult	CAR, LEH	
10	M	Adult	CAR, LEH, ATL	PER, DIS
11.1	M	Adult	N/A	PH
11.2	F	Adult	LEH	PH
13	F	Middle Adult	CAR, LEH, ATL	ENT, JPS
14	-	Adolescent	LEH, ATL	ENT
16	M	Middle Adult	CAR, LEH, ATL	
17	M	Young Adult	CAR, LEH, ATL	ENT
18	M	Young Adult	CAR, LEH	PH, ENT, JPS
19	M	Young Adult	CAR	
20	F	Adult	ATL	ENT, JPS, JPO
21	M	Middle Adult	ATL	PH, ENT, JPS, JPO
23	-	Child		
26	F	Adult		PH
29	M	Middle Adult	CAR, ATL	PER, ENT, JPS, JPO, TR
30	M	Middle Adult	CAR, LEH, ATL	PER, ENT, SCH, JPS, TR
31	U	Middle Adult	CAR, LEH, ATL	PER, DIS, ENT, JPO, TR
33	M	Middle Adult	CAR	PER, ENT
41	-	Child		PER
42	M	Adult	ATL	
43	-	Adolescent		
44	M	Adult	N/A	PER
45	M	Middle Adult	N/A	PH, PER
46	-	Adolescent	ATL	PH, PER, ENT, SCH, TR
47	F	Young Adult	CAR, LEH, ATL	
48	F	Adult	N/A	
49	-	Infant		
50	M	Young Adult	N/A	JPS
52	F	Middle Adult	N/A	
55	M	Middle Adult	CAR, LEH, ATL	DIS, ENT, JPS, TR
56	-	Adolescent	CAR, LEH	
57	M	Middle Adult	CAR	PER, ENT, JPS
59	M	Middle Adult	CAR	PH, PER, ENT, JPS
60	M	Older Adult		PH, PER, ENT, JPS, JPO, TR
62	U	Adult	N/A	
63	M	Middle Adult	CAR, LEH, ATL	PH, ENT, SCH, JPS, JPO
64	M	Young Adult	CAR, LEH	PH, PER, ENT, SCH, TR
65	U	Middle Adult	CAR, LEH	PER, SCH
66	U	Middle Adult		PH, PER, TR
68	M	Middle Adult	CAR, ATL	PER
69	M	Adult	LEH, ATL	ENT, SCH, JPO, TR
70	-	Infant		DIS
15.1/67.1	-	Adolescent	CAR, LEH	ENT
15.2/67.2	F	Middle Adult	ATL	PH
15.3/67.3	U	Adult	N/A	

In addition to common diseases, twenty-one percent of the adult population (n=9) experienced significant skeletal trauma. All skeletal fractures were healed or healing at the time of death, and therefore were not the immediate cause of death. Two subadults, both estimated to be in their late teens, also suffered from healed antemortem fractures. Four of the adults and one adolescent experienced multiple trauma and excluding individuals of unknown sex, traumatic injuries were found exclusively in males.

Individual relative risks for non-dental pathologies varied across demographic groups and activity levels (as inferred by well-developed entheseal lesions). Among demographic cohorts, adults and males seemed to be more likely than subadults and females to have skeletal pathologies. Specifically, adults were more than twice as likely to have joint pathologies than subadults. However, there were no statistically significant differences between age groups for joint pathologies or any other combination of pathological outcomes (see Table 2). Among sex cohorts, although males experienced higher proportions of pathological stress than females in every category, they were not significantly more likely than females to have experienced any form of pathological insult. In activity cohorts, individuals with enthesopathies and/or joint degeneration were significantly more likely to suffer from additional activity-related strain as well other pathological conditions (see Tables 3 & 4).

Colonial Demography and Health

As a principal settlement of the Baymen, the demographic makeup of the SGC population should be somewhat consistent with that of the broader Bay Settlement and other nearby British colonies. Demographic insights gained from the osteological analysis at SGC are important because the histories of the Baymen that have been uncovered in the personal accounts of merchants and explorers (Henderson, 1809; Uring, 1726) often failed to include precise estimates of the population's size and demography. The earliest records of the composition of the Bay Settlement come from colonial archives, having been formally reported in census records beginning in 1790. According to this inaugural census, adult males outnumbered females two to one in the Bay Settlement (Belize Archives and Records) and made up approximately half of the total population at the close of the eighteenth century. This pattern has been reflected in other British colonies in the West Indies as well (Ward, 1998) and appears relatively constant across economic and racial lines.

Similarly, the sex ratio of the burial population at SGC was heavily biased towards males, who made up 56% of the total population (including subadults) and 78% of the adult population of known osteological sex. The group was relatively young, with 37% of the total population having an estimated age-at-death of under 35 years. A colonial populace composed mainly of young males might reflect initial British colonization efforts, which disproportionately featured influxes of single men who migrated to the Caribbean and Central America in search of economic opportunity (Pooley and Turnbull, 2003). In addition, the importation of enslaved laborers would have undoubtedly increased the number of young men in the settlement as shipping manifests and West Indian market records show that larger numbers of enslaved males than females or children were brought to the British Caribbean, particularly in the 18th century (Eltis and Engerman, 1992). Although it is unknown whether the individuals in this study were free, enslaved, or a combination of the two, similar age and sex ratios reported in historical sources indicate that it is a representative sample for the larger Bay population.

Osteological indications of adult health and disease at SGC are also consistent with those found in other nearby British colonies. As previously reported, frequencies of common dental pathologies (i.e. caries and tooth loss) were high but not significantly different from those in contemporaneous burial assemblages from Europe and North America (WORD database; Cowie et al., 2008; Blakey and Rankin-Hill, 2009; Fleskes et al., 2021). The frequent occurrence of caries and tooth loss could have resulted from poor access to oral healthcare or a highly cariogenic diet that emphasized the consumption of sugars and starches. In the case of the colonists at the Bay of Honduras, both

Table 2. Risk of Pathologies by Age and Sex Cohorts. RR: relative risk of adults or males having a condition relative to subadults or females, respectively. *Statistically significant at p=0.05 (two-tailed Fisher's exact test).

	Age			*Sex*		
Condition	*Subadult*	*Adult*	*RR*	*Female*	*Male*	*RR*
Any activity marker	40%	55%	1.20	25%	66%	1.97
Enthesopathy	80%	77%	0.92	50%	81%	1.35
Joint change	10%	45%	2.49	25%	52%	1.55
Pathology or trauma	40%	62%	1.36	38%	69%	1.55
Pathology	30%	60%	1.64	38%	66%	1.67
Trauma	20%	21%	0.79	0%	24%	2.17
Any condition	60%	76%	1.20	63%	83%	1.24

Table 3. Risk of Pathologies by Activity Markers Cohorts. RR: relative risk of individuals with activity markers having a condition relative to those without. YIndividuals for whom entheseal presence could not be assessed were excluded from this cohort. *Statistically significant at p=0.05 (two-tailed Fisher's exact test).

	Enthesopathy[Y]			*Joint Pathology*		
Condition	*Absent*	*Present*	*RR*	*Absent*	*Present*	*RR*
Enthesopathy	-	-	-	50%	100%	1.88*
Joint change	0%	71%	5.67*	-	-	-
Pathology or trauma	14%	75%	3.00*	43%	80%	1.78*
Pathology	14%	67%	2.67	39%	75%	1.81*
Trauma	0%	42%	3.33	11%	40%	2.90*
Any condition	14%	88%	3.50*	57%	90%	1.54*

Table 4. Risk of Pathologies by Combined Activity CohortY RR: relative risk of individuals with both activity markers having a condition relative to those without. YIndividuals for whom entheseal presence could not be assessed were excluded from this cohort. *Statistically significant at p=0.05 (two-tailed Fisher's exact test).

	Enthesopathy + Joint Pathology		
Condition	*Absent*	*Present*	*RR*
Pathology or Trauma	21%	88%	2.65*
Pathology	21%	82%	3.09*
Trauma	14%	47%	2.35

likely played a role. Historical accounts of buccaneer camps and logwood settlements suggest the settlers relied heavily on imported foods from Europe—such as flour and salted meats (Dampier, 1937; Wilk, 2006)—and that their diets were supplemented with local game and illegally farmed provision crops like yams, sweet potato, and plantains (Dampier, 1729; Wilk, 2006). The consumption of rum punch, a favorite drink of the Baymen (Uring, 1726), would have undoubtedly contributed to instances of poor oral health as well.

Diseases of childhood, as evidenced by the frequent observation of LEH and PH, were another common feature of the population. Over half (n=22) of those with observable permanent dentition had at least one visible LEH. PH was also common and affected 15 of the 41 individuals for whom it could be assessed. For the 43 individuals for whom the presence of either LEH or PH could be evaluated, 72%

(n=31) exhibited at least one of these pathologies and 14% (n=6) exhibited both. Three probable cases of rickets, which usually develops in childhood as a result of vitamin D deficiency (Ortner, 2003), were also identified among those with other indicators of childhood disease. Because it is unclear whether or not the individuals interred in the cemetery grew up locally or abroad, it is impossible to say whether or not childhood pathologies were a direct result of the Bay environment. What is clear is that the majority of the Baymen living at SGC during the 18th century experienced enough significant health stress during their formative years that it left impressions on their bones.

Resource Extraction and Accumulated Life Stress

From the 31 individuals whose entheseal sites were evaluated, we identified a pattern of activity-related stress among a subset of the settlers at SGC. Over three-quarters of the Baymen exhibited joint pathologies and/or entheseal changes consistent with strenuous labor, while the remaining quarter showed very few signs of physical stress (see Table 3). We suggest that the pattern of exaggerated entheseal development and joint degradation in the majority of the population at SGC is a reflection of settler participation in logwood and mahogany extraction economies.

Although joint degeneration and enthesopathies often occur as a result of mechanical loading stress, they are also known to increase with age due normal wear and tear to the skeleton (Aufderheide, A.C. Rodríguez-Martín, 1998; Cardoso and Henderson, 2010). As such, it has been argued that researchers have sometimes over-interpreted the presence of these markers without proper consideration of age-related causal factors. However, following Kelley and Angel (1987) and Wilczek et al. (2009), we contend that when moderate to severe enthesopathies and joint pathologies accumulate in younger individuals, it indicates that they were being incorporated into the adult labor force early in life. We therefore suggest that the patterns of joint degeneration and entheseal stress present at SGC reflect not only the repeated use of muscle groups utilized in logwood and mahogany extraction, but also the presence of chronic bodily strain from significant manual labor among individuals aged 12-19 years.

Timber extraction in the Bay of Honduras was grueling work and undoubtedly took a physical toll on its laborers. Logwood stands in the Bay Settlement were located along inhospitable and swampy riverbanks where the trees rose 15 to 20 feet in height, with trunk widths up to one foot in thickness (Camille, 1996; Kahr et al., 1998). During the dry season, logwood works were scouted and temporary camps built for small crews of men who would fell and prepare timber for export (Dampier, 1729; Gibbs, 1883). After felling, the logwood was ‘chipped’ to remove the bark and sap, cut to the most convenient size for transportation (Uring, 1726; Dampier, 1729; Gibbs, 1883), and dragged to the nearest riverway or heaped into a pile for later retrieval. Once the rainy season began, the Baymen traveled in small dories to the collections of felled logwood, where it would be gathered and floated downriver for export. As coastal logwood works were depleted and the Baymen were forced further inland for timber, additional laborers were needed to fell and transport logwood across increasingly large distances (Joseph, 1974).

Subsequently, the shift to mahogany extraction became even more strenuous owing to the large size and sparse distribution of mahogany trees. Often requiring groups of up to fifty men (Gibbs, 1883; Camille, 2000), the process of extraction began with a ‘hunter’ cutting through the bush for several days to select a suitable region of the surrounding forest in which to situate a work. After establishing a camp for lodging and stores, tracts of land were cleared for each mahogany tree to be extracted and transported back to the main work (Gibbs, 1883; Morris, 1883). At each mahogany site, axe-men constructed raised platforms, known as a ‘barbeques’, from which they would fell the tree. Branches and trunks were reduced at the felling site and logs were then hauled back to the works for squaring and preparation for the market. Until the introduction of oxen at the start of the 19th century, mahogany cutters hauled the timber to camp themselves by rolling the logs or sliding them over skids along cleared pathways, sometimes having to transport the logs up to one mile in distance (Camille, 2000). Similarly to logwood, the mahogany logs remained at the camp until the rainy season flooded the rivers, when the timber was floated downstream and caught with a large chain, or 'boom', sorted by the owners, and finally exported abroad. For Baymen clearing brush, felling trees, and manually transporting timber to the shore for export, labor-induced skeletal injury was a part of daily life. Spinal degeneration and entheseal hypertrophy of the upper limb would be expected and frequent.

The most commonly affected entheseal sites at SGC were those associated with the pectoralis major, teres major, and the deltoideus muscles. Functionally, all three muscles work to extend and medially rotate the humerus. In addition, the teres major is used in humeral adduction, the pectoralis major in adduction and flexion, and the deltoideus in abduction, flexion, and external rotation. As a group, these muscles are used in many activities dependent on the upper limb, including climbing, swimming, throwing, and wielding an axe. The development of entheseal changes along these attachment sites has been associated with habitual rowing and kayaking in coastal populations (Hawkey and Merbs, 1995) and has also been proposed as a consequence of enslavement and heavy lifting associated with manual labor (Kelley & Angel, 1987).

Younger individuals were not exempt from these stressors. By the early 1800s, most enslaved male children who had reached ten years of age in the greater Bay Settlement were already conscripted into logwood and mahogany workforces (Bolland, 1994). In the cemetery at SGC, 80% of 12-19 year olds exhibited moderate to severe hypertrophy and/or stress lesions on their humeri. One of these individuals additionally suffered from multiple herniated discs in their spinal column. While we do not have data confirming the presence or absence of enslaved individuals buried in the cemetery at SGC, we can confirm with skeletal analysis that young individuals in the community were consistently engaging in physically demanding activities.

The co-occurrence of activity-related pathologies is clearly visible at SGC. Individuals who scored positive for enthesopathy development were almost six times as likely to have been affected by joint osteophytosis, eburnation, or schmorl's nodes. The correlation of these pathologies is particularly evident when considering that among those assessed for entheseal development, *every* individual who showed signs of joint degeneration also had at least one moderate to severe humeral enthesopathy.

The settlers affected by activity-related pathologies also suffered disproportionate amounts of pathological and traumatic insults relative to their peers. These individuals were more likely to exhibit skeletal markers of disease and trauma. For example, if an individual at SGC suffered from enthesopathies, joint pathologies, or both, they were between ~1.75 and 3x more likely to have suffered from additional disease and/or trauma. Two of three suspected cases of rickets were identified among this subgroup, as were eight of 11 cases of trauma.

It is difficult if not impossible to determine the exact cause of ancient traumas, and most fracture injuries are the result of accident instead of intentional violence (Lovell, 1997). However, injury recidivism and cranial traumas are often strong indicators of interpersonal violence (Walker, 1989; Martin and Harrod, 2015) and trauma to the hands and posterior ribs have also been implicated in cases of assault (Lovell, 1997). In this study, seven individuals exhibited trauma(s) consistent with interpersonal violence, and six of the seven have been identified as likely participants in the timber industry or another form of heavy manual labor.

The strenuous working conditions, rough terrain, and challenging climate of the Bay Settlement undeniably impacted the health and physical bodies of laborers in the logwood and mahogany industries, and it is likely that many of those buried at SGC carried the accumulated burden of this colonial legacy with them into death. As an example, one individual (who can be considered typical for those interred in the cemetery) had multiple skeletal indicators of lived stress. Like many individuals in the SGC cemetery, this person was most likely a male aged between 35 and 50 years at the time of death. They exhibited strong enthesopathies, where marked skeletal deposition and stress lesions at the insertion sites for the deltoid, pectoralis major, and latissimus dorsi indicate that they spent considerable time engaging their upper body. They suffered from multiple joint pathologies, including schmorl's nodes and vertebral osteophytosis, which can result from mechanical stresses as well as age-related factors. Their right clavicle was malformed and the shaft significantly thickened as the result of a healed antemortem fracture. In addition, generalized periosteal reactions were visible on their femora, tibiae, and left radius. They had numerous dental pathologies, including five visible caries, two LEH, and at least two instances of antemortem tooth loss with accompanying alveolar resorption. Thus, in addition to the skeletal evidence of strenuous labor, this individual was clearly affected by physical trauma (whether intentional or accidental) and experienced numerous periosteal reactions and dental pathologies that are commonplace in other colonial burial populations suffering from chronic stresses such as poor nutrition, inadequate healthcare, and enslavement.

This analysis has shown how economic practices associated with British colonization at SGC shaped the bodies of individuals interred in the cemetery. The patterns of musculoskeletal stress and joint degradation observed in a subset of the cemetery population are consistent with heavy labor and have been documented in other bioarchaeological studies of enslaved and working-class cemeteries. In addition, the individuals whose labor patterns are written in their bones appear to have disproportionately suffered from traumatic injuries and experienced depressed levels of health when compared to their contemporaries in the settlement. Individuals in the SGC cemetery can therefore be parsed into two subsets: a large contingent with visible links to heavy labor and depressed health, and a small subset of individuals without these markers. The pattern of biological differentiation within the cemetery may be reflective of the economic and/or social stratification of the greater colonial population, as one might expect in a settlement with a majority working class or enslaved population and a local ruling elite.

Paradoxically, there is no evidence of geographical stratification or differential burial treatment that would suggest individuals interred in the cemetery at SGC belonged to distinct cultural, social, or economic groups. Thus, in this remote outpost on the frontier of British expansion, although inequality was not made visible through material culture or funerary practices, it is evident in the bodies of the colonial residents themselves. This study therefore offers an important illustration of one way that bioarchaeological analyses can be used as a means of elucidating difference and power when the usual material trappings remain silent.

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26 ANCIENT MAYA ARCHAEOLOGY OF THE MOUNTAIN PINE RIDGE FOREST RESERVE

Jon Spenard, Michael Mirro, and Javier Mai

The Mountain Pine Ridge Forest Reserve is renowned for its natural beauty, but few ancient Maya archaeological sites have ever been recorded there. The paucity of known monumental centers has resulted in it receiving little archaeological attention and an overall view that it is largely devoid of cultural heritage. Yet, the region has long been regarded as the primary source of vital raw materials for the ancient Maya, such as granitic rock for grinding stones. Contrary to the commonly held view that the reserve is a vacant archaeological landscape, recent research by the Rio Frio Regional Archaeological Project is revealing the Mountain Pine Ridge Forest Reserve is a region is rich with a variety of types of archaeological sites, many unique to it. Here we report on the newly documented monumental center of Nohoch Batsó, and the Buffalo Hill Quarries, an industrial-scale multicomponent granitic rock quarry and ground stone implement workshop, the first of its kind ever recorded in the Maya Lowlands.

Introduction

Figure 1. Satellite image of central and southern Belize showing locations of known centers, including those mentioned in the text. The orange polygon indicates the RiFRAP permit concession area.

The Mountain Pine Ridge Forest Reserve is celebrated in Belize for its unique natural beauty–stunning waterfalls, relaxing pools, and easy to access caves–but it is considered a region with limited cultural heritage. In fact, when reviewing maps of known archaeological sites in central Belize, it appears largely vacant except for one unstudied site, a few caves and a possible shrine, seeming to affirm a minimal ancient Maya presence (Figure 1). Yet, it has long been regarded by archaeologists as a primary source of vital resources for ancient Maya life including pine trees, game animals, and an array of mineral resources, particularly slate, shale, and granitic rock for making *manos, metates*, and other ground stone implements (Graham 1987; Healy et al. 1995; Lentz et al. 2005; Morehart 2011; Parker and Spenard 2020). Recent research by our Rio Frio Regional Archaeological Project (RiFRAP) reveal that the Mountain Pine Ridge Forest Reserve was far from a culturally barren landscape; instead, it is a distinct archaeological region rich with a wide array of site types, many unique to it. In this paper, we describe for the first time two previously unrecorded ancient Maya sites in the Mountain Pine Ridge Forest Reserve. One is Nohoch Batsó, a Classic period center. The other is the Buffalo Hill Quarries, an extensive, industrial-scale, multicomponent ancient Maya granitic rock quarry and ground stone implement workshop site, a type of site heretofore previously undocumented anywhere in the ancient Maya world.

Environmental and Cultural Overview

A description of the surface geology of the Mountain Pine Ridge Forest Reserve is necessary for understanding the variety of types of archaeological sites found there. The following geological description is summarized from Bateson and Hall (1977), Martens and colleagues (2010), Shipley and Graham (1987), and Weyl (1980), and personal observation.

There are three distinct surface geological regions in the Mountain Pine Ridge Forest Reserve. At the center is its namesake, the Mountain Pine Ridge, one of three granite-bearing regions in the Maya Mountains. Those sources are the only granitic rocks known in the

Maya Lowlands. As a point of clarity, we use the abbreviation "MPR" to refer specifically to that geographic region, whereas "reserve" refers to the designated lands managed today by the Forest Department. Along the western boundary of the reserve, the granites are overlain with residual cave-filled limestone hills that have been separated from their parent Vaca Plateau by the Macal River. The north, south, and east sides of the reserve are defined by the Santa Rosa Group, a geological conglomerate of hard sandstone, quartz, phyllite, and other contact-metamorphic sediments. We have yet to conduct any research in the Santa Rosa Group areas, and for that reason, we continue only with a discussion of the former two regions.

The geology of the two regions under investigation create distinct biomes leading to their differential use by the ancient Maya. The limestone areas are covered in nutrient rich soil from which broad-leaf forests grow. Such areas are good for agriculture, and it is in them that most ancient Maya settlements were founded throughout the lowlands (Fedick 1995). Before we located Nohoch Batsó, Mahogany was the only recorded ancient settlement in the limestone areas of the reserve, but it remains unmapped and unstudied (Moyes et al. 2017). Other nearby Classic period centers outside of the reserve include Caledonia (Awe 1985; Healy et al. 1998), Minanha (Iannone 2001, 2005), Pacbitun (Healy 1990; Powis et al. 2017), and Ramonal (Awe et al. 2005). Caledonia and Ramonal are situated directly adjacent to the Macal River to the south of the reserve, but on the opposite bank. The extensive Caracol road network also extends to near the southern banks of the Macal River suggesting economic interest in the resources of the reserve from that site (Chase et al. 2014). Minanha and Pacbitun are the nearest major population centers to the west and north respectively. Several Maya ritual cave sites have also been recorded in the limestone hills, and ceramic styles suggest that most ceremonial activity took place in them during the Late Classic period (Mason 1928; Mirro and Spenard 2018; Moyes et al. 2017; Pendergast 1970; Spenard and Mirro 2020).

The MPR granites erode into acidic, nutrient-leached soils from which grows an open, pine-scrub-savanna that stands in stark contrast to the closed canopy broad-leaf forest of the limestone regions. Ancient Maya settlements have yet to be recorded in the MPR, likely due to the very poor quality of the soils, but Bullard (1963) documented a possible shrine site associated with a granite outcrop near the Rio On. Although the site was not excavated, ancient Maya ceramics and an obsidian blade fragment were collected from it, revealing its antiquity. Wright and colleagues (1959:113) note rectangular pits in granitic rock in the MPR that they propose may be where the ancient Maya quarried slabs of stone to make metates. Unfortunately, the locations of the pits are not given, and they have never been investigated archaeologically.

Several sourcing studies on ground stone objects from Maya centers throughout Belize and Guatemala reveal the MPR granites were the preferred raw material source over the other two outcrops (Abramiuk and Meurer 2006; Brouwer Burg et al. 2021; Halperin et al. 2020; Shipley and Graham 1987; Tibbits 2016, 2020; Tibbits et al. 2022). In Belize, MPR granites dominate assemblages from all the sites that have been tested, except for Alabama in the Stann Creek District. There the local granite was preferred, but some material from the MPR was also identified. As far north as La Milpa and Dos Hombres, MPR-sourced materials account for the entire collection of granitic objects, although locally available rock was preferred overall for making ground stone implements. In Guatemala, ground stone implements made from MPR granites have been reported from Seibal, Tikal, Uaxactun, and Ucanal (Halperin et al. 2020; Moholy-Nagy 2003; Shipley and Graham 1987). As with the northern Belize sites, the artifacts from the Guatemalan centers were made from a variety of materials overall, but when made from granitic rock, the MPR source was preferred over the other two. Although no testing has been done on granitic objects from Maya sites in Mexico, the presence of MPR-sourced material at La Milpa and Dos Hombres in far north west Belize near the international border suggests future sourcing studies are likely to identify it in Campeche and Quintana Roo.

The overall pattern revealed from the sourcing studies is that the MPR granites were clearly preferred over the other two sources, but

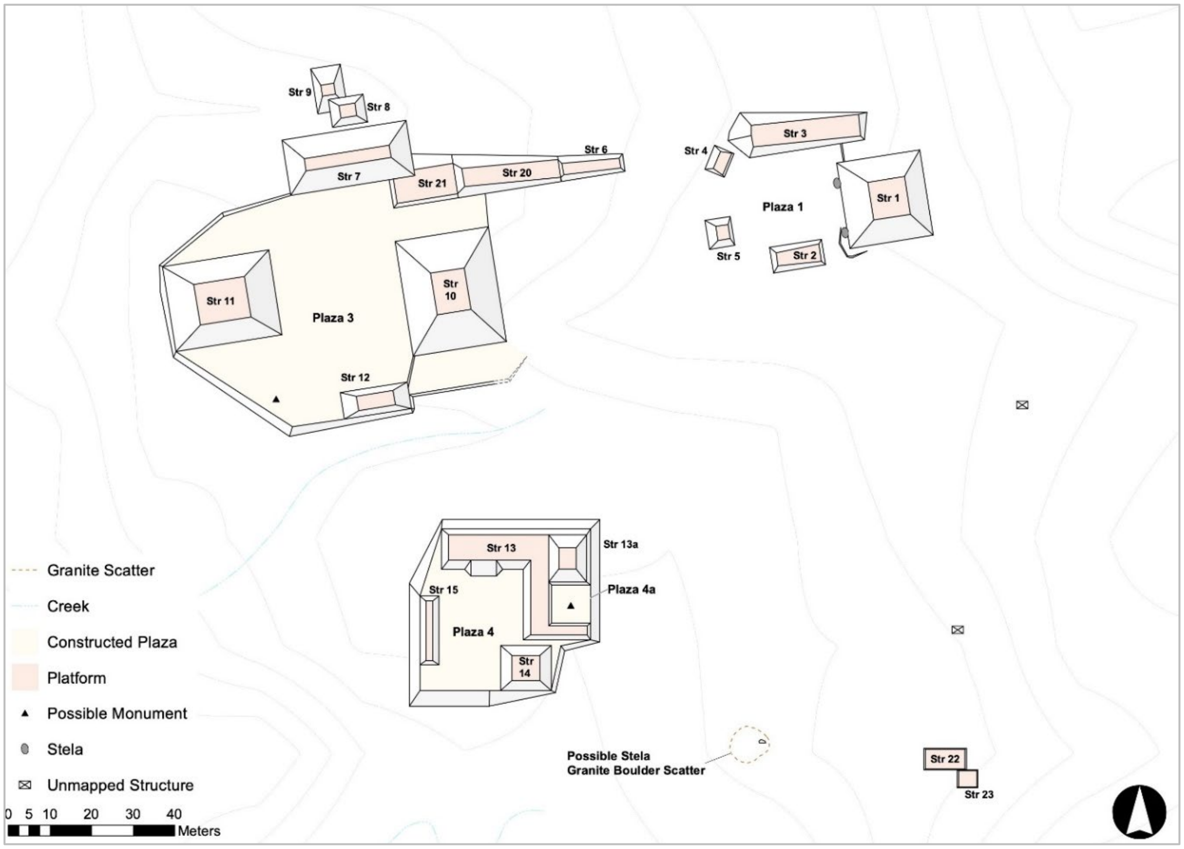

Figure 2. Plan map of the core zone of Nohoch Batsó site indicating structure and plaza numbers and locations of monuments.

questions about raw material acquisition remain largely unanswered (Brouwer Burg et al. 2021). Archaeologists have speculated that cobbles may have been collected opportunistically from the streams and creeks that drain the MPR, while others have suggested it was collected through extractive enterprises, perhaps controlled by sites such as Caledonia and Caracol (Awe 1985; Brouwer Burg et al. 2021; Chase et al. 2014). Moreover, until the recent discovery of a ground stone workshop at Pacbitun where MPR granites were shaped into *manos* and *metates*, the ancient manufacturing process was unknown (Skaggs et al. 2020; Tibbits 2020; Ward 2013). Although the Pacbitun data help understand the manufacturing process, the roll the site played in overall MPR granitic rock economy of the Maya Lowlands remains unclear. Our discovery of the Buffalo Hill Quarries, described below, helps resolve some of these questions, and reveals a complex industry that we are only beginning to understand.

Summary of Research

We initiated the RiFRAP in 2018 with the intention of it being the first long-term investigation of the Mountain Pine Ridge Forest Reserve's ritual landscape. Our focus was the known caves in the limestone region (Mason 1928; Pendergast 1970) and the possible shrine identified by Bullard (1963) in the MPR. Our first two field seasons were dedicated to relocating and studying the caverns that have been previously improved for tourism by the Forest Department (Spenard and Mirro 2020). When time or circumstances permitted, we have also conduct pedestrian survey of the MPR to relocate the possible shrine and to document any other traces of ancient Maya activity there. These activities led to the discoveries of Nohoch Batsó and the Buffalo Hill Quarries. Though studying cave ritual remains a core focus of the RiFRAP, the newly documented sites have broadened the project's scope to understanding ancient Maya habitation in the reserve and the granitic rock implement economy of the Lowlands.

As they have been recently discovered, our work at both sites is limited. We located Nohoch Batsó at the end of the 2019 field season while reconnoitering the Rio Frio valley to relocate Rio Frio Cave E (Pendergast 1970) and document any other cave sites there. Investigations of Nohoch Batsó began in 2022 with a focus on mapping the site, cleaning, and backfilling looter trenches, and conducting test excavations to establish the site chronology. Laboratory analysis remains underway, but ceramic styles suggest the site dates from at least the Early Classic period through possibly the early Postclassic, although most material dates to the Late/Terminal Classic. The ceramic dates align with those collected from the nearby Rio Frio caves suggesting the inhabitants of Nohoch Batsó were the ones using the caverns.

The Buffalo Hill Quarries are located on an elevated ridge immediately south of Pinol Sands. They were noted several years ago by co-author Mai who brought them to the attention of the project in 2022 when we were surveying nearby. Time and other research commitments did not permit a full exploration of the site during that field season. Nevertheless, we mapped an area approximately 16 ha, but the site continued beyond what we were able to survey. Surface collections of select diagnostic or representative samples of ceramics, production waste, quarrying and manufacturing tools, as well as discarded and unfinished ground stone products were made. Unfortunately, the ceramics are too eroded for classification or stylistic identifications, but their presence confirms the antiquity of the site.

Site Descriptions

Nohoch Batsó

Nohoch Batsó is a medium-sized Maya center located above a floodplain on a valley terrace between two tributary creeks of the Rio Frio between Rio Frio caves C and E (Mason 1928; Pendergast 1970). The site core has a primary east-west alignment and consists of approximately 30 structures arranged around three or four plazas, labeled Plaza 1 through 4 (Figure 2). Structures were numbered in the order they were located and recorded. Overall, the site core is relatively intact with fewer than five looter excavations encountered. A range structure complex and additional plaza, Plaza 5, (unmapped) lie to the south and north ends of the valley respectively (Figure 3). Although we have yet to conduct systematic survey of the hinterlands, we have identified several low, isolated mounds on the valley floor, as well as agricultural terracing and a hilltop rural settlement cluster to the east.

Plaza 3 is the largest in the core and it, along with Plaza 1 defines the site's east-west orientation. The plaza is flanked on the east by Structure 10, an 8-10 m tall pyramidal structure with a staircase on its west side. Structure 11 is a 5 m tall mound on the opposite (west) edge of Plaza 3 from Structure 10. It is flanked to the south by an ancillary, abutting mound (unmapped) that collectively resembles an E-group (Aimers and Rice 2006), or Eastern Triadic Assemblage-(Awe et al. 2017) architectural arrangement. Structure 7, is a steep, 5-6 m tall range structure that bounds the north side of the plaza. The south side of the plaza is partially enclosed by the low-lying Structure 12.

Plaza 1 sits at a slightly higher elevation than Plaza 3. A series of abutting range structures stretching from Structure 7 indicate the two plazas comprise a single architectural unit. Structure 1 at the east side of the plaza is the largest structure in Plaza 1. It is a 4 m tall range structure facing west with an outset staircase leading to its summit from the partially enclosed plaza floor. A snaped phyllite stela (Stela 1) and butt at the northern stair-side outset was noted when we first documented the site (Spenard and Mirro 2020) (Figure 4). To view a digital 3D model of the monument, navigate to https://skfb.ly/6YFzu. A companion monument of the same material (Stela 2) was unintentionally uncovered when setting up a sifting screen in the southern stair-side outset during our investigations (Figure 5). To view a digital 3D model of that stela, navigate to https://skfb.ly/oCnRX. We inspected both monuments for carving, but none was noted. The presence of the two stela flaking the central staircase suggests at least a third and possibly other monument are present in front of the structure along its primary axis. A large looter's trench was dug into the east (back) side of the structure revealing three construction phases.

We focused our initial excavations of Nohoch Batsó on Plaza 1 due to the presence of

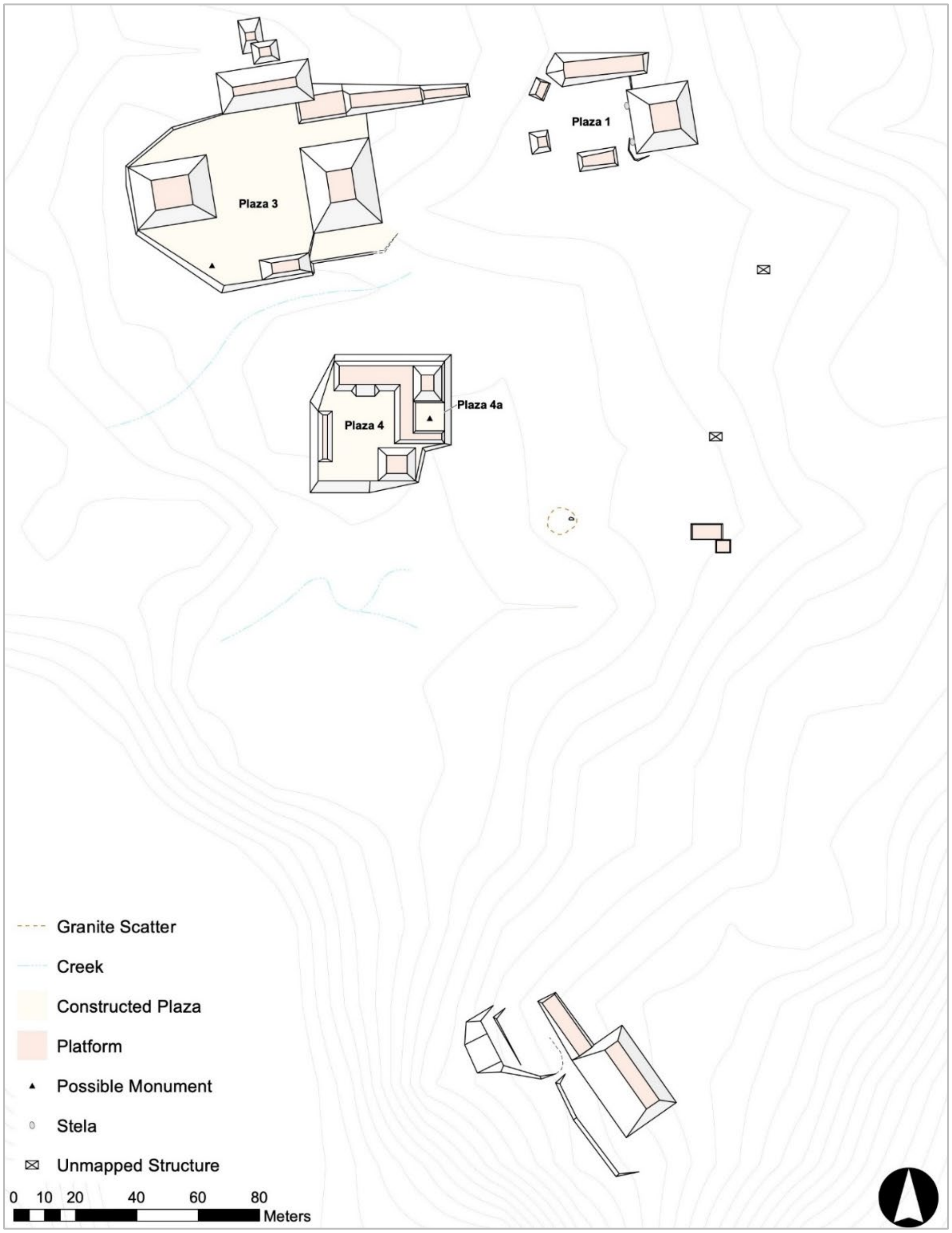

Figure 3. Settlement map of Nohoch Batsó site core and confirmed mounds and architectural groups in the site periphery.

Stela 1 and the exposed architecture revealed in the looter's trench. Our goals were to establish a preliminary site chronology by recovering the cache at the base of the monument and artifacts discarded by looting activities. We also aimed to gain a clearer understanding of the structure's construction sequence by clearing and then backfilling the trench. Our excavations of Stela 1 are ongoing, and we have yet to locate its cache. Nevertheless, we identified three plaza surfaces the earliest of which retains a partially intact plaster surface. That sequence matches the one revealed in the looters trench on the opposite side of the structure. Several fragments from spiked and appliqué censers, resembling the "face caches" from Caracol (Chase and Chase 1998)

Figure 4. Screen capture of 3D digital model of Nohoch Batsó Stela 1.

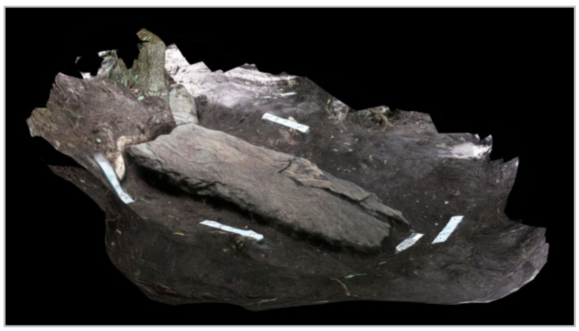

Figure 5. Screen capture of 3D digital model of Nohoch Batsó Stela 2

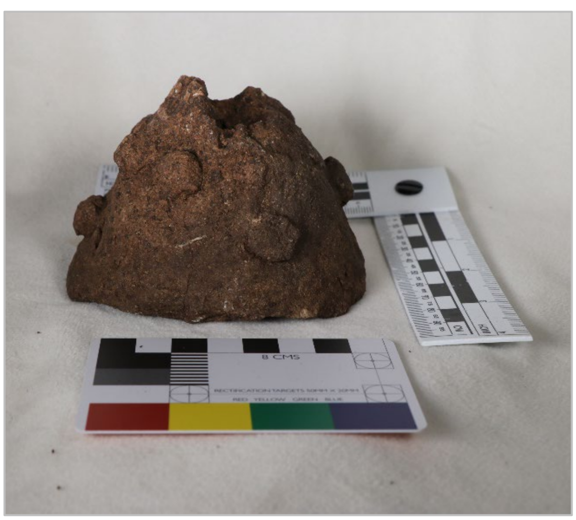

Figure 6. Spiked censer lid (Candelario Appliqued) recovered from side of toppled Stela 1 (photograph by J. Spenard).

were recovered in both contexts suggesting a ritual function for the complex and Late to Terminal Classic period use.

Stela 1 is pointed and tapered, while its companion monument has parallel sides and a square top. They would have both stood 2 m above the terminal plaza surface although excavations in front of the butt of Stela 1 reveal it was erected at least two construction phases earlier. The monuments were toppled in antiquity revealed by snap fractures at their bases. Iannone (2005) recorded similar treatment of the stelae from Minanha, which he attributed to purposeful termination associated with the abandonment of the site at the beginning of the Terminal Classic period. His dating of the stela toppling events at Minanha provide a baseline for those we recorded at Nohoch Batsó, suggesting a Terminal Classic period abandonment for the site. Interestingly, our Stela 1 excavations uncovered a spiked censer lid (Candelario Applique) that was placed aside the toppled monument on the terminal plaza floor, indicating some local population remained connected with the site even after it was abandoned (Figure 6).

Plaza 2 (unlabeled on the map) sits between Plazas 1 and 3, but it unconfirmed because it lacks an enclosing structure to the south. A possible plaza edge was noted but thick vegetation covers that area of the site. Forest Department regulations require approval for vegetation removal, which we did not have at the time of study. Future excavations that would have permission to clear the area of vegetation are necessary to confirm the nature of the space. Plaza 4 is on an elevated platform, 5 m above the valley floor, and 40 m south of Plaza 3. It is partially enclosed, giving it the appearance of a palace-like structure.

Plaza 5 is 200 m northwest of Plaza 3. It has a slight, but obvious different orientation than the other plazas of the site. Preliminary lidar data of the area indicate the plaza is partially closed, but on the valley floor or low platform. The northern and southern edges are flanked with range structures, and the eastern and western edges are flanked by series of smaller mounds.

The southern complex is made up of two abutting range structures aligned northwest-southeast on an elevated natural terrace on the same hill that Rio Frio Cave C penetrates. It is 180 m southeast of Plaza 3, and a series of terraces constructed on the hillside below it would have given the complex a stepped-

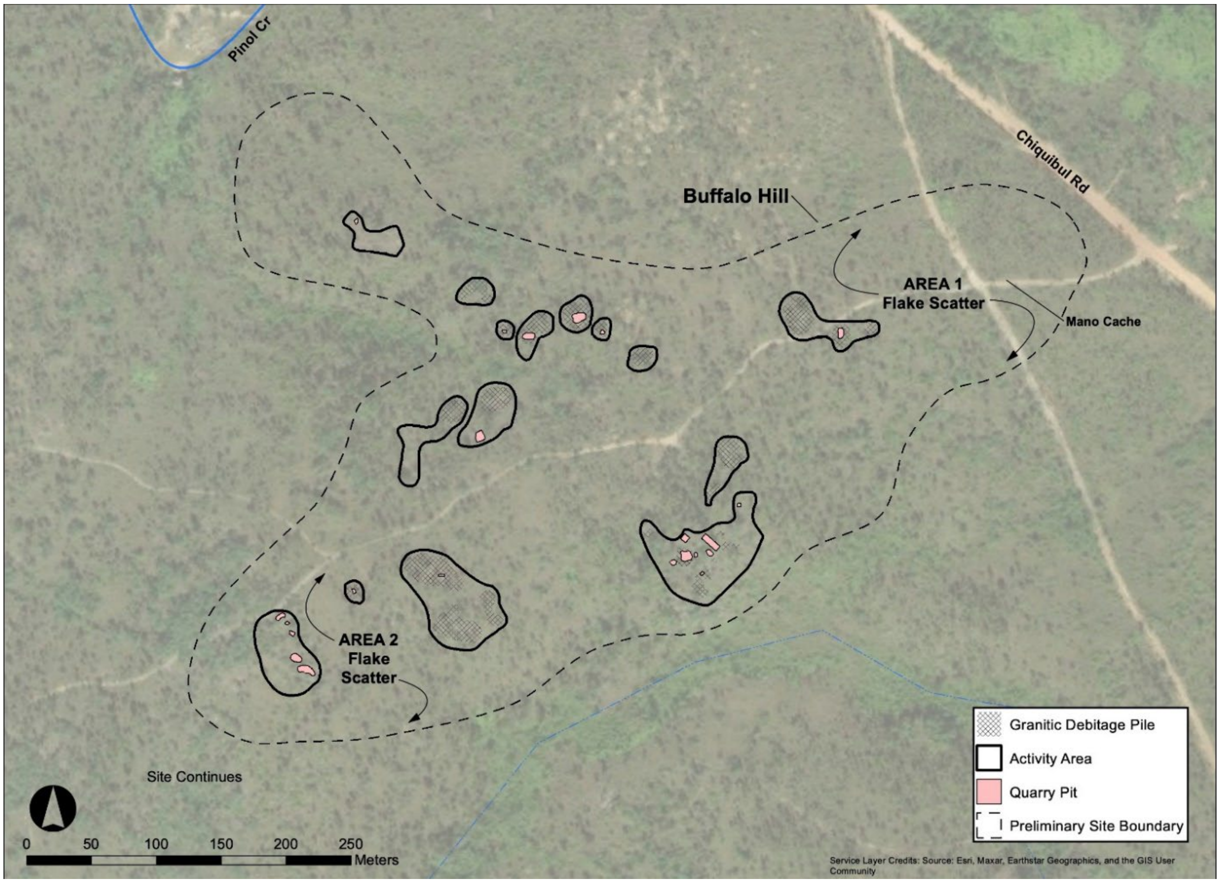

Figure 7. Plan map of Buffalo Hill Quarries site indicating the survey boundary, activity areas, quarry pits, and piles of granitic rock debitage.

Figure 8. Photograph of granitic rock debitage pile in the Buffalo Hill Quarries site from which some of the waste material was collected for gravel (photograph by J. Spenard).

pyramid-like appearance, suggesting a possible ritual function for it.

Buffalo Hill Quarries (MPR-2022-02)

The Buffalo Hill Quarries is a multicomponent, industrial-scale site consisting of granitic rock extraction loci and ground stone implement workshops on the west side of Chiquibul Road on a low flat-topped granitic ridge south of Pinol Creek in the northern half of the MPR (Figure 7). The full extent of the site has not yet been defined, and it may continue farther north and southwest along the ridgeline. As mapped, the site is spread over an area of about 16 hectares and measures 775 meters east-west and 550 meters north-south. Fifteen activity areas were recorded where granitic boulders and outcrops were quarried. Two associated areas with a low density of chert flakes are also present. Modern disturbance is minimal overall, although one area of the site was recently quarried for gravel, and some of the debitage piles were incorporated into military training exercises (Figure 8).

There was variability between activity areas with some exhibiting much more cultural activity and complexity than others. Minimally each area contained granitic debitage and rock outcrops or boulders exhibiting modification. At most areas hammerstones of quartzite, a very hard durable chert from the Santa Rosa Formation, or granitic rock were observed. The following is a list of features and cultural materials observed throughout the site.

Quarry pits: these varied in size and depth across the site ranging from 1 to 2 meters in diameter and 20 to 30 cm deep to over 20 meters in length, 5 meters wide, and over a meter deep. Pit bases were often clear of debitage with piles found around the feature margins. This distribution pattern resembles the work areas documented at Pacbitun's ground stone tool workshop (Skaggs et al. 2020). Cut faces where slabs were removed, sometimes exhibited flake scars. They were often observed on the margins of pits.

Isolated cut faces: are modified granitic boulders from which slabs of material was removed from the rock face. They were often smaller in scale than quarry pits and were not excavated below the surface.

Figure 9. A bedrock milling feature/possible mano refining site from the Buffalo Hill Quarries site (photograph by J. Spenard).

Bedrock milling features/mano reshaping station: these features consist of shallow ovoid to circular basins cut into bedrock outcrops exhibiting lightly polished grinding surfaces (Figure 9). Features measure between 25 to 32 cm in diameter or length and between 3 and 8 cm deep. A total of 10 were documented throughout the site. They are likely the result of mano refining. In his ethnoarchaeological study of a traditional *metatero* from the Guatemalan highlands, Hayden (1987:Figure 2.21) included a photograph that depicts the process of mano refining. Although not elaborated in the text, the photo shows the tip of the mano being supported in a cup-like basin of dirt that resembles the milling features we identified at the Buffalo Hill Quarries.

Cairns: two cairns and a possible dispersed cairn were recorded. They consist of 20 to 30 stones between 20 and 40 cm in size stacked three to four courses high within a 1 meter area. Their purpose remains unclear.

Ritual structure: a possible shrine was identified on the eastern side of a quarry pit backfilled with local sediments. It sits vertically

Figure 10. Photograph of possible shrine in the Buffalo Hill Quarries site (photograph courtesy of K. Martinez).

Figure 11. Photograph of large conchoidal fractured granitic flake from the Buffalo Hill Quarries site (photograph by J. Spenard).

erected, resembling an altar. Only one was recorded (Figure 10).

Granitic debitage: this reduction waste product was found near modified boulders and bedrock and quarry pits as low mounds and berms up to 1.5 m high to low density scatters near lesser worked faces. Debitage include flakes of granitic rock, which often exhibited bulbs of percussion and other common anatomical features of conchoidal fractured rock (Figure 11). The flakes range in size from 2 to 40 cm in length.

Hammerstones: hammerstones were found throughout the site often mixed into the debitage, on the ground surface near the margins of the activity areas, and in the quarry pits. In a few instances, hammerstones were found in clusters of three or four. Hayden (1987) reports that the *metateros* of highland Guatemala will often cache their quarrying and shaping tools near their worksites to avoid transporting them. They also hide them away to prevent others who visit the site from taking them. The clustering of hammerstones noted in the Buffalo Hill quarries may represent a similar purpose.

We recorded 69 hammerstones. They were either spherical or disc shaped and ranged in size from 12 to 20 cm in diameter, although the largest was found to exceed 30 cm. Weights were not collected. Many had been broken into in flakes and possibly repurposed for tasks such as abrading (Hayden 1987). A variety of materials was used but quartzite was predominat in the recorded assemblage. That material was imported to the site; however, it is readily available nearby in the Santa Rosa Formation to the north and east.

Mano preforms: approximately 54 mano preforms were plotted, but that number likely under represents the total number present. Preforms in the earliest stages of reduction were often difficult to discern from debitage making a full count difficult. Moreover, some “preforms” may have been used as pics and other types of reduction tools making this class of artifact difficult to discern overall. Much more study will need to be made of them to differentiate between discarded and incomplete products from production tools. Several types of preforms and stages of reduction were observed.

Metate preforms: Ten metate preforms were recorded although many more were likely present (Figure 12). Only slabs of stones that exhibited pecking scars and evidence of shaping were tabulated. Several slabs of stone that lacked those traits were regularly observed, some likely representing earlier stages of production; however, they were not tabulated. The items varied in shape and size, although most were ovular with diameters between 35-40 cm.

Monument preform: a single possible monument preform was observed within a quarry pit. It measured approximately 65 cm long and tapered from 20 cm wide to 10 cm longitudinally.

Figure 12. Photograph of a broken metate preform from the Buffalo Hill Quarries site (photograph courtesy of F. Quiros).

The lateral margins showed evidence of pecking and shaping.

Flaked stone: Approximately 10 flakes, mostly of quartzite were noted throughout. Some appear to be fragments of broken hammerstones that were repurposed while others appeared to be purposefully flaked from a core. Identified tools include one core and one utilized flake.

Area 1 is a sparse scatter of lithic debitage on the eastern margins of the site. The boundaries of the scatter were not defined, and it likely extends farther north and south. Materials include various cherts, imported from regions beyond the MPR, and quartzite, which was likely locally sourced from the Santa Rosa Formation. The scatter included a diverse set of flake types including primary, secondary, tertiary, thinning, and other types, as well as fragments, shatter, and cores. Many have use wear on their margins. A total of 52 flakes were collected, although the actual total may be in the hundreds. Time and field conditions did not permit for a full systematic survey. At the eastern most extent of the area, a cache of a two stacked manos buried in the ground were observed in the roadbed. The top mano was disc shaped while the bottom was hemispheric.

Area 2 is a low-density lithic scatter of lithic debitage located near the western end of the Buffalo Hill Quarries site between two activity areas. The boundaries of the scatter were not defined and only a few flakes were documented; however, the assemblage is similar to that of Area 1.

Conclusions and directions for future research

The discovery of the two ancient Maya sites described here, Nohoch Batsó and the Buffalo Hill Quarries, has significantly altered the scope of our project's overall research agenda. Our work on them is in its infancy and many studies, and much analysis remain to be done. As such, we conclude this paper with a series of future research goals and questions to be addressed for each of the described sites and the reserve in general.

For Nohoch Batsó, we have strong evidence of a Late to Terminal Classic period occupation in Plaza 1 and a revisit to the site after it was abandoned. Are there older deposits there, and how does its chronology of Plaza 1 compare to other parts of the site? Where did the post-abandonment population live, and what connection did they have with the original inhabitants of the site? Were they early Postclassic visitors returning to their ancestral home, or were they a later group who happened upon it, perhaps related to the inhabitants of Tipu to the north? Given the alignment of Plaza 5 differs from the other plazas at the site and that is a considerable distance from the core, was it occupied at the same time or does it date to an earlier or later occupation? The site occupies a significant portion of the valley and few house mounds have been identified. The surrounding hills are steep and little agricultural terracing has been documented. How big the supporting population and where did they live, and where did they farm?

The Buffalo Hill Quarries are more than 5 km north of Nohoch Batsó, a span than can be generously described as rugged terrain that also includes crossing the deep cut of the Rio On if a direct route was taken. That distance and difficulty of travel makes it unlikely that people from Nohoch Batsó were working the quarries. The wide demand for MPR granite throughout the eastern Lowlands and sheer size of the site indicates regular industrial scale production and full-time specialists rather than part-time crafters. Considering the above, who was working them? Was it a local permanent population or did *metateros* from sites such as Pacbitun travel there for periods of time when products were in demand? If there was a permanent, local population, was the production and distribution of finished products managed, and if so by what site(s)? Local knowledge suggests other quarry sites are present in the MPR. Were they worked the same way and by the same *metateros* as those using the Buffalo Hill Quarries site? Were the finished products from the quarry sites part of the same supply chain supporting the demand for the eastern Lowlands, or were quarries and quarry workers supporting distinct networks? The possible monument we recorded at the quarries coupled with the shrine recorded by Bullard (1963) suggests ritual was a component of the quarrying and production process. If that is the case, what were the rituals performed for? Many contemporary Maya groups believe in a supernatural being or beings who are the owners of the land and its resources. These “Earth Lords” are commonly petitioned before hunting or planting a filed and ritually thanked after the action was successfully completed. Were the ritual sites on the MPR affiliated with the granite quarries used for similar purposes?

On a more regional level, Nohoch Batso’ is closest known center to the Buffalo Hill Quarries. What role, if any, did the inhabitants of that site have in organizing and controlling the quarry work? How is Nohoch Batso’ related to the other rumored quarries in the MPR? Was the site established to control and manage those resources and their distribution? Finally, the ceramics recovered from the site show a strong Caracol influence. What was the relationship between the two sites? What about its relationship other closer neighbors such as Minanah and Pacbitun? The presence of the stelae in Plaza 1 indicate the site was ruled by an *ajaw* (Stuart 1996). What role did the Nohoch Batsó royalty play in local and regional geopolitics?

All of these questions reveal that far from a region devoid of ancient Maya sites, the Mountain Pine Ridge Forest Reserve was a Maya cultural landscape rich in archaeological sites unique to it. We have only begun to scratch the surface of understanding the rich cultural heritage there. Questions like those above will guide our research for years to come. As they suggest, much work remains to be done as we continue to define this unique archaeological region.

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27 *INVESTIGATING GRANITE TOOL PRODUCTION ON PACBITUN'S WESTERN PERIPHERY*

Adam King, Sheldon Skaggs, and Terry G. Powis

Between 2012 and 2015, investigations into a small mound with mano blanks and granite debitage on its surface introduced the possibility that intensive granite tool production took place on Pacbitun's western periphery. Those investigations revealed the mound was an accumulation of granite sand, debitage, and chert tools consistent with ethnographic examples of mano and metate production. However, the amount of granite debris suggested some 4000 manos and metates were produced during the use life of the mound. In 2015 and subsequent seasons, an additional three similar granite debris mounds were confirmed through limited testing. In 2021, a research project was initiated focused on understanding the extent, dating, and organization of granite tool production at Pacbitun. This paper reports survey and testing efforts that have revealed what appears to be a granite tool producing community cover some 1km^2 and dating to the Late Classic period just west of Pacbitun's epicenter.

Introduction

The politically fluid landscape of the Late Classic period brought an important development to the periphery of Pacbitun. Beginning in 2012, PRAP staff and crew began to recognize evidence for potential large-scale production of granite grinding tools, particularly manos, on Pacbitun's western periphery. Extensive excavation of a small mound, named Mano Mound, with granite flakes and mano blanks on its surface revealed evidence that the location was used to produce as many as 4000 granite tools all during the Late Classic period (Balinger et al. 2015; Cartagena 2018; Skaggs et al. 2016; Skaggs et al. 2020; Ward 2013). Additional limited testing and survey focused on similar features revealed that more granite production mounds were present in the vicinity potentially representing a granite working community.

Previous Research

To better understand this, the Pacbitun Western Periphery Granite Survey was initiated in the summer of 2021. During the summer 2021 season, three additional granite debris mounds were tested as was a nearby house mound. One-meter units were excavated through the summits and just off the flanks of the mounds. The summit excavations revealed a stratigraphic profile consistent with the original mound tested in 2012, which consisted of a thick layer of granite sand mixed with granite and chert debitage, hammerstones, and mano blanks and fragments (King et al. 2022).

Ethnographic descriptions of granite tool production identify three stages (see Cook 1982, Jaime-Riveron 2016, Searcy 2011). The first stage consists of roughing out granite blocks, something that may be happening in the Mountain Pine Ridge. The second stage involves forming blanks through percussion flaking, and the final stage consists of abrading to create the final shape. In our excavations, the thick layer of sand was produced by the final stage of tool production, while the granite flakes were the result of shaping through percussion flaking. The chert flakes were produced as chert cobbles were used as the hammerstones to shape the granite.

The flank excavations conducted on two debris mounds in 2021 uncovered small walls. Each mound tested was positioned at the edge of an agricultural terrace. The walls found were not part of the terrace construction but appear to have been constructed to maintain a stable working surface. In both cases, the walls began as large unworked pieces of limestone but were eventually raised with spent hammerstones, mano fragments, and smaller pieces of limestone as the sand and granite flakes accumulated. It appears these mounds were prepared and maintained working platforms that likely were used for several seasons. Each season hundreds of granite tools were made, with the total represented by the mounds being on the order of several thousand.

All three mounds tested in 2021 had a small, isolated house mound within 50m. The presence of mano fragments, chert hammerstones, and granite flakes on these mounds suggested that they were directly related to the nearby granite reduction platforms. The

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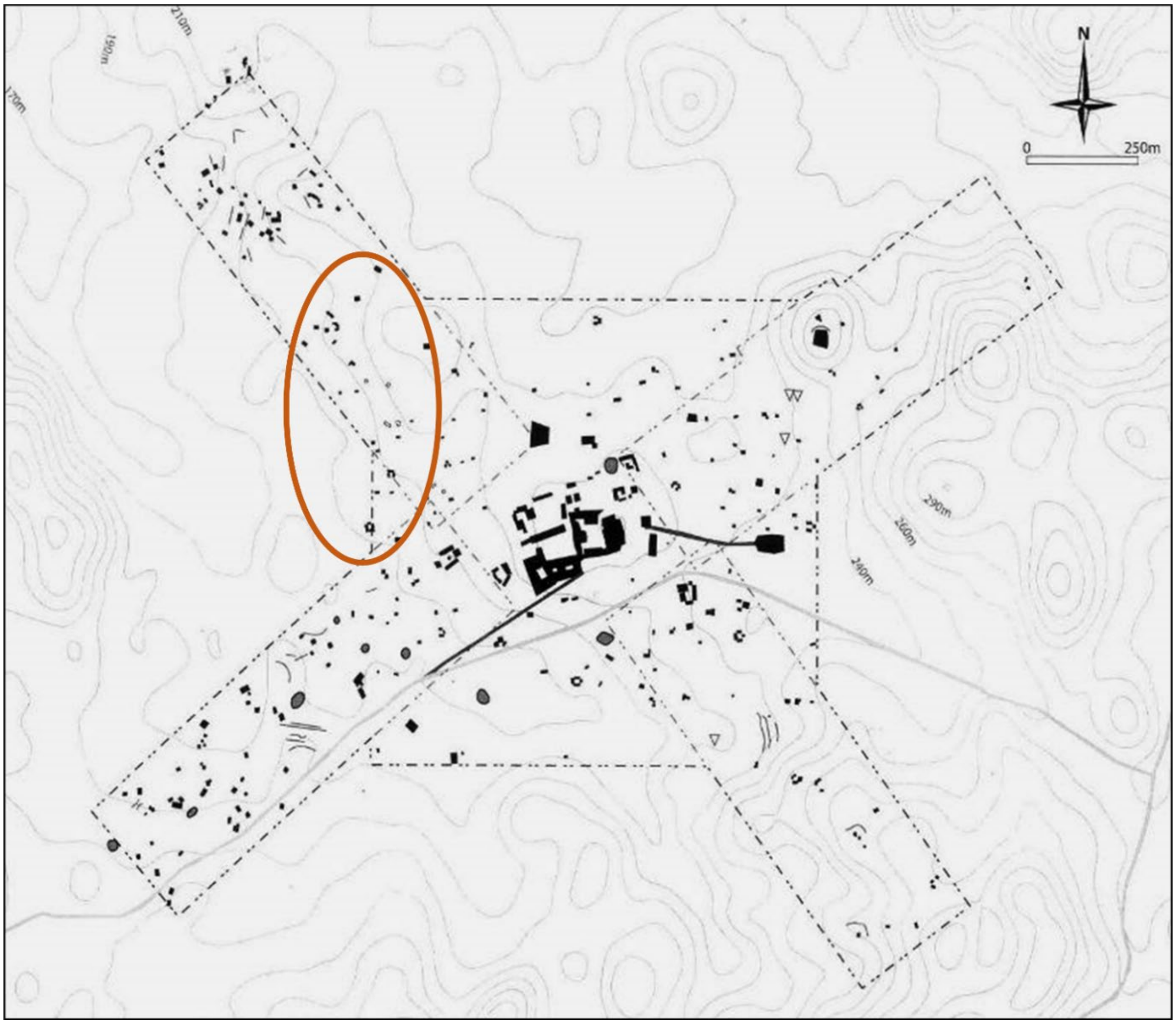

Figure 1. Presumed location of Pacbitun's granite working community.

testing confirmed the presence of a small amount of granite working debris and also produced pottery dating the mound to the Late Classic period matching the small number of diagnostics found in the granite debris mounds.

Survey, Testing, and Excavations of Mano and Metate Production Areas

After the summer 2021 season, a total of 8 granite debris mounds had been confirmed through testing, representing the production of tens of thousands of granite tools. Given that as many as 20 other possible mounds had been identified in previous seasons, the Pacbitun Western Periphery Granite Survey was continued in the summer of 2022 with the following objectives: 1. Try to understand the overall extent of the proposed granite working community, 2. Confirm the presence of additional granite debris mounds through testing, and 3. Explore the connection between granite production and closely located small plazuela groups. These objectives were addressed through pedestrian survey and limited testing.

Pedestrian Survey

The original work focusing on granite production mounds from 2012 to 2018 and more recent testing in 2021 demonstrated that the core of the suspected granite producing community was centered in an area to the northwest of Pacbitun's core (Figure 1). Given the time and labor available, it was decided to conduct the survey in 200-m wide transects oriented at the cardinal directions starting at the center of the presumed community (Figure 2). The production mounds and their scatter of associated granite debris are substantial enough to be visible without systematic testing, so the survey consisted of full coverage walk-over inspection of all areas not covered by dense vegetation. This requirement of necessity determined the specific areas to be investigated (Figure 3). A total of 94 acres was surveyed in the summer of 2022, another 61 acres was surveyed in 2021, making the total coverage 154 acres.

The Northeast Transect was almost entirely open and revealed the absence of any production debris mounds. This suggests that intensive granite tool production did not extend to the north beyond the debris mounds recorded from 2018 to 2021. The Southwest Transect was heavily vegetated with only limited areas of surface visibility. An additional four debris mounds were recorded within the original transect. Areas further to the east but still south of the presumed center of the community had greater surface visibility but contained no new granite debris mounds. We interpret this to indicate that we found the southern boundary of the granite producing community.

Much of the Northwest Transect had been investigated in 2021, so the decision was made to focus on areas further to the west where surface visibility was good. In total, an additional nine debris mounds were located on the Northwest Transect. Not far beyond the limits of our 2022 survey, the landscape is dominated by significant topographic rises, which we assumed would mark the western boundary of intensive granite production. Part of the Southeast Transect had been investigated in 2015 (Skaggs et al. 2016) and other portions were effectively surveyed as part of the Southwest Transect. This effort brought the survey to the very edge of the Pacbitun architectural core. As noted, no new debris mounds were recorded in this area.

Production Mound Testing Results

In an effort to ensure that the debris mounds identified during survey were indeed the result of granite took making, small tests were excavated into a sample (Figure 3). Tests consisted of 50-cm^2 units excavated in natural levels. Previous more intensive investigations of

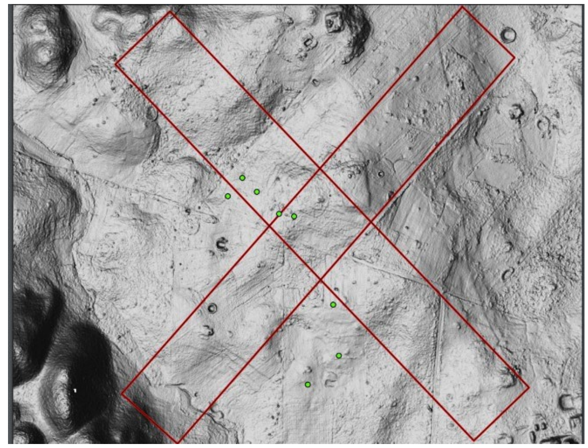

Figure 2. Proposed survey transects (green circles are previously confirmed granite debris mounds 2012-2021. Pabitun's site core is located in the bottom right).

Pacbitun granite debris mounds (Skaggs et al. 2016, King et al. 2022) have demonstrated that these features consist of approximately 50 to 70cm of granite sand mixed with some granite flaking debris, chert hammerstones, and tool blanks and failures. The peripheries of the mounds contain more dense concentrations of granite flaking debris and sometimes retaining walls. Given this, the 2022 testing focused on the summit of suspected debris mounds and recognized the key diagnostic feature as the dense accumulation of granite sand.

On the Northwest Transect, three suspected debris mounds were tested. Two contained the key diagnostic of granite sand, while the third was identified as an isolated habitation mound. Two additional suspected production mounds were tested on the Southwest Transect, and both also consisted of a dense accumulation of granite sand. Two other potential debris mounds were tested on the eastern edge of the granite producing community as originally recognized. This area has a high concentration of small topographic features. One of the features was identified as an isolated habitation mound and the other a debris pile from field clearing.

Ceramics were collected from natural levels as excavations progressed. In only three of the four confirmed debris mounds was pottery recovered and the collections were extremely small and often eroded to the point where type assignments were impossible. Table 1 presents identifications made by Terry Powis and Sheldon

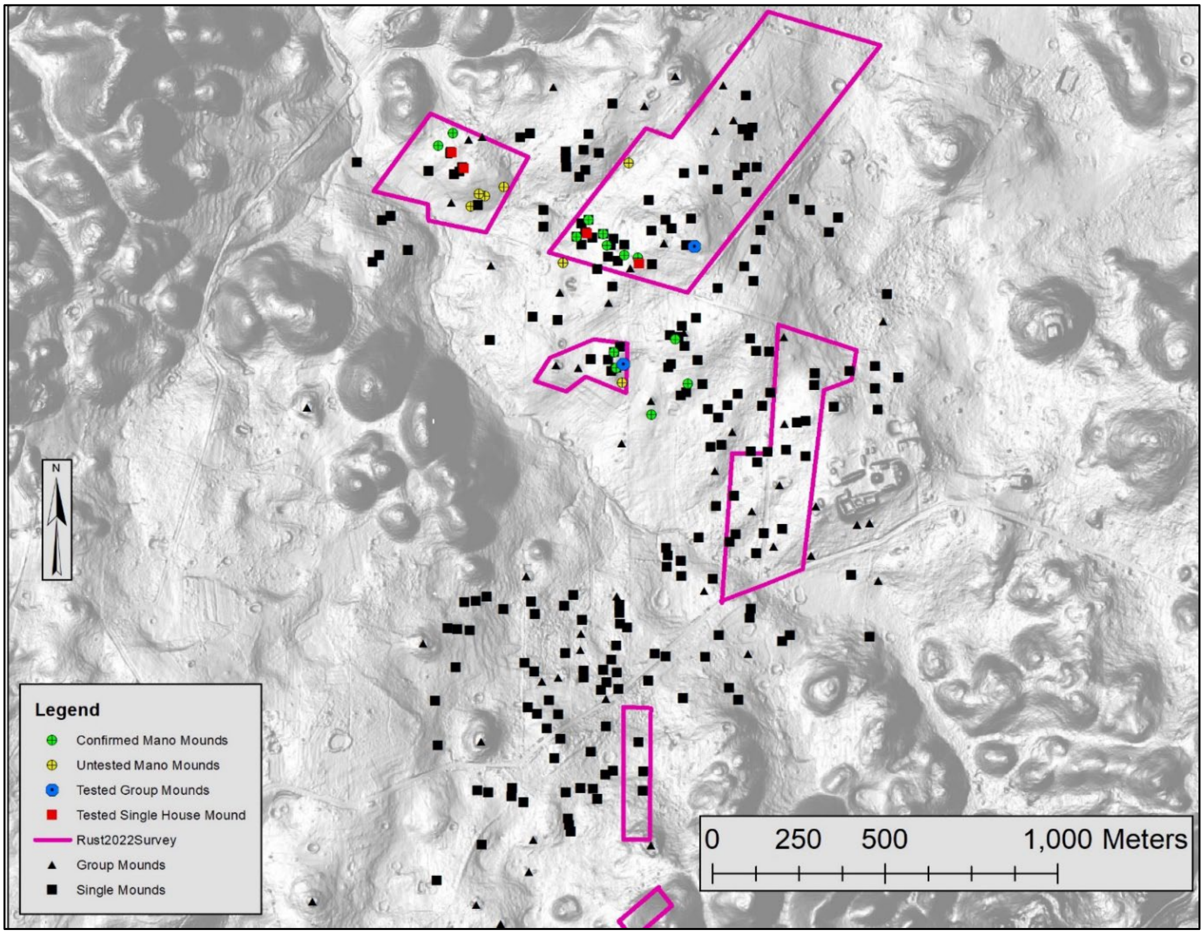

Figure 3. 2022 Survey Areas.

Table 1. Diagnostic Ceramics Recovered from Debris Mound Testing.

Unit	Stratum	Count	Character	Period/Phase	Types
22-R8-MM1-1	Sand	3	body	Spanish Lookout	Cayo Unslipped, Dolphin Head Red
		12	body	Late Preclassic	Sierra Red
		1	ring base	Spanish Lookout	
22-R8-MM2-1	Topsoil	9	body	Spanish Lookout	Cayo Unslipped
	Sand	3	body	Spanish Lookout	Cayo Unslipped
		4	body		
22-Q7-MM2-1	Topsoil	1	body	Spanish Lookout	Belize Red
		6	rim		
		37	non-diag		
	Sand	1	body	Spanish Lookout	Belize Red
		2	rim		
		15	non-diag		
22-Q7-MM1-1		-	-	-	No Ceramics

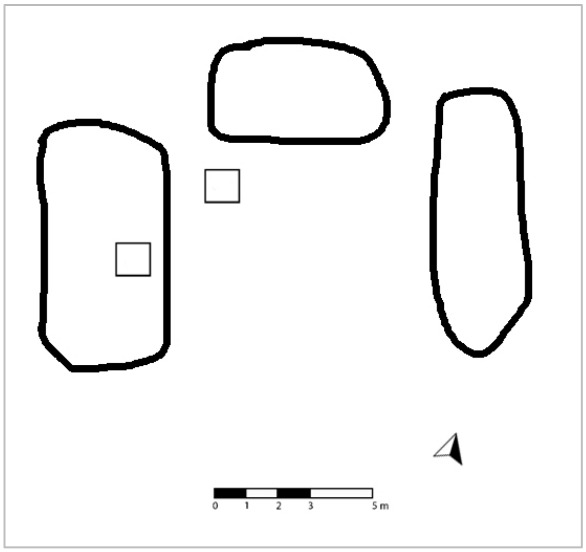

Figure 4. Units 22-R8-1-1 and 22-R8-1-2 in mound group in southwest survey area.

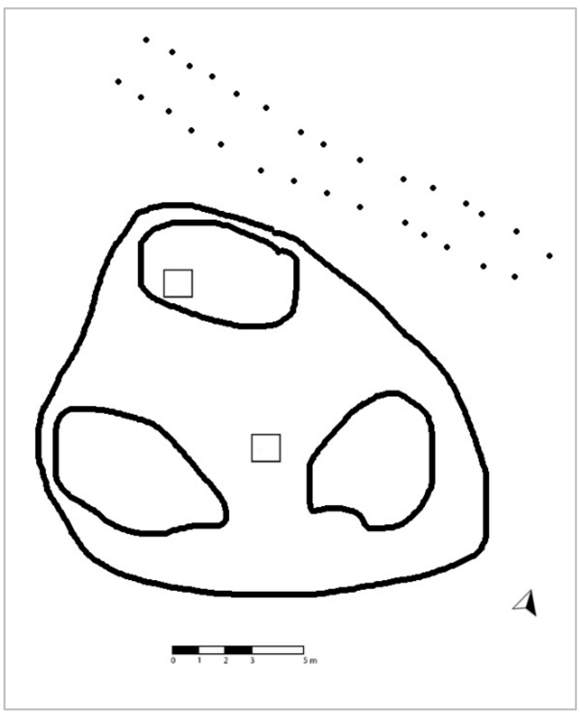

Figure 5. Units 22-R8-2-1 and 22-R8-2-2 in mound group in northeast survey area.

Skaggs of the diagnostic pottery recovered from the four debris mounds tested. Consistent with the results of previous testing, the majority of identifiable diagnostics date to the Late Classic period.

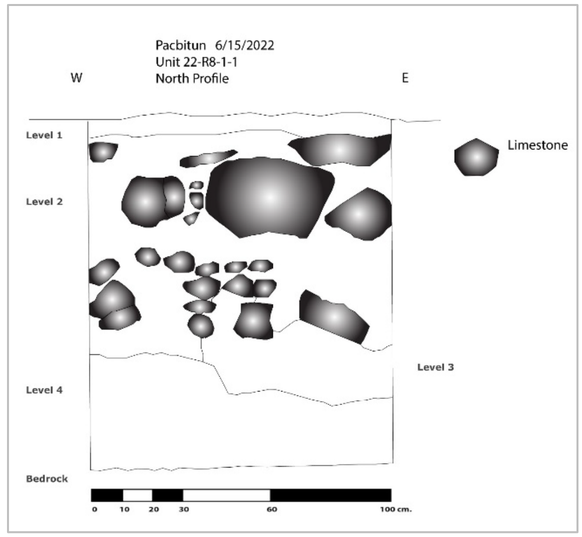

Figure 6. North profile of Unit 22-R8-1-1.

Small Group Testing

During the 2022 season, two small mound groups (Figure 3) located near debris mounds and associated households were also tested. The objective was to find evidence that these larger household groupings were also involved in granite tool production, possibly as production managers or mobilizers of finished tools. In both groups, a 1m test unit was excavated into the northern or western platform and another 1m test unit into the plaza (Figures 4 and 5).

Excavation in Unit 22-R8-1-1 found Late Classic ceramic material and only a few chert hammerstones in the top two layers (Table 2, Figure 6) connected to the apparent stone alignments. These layers rested on a dark brown soil wedge (Level 3), on the eastern side of the unit, with Late Pre-Classic and Middle Preclassic ceramics. The thick tan soil directly on bedrock (Level 4) also contained a mix of these types of ceramics. No evidence was found of the intervening 600 years of ceramic types between the occupations in Level 2 and Levels 3 and 4.

Excavation in Unit 22-R8-1-2 (Table 3, Figure 7) found only the soils and ceramics corresponding to Levels 1 and 2 in Unit 22-R8-1-1, and then a layer of around 5cm wide pebbles (Level 3) above a tan soil and bedrock. Level 3 was likely a supporting layer for plaster or floor surfaces between the buildings. Ceramics from Level 1-3 all dated to the Late Classic period.

Table 2. Artifacts Recovered from Test Unit 22-R8-1-1.

Level	Ceramic	Character	Period/Phase	Types	Granite	Chert
1	22	body	Spanish Lookout	Belize Red, Cayo Unslipped	1 flake 5cm+,1 flake <3cm, biface	8 flakes, 2 cobble frag
	112	non-diag				
2	20	body	Spanish Lookout	Belize Red		7 flakes, 2 cobbles
	3	rim	Spanish Lookout	Belize Red		
	1	ring base	Spanish Lookout	Belize Red		
	1	body	Late Preclassic	Sierra Red		
	22	rim				
	1	ring base				
	233	non-diag				
3	1	rim	Late Preclassic	Polvero Black		1 flake
	1	rim	Late Preclassic	Sierra Red		
	54	non-diag				
4	2	rim	Late Preclassic	Laguna Verde (Early facet)		
	4	rim	Late Preclassic	Sierra Red		
	3	rim	Middle Preclassic	Savana Orange		
	4	rim	Middle Preclassic	Jocote Orange		
	4	rim				
	113	non-diag				
5	1	rim	Late Preclassic	Laguna Verde (Early facet)		1 flake
	4	rim	Late Preclassic	Sierra Red		
	7	rim	Middle Preclassic	Savana Orange		
	4	rim	Middle Preclassic	Jocote Orange		
	1	rim	Late Preclassic	Paila Unslipped		
	45	non-diag				

Excavation in Unit 22-R8-2-1, located on the northern mound in Figure 8, was the opposite of previous group mound excavations. In this case, the unit into the mound had less occupation history than the one in the plaza (Table 4). Just below the topsoil layer (Level 1 in Figure 8) was a ballast stone layer (Level 2A) suggesting the structure had a poorly preserved floor. A few small mano fragments and 1 metate fragment were found in these layers. Below this level was a layer of gray marl (Level 3) with a compact floor sitting on a brown soil (4) with another plaster floor at the bottom. The layer under the floor (Level 5) was a dark brown soil as well and was sitting on a paleosol. All these layers had ceramics dating to the Late Classic period, despite the overall depth. The paleosol had a mixture of Late Classic and also Middle Preclassic period ceramics, as happens at many places around Pacbitun. Excavation in Unit 22-R8-2-2, the plaza unit located between the southern two mounds in Figure 8 (see Table 5), revealed that the topsoil layer (Level 1) was disturbed by a rodent burrow that ran in the middle of the unit north/south through Level 2.

Level 3 was a dark brown soil sitting on a paleosol like Level 4 in Unit 22-R8-2-1. This layer had mostly Middle Preclassic ceramics, with one Late Classic sherd dating the layer to that period. The paleosol had only Middle Preclassic ceramics.

Table 3. Artifacts Recovered from Test Unit 22-R8-1-2.

Level	Ceramic	Character	Period/Phase	Types	Granite	Chert
1	4	body	Spanish Lookout	Belize Red	1 flake 2cm<, 1 flake 5cm<	2 flakes
	2	rim	Spanish Lookout	Belize Red		
	1	ring base	Spanish Lookout	Belize Red		
	7	rim				
	3	ring base				
	1	foot				
	60	non-diag				
2	7	body	Spanish Lookout	Belize Red	1 flake 5cm+	7 flakes
	2	rim	Spanish Lookout	Belize Red		
	10	rim				
	2	ring base				
	131	non-diag				
3	1	rim	Spanish Lookout	Belize Red	1 flake 5cm+	1 flake
	1	rim	Spanish Lookout	Cayo Unslipped		
	6	body	Spanish Lookout	Belize Red		
	7	body	Spanish Lookout	Dolphin Head Red		

Table 4. Artifacts Recovered from 22-R8-2-1.

Level	Ceramic	Character	Period/Phase	Types	Granite	Chert
1	10	Body	Spanish Lookout	Belize Red	1 flake 5cm+, 2 mano frag	4 flakes
	1	Body	Spanish Lookout	Cayo Unslipped		
	1	Rim				
	3	Ringbase				
	63	non-Diag				
2	1	Rim	Spanish Lookout	Belize Red	1 metate frg	1 flake
	4	Rim				
	6	non-Diag				
3	1	Body	Spanish Lookout	Belize Red	1 mano frg	8 flakes
	12	Rims				
	1	Ringbase				
	49	non-Diag				
4	3	Body	Spanish Lookout	Belize Red		3 flakes
	6	Rim				
	45	non-Diag				
5	1	Rim	Spanish Lookout	Belize Red		7 flakes
	1	Body	Spanish Lookout	Belize Red		
	1	Rim				
	31	non-Diag				
6	3	Rim	Spanish Lookout	Cayo Unslipped, Matte		2 flakes
	1	Rim	Late Preclassic	Sierra Red		
	3	Rim	Middle Preclassic	Savana Orange		

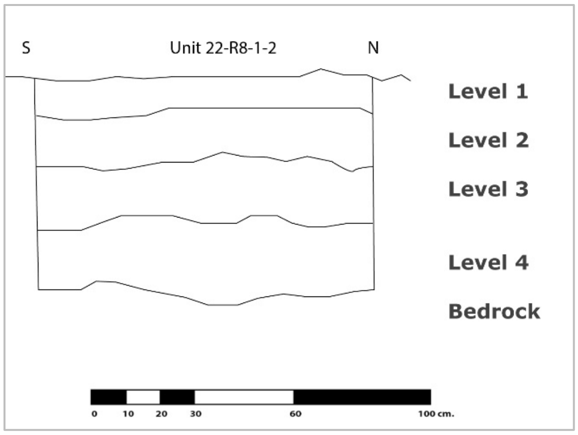

Figure 7. West profile of Unit 22-R8-1-2.

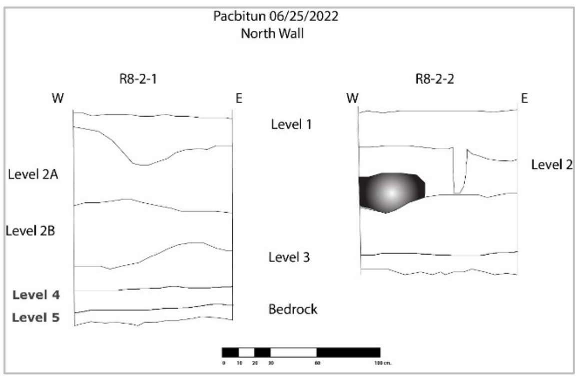

Figure 8. North profile of Unit R8-2-1 and R8-2-2.

2022 Survey and Testing Conclusions

In the summer of 2022, we recorded an additional 13 debris mounds and tested four, bringing the total number of debris recorded on the western periphery of Pacbitun to 21. Of those, 12 have been confirmed to be the accumulation of granite tool production through testing (Skaggs et al. 2020, King et al. 2022), while the remaining were identified by surface accumulations of granite flakes along with preforms. We recognize that there are areas directly to the north and south of the center of the proposed production community that were not surveyed and likely contain more debris mounds. Despite this, the investigations completed so far leave us reasonably confident in arguing that the granite producing community is limited to an area on the northwestern periphery of Pacbitun's core covering approximately 1 km^2 in overall extent.

Our testing of nearby small Plazuela groups was intended to investigate whether those larger households were involved in granite tool production at some level. While both groups had Late Classic occupations, we recovered no clear evidence that the residents of these households were directly involved in the management of tool production or the accumulation of finished tools. Admittedly, our testing was limited and evidence for those kinds of activities may be difficult to identify.

Granite Tool Production Project Conclusions

To date, 21 granite debris mounds have been identified in an area approximately 1 square kilometer in extent some 500m northwest of Pacbitun's epicenter. All confirmed debris mounds share the same stratigraphic characteristics, which was identified previously (Skaggs et al. 2016), and are consistent with ethnographic descriptions of the remains of granite tool production. Each debris mound consisted of up to 75cm of granite sand, produced during the final shaping stages of tool production, along with an assemblage of small to medium-sized granite flakes. Included in these strata were scattered broken mano blanks and chert hammerstones and debitage associated with the initial stages of percussion shaping of the tools.

In 2021, two of the mounds were tested on their flanks, where small retaining walls were recorded (King and Skaggs 2022). These appear to have been constructed and increased in height as tool production continued and sand and flaking debris piled up. A comparison of the artifact assemblages recovered in mound summit test units with those from flank excavations reveals that large flakes from early stages of tool shaping were cleared from the mound summits and deposited over the flank. This suggests these debris mounds were prepared and maintained platforms representing multiple episodes of tool production activities, possibly over several seasons.

Despite the great abundance of granite sand and debitage, datable material like ceramics were comparatively scarce. All of the mounds tested so far produced pottery assemblages consistent with only a Late Classic period occupation. This fits well with Sunahara's (1995) observation, based on survey and testing in Pacbitun's periphery, that most of the house mounds and small groups were occupied primarily during the Late Classic period.

Table 5. Artifacts Recovered from 22-R8-2-2.

Level	Ceramic	Character	Period/Phase	Types	Granite	Chert
2	8	body	Spanish Lookout	Belize Red		2 flakes
	1	vessel	Late Preclassic	Sierra Red		
	24	rim	Spanish Lookout	Dolphin Head Red		
	2	ring base				
	58	non-diag				
3	1	rim	Late Preclassic	Laguna Verde		2 flakes
	7	rim	Late Preclassic	Sierra Red		
	2	rim	Middle Preclassic	Savana Orange		
	2	rim	Middle Preclassic	Jocote Orange		
	1	rim	Tiger Run/Spanish Lookout	Teakettle Black, Meditation Black		
4	1	rim	Late Preclassic	Sierra Red		2 flakes
	4	rim	Middle Preclassic	Savana Orange		
	5	rim	Middle Preclassic	Jocote Orange		

In total, it appears the intensive granite tool production was concentrated in an area about 1km^2 and consisted of small granite debris mounds interspersed among isolated single households. In 2021, two of those isolated households, each within 50m of a tested granite debris mound, were tested. Each produced limited amounts of granite flaking debris and granite tool blanks, as well as Late Classic period pottery. We propose that the residents of the isolated households were the ones who created and used the nearby production debris mounds.

In the western area of the community, both debris mounds and households are located on agricultural terrace, while in other parts of the community, both are positioned at the margins of hills or raised topographic features. This connection between tool production and slope edges is meaningful, but currently not understood. Equally interesting is the choice of agricultural terraces. Their use for granite tool production instead of food production suggests that the impetus for large scale tool making overshadowed the need for food.

The results generated so far lead us to argue that intensive granite tool production took place exclusively during the Late Classic period in a single community located on the northwestern periphery of Pacbitun. The interspersing of isolated households among debris mounds, suggests that production may have been conducted at the household level. While there is still more to learn about production at this level, equally important will be understanding how production was managed above the household level and how the tools produced were mobilized to serve what we assume are trade networks reaching far beyond Pacbitun. Both the scale and process of production, as well as the management and mobilization of granite tool production will be the focus of continuing investigations.

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28 CHALLENGES IN BUILDING ARCHAEOLOGICAL CHRONOLOGIES IN THE STANN CREEK DISTRICT

Meaghan M. Peuramaki-Brown, Shawn G. Morton, Matthew Longstaffe, and Jillian M. Jordan

Key to archaeological research is our ability to recognize and define material-culture patterns and organize such patterns in time and space. Since 2014, the Stann Creek Regional Archaeology Project (SCRAP) has focused on understanding processes of settlement development and growth at the Ancestral Maya town of Alabama in East-Central Belize, constructed and occupied primarily during the transition period between the late facet of the Late Classic to Terminal Classic periods. While we may never know precisely who settled Alabama and why, we aim to answer questions about the where, when, and how of its development in our ongoing research. In following these lines of inquiry, we have had to grapple with several obstacles that have frustrated standard practices of building archaeological chronologies at the site. Such barriers include earthen-core architecture with minimal artifact refuse within platform cores. Additionally, local and regional soil conditions that result in a poorly preserved and highly fragmentary ceramic assemblage and no preservation of human or faunal remains to date. Finally, we face the difficulties of constraining the radiocarbon calibration curve during the primary period of Alabama's settlement and growth. This paper details these problems and outlines our various approaches in their confrontation.

Introduction

Our ability to order time is critical to archaeological discussions of past transformations, transitional expressions, and adaptations. Since 2014, the Stann Creek Regional Archaeology Project (SCRAP) has focused on understanding the life history of the ancient town known today as Alabama (Figure 1). We currently understand that this ancestral Maya community was constructed and occupied primarily during the transition period between the late facet of the Late Classic to Terminal Classic periods, roughly 700 to 900 CE (Peuramaki-Brown 2017). Though we may never know who exactly settled Alabama and why, we can determine the where, when, and how of its development.

In pursuing these questions, we have had to grapple with several obstacles that have frustrated standard practices of building archaeological chronologies at the townsite. Archaeologists typically rely on three basic building blocks to outline site chronologies. These include stratigraphy (Block 1) and artifact seriation (Block 2) to produce relative dates, and radiocarbon dating (Block 3) to produce absolute dates. We begin this paper by introducing the problems we currently face with building chronologies at inland sites of the Stann Creek District, such as Alabama. We then further explore the mentioned building blocks and introduce how we are overcoming some of the issues we face to better outline Alabama's chronologies.

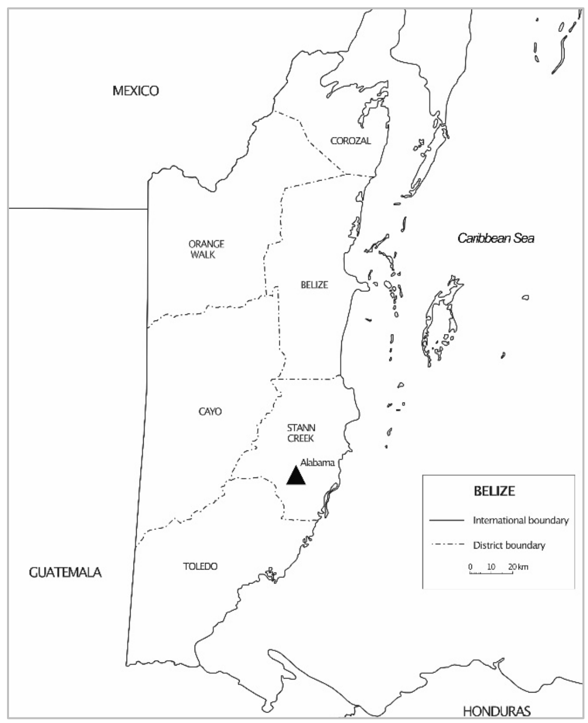

Figure 1. Map of Belize showing districts and location of Alabama.

Problems

Since the beginning of archaeological research in the Stann Creek District, several problems have stood in the way of standard chronology-building practices (Peuramaki-Brown et al. 2020). These include earthen-core architecture that include few to no artifacts within fills. Often, the stone exteriors are found to be effaced by the time archaeologists reach them, related to modern agricultural and construction practices as well as ancient pillaging. Platforms also typically lack clear floor caps to allow for sealed contexts, and few seem to contain primary deposits (e.g., caches) in locations typical of other Ancestral Maya constructions. Inland soil conditions that are clay-rich, acidic, and wet, also result in poorly preserved and highly fragmentary pottery assemblages, often lacking clear diagnostics of form or decoration. These conditions also typically lead to zero preservation of bone or shell. Finally, the relatively short primary construction and occupation period at Alabama is associated with difficulties constraining the radiocarbon calibration curve. We further discuss these issues below as we explore our related building blocks.

Block 1: Stratigraphy

The most basic source of chronological control is stratigraphy: separating different layers of dirt, rocks, artifacts, ecofacts, and features that define separate acts or episodes of behaviour. Careful stratigraphic control can help us write a story by putting these deposits in a sequence (Harris 1979). Understanding sequences of deposits can help us put big-picture events (e.g., arrivals, departures, construction, destruction) in order. They can also shed light on the shorter or smaller stages that make up longer or more significant events. In the case of architecture, stratigraphic construction sequences can vary significantly from structure to structure at Alabama. Some platforms are made chiefly of compact earthen materials with a facing of local granite-block masonry (Tibbits et al. 2022), while others have cores of loosely piled stone with sandy-clay matrix in between. Some have backing masonry and core faces, while others do not. Still, by paying attention to stratigraphy and not relying on prior assumptions regarding Ancestral Maya architecture, we can think of structures not as "things" on a landscape but as "processes"—a series of events over time. The clearer the layering, the clearer the picture. An ideal architectural sequence at Alabama would be the shared construction platform of Structures 1 and 2 (Figure 2). Without any additional information, we can identify a sequence of distinct growth phases at this locale, following basic laws of stratigraphy.

Figure 2. Stratigraphic sequence of Structures 1 & 2 construction platform.

We did not recover cultural materials from the deepest layers (blue). We interpret this layer as natural, having formed before people started living and building here, though keeping in mind our significant preservation issues in the Stann Creek District. Then, we get a thin layer of cultural material that marks when people arrive (purple). The first architectural construction is a single-course, masonry-faced platform (red) with an earthen core, oriented north-south. Ancient Alabamans used this structure for some time before partly covering it with a larger, more complex platform (yellow), oriented east-west. They then covered up the bottom courses of masonry on this later platform and the entire older platform with plaza construction material (orange). Post-abandonment transformations are characterized by building fall, colluvium, and natural soil development (green). Thus, we can create a relative timeline for the sequence of events associated with the building and

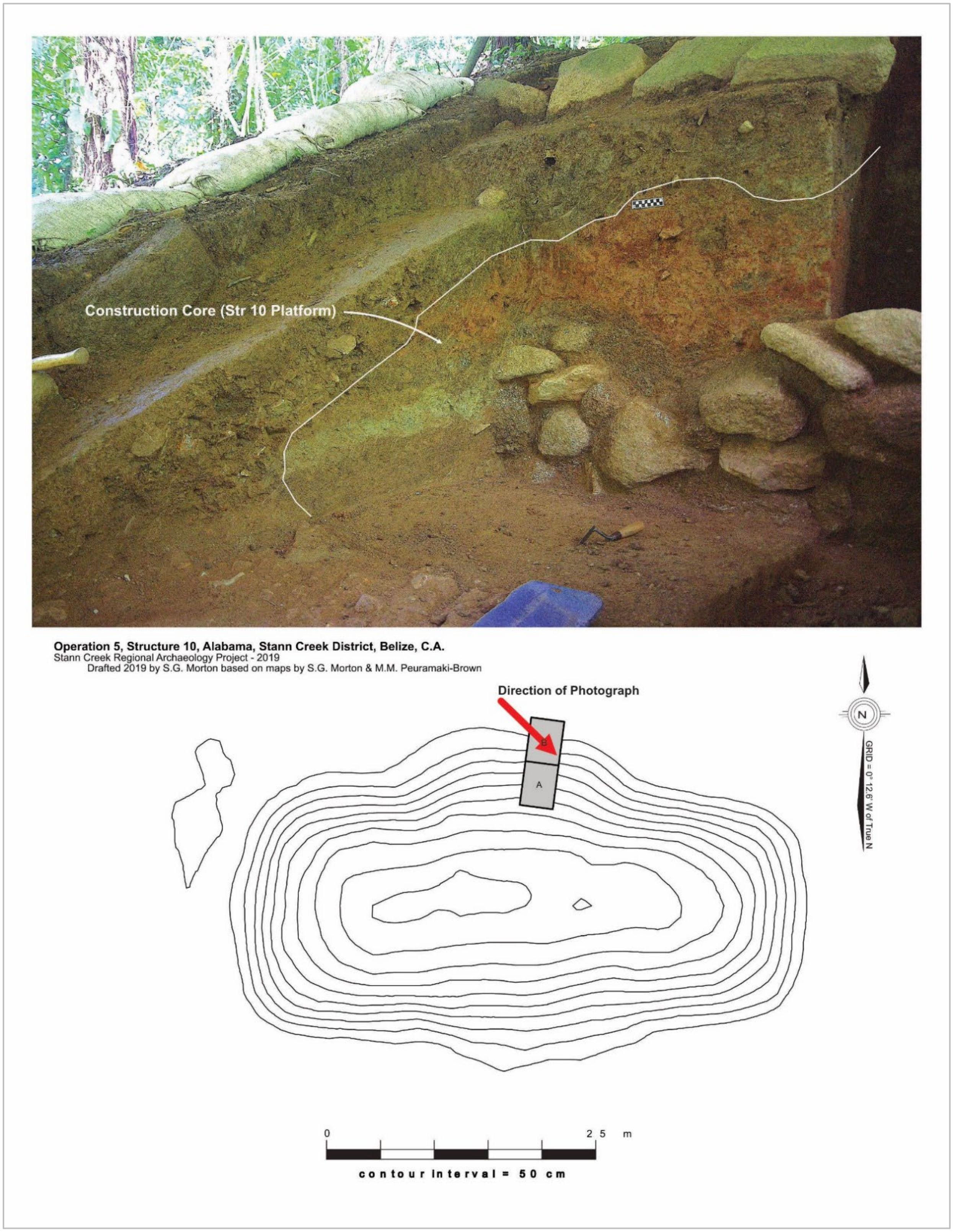

Figure 3. Diverse textures and colors of earthen matrix in the construction core of the north "stair" of Structure 10.

abandonment of this part of the site. If we do this over and over, we can build a more complete picture for the site—this is standard archaeological practice. For example, by expanding on our earlier work with stratigraphy and spatial layout (Peuramaki-Brown and Morton 2019), we can now tentatively identify a chronological shift in architectural construction at Alabama, with earthen construction cores dominating the first part of the main occupation period and stone cores appearing more frequently later. One of the problems with reconstructing chronology based on stratigraphy at Alabama is that town builders heavily favored earthen materials for their platform cores, which require long profile exposures to properly examine. In some cases, such as Structure 10 in the downtown core, different colors and textures of soil were used to build a possible outset stair (see below; Figure 3) and the main platform. These differences allow us to tease apart potential different stages and tasks of construction. Consulting archaeological literature from the Eastern Woodlands and American Southeast suggests that such layering may not be random (Sherwood and Kidder 2011). The laying down of earthen materials with diverse properties may contribute to structural stability. That the earthen mounds of Stann Creek District may similarly represent more sophisticated architectural choices than previously suspected (Pendergast 1990) is something we are just beginning to explore at Alabama. Nevertheless, this same image illustrates our problem. Based on the shape of the building, we had thought we would find an outset stair leading to the top of the Structure 10 platform, despite significant topographic disturbance due to large trees growing across the structure. Elsewhere on site, Alabamans constructed stair steps of granite risers and treads. However, we found no such steps in our excavations at Structure 10. Were the stones removed in antiquity or the more recent past? Were they never put in place, and was the structure abandoned mid-construction? Was this a ramp? Were the stairs perhaps made of perishable materials, like wood? In this case, our problems go well beyond the chronological. It can (and often does) get worse! For most mounds at Alabama—especially in the settlement—we lack the clear layering visible in Structure 10. These mounds have degraded over the last thousand years through root and water action and modern agricultural activity. Portions of the ancient insides have become parts of the contemporary outsides. Moreover, we cannot always tell the difference! For instance, at ALA-047A (a 2+ m tall mound in the orchard settlement zone), we could not identify the line separating the preserved portions of the effaced earthen-core mound from eroded material (Morton et al. 2016). So, we had to get creative. We, therefore, introduced a technique into our field methods involving a chaining pin marked with a sharpie. We laid a grid across our excavation profile wall into the mound and pressed the pin's point into the wall with as consistent pressure as possible. From this, along with noting the location of random bits of disintegrating pottery, we could identify areas of greater compaction that were likely intact portions of the platform core. We have used simple artifact densities at other mounds—noting higher concentrations outside the platforms than within their cores (Pennanen and Peuramaki-Brown 2016). Of course, it would be even better to use the few artifacts we do find within our stratigraphic layers to refine our interpretations. This is where artifact seriation comes into play.

Block 2: Artifact Seriation

As at most Ancestral Maya sites, the artifact type we encounter most frequently at Alabama is pottery. Therefore, ceramic seriation is an additional tool for determining when stages or events happen. Archaeologists can take advantage of groupings of artifact attributes to identify patterns across space and cultures and, crucially, for our present purpose, over time (O'Brian and Lyman 2002, 2006). The poor preservation of pottery at Alabama has resulted in the loss of many stylistic attributes—colour, decoration, and form—that archaeologists typically use to identify and date pottery (Graham 1994; Howie and Jordan 2018; MacKinnon 1989). At times, deterioration is so significant that no exterior surface treatment survives, and we cannot even remove sherds from the ground—only a sherd-shaped "smear" remains (Figure 4). This most often occurs with pottery that contains carbonate inclusions/temper, which are leached from sherds when deposited over time in the local

Figure 4. Pottery "smear" in construction core at Alabama.

acidic soils. As a result, the ceramic assemblage at Alabama requires starting with an approach that focuses on preserved attributes. Specifically, we look at the details of pastes: the materials a pot is made of, involving combinations of clay, natural inclusions, and added materials called temper (Jordan et al. 2021; Rice 1976, 2013). We use these data to determine where a pot was made geographically and are starting to use them to understand chronology. So far, we have analyzed 100% of the surface-collected ceramic assemblage from across the Alabama settlement, including non-diagnostic body sherds, using various analytical techniques to understand where and how people made pottery (Jordan 2022). The most basic way to characterize ceramic fabrics is to document attributes like the colour and shape of inclusions using the naked eye or a geological loupe. Another analytical technique that we employ is microscopy using a handheld Dino-Lite USB microscope. This microscope allows us to record additional attributes, such as sorting and frequency estimations of inclusions or remaining voids. We then employ thin-section petrography to help us further identify included minerals and rocks by their associated attributes under plane-polarized and cross-polarized light. Using the above techniques, we have identified 11 different paste groups at Alabama and assigned 2948 sherds to one of these or categorized them as unknown. We now know that at least four paste groups were made at Alabama or elsewhere in the district. To build our ceramic seriation for chronology, we are now following several steps. We are continuing to assign recovered ceramics to established ceramic systems and type: variety classifications, when possible, which we can use to determine chronology based on comparisons. If we cannot do this, we continue defining our own. We continue to add data on form and surface treatment to our existing paste categories. We are also starting to use our aforementioned excavation/architectural stratigraphies to determine if and how local paste compositions change throughout Alabama's history. Finally, we also continue to determine if pastes from different regions (e.g., southern Belize vs. central Belize) appear in different frequencies over time at Alabama.

Block 3: Radiocarbon Dating

The final building block involves radiocarbon dating—an absolute dating technique—which we must use to anchor our relative stratigraphic and seriation chronologies. We think of some parts of the archaeological record, such as pieces of carbonized wood or preserved organic materials like shell or bone, as having an internal clock (Taylor and Bar-Yosef 2016:28-34). We know how to read this clock by looking at the ratio of two different types of carbon isotopes. Carbon, often referred to as the building block of all organic life on Earth, is one of the most abundant elements in the universe. The carbon cycle is nature's way of continually circulating carbon from the atmosphere to the Earth and back to the atmosphere, providing carbon to all living organisms. Generally speaking, plants capture carbon dioxide from the atmosphere through photosynthesis. Animals (including humans) get carbon by consuming these plants, and the carbon is returned to the atmosphere through respiration and decomposition. Radiocarbon dating hinges on having more than one form of carbon (Taylor and Bar-Yosef 2016:100). All carbon has an atomic

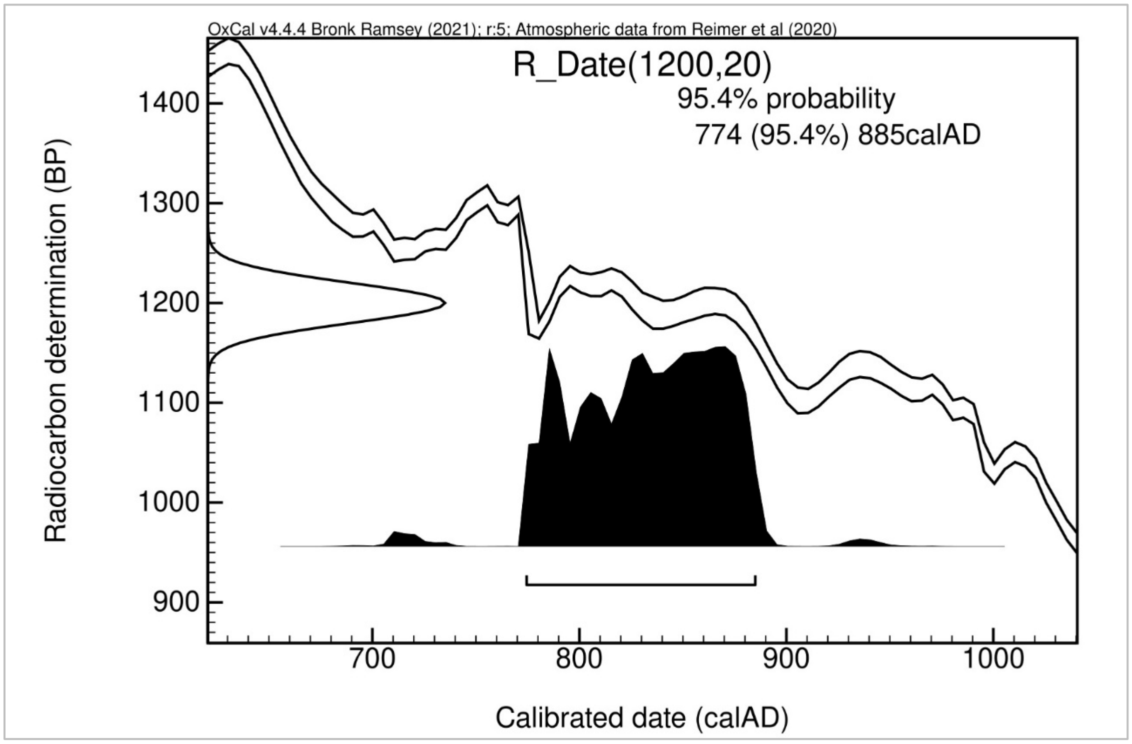

Figure 5. A simulated date (1200 BP ± 20) along a "flat" part of the radiocarbon calibration curve producing multiple intercepts and a wide probability range that spans much of the Terminal Classic period (800-900 CE).

nucleus containing six protons. Ninety-nine percent of all carbon has six neutrons: a form of carbon called Carbon-12 (^{12}C). The second form of carbon, Carbon-14 (^{14}C), has eight neutrons and is created in the atmosphere when cosmic rays interact with nitrogen. Although ^{12}C and ^{14}C behave similarly, ^{14}C is unique because it is "unstable." This means that once a living creature dies, the ^{14}C in it begins to decay at a constant rate. While ^{14}C is slowly degrading, the amount of ^{12}C will always remain the same. By calculating the ratio of ^{14}C to ^{12}C, we can measure how many years have passed since the organism died. When we recover carbonized wood in the archaeological record of Alabama, we can send samples to laboratories for analysis, which we then use to date a context. One important consideration is that the proportion of radiocarbon in the atmosphere varies over time and space. Accordingly, radiocarbon dates need to be calibrated to produce dates comparable to calendar age estimates (Bronk Ramsey 1995; Buck et al. 1991; Reimer et al. 2020). Because the abundance of radiocarbon was not constant in the past, the slope of the radiocarbon calibration curve frequently changes, creating sections where the slope is "steep" and others where it is "flat." The calibrated date is precise if your radiocarbon date lands on a steep section of the calibration curve. Conversely, drawing a line from a radiocarbon date to flat sections of the calibration curve can intersect in more than one place, resulting in a wide calibrated date distribution (Taylor et al. 1996:661-662). Unfortunately, one of the problems encountered at Alabama is the timing of its rapid growth and development, which corresponds to a relatively flat area of the calibration curve (Figure 5). Further, if we want to use carbon dating to gain meaningful insights into the human past, we must be specific about what we are trying to date (Hamilton and Krus 2018:198). Some of the most common questions an archaeologist will ask include, how old is this site? When was this platform constructed, and how long was it used? When we ask these questions at Alabama, we must carefully consider which stratigraphic contexts we sample to best answer the question at hand. For instance, it seems reasonable to analyze a carbon sample from the construction core of a platform if we want to know when it was built. At many Maya sites, the construction core of platforms consists of limestone rubble. These also include artifacts and pieces of carbon deposited by builders as they took advantage of nearby midden material to use in fill or from other activities associated with construction. These are invaluable contexts for providing chronological markers for the construction event and previous occupations around the platform. Ancient Alabamans constructed their platforms primarily using earthen material, sometimes containing carbonized materials. The radiocarbon dates we get from construction cores often come back several centuries to thousands of years too early, given what we know about the site, the region, and the associated artifact types we can identify. This reflects "old carbon," which was naturally deposited on the landscape and inadvertently ended up in the platform when Alabamans quarried the earth for construction materials. Instead of trying to get reliable dates from the construction core, we have more success dating the approximate period of mound construction by selecting samples from the prepared construction surface underlying the platform itself and occupation dates by analyzing samples from associated features and habitation debris. We have also begun employing Bayesian chronological modelling to improve our radiocarbon chronologies at Alabama. In short, Bayesian chronological modelling combines radiocarbon dates with information from the archaeological record (called “priors”), such as stratigraphy and ceramic seriations or sequences (Bayliss 2009; Bronk-Ramsey 2009). This combination helps to address some of the challenges we have described. Incorporating priors with probability distributions from radiocarbon dates allows us to use the relative ordering of samples in a stratigraphic sequence to constrain wide date ranges to a narrower range. One of the main benefits of Bayesian analysis is an increase in the precision of dating compared to calibrated radiocarbon dates that we would otherwise only consider individually. Many have demonstrated that Bayesian analysis is an invaluable technique at archaeological sites across the Maya Lowlands (Arroyo et al. 2020; Culleton et al. 2012; Ebert et al. 2016; Hanna et al. 2016; Hoggarth et al. 2016, 2021; Inomata et al. 2017; Tsukamoto et al. 2020; Vadala and Walker 2020). We are currently using this method to develop more precise platform construction and occupation models in Alabama's settlement zone (Longstaffe and Peuramaki-Brown, forthcoming).

Conclusion

While the various methods we have described may not provide perfect solutions to our many challenges, they are positioning us to understand better the relative and absolute timing and tempo of development processes at ancient Alabama. Such studies and the information generated represent a necessary first step, a baseline dataset, upon which more complex questions, analyses, and interpretations may be constructed. No matter the site or the project, archaeologists continually return to, refine, and ground their work by answering where, when, and how.

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29 THE IMPORTANCE OF USING SEDIMENT CHEMISTRY TO INTERPRET ANCIENT MAYA SALT MAKING ACTIVITIES AT THE PAYNES CREEK SALT WORKS

E. Cory Sills and Heather McKillop

Chemical analysis of soils and sediments are useful for finding activities and defining space not readily apparent in the artifact assemblage due to varied preservation. In the Maya cultural area, chemical analysis of anthropogenic and naturogenic terrestrial soils and marine sediments have been used to find activities that occurred at ancient Maya sites both inside and outside of buildings. The Underwater Maya project has adapted soil chemistry, usually conducted at terrestrial sites, to the submerged Paynes Creek Salt Works. The acidic red mangrove peat has remarkably preserved wooden posts that form the outline of buildings and botanical remains but does not preserve bone or shell. The differential preservation at the salt works could obscure the full plethora of activities taking place, under shadowing the complexity of production of salt for the Late Classic Maya. In this paper, we discuss the importance of soil and sediment chemistry analysis in the Maya are, methods for sampling sediment at the Paynes Creek Salt Works, and the chemical signatures of human activity that are most likely to occur at the salt works.

Introduction

Soil and sediment chemistry has been used to find and evaluate ancient Maya activities and features not readily identified through architecture and artifact assemblages. At the Paynes Creek Salt Works, Belize chemistry of marine sediment has proved successful in defining activities associated with salt production inside and outside of wooden buildings at Chan b'i (Figure 1; Sills et al. 2016). The success of adapting chemical analysis from terrestrial contexts to marine sediments at Chan b'i underscores its utility for discovering additional activities that were occurring in conjunction with salt production elsewhere at the Paynes Creek Salt Works. The Underwater Maya Project has collected marine sediment from the inside and outside of wooden buildings at two of the largest salt works, Ta'ab Nuk Na and Ek Way Nal, as part of a National Science Foundation Grant to the authors titled *Labor Relations in a Traditional Complex Society* (Figure 2). The purpose of chemical marine sediment analysis is to discover residues associated with human settlement and activity not preserved in the acidic peat matrix that has preserved wooden posts and botanicals.

Ta'ab Nuk Na and Ek Way Nal each has ten buildings that provide an opportunity to compare the range of activities that were taking place in addition to salt production. The results of floatation surveys indicates that at least one of these buildings at each site was used as a residence, challenging an assumption that salt production was a tertiary part of the ancient Maya Classic period economy (McKillop 2019; McKillop and Sills 2001, 2002). Considering this new information, the application of sediment chemical analysis to these underwater sites is used to explore the possibility of activities and features that have been identified through the

Figure 1. Map of the Maya area showing the location of The Paynes Creek Salt Works and site mentioned in the text. Map by E. Cory Sills.

artifact assemblage and ethnographic analogy. The finding of residences at the salt works requires a re-evaluation of the size and organization of space within buildings and in yards than what has previously been associated with salt kitchens.

Activities previously identified at the Paynes Creek Salt Works includes salt production, brine enrichment, salt drying or drying fish, wood working, food preparation, and ritual behaviors (McKillop 1995, 2002, 2019; McKillop and Aoyama 2018; McKillop and Sills 2021; Sills and McKillop 2018). Salt was produced indoors in salt kitchens using the boiling method where salty water is placed in pots over fires and boiled until all that remains is salt (McKillop 1995, 2002, 2019). This method of salt production leaves behind briquetage which is the broken pottery from the process and consists of pottery vessels, cylinder supports, and spacers, sockets, and bases that attached to the vessels and evenly distributed them across the fire (see Reina and Monaghan 1991; McKillop 1995: Figure 10, 2002). The pottery vessels were broken to remove the salt inside. After finishing the salt production, the briquetage was swept to the corners and walls with some retained in the fire for heating (McKillop 2002; Sills and McKillop 2018). The briquetage was produced locally but evidence that the pottery was fired at the salt works is missing (McKillop 2019). Other materials required for boiling brine is firewood that was possibly stored in the salt kitchen or nearby.

Brine enrichment is typical of salt production using the boiling method (Andrews 1983; MacKinnon 1989; Reina and Monaghan 1981; McKillop 2002, 2019). Salt-laden soil is elevated on a platform with holes at the base and a collecting vessel below. Brine is poured on the salt-laden soil and collected underneath. This process is repeated continuously until the brine is salty enough for boiling. At Sacapulas, balls of corn are used to test the salinity prior to boiling (Reina and Monaghan 1981). If they float, then the brine is ready for boiling. Evidence of brine enrichment was recovered from the Eleanor Betty Salt Works where a funnel was found underneath a canoe (McKillop 2019; McKillop et al. 2014).

Use-wear analysis of stone tools from the Paynes Creek Salt Works has revealed evidence of salt-drying fish and woodworking as well as a

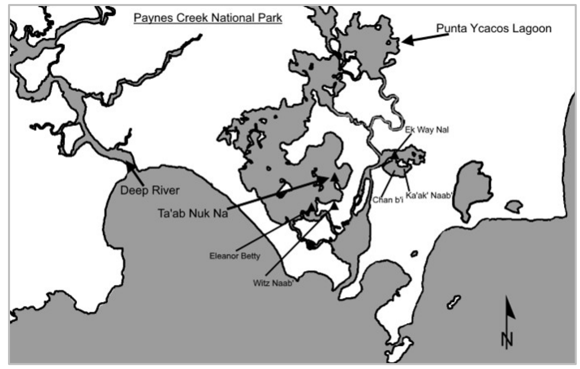

Figure 2. Map of Paynes Creek National Park showing locations of Chan b'i, Ta'ab Nuk Na, and Ek Way Nal salt works. Map created by E. Cory Sills.

fishing weight (McKillop and Aoyama 2018; McKillop 2019). Additional artifactual evidence of salt-drying fish such as fish bones is missing. Food preparation likely occurred inside or close to a residence or around hearths. Evidence of food preparation found at the Paynes Creek Salt Works includes manos and metates and preserved native palm fruits (McKillop 2019). The remains of bones from meals are absent. The Maya commonly buried their dead in the floors of their homes, which may have occurred at the residences found at Ta'ab Nuk Na and Ek Way Nal. Evidence of rituals performed at the salt works includes ocarinas (figurine whistles) and Belize Red serving bowl sherds (McKillop 2002, 2019). Sediment chemistry may reveal evidence of saltdrying of fish, burials, and further define the spatial division inside of salt kitchens, residences, and yards.

Chemical Analysis of Soils and Sediments in the Maya Area

Except for a study conducted at the ancient Maya salt work of Chan b'i (Sills et al. 2016), soil chemistry in the Maya area has been conducted on terrestrial soils These studies have largely focused on architecturally defined ancient cities with defined plazas and buildings (Anderson et al. 2012; Cap 2015; Cook et al. 2006; Coronel et al. 2015; Dahlin et al. 2007; Fulton et al. 2017; Hutson and Terry 2006; Lamoureux-St-Hilaire et al. 2018; LeCount et al. 2016; Parnell et al. 2002a, 2002b; Terry et al. 2004; Wells et al. 2000; Wells 2004). Ethnoarchaeological studies of modern Maya house floors have been conducted to evaluate the results of chemical soil analysis results from archaeological sites (Fernández et al. 2002; Middleton and Price 1996). Numerous activities associated with human activities and features that leave behind residues on earthen floors, plaster floors, and the landscape include food preparation, consumption, and disposal, storage of food, hearth placement, burials, middens, craft production, rituals, feasting, marketplace activities, and salt making (Anderson et al. 2012; Barba 2007; Cap 2015; Cook et al. 2006; Coronel et al. 2015; Dahlin et al. 2007; Fulton et al. 2017; Hutson and Terry 2006; Lamoureux-St-Hilaire et al. 2018; LeCount et al. 2016; Parnell et al. 2002a, 2002b; Sills et al. 2016; Terry et al. 2004; Wells et al. 2000; Wells 2004).

Chemical analysis of plazas in ancient Maya cities show that many activities occurred in these spaces. High values of phosphorus from the main plaza at El Coyote, Honduras indicate areas with food preparation and consumption (Wells 2004). The combination of barium, magnesium, manganese, and zinc found in the plaza at Palmarejo, Honduras was interpreted as an area for the burning of incense and food consumption associated with rituals (Fulton et al. 2007). Disposal areas were found at Xtobo, Mexico was associated with craft production due to the combination of copper, iron, manganese, and lead (Anderson et al. 2012). Marketplaces occurring in plazas have been identified by the presence of phosphorus and zinc indicative of food preparation and consumption activities at the sites of *Chunchucmil* and Cobá, both in Mexico, and at Buenavista del Cayo (Cap 2015; Colonel et al. 2015; Dahlin et al. 2007; Terry et al. 2015). Iron, associated with butchering coupled with phosphorus and zinc were found in a proposed marketplace at the site of Telchaquillo, Mexico (Terry et al. 2015).

Inside of buildings, in more restricted areas than plazas, phosphorus is also associated with food preparation, consumption, and food storage such as maize (Eberl et al. 2012; Fernández et al. 2002). Phosphorus has also been found in food disposal areas such as middens Wells et al. 2000). Potassium and magnesium have higher amounts in areas near hearths (Fernández et al. 2002). Also, phosphorus and magnesium have been associated with hearths especially if food is prepared or consumed in the area (LeCount et al. 2016). Phosphorus is associated with the doorways and the edges of buildings likely due to frequent sweeping inside towards the edges (Anderson et al. 2012; Hutson and Terry 2006; Parnell et al. 2002b; Terry et al. 2004). Iron concentrations are associated with pyrite at elite residences at Aguateca, Guatemala (Terry et al. 2004). Lead has also been associated with craft production and/or combined with other elements such as mercury, iron, and zinc (Cook et al. 2006; Parnell et al. 2002a, 2002b). Many of these elements overlap in areas where cooking and food preparation occur suggesting that craft production occurred in the same places as food production and consumption (Dore and López Varela et al. 2010; Lamoureux-St-Hilaire et al. 2018; LeCount et al. 2016)

Heavy metals such as those mentioned above were found at Piedras Negras suggesting that houses were painted by the combination of but not limited to copper, iron, manganese, lead, and zinc (Wells et al. 2000). At Cerén, El Salvador, hematite was found within every excavated household denoting its common use (Sheets 2000). Mercury and cinnabar were found at *Chunchucmil* associated with a burial (Hutson and Terry 2006) and at Cancuén, Guatemala (Cook et al. 2006). Mercury and iron were found in floors at Actuncan, Belize possibly associated with the use of cinnabar and ochre (LeCount et al. 2016).

Areas where trace elements are diminished does not mean that activities were not occurring (Wells 2004). Instead, areas with low phosphorus can be interpreted as walkways (Parnell et al. 2002b; Terry et al. 2004) or areas under the eaves of buildings (Parnell et al. 2002a). Areas that do not have regular use or are isolated exhibit low phosphorus (Fernández et al. 2002). Also, flint knapping can occur in areas with low phosphorus but with an increase in iron (Cap 2015).

Analysis of marine sediment from Chan b'i using chemical analysis was successful in defining salt making activities (Sills et al. 2016). The Chan b'i site is underwater in the East Lagoon of Punta Ycacos Lagoon. The site consists of at least one building with room division and two out flaring lines of palmetto palm posts. Phosphorus, magnesium, and potassium occur in the central area of the building next to wooden posts. Additionally, aluminum, iron, and sodium occur in these areas confirming that the floors were swept and the ash from fires and salt production were pushed to the walls. The results of chemical analysis were supported by two transect excavations through the building that yielded abundant briquetage inside and directly surrounding the building. The elements that were present inside the building were minimal between the two lines of palmetto palm posts suggesting salt production was not occurring there. The area is also bereft of salt making pottery and lower in elevation than the wooden building. The sea floor has thick silt—20 cm and greater in depth—that overlays the red mangrove peat. However, the area is demarcated by palmetto palm posts which implies some function associated with the building. Correspondingly, sodium is lower in this area than all the other tested marine sediment samples from Chan b'i. A hypothesis is that the area was used to extract salty peat for enriching the salinity of salty water before it was evaporated in pots over fires (Sills et al. 2016).

Figure 3. Photograph of a laying out a transect at Ek Way Nal to sample marine sediment. Photograph by Cher Foster.

Figure 4. Photograph of an example of collecting marine sediment in a sterile whirl-pak at Ek Way Nal. Photograph by Cher Foster.

Sedimentscape and Preservation at The Paynes Creek Salt Works

The Paynes Creek Salt Works are in Paynes Creek National Park, southern Belize. All but two of the salt works, Witz Naab and Killer Bee, are located underwater in Punta Ycacos Lagoon (McKillop 2002; Watson and McKillop 2019). The lagoon is subject to tidal variations as most of the water is supplied by the Caribbean Sea with some fresh water from nearby Fresh Water Creek that drains from the nearby pine savannah. The salinity of the Punta Ycacos Lagoon fluctuates depending on rain fall—more salinity in the dry season and less in the rainy season. The vegetation around the lagoon is a mangrove ecosystem dominated by red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*).

The salt works were once on dry land but close to the lagoon as a source of brine for evaporating in pots over fires. After the salt works were abandoned at the end of the Late Classic period, rising seas inundated the salt works with some of the sites keeping pace with sea level rise due to mangrove accretion. The sea floor consists of firm peat overlain with a layer of silt. The peat is formed by organic red mangrove tissues (McKillop et al. 2010a and 2010b). Loss-on ignition indicates high organic matter accounting for approximately 60% of the sediment (McKillop et al. 2010a and 2010b). The peat has remarkably preserved wooden posts and other botanical remains including cohune endocarps (*Attalea cohune*) (McKillop 2005; McKillop and Sills 2021) but is not conducive to the preservation of bone and shell (Sills et al. 2016). The wooden posts were made from a variety of hardwoods including black mangrove and other species (Robinson and McKillop 2013). Most sites have lines of palmetto palm posts (*Acoelorrhaphe wrightii*) used as land retaining walls (McKillop and Sills 2017; McKillop 2019).

Sediment Collection at the Paynes Creek Salt Works

Marine sediment samples have been collected from Chan b'i (Sills et al. 2016), Ta'ab Nuk Na, and Ek Way Nal. Transects were established at each site to sample the inside and outside of buildings, marked by the presence of a wooden posts, and to include open areas defined

Table 1. Potential Marine Sediment Chemical Signatures of Ancient Activities at The Paynes Creek Salt Works. Information below is inferred from the available literature on chemical analysis of soils and sediments.

Activity	Chemical Signatures
brine boiling	phosphorus, magnesium, potassium
storage of food	phosphorus, magnesium, calcium
storage other	low phosphorus
briquetage production	aluminum, magnesium, manganese, potassium, zinc
salt enrichment	low sodium
salt drying fish	sodium, iron, calcium, strontium
fish processing	iron, calcium, strontium
wood working	low phosphorus, iron
food preparation, disposal, and consumption	phosphorus, zinc, aluminum, magnesium, barium, manganese
ritual	barium, magnesium, manganese, zinc
burial	phosphorus, strontium, calcium, mercury, iron, lead, copper, manganese
other craft production	copper, iron, manganese, lead

as yards (Figure 3). The samples were collected to correspond with planned or potential excavations (Sills et al. 2016). A 1 x 1 m grid frame was placed along transects, with marine sediment collected at 50 cm and/or 1 m intervals. Samples were collected using a stainless-steel spoon to collect a 2 to 3 cm section of the sea floor for analysis. The marine sediment was placed in a sterile labeled whirl-pak bag (Figure 4). Notes about the location of each sediment sample and the condition of the sea floor were made in a water-resistant book. Photographs were taken of the sediment and the procedure. The marine sediment was excavated under permit by the Institute of Archaeology of Belize to Heather McKillop. The sediment is currently stored at the Louisiana State University Archaeology Laboratory.

The sediment from Chan b'i was analyzed by Christian Wells at the Laboratory for Anthropogenic Soils Research at the University of Southern Florida using the digestive technique of inductively coupled plasma-mass spectroscopy (ICP-MS) (Sills et al. 2016). The marine sediment from Ta'ab Nuk Na has undergone chemical analysis at the Louisiana State University AgCenter and is awaiting analysis by the authors. Selecting marine sediment samples from Ek Way Nal is ongoing. Sediment from Ta'ab Nuk Na and eventually Ek Way Nal will be analyzed by using a digestive process called inductively coupled plasma-atomic emission spectrometry (ICP-AES). Both ICP-MS and ICP-AES detect trace elements that have bonded to the soils and sediments. The instruments used for these studies report the results in ppm of numerous elements that are indicative of human settlement including calcium, iron, magnesium, manganese, phosphorus, potassium, zinc, aluminum, and lead to name a few.

Modeling Chemical Signatures of Activities at The Paynes Creek Salt Works

Many activities can be detected by chemical analysis of marine sediment at the Paynes Creek Salt Works including brine boiling, food storage, other storage, pottery production, brine enrichment, salt drying of fish, fish processing, wood working, food preparation, disposal, and consumption, rituals, burials, and other craft production (Table 1). Brine boiling was occurring indoors in salt kitchens at the Paynes Creek Salt Works. Chemical signatures of this activity would resemble those identified at Chan b'i with phosphorus, potassium, and magnesium occurring together (Sills et al. 2016). Potassium and magnesium are often associated with fires and wood ash and could also represent hearths or areas of burning for rituals (Fulton et al. 2017; LeCount et al. 2016; Wells 2004).

Food storage associated with a residence and/or salt production would have phosphorus, magnesium, and/or calcium. At Sacapulas, if balls of corn float in the brine, then it is ready for boiling (Reina and Monaghan 1981). Other storage associated with salt production would include storage of firewood and pottery. These likely would have lower phosphorus than brine boiling. Pottery storage would also have aluminum and manganese present (Sills et al. 2016). Briquetage production would include materials that are present in the clay and temper of locally produced pottery such as aluminum, magnesium, manganese (Sills et al. 2016) and potassium associated with fires. Brine enrichment would have areas of low phosphorus as those areas that are not engaged in food storage, consumption, or disposal (Parnell et al. 2002b; Terry et al. 2004). Also, sodium values would be lower than the inside of salt kitchens (Sills et al. 2016).

Other activities tangential to salt production such as salt drying of fish and fish processing would have phosphorus present as well as calcium and strontium found in bone and shell. Wood working areas would likely have less phosphorus, but iron would be present due to the stone tools required to work with the wood (Cap 2015). Consuming, preparing, and disposal of food would have phosphorus but also zinc, aluminum, magnesium, barium, and/or manganese (Fernández et al. 2002; Parnell et al. 2002a). Many of the buildings and salt kitchens could also show evidence of ritual as well as burials as is noted at Cerén where hematite was common in most residences (Sheets 2000). Hematite along with other pigments could be present and would include the presence of iron, manganese, copper, lead, and/or mercury (LeCount et al. 2016; Terry et al. 2004).

Conclusions

Chemical analysis to detect elements associated with human activities in soils and sediments is an important method for discovering additional activities missing from the artifact assemblage due to differences in preservation. Chemical sediment analysis such as ICP-MS and ICP-AES has been successful in finding additional activities as well as defining salt kitchens at the Paynes Creek Salt Works. The environmental factors at of an acidic anaerobic sediment and sea-level rise after the sites were abandoned preserved wooden buildings and botanicals but not bones or shell. Combining various methods including excavation, artifact analysis, use-wear analysis, and ethnographic sources with sediment chemistry aids in defining the organization of production at the Paynes Creek Salt Works. The Paynes Creek salt makers were engaged primarily in salt production inside of salt kitchens for surplus production living next to their salt works. The pottery used in salt production was produced near-by and brine enrichment occurred close to the salt kitchens. However, the adoption of chemical analysis of sediment will illuminate other possible activities and features such as salt drying fish, fish processing, ritual, burials, brine enrichment, residences, and craft production.

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30 EXCAVATIONS OF BUILDING A AND LINE OF PALMETTO PALM POSTS AT EK WAY NAL, BELIZE

Hollie Lincoln, Heather McKillop, and E. Cory Sills

This paper summarizes excavations of a suspected fish processing location at the submerged site of Ek Way Nal located in Paynes Creek National Park. Based on use-wear analysis of chert tools found near Building A and a line of palmetto palm posts indicated that fish processing was taking place at Ek Way Nal. In addition to fish processing, Ek Way Nal represents one of 110 Late Classic salt making settlements of the southern coast of Belize. Analysis of survey data, excavation data, and artifact analysis provides information about settlement organization, trade relationships, and activities taking place at the Paynes Creek Salt Works. Excavation data also suggests the presence of a deflated leaching mound created through long-term production of salt at this site. High volumes of charcoal indicate large amounts of wood harvested and burnt for brine boiling. Low-quality and high-quality stone tools and debitage indicate local and long-distance acquisition of stone materials. Artifacts associated with preserved wooden structures indicates building function across the site.

Introduction

Remnants of pole and thatch buildings are embedded and preserved in the sea floor at over 70 sites located in Punta Ycacos Lagoon in Paynes Creek National Park (McKillop 2019; McKillop and Sills 2021). Ek Way Nal is one of the largest sites in the Paynes Creek Salt Works (Figure 1). The sites produced large quantities of salt for export using a brine-boiling method (Feathers and McKillop 2018; Feathers et al. 2017; McKillop 1995, 2002, 2019; McKillop and Sills 2021; Somers 2007; Watson and McKillop 2019). Salt played a key role in the nutrition of the ancient Maya, was one of the only methods by which food could be preserved, could be used to fix dye coloring in textiles, tan hides, used for medical purposes, and improved flavoring of food (McKillop 2018; Williams 2010).

Although no formal excavations had taken place at Ek Way Nal prior to 2022, wood posts and other artifacts on the sea floor including ground stone, chert, diagnostic pottery, and obsidian were individually mapped with a total station and collected during systematic survey in 2006 and 2007 (McKillop 2019; McKillop and Aoyama 2018; McKillop et al. 2019; McKillop and Sills 2021). Ten buildings were mapped and used as a guide for excavations. The presence of large quantities of briquetage--pottery used during the production of salt cakes--indicates that multiple buildings at Ek Way Nal were used as salt kitchens, whereas others functioned as residences (McKillop and Sills 2021).

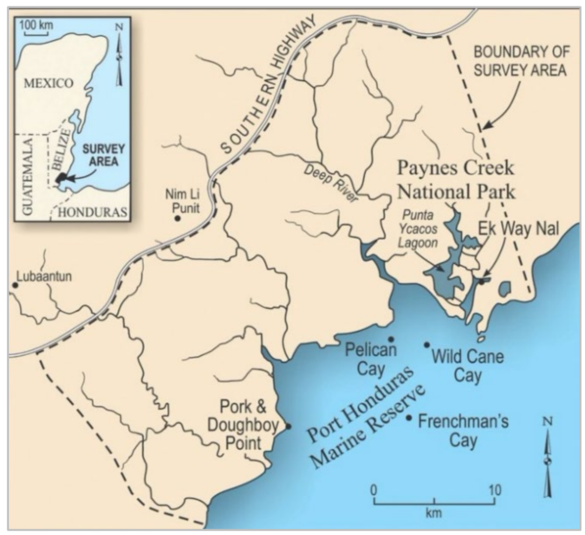

Figure 1. Location of Ek Way Nal in the Punta Ycacos Lagoon in Paynes Creek National Park, Belize (Map by Mary Lee Eggart, Louisiana State University).

Salt making at the highland villages of Sacapulas, Ixapa, and San Mateo Ixtatán provide modern-day comparisons of similar salt production methods (Andrews 1983; McKillop and Sills 2021).

Mapped artifacts associated with each building indicate their use. Domestic refuse such as food remains, tools used for food processing, ritual items such as ocarinas, and pottery for storage of food indicates a building was residential in nature (McKillop and Sills 2021; Williams 2008b). In contrast, a lack of artifact diversity paired with high volumes of briquetage indicate areas or buildings used in the salt production process (McKillop and Sills 2021).

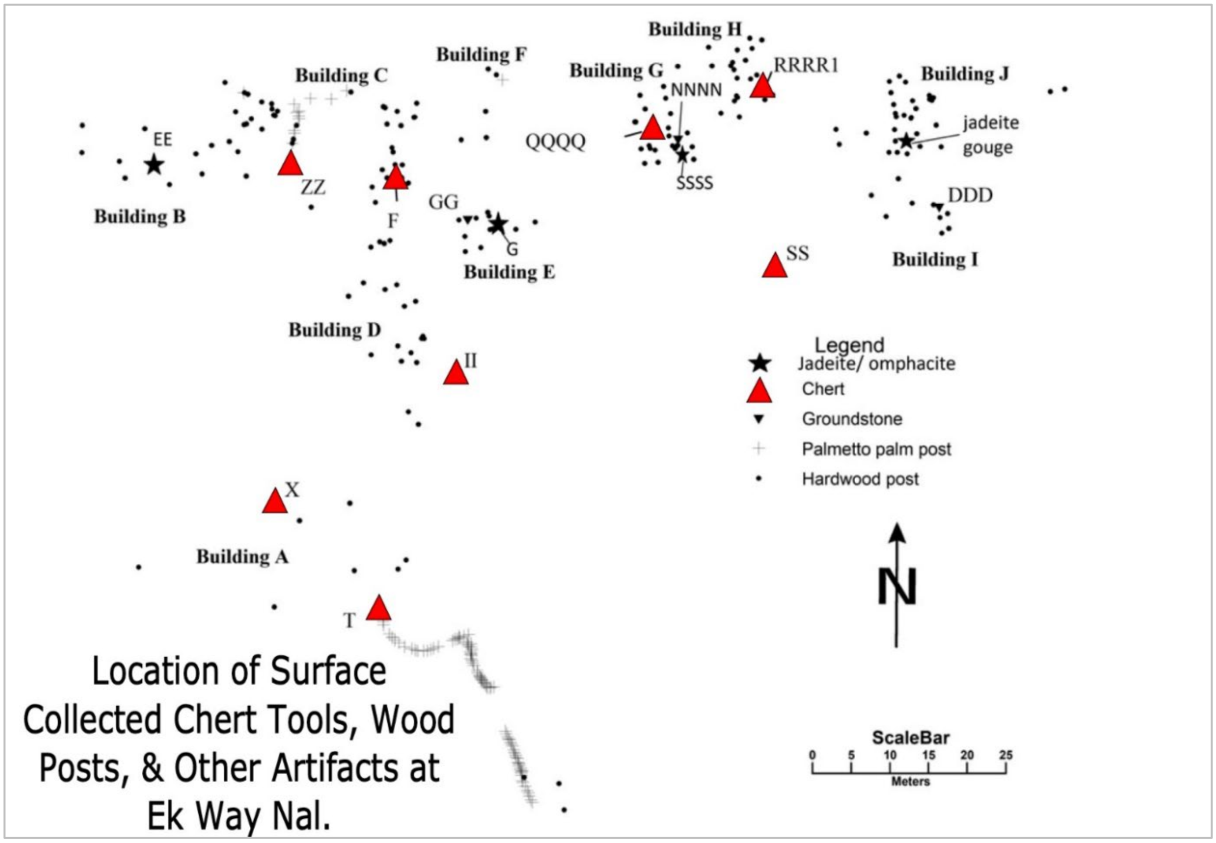

Figure 2. Map of surface collected chert tool locations. Artifacts are labeled with sea floor catalog letters that correspond to Table 1. (Map by Heather McKillop).

Figure 3. Image showing location of building A. Yellow flags on the left side of the photo show the location of transect 1. Orange flags on the right side of the image mark palmetto palm posts (Photo by Hollie Lincoln).

Indicators of fish processing and fish salting may include the presence of fish bones, stone tools used for cutting fish, and a drying rack or salting box (McKillop 2019). Use-wear analysis indicates that two chert stone implements, from buildings A and C at Ek Way Nal, were used for cutting fish or meat (McKillop and Aoyama 2018). A third chert tool near building A, near a line of palmetto palm posts was found to be used for scraping hide (McKillop and Sills 2021; McKillop and Aoyama 2018). The locations of these chert tools suggests that fish processing was taking place on the western periphery of the site (McKillop and Sills 2021). Historical documentation and archaeological evidence indicate that the coastal Maya traded salted fish and salt cakes with inland sites (McKillop 2019, 2022). Salt was one of the few means by which the Maya could preserve food. The practice of salting fish allowed for its consumption after transport or storage (Williams 2010). Modern fishing communities in near Lake Cuitzeo in Mexico still practice this preservation method and continue to trade fish for salt (Williams 2008, 2010). People living and working at Ek Way Nal would have utilized marine resources for sustenance and ritual purposes. Marine resources, such as salted fish, would have been desirable to inland communities and a valuable trade good.

Obsidian blades are commonly found throughout the Paynes Creek Salt Works (McKillop 2005). Use-wear analysis at other Maya sites has indicated that obsidian blades were used in food production activities. At Kaminalijuyu, obsidian blades are used for scraping and cutting activities (Hirth 2003). Use-wear analysis at Aguateca shows obsidian blade fragments were used for wood working and for cutting meat and hide (Aoyama 2011). Knives or scrapers made of obsidian or other stone tools were utilized in ancient times but have been replaced by modern tools at traditional salt-making communities in Mexico (Williams 2008b).

Radiocarbon dates of wood post samples from each building at Ek Way Nal suggest that buildings A, C, D, E, F, and H were constructed at the end of the Late to Terminal Classic (A.D. 600-900), whereas buildings B, G, and J were constructed slightly earlier at the beginning of the Late Classic (McKillop and Sills 2021) (Figure 2). The presence of Belize Red and Warrie Red pottery at Ek Way Nal supports these dates. Radiocarbon dating of red mangrove peat, organic material that has accumulated due to rising sea-levels, has also indicated that the Paynes Creek Salt Works were operating during the Classic Period (A.D. 300-900) (McKillop et al. 2010).

Excavations in Building A

One of several goals for the 2022 field season at Ek Way Nal was to assess whether additional evidence of fish or meat processing could be identified at the site. Excavation units were placed across most of the site to collect a sample of data from the interior and exterior of each identified building, including building A. With additional mapped buildings and artifacts to the east of a line of palmetto palm posts associated with building A, transects were placed on what was considered the interior of this boundary. The line of posts may have served as a fence delineating indoor and outdoor space or to protect the shoreline from rising tides (McKillop and Sills 2021).

Building A (Figure 2) and an associated line of palmetto palm (*Acoelorrhaphe wrightii)* posts are the southernmost mapped features at the site of Ek Way Nal. A site has been defined by McKillop and Sills (2021:3) as "a cluster of artifacts and posts at least 10 meters in distance from another." Additional sites associated with salt making activities are located northeast, east, and southeast from Ek Way Nal and building A. A raised area of living mangroves sits roughly west to east in between building A and the other mapped buildings at Ek Way Nal. The accumulation of sediment and organic material has created a high point at this site and is often visible above water during low tide.

Although virtually no animal remains were recovered from the salt works, use-wear study of chert tools provided evidence of fish processing. Red mangrove peat creates a highly acidic and anerobic underwater environment which means that any archaeological materials made up of calcium carbonate are destroyed through time (McKillop et al. 2019). For this reason, a lack of fish or animal bones in the lagoon is not surprising.

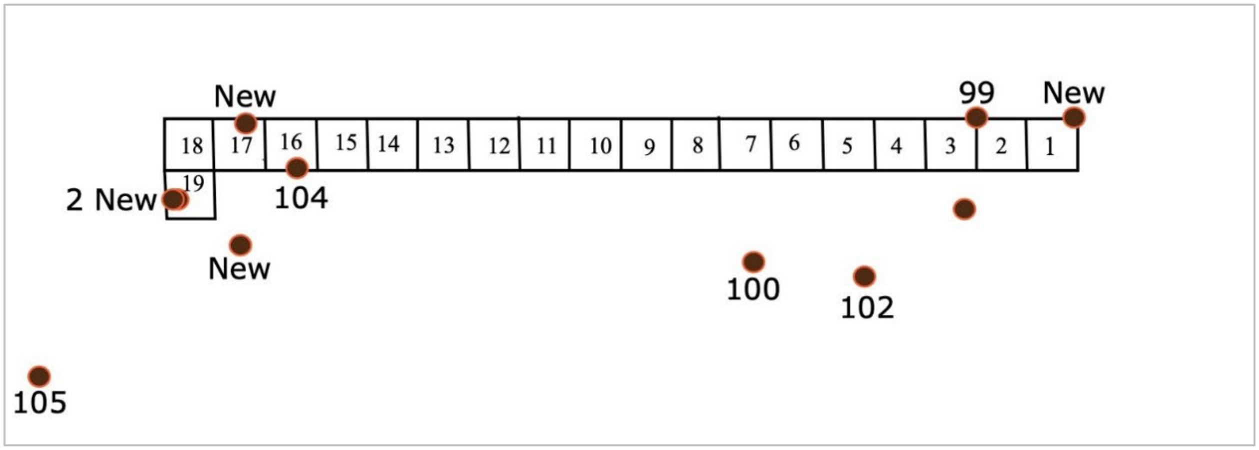

Figure 4. Map showing Building A, transect 1, units 1-19, and previously mapped and numbered wood post locations next to newly-found wood posts. (Map by Hollie Lincoln).

Microscopic analysis of use-wear on 21 chert tools from sites in the Paynes Creek Salt Works indicates the primary activities requiring chert tools involved wood working activities, as well as cutting fish or meat, and scraping hide or scaling fish (Table 1; McKillop and Aoyama 2018). Although most tools were multi-purpose, fish, meat, and hide were the most worked materials (McKillop and Aoyama 2018). Four of the 21 tools analyzed were from Ek Way Nal. Of the four tools analyzed, two tools were used for fish and/or meat processing, one was used for scraping of animal hide, and one was used for woodworking (Table 1). Four additional chert tools were also located during systematic sea floor survey but were not analyzed for use-wear (Table 1).

Fish weights or other gear have not been found at Ek Way Nal (McKillop and Sills 2021). However, a side-notched stone resembling a fishing weight was found at Ta'ab Nuk Na. Spindle whorls, potentially used to produce fishing line were found at site 6 (McKillop 2019; McKillop and Sills 2021). At nearby Wild Cane Cay, fishing weights, fish bones, and manatee bones were found in midden deposits dating to the Late Classic period (McKillop 2005).

Methods

Positioning of transects involved selecting two previously mapped wood posts that extended beyond the northern and southern extent of building A (Figures 3-4). Transect lines were measured with a tape measure on the sea floor surface and marked with yellow ropes that extended from each post. Using the tape measure as a guide, consecutive one-by-one meter units were marked with PVC piping. Each square unit was divided into four subunits using during excavation, using a metal or plastic gridded unit that could be placed on the sea floor. Each subunit was excavated in 10 cm levels using a trowel. Matrix from each subunit was placed into a mesh bag and transported away from the excavation site using a research flotation device. All material removed from each subunit was screened using ¼ inch mesh and water from the lagoon.

The goal of transect 1 was to recover archaeological materials from the interior and exterior space of a group of wooden posts making up Building A. A total of 19 one meter by one-meter units were positioned along a transect line running roughly north to south. Of those 19 units, only 15 were excavated to avoid disturbing the living mangroves. Nine of 13 units were excavated to 10 cm below sea floor surface, three units to 20 cm, and three units to 30 cm (Figure 4). Transects 2 and 3 were positioned on the eastern side of the line of palmetto palm posts. Seven units on transect 2 and five units on transect three were excavated to a depth of 10cm below the seafloor surface. Variation in unit depth occurred for a variety of reasons. In some instances, deeper units were dug to assess the density of cultural material at deeper levels. Excavation to 10cm in depth allowed for more data to be collected over a larger spatial area.

Table 1. Surface collect chert tools from Ek Way Nal. Descriptions and use-wear analysis from McKillop and Aoyama (2018). See Figure 2 for locations of chert artifacts.

Seafloor Catalog ID	Description	Identified Use
F	Lenticular Biface	Wood cutting, whittling
T	Recycled Biface	Scraping hide
ZZ	Stemmed Biface	Cutting fish/meat
X	Stemmed Biface	Cutting fish/meat
QQQQ	Large Flake	N/A
RRRR1	Unifacial Stemmed Point	N/A
SS	Unifacial Stemmed Point	N/A
II	Shouldered Biface	N/A

Table 2. Artifact count by transect.

Transect 1 Artifacts	Count
charcoal	18217
Cohune endocarps	12
Coyol endocarps	8
Crabbo seeds	6
hog plum seeds	1
Belize Red body sherds	24
unknown pottery	23
Punta Ycacos body sherds	345
Punta Ycacos cylinder supports	143
Punta Ycacos socket	22
Punta Ycacos rims	49
Amorphous clay lumps	20216
clay ball	1
unknown pottery	30
Warrie Red body sherds	165
Warrie Red rims	4
chert flakes	4
obsidian blades	4
quartz flake	1

Transect 2 Artifacts	Count
charcoal	39275
Amorphous clay lumps	6
Warrie Red rims	2

Transect 3 Artifacts	Count
charcoal	296
Crabbo seeds	1
unknown rim	1
Punta Ycacos body sherds	8
Punta Ycacos socket fragments	2
Punta Ycacos cylinder supports	7
Amorphous clay lumps	0
Warrie Red body sherds	10

Artifact densities were the highest in transect 1, with very little cultural material being recovered from transect 2 or 3.

After a unit was excavated to its final depth, a sediment sample was removed from the center or eastern wall of the unit. These samples were labeled with transect and unit information and transported to the Village Farm laboratory for fine-mesh screening. Fine window screen mesh was placed inside of a large ¼'' mesh screen. Sediment samples were screened by hand with water to aid in separating the light organic materials, including fine mangrove roots, from any artifacts.

Results

Artifacts recovered from excavations of Building A, transect one include fragments of seeds, large amounts of charcoal, a variety of pottery including Warrie Red, Belize Red, Punta Ycacos Unslipped briquetage, four obsidian blade fragments, chert debitage, quartz pounding tools, and one large quartz flake (Table 2). All three transects contained abundant charcoal. Transect two contained almost no other artifacts, whereas transect three had small amounts of pottery, including sherds of Warrie Red and Punta Ycacos Unslipped, two Punta Ycacos socket fragments, and seven Punta Ycacos cylinder fragments. A combination of Punta Ycacos body sherds, rim sherds, sockets, and cylinders, Warrie Red body and rim sherds, and Belize Red body and rim sherds were dispersed across transect 1.

Five unmapped wood posts were located during excavation of transect 1. To document the new wood posts in relation to the previously mapped wood posts, a map was produced using the transect one line as a baseline. With the addition of the new posts in this area, a small rectangular building was located at the northern end of transect 1 (Figure 4). Units 16, 17, 18, and 19 are located on the interior and exterior of this building. Units 17 and 19 are also where three obsidian blade fragments, one large quartz flake, and three chert flakes were found. Additional posts exist on the southern end of transect 1. However, their configuration is unclear (Figure 5). Excavations of transects two and three produced few artifacts (Table 2). Artifact density was greater across transect 1, with density and variability in artifacts increasing in the northern most units.

No evidence of micro-debitage or fish bones was found in the sediment samples collected from any of the building A transects. However, one fish bone was found wedged next to hardwood post 1.

Summary

Lines of palmetto palm posts are found at other sites at the Paynes Creek Salt Works and appear to have been used as fences or to delineate yard or plaza space (McKillop 2022). These types of features are also used at modern coastal locations in Belize for protection of shorelines (McKillop and Sills 2021). At the Yotot site, another one of the Paynes Creek Salt Works, minimal artifacts were found within a fenced space, whereas abundant briquetage was inside and next to the buildings (McKillop and Sills 2016). A lack of artifacts associated with the line of palmetto palm posts near building A at Ek Way Nal exhibits similar qualities to the fenced space at the Yotot site.

In the absence of preservation of bone in the acidic mangrove peat matrix of the excavations at Ek Way Nal, the only indication that fish processing we currently have at at the site is through the use-wear analysis completed on chert stone tools (McKillop and Aoyama 2018). However, additional objects related to fishing, including fishing weights, spindle whorls, fish bones, and manatee bones are present at other associated sites in and near the lagoon. More evidence of fish processing may be obtained through additional micro-wear analysis of stone tools.

The presence of botanical materials including endocarps of the native palms, cohune and coyol, as well as craboo and hogplum seeds may indicate that the ancient maya were consuming these fruits. At the Stingray Lagoon site, also part of the Paynes Creek Salt Works, radiocarbon from coyol, cohune, and mamey remains dated to the Late Classic (McKillop 2019). Abundant charcoal, in addition to briquetage is expected in areas where salt production was taking place. The brine boiling method utilized by the ancient Maya in Punta Ycacos Lagoon involved building fires to boil pots of enriched brine to produce salt cakes (McKillop and Sills 2021). Harvesting of large amounts of wood over time was necessary to continuously boil salty brine (Robinson and McKillop 2013). Large amounts of charcoal likely mark locations where salt kitchens were

Table 3. Total pieces of charcoal from each excavation transect associated with building A.

Total Pieces of Charcoal from Each Transect and Building Excavation		
Bldg. A, Tr. 1	Bldg. A, Tr. 2	Bldg. A, Tr. 3
18,217	**39,275**	**296**

Table 4. Artifacts collected from seafloor surface at building A.

Building A, Surface Collected Artifacts	
UUUU UUU	PY Bowl
VVVV VVV	Cylinder End
WWWW WWW	Sherd with Hole
XXXX XXX	Incised, Unknown sherd
YYYY YYY1	Belize Red Rim
YYYY YYY2	Pedestal Base Bowl
ZZZZ ZZZ1	Ocarina Head
ZZZZ ZZZ2	Quartz Pounding Tool
AAAA AAAA	Quartz Pounding Tool
BBBB BBBB	Burner (3 pieces)
CCCC CCCC	5 Sherds
DDDD DDDD	Large Base (3 pieces)
EEEE EEEE	Unit Stamped Rim (3 Pieces)
FFFF FFFF	Base
GGGG GGGG	Base/Socket
AAA AA AA	Fish Bone

located or areas where charcoal was disposed of over time. Other salt making sites, including the Placencia Salt Works to the north retain piles of leached soil from the brine enrichment process. Due to sea level rise and wave action, leaching mounds in the Payne Creek Salt Works are rare. Remnants of leached soil appear at two sites, Killer Bee and Witz Naab. Excavations of these mounds revealed bits of briquetage and charcoal discarded from salt kitchens nearby (Watson and McKillop 2019; Watson et al, 2013; McKillop 2022). The quantity of charcoal associated with building A far exceeds amounts found at all other excavated areas at Ek Way Nal. Large amounts of fragmented briquetage are also present in this area (Table 3).

Stone tools and debitage recovered from the building A transects included four chert flakes, four obsidian blade fragments, one quartz flake, and two surface collected quartz pounding tools (Tables 2, 4). Prior analysis of chert tools from the site of Ta'ab Nuk Na indicated that formal tools were imported from northern Belize in finished forms (Lincoln 2022). Neither the quartz pounding tools nor the chert debitage appear to be from the high-quality sources imported from northern Belize. Low quality chert flakes and quartz tools are likely of local origin. However, the formal tools previously mapped and collected from the seafloor surface at Ek Way Nal appear to be comprised of tool forms commonly produced at Colha during the Late Classic. Overall, minimal stone tools were located during excavations in 2022.

Conclusions

At the Placencia Salt Works, 22 earthen mounds at 13 salt-making sites are described as "low-lying, amorphous shapes, ranging from 1.0-1.5 m in height (MacKinnon and Kepecs 1989; Watson and McKillop 2019)." These mounds of leached soil, produced during the brine-enrichment process in the production of salt cakes include broken pottery, a variety of broken briquetage, soil. Stratigraphy of excavations at Witz Nab and Killer Bee included similar artifacts and included several layers of charcoal (Watson and McKillop 2019). Large amounts of charcoal and fragmented briquetage and pottery in transect 1 is adjacent to a raised linear patch of modern mangroves and may suggest a deflated salt leaching mound (McKillop 2022).

A rectangular building marked by four wood posts at the northern end of transect 1 contained obsidian blade fragments and other stone debitage. Several meters north of this building, a variety of fine pottery and an ocarina were found on the sea floor next to a dense mound of sediment containing large amounts of artifacts including pottery and briquetage related to salt making in addition to other pottery types.

The configuration of wood posts on the southern and central area of transect one is unclear. Transects 2 and 3 were located next to the line of palmetto posts. Few artifacts were recovered from those areas. This linear feature mimics features seen at other sites including the Yotot site and may have functioned as a retaining wall. Minimal artifacts on the eastern side of this feature contrasts to a complete lack of artifacts on the western side of this feature and suggests that the palmettos functioned to combat tidal or weather changes approaching from the west. The proposed leaching mound sits just to the east of this palmetto palm post wall, with multiple buildings just beyond.

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31 SEA-LEVEL RISE AND SETTLEMENT AT EK WAY NAL: CORING THE PAST

Cheryl Foster, Heather McKillop, and E. Cory Sills

Excavations in the spring and summer of 2022 were carried out at the underwater ancient Maya salt work of Ek Way Nal in Punta Ycacos Lagoon, Paynes Creek National Park, Belize. Ek Way Nal provided salt to the ancient Maya during the Late and Terminal Classic periods (600-900 C.E.). In additional to excavations in buildings at the site, a 1 X 2 m unit was excavated to extract a sediment column for examining the relationship between the ancient Maya settlement at Ek Way Nal and sea-level rise. In this article, the excavations, extraction of the sediment column, and processing it for laboratory analyses are described. Field observations are discussed. Fine red mangrove root (Rhizophora mangle) and charcoal samples were extracted from the sediment column for radiocarbon dating. The results from the datum core excavation indicate that sea-level rise occurred before, during, and after the ancient Maya occupation at Ek Way Nal.

Introduction

Excavations in mangrove peat at the site of Ek Way Nal were carried out in order to extract a sediment column to investigate the relationship between the ancient Maya at the site and sea-level rise. The underwater site of Ek Way Nal is one of 110 sites that make up the Paynes Creek Salt Works in Punta Ycacos Lagoon in southern Belize that were used by the ancient Maya during the Late to Terminal Classic period (A.D. 600-900 C.E.; Figure 1; McKillop 2019). The salt works were built on dry land that was mangrove peat. The peat preserved the wooden posts that were driven into the ground during building construction (McKillop et al. 2010).

At some point, the sites were flooded by rising seas. The timing and rate of sea-level rise can be determined by radiocarbon dating red mangrove peat, which is a proxy for sea-level rise. As sea levels rise, red mangroves grow upwards to keep their leaves above water, trapping detritus in the root systems that becomes mangrove peat. In the inshore lagoon system between the coast and the Belize barrier reef there is 12 m of red mangrove peat accumulation during the Holocene (Toscano et al. 2018).

The submerged site of Ek Way Nal has ten pole and thatch buildings, constructed with over 200 hardwood posts (McKillop and Aoyama 2019; McKillop et al. 2019; McKillop and Sills 2021:4). A modified pedestrian survey was used at Ek Way Nal to locate and map the site and the artifacts and posts. The survey team floated on Research Flotation Devices (RFDs) in a line, feeling the sea floor for posts and artifacts.

Figure 1. (Left) Map of Maya area with box highlighting location of Paynes Creek Salt Works (McKillop 2017b:702).

This method of survey reduces the risk that the posts and artifacts on the seafloor are damaged by walking across the site.

The underwater site of Ek Way Nal is bisected by a strip of land (Figure 2). A 1 m x 2 m unit was excavated to a depth of 170 cm on this strip of land (Figure 3).

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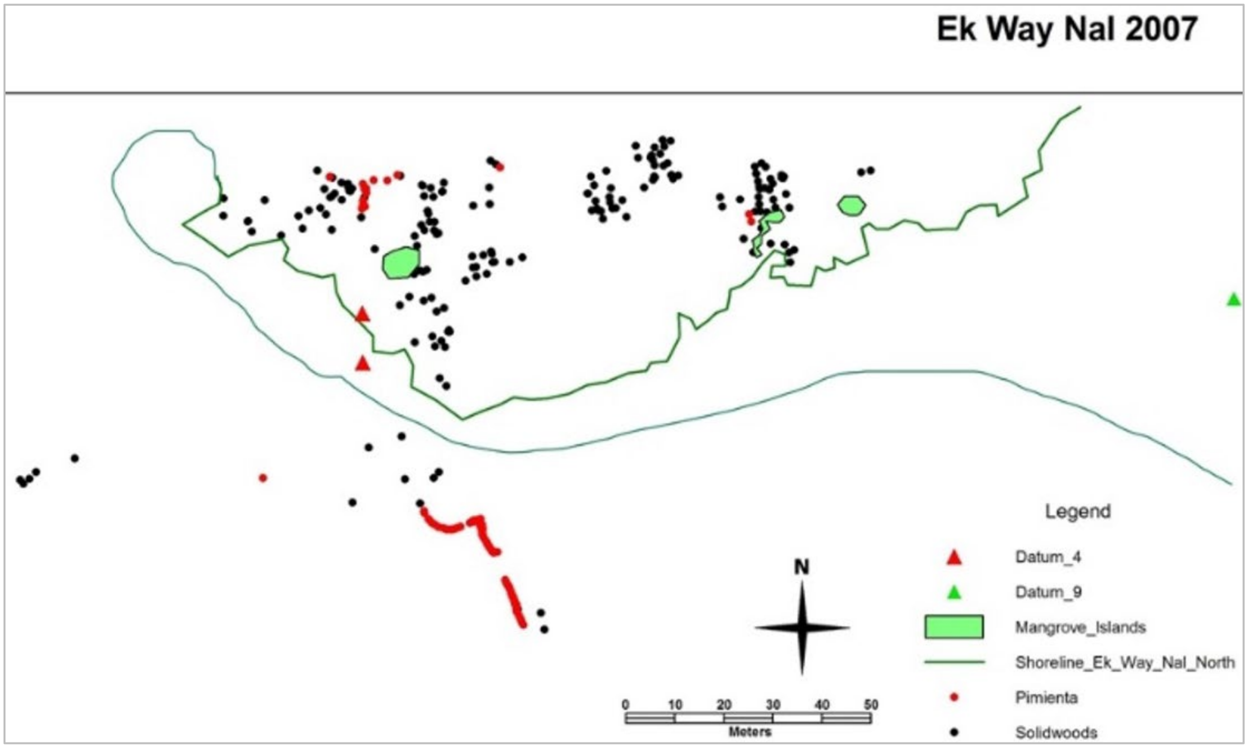

Figure 2. Map of Ek Way Nal with box indicating location of core excavation and arrow indicating location of sediment column within excavation. Map from H. McKillop, modified by C. Foster).

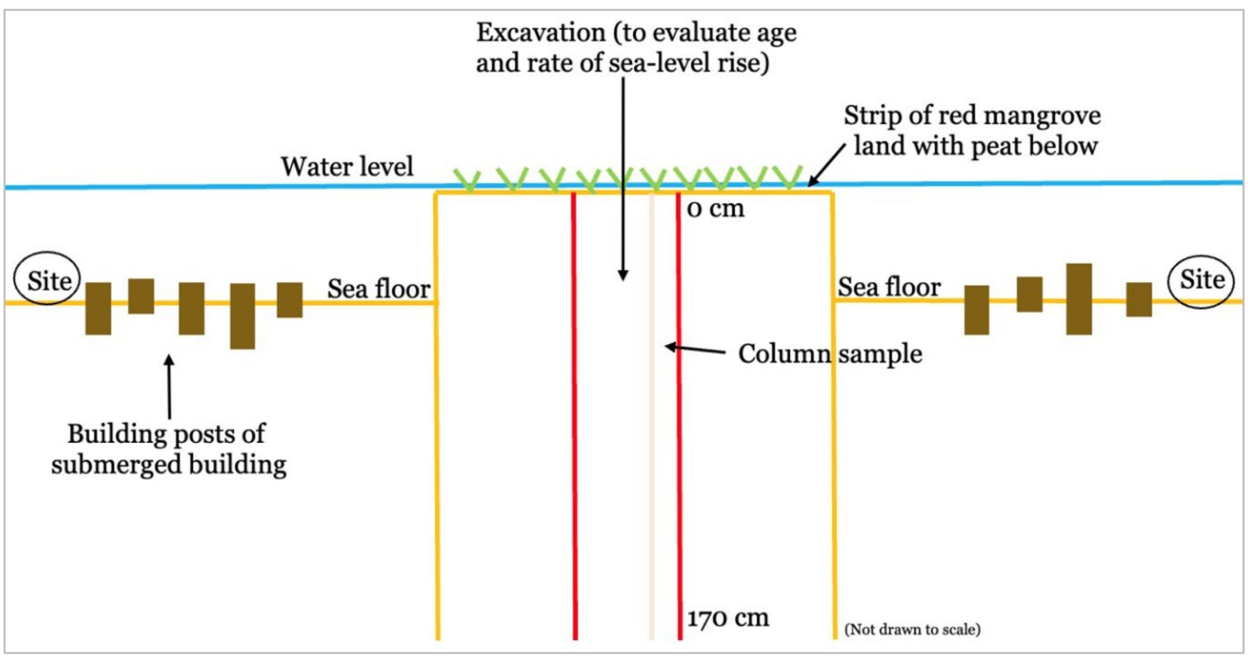

Figure 3. Schematic drawing of core excavation in relation to submerged buildings at Ek Way Nal. Drawing by C. Foster.

The main goal of the excavation was to extract a sediment column from an excavation wall to address sea-level rise, to determine if the site continued through the land, and to recover any temporal or diagnostic pottery. If the strip of land is a natural formation, formed prior to the ancient Maya occupation at the site, the sediment column sample and peat excavations would show a continuous record of mangrove deposits from the surface to the base of the excavation. Alternatively, the site may have been continuous, with red mangrove peat deposited over the site as a result of sea-level rise. Cutting a sediment column from an excavation wall in the unit placed on the strip of land was undertaken to select peat samples and any diagnostic artifacts.

History of Mangrove Coring in the Maya Area

Mangrove cores in coastal areas can provide information on sedimentation rates, vegetation variation, sea-level rise, and marine and coastal landscapes (Jaijel et al. 2018; McKee et al. 2007; McKillop et al. 2010a, 2010b; Monacci et al. 2009; Torrescano and Islebe 2006). Toscano and Macintyre (2003) used *Rhizophora mangle* (red mangrove) peat and *Acropora palmata* (Elkhorn coral) to construct a western Atlantic Holocene sea-level curve. The researchers used 145 dates from samples collected in Belize, the Florida Keys, and elsewhere in the Caribbean. The depths of the coral and the peat allowed the researchers to revise an earlier sea-level cure (Lighty et al. 1982). The segment of the curve corresponding to 2,000-400 years ago indicates a rate of sea-level rise half that of the past 100 years. Archaeologists can relate calibrated radiocarbon dates to this corrected western Atlantic Holocene sea-level curve.

A study by Karen McKee and colleagues (2007) examines the rates of elevation change and the accumulation of mangrove root matter from Twin Cays and Cat Cay in Belize to understand mangrove peat formation. Some of the mangrove peat in this study dates to more than 7000 years. The researchers also compared the modern elevation changes to past peat development, using geological rates of peat accumulation calculated by radiocarbon dating of peat cores from Belize, Panama, and Honduras. These elevation changes were compared to the corrected sea-level curve for the western Atlantic area. Results indicate that, in response to sea-level rise, mangroves may move vertically and laterally and act as an integral natural defense for coastal ecosystems against sea-level rise.

A study of the settlement and sea-level rise at Marco Gonzales, Ambergris Cay, Belize used sediment cores and probes to reconstruct the landscape (Mazzullo et al. 1987; Mazzullo and Reid 1988; Graham and Pendergast 1989). The researchers reconstructed past sea levels. Starting at 3,500 B.P., sea levels rose from a depth of 1 m below present, to 30 cm below present at 2,000 B.P., to 15 cm below present at 750 B.P. The depth at 2,000 B.P. correlates to the first occupation at the site. Mangrove accretion at the site is a recent occurrence, meaning that the landscape was an open marine environment from 3,500 B.P. to 750 B.P.

Monacci et al. (2009) studied an 8 m-long mangrove peat core from Spanish Lookout Cay, Belize to investigate mangrove ecosystem changes during the Holocene. The peat from Spanish Lookout Cay is younger than that at Twin Cays and Cat Cay, starting at approximately 8,000 cal. years BP. The mangrove peat at Spanish Lookout Cay decreased at approximately 4,000 B.C. In another study, researchers investigated a 2.5 m long sediment core from El Palmar, Mexico using a Dachnovsky corer (Torrescano and Islebe 2006). Fossil pollen grains extracted from the core showed a distinct change from tropical forest dominated by *Moraceae* and *Fabacaeae* to a mangrove system comprised of *Conocarpus erecta* and *R. mangle* around 4,600 YBP. The researchers attribute the change in vegetation to changes in sea level, which rose approximately 2-3 m between 6,000 and 4,000 cal. BP.

Jaijel et al. (2018) analyzed sediment from six cores to reconstruct the environmental changes during the past 3,000 years at the ancient Maya site of Vista Alegre on the north coast of the Yucatán, Mexico. The research suggested that the ancient coastal landscape was more suitable for settlement in the past. The abandonment of the site was identified by a decrease in shell content and overall foraminifera numbers in the sediment cores followed by an increase in organic content due to sea-level rise.

Previous Sea-level Research at the Paynes Creek Salt Works

In 2008, a column of sediment was cut from a vertical face of a hole dug into the sea floor between Sites 14 and 15 (K'ak' Naab' and Sak

Nuk Naj, respectively) in Punta Ycacos Lagoon (McKillop et al. 2010a, 2010b). This K'ak' Naab' sediment core was used as a template for the Ek Way Nal methodology. The 1.5 m long K'ak' Naab' sediment column was cut in 10 cm increments, wrapped in cling wrap, placed in Ziploc bags with arrows indicating orientation, and exported to Louisiana State University. Several analyses were carried out on the mangrove sediment, including loss-on ignition, microscopic sorting and identification of organic material, and AMS radiocarbon dating. For the loss-on ignition, small samples of each of the 15, 10 cm sections were weighed, dried in an oven to burn away the organic matter, then weighed again. The difference in weight is the percentage of organic matter present in the sample. The average organic matter in the column sample was 65%, which is high and consistent with red mangrove from coastal Belize (McKillop et al. 2010a, 2010b).

The microscopic sorting and identification of the sediment column included selecting sediment from 0-10 cm, 10-20 cm, 20-30 cm, 30-40 cm, 70-80 cm, 10-11 cm, and 11-12 cm depth. The samples were rinsed through a 1 mm sieve, and placed in water in a Petrie dish. They were sorted according to root size and other organic matter. Results show that the column sample is comprised largely from *R. mangle* (McKillop et al. 2010a, 2010b). The top, bottom, and several intermediate layers of the column sample were radiocarbon dated. The column sample shows a 4,000-year record of continuous and gradual sea-level rise in the Paynes Creek Salt Works.

In 2012, excavations at Witz Naab' and Killer Bee investigated the origins of earthen mounds found at the sites (Watson and McKillop 2019; Watson et al. 2013). The mounds were similar to those found at other salt making sites in the Maya area, notably the Guzman mounds (Nance 1992) and mounds in the Placencia lagoon area (MacKinnon and Kepecs 1989). The Guzman mound contained leached soils, dense areas of charcoal, and remains of salt-making pottery (Nance 1992). The mounds in the Placencia lagoon area were low-lying, ranging from one to one and a half meters in height. The mounds at Witz Naab' and Killer Bee were both low-lying and covered with modern vegetation.

Figure 4. Picture of Ek Way Nal sediment column excavation unit. Trowel marks location of column sample in bottom left corner. Photo by Hollie Lincoln, Louisiana State University.

The mounds at both sites produced briquetage. Results of the excavations indicate that the mounds were created as part of the brine enrichment process.

In 2019, two sediment columns were cut at the Ta'ab Nuk Na underwater site, including one beside post 145 in Building B, a residence (McKillop and Sills 2022). The other column was cut beside a large beam, termed Nunavut, at the western periphery of the site.

The Ek Way Nal Sediment Core

Set-up and Excavation

The Ek Way Nal core excavation was located on the strip of land that bifurcates the site and that is covered in living red mangroves. The excavation measured 1 m x 2 m and was set up 3 m southeast of the Ek Way Nal datum in an area void of vegetation (Figure 4). The core excavation was divided into two units, with unit 1 being the unit closest to the site datum (farther north) and unit 2 being the southern unit. The excavation was dug with shovels for the first 20 cm. The presence of a few small sherds and charcoal below 20 cm depth prompted the switch to trowels and hand-sorting of the sediment. Wooden box screens with ¼" wire mesh were used to screen sediment after endocarps from native palm fruits were found in the 30-40 cm level. The artifacts were bagged by 10 cm excavation level. Unit 1 was excavated to 70 cm depth. Unit 2 was excavated to 170 cm depth. Unit 1 was used to access the deeper unit 2 in the excavation. Shovels were used in unit 2 below 100 cm where little cultural material was found.

The sediment continued to be water-screened, with all the artifacts collected.

The excavation unit was below the water surface. Once the water level was over a meter deep in the excavation, the team wore dive masks and snorkels to excavate. Below 100 cm, the excavators held their breath while digging, which increased the time to excavate each level. Loose silt and sediment accumulated at the bottom of the excavation. Before begging to excavate each day, this loose accumulation layer was removed.

Mangrove branches and thick roots in the lower depths made excavation difficult. A large mangrove root, at 170 cm depth extended across the unit, precluding deeper excavation.

Excavating the Sediment Column

Once unit 2 reached 170 cm depth, preparations were made to extract a sediment column from the eastern wall, which was the best sediment devoid of large roots. A 2.4 m-long, ½ inch diameter PVC pipe was sunk into the bottom of the excavation at 1.5 m from the northwest corner of the unit along the eastern wall of the excavation. A cut was made in the pipe at the sea floor to mark 0 m. Small cuts were made in the pipe every 10 cm to act as a tactile guide while cutting sediment samples underwater.

A trowel was stuck into the wall at the 10cm notch in the PVC pipe, marking the bottom of the first 10 cm sample of the sediment column. A tape measure was used to measure 10 cm into the wall face from the PVC pipe, marking the back of the first sample. Then, the tape measure was used to measure 10 cm to the left of the pipe, marking the side of the sample. A stainless-steel kitchen knife with an 18" blade was used to slice the 10 cm^3 sample from the excavation wall face (Figure 5). The 10 cm^3 sample was wrapped in plastic cling wrap with arrows drawn on the wrapping to indicate the top of the sample and the word "FACE" was written on the front of the wrapping to indicate which side was exposed to the open excavation. Additionally, "0 m" was written on the top of the sample face and "10 cm" was written on the bottom of the sample face to indicate the depth of the sample. The labeled and wrapped sediment sample was placed in a plastic box for transport and storage. This process was repeated for each 10 cm depth, for a total of 17 samples.

Figure 5. Photo of a 10cm^3 sediment sample being removed from the excavation wall. Photo by H. McKillop.

Figure 6. A section of the mangrove sediment column after being selectively cut. Photo by C. Foster.

In an effort to reduce the size and weight of the column sample as a whole, each 10 cm^3 sample was later cut to a standard size. Each sample was unwrapped and photographed. The height of each sample was kept the same to ensure the entire depth was represented in the column sample.

Figure 7. Fine red mangrove roots, charcoal, quartz, and other materials under magnification from the 48-50cm depth of column sample. Photo by C. Foster.

However, the depth and width of the samples were cut for storage and shipment. Each sample was examined for large roots and overall stability, and the best portion was selected (Figure 6). The sample was re-wrapped in new cling wrap with the same information on the outside. The samples were placed in plastic boxes and exported under permit by the Government of Belize to the Louisiana State University Archaeology Lab, where they were placed in refrigerated storage.

Sampling the Sediment Column for Radiocarbon Dating

The sediment column was laid out in stratigraphic order on a counter in the Archaeology Lab at Louisiana State University next to a measuring tape, with 0 cm at the top of the sediment column (indicating the sea floor). A small sample (approximately 1 teaspoon) was taken from the sediment column at the 48-50 cm depth using a stainless-steel paring knife. The sample was rinsed using a No. 25 geologic sieve to remove the sediment. The remaining material was placed into a Petrie dish with water (Figure 7). The material was sorted using a microscope and needle-nose tweezers. Each material (fine mangrove roots, coarse mangrove roots, pottery, charcoal, quartz) was placed into a separate glass vial with water. The fine mangrove roots were placed in distilled water for the radiocarbon dating process.

The wet fine mangrove roots and charcoal were weighed before being placed in a drying oven at 60˚C for 18 hours. The samples were removed, weighed again, and placed in dry, labeled glass vials, ready to be sent for Accelerated Mass Spectrometer (AMS) dating. The fine mangrove roots and charcoal were selected from the 48-50 cm depth to provide absolute dates for both the environmental (roots) and cultural (charcoal) activities.

Results

Mangrove peat extended from the sea floor to 170 cm depth. Cultural material was recovered between 20-80 cm depth, with the highest density at 40-50 cm depth. The presence of the mangrove peat deposits throughout the entire sequence of the column sample (170 cm) signifies that the strip of dry land with living red mangroves is a natural formation, formed prior to the ancient Maya occupation at the site and continuing during and after their occupation and subsequent abandonment. The mangrove sediment column provides a continuous record before, during, and after the site was in use.

The consistency of the mangrove peat differed by depth. The peat in 0-40 cm of the excavation was dense and thick with both fine and coarse mangrove roots and other detritus. The peat could easily be picked up in chunks and handed to a team member for screening. Pockets of sandy sediment were found periodically throughout these levels as well. The mangrove peat decreased in density from 40-100 cm depth. Coarse red mangrove roots were less frequent with increased depth. The 100-170 cm depth consisted of loose, silty sediment with few large mangrove roots or other detritus. The sediment was not solid peat, so it was removed by hand. Areas of light gray clay were found associated with the charcoal deposit around the 40-50 cm depth.

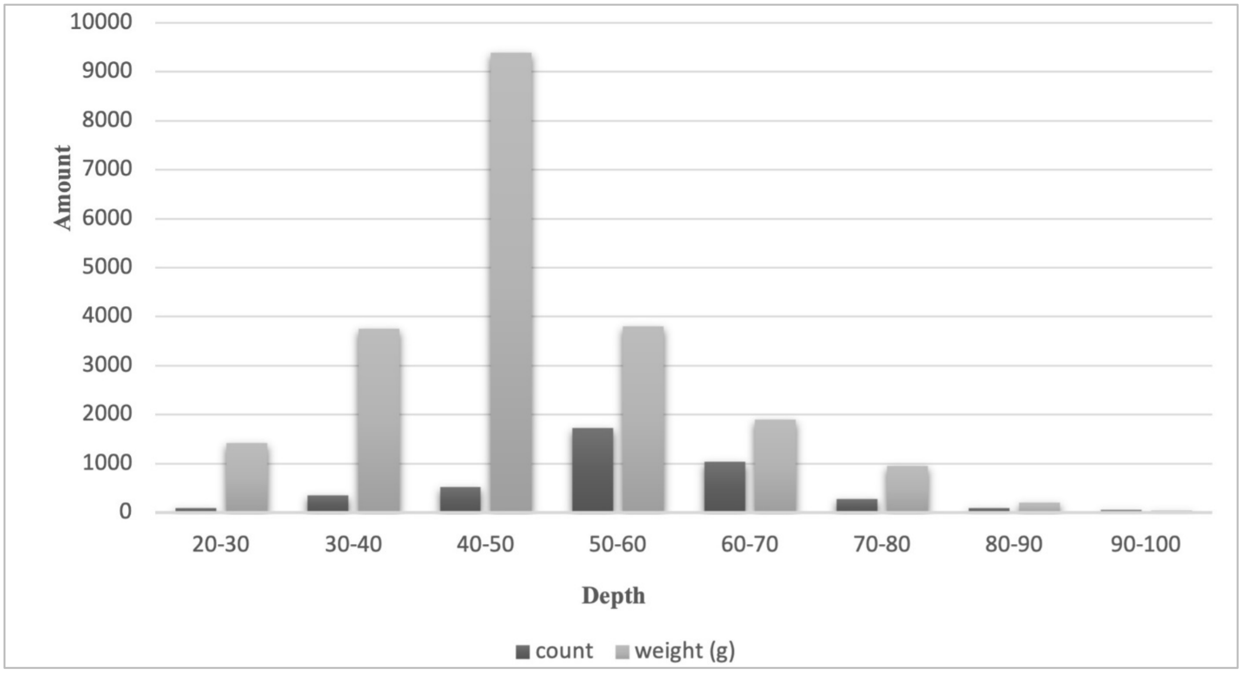

Figure 8. Bar graphs showing Punta Ycacos Ceramic Counts and Weights from Core Excavation.

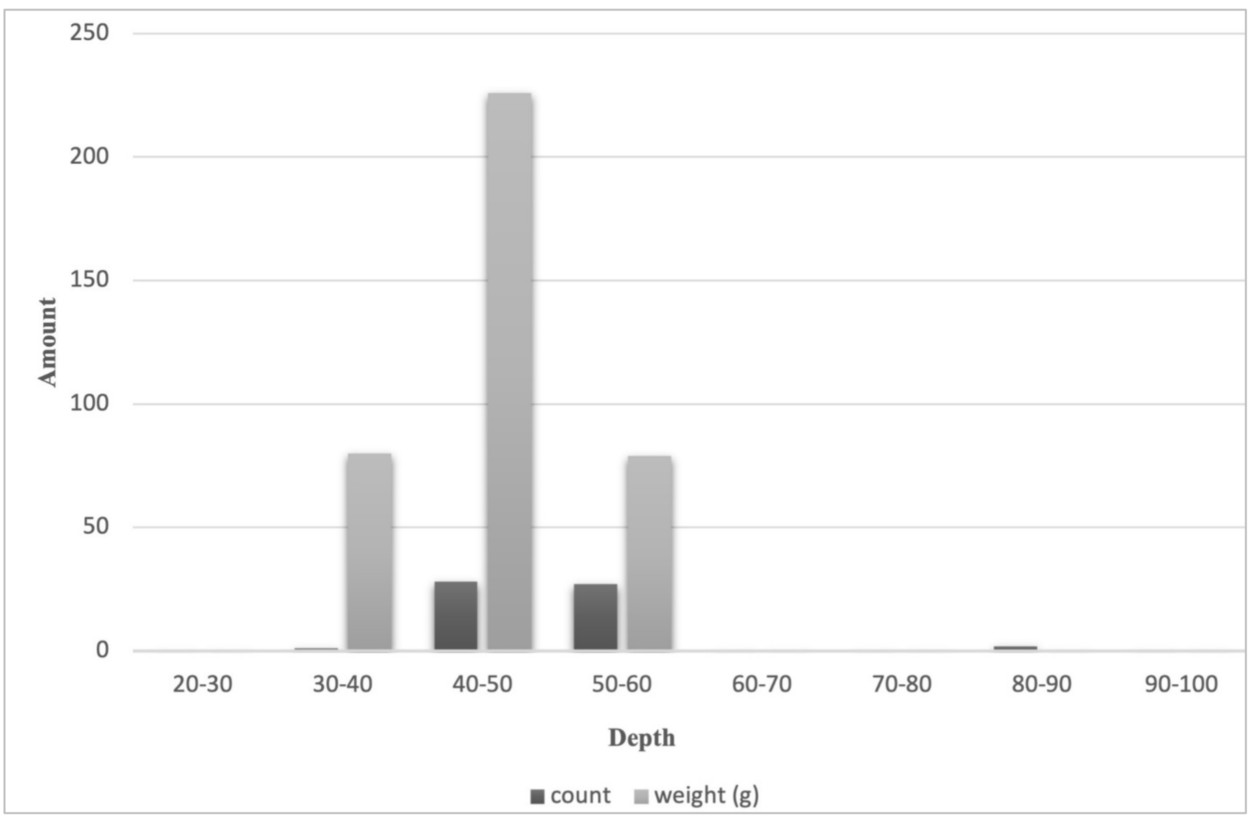

Figure 9. Bar graphs showing Warrie Red Sherd Counts and Weights from Core Excavation.

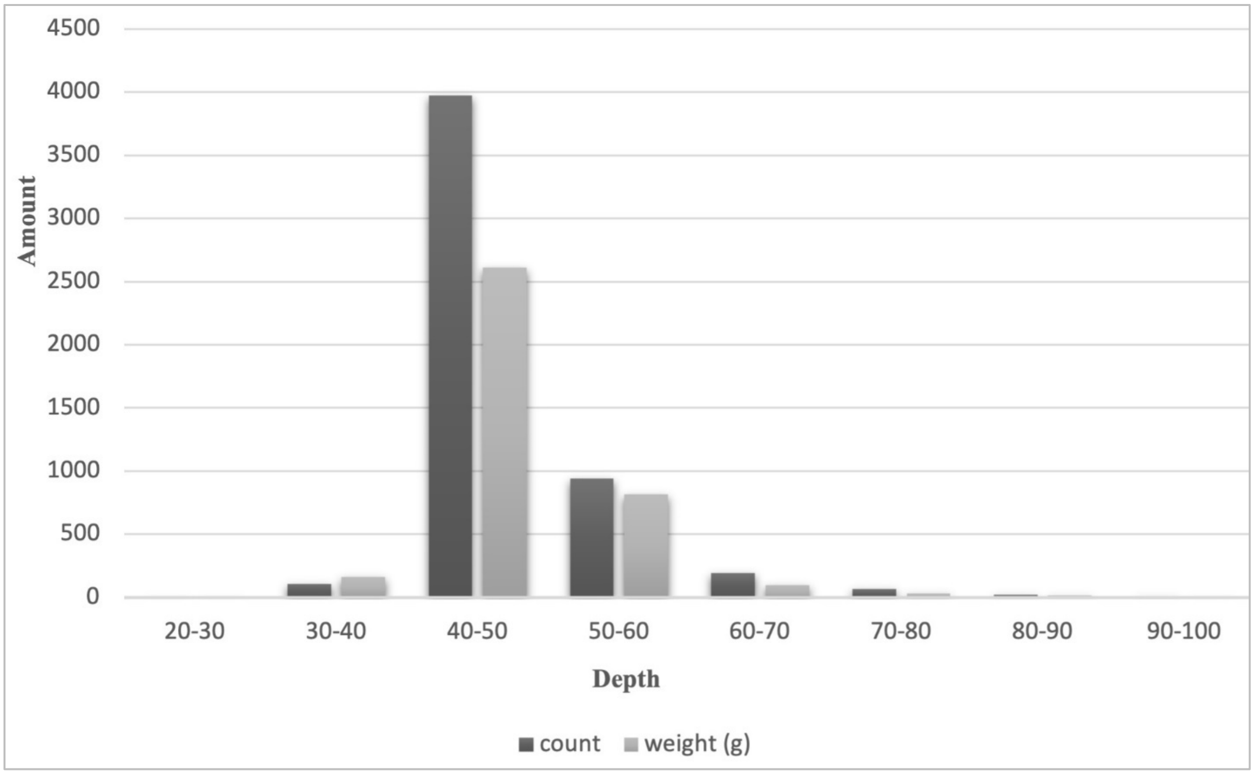

Figure 10. Bar graphs showing charcoal Counts and Weights from Core Excavation.

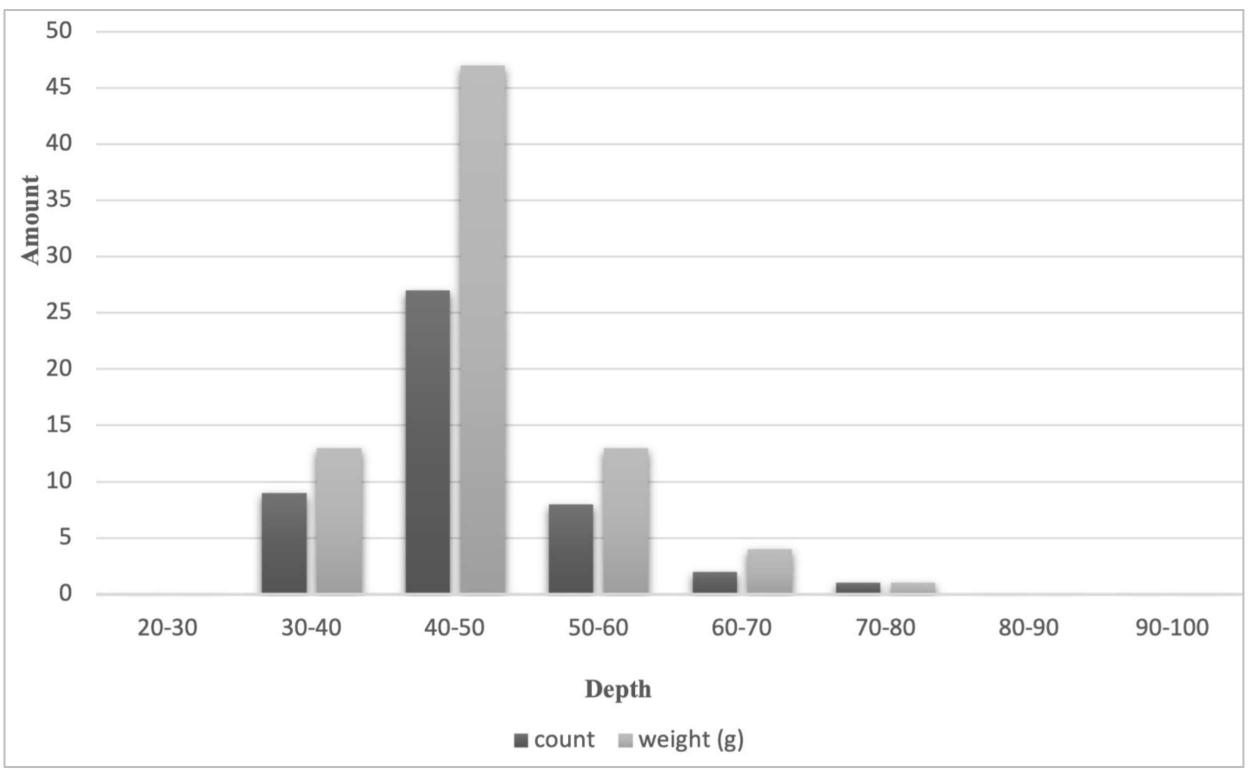

Figure 11. Bar graphs showing seeds and native palm endocarp Counts and Weights from Core Excavation.

Cultural Material

The excavation produced several different artifact types. Excavation levels 0-10 cm, 10-20 cm, and 100-170 cm produced few artifacts. Most of the artifacts are pottery assigned to the Punta Ycacos Unslipped type. They include rim and body sherds, cylinders, vessel supports, and amorphous clay lumps (ACL), which are the unidentifiable remnants of the salt-making pottery, or briquetage. Punta Ycacos ceramics made up much of the weight of all the artifacts combined. There is a minor amount of Late to Terminal Classic Warrie Red sherds, both rims and bodies. Warrie Red ceramics are used at the Paynes Creek Salt Works as storage jars (McKillop 2002:77-86). The other cultural material was charcoal, which was found in excavated levels with artifacts. The highest density of material, by weight and count, was 40-50 cm depth (Figures 8-10). A dense charcoal deposit was found at approximately 47 cm in the excavation. Other botanical material includes native palm endocarps (coyol and cohune) and crabbo seeds (Figure 11). A few other sherds were found in levels 20-80 cm depth of the excavation.

Discussion

The 170 cm sediment core cut from a unit on the strip of land that currently divides the underwater site of Ek Way Nal was not present during the Late to Terminal Classic settlement. The strip of land currently forms a boundary between the East lagoon and the Main Channel areas of the Punta Ycacos Lagoon system.

The presence of artifacts in the sediment column at the same depth as the underwater deposits on both sides of the strip of land indicate the site was continuous during the Late to Terminal Classic periods. At some point after the site was abandoned, sea levels submerged most of the site, except a shallow area where red mangroves took hold, growing taller as sea levels rose, with mangrove peat forming in the root systems. Future radiocarbon dating of the fine red mangrove roots from the Ek Way Nal column will indicate when this occurred.

Similar to the mounds at Witz Naab' and Killer Bee (Watson et al. 2013), the strip of dry land bisecting the Ek Way Nal site has modern vegetation growing on it. Additionally, the excavation revealed the remains of salt-making pottery and dense areas of charcoal. The presence of briquetage and abundant charcoal in the excavation may indicate it was a leaching area, produced from the brine enrichment process.

Conclusions

Excavations on a strip of land bifurcating the ancient Maya salt works site of Ek Way Nal were done in order to extract a sediment column from the seafloor. This sediment core was cut from a wall of the unit in 10 cm levels to 170 cm depth. The presence of cultural material within the excavation and core indicates that the ancient Maya site continued across the strip of land in antiquity. The presence of mangrove peat throughout the sediment core suggests that sea-level rise was occurring before, during, and after the ancient Maya occupation at the site. Future research includes radiocarbon dating different levels to clarify the timing and rate of sea-level rise in relation to the settlement at Ek Way Nal.

Acknowledgements The research was carried out under excavation and export permits from the Belize Institute of Archaeology to Heather McKillop and funded by a National Science Foundation grant #1826653 awarded to Heather McKillop and E. Cory Sills entitled "Labor Organization in a Traditional Complex Society." The field team included Rachel Watson, Hollie Lincoln, Rianna Bowen, Kaitlin Samples, Conner Flynt, Jackie Young, and the authors. The sediment core excavation was carried out by Cher Foster, Hollie Lincoln, and Rianna Bowen.

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32 THE CLASSIC PERIOD MAYA FIGURINES OF THE SOUTHERN BELIZE REGION: A COMPARISON OF NIM LI PUNIT, PUSILHA AND LUBAANTUN

Mario Borrero, Luke Stroth, and Geoffrey Braswell

Figurines are small, portable pieces of art that were popular in the ancient Maya world. Typically made of fired clay, they portray individual humans, animals, and mythic beings in an assortment of poses and scenes. We report the results of an iconographic analysis of 215 whole and fragmentary figurines excavated in the last 20 years at three Late Classic period sites in the southern Belize region: Nim li Punit, Pusilha, and Lubaantun. Although Early Classic figurines were often modeled, the Late Classic saw a shift to mold-made figurines. This allowed higher levels of production and the repetition of certain motifs. The study of this dataset contributes to our understanding of household activities, gender, and social roles. Together, these collections reveal strong interest in everyday women's work, warfare, and, especially, athletic ritual. The widespread distribution of figurines and the range of subjects they display provide an opportunity to view Maya life from the perspectives of commoners and elites, and from the mundane to the supernatural. We argue that figurines in the Southern Belize Region were more heavily focused on public spectacles of ritual as opposed to private domestic rituals.

Introduction

Since 2002, members of the Pusilha Archaeological Project and the Toledo Regional Interaction Project have recovered figurines from excavated contexts at three major sites in southern Belize: Pusilha, Nim li Punit, and Lubaantun. Ceramic figurines are three-dimensional objects made of fired clay. They were made by all Mesoamerican culture groups from the late Archaic onwards. Figurines depict a wide variety of beings with their possessions and paraphernalia, and show them in particular roles and performing tasks. As an iconographic source, they reveal aspects of everyday life, culture, and belief through the depiction of men, women, children, animals, and supernatural beings.

There is a long history of analysis, study, and documentation of Mesoamerican figurines, and Classic Maya examples from southern Belize have been important to their understanding since the 1920s. These include figurines excavated by the British Museum at Lubaantun and illustrated by Thomas A. Joyce (1935), as well as pieces recovered by Norman Hammond in the 1970s from the same site (Figure 1). Our study builds on this legacy and discusses further evidence of figurine distribution across what today is Toledo District.

The sites of Pusilha, Lubaantun, and Nim li Punit are located on or adjacent to excellent farm land with access to the coast (Figure 2).

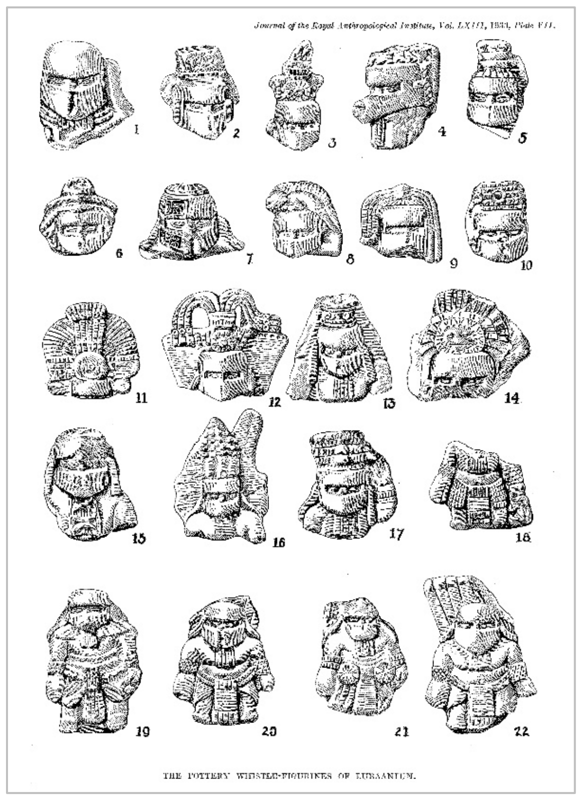

Figure 1. Boxer figurines from Lubaantun documented by the British Museum project (Joyce 1933: Plate 7).

Several researchers have defined southern Belize as a cultural region, but note that in some ways, Pusilha is an outlier (Braswell 2020; Dunham et al. 1989; Hammond 1975; Leventhal 1990, 1992).

In her analysis of ceramic materials from Pusilha, Cassandra Bill notes ties between the pottery of that city and those of southwestern Petén, and posits that the settlers of Pusilha may have come from there (Bill and Braswell 2005). Our analysis of the figurines supports her conclusions. The Pusilha figurines are closer in theme and iconographic content to examples from Petén than to figurines from other sites in the Southern Belize Region. Put another way, the plastic arts of Pusilha are quite distinct from those of the other sites of the Southern Belize Region, and reflect different historical origins and cultural ties.

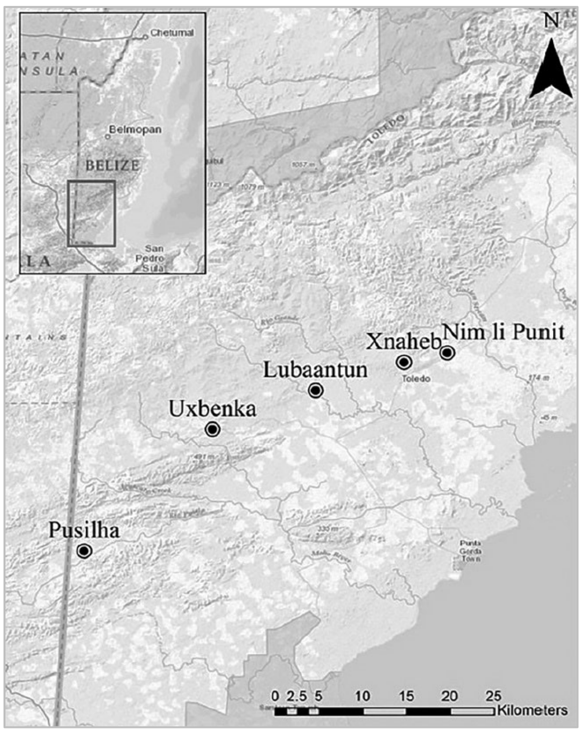

Figure 2. The principal archaeological sites of inland Toledo District, Belize (map by Mark Irish).

Early Classic versus Late Classic Mesoamerican Figurines

Most Preclassic figurines of the Maya and other Mesoamerican cultures were solid, modeled, and typically depict females or children, although some whistles and hollow figurines were made (Lesure 1999, Marcus 1996, Rands and Rands 1965). To date, no pottery that can be unambiguously dated to the Preclassic period has been found at an open-air site in southern Belize, nor have figurines from this time period been identified in the region.

Figure 3. Early Classic figurines and fragments from Nim li Punit. (a) frog or toad; (b) fragmentary head; (c) seated lord from Tomb VI (photos by Mario Borrero)

Nim li Punit is the only site that we have excavated with a substantial Early Classic occupation, and therefore is the only one where we have recovered Early Classic figurines. These were found in secure architectural contexts and were associated with Early Classic pottery, including orange-slipped flanged bowls and Teotihuacan-inspired direct-rim tripod vases. In total, we have seven examples. One figurine is a hollow toad or frog with pock marks decorating its back and hind legs; it is possibly part of a larger composite piece (Figure 3a). Three are head fragments that appear alike. They each have almond-shaped slanted eyes, a bulbous nose, and a mouth carved as a slit; two of these have a round, flat feature on the head symbolizing hair or a hat (Figure 3b). The most highly-crafted Early Classic figurine from our collection is that of a seated elite male (Figure 3c). This particular figurine was recovered from Tomb VI, an Early Classic elaborate crypt dating to around A.D. 400 that was disturbed in antiquity (Braswell et al. 2018). It is modeled with a hole through the torso that would have allowed the figurine to be suspended on a cord. The eyes, necklace, and turban style hat were attached as appliques. Although the number of Early Classic figurines known so far from southern Belize is small, their production techniques and themes are starkly different from those seen in the Late Classic.

Changes in the manufacture, iconography, and function of figurines from the Early to the Late Classic period imply temporal shifts in their cultural importance.

Figurine Manufacture during the Late Classic Period

Late Classic figurines typically are hollow, mold-made wind instruments. Most depict individuals and show a high level of detail applied to dress and accessories. The Late Classic shift to mold-made figurines points to a greater demand for these instruments, which were used in domestic contexts, public rituals, or both (Marcus 2019:7). The great increase in their popularity is demonstrated by the fact that nearly all figurines in our current collection date to Late or Terminal Classic contexts.

Late Classic figurines were made by pressing clay into a mold to create the front portion of the piece. The backs of the figurines were added later after the clay became leather hard. Four fragments of molds have been recovered: two from Lubaantun, and one each from Nim li Punit and Pusilha. The advantage of using a mold is that it lowers the requisite talent level needed to make figurines, standardizes production, and greatly increases the quantity of figurines that can be produced (Marcus 2019:9).

Figure 4 displays a partial mold and a figurine fragment that were recovered from the Gateway Acropolis at Pusilha. The figurine was made from a very similar mold as the one pictured; the most significant difference is that the mold also has a decorated belt. A low count of molds across our collection is typical of major Maya sites from this time period. We suspect this is because most mold-made figurines were produced outside of site cores as a cottage industry practiced at commoner households. We still need to locate the residences of figurine makers.

A quarter of the figurines from Nim li Punit and almost half of those from Lubaantun and Pusilha have been conclusively identified as musical instruments (Figure 5). Nonetheless, we believe that a majority of the remaining fragments also belonged to wind instruments. These are called whistles, but more accurately they are ocarinas that can play a limited number of notes. The instrument portion of the figurine is usually located on the back of the object. The base and body of the figurine form a single chamber resonator with a mouth piece that extends towards the back along with two stops of roughly equal size that would have allowed for the production of just three different notes.

The base or feet of the figurine and the jutting mouthpiece form a tripod allowing the figurines to stand upright and possibly be arranged in scenes for rituals. Rattles and clappers have been recovered from other Maya sites, but we have not identified them in our collections from southern Belize; this may be a regional characteristic. A single example of a ceramic flute, also commonly known from other regions of Mesoamerica, was recovered from Pusilha (Figure 6). In addition, two flutes made of bone were excavated at Nim li Punit. These, therefore, were known in southern Belize.

In addition to ocarinas, the Maya of southern Belize did make true whistles, most commonly in the form of small birds. Whistles are often thought of as toys or as bird calls for hunts. A small figurine whistle (Figure 7) was discovered as part of a special cache at Structure 50 of Nim li Punit (Braswell et al. 2019). The whistle still functions, and our excavation team greatly enjoyed hearing its sound when it was recovered after more than 1,200 years.

Data Collection and Figurine Analysis

We developed a two-fold approach for data collection focused on physical and iconographic attributes of the figurines. Our analytical approach builds on coding systems proposed by Halperin (2019) and Marcus (2019). Inputs for each entry include: context, artifact number, a longer descriptive name, height, width, thickness (each in millimeters), and mass (in grams). The artifact number consists of a letter code for the site and a unique three-digit number assigned to each figurine. This code associates each artifact with its photographs, 3D models, and entered data. Each figurine or fragment was photographed at least twice to document the front and back of the piece; these photographs also were logged into the data entry sheet. For particularly special pieces, additional photographs were taken and 3D models were made using photogrammetry techniques. We recorded the manufacturing technique for each piece, noting if it was modeled, mold-made, carved, contains appliques, or exhibits some combination of techniques. When traces of a slip or paint were present, these were coded as surface finish.

The remainder of data entry pertains to iconography and the decoration of the piece, entered as a numerical code. This allowed for a fast and standardized analysis of each piece. Coded categories include: function, number of figures, motifs, apparent sex and age, headdress type, clothing, ornamentation, facial expression, and items in the hand. A category such as "clothing" could have 1 to 5 numbered codes that account for all the different elements appearing on a single piece. Finally, we included a column for additional comments on each piece that add to the description. Our analysis provides a high level of detail for each individual figurine in terms of documentation, photography, and modeling. Using these methods, we classified and entered data for about 50 figurines per day.

The Southern Belize Figurine Dataset

A total of 215 figurines were analyzed. Ninety-five (44%) figurines and fragments are from Nim li Punit, 64 (30%) are from Lubaantun, and 56 (26%) are from Pusilha. They all seem to be made of locally procured clays that range from a yellowish to reddish orange color that resemble the paste used to create common monochrome red pottery found at each site.

Most of these figurines were found in secondary deposits, generally in refuse incorporated into the construction fill of buildings. A few more were recovered as plaza finds and might date to peri-abandonment times. A few pieces came from surface contexts; these were brought to our attention by locals or found by site caretakers while cutting grass. Unfortunately, they lack detailed provenience beyond the site level. Given their number and proximity to places of public ritual, it seems likely that many figurines played a role in public gatherings, unlike the hand-made figurines of earlier periods.

Manufacture

Most figurines were mold-made. Fully 61% (n=58) of the figurines from Nim li Punit, 72% (n=46) of those from Lubaantun, and 79% (n=44) of those from Pusilha were made using this production technique, indicating its popularity during the Late to Terminal Classic periods. If we exclude the seven figurines recovered from Early Classic contexts at Nim li Punit, the proportion of mold-made figurines at that site is 66%—nearly identical to that of the other sites. The second most common technique of manufacture is modeling. Thirty-three percent (n=31) of the figurines from Nim li Punit, 25% (n=16) of those from Lubaantun, and 14% (n=8) of those from Pusilha are modeled. The surfaces of ceramic artifacts of all sorts are only poorly preserved in southern Belize. We assume that many of these figurines once had decorated surfaces, but only seven figurines retain traces of paint and six more have traces of a slip.

Iconography

Our fascination with figurines is in part due to their small portable size and their artistic representation of a past worldview. The motifs that they depict reveal how ancient artists interpreted their physical, social, and spiritual worlds. Moreover, ancient producers drew upon shared narratives, folk tales, and themes for inspiration. The fact that iconographic motifs and style are repeated across the region highlight that the Maya of southern Belize shared a set of cultural norms. Specifically, the performance of similar rituals would have required similar figurines.

The number of characters depicted in these scenes are similar across the three sites. Those with only one central figure are the most common: 75% (n=71) of figurines from Nim li Punit, 83% (n=53) from Lubaantun, and 89% (n=50) from Pusilha display just a single individual.

Across the three sites, three quarters of all figurines for which sex/gender could be determined are male. This determination was made based on the presence of elite male clothing, hairstyles, and accessories (Figure 8). Females are usually shown standing and have characteristic hairstyles and outfits. There is a level of action for the females, with some shown carrying children or vessels, working with weaving looms, or tending animals (Figure 9). A great level of detail is displayed in dresses with woven designs and fringed skirts. The fancy patterned textiles and body ornamentation shown on these women accentuate their high social status.

Most figurines depict adults. Figurines showing children were found at two sites, Nim li Punit and Lubaantun, and they are always accompanied by a female adult. Only a handful of diagnostically elderly individuals were encountered: four figurines at Nim li Punit, three at Pusilha, and a lone example at Lubaantun.

Ornamentation of the hair, face, limbs, or dress highlights the varied ways the ancient Maya had of decorating their bodies. For the head, headbands and headdresses are quite commonly shown on the figurines from all three sites. Hats also are depicted, along with a distinct turban (Figure 3c), best known as a sign of royalty at Copan and Quirigua. Individuals also wear accessories decorating their bodies and extremities. These include armbands, bracelets, necklaces, pendants, ballplayer belts (or *yugos* with *hachas*), rings, nose clips, nose tubes, ear spools, and earrings.

In addition to humans, animals also are depicted. The most popular at Nim li Punit is the bird (n=4), perhaps a reference to the sound of the instrument as it is blown. Birds are a theme common at other sites in the Maya area, but are not represented in our samples from Lubaantun. Felines are the next most popular animal at Nim li Punit (n=2), and we also found one example at Lubaantun. In significant contrast, the Pusilha figurines contain more animals than the other sites, as well as the greatest diversity. There, monkeys and dogs are frequently depicted. An entertaining theme seen most often at Pusilha is that of elite women with animal pets or companions.

Ancient Ritual Sports

The ritual boxer is a very common character depicted on figurines from the Southern Belize Region, and has been known since the British Museum project at Lubaantun (Figure 1). These wear a heavily padded slit "ninja" helmet and have at least one gloved or bound hand. In addition to their thick helmets, boxers also hold a stone weight resembling a ball in one or both hands (Figure 10). Most interesting, they are not shown wearing the beaded necklaces or other adornments of elite male figures. For an excellent description of ritual boxing in Mesoamerican art, as well as an ethnographic account of the sport as still played in highland Mexico and a discussion of how it relates to rain rituals, we refer the reader to Taube and colleagues (2009).

Although commonly represented at both Nim li Punit and Lubaantun, no boxers are present in our collection from Pusilha, perhaps further indicating cultural differences between that city and the other settlements of the Southern Belize Region. Another possibility is that, if ritual boxing was important to rituals designed to bring the rain, boxer figurines may have increased in importance during the Terminal Classic at a time when rainfall became irregular and when Pusilha was already in decline. Alternatively, this could be a sampling issue. That is, perhaps we did not excavate at places at Pusilha where rain rituals were performed and boxer figurines were discarded. Nonetheless, the ubiquity of boxers elsewhere and lack of them at Pusilha does seem to be significant to us.

Although present, the low count of ballplayers in southern Belize starkly contrasts to that found at other sites dating to the Late and Terminal Classic, such as Copan and Aguateca. Such ballplayer figurines were found at all three southern Belize sites, but are not nearly as common at Nim li Punit or Lubaantun as boxers. We recovered just one ballplayer figurine at Nim li Punit and two at Lubaantun (Figure 10). Three ballplayer fragments were excavated at Pusilha, but strangely only their torsos remain, raising questions about ritual termination and discard patterns.

Unlike the boxers, who do not wear ornaments indicating high status, the ballplayers sport bead necklaces, pendants, and other symbols of elite status. The lone ballplayer found at Nim li Punit (Figure 10, bottom left) wears a wind jewel, indicating kingly status and participation in the agricultural scattering ritual. This may, in fact, be an image of the large jade pendant found in Tomb V and depicted on Nim li Punit Stelae 2 and 15 (Braswell 2017, 2022; Prager and Braswell 2016). Given that scattering was performed and the ballgame sometimes played by kings, and that both are related to the agricultural cycle of maize, this figurine may suggest that the two rituals were linked and sequentially performed.

Figure 4. Figurine mold (a) and female figurine fragment (b), both from Pusilha (photos by Mario Borrero).

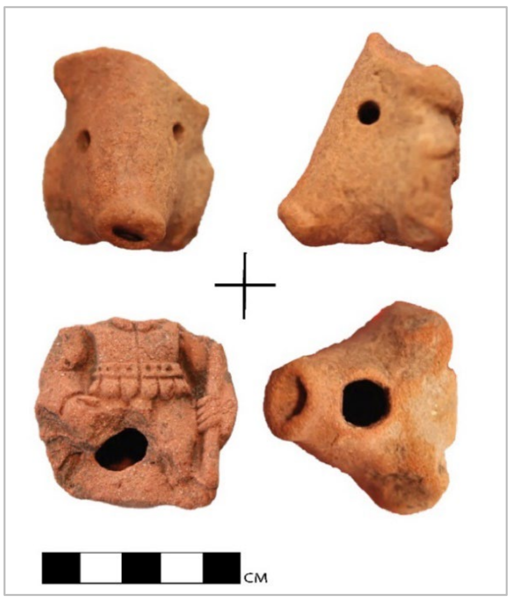

Figure 5. Musical instrument portion of ocarina figurines, Nim li Punit (photos by Mario Borrero).

Figure 6. Mouth-piece of a ceramic flute, Pusilha (photos by Mario Borrero).

Figure 7. Small bird whistle dating to the Terminal Classic, Nim li Punit (photos by Mario Borrero).

Figure 8. Elite male figurines. (a-b): Nim li Punit; (c) Lubaantun; (d) Pusilha (photos by Mario Borrero, not shown to scale).

Figure 9. Female figurines. (a-b). Heads showing ear spools, other jewelry, and hairstyles (Nim li Punit); (c) woman carrying a water jar with a young child on her back (Lubaantun).

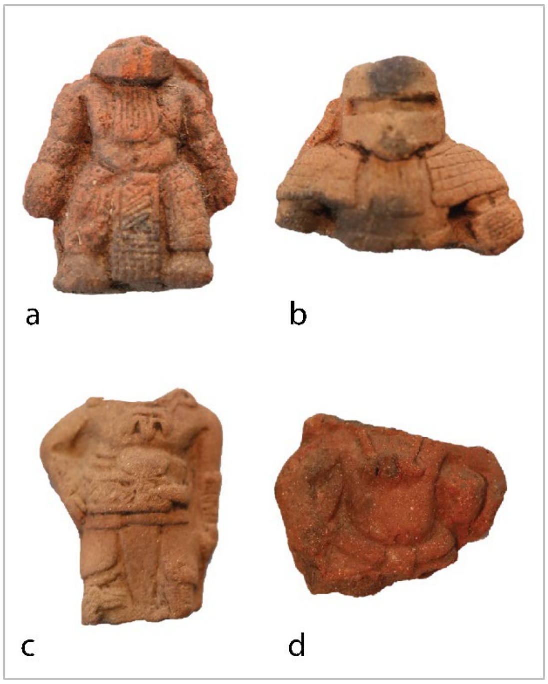

Figure 10. Boxers and ballplayers. (a-b) Boxers, Nim li Punit; (c) royal ballplayer with Wind Jewel, Nim li Punit; (d) elite ballplayer, Lubaantun (photos by Mario Borrero, not shown to scale).

Figure 11. A boxing match featuring two combatants, Lubaantun (photo by Mario Borrero).

The popularity of boxer and ballplayer figurines may imply that public spectacles were a driving factor of figurine production. These ritual games were events that probably were played in the open public spaces of the sites. The figurines could have been blown as noisemakers during the contests, adding to their theatricality. One interesting figurine shows two ancient boxers in action (Figure 11). This tableau may depict a particularly important occasion (or one soon to occur), a remarkable fight, an underdog story, or an important encounter between two particularly powerful athletes/ritual practitioners. Spectators of such ritual contests may have been purchased or have been given as souvenir figurines, much like those sold at both modern-day churches and sporting events. Afterwards, they would return to their home villages and could play the instruments and display their figurines to recount these memorable narratives.

Discussion and Conclusions

Just seven Early Classic figurines have been recovered by our projects, all at Nim li Punit—the only one of the three sites with a substantial Early Classic population. Although the sample is small, they seem to be associated with burials and perhaps other ritual contexts. The majority of the figurines in our study date to the Late and Terminal Classic periods. Most were produced using molds, a method that standardized their appearance and greatly increased their production, likely to meet a new demand for figurines across the Maya world after A.D. 600. The ability to produce an increased number of figurines while maintaining a high level of detail and standardization, coupled with their small size and portability, made ceramic figurines a highly efficient medium for the transport of ideas and motifs across a wide geographic region in a relatively short period of time. These 215 whole and fragmentary figurines from southern Belize show that the ancient Maya who made them had connections with Petén, the southeastern Maya periphery, and with western and northern Belize. One possibility to consider is that the figurines stood in for those living or dead who could not attend and witness a ritual or public spectacle.
The similarities seen across the collections from these three sites bolster the argument that southern Belize formed a cultural region distinct from other parts of the Maya lowlands. A focus on elite men and the ritual sporting activity of boxing distinguishes the Southern Belize Region from other areas of the ancient Maya world. But we also stress that figurines, like ceramics, hint at sub-regional differences that may be connected to alternative exchange networks or local histories. Specifically, while close ties are seen between the samples from Nim li Punit and Lubaantun, the

figurines of Pusilha stand apart in subject matter. They feature more women with children or animals, lack boxers, and perhaps have more ballplayers. Overall and like the pottery, the figurines of Pusilha have more in common with collections from the southern Maya lowlands of Petén, supporting the hypothesis that the population of that city came from the west at the end of the Early Classic period.

The details of dress, ornamentation, and hairstyle preserved on the ceramic figurines of Nim li Punit, Lubaantun, and Pusilha reflect the richness of ancient Maya cultural materials that do not survive in the archaeological record. The focus on elite garb and almost exclusive representation of adults (with few children always attended by a mother), reveal the potential use of figurines as teaching devices for children that highlight the social structure of the Maya world, as well as aspects of performative and theatrical ritual. Moreover, playing the ocarinas that display boxers and ballplayers would bring spectators—including children—into such ritual performances. In a similar manner, figurines teach us about past ancient Maya customs and cultural norms, and draw us closer to their theatrical rituals.

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33 (RE)BUILDING CHRONOLOGIES AND SPHERES OF INTERACTION IN SOUTHERN BELIZE: EXCAVATIONS FROM EK XUX, MUKLEBAL TZUL, AND IX KUKU'IL

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We discuss newly developed chronologies for two Classic Maya centers – Ek Xux and Muklebal Tzul – in the Maya Mountains of southern Belize. Previous research by the Maya Mountains Archaeological Project investigated these remote centers in the late 1990s and early 2000s. In 2022, the Bladen Paleoindian and Archaic Archaeological Project re-established archaeological research at Ek Xux and Muklebal Tzul with the goals of developing more detailed, multiproxy chronologies to understand the development and decline of each center, how they articulated with each other, and their relationships to nearby mortuary rockshelters. Here, we discuss the results of our 2022 test unit excavations, detailing the construction history of two elite residences as well as the civic ceremonial core of Ix Kuku'il in the foothills of the Maya Mountains. We provide a preliminary analysis of their chronologies based on architectural constructions and ceramic typologies. Finally, we highlight regional connections and interaction spheres of southern Belize drawing on our findings from the Ek Xux and Muklebal Tzul excavations and previously published ceramic typologies. This paper provides a foundation for future research in incorporating the Maya Mountain centers into multiproxy chronologies and the interaction spheres of southern Belize and beyond.

Introduction

Archaeological research in southern Belize has occurred for nearly a century, with the first excavations at Lubaantun in 1926 (Joyce 1926). In the past 35 years, long-running research programs resulted in a deep understanding of the civic ceremonial cores of several regions; others focused on the development and decline of the regional settlement systems. Yet of the more than 20 Classic Maya centers in southern Belize, only a handful have undergone archaeological research, leaving gaps in our understanding of the regional interactions and chronologies. Here, we build upon the foundations of other projects including the Maya Mountains Archaeological Project (MMAP), Toledo Regional Interaction Project (TRIP), and Uxbenká Archaeological Project (UAP), incorporating new data focused on two Maya Mountains centers, Ek Xux and Muklebal Tzul, into our understandings of the regional chronologies and interactions of southern Belize (see also Braswell and Prufer 2009).

The goals of the 2022 field work at Ek Xux, Muklebal Tzul, and Ix Kuku'il focused on understanding the construction of the civic ceremonial cores including elite residential areas at these three centers, with an emphasis on chronology building. Prior to these excavations, research was conducted at Ek Xux and Muklebal Tzul in the 1990s and early 2000s as part of Peter Dunham's MMAP. Limited excavations at Muklebal Tzul focused on salvage excavations of looted tombs and a pseudo-cave well-constructed beneath the civic ceremonial core (Prufer and Kindon 2005). Excavations at Ek Xux focused on elite houses in the civic ceremonial core. In the foothills, under the auspices of Keith Prufer's UAP, previous research at Ix Kuku'il focused on developing settlement chronologies rather than on the civic ceremonial core (Thompson 2019). Here, we build upon these foundations to develop more detailed chronological sequences for southern Belize, illuminating the development, decline, and interactions between these centers with other, well-studied regional centers.

Background of Southern Belize

Southern Belize encompasses modern Toledo and Stann Creek districts and comprises four distinct ecological zones: the Cayes and Caribbean Sea, the flat coastal plains, the southern foothills of the Maya Mountains, and the Maya Mountains. While more than 20 Classic Maya centers are present in southern Belize (Figure 1), we focus on the inland centers, specifically those in the foothills and mountains. Nonetheless, extensive research by McKillop and Sills (2022) details coastal communities, including Ta'ab Nuk Na and Ek Way Nal, who engaged in salt production, and were trading with inland centers such as Lubaantun. The ebbs and flows of trade and exchange suggest differing spheres of interaction and relational networks

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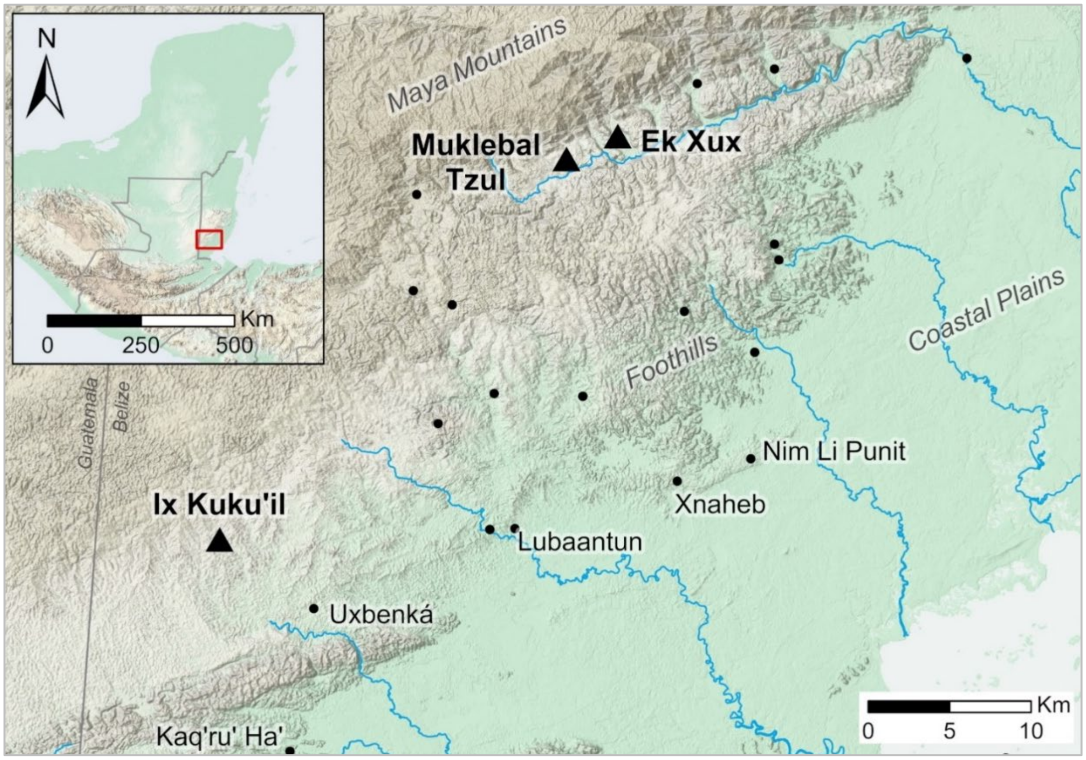

Figure 1. Map of Southern Belize highlighting centers with 2022 excavations, centers discussed in detail in the text, and other southern Belize centers. (Map by AE Thompson).

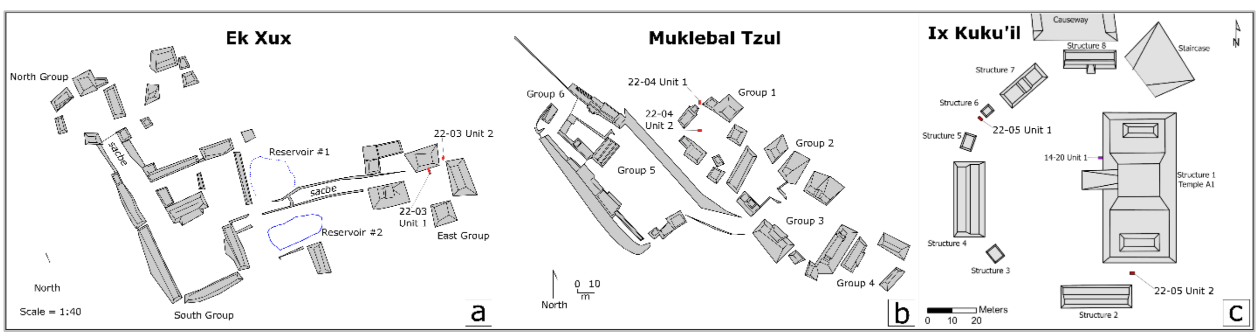

Figure 2. Location of 2022 test unit excavations at Ek Xux (a), Muklebal Tzul (b), and Ix Kuku'il (c). (Maps by AE Thompson).

between the rulers of the southern Belize kingdoms.

By 10,500 BCE, the first humans passed through southern Belize and small semi-nomadic communities were residing in the region throughout the Paleoindian and Archaic periods (Prufer and Kennett 2020). Buried paleosols and features in agricultural fields near Uxbenká date to the Late Archaic and Middle Preclassic (Culleton 2012). A small cist excavated into bedrock held an individual with no grave goods; the human remains were directly dated to 60 BCE (Thompson and Prufer 2021), providing evidence for sedentary lifeways by the Late Preclassic (300 BCE - 250/300 CE). Shortly thereafter, around 100 CE, major anthropogenic landscape modifications occurred at Uxbenká, with the construction of its civic ceremonial core (Prufer et al. 2011; Prufer and Thompson 2016). Evidence for continued growth in southern Belize is visible at Kaq'ru' Ha' (Novotny 2015), Ix Kuku'il (Thompson and Prufer 2019), and Nim li Punit (Braswell 2022) during the Early Classic (250/300 - 600/650 CE). Populations peaked in the Late Classic (600/650 - 800 CE), with the establishment of Lubaantun, Xnaheb, Ta'ab Nuk

Na, and numerous other regional centers (Dunham et al. 1989; Leventhal 1990; McKillop and Sills 2022; Prufer 2002). Political disintegration swept across the region in the late 700s and early 800s CE (Ebert et al. 2014), although local communities were resilient to these broad political changes based on radiocarbon dates from the 900s - 1100s CE in household contexts at Uxbenká and Ix Kuku'il (Prufer and Kennett 2020; Thompson and Prufer 2021) and on the coastal community of Ek Way Nal (McKillop and Sills 2022). Small communities continued to reside in southern Belize until the 1880s, when Mopan and Q'eqchi' communities established modern villages including San Antonio and Aguacate (Downey 2009; Thompson 2019; Wilk 1997).

2022 Field Excavations

The 2022 field work at Ek Xux and Muklebal Tzul in the Maya Mountains, and Ix Kuku'il in the southern foothills, focused on chronology building through small, test unit excavations. Previous research in the late 1990s by the MMAP produced rough chronologies based on local ceramic typologies and radiocarbon dates (Kindon 2002; Prufer 2002). The radiocarbon dates are from the tomb contexts at Muklebal Tzul and near-surface contexts at Ek Xux and, therefore, do not inform the time depth and full occupational sequences of these centers. To begin building more detailed chronology at Ek Xux and Muklebal Tzul, at each center, one unit was placed near the center of the selected plaza adjacent to a structural platform and the second unit was placed at the edge of the plaza, providing information about the construction sequences of these elite residential areas (Figure 2). In 2014, a test unit excavation occurred in front of the E-Group at Ix Kuku'il (Thompson and Prufer 2016), so both units excavated during the 2022 field season were placed along the plaza edge, to capture potential anthropogenic landscape modifications (see also, Prufer and Thompson 2016).

Ek Xux

Ek Xux is located in the Maya Mountains in the Bladen Nature Reserve, a 2-day walk from the nearest village. It sits on the alluvial floodplain of the Bladen Branch of the Monkey

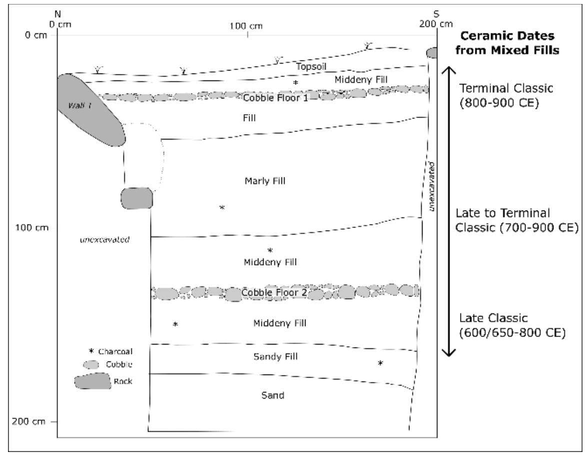

Figure 3. East Wall Profile of Unit 2 at Ek Xux with ceramic chronologies added to the profile. (Profile and digitization by AE Thompson).

River in the Ek Xux Valley. Steep, karst mountains frame the edges of the valley, naturally bounding the settlement extent of Ek Xux. Ek Xux consists of a large open plaza - the South Group - connected to two elite residential areas - the North Group and the East Group - by *sacbe'ob*. The civic ceremonial core is surrounded by more than 159 residential structures clustered into 86 *plazuelas* (Thompson et al. 2021). Previous excavations by the MMAP focused on the two northern buildings in the elite residences - Structure 15 in the North Group and Structure 23 in the East Group (Prufer 2005). Here, we focus on the earliest foundation and constructions of the valley center. The 2022 excavations were placed in the East Group plaza, one in front of Structure 23, and one at the edge of the plaza, to the east of Structure 23.

The unit placed along the edge of the East Group plaza revealed nearly 2m of anthropogenic landscape modifications to elevate the plaza from the surrounding valley floor. First, the sandy valley floor was covered with a hard, limestone rich surface, followed by a 25cm thick dark midden fill. The midden fill contained charcoal and ceramics, similar to that seen at Uxbenká (Prufer and Thompson 2016). Late Classic ceramics were recovered from the midden fill. A cobble floor (Cobble Floor 2) was placed across the plaza (Figure 3), nearly 1.25 cm beneath the modern surface. Several fill layers were placed on top of Cobble Floor 2, followed by another Cobble Floor (Cobble Floor 1). This was likely the final floor created in the plaza before abandonment. The shallow layers above the cobble floor also contained Terminal Classic ceramics. This unit showed at least three living surfaces that likely extended across the plaza, with the majority of the construction occurring during the Late and Terminal Classic.

The second unit was placed in front of the central staircase of Structure 23. An abundance of charcoal, lithics, and broken pottery, possibly representing a termination ritual, were found above Cobble Floor 1. Ceramics from the feature include Puluacax Unslipped, indicating a Terminal Classic occupation after the construction of Cobble Floor 1. At the base of Structure 23, fills of varying colors of soils and clays suggest different construction events, although no architectural constructions such as cobble or plaster floors were identified. This unit, which was excavated to a sterile sand nearly 2 m beneath the surface, corroborates the construction sequences identified in the other unit in the East Group plaza (Figure 4).

The 2022 excavations at Ek Xux revealed that the East Group plaza was raised nearly 2 m, but that these constructions occurred primarily during the Late to Terminal Classic. While earlier constructions and occupations at Ek Xux are possible, the East Group plaza construction occurred centuries after the initial constructions at foothill centers Uxbenká and Nim li Punit. Spindle whorls provide incipient evidence for elite craft production at Ek Xux's East Group. Importantly, the ceramics and obsidian in the East Group provide insights into the spheres of interaction between the elite residents of Ek Xux and other Lowland Maya centers.

Muklebal Tzul

Muklebal Tzul is located in an upland karst ridgetop in a high relief valley of the Maya Mountains. Muklebal Tzul was mapped by Kindon (2002), who documented 205 residential structures in 67 *plazuela* groups across 2.5 km^2 (Thompson et al. 2021). The civic ceremonial core and associated settlements are dispersed across hilltops, similar to settlement patterns present at the foothill centers of Uxbenká, Ix Kuku'il, Lubaantun, Nim li Punit, and Xnaheb. The Muklebal Tzul civic ceremonial core consists of six discrete architectural groups. Groups 1 and 4 were likely elite residential spaces while

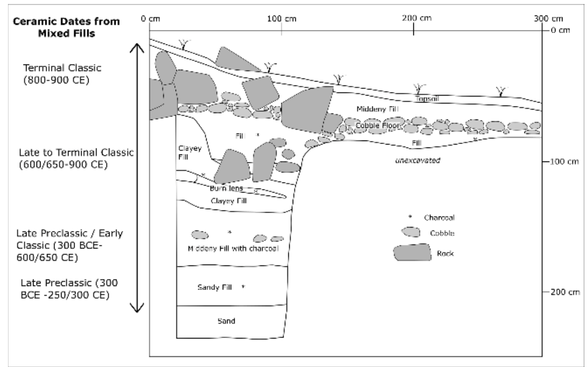

Figure 4. East Wall Profile of Unit 1 at Ek Xux with ceramic chronologies added to the profile. (Profile and digitization by AE Thompson).

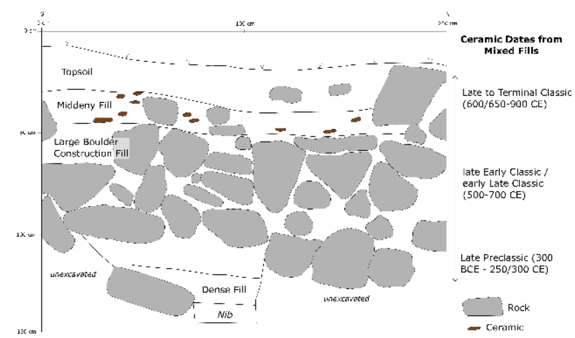

Figure 5. West Wall Profile of Unit 1 at Muklebal Tzul with ceramic chronologies added to the profile. (Profile by AE Thompson and digitization by AE Thompson and C Ploetz).

Groups 2, 3, 5, and 6 were public spaces in the civic ceremonial core. The 2022 excavations were placed in Group 1, one unit in the center of the plaza and the other at the edge of the plaza.

The unit placed in the middle of the plaza aligned with trends present in central plaza units at Uxbenká and Ix Kuku'il, with little depth or stratigraphy before reaching *nib* (i.e., bedrock) at 30-40 cm beneath the surface. Nonetheless, a plethora of ceramic and lithic artifacts were recovered from the 1m-x-2m excavation unit, alluding to the wealth of the Group 1 occupants. A small slate pendant and spindle whorl were identified, showing the personal adornments and possible elite craft production at Muklebal Tzul. Ceramics from this unit date from the end of the Early Classic through the Late to Terminal Classic.

The unit placed along the edge of Muklebal Tzul Group 1 plaza shows similar trends to the construction sequences noted at Uxbenká and Ix Kuku'il. Large boulder construction fill was placed on top of bedrock to widen and raise the plaza nearly 75 cm (Figure 5). Late Preclassic to Early Classic sherds were among the large boulder construction fill. On top of the large boulder construction was the remains of a cobble floor that likely was plastered in antiquity. The floor was covered with ceramics and lithic debitage, indicative of a midden or possibly a termination event. Pottery from above the cobble floor dates to the Late to Terminal Classic.

The 2022 excavations at Muklebal Tzul provide some of the first insights into the construction of the plazas at the Maya Mountains center and are similar to construction methods elsewhere in southern Belize. These initial constructions may have occurred during the Late Preclassic to Early Classic and the elite residential space was occupied into the Terminal Classic. Likewise, the presence of Puluacax Unslipped shows connections and ties with other southern Belize centers, despite the distance between them.

Ix Kuku'il

Ix Kuku'il is located along the Yax Ha, northwest of the modern community of San Jose (Thompson and Prufer 2016). From 2013-2017, under the auspices of the UAP, 325 residential buildings that clustered into 122 *plazuelas* were documented (Thompson 2019). More than 35 of the *plazuelas* were dated using ceramics and radiocarbon (Thompson and Prufer 2019, 2021). However, the emphasis on understanding the Ix Kuku'il settlement resulted in little knowledge of the civic ceremonial core. Group A, the Ix Kuku'il Stela Plaza, contains a 10 m inline eastern triadic pyramid (i.e., E-Group) and a 4.2 m stela (Figure 6). In 2014, a small 1m-x-2m test unit was placed in the plaza along the western side of the E-Group north of the central staircase; this unit yielded little to no chronologic information aside from a Late Classic Remate Red sherd found in the topsoils of the shallow unit. The goal of the 2022 excavations was to understand the construction of Ix Kuku'il Group A plaza.

Two test units were placed along opposite edges of the circular plaza - one on the northwest edge between Structures 5 and 6 and a second on the southeastern edge between Temple

Figure 6. Chris Ploetz and San Jose community members standing next to the fallen 4.2m stela in the plaza of Ix Kuku'il Group A. It remains unclear if the stela is carved on the side facing down as it has never been flipped. (Photo by AE Thompson).

A1 and Structure 2. The second unit revealed little information as it was less than 1 m deep. While it contained four distinct stratigraphic levels, a total of 28 small, broken undiagnostic body sherds were recovered, providing no additional chronologic information (Thompson and Ploetz 2022). The first unit showed massive anthropogenic landscape modifications. Rather than using large boulders to raise the plaza as seen at Uxbenká (see Prufer and Thompson 2016) and Muklebal Tzul (see above), the plaza was raised and flattened with more than a meter of crushed *nib* fill (Figure 7). Intermixed with the *nib* fill, proving that it was anthropogenic and not a natural breakdown of bedrock, were possible Early Classic ceramic sherds (Jillian Jordan, personal communication 2022) and charcoal. Large rocks were placed on top of the crushed *nib* fill, creating a surface for the plaza. More fill and a possible cobble floor were identified just below the modern surface.

In contrast to the 2022 excavations at Ek Xux and Muklebal Tzul, few artifacts were

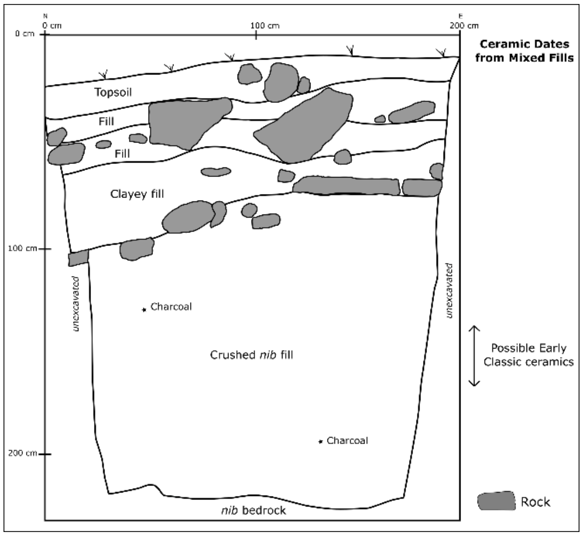

Figure 7. North Wall Profile of Unit 1 at Ix Kuku'il with ceramic chronologies added to the profile. (Profile by AE Thompson and digitization by AE Thompson and C Ploetz).

identified in the two units at Ix Kuku'il. The potentially Early Classic sherds allude to the construction of the main plaza between 250/300-600/650 CE, although radiocarbon dating will corroborate that date. Nonetheless, the excavations at Ix Kuku'il revealed massive landscape modifications to raise the plaza more than a meter, providing insights into the ability of local rulers to harness labor for these monumental efforts.

Continuing to Build Chronologies in Southern Belize

Previous research in southern Belize has focused on chronologies constructed from ceramics (e.g., Lubaantun, Hammond 1975; Nim li Punit, Fauvelle et al. 2012; Uxbenká, Jordan 2019) and detailed epigraphic records (e.g., Pusilha, Prager et al. 2014; Uxbenká, Wanyerka 2009). Recently, multiproxy chronology building relying on ceramics, AMS ^{14}C radiocarbon assays, and when possible epigraphic data, provide insights into the shortcomings of single-proxy approaches. At both Ix Kuku'il and Uxbenká, the ceramic dates suggest shorter occupations than the radiometric dates. For example, at Ix Kuku'il, the earliest radiocarbon date is from the directly dated human remains from a burial within a small household; this dates to approximately 60 BCE (Thompson and Prufer 2021). However, the earliest ceramics date to the Early Classic (250-400 CE). Likewise, the latest ceramics identified at Ix Kuku'il date to the Late Terminal Classic (700-900 CE), while several radiocarbon dates from hinterland households fall well beyond 1000 CE (Thompson and Prufer 2021). These findings illuminate the need for multiproxy approaches (Thompson and Prufer 2019), combining both radiocarbon dates with ceramic chronologies. Furthermore, this approach can help us build a more detailed understanding of local variations in ceramic production and distribution.

Ceramics

Southern Belize is a region that only recently has received the same attention from archaeological researchers that has been focused on other areas of the Maya lowlands, and ceramic research has lagged even further behind. Early work in the Toledo District at the center of Lubaantun by Hammond (1975) produced an excellent site/center ceramic typology for the Late Classic, and more recently projects focused on the centers of Uxbenká (Jordan 2019), Pusilha (Bill and Braswell 2005), and Nim Li Punit (Fauvelle 2012) have produced ceramic chronologies for some of the larger centers in the region. Kindon (2002) discussed preliminary analyses of the limited ceramics identified by the MMAP at Ek Xux and Muklebal Tzul. McKillop's (2002) extensive research on salt production and trade along Belize's southern coast and cayes has documented ceramic typologies for smaller sites along the coast, but there hasn't been a similar focus on smaller inland centers nor an effort to build regional and comparative ceramic chronologies and typologies. The current research presented here is a start towards that goal and is based on a preliminary analysis of ceramics excavated from Ek Xux and Muklebal Tzul during the 2022 field season.

Ceramic Methodology

Ceramic research in the southern Maya Lowlands utilizes the frameworks created for three regions, because their publication came early in the history of Maya archaeology. These include the ceramics from Uaxactún in the Petén (Smith 1955), and typed by Smith and Gifford (1966); the ceramics from the Pasión region at

Altar de Sacrificios (Adams 1971) and Seibal (Sabloff 1975); and the ceramics of Barton Ramie in the Belize Valley (Gifford 1976). This hierarchical framework, known as type: variety/mode analysis, places greatest emphasis on surface characteristics, and becomes less useful as a tool when analyzing eroded material. In the absence of well-preserved surfaces, modal characteristics such as rim and lip shape, vessel form, and paste and temper characteristics are also extremely useful in pottery identification and are too often ignored. The latter have proven extremely useful in southern Belize (Jordan 2019) with highly eroded ceramic assemblages.

The identification of ceramic types and ultimately ceramic complexes from the 2022 excavations at the centers of Muklebal Tzul and Ek Xux are a start in defining relative chronologies for the Maya Mountains subregion of southern Belize. Additionally, the advantage of utilizing a type: variety/mode analysis is the ability to compare the ceramics of a center or region with other more distant centers and regions utilizing the concept of the ceramic sphere. The definition of the ceramic sphere concentrates on typological similarities and dissimilarities between ceramic complexes and "exists when two or more complexes share a majority of their most common types" and "makes possible the recognition of two degrees of content similarity: high…and little or none" (Ball in Gifford 1976:323-30; Willey et al. 1967: 306). Diagnostic types are abundant and widely shared among the ceramic complexes that constitute a sphere and are therefore quantitatively rather than qualitatively defined by their abundant, shared presence in numerous complexes. Ceramic spheres can map inter-center and interregional connections, based on content similarity of pottery, and are dynamic rather than static in time and space.

Ceramic Chronologies from the Maya Mountains

The analysis of the ceramics from the excavations at Muklebal Tzul show an initial occupation beginning in the Late Preclassic (c. 300 BCE to 250/300 CE), with the identification of types of the Sierra Red Group. Due to erosion, Early Classic ceramics (c. 250/300 CE to 600/650 CE) are identified based entirely on vessel forms, including basal flange bowls and small, unslipped jars with grooved lips. Occupation continues through the Late Classic to Terminal Classic (600/650 CE to 900 CE) evidenced by the presence of Cubeta Incised (Achote Black Group) (Smith and Gifford 1966), eroded polychromes, and large monochrome red bowls and dishes, whose vessel forms are similar to Garbutt Creek Red and Vaca Falls Red (Gifford 1976), as well as smaller monochrome red bowls of the Remate Red Group (Hammond 1972). The presence of the easily identifiable large, thick-necked jars of Puluacax Unslipped (Hammond 1972) is another strong indicator of Late to Terminal Classic occupation.

The analysis of ceramics from the excavations at Ek Xux define an occupation from the Late to Terminal Classic Period (600/650 CE to 900 CE), although mixed deposits include a few earlier sherds. The ceramic assemblage includes Chilar Fluted and Achote Black (Smith and Gifford 1966), eroded Late Classic polychromes, and larger bowl forms similar to Rubber Camp Brown (Gifford 1976). Smaller bowls and dishes of the Belize Red Group, including Platon Punctated-incised (Gifford 1976), and the large Puluacax Unslipped jars confirm an occupation history in the Late to Terminal Classic.

Multiproxy Approaches: Ceramics and Radiocarbon

Combining ceramic data with radiocarbon data produces more robust and powerful methods for building chronologies than single proxy alone. While radiocarbon dates provide absolute dates usually with errors typically in the range of plus or minus 15 to 20 years, they are expensive, costing hundreds of dollars per sample. Fortunately, even limited radiocarbon dating can be bolstered with ceramic data to enhance our assessments of the past (Figure 8). Here, we use the new ceramic data from Muklebal Tzul and Ek Xux combined with previously reported AMS ^{14}C dates to expand the occupational histories of these two Maya Mountain centers. We also compare these new chronologies to the established chronologies of other regional centers in southern Belize. We hope to build on this analysis with additional AMS ^{14}C dates in the future.

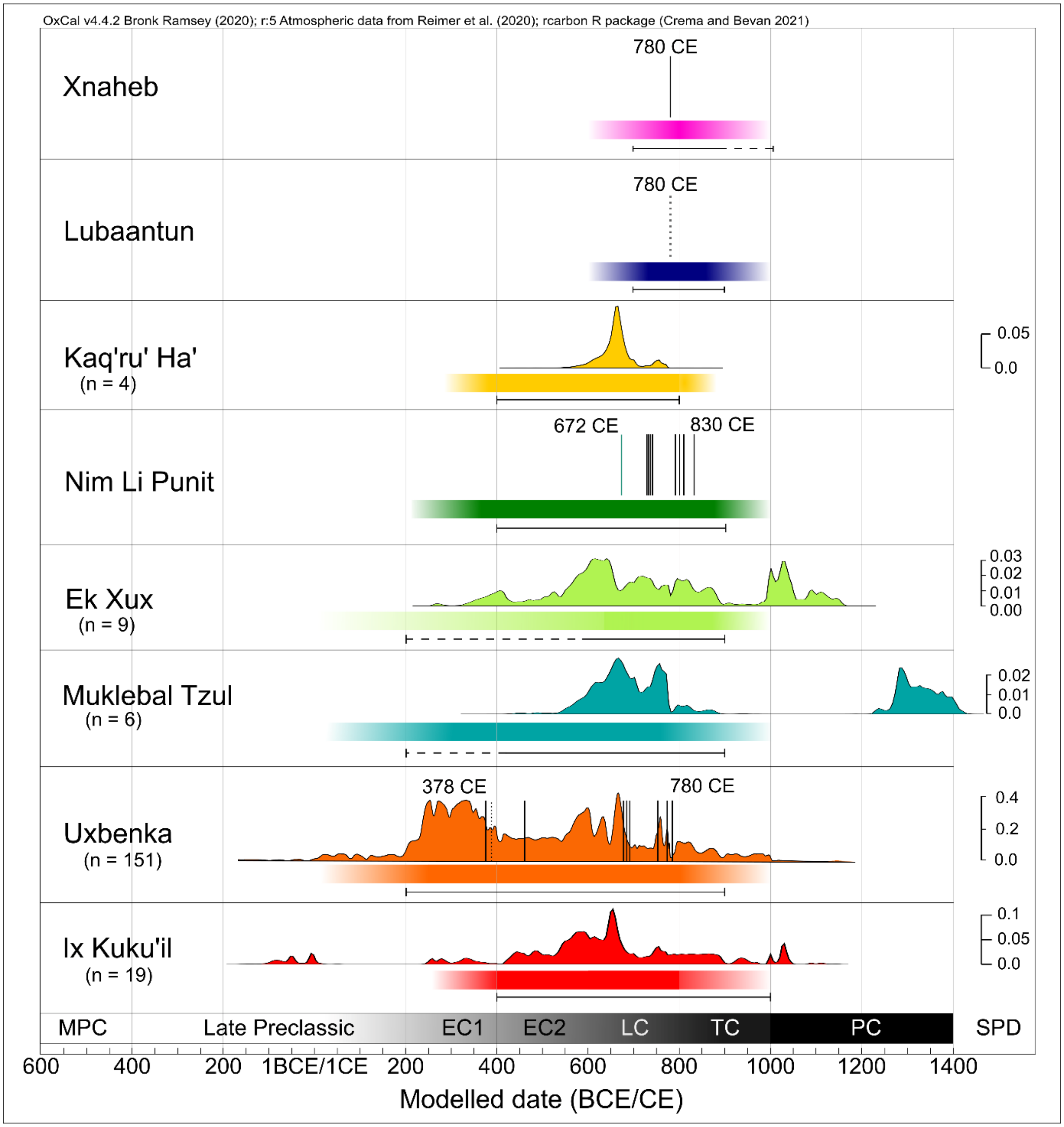

Figure 8. Multiproxy chronologies of southern Belize centers showing the summed radiocarbon dates (OxCal curves), ceramic dates (horizontal bars), and hieroglyphic dates (vertical lines). Number of radiocarbon dates is listed beneath the center name. Hieroglyphic dates include recorded dates on monuments (black vertical line) and artifacts (teal vertical line) and stylistic monument dates (dashed vertical line). (Figure by AE Thompson; modified from Thompson et al. 2021: Figure 2).

The results of the 2022 field season push the earliest foundation dates of Muklebal Tzul back several centuries. Previous research by Kindon (2002) concluded that the majority of ceramics at Muklebal Tzul were akin to Hammond's (1975) Late Classic Turneffe Unslipped (27%) and Hondo Red (48%). Temporally, our findings largely parallel Kindon's preliminary results, suggesting that the majority of Muklebal Tzul's occupation was during the Late to Terminal Classic, albeit we identified a broader variety of ceramic types than Kindon. We also found that the initial construction of the elite plaza likely occurred at the end of the Late Preclassic or during the Early Classic. The earliest living surfaces contained ceramics dating to 500-700 CE, and the presence of Puluacax Unslipped and other Late to Terminal Classic pottery, alludes to a continued occupation beyond the 800s or 900s CE. The six previously reported radiocarbon dates are from tomb contexts (Prufer 2002: Table 9.1) and restrict the dates of Muklebal Tzul to 600-800 CE with a possible revisitation of the tombs in the Middle Postclassic (Figure 8). Hopefully, future radiocarbon dates from the 2022 field season will corroborate the ceramic data, helping us to further refine the chronology of Muklebal Tzul's Group 1.

Previous scholarship at Ek Xux hypothesized that it was an Early Classic center with ephemeral ritual activities continuing throughout the Late Classic, likely as Maya Mountains occupants passed through on their way to nearby rockshelters, which were used for mortuary purposes (Prufer 2005). The nine previously reported radiocarbon dates from Ek Xux (Prufer 2002: Table 8.1) indicate the majority of occupation was from 600 - 850 CE with a short hiatus in the 900s followed by continued use in the Early Postclassic (Figure 8). Furthermore, Kindon (2002) found that 75% of ceramics were akin to Hammond's (1975) Late Classic Turneffe Unslipped. The results of the 2022 field season build upon these previous dates, revealing that the majority of the construction at the Ek Xux East Group plaza occurred during the Late to Terminal Classic. The deepest excavation levels contain a mix of Late Preclassic and Early Classic sherds, but all other levels in both excavation units contained Late to Terminal Classic ceramics. Thus, it seems the East Group elite household of Ek Xux underwent at least two remodeling events to the plaza floor during the Late to Terminal Classic, raising the plaza nearly two meters.

Ceramic Interaction Spheres

The preliminary analysis of ceramics from the 2022 excavations, and the identification of specific ceramic types suggest that this region in southern Belize sits at the intersection of overlapping ceramic spheres. During the Late Preclassic, the presence of waxy slipped sherds of the Sierra Red Group connects this region to the pan-southern lowland Maya Chicanel ceramic sphere at a time of increasing ceramic homogeneity across the entire region (see Ball in Gifford 1976). During the Early Classic, the assemblage is typified by a locally made type, Santa Cruz Red (Jordan 2019), as well as linked to the Petén centered Tzakol Sphere ceramics with the presence of monochrome and polychrome bowl forms of the Petén Gloss fine ware tradition (see Ball in Gifford 1976). However, small sample sizes obscure other possible connections until the Late Classic.

During the Late to Terminal Classic the ceramic assemblage includes types of the Petén Gloss fine ware tradition including sherds in the Achote Black Group, and eroded polychromes in the Saxche and Palmar Orange Polychrome Groups linking this region to the central Maya Lowlands in the Petén (Smith 1955; Smith and Gifford 1966). There are also examples of ceramics of the Belize Red Group, manufactured with a volcanic ash paste (British Honduras Volcanic Ash Ware) that may have a production locale in the Belize River Valley at the center of Baking Pot (Jordan et al. 2022). Additional types and vessel forms, similar to the Belize Valley (Vaca Falls Red, Garbutt Creek Red, and Rubber Camp Brown as described in Gifford 1976) link this region to the Belize Valley. Lastly the presence of Remate Red Group sherds similar to those at Lubaantun (including Remate Red and Chacluum Black as described by Hammond 1975) and Puluacax Unslipped demonstrate a strong local ceramic tradition from 600/650 CE to 900 CE throughout southern Belize.

As Rice and Forsyth (2004: 53) have suggested, the participants in a ceramic sphere must have shared ideas about what was appropriate or customary, copying vessel shapes, surface colors, or decoration, within a region through trade, exchange, and travel, and while "elite wares" may change relatively rapidly through gift giving or exchange, basic utilitarian serving, cooking, and storage vessels are likely less sensitive to change. The small sample size from the 2022 excavations, as well as prior work in southern Belize, especially at Lubaantun (Hammond 1972) and Uxbenká (Jordan 2019) suggest that the inhabitants were connected to outside regions throughout Maya prehistory, although the nature of this interaction is unknown and changes through time.

Conclusions

In the 2022 field season, we began re-building our knowledge of chronologies of the Maya Mountains centers of Ek Xux and Muklebal Tzul through test unit excavations. Our preliminary analysis of construction events and ceramics of the elite residential plazas hint at a Late Preclassic to Early Classic beginning at Muklebal Tzul, hundreds of years earlier than previously documented. Both centers peaked during the Late to Terminal Classic with the majority of construction during this time. This follows regional trends at Uxbenká, Nim li Punit, Kaq' ru' Ha', and Ix Kuku'il. Collaborations between archaeological projects and integrating multiproxy chronology building will encourage deeper understandings of the development and decline of the Classic Maya kingdoms in southern Belize and the dynamic interactions between their occupants.

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34 CURATING CULTURAL HERITAGE: THE CERAMIC COLLECTIONS OF BELIZE

Sylvia Batty and Laura J. Kosakowsky

The long and rich history of archaeological research in Belize has produced an unparalleled whole vessel and ceramic sherd type collection spanning the entire country and all of Maya prehistory. Such ceramic collections are imperative for cross-dating and understanding inter-site and interregional connections. The Institute of Archaeology (IA), NICH, has been actively engaged in systematically curating their collections through reorganizing type collections, checking the proveniences of whole vessels, and attempting to identify contexts of unprovenienced pots. Specifically, the IA has been curating the National Collections by providing better storage and organization, however this is an ongoing process that needs the attention and support of all archaeologists conducting research in Belize, in the same way that researchers have focused on excavation and "the site". The IA has received few type collections from current and past archaeological projects since the 1980's, and project record-keeping in the laboratory has not always paid the necessary nor equal attention to detail as excavation records. As researchers interested in the archaeological history of the country, both foreign projects and government entities have a responsibility to the cultural heritage and patrimony of Belize. Thus, it is necessary to curate these collections properly so that they remain available to future archaeological endeavours, students, researchers, and the people of Belize.

Introduction

In January of 2020, the junior author was invited by the Institute of Archaeology to spend a week reorganizing the ceramic sherds that are part of the national collections in Belmopan, at the same time that the senior author worked on organizing and identifying whole vessels that lack provenience. The sherd collections include material from some of the earliest archaeological projects conducted in Belize in the 1970's and 1980's, and together with the whole vessels are an unparalleled resource for archaeological students and researchers in Belize and across the Maya lowlands, as well as for the people of Belize. In this paper we will focus on why these ceramics are so important for research, but more importantly for the heritage of Belize, and why we must do more to curate these collections for the future.

Why are Maya ceramics and type collections so important?

We are all familiar with the most well-known whole Maya vessels that have been excavated in Belize, and while they are beautiful and as a result sadly coveted by looters and collectors, their true value lies in how they can inform on prehistoric Maya culture. Maya ceramics were used by all socioeconomic groups, they preserve well, and are the most ubiquitous material culture found in archaeological excavations. Comparative collections are important for understanding cross-dating and intersite and regional connections. Traditional ceramic analyses for Maya Lowland pottery are based on classifying them using the type: variety-mode classification system (Gifford 1976; Smith and Gifford 1966). Ceramic types are described primarily based on surface characteristics, color of slip and decoration, and secondarily on the basis of vessel form.

However, since the adoption of this classification scheme in the 1960's (Willey et al. 1967) by most Mayanists, ceramic research has advanced to include technological studies of the composition of the clay utilized to make pottery, including paste and temper, and more advanced techniques such as X-Ray Fluorescence and Neutron Activation Analysis that can provide information on the source locations for ceramic production, trade, and exchange. Thus, while Maya ceramics are sensitive to chronological change, as styles change through time, and provide archaeologists with information on relative dating, they do more than document occupation histories of archaeological sites, and can inform on prehistoric Maya behaviour and practice, and link us all to the past.

How is the Institute of Archaeology Curating the Collection?

Historically, the Institute of Archaeology has stored the ceramic type collections in wooden cabinets in the old Institute of Archaeology offices in Belmopan (Figure1).

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Figure 1. Original wooden cabinets A, C & D housing the ceramic type collection at the Institute of Archaeology, Belmopan.

These cabinets have been exposed to agents of deterioration including termites and rodents, incorrect relative humidity, and water, with drawers that at worst have collapsed completely, and at best are difficult to open or in some cases no longer fit into the cabinet. The original wooden cabinets, A through D, consist of four sets of seven drawers each storing material from Santa Rita (Chase 1982, 1984); the Corozal Survey (Ball 1983, 1993), El Pozito (Case 1982; Eppich 2000), and Albion Island; Cuello (Hammond 1978, 1985, 1991; Kosakowsky 1983, 1987; Kosakowsky and Pring 1998), Nohmul (Chase 1982; Hammond 1985), and the Corozal Project (Hammond 1975, 1976, Pring 1998); the Belize Valley (Ford 1986; Gifford 1976; Lucero 1994, 2001); Stann Creek Sites (Graham 1994); Wild Cane Caye (McKillop 2002); Caves Branch (Graham et al 1980); and Petroglyph Cave (Reents Budet 1980). The Cerro Maya type collection (Robertson 1980) is stored in a separate plastic box.

Interventions Conducted

The sherd collections were cleaned where needed, and placed in new heavy mil plastic bags, that were relabeled on the outside with tags placed on the inside. The Institute of Archaeology purchased one cabinet with metal drawers to replace the old wooden one (Figure 2). What follows is a discussion of the current condition of the ceramic type collection and the descriptions of the needed interventions.

Cabinet A, Drawers A1 through A7 contain a type collection from the site of Santa

Figure 2. New metal cabinet for the ceramic type collections at the Institute of Archaeology, Belmopan.

Rita. It consists of all major types from the site and is a representative collection that is in good shape. Where needed the ceramics were placed in new bags with newly written labels with the assistance of Ms. Sigourney Allen.

Cabinet B containing the type collection from the Corozal Survey Project and El Pozito was the most damaged by termites. The insect activity left permanent discoloration on the surfaces of many sherds, eroding them beyond recovery, and these were removed from the type collections (Figure 3 left). Of the seven drawers only one (B4) was intact and the others had collapsed into each other mixing the sherds and their original context. Any intact bags were relabeled and placed in new bags, and the remaining sherds were washed by Ms. Edice Hua and Mr. Jeremiah Chiac at the Institute of Archaeology and re-sorted into a generalized Northern Belize type collection with the assistance of Mr. Paul Smith (Figure 3 right).

Cabinet C is in good condition. Drawer C1, a type collection from the site of Cuello (Early Middle Preclassic through Late Preclassic) and the Northern Belize Corozal Project (Early

Figure 3. Before (left) and After (right). Sherds from collapsed Cabinet B and drawers with loose sherds are pictured on left. After cleaning, sorting and re-typing, the sherds were placed in newly labelled bags on right.

Middle Preclassic through Terminal Classic) was checked and re-bagged and labeled, as was Drawer C7, a type collection from the Terminal Classic period at Nohmul, and the Early Classic and early Late Classic from the Belize Valley, with the assistance of Ms. Sigourney Allen. Both drawers consist of most major types from the region and are a representative collection that is in good shape. Drawers C2-C6 are a collection of type sherds from Stann Creek sites, created by Dr. Elizabeth Graham. This collection consists of bags of large quantities of the same ceramic types and could be reduced in size by selecting only a handful of representative sherds of each type.

All the drawers in Cabinet D are intact and were checked and re-bagged and labeled with the assistance of Dr. Holley Moyes and Ms. Erin Ray. However, Drawer D1, from the Belize Valley and Drawer D2 from Caves Branch (Dr. E. Graham) no longer fit back into the cabinet. Drawer D3 is intact and contains material from Wild Cane Cay (Dr. McKillop). This drawer has non-ceramic items in it as well. Drawers D4-7 contain a type collection from Petroglyph Cave (Dr. Dorie Reents-Budet) that is in good condition.

The Institute of Archaeology has made a marvelous commitment to reorganizing the type

Figure 4. Whole vessels in the national collections at the Institute of Archaeology, Belmopan. Images demonstrate the need for climate-controlled storage and more space to house the pottery.

collections with their purchase of new metal cabinets and shelving that will preserve the ceramics for continued use. As mentioned previously, a similar effort is being made to curate the whole vessel collection. Wherever possible, whole vessels that are still stored at the old offices of the Institute have been moved to dry storage shelves, organized by archaeological site, and the windows have been shaded from sunlight, though there is urgent need for climate controlled storage facilities (Figure 4). The senior author worked to identify pots that lack provenience; i.e. the numbers on the vessels do not match any known existing archaeological projects or are unnumbered. Current guidelines require all whole vessels to remain in Belize with documentation, at the end of an archaeological project and turned over to the Institute of Archaeology. Vessels that are exported for technological analyses must be returned to the country when the research is completed. However, as archaeologists given the privilege of working in Belize we must do more to help curate this part of the cultural heritage of Belize.

What is Cultural Heritage?

While the many beautiful and well-known archaeological sites of Belize are the most visible representation of what we do, archaeology projects conducting research in Belize do so as part of a community of colleagues across borders. Every researcher is also within a wider community that includes the people of Belize and should strive to promote public education and collaboration, and the recognition that the study of the past takes place in the present (Herr, Lyons, and Hays-Gilpin 2021; McAnany and Rowe 2015). The National Institute of Culture and History (NICH), through its departments, the Institute of Archaeology and the Institute for Social and Cultural Research, are responsible respectively for maintaining the cultural heritage of Belize, both tangible and intangible. Beyond this, archaeology exists within the public sphere, where research is engaged, debated and negotiated by a variety of stakeholder communities with differing values. Despite the fact that funding agencies in the United States require a statement of broader impacts, too often this is an afterthought rather than a priority.

Upon excavation, ceramics and ceramic type collections enter the public domain where they become tangible representations of the heritage and national identity of Belize, and value systems create intangible connections through meaning-making by access to the tangible. We want to emphasize that the 'life' of archaeology collections continues beyond research, and therefore by conducting any excavation, archaeologists are engaging with Public Archaeology either passively or actively. This follows the University College London typology of public archaeology (Moshenska 2017); specifically ethical guidelines should govern academic archaeology's access to and engagement with ceramics and archaeology education.

UNESCO (The United Nations Educational, Scientific and Cultural Organization) defines cultural heritage as including artifacts, monuments, a group of buildings and sites, and museums that have a diversity of values including symbolic, historic, artistic, aesthetic, ethnological or anthropological, scientific and social significance. It includes tangible heritage (movable, immobile, and underwater), and intangible cultural heritage embedded into cultural, and natural heritage artifacts, sites or monuments. This definition excludes intangible cultural heritage related to other cultural domains such as festivals and celebrations. UNESCO and other similar organizations (ICROM, ICOMOS) utilize values-based approaches to explore how different communities – communities being defined as a group of people with shared values, interests and needs – access and engage with heritage.

However, Beardall (2021:19) discovered that cultural heritage in Belize is about self-identification, combining both ethnicity and culture. Protections for cultural heritage are legislated by the National Institute of Culture and History and include all ancient monuments and antiquities. This doesn't mean only archaeological sites and museum-quality pieces but all artifacts. As Beardall (2021: 84) further outlines, a shared cultural heritage, based on nationality rather than ethnicity, means that this entirety of ancient and recent history belongs to all Belizeans.

Why is this important and are there solutions?

The value of public education efforts on the archaeology and heritage of Belize cannot be understated (McGill 2015). The Institute of Archaeology engages in numerous public education outreach efforts every year, as do non-governmental organizations such as the Heritage Education Network and Fajina Outreach. Many archaeology projects engage with local communities through archaeology days, public talks in local communities, visits to local schools, and training next generation Belizean archaeologists (see Beardall 2021 for a comprehensive discussion).

The Conditions for Archaeological Research that all projects sign with the Institute of Archaeology to permit their annual excavations and laboratory work require that all complete vessels be deposited in Belmopan, however, there is no requirement that a ceramic type collection must be provided, and we suggest that it should be included as a condition when a project ends. Perhaps that is why the type collections, currently in Belmopan, represent projects from the 1970's and 1980's. Today, most archaeological projects house their sherds in storage facilities on site, not always easily accessible or climate controlled, though some like the Lamanai Project, under the direction of Dr. Elizabeth Graham, have invested in metal storage boxes at great expense. In order to do any comparative analyses researchers must travel from site to site and do so while the project is actively working in country; a feat not easy to and

Figure 5. Frank Tzib and the San Antonio Women's Cooperative, accessing past ceramics and ceramic technologies to preserve the tangible cultural heritage of Belize.

perhaps impossible to accomplish given time and timing. Dr. Jaime Awe has hosted several ceramic workshops at his residence in Cayo, where archaeologists have brought comparative collections to foster discussion and dissent, however this also requires a commitment to extra time and travel that isn't always feasible. Additionally, external funding for ceramic workshops has been difficult to secure. If instead, all projects committed to providing a ceramic "type" collection to the Institute of Archaeology, it would make comparative research easier, and provide a more holistic picture of the prehistoric Maya of Belize. These type collections need not always be organized by traditional type: variety-mode depending on the focus of the research but could also be examples of regional and site pastes and temper for comparative purposes. Comparative sherd collections have value not only to archaeologists but to the public education efforts by the Institute of Archaeology in communities and schools throughout the country.

The most obvious solution to help curate the National Ceramic Collection of Belize is money. Archaeological projects tend to prioritize excavation over laboratory work, and often it is difficult to convince funding agencies to support laboratory only seasons, or money for durable goods such as storage materials and facilities in our budgets. Our responsibility does not end when the last open unit is backfilled. Rather, this is just the beginning of public engagement with archaeological finds. The motto of the Institute of Archaeology "is preserving the past for the future." This necessitates a delicate balancing act of preserving the tangible past, anticipating the needs and values of future communities, and ensuring access in the present. We urge all stakeholders to do more to ensure that all are able to access the tangible past. We close by recognizing indigenous and descendant knowledge-bearers (Figure 5: e.g. Frank Tzib, the San Antonio Women's Cooperative, and the Magana family) who are already accessing past ceramics and ceramic technologies as a means of cultural expression and transfer, and we look forward to a future where all stakeholders are active participants in archaeological research.

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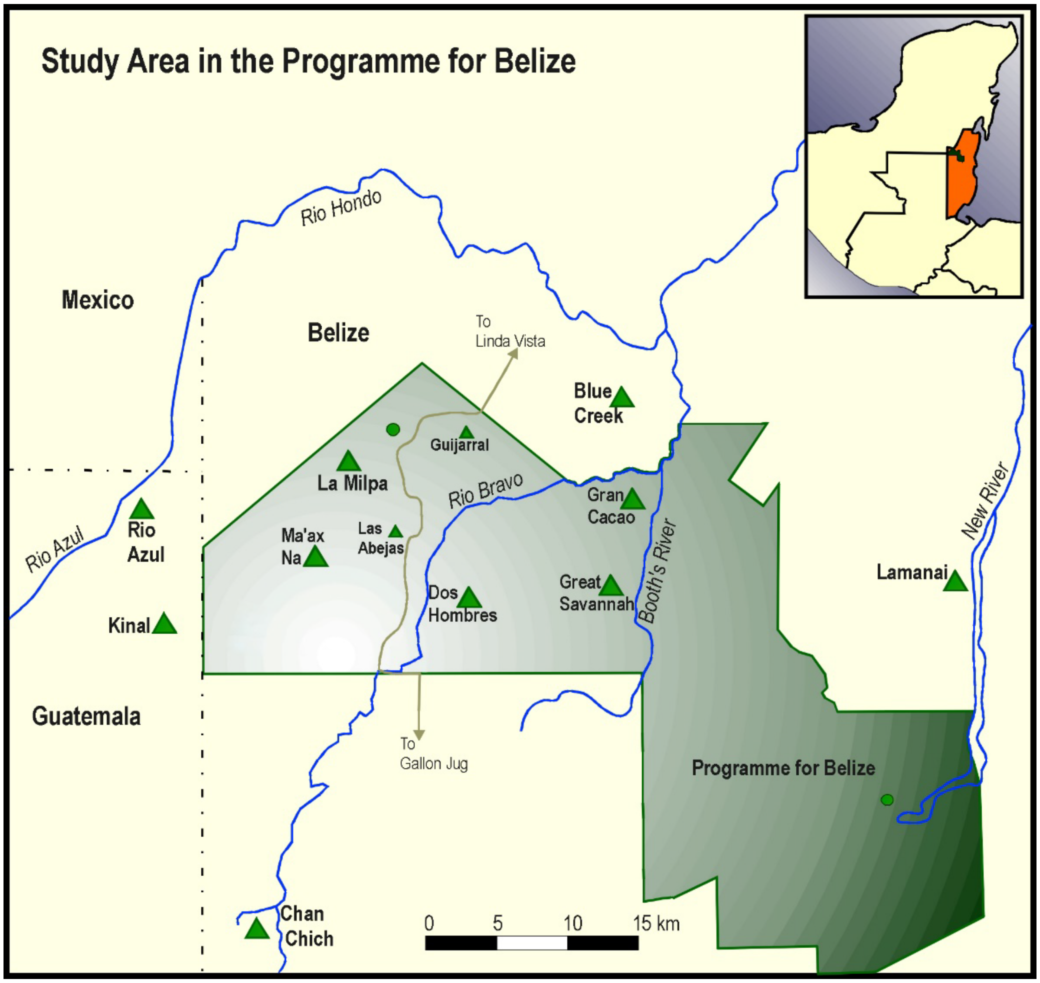
SECTION THREE: *FEATURED PAPERS FROM THE PROGRAMME FOR BELIZE ARCHAEOLOGY PROJECT*



Map of the Programme for Belize property with locations of featured archaeological sites

35 ETHNOBOTANICAL AND PALEOETHNOBOTANICAL RESEARCH AT THE PROGRAMME FOR BELIZE ARCHAEOLOGICAL PROJECT

Luisa Aebersold, Thomas C. Hart, Debora C. Trein, and Fred Valdez, Jr.

In addition to understanding humanity through material culture, the archaeological record also has the capacity to provide botanical data which provides insight to ancient environmental landscapes, climate patterns, and provides a baseline for agroeconomic systems and foodways. Studying archaeobotanical records is vital to a holistic interpretation of material culture and contributes to understanding degrees of variation between ecological and cultural areas. Together with archaeobotany, ethnobotanical survey can also offer valuable contextual evidence when studying past environments. Despite spatial and temporal discontinuities in plant-use and knowledge systems, ethnobotanical data viewed with a critical lens can also provide data missing from the archaeological record which is inherently not exhaustive and relies heavily on interpretation. Ethnobotanical and paleoethnobotanical research at the Programme for Belize Archaeological Project (PfBAP) includes ethnobotanical interviews conducted in the nearby town of San Felipe and archaeobotanical investigations at Structure 3 at the site of La Milpa. By combining a modern analogue of plant practices and knowledge systems via ethnobotanical survey, collecting plant specimens for an archaeobotanical reference library, collecting soil samples from new projects, and sampling artifacts for residues, archaeobotanical research at PfBAP continues to expand what we know about the ancient Maya in northwestern Belize.

Background

The study of ancient plant remains through paleoethnobotanical analysis links with ethnobotany to provide a diachronic perspective on Maya land use and subsistence practices. Paleoethnobotanical research is characterized by the identification of macrobotanical and/or microbotanical remains recovered through archaeological excavations, artifact residue analysis, and/or paleoenvironmental coring of sediments. Scholars interpret these remains within the larger archaeological contexts and describe the patterns that they see. Ultimately, paleoethnobotanical studies contribute to understanding causes of the archaeobotanical signature and how they relate to larger social trends.

Paleoethnobotanical research in the Maya region began with early attempts to recover botanical remains in opportunistic *in situ* collection of charred materials rather than through systematic collection of soils. The very first publication was about a small cob of tepecintle maize found in the rubble of temple E-11 at Early Classic Uaxactun, Guatemala (Wellhausen et al. 1957:30; Ricketson Jr. and Ricketson 1937). In 1965, Nal Tel-Chapalote maize kernels from a late Classic context and possible bean, squash, and cacao seeds from Middle Preclassic horizons were recovered by Willey and colleagues (1965) from sites in the Belize River Valley. It was not until Stuart Struever's article in *American Antiquity* (Struever 1968) that archaeologists began to systematically recover archaeobotanical remains in the New World (Pearsall 2015).

Systematic recovery of macrobotanical remains began in the late 1970s and focused on what foods were present at Archaic and Preclassic/Formative sites in Belize such as Colha (Miksicek 1979) and Cuello (Miksicek et al. 1981; Hammond and Miksicek 1981). Research then shifted to later time periods, focusing on remains from large centers such as Tikal (Lentz and Hockaday 2009; Lentz et al. 2014), Dos Pilas (Cavallaro 2011), El Perú (Cagnato 2016), and Copán (Lentz 1991), as well as smaller settlements such as Albion Island (Miksicek 1990) and Wild Cane Cay (McKillop 1994).

Plant microfossil analysis in the form of pollen, phytolith, and starch grains has been met with limited success despite its use in other parts of the Neotropics with similar ecological conditions, such as Panama (Piperno 1985; Piperno and Holst 1998). See Brokaw et. al (this issue) for a detailed discussion on the role of palynology in paleoenvironmental construction in the Lowland Maya region. The potential for phytolith research was first recognized in Belize at the site of Cuello (Hammond et al. 1979) at the same time that macrobotanical remains were beginning to be recovered from sites such as Colha (Miksicek 1979). Starch grains were first studied in Belize by Cummings and Magennis' examination of dental calculus of 24 individuals

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from Kichpanha (Cummings and Magennis 1997). Despite a handful of studies that have been produced (Abramiuk et al. 2011; Bozarth and Guderjan 2002, 2004; Cagnato 2016; Morell-Hart 2011; Rosenswig et al. 2014; Simms et al. 2013) phytolith and starch grain analysis in the Maya region is still in its infancy.

A diverse landscape makes up the background environment of the ancient Maya and modern Maya communities. The earliest ethnographic efforts to study Maya plant use occurred during the Spanish conquest with Diego de Landa's *Relación de las cosas de Yucatán* (de Landa and Tozzer 1966). Modern efforts to study plant use began in in the first half of the twentieth century (i.e. Popenoe 1919), and slightly predated efforts (Standley 1930) to study the forest ecology of Maya region. These early ethnographies included seminal works by Thompson (1930), Roys (1931), Harper (1932), Lundell (1933a, 1933b, 1938), and Wauchope (1938) which consisted of lists of plant taxa and their uses.

More detailed ethnographic accounts were produced throughout the second half of the twentieth and into the first half of the twenty-first centuries (Anderson 2010; Atran and Ek' 1999; Barrera et al. 1977; Berlin et al. 1974; Beltrán Frias 1987; Bronson 1966; Breedlove and Hopkins 1971; Breedlove and Laughlin 1993; Flores and Balam 1997; Guen et al. 2013; La Torre-Cuadros and Islebe 2003; Redfield and Villa Rojas 1962; Steinberg 1999; Tuxil et al. 2010; Zarger and Stepp 2004). Volumes on useful Neotropic vegetation have also been published by Alcorn (1984), de MacVean (2003), Lentz and Dickau (2005), Balick and Arvigo (2015), Ford (2008), and Ford and Nigh (2015). These reviews expanded the collective knowledge of contemporary Maya plant use but still relied upon the assumption, rather than archaeological evidence, that there is a direct connection between ancient and contemporary Maya plant use.

For the Programme for Belize Archaeological Project (PfBAP) and northwest Belize, Aebersold (2018) represents the only ethnobotanical research that has been conducted in this area. Research at PfBAP includes ethnobotanical and paleoethnobotanical components contributing to understanding early Maya economic systems by providing overlap in horticultural and agricultural practices in the region. Furthermore, ethnobotanical research builds on the overarching goal of the paleoethnobotany program in PfBAP to understand the subsistence practices, foodways, and environmental circumstances in northwestern Belize led by Hart et al. (In press).

Ethnographic Survey in Northwest Belize

Aebersold conducted ethnobotanical interviews in 2016 and 2017 in the community of San Felipe to catalogue local plant practices used for supplementing diet, construction materials, household goods, and medicinal or hygienic purposes (Aebersold 2018) (Figure 1). This exercise in studying modern practices links ethnobotanical accounts with archaeobotanical data in the area to complement research on Maya food systems directed by archaeologists at PfBAP. Information collected during eight semi-structured ethnobotanical interviews conducted in Spanish chronicled common household gardening practices, *milpa* practices (also known as swidden or slash and burn agriculture), common cuisine, *ofrenda* practices (also known as *primisias* or offerings), and some hunting and gathering practices. Demographics included male and female participants ranging in age between 60 and 90 years old who self-identified culturally to Mopan, Q'eqchi', or Yucatec Maya. One person identified culturally as half Belizean and half British.

Patterns Observed in *Milpas* and Household Gardens

Two of the best-known food-related practices amongst the modern Maya are *milpas* and the cultivation of household gardens. *Milpa* agriculture involves a maize-based polyculture system in a cycle of cultivation and abandonment. Small-scale farmers burn forests to remove vegetation and redeposit nutrients, grow crops for a limited number of growing seasons, then move to a different section of the forest. These farmers will cycle back to reclaim their now fallowed fields many seasons later. This form of landscape management is widely practiced by small-scale farmers and horticulturalists in the Maya region (Ford and Nigh 2010; Nigh and Diemont 2013).

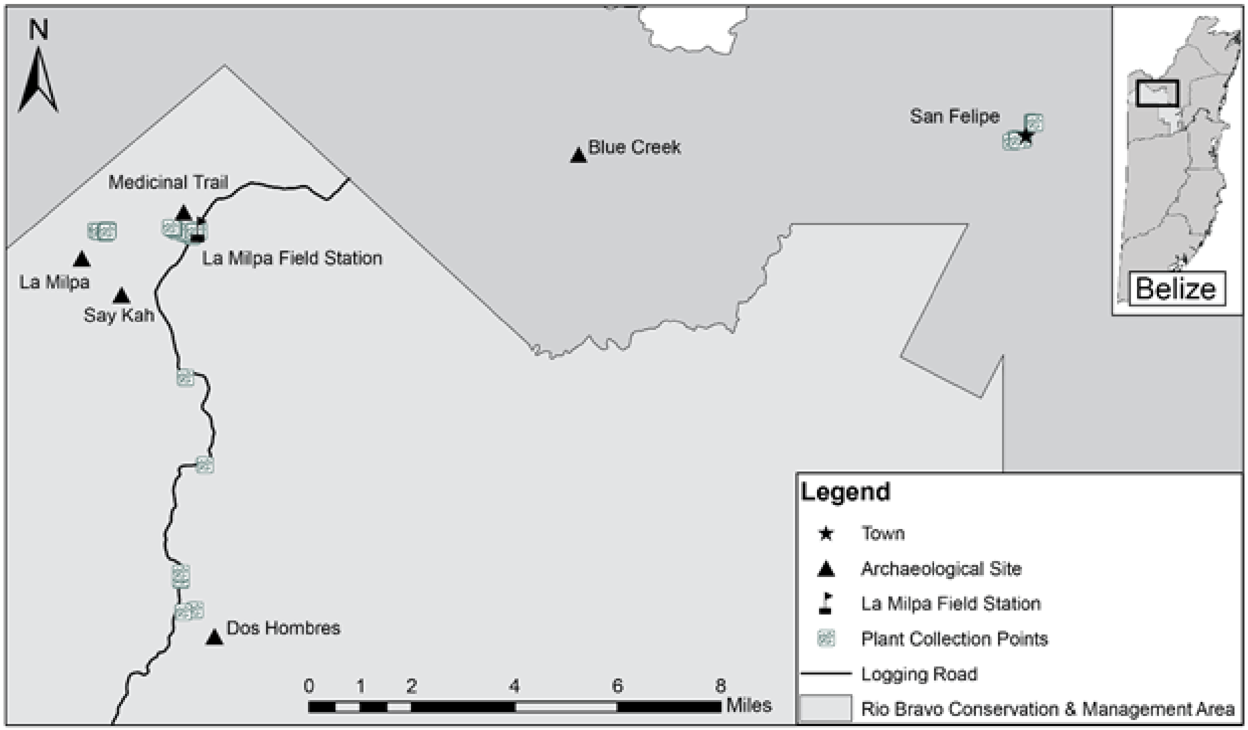

Figure 1 – Map of 2016 and 2017 plant collection points from Aebersold et al. (in press).

Milpas are far less common in San Felipe than household gardens, in spite of being one of the most discussed forms of landscape management strategies in Maya literature. There are very few *milpa* farmers, or *milperos*, who must devote full-time effort in order for the *milpas* to be successful. In general, *milpa* farmers grow a variety of cultigens overlapping with garden plots, for example maize (*Zea mays* L.), beans (*Phaseolus* spp.), squash varieties (Cucurbitaceae), avocado (*Persea americana* Mill.), chili (*Capsicum* spp.), etc. Tending *milpa*s away from the home also provides an opportunity to forage for useful herbs that grow in disturbed areas that can then be transplanted to home gardens.

Milpa fields are treated with fertilizer and compost throughout planting cycles to maintain soil nutrients. Fallen trees are used for mulching, and synthetic fertilizers or chicken droppings may be used to as fertilizer. The two seasons for planting in *milpa*s occur between May to June and in November, due to wetter conditions. In addition to tending fields, *milperos* take part in a variety of rituals and *primisias* or *ofrendas*. *Ofrendas* can include drinks like *cocolmeca* or *atole*, and are poured on the corners of a *milpa* field before burning. Other customs include whistling while burning fields to guide fire or having children make frog calls to bring on the rain at the beginning of the planting season (Aebersold 2018; Redfield and Villa Rojas 1962). These types of cultural practices add a unique facet to plant studies, especially as many of these traditions begin to disappear.

Household gardens are ubiquitous in San Felipe, and are generally located in courtyard areas and surrounding residences (Figure 2). Common cultigens include maize (*Zea mays* L.), beans (*Phaseolus* spp.), avocado (*Persea americana* Mill.), chili peppers (*Capsicum* spp.), mango (*Mangifera indica* L.), coconut (*Cocos nucifera* L.), *achiote* (*Bixa orellana* L.), sweet potato (*Ipomoea batatas* (L.) Lam.), papaya (*Carica papaya* L.), pumpkin (*Cucurbita pepo* L.), lime (*Citrus* spp.), hog plum (*Spondias radlkoferi* Donn. Sm.), oregano (*Plectranthus amboinicus* (Lour.) Spreng.), chaya (*Cnidoscolus aconitifolius* (Mill.) I.M.Johnst.), *makilito* or malanga (*Xanthosoma sagittifolium* (L.) Schott), tomato (Solanaceae), and cashew (*Anacardium occidentale* L.). More than half of cultigens grown in house gardens or adjacent plots are grown primarily for their edible components such as fruits, beans, tubers, or leaves. Other common plant species include guava, limón (*Citrus* spp.), *epazote* (*Chenopodium ambrosioides* L.), *guanábana* (*Annona muricata* L.), habanero (*Capsicum chinense* Jacq.), coconut (*Cocos nucifera* L.), chaya (*Cnidoscolus aconitifolius* (Mill.) I.M.Johnst.), hog plum (*Spondias radlkoferi* Donn. Sm.), and tamarind (*Tamarindus indica* L.) (Aebersold 2018; Greenberg 2003).

Figure 2 – Examples of house garden plants. A. *Flor de izote* (*Yucca guatemalensis*), B. Pito (*Erythrina standleyana*), C. *Ziricote* (*Cordia dodecandra*), D. *Oregano grueso* (*Plectranthus amboinicus*).

Ethnobotanical interviews also provided data on how house gardens and *milpa* plots provide specialized resources which are used to treat ailments, function as condiments, provide construction material, or serve other purposes. For example, the popular herb with the common Spanish name of *oregano grueso* (*Plectranthus amboinicus* [Lour.] Spreng) also doubles to treat ailments such as cough, earache, or stomach issues. Basil (*Ocimum basilicum* L.) is often used to help treat various conditions like fever, lower back pain, headaches, earaches, vision problems, skin ailments, and stomach pains. Other herbs, which are also used as condiments, serve multiple medicinal purposes including, *culantro* (*Eryngium foetidum* L.), *flor de ajo* (*Mansoa hymenaea* Gentry), *sorosi* (*Momordica charantia* L.), *epazote* (*Chenopodium ambrosioides* L.), *siempre viva* (*Kalanchoe pinnata* (Lam.) Pers.), *ix canaan* (*Hamelia patens* Jacq.), *pito* (*Erythrina standleyana* Krukoff), and *piñon* (*Jatropha curcas* L.) (Arvigo and Balick 1998; Balick and Arvigo 2015). One household garden also maintained tobacco (*Nicotiana tabacum* L.) exclusively for medicinal purposes to treat fevers, joint pain, and inflammation. *Izote* flowers (*Yucca guatemalensis* Baker) are decorative, often cooked in egg dishes, and are used to treat a fever. The *izote* pods and seeds can be used to keep kerosene lamps clean (Balick and Arvigo 2015).

Many plants in San Felipe gardens are used to make textiles or provide needed fibers like cotton (*Gossypium hirsutum* L.). In some instances, people in San Felipe recall using *palo de tinta* (*Haematoxylum campechianum* L.) to dye clothing, but it is a rare occurrence today (de MacVean 2003). Similarly, henequin (*Agave fourcroydes* Lem.) has been used for weaving ropes or hammocks (Balick and Arvigo 2015; Colunga-García Marín 2003). The fibers of common reeds, or *bejuco*, are used for basketry. Other economic species used for housing materials or crafts include trees like cedar (*Cedrela odorata* L.), pine (*Pinus*), and *ziricote* (*Cordia dodecandra* DC).

There are many uses for household and *milpa* plants, however, survey results suggest that *milpa*s are less common in San Felipe due to financial and logistical challenges. A *milpa* can be as far as six to seven miles from home thereby limiting the amount of time and energy that can be spent in *milpa* tending and maintenance. *Milpa*s are also rare due to modernization, or because of low crop yields or little income produced from fields per household (Ewell and Merrill-Sands 1987; Greenberg 2003). Another challenge to maintaining *milpas* and house plots is the availability of irrigation. Many San Felipe residents rely on town well water to irrigate gardens, which requires transportation. Others rely solely on seasonal rain, which can be risky during drier years or if the rainy season is delayed.

Archaeological Implications of Ethnobotanical Research

San Felipe ethnobotanical interviews provide modern examples of horticultural and small-scale agricultural practices in northwest Belize that are believed to have their origins in the pre-contact Maya. A brief survey of botanical resources found in San Felipe reflects many overlaps in contemporary and ancient gardening practices contributing to our understanding of past landscapes. Cultivation of maize (*Zea mays* L.), beans (*Phaseolus*), squash (Cucurbitaceae) varieties, avocado (*Persea americana* Mill.), sweet potato (*Ipomoea batatas* (L.) Lam), *makilito* (*Sagittaria* spp), and chili peppers (*Capsicum* spp.) are among the most commonly observed today and in archaeological assemblages (Feinman et al. 2007; Ford and Nigh 2015; Lentz and Hockaday 2009; Ogata et al. 2006; Zizumbo-Villarreal et al. 2012).

Ethnobotanical studies often reveal less conspicuous aspects of what we see in archaeobotanical records. Many plant varieties produce brightly colored flowers to be enjoyed rather than grown for their edible or utilitarian properties. In one case, a resident was known for growing a variety of flowering plants for the community church and for special occasions. This use may be difficult to identify in an archaeological record, but is no less important to note because home gardens or plots are not exclusively comprised of common plants or herbs grown strictly for consumption or medicinal uses. Plants like hibiscus, orchids, cacti, and succulents often decorated courtyard and garden areas in San Felipe.

Another social aspect of San Felipe which archaeological assemblages often cannot determine is the origins of traded plants. Many times, plants and seedlings are exchanged between neighbors or passed down between family members. For example, one household proudly grew heirloom habanero peppers that were passed down over two generations. Although habañeros and other peppers are difficult to identify in the archaeological record, the archaeological site of El Cerén provides evidence for their presence in households (Lentz et al. 1996).

Household gardens in San Felipe also include a variety of trees, which are useful because many tree taxa regenerate quickly, provide shade, construction, thatching material, or fuel resources, and provide a root matrix that prevents soil erosion (Goldstein and Hageman 2010). Lentz et al. (1996) gave numerous examples of economic fruit trees grown in house gardens or adjacent fields that are found also in San Felipe, including cashew, guava, hog plum, and papaya (Aebersold et al. In press).

To compare, the Classic Maya likely maintained similar gardens and orchards in which they maintained seed and vegetable crops, fruit trees, root crops, succulents, condiment plants, and utilitarian plants (Kennett and Beach 2013). At Chunchucmil and the Puuc region, evidence from ancient Maya house gardens includes a variety of edible plants, plants used as condiments, and plants likely used for medicinal purposes (Dunning and Beach 2004; Kennett and Beach 2013).

This research also supports Goldstein and Hageman's (2010) argument that many times maize, beans, and squash are overemphasized in the archaeological record, which can potentially distract research from other research on plant use. Goldstein and Hageman (2010) provided evidence for heavy reliance on successional forest taxa associated with fallowing agricultural practices, this was confirmed with the current ethnographic research in San Felipe. Similar evidence from Chispas and Guijarral, Belize suggests food resources predominately came from fallow fields, weeds, and from *bajo* resources (Goldstein and Hageman 2010).

The recently documented practices at San Felipe confirm that people continue to use a patchwork of environments highlighting diverse strategies employed by the ancient Maya. Understanding these mechanisms strengthens future botanical research strategies involving what we know and observe in botanical patterns. The research at San Felipe demonstrates that even with the significant cultural and chronological distances between the ancient Maya and their descendants, there are continuities in knowledge systems regarding plant cultivation. This research is further supported by paleoethnobotanical studies in the area focusing on ancient land use and subsistence practices observed in the archaeological record.

Paleoethnobotany

The overarching goal of the paleoethnobotany program in the Programme for Belize Archaeological Project is to understand the subsistence practices, foodways, and environmental circumstances during the transition from Late Classic to Terminal and Postclassic communities in northwestern Belize. Paleoethnobotanical research began in 2005 and demonstrated that, contrary to popular belief, charred and desiccated ancient plant remains can be recovered from Neotropical contexts. In 2005, Jon Hageman and David Goldstein excavated middens at the sites of Guijarral, Bronco, Barba, and Chispas to test methodologies for recovering macrobotanical remains. They found that the best way to recover remains was to take 10 L of sediment from each context and process 5 L through flotation and 5 L through dry sieving (Hageman and Goldstein 2009). The list of taxa recovered from these sites includes traditional crops such as maize (*Zea mays* L.), fruiting forest trees such as *Zuelania* spp., and wild plants such as *Asclepias longicornu* Benth.

The results from the 2005 Hageman and Goldstein excavations revealed separate archaeobotanical signatures associated with periodic feasting and with commoner daily activities. Fruit and seed remains found exclusively in the Guijarral feasting midden included *Zuelania* sp., *Psidium* sp., *Guazuma* sp., *Amaranthus* sp., *Malva* sp., and *Orbignya* sp. Fourteen species were common to both Chispas domestic midden and Guijarral feasting contexts and included *Brysonima* sp., *Cecropia* sp., cf. *Chusquea* sp., *Zea mays* L., *Oenothera* sp., and unknown seeds from Solanaceae, Fabaceae, and Asteraceae families. Only one taxon was found exclusively in the domestic midden of Chispas: *Potamogeton* sp. (Goldstein and Hageman 2010:421). This early research also provided insights into provisioning and feasting activities (Goldstein and Hageman 2010).

After a ten-year hiatus, paleoethnobotanical research resumed at PfBAP in the summer of 2016 and included expanding the existing botanical reference collection established by Hageman and Goldstein, collecting soil samples from new projects, and sampling artifacts for residues. In the summer of 2016, the authors collected 42 modern comparative plant specimens in the Rio Bravo Conservation and Management Area. These taxa were common forest species and formed the basis of macrobotanical, phytolith, and starch grain reference collections at the University of Texas at Austin, as well as the Programme for Belize Archaeological Project based there, and will be useful for examining taxa anywhere in northwest Belize. For a detailed list of collected taxa see Aebersold (2018).

In the summer of 2017, Thomas Hart, Debora Trein, and Fred Valdez excavated 11, 1 x 0.5 m units along a terrace behind structure three of La Milpa and collected soil samples for macrobotanical, phytolith, and starch grain analysis. These samples will determine what was growing on the terrace, the relationship to the changing environmental conditions of the Late Classic, and how those crops relate to the ceremonial activities that occurred in the nearby ceremonial plaza at La Milpa (Trein et al. In review). Lastly, soil samples for macrobotanical and microbotanical analysis and artifact residues have been collected from the Dos Hombres to Gran Cacao Transect, Dos Hombres, Mulchen Witz, Chawak But'tob, Medicinal Trail, 'Tsak Naab, La Obra, and Wari Camp sites at PfBAP (Hart and Valdez In Press). The remains from these projects are still being analyzed.

The patterns associated with the feasting at Guijarral and the commoner daily activities at Chispas indicate an extensification of plant resources and broadening of resource base during the Late Classic in northwest Belize. The presence of some of the same species at both sites indicates a shared landscapes and subsistence base. However, the feasting events at Guijarral point towards efforts to create and maintain power and social inequality even within this small community (Goldstein and Hageman 2010).

Discussion and Conclusions

Ethnobotanical and paleoethnobotanical data provide complementary lines of evidence that provide a holistic understanding of the interrelationship between the Maya and their environment. The analysis of botanical remains recovered by Goldstein and Hageman (2010) would not have been possible without the ethnographic data collected by earlier scholars. The only way to determine that there were feasting events at Guijarral was to compare the archaeological taxa with known ethnographic and ethnohistoric feasting accounts. When Aebersold interviewed participants at San Felipe, she uncovered ethnographic evidence in the *milpa*s and household gardens to support the Hageman and Goldstein (2010) argument that maize, beans, and squash are overemphasized in the archaeological record thereby obscuring our understanding of the dietary breadth of the ancient Maya. The question is not if, but to what degree, there is a connection between the ancient Maya, modern Maya descendants, and the environment in which they live. And, more importantly, how can various disciplines and interested parties work together to develop a sustainable system that preserves and honors the past while benefiting the present and future peoples of Belize?

An additional consideration is the integration of community-based archaeology into paleoethnobotanical research. Traditional customs and practices surrounding plant knowledge are obscured in today's market-based economy, but can provide a unique perspective. Aside from contributing to botanical survey and archaeological studies, paleoethnobotanical research can be considered a contribution to a form of community-based archaeology. This concept has been popularized with the emergence of indigenous archaeology in the United States. It is considered to be a space in which archaeology and indigenous knowledge systems attempt to coexist. By definition, this approach includes the perspectives and voices of people who consider themselves related to the archaeological investigation by culture, biology, or descent (Lippert 2007). Thus, community members from San Felipe and other nearby towns have worked closely with archaeological projects for several decades. San Felipe collaborators contributed to this research by sharing their plant knowledge and generously providing plant specimens for herbarium curation. These herbarium collections and ethnobotanical accounts continue to build and chronicle paleoethnobotanical research at PfBAP and the surrounding Lowland Maya area.

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36 RESEARCH ON ANCIENT AND MODERN ENVIRONMENTS IN THE PROGRAMME FOR BELIZE ARCHAEOLOGICAL PROJECT: FOCUS ON VEGETATION

Nicholas Brokaw, Sheila E. Ward, and Thomas C. Hart

We review research on ancient and modern environments in the Programme for Belize Archaeology Project (PfBAP), focusing on studies of the vegetation. A goal is to show how these studies complement each other. To describe the ancient environment, paleobotany uses fossil pollen, phytoliths, starch grains, and geochemical signatures. In recent research, phytoliths and starch grains are collected from surface samples and paired with geochemical signatures, floral inventories, and contemporary pollen signatures to construct environmental analogues of ancient environments. To study the modern environment, forest ecology uses repeated inventories of tree species in forest stands. These studies have shown how variable the old-growth forests of the area are in in space and in time. Forests range greatly in composition of tree species, tree stem density, number of tree species, and in rates of tree mortality, recruitment, and growth. This variation can be related to underlying variation in soil and slope, and patterns resulting from natural disturbance by flooding and wind. We give examples of synergy between the study of ancient and modern environments in the Maya region that demonstrate fruitful interactions between these disciplines for paleobotanists, ecologists, and archaeologists.

> "The Old Empire Maya undoubtedly were an agricultural people, as are their modern descendants; they depended largely upon the produce of their cornfields (milpas), dooryards, orchards, and the native forests to supply their needs for food and other vegetable products… May we not assume that their presence [trees living today] indicates that the species were planted or given special protection by the Maya and were of some importance in their economy?" (Lundell 1938:37-38).

Introduction

Lundell's quote suggests that we can better understand both the ancient Maya and the modern forest if we link studies of ancient and modern environments. In this paper we describe paleoenvironmental and modern ecological studies in the Programme for Belize Archaeology Project (PfBAP) research area. Our goal is to explore how these disciplines can complement each other and synergize understanding of the Maya environment past and present. We focus on plants and forests. Ethnobotany can also advance this goal; Aebersold (this volume) describes ethnobotanical research in the PfBAP.

The PfBAP research area is located in northwest Belize (Figure 1, Trein and Valdez, this volume). It is coterminous with the Rio Bravo Conservation and Management Area (RBCMA), a 100,003-ha reserve established in 1988 and managed by the Programme for Belize (PfB) for conservation, environmental education, and sustainable uses. The PfBAP was established in 1991 and is a platform for multiple disciplines contributing to our understanding of the Maya region (Trein and Valdez, this volume).

Study of the Ancient Environment

Microscopic plant remains have been used to study ancient environments for a diachronic perspective on vegetation and Maya land use. In particular, analysis of pollen deposits in lake and swamp cores from the lowland Maya region have been employed in the reconstruction of the paleoenvironment, the timing of deforestation, climatic variability, environmental change, and the development of *milpa* and wetland agricultural systems. Pollen studies in the region started in the late 1960s, with the coring of the Laguna de Petenxil, Guatemala (Tsukada 1966). Numerous studies followed (Leyden 2002).

Analysis of fossil pollen and radiocarbon dates from the Maya site of Colha, Belize, 50 km northeast of the PfBAP research area, has revealed a history of human impacts on vegetation and terrain (Jones 1997). The pollen record showed forest clearing, constructions of canals and raised fields, and the presence of prehistoric domesticated plants. Pollen cores from Laguna Verde, 5 km northeast of the PfBAP area, revealed frequent changes in the dominance of different vegetation associations in the past

4,500 years (Morse 2009). In this study, the pollen signature of forest varied through time but did not show clear presence, decline (attributed to ancient land use), and recovery as seen in other studies (Leyden 2002). This may have been attributable to masking of forest taxa by a heavy signature of wetland species, but could also have been due to a continuous presence of humans and disturbance around the coring site, rather than settlement and subsequent abandonment. Interestingly, the results included pollen from species not just absent from the contemporary flora, but indicating a climate wholly different from the present, such as *Liquidambar styraciflua* L. (sweetgum). This species is found in the temperate zone and at high elevations in southern Belize.

In a recent study in the vicinity of Laguna Verde naturally dispersing pollen was collected in present-day marsh; pine savanna; and upland, riparian, secondary, and swamp forests (Bhattacharya et al. 2011). The pollen collected in each of these present-day vegetation types was identified as pollen of species currently found in those types. This suggested that the ancient pollen in cores reliably indicates the presence of particular vegetation types in ancient times.

In the PfBAP research area itself, palynology, water chemistry, magnetic susceptibility, and soil chemistry have been used to reconstruct the history of local and regional environmental trends in wetlands (e.g., Krause et al. 2019a, 2019b). A project has commenced using phytoliths and starch grains collected from present-day surface samples that are paired with geochemical signatures, floral inventories, and contemporary pollen signatures to construct environmental analogues of ancient environments (Hart et al. 2016). This project will expand to include additional vegetation types and thus extend its regional relevance. Other research on paleoethnobotany using macrobotanical remains is also being carried out (e.g., Hageman and Goldstein 2009).

There remains need and opportunity for much additional research on vegetation in ancient upland environments in the PfBAP area. For example, several permanent bodies of water have yet to be sampled via cores for pollen analysis and other studies.

Study of the Modern Environment

The ancient Maya departed the PfBAP area in the 11th Century CE (Zaro and Houk 2012), leaving the area mostly uninhabited since then (Figure IX, in Wright et al. 1959; Figure 3, in Weaver and Sabido 1997). In 1875 the Belize Estate & Produce Company gained control of the area for logging and excluded other uses (Dalhart Courtney, personal communication). The company established a few roads and small settlements and logged only a few species (Weaver and Sabido 1997), and the area remained in forest. PfB and other owners have protected the area since the late 1980s.

Study of the present environment in the PfBAP area began in 1988 and has focused on forest ecology. These studies followed typical phases of ecological research. First, we learned to identify the tree species present in the PfBAP area. Second, having learned the species, we were able to see the patterns that species populations exhibited in space and time. Third, we are now studying how those population patterns might be explained by the influence of the present environment versus the influence of ancient Maya land use. In addition, our research has progressed to larger spatial scales, focusing first on forest trees, second on forest stands, and third on forest landscapes (forest "stands" are areas of fairly uniform tree species composition and structure).

Composition of Tree Species

In 1988, from a base at Chan Chich Lodge (then under construction), south of the present PfBAP research area, we began exploring forests and collecting plant specimens. In 1989, from a forest camp near the site where PfB's La Milpa Ecolodge and Research Station was to be built (Figure 1), we began surveying forests and flora, by walking compass lines and attempting to identify trees at points along the lines. In succeeding years, we continued efforts to learn the flora while installing tree inventory plots (see below). In 2019 Dr. Steven Brewer, foremost expert on the Belize tree flora, collected in the research area and helped us with difficult identifications. We estimate that the PfBAP research area contains at least 300 species of trees (self-supporting, single-stemmed woody plants, including plants that attain just a few meters'

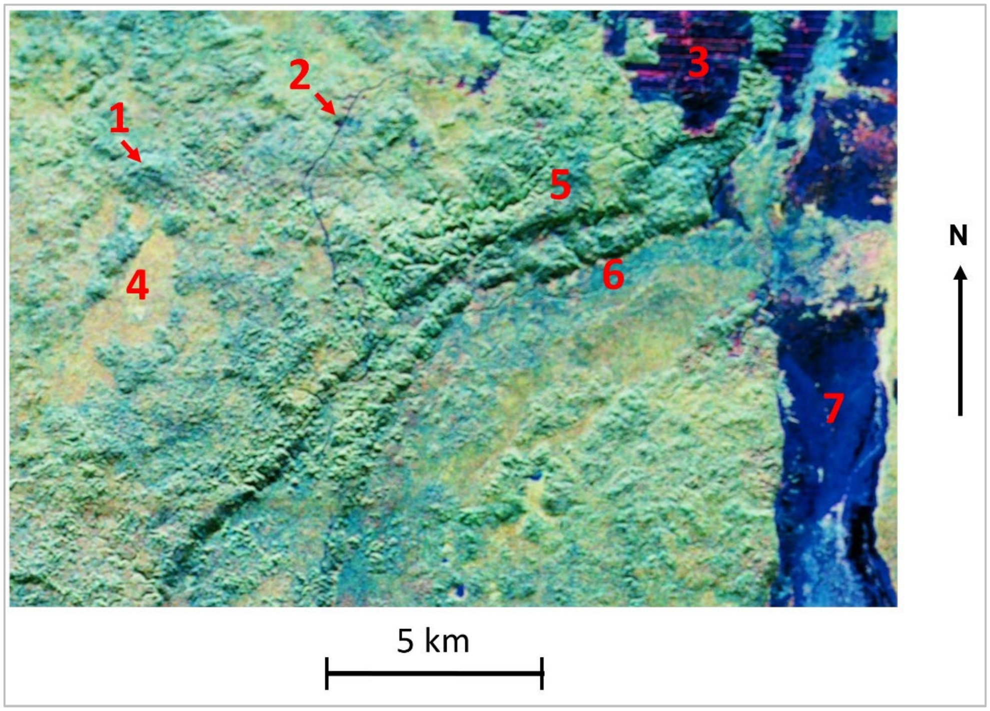

Figure 1. AIRSAR (Airborne Synthetic Aperture Radar) image obtained in 1991, showing region of the Programme for Belize Archaeology Project research area. Different colors and textures on the image indicate different topographic features and natural vegetation types. Hills are visible as rough, coarsely grained areas. Escarpments are visible as linear, rough, coarsely grained areas. Numbers indicate cultural sites, modern farmed areas, and vegetation types. **1** = site of La Milpa ruins, **2** = site of La Milpa Ecolodge and Research Station (Programme for Belize) and R. E. W. Adams Research Facility ("Texas Camp"), **3** = large-scale agriculture, **4** = bajo forest (low, thick forest in shallow depressions underlain by thick clay), **5** = upland forest, **6** = riparian forest, **7** = marsh. AIRSAR image Courtesy of Jet Propulsion Laboratory, Pasadena, California; Tropical Rain-Forest Ecology Experiment, led by Gregg Vane.

height). We treat 139 of these species in our field guide *Trees of La Milpa* (Brokaw et al. 2021).

Patterns of Tree Species

In 1990, from a base at PfB's new La Milpa Ecolodge, we began research on patterns of tree species composition in space, on change of tree communities over time, and on patterns in tree phenology (seasonal changes in flowers, fruit, leaves).

Trees tend to have species-specific requirements for soil depth, type, moisture, and nutrient composition. These environmental characteristics vary predictably along the "catena", which is the sequence of soils along the topographic gradient from hilltop to valley bottom (Furley and Newey 1979). Therefore, to capture the range of spatial differentiation among forests in the RBCMA we established 1-hectare permanent sample plots (PSPs) in each of four forest types ranged along the catena: 1) upland dry forest, on upper slopes with relatively thin and dry soils; 2) upland mesic forest, at midslope or on nearly level areas, with relatively deep and moist soils; 3) cohune palm (*Attalea cohune* Mart.) forest, found typically in small patches (10s of hectares) in areas of deep but well-drained soil at the base of slopes or in other level areas, and 4) riparian forest, bordering rivers, with very deep, damp soil (Figure 2). Upland dry and mesic forests are widespread in the area, while cohune palm and riparian forests cover less area but are important because they have fast tree growth, valuable tree species (e.g., mahogany [*Swietenia macrophylla* King.], and, in riparian forest, high species diversity.

In 1991, we inventoried the trees in the four PSPs. We marked, mapped, and measured the diameter of all trees ≥ 10 cm diameter at breast height (dbh, at 130 cm along the stem from the point where it is rooted). In the period 2015-2016, while based at the R. E. W. Adams Research Facility (Figure 1), we re-inventoried

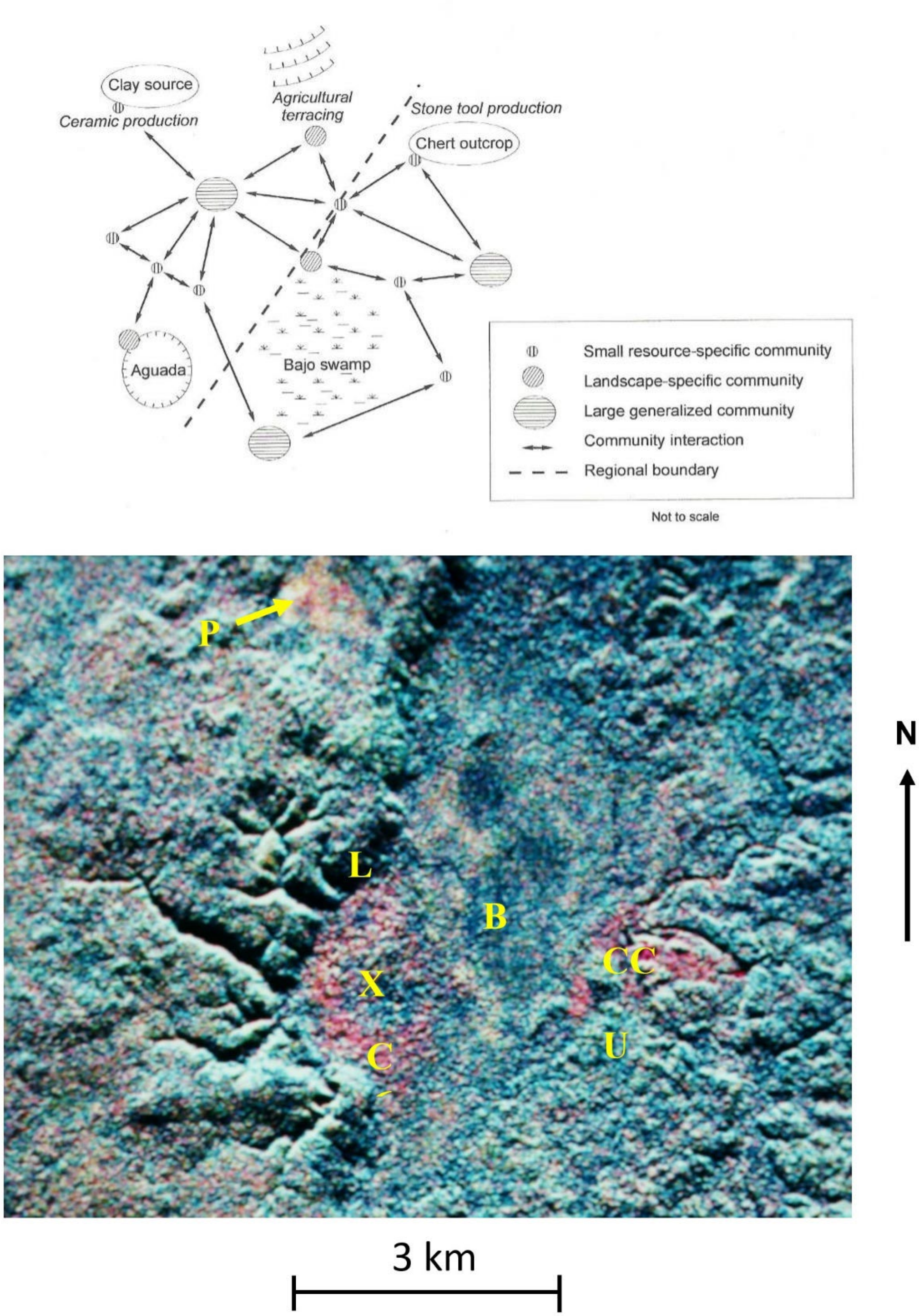

Figure 2. a. Model of ancient community locations, interactions, and resources in the Maya region (Scarborough and Valdez 2003). **b.** AIRSAR (Airborne Synthetic Aperture Radar) image of area near Chan Chich ruins in 1991. The textures and colors indicate topography and different vegetation types. B – bajo forest, C – cohune palm (*Attalea cohune*) forest, CC – Chan Chich Maya site, L – La Lucha Escarpment (30-60 m high), P – pine forest, U – upland forest, X – Xaxe Venic Maya site. AIRSAR image Courtesy of Jet Propulsion Laboratory, Pasadena, California; Tropical Rain-Forest Ecology Experiment, led by Gregg Vane.

the PSPs, to measure the diameter growth of surviving trees, record tree mortality, and record recruitment (growth of trees into the ≥10 cm dbh class). During 2017-2019 we added a subsample of all self-supporting stems ≥1.0 and < 10.0 cm dbh in the PSPs, thus including small trees, tree saplings, and shrubs (multi-stemmed woody plants).

The PSPs are in old-growth forest, as indicated by large tree size for this climate (c. 1500 mm yr^{-1} rainfall), complex three-dimensional structure and presence of large lianas (woody vines; Budowski 1965), and presence in the shaded understory of saplings of canopy species, which replace the canopy trees and tend to stabilize species composition (unpublished data). In addition, historical records confirm that the area has long been uninhabited (e.g., Wright et al. 1959, Figure IX). Thus, the patterns we recorded among PSPs are mature expressions of environmental differences among the sites, rather than expressions of different successional (forest age) stages.

PSP results showed strong differences among the forest types in number of stems, number of species, and composition of species, as expected (Table 1). For example, the number of trees ≥10 cm dbh ranged from 374 to 700 ha^{-1}, and the number of species ranged from 46 to 59 (see below). Variation of species composition across the landscape is evident from the fact that species similarity was low; two of the PSPs had only 23% of their tree species in common (Table 1). Variation in dynamics (growth, mortality, recruitment) among the PSPs was also great (Table 1).

In 1990-1991 we made periodic observations of phenology, visually inspecting trees in the PSPs for flowers, fruits, and leaf fall and renewal. Results showed that the amount of flowering peaks in the mid to late dry season (March and April) and is least in the late wet season (December) (Hess 1994). Fruiting patterns are not so clear, but fruit abundance appears to be relatively higher in the late dry season and early wet season (June). The forest is essentially evergreen; however, leaf drop is highest in the dry season and new leaves appear mostly during the dry season and early wet season.

Explanation of Tree Species Patterns: Spatial Patterns

Recently we have focused on causes of the variation in tree stem, species numbers, and composition among forest types in the PfBAP area. We mention just some of several possible causes for variation in stem number and species composition. Other causes are linked to changes in time (see below).

The upland dry forest PSP had the highest stem number. This may reflect less favorable growing conditions that reduce tree size, which, in turn, allows more stems to occupy a given area. The cohune palm PSP had the lowest stem number. This may reflect the dominance of cohune (*Orbignya cohune*), a large palm that suppresses other trees by casting shade and dropping large fronds that impede tree seedling establishment. An observer will note how open (lacking shrubs and saplings) the understory of a cohune forest is.

The low similarity in tree species composition among PSPs reflects PSP results showing that many tree species, including dominant species, are typically found at predictable but different points on the catena (unpublished data; but as shown clearly at Tikal, Guatemala [Schulze and Whitacre 1999]). This suggests that those species have particular requirements for soil and drainage conditions and that the present environment strongly influences their distributions and abundances. However, in the dense forest, most tree seeds fail to germinate, and most germinated seedlings fail to survive. Thus, the presence of any tree ≥10 cm dbh also depends on a long history of favorable seed dispersal, seedling establishment, and subsequent growth and survival, suggesting that the contingencies of history are also important.

The history of forest in Belize has been dramatic. The forest grew back after much of it was cleared or used by the ancient Maya (cf. Anselmetti et al. 2007), begging the question of how much the current patterns of tree species distribution and abundance reflect ancient land use and forest management, versus how much the current patterns reflect present environmental variation along the catena. Some researchers argue that tree species composition Maya region largely reflects ancient Maya forest management (e.g., Ross 2011). In 2007 archaeologist Stanley

Table 1. Comparison of tree communities in four 1-ha permanent sample plots (PSPs) in the Programme for Belize Archaeological Project research area, Belize. The plots are located at different points along the topographic catena (see text). All trees ≥10 cm dbh (see text) were identified, mapped, measured for dbh, and marked with a tag uniquely numbered for each tree. Plots were first inventoried in 1991 and again in 2015-2017. Note the great range in values, indicating how different the forest types are in structure, composition, productivity (growth), and dynamics. Among the four PSPs, the riparian PSP exhibits the highest species number, growth, mortality, and recruitment.

Measure	**Range among plots**
Stem density[a]	374-700 ha^{-1}
Species number[a]	46-59 ha^{-1}
Species similarity between plots[b]	23-50%
Average diameter growth[c]	1.6-1.9 mm yr^{-1}
Mortality[d]	25-54%
Recruitment[e]	13-52%

[a]In first inventory.
[b]In the first inventory, percent of all species occurring in two plots (in one or the other or both plots) that occurred in both plots (based on presence-absence of species in the plots, not on species abundances).
[c]Average of diameter increments during the 25 years between the first and second inventories, for all trees present in both inventories.
[d]Percent of all trees that were present in first inventory that were not present in the second inventory.
[e]Percent of all trees that were recorded in the second inventory that were not recorded in the first inventory.

Walling invited us to address this question at his research site, Chawak But'o'ob. This led to research there and at archaeologist Marisol Cortes-Rincon's Dos Hombres-Gran Cacao site. Although we are still studying connections of present tree populations with ancient land use, we think that one likely and strong influence is ancient, farming-induced soil erosion that would have changed soil characteristics along the catena, and therefore have influenced subsequent spatial patterns and abundances of tree species recolonizing the landscape (Whitacre and Schulze 2012) after the Maya decline in the area c. 1000 years ago (Zaro and Houk 2012).

The ancient Maya used the chicle tree (*Manilkara zapota* (L.) P. Royen) for construction and consumed its fruit. Possible ancient management of the species might have changed its local population genetics. However, results of a study on the genetic structure of present populations of the chicle tree in the PfBAP research area do not suggest ancient management (Thompson et al. 2015a).

In 1991 we scaled up from forest stands (the PSPs) to the landscape using Airborne Synthetic Aperture Radar (AIRSAR) imagery of northwest Belize, obtained in 1990 by the Jet Propulsion Laboratory (Figure 1). We identified major forest types on the AIRSAR image and mapped and calculated the area of them in part of what is now the PfBAP research area. Patterns in the image clearly show the relationship between topography and forest types. Recent acquisition of LIDAR imagery for the research area is helping us refine the correlation of forest types with both environmental and historical influences; topography and Maya features show clearly in the LIDAR image. There has been additional research on forest patterns in the PfBAP research area (Weiher 1996) and in coffee plantations nearby (Billings 1996).

Explanation of Tree Species Patterns: Temporal Patterns

Over the 25 years between inventories there were also strong differences in growth, mortality, and recruitment among the PSPs (Table 1). Tree mortality among the PSPs ranged from 25 to 54% between inventories; in other words, from ¼ to ½ of the trees ≥10 cm dbh and present at the first PSP inventory had died by the time of the second inventory. Conversely, recruitment (stems growing into the ≥10 cm dbh class) ranged from 13 to 52% of stems present at the second inventory (Table 1). In other words, ½ the stems ≥10 cm dbh were new at the second inventory in one PSP (riparian).

The riparian PSP also had the highest rates of mortality and growth and had the highest number of species (Table 1). We attribute this to the effects of the river. The river keeps the soil moist and periodically adds nutrient-rich sediment to riparian forest. This would promote fast tree growth. However, periodically flooded soils provide poor root anchorage, leading to frequent treefall and mortality for the fallen tree and those it crushes. Yet the fallen trees open the canopy and light penetrates below, stimulating recruitment and growth. Thus, there is rapid but compensating mortality and recruitment. Moreover, the heterogeneous light climate and high rate of recruitment likely contribute to the high number of species in the riparian PSP. High light allows many kinds of species to colonize, and, based simply on high colonization, the more stems that enter a given area over time, the more species that are likely to be found there at any given time.

The other PSPs were less dynamic, but, overall, studies in the four PSPs show how variable in time and space old-growth forest has been in the PfBAP study area.

Conclusion

Our review shows that in PfBAB area we are developing an understanding of the ancient environment through paleobotanical research, and that we have substantial information on the modern environment in terms of forest ecology. One of our goals is to illustrate potential synergies between studies of the ancient and modern environments. We conclude with two examples of this synergy from areas of the Maya region comparable to the PfBAB area.

The first example is from Tikal, Guatemala. Based on large samples, there is a strong correlation between the abundances of tree species in surveys of the modern forest and their abundances in the archaeobotanical record of carbonized plant remains (Thompson et al. 2015b). Moreover, the 10 most abundant species in the modern forest were collected as archaeobotanical specimens more frequently than would be expected at random. The authors conclude that these results suggest that 1) modern species abundance reflects past management by the ancient Maya, or 2) the ancient Maya could simply have been using the already most abundant species in the forest, but 3) it is still likely that the overall forest composition was influenced by the Maya. This in depth, albeit equivocal, study is a model effort to connect ancient and modern environments.

The second example is from the area of Chan Chich ruins (Figure 1). Researchers in the PfBAP have proposed a heterarchical model of economic and political interactions among communities of the ancient Maya. The model is based on the heterogeneous spatial distribution of natural resources over the landscape (Scarborough and Valdez 2003). In their graphic model, communities are shown in relation to topograpy, vegetation types, farmed areas, and natural resources such as chert (Figure 2a). An AIRSAR image of the Chan Chich area (Figure 2b) shows how plausible this model is. The image shows the spatial array of topography and numerous different vegetation types near Chan Chich, uncannily similar to the model. In addition to supporting this model of ancient community organization, the image suggests both how archaeologists can profit from studies of the modern environment for interpreting their findings and forest ecologists profit from awareness of possible ancient influences on the modern mosaic of forest types. Together, the model and the image show how a synthesis of research on ancient and modern environments enriches both.

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37 SOCIAL, ECONOMIC, AND POLITICAL CHANGES: AN INTEGRATION OF CERAMIC AND LITHIC DATA FROM THE THREE RIVERS REGION

David M. Hyde and Lauren Sullivan

Archaeological research in northwestern Belize indicates a long history of occupation beginning in the Middle Preclassic and ending with abandonment in the Terminal Classic. The collection and analysis of ceramic and lithic data on a broad regional scale and across the entire range of settlement hierarchy allow for a comprehensive examination of social and political changes that occurred across the region. Stylistic changes in the ceramics, the continuity of lithic forms, and depositional patterns of both artifact classes provide information on the activities that occurred between the Late and Terminal Classic in the Three Rivers Region
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Introduction

On a large scale, the Programme for Belize Archaeological Project (PfBAP) is focused on regional settlement patterns in order to examine the development and decline of economic, political, and social structures of the ancient Maya. The ceramic and lithic data presented here are from a number of sites ranging in size and position in the regional hierarchy and from a variety of cultural contexts. First, we will provide a basic chronology of the area and then will provide a more detailed discussion on the social and political changes that occurred between the Late and Terminal Classic as based on ceramic and lithic data.

Outside of the Maya area, analysis of lithic artifacts has traditionally been used, in part, for establishing chronological sequences for a region or culture area (i.e. Des Planques 2001; Justice 2002a, 2002b; Kooyman 2000; Turner and Hester 1993). However, Maya stone tool forms remain relatively static over time, from the Late Preclassic through the Terminal Classic, particularly in the Three Rivers Region (Hyde 2003). Therefore, most of the chronological evidence presented here is based on pottery, as well as architectural construction phases and associated radiocarbon dates.

Three Rivers Region Chronology

Evidence for early occupation in the Region dates to the early Middle Preclassic (beginning ca. 1000 BCE) and, for the most part, consists of scattered sherds without any clearly defined architecture (Adams 1999). Late Preclassic deposits (beginning ca. 400 BCE) are characterized by the presence of Chicanel sphere ceramics and have been recovered from the majority of excavated sites indicating a population increase across the region. Early Classic occupation is seen in Tzakol ceramic types and is noted in tombs from Dos Hombres, Dos Barbaras, and La Milpa and suggest ties to sites such as Uaxactún, Tikal, and Teotihuacan (Sullivan and Sagebiel 2003).

During the last part of the Early Classic (Tzakol 3) and beginning of the Late Classic (Tepeu 1) there was a population decline throughout the area that may be related to Teotihuacan's decline, Tikal's withdrawal from the area, and the abandonment and destruction of Rio Azul (Adams 1995, 1999; Braswell 2003; Willey 1974).

There was a dramatic population increase in the latter half of the Late Classic (Tepeu 2 – 650/700-800 CE), which is by far the most successful period across the Three Rivers Region. Hageman and Lohse (2003) estimate that there was an increase from 110 people per km^2 in the Early Classic to 510 people per km^2 by the second half of the Late Classic (Tepeu 2). The site of La Milpa alone is thought to have had a population of somewhere between 50,000 and 60, 000 within a 6 km radius (Sagebiel 2005:45). This prosperity is reflected in an increase in the number of sites of all sizes, resource specialized communities, the construction of residential and monumental architecture and the large quantity of ceramic and lithic artifacts recovered. During this time, La Milpa began an extensive building project including a resurfacing of Plaza A, the construction of several range structures, two ball courts (Tourtellot et al. 1994), and Structure 3 was significantly enlarged (Trein 2016). Dos Hombres also underwent a period of rapid growth at this time (Houk 1996). Numerous agricultural modifications, water management features, and a strong Tepeu 2-3 ceramic complex are also noted. By the end of the Terminal Classic/Tepeu 3 (800-900 CE) data from the region suggest a drastic decline in population (Robichaux 1995; Adams 1999), a halt in monumental construction at most sites, a reduction in elite activity, and a decrease in ceramic & stone tool production and quality. A number of sites appear to be ritually terminated at this time based on dense concentrations of ceramic sherds, lithics, and other artifacts (Houk 2000, 2012; Sullivan 2012). There is limited evidence for Postclassic occupation and visitation in the upland area on the escarpment. Data from La Milpa (Zaro and Houk 2012) indicates that while the political authority of the site was greatly reduced by the Terminal Classic, certain sectors of the site core remained occupied into the tenth century. Evidence for visitation is more widespread in the form of monument veneration, censer fragments, and Postclassic arrowheads (Houk et al. 2007; Thompson and Hyde 2019).

Ceramics of the Three Rivers Region

The ceramic analysis was based on the traditional type-variety method established by Wheat et al. (1958) and applied to the Maya lowlands by Smith et al. (1960). Over 200,000 sherds were examined with the well-preserved ones used to develop type descriptions, although the many eroded sherds were typed, when possible, based on form and/or paste. To date, approximately 90 different types have been identified, and the vast majority dates to the Late Classic (some 80%). While coeval with a surge in monument construction and architectural elaboration across the region, this number may be inflated to some extent as much of the research in the area has focused on the Late Classic. Common ceramic types recovered from this time period include: Achote Black, Chilar Fluted (Figure 1), Cayo Unslipped (Figure 2), Cubeta Incised, Encanto Striated, Palmar Orange-polychrome, Subin Red, and Tinaja Red. Modeled censer vessels have also been recovered. Popular vessel forms include bolstered rim bowls (Figure 3), large thick-walled utilitarian jars, smaller thin-walled jars, and beveled lip plates.

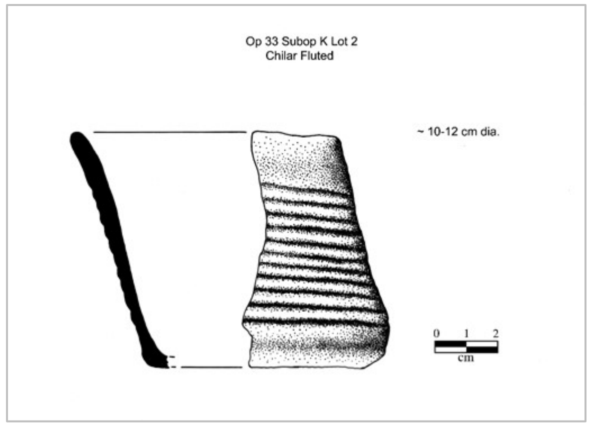

Figure 1. Chilar Fluted (by Dee Turman).

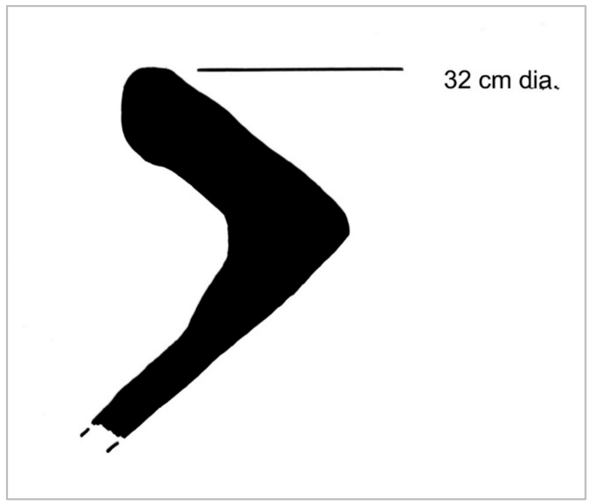

Figure 2. Cayo Unslipped (by Dee Turman).

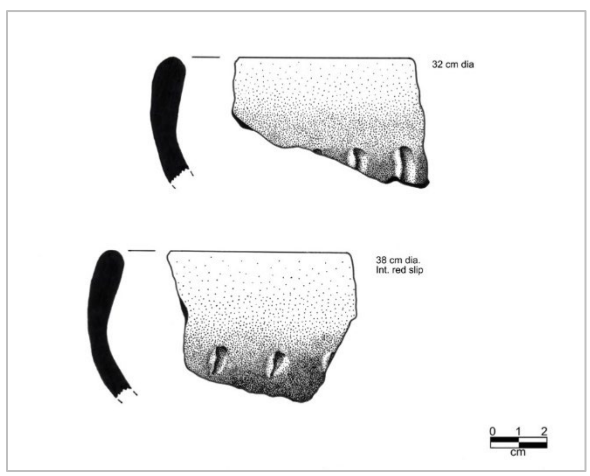

Figure 3. Bolstered Bowl (Kaway Impressed) (by Dee Turman).

A study of vessel shape and size, along with Neutron Activation Analysis by Manning (1997), suggests the inhabitants of the region were socially and economically integrated with the surrounding community at the regional level. Some interregional interactions between a number of sites such as Gran Cacao, Dos Hombres, and Las Abejas (in the PfBAP area) and Uaxactún, Tikal, Holmul, Altun Ha, and Buenavista have also been demonstrated (Manning 1997). In the Late Classic, a decrease in prestige vessels and increase in locally produced utilitarian types is observed, becoming more pronounced in the Terminal Classic (Sullivan and Sagebiel 2003). Macroscopic and petrographic analysis suggests that utilitarian vessels, specifically Cayo Unslipped, were produced on a local level by the end of the Late Classic and into the Terminal Classic (Brennan 2011). Brennen (2011) notes heterogeneous paste recipes that varied greatly and are consistent with a "non-standardized mode of production." Local production and variation are also seen with Tinaja Red jar rims collected from Dos Hombres, Las Abejas, and Guijarral. While vessel diameter was similar between sites, vessel height varied tremendously. Manning (1997:450) hypotheses that these jars were used for water transport and that a higher neck height was associated with being further from a water source. These patterns may be the result of a change in ceramic production from centralized, observed during the Early Classic, to non-centralized, organized on a more local level (Sullivan 2002, Sullivan and Sagebiel 2003). Adams (1995) suggests that the area suffered a disintegration from the centralized states that were typical of the Early Classic.

Identifying the transition from the Late Classic to the Terminal Classic has been problematic in the Three Rivers Region (Sullivan et al. 2007). One of the difficulties is trying to isolate Tepeu 2/Late Classic and Tepeu 3/Terminal Classic ceramics. This problem is exacerbated by the fact that Terminal Classic ceramics might represent occupations of earlier (Tepeu 2) structures without new construction layers to better aid in chronological separation (Graham 1985, Lincoln 1985, Masson 1995). The region also lacks many of the standard Terminal Classic markers such as Fine Orange (Figure 4),

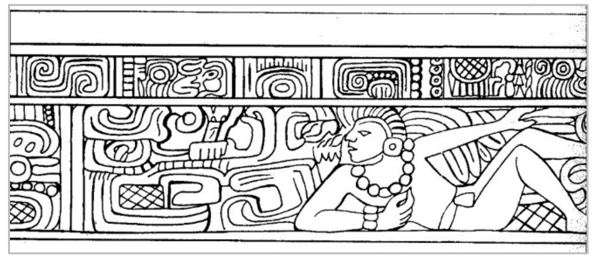

Figure 4. Pabellon Modeled-carved fine orange vessel fragment from Courtyard C-1, Chan Chich (illustration by Ellie Harrison, after Houk [2000:Figure 12.3]).

Figure 5. Face vessel (photo courtesy of PfBAP).

Plumbate, and other finewares (Sullivan et al. 2007).

Excavation at La Milpa recovered several fragments of Fine Orange and other distinct Terminal Classic markers, although they occur at different levels of the deposit and are mixed with Late Classic types (Sullivan 2012). Radiocarbon dates from areas associated with this deposit range from A.D. 720 to 1386 (Moats et al. 2012: 46). By the end of the Terminal Classic/Tepeu 3 there is a decrease in the predominant Late Classic types across the region.

Ceramic data also indicate the following general trends from the Late to the Terminal Classic across the region: an increase in utilitarian wares, an increase in the thickness of the large vessels, an increase in the use of "face" vessels with appliquéd and modeled decoration (cf. Chase and Chase 1996) (Figure 5), the appearance of slate ware and/or imitation slate ware, and a decrease in the overall quality of the ceramics. These changes coincide with overall decline of many sites in the central Petén (Sullivan et al. 2007).

Lithics of the Three Rivers Region

Much of the artifactual material culture encountered and recovered from Maya excavations in the Three Rivers Region, and in other regions, is derived from fill used during architectural construction. Construction fill provides the core of many structures, substructures, platforms, and other architectural features. In the Preclassic, the fill is often a dry cobble fill, with some discarded and broken artifacts, but very little sediment. By the Late Classic, the fill is a mix of cobbles, sediment, and midden or midden-like material, especially ceramics sherds and lithics. Artifacts recovered from the fill of a single structure can include Late Preclassic Chicanel, Early Classic Tzakol, and Late Classic Tepeu types. This construction fill assemblage of material from such a large time span is the result of the Maya builders scavenging material from a wide range of sources to use as fill, including from contemporaneous middens, but also non-contemporaneous middens from abandoned households or structures. Also, it would seem likely, the builders would occasionally travel some distance to collect necessary material.

Since ceramic types change relatively quickly, and using the principle of *terminus ante quem*, it would be argued a hypothetical feature was constructed during the Late Classic since Tepeu is most recent ceramics in the assemblage. Since Maya stone tools are not as temporally dynamic, they are not useful for chronology. Construction fill is essentially a secondary context, derived from primary contexts that extend across an uncertain range of time and space. Therefore, the analytical value of the lithics derived from construction fill, especially Late Classic fill, is limited. Since it is generally impossible to know the primary context of lithics recovered from such a chronologically mix assemblage, it cannot be argued that they are the result of activities associated with that structure or the group. The flakes and bifaces recovered from fill that is mixed could be associated with flintknapping that occurred hundreds of years earlier or hundreds of meters away.

Assemblages of non-fill lithic material that appears to be in its primary context are the kinds that provide considerable insight into the lithic technological organization as they relate to

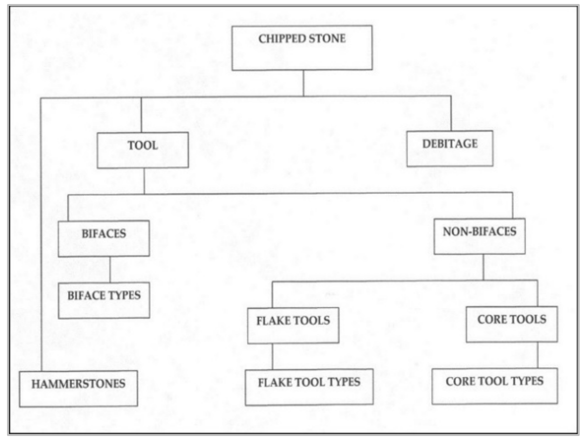

Figure 6. Flow chart showing morphological segregation of chipped stone. (Adapted from Andrefsky [1998: Figure 4.2]).

the political, social, and economic organization. The stone tool morphological typology developed for the Three Rivers Region uses the Colha classification created by Hester and Shafer (Hester 1985; Shafer and Hester 1983) as a base; however, it has limitations when applied to data from the Three Rivers Region (Hyde 2003). The raw material used at Colha is of the highest quality providing flintknappers at that site a great deal of control over the removal of flakes and, ultimately, the final form of the tool being manufactured. In the Three Rivers Region, most of the local chert is of inferior quality, being coarse grained or having many inclusions (Hyde 2003). Therefore, even a skilled flintknapper cannot produce a tool of equal craftsmanship to that produced at Colha using local material.

The stone tool classification for the Three Rivers region uses Andrefsky's (1998) morphological typology flow chart as a starting point and modifying it as necessary to match the specimens in the region. The first distinction in segregating lithic material is between tools and non-tool artifacts (Andrefsky 1998:75; Hyde 2003; Figure 6). Tools are then further separated into bifaces and non-bifaces. The unmodified pieces are called debitage. Although debitage has been collected and analyzed, this paper focuses only on the tools.

Like the ceramic data, the lithic data also supports the assertion of specialized local production during the Late Classic. In the Maya region, debitage mounds have received the greatest amount of attention and research

Table 1: Indicators of Craft Specialization.

INDICATOR	REFERENCE
recovery of early, middle and late stage preforms	Meadows 2000
consistent end-product	Lewis 1995
recovery of implements broken and discarded during manufacture	Meadows 2000
recovery of few medial fragments relative to proximal and distal	Dockall 1994
low incidence of error	Roemer 1984
recovery of refits	Shafer and Hester 1991
high degree of skill in tool manufacture	Torrence 1986
standardization in error types	Torrence 1986
consistency in size and shape of end product	Torrence 1986

regarding lithic craft specialization. There are some problems of accepting debitage mounds *a priori* as workshops. For instance, Moholy-Nagy (1990) has shown that neighborhood dumps can form debitage mounds that have the appearance of a workshop. Several scholars have investigated debitage deposits and from that body of work several indicators have proven successful in identifying lithic craft specialization (Table 1). Evidence for lithic craft specialization with varying levels of intensity is present at at-least five sites within the Three Rivers Region: El Pedernal (Hyde and McDow 2003), La Milpa North (Heller et al. 2015), and Chan Chich (Meadows 2000), Maax Na (King and Shaw 2013) and El Arroyo (Jespersen-Tovar 1996). All functioned differently and were situated at different levels within the Maya social hierarchy. The development of craft specialization at each location was the result of similar demands for agricultural tools and each location possessed an abundance of locally available raw material. The social factors exacting pressure on each of these communities to develop lithic craft specialization was, however, very different. For example, residents of El Pedernal turned to agricultural intensification during the Late Classic to provide surpluses for a massive increase in the population in and around Río Azul (Hyde and McDow 2003). Whereas at El Arroyo, a small site with a relatively short occupation history, a "cottage industry" level of craft production developed to facilitate the clearing of land for agriculture (Hyde 2003; Jespersen-Tovar 1996).

Additional insight on Maya social organization from lithics is derived from "minimal ceremonial centers" (Hyde 2003) which may have functioned in variable ways relative to their position in the supralocal community, and that the stone tools found at these sites reflect this variability. Minimal ceremonial centers located near each other were integrated with each fulfilling a special role. Collectively these sites would have constituted a local economy. For example, the manufacture of agricultural tools in the Late to Terminal Classic at Las Abejas seems to indicate that agricultural production was an important component of its economy (Figure 7) as the oval biface was the most common type of tool recovered at Las Abejas. A high proximal to distal fragment ratio observed in oval bifaces is indicative of intensive farming (McAnany 1992). At Las Abejas there is a 2:1 ratio of proximal fragments to six distal fragments, supporting the idea that farming was important to the residents (Sullivan 1997:178). This contrasts with the larger ceremonial center of Dos Hombres where a 3:1 ratio of proximal to distal fragments is noted (Dippel 1996:22). Dos Barbaras is located less than one kilometer from Las Abejas, is similar in size, but has a much different trend in lithic tool use (Figure 7). Rather than being dominated by any one type, there is a greater range of lithic tool forms as Dos Barbaras, and notably there is a relative lack of agricultural tools (Hyde 2003). Cores, hammerstones, and recycled bifaces (which are often used as hammerstones) make up 46% of the assemblage,

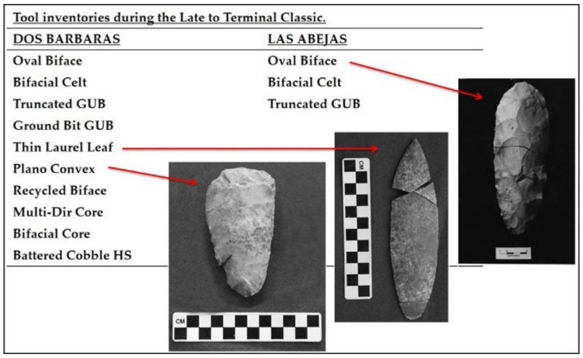

Figure 7. Tool inventories for Dos Barbaras and Las Abejas during the Late to Terminal Classic.

suggesting that expedient flake tools were an important component of the lithic economy at Dos Barbaras and may be related to some economic specialization at this site (Hyde 2003).

The proximity of Dos Barbaras to Las Abejas, and the variability between these two sites' stone tool assemblages suggests that these centers were integrated, allowing each to develop a specialized function within the local economy. The sites' locations near agricultural areas most likely allowed the sites a degree of self-sufficiency for the occupants were able to meet their own subsistence needs without needing to rely on other centers.

Conclusion

In summary, the ceramic and lithic data presented here speak to the localized production that became prevalent in the Late Classic at small and large sites across the Three Rivers Region. Increasing populations during this time may have encouraged the Maya to have developed different "resource-specialized communities" (Scarborough and Valdez 2003) that tried to "diversify production as much as possible" (Dunning et al. 2003:24) which resulted in high levels of specialization and exchange and an increase in diverse resource specialized communities.

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38 ANCIENT MAYA HINTERLAND SETTLEMENTS EAST OF LA MILPA: HUN TUN, MEDICINAL TRAIL, AND LA MILPA EAST

David M. Hyde, Robyn L. Dodge, and Estella Weiss-Krejci

The hinterland east of La Milpa Center is distinctive of an upland landscape with bajos on its edges, a few formal courtyard groups, monuments, and numerous informal clusters of mounds. Multiple landscape modifications such as terraces, depressions, chultuns, and linear features are present in these eastern hinterland settlements as well. This paper will provide an overview of the excavations into specific hinterland communities: La Milpa East, Hun Tun, and the Medicinal Trail Community. Associated aguadas, or seasonal water holes, and dry depressions are present as well and will be discussed to document variable strategies of ancient Maya economy and water management. Archaeological evidence contributes to an interpretation of the function of these hinterland settlements and the role they played in contributing to the larger, regional influence of the La Milpa polity.

Introduction

Hinterlands are the remote or less developed areas of a region, and generally associated with subsistence agriculture. The increasing prevalence of hinterland settlement studies in the Maya Lowlands find densely populated landscapes with a range of mound sizes and arrangements, as well as a diverse assortment of features. The majority of people in ancient Maya society lived in the hinterlands, and, through their labor, supported both hinterland and major center inhabitants and were both the primary consumers and providers of services. In the hinterlands, the larger households represent Maya commoners whose status was elevated above most of the community's inhabitants, providing them with limited social power (Hyde 2011; Lucero 2001). The limited social power of these hinterland elites is manifest by way of overseeing secondary, localized community-based religious and political leadership duties.

This chapter discusses research results from ancient settlements and landscape features located in the Eastern La Milpa Hinterlands (ELMH) between 3.5 and 6 km east of the large urban polity of La Milpa Center (Figure 1). This hinterland area is part of the La Lucha Uplands which support upland forest on well-drained soils within an Eocene limestone plateau. The area is diverse, with *bajos* on its edges, formal courtyard groups, monuments, water management features, linear berms, and numerous informal clusters of mounds.

The main three sites that we will focus on are La Milpa East, a middle-level administrative center (Iannone and Connell 2003:3) and satellite of La Milpa Center (Tourtellot *et al.* 2002), and Hun Tun and Medicinal Trail, both commoner settlements that functioned as agricultural communities organized around household groups (Dodge 2016; Hyde 2011). This discussion will provide an overview of the cultural history and ongoing research at these three sites, along with an interpretation of the roles played in contributing to the larger, regional influence of the La Milpa polity.

Research History of the ELMH

Research in the ELMH has been conducted under the auspices of the La Milpa Archaeological Project (LaMAP, 1992-2002), the Medicinal Trail Hinterland Communities Archaeological Project (MTHCAP, 2009-2020), the Hun Tun Archaeological Project (HTAP, 2008-present), and the Programme for Belize Archaeological Project (PfBAP, 1992-present). The first investigations in the area comprise a number of survey transects in the 1990s, including the 6 km-long LaMAP Eastern Transect (Tourtellot *et al*. 2003a, 2003b). Other efforts include seven survey blocks that were surface-sampled and tested (Levi 1996; Rose 2000). The first excavations within the LaMAP Eastern Transect, and its extension, were conducted by Chantal Esquivias in 1996 (Hammond *et al.* 1996:86), Gloria Everson in 1996, 1998 and 2000 (Everson 2003), Jason Gonzalez in 1998 (Gonzalez 2012), and Estella Weiss-Krejci in 2000 and 2002 (Weiss-Krejci and Sabbas 2002).

The largest site on the LaMAP Eastern Transect is La Milpa East which was discovered by Tourtellot on the summit of a steep hill at 3.5 km east of La Milpa Center (Tourtellot *et al.* 2003a) (Figure 2). Excavations were conducted

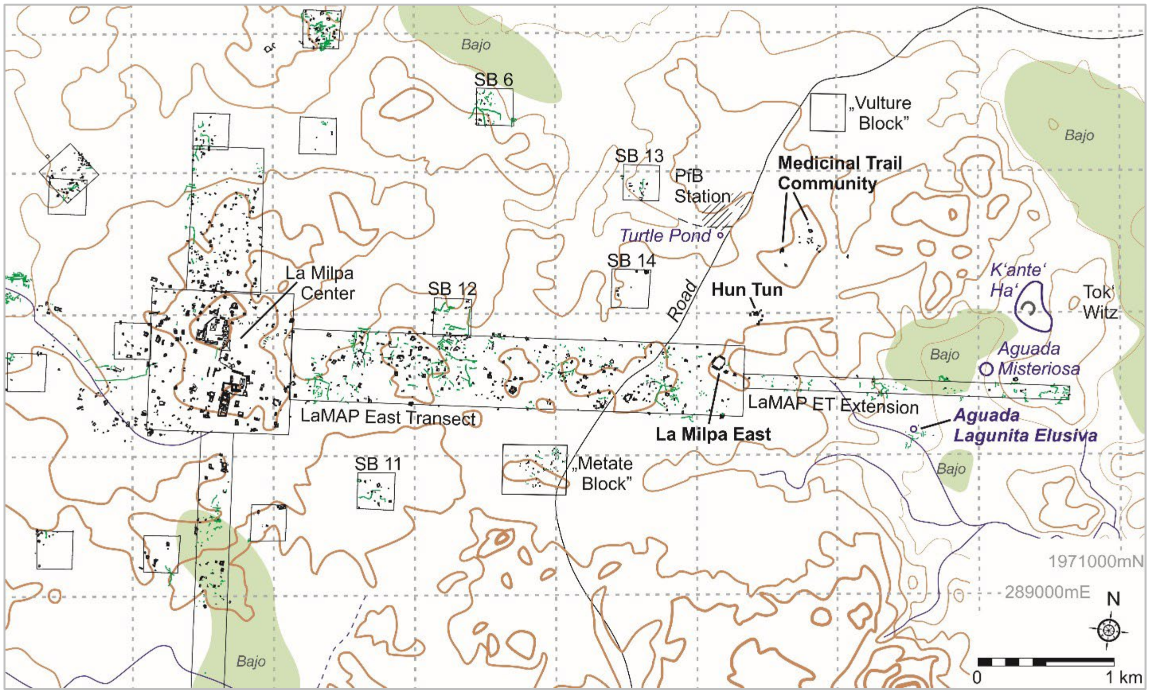

Figure 1. Map showing the location of the sites discussed in the text (UTM Grid; contour lines Military Survey UK; based on the LaMAP survey by Gair Tourtellot, modified by Estella Weiss-Krejci).

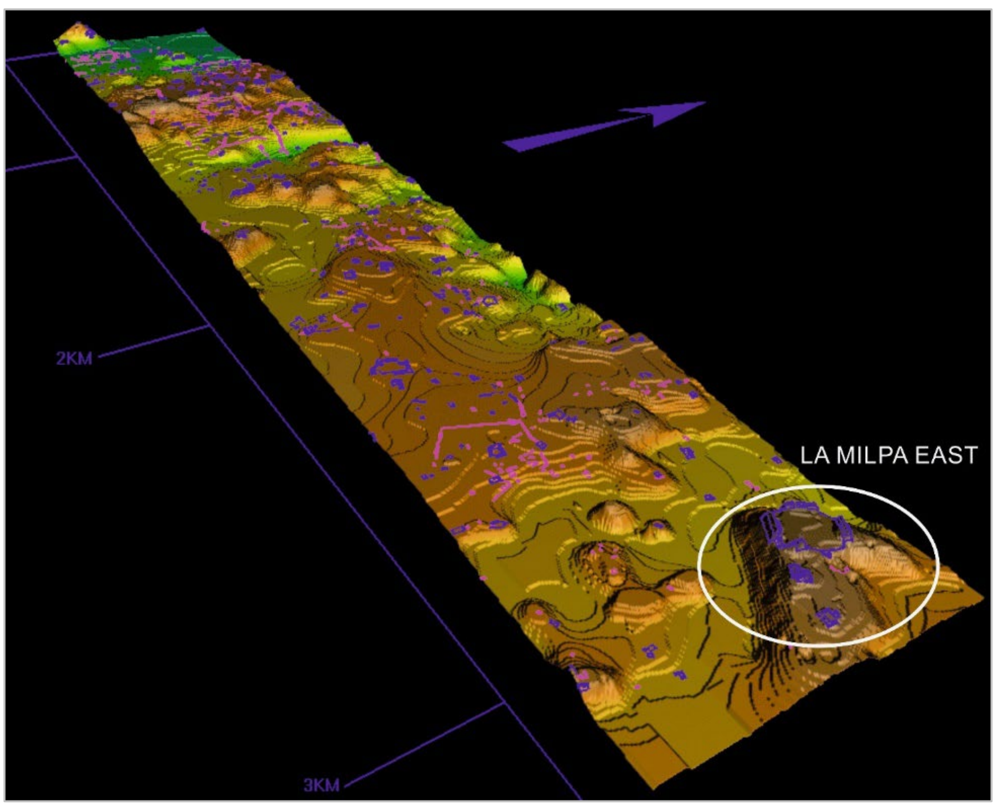

Figure 2. Map of the LaMAP Eastern Transect (Graphics by the La Milpa Archaeological Project and Francisco Estrada Belli based on the LaMAP survey by Gair Tourtellot).

by Everson (Everson 2003) and Weiss-Krejci (Weiss-Krejci 2009; Weiss-Krejci and Brandl 2012; Weiss-Krejci and Sabbas 2002).

As part of her water management research, Weiss-Krejci (Weiss-Krejci 2009:157-164; Weiss-Krejci and Brandl 2012) directed excavations at *Aguada Lagunita Elusiva* from 2008 to 2011, an *aguada* located to the south of the LaMAP East Transect extension. In 2003 Nicholas Dunning and Timothy Beach (2010:382) took a core from the center and Ezgi Akpinar-Ferrand (2011) excavated a few test pits in its surroundings in 2008. In 2011, Weiss-Krejci and her team (Weiss-Krejci and Brandl 2012) discovered *Aguada Misteriosa*, the *cival* K'ante' Ha', and a small associated site on top of a steep hill to the east of the *cival*, which was named Tok' Witz (Figure 1), all north of the LaMAP East Transect extension. No excavations were made.

The Medicinal Trail Community, which is located 4-5 km east-northeast of La Milpa Center, was first excavated by Laura Ferries and Danica Farnand (see Hyde 2011). In 2004, David M. Hyde mapped Groups A and B (Hyde 2011), and has excavated and surveyed in and around the community since then, uncovering a landscape of numerous, mostly informal clusters of mounds, but also many terraces, linear berms, *chich* mounds, and other landscape modifications (Hyde 2011) (Figure 1). A number of individual mounds, architectural groups, and water and soil management features in and around Medicinal Trail have also been investigated in parallel by a number of scholars working in collaboration with Hyde (see Hyde 2011).

Hun Tun is located approximately 4 km east of La Milpa Center, south of Medicinal Trail, and northeast of La Milpa East, and has been mapped and excavated by Robyn Dodge since 2008 (Dodge 2016) (Figure 1). The site consists of major ceremonial plazas and courtyards, household groups, monuments, seasonal water depressions, and agricultural terraces.

The ELMH from the Middle Preclassic to the Postclassic

The earliest evidence for occupation in the ELMH comes from Groups A and M of Medicinal Trail, which was first occupied in the Middle Preclassic (c. 1000-400 BCE) (Hyde 2011, 2018). In addition to Groups A and M, evidence for Late Preclassic (400 BCE-CE 250) at Medicinal Trail can be found at Groups B, E, H, and I (Hyde 2011). There is no evidence for the Late Preclassic at Hun Tun, and, on the LaMAP East Transect, there does not appear to be any additional evidence for Preclassic construction activity in the ELMH beyond 2.5 km east of La Milpa Center (Sagebiel 2005:603).

Several structures tested on the LaMAP East Transect and its extension, the La Milpa East temple, as well as nearly every group investigated at Medicinal Trail contained evidence for Early Classic (250-550/600 CE) occupation (Hyde 2011; Sagebiel 2005). Analysis and dating of the pollen core from *Aguada Lagunita Elusiva* show that it and its surroundings were heavily used for agriculture from the latter part of the Early Classic (after 400 CE) (Dunning and Beach 2010:381).

Everson's (2003:304-326) excavations confirm that during Late Classic I (550/600-650/700 CE), new houses were built on the East Transect extension (Operation G35), whereas others were abandoned (Operations G 32/Structure 2134, G 33/Group 2169, and G 34/Group 2090). At *Aguada Lagunita Elusiva*, a smashed but almost complete Late Classic I Dolphin Head Red plate indicates the use of the water source around this time. At Medicinal Trail, Late Classic I ceramics have been recovered throughout the entire settlement (Hyde 2011).

In Late Classic II (650/700-800 CE), a significant population increase occurred in the larger region, possibly due to immigration from the west (Hageman and Lohse 2003; Hammond and Tourtellot 2004; Sagebiel 2014:133), though internal growth may have also contributed. Much of the newly expanded residential zone became densely settled. Hun Tun was first constructed during this time period (Dodge 2016) and La Milpa East (Everson 2003; Sagebiel 2014; Tourtellot *et al.* 2003a; Weiss-Krejci 2008) and Medicinal Trail (Hyde 2011; Ward *et al.* 2015) were rebuilt and enlarged. La Milpa East continued to be an important center in the Late Classic III (800-900 CE).

Much of the area was abandoned at the end of the Classic Period in the second half of the ninth century CE (Dunning and Beach 2010:381),

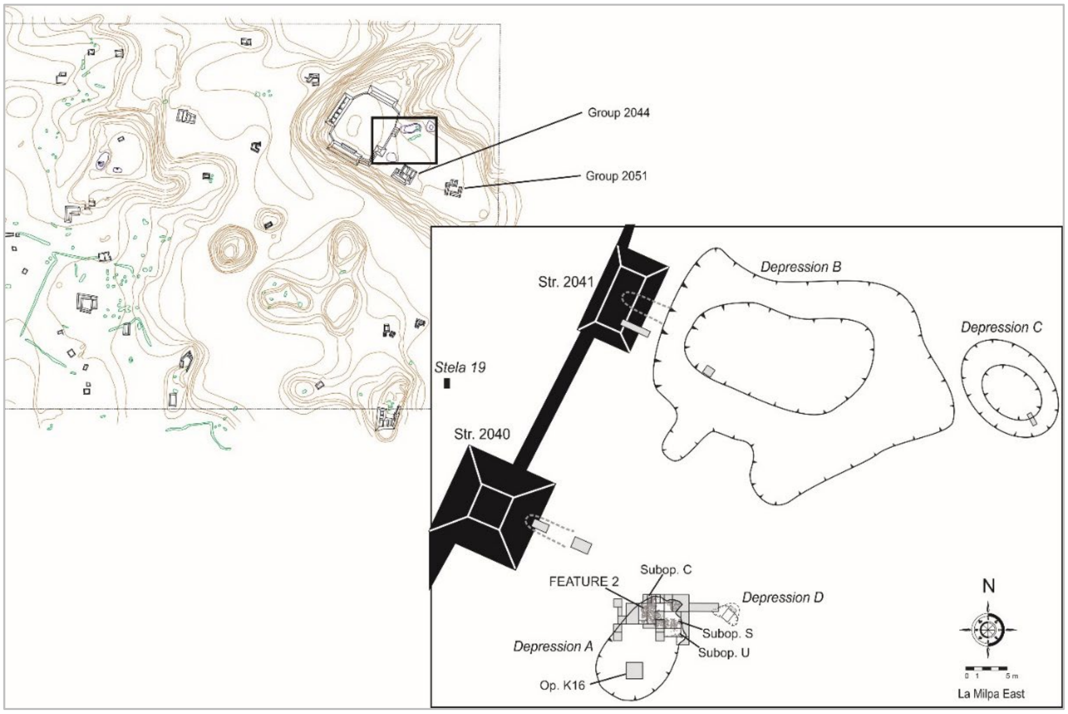

Figure 3. Excavations at La Milpa East (Maps: left Gair Tourtellot, right Estella Weiss-Krejci).

although habitation has been suggested in urban centers like La Milpa until the eleventh century (Zaro and Houk 2012), with intermittent Middle and Late Postclassic stelae resetting and dedicatory offerings of Yucatecan-style ceramic censers thereafter (Hammond and Bobo 1994; Sagebiel 2014:119; Zaro and Houk 2012). Small side-notched Postclassic projectile points have been found sparsely across the area (Houk *et al.* 2008:99; Martinez 2008:37; Norman Hammond, personal communication), and Postclassic visitation was documented at Group B of Medicinal Trail, consisting of fragments from at least three *incensario* vessels and three small Postclassic bowls discovered in front of and behind Structure B-1, a pyramidal shrine (Hyde 2011). A Postclassic visitation has also been documented at Hun Tun Group A, Structure A-1, by the presence of a small ceramic sherd assemblage (Dodge 2016).

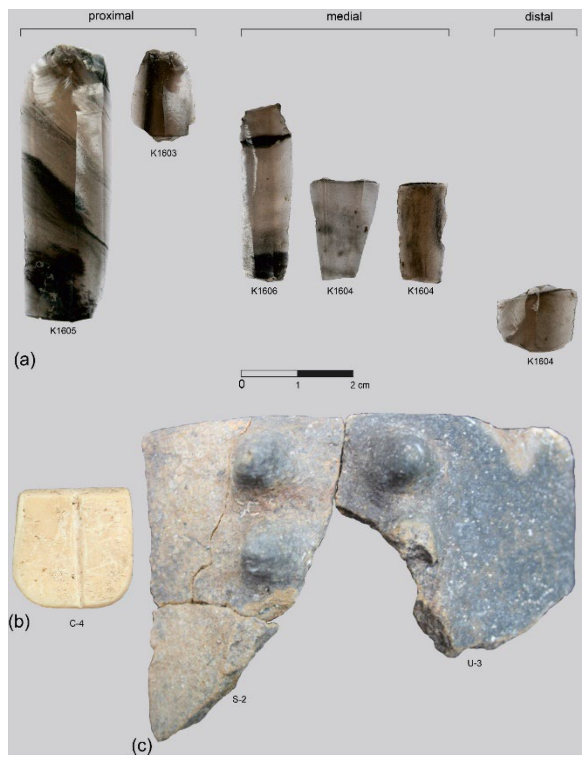

Figure 4. La Milpa East, Depression A artifacts (a) dorsal view of six obsidian blade fragments (Op. K16); (b) shell ornament (Subop. C); (c) two refitted Late Classic III Miseria Appliquéd spiked incensario sherds (Subops. S and U) (Photos: Estella Weiss-Krejci).

Description of Sites

La Milpa East

La Milpa East (Figure 3) is a middle-level center characterized by a large, 5,000 m^2 open plaza, which would have supported the gathering of a large number of people (Tourtellot

Figure 5. La Milpa East, Depression A, Feature 2 (Photo: Estella Weiss-Krejci).

et al. 2003a). The plaza is surrounded by three multi-room range structures in the north-northeast, west-northwest, south-southwest, and a temple (Structure 2040) and another structure (Structure 2041) in the east-southeast.

Outside the main plaza, in the eastern and southeastern parts of the site there are four dry depressions (Depressions A-D), one *chultun*, and two patio groups (Group 2044 and 2051). Of note, Depression A served as a reservoir in the Early Classic and Late Classic I with an estimated capacity of 151,000 liters. In all probability, towards the end of Late Classic II the depression was rapidly filled in with gravel and an estimated 200,000 sherds including a large quantity of Late Classic II Pedregal Modeled *incensario* and Daylight Orange, Darknight variety sherds, suggesting a strong ritual component (Sagebiel 2005:274). Other artifacts from the depression were 37 obsidian blade fragments and one shell ornament (Figure 4a, b). Associated with the fill layer is an apsidal structure (Feature 2) which resembles Terminal Classic Yucatec style shrines (Figure 5). The structure was disturbed and partially demolished at a later point in time, most likely in Late Classic III. Two fitting Miseria Appliquéd spiked *incensario* sherds (Figure 4c) were found in the disturbed area in two separate contexts (Sullivan 2013).

La Milpa East probably assumed a middle-level site status during Late Classic II, while many of the residential groups close to La Milpa East were built or expanded (Sagebiel 2005:667), with at least one of these expansions being associated with a dedicatory deposit (Everson 2003:302; Sagebiel 2005:406).

La Milpa East continued to be an important center in Late Classic III and it is possible that the large Group 2044 originated during this time. Three test pits in the plaza indicate that the laying of the plaza fill occurred as late as the Late Classic III. The plaza also contains the site's only altar and stela (Stela 19), oddly placed off the northwest corner of the temple. The stela was probably erected in Late Classic III when the plaza fill was constructed (Sagebiel 2005:694-696). Stela 19 is in free sightline with Temple 1 of La Milpa Center (Hammond *et al.* 2014:88-89).

Hun Tun

Hun Tun has a varying topography with water management features and agricultural terraces along its southeastern boundary (Dodge 2016; Figure 6). Several formal courtyard groups of differing size, scale, and function are present. The plaza groups are distributed between elite and non-elite households, ceremonial plazas, and informal clusters of low-lying platform mounds, some with perishable structures on top (Dodge 2016). Ceramic data is consistent across the entire site, showing an entirely Late Classic II and III occupation (Dodge 2016). One small ceramic assemblage of sherds dating to the Postclassic was identified in shallow context within Group A at Hun Tun (Dodge 2016).

The architectural and material culture from Hun Tun suggests that internal social stratification existed amongst the courtyard

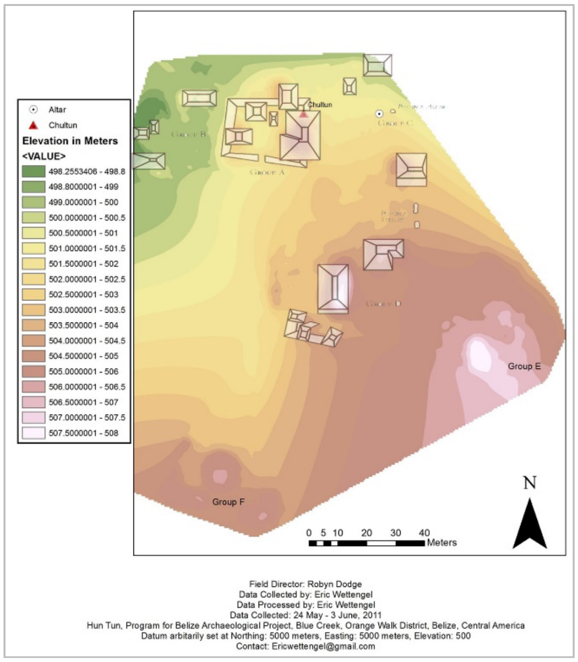

Figure 6. Map of Hun Tun.

Figure 7. Hun Tun, god pots; left: 4-AQ-6 in situ; right: 3-U-7 reconstructed (Photos: left Robyn Dodge, right Bruce Templeton).

Figure 8. Hun Tun, cache and chultun (Photos: left Bruce Templeton, right Robyn Dodge).

groups (Dodge 2016). Group A is the site center and served as an elite residential courtyard with ritual functions and has restricted access. All structures within Group A were built on top of a basal platform and either plastered or painted. The group is characterized by tiered structures (such as A-1) that were repeatedly modified and renovated, a sweathouse, and a clay-filled *chultun* (Dodge 2016), all associated with various caches and dedicatory offerings (Figures 7, 8, and 9). Prestigious or "exotic" material culture was recovered exclusively in Group A. Architecture in Group D, which has not been excavated to date, is consistent with structures built on top of a basal platform with restricted access similar to the structures in Group A.

The remainder of the site includes Groups B and C, which are packed earth courtyards with low-lying cobble platforms and perishable superstructures. Dodge (2016) interprets Group B to be a grouping of houses most likely associated with domestic chores. Conversely, in spite of the relatively humble architecture, Group C is unique due to the placement of a plastered limestone altar at the center of the group, which was sourced from and unknown location outside of Hun Tun (Brennan, personal communication 2012). Dodge (2016) suggests that Group C may have served administrative as well as ritual functions. Several limestone monuments, agricultural terraces, and a water depression feature encompass the southeastern edge of Hun Tun. These features have been investigated through survey, sampling, and cursory excavations (Dodge 2016).

Medicinal Trail Community

The Medicinal Trail site is a dispersed hinterland community of formal courtyard groups, numerous informal clusters of mounds, and multiple landscape modifications such as terraces, depressions, and linear features (Hyde 2011; Figure 10). Most of the mounds and other features visible on the surface date to Late Classic II and III, though the earliest occupation of the community occurred in the Middle Preclassic (Hyde 2011, 2018).

The settlement is hierarchical in organization. There are three, large, formal groups at the site, Groups A, B, (residential) and M (non-residential). In their Late Classic

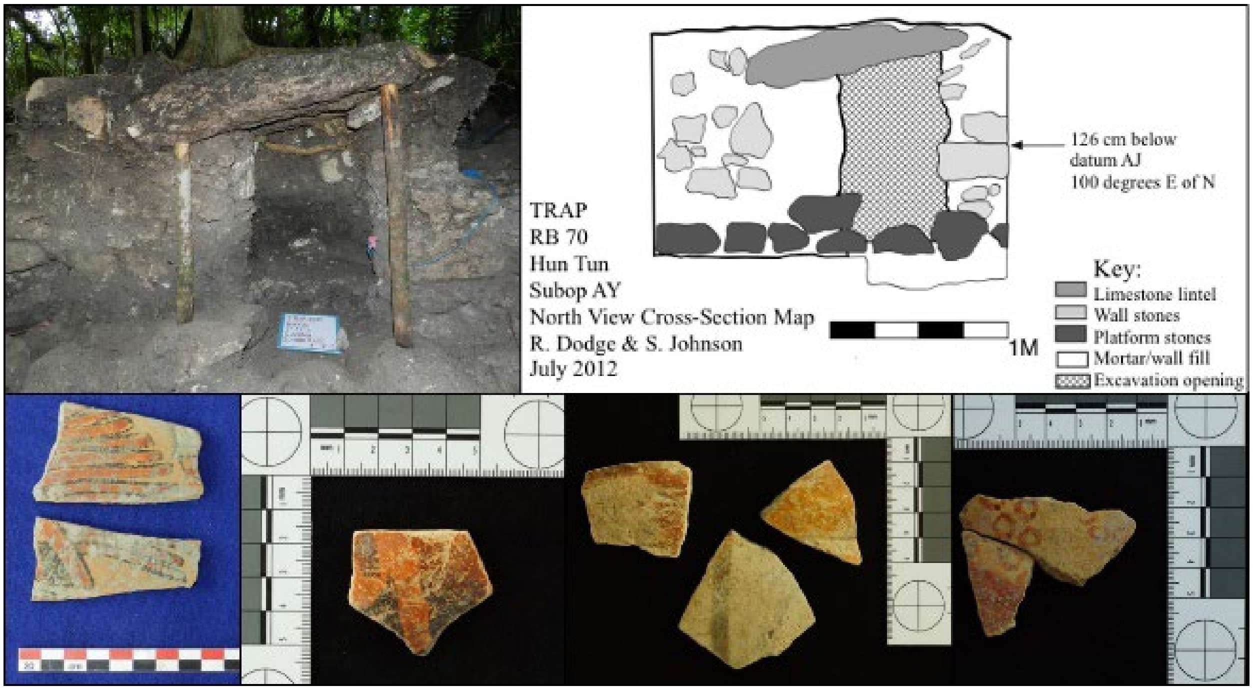

Figure 9. Hun Tun Sweathouse and associated artifacts. (Photos and drawing: top Robyn Dodge, photos bottom Bruce Templeton).

construction phase, Groups A and B are relatively large residential plaza groups about 200 m apart from each other, located on the same ridge top (Figure 11). Each was built on an artificial plaza platform and consist of multiple mounds, surrounding shared central spaces, with a large eastern structure. Groups A and B are not only larger and more formal than all the others, but they can also be conceptualized as "expensive settlements" with finely cut limestone blocks used in their construction, the plastering of the plaza courtyards and the interiors of the structures, and vaulted roofs (Hyde 2011). Multiple *caches* and burials have been identified at both Groups A and B. Evidence for Postclassic pilgrimage and visitation has also been observed in the form of fragmented *incensario* vessels and Postclassic bowls (Figure 12) (Hyde 2011), demonstrating the enduring significance of these spaces after the site was abandoned.

The elevated status of these groups also has a long history. At Group A, a Late Preclassic 3.5 m-diameter masonry round structure was uncovered (Figure 13, 14a). No postholes, plaster surface, or masonry architecture were found on top of the round structure suggesting that the platform was used for ritual performances, perhaps for the community (*i.e.* Aimers *et al.* 2000). A burial found within this structure, accompanied by two ceramic vessels, was interpreted to be a possible founding member of the household (Hyde 2011). A T-shaped platform was also identified in association with the round structure (Figures 13 and 14b) (Hyde 2011). This structure is also associated with two burials, one of which showing dental modification (Hyde 2011; Figures 13, 14c and 14e).

As settlement moves further away from Groups A and B it is less formal and closely associated with terraces and other landscape modifications. Groups C and I, located near Group B, are semi-formal and considerably smaller. Group C consists of two or three structures on a shared platform that was plastered. Numerous groundstone implements were recovered, and to the east there is a *chultun* (Hyde 2011). Group I, directly east of Group B, is a smaller version of Group B, having a similar layout. Unlike Group B, however, Group I's architecture is defined by poorly shaped or unshaped limestone blocks, and likely furnished with perishable superstructures.

Groups F and H are different from all aforementioned groups in that they are not

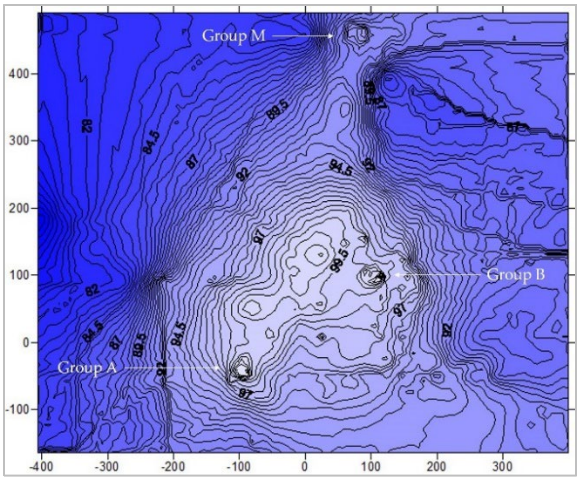

Figure 10. Map of a portion of the Medicinal Trail Community, with key architectural groups identified (Contour map generated by David M. Hyde).

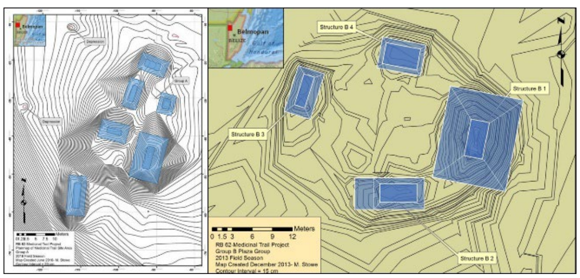

Figure 11. Maps of Group A (left) and B (right) (Contour maps generated by Michael Stowe, modified by David M. Hyde).

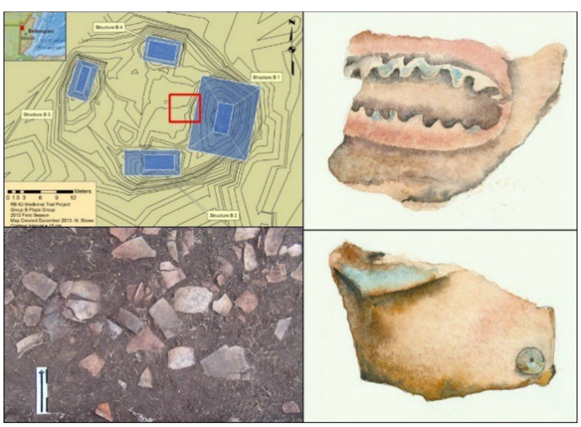

Figure 12. Postclassic sherds associated with Structure B-1, Group B, Medicinal Trail.

believed to be residential. Group F is located south of Group C and is associated with numerous depressions and linear berms. Along the top edges of the depressions are *chich* mounds. Group H consists of four low mounds spread out between Groups B, I, and C, with an escarpment to the east. At least two of these are bi-level mounds, and at least one of these, Structure H-1 has postholes on the bedrock that likely supported some form of cover for a porch. The other mounds of this group consist of a couple of low mounds and there are numerous *chultuns* in and around this group. Along the eastern transect, from Group F extending about a kilometer there are numerous informal residential clusters of mounds. Extensive landscape modifications in the form of terraces and linear berms are found east and west of Group A, downslope from the ridgetop.

The ELMH Rural Landscape

The many field walls and terraces, as well as larger natural water features, which surround Medicinal Trail, Hun Tun, and La Milpa East, suggest that the ELMH was of high agricultural importance. Hyde's eastern transect and excavations at Group F have identified numerous mounds, mostly informal clusters, but also extensive terraces, linear berms, *chich* mounds, and other landscape modifications (Hyde 2011).

In the Late Classic, the area around the *Aguada Lagunita Elusiva* must also have been one of intensive agricultural production (Figure 15). The *aguada*, a roughly circular seasonal water hole ranging between 27 and 30 m in diameter with a surface of 615m^2 and a present capacity of approximately 450,000 liters, is situated in a region of low residential density and is surrounded by box terraces. These terraces are believed to have acted as seedbeds or intensive gardens that allowed Maya farmers better control of their cultivation areas in terms of fertilization, pest control, and the application of water (Dunning 2004; Lohse 2004:129).

Weiss-Krejci's excavations revealed that the ancient Maya had heavily modified the *aguada*. In its southern part, a chert cobble layer was found, and in the north-northwestern portion, an assemblage of two artificial chert cobble layers, separated from each other by a thick gray clay layer, was discovered (Figure 15). The upper layer dates to the Late Classic II/III, the lower one to or before the seventh century CE. The purpose of the rock fixtures was probably to guarantee better accessibility, regulate water inflow, and preserve the water resource. However, a ritual

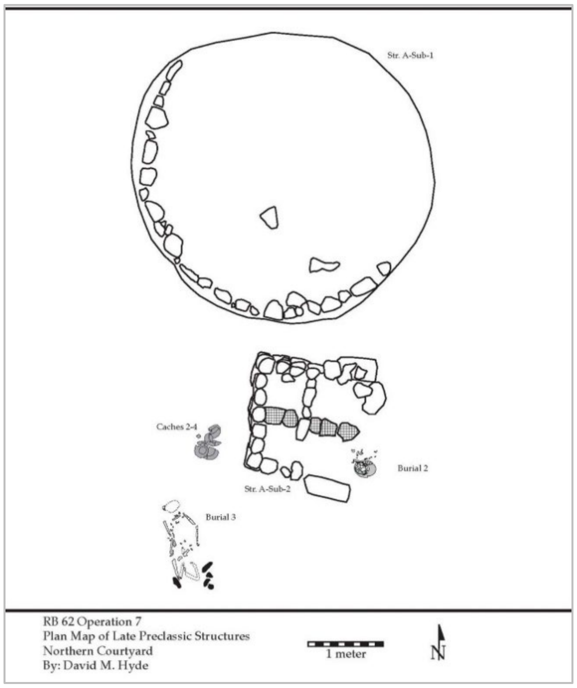

Figure 13. Late Preclassic ceremonial precinct at Group A, Medicinal Trail Community (Drawing: David Hyde).

function should not be ruled out. Like Feature 2 in Depression A at La Milpa East, the chert cobble layer might be a semicircular or circular platform.

The most predominant materials in the *aguada* are clay and high-quality chert. Core preparation and production of expedient tools took place *in situ* because massive waste from intense flint knapping activities was found in almost all units during the excavations. Weiss-Krejci and Brandl (2012) conducted analysis of mini- and micro-debitage from selected samples from the lower cobble layer through flotation. The results clearly show a high quantity of mini- and especially micro-debitage, which indicates that knapping activities did take place here. In the course of the ninth century CE, the area around the *aguada* was abandoned and recolonized by upland forest (Dunning and Beach 2010:381-382).

Discussion

Preclassic and Early Classic Socio-Political Community-Organization in the ELMH

The effective lack of Middle Preclassic ceramics from La Milpa Center (Sagebiel 2005:165), which given its monumental size is likely due to sampling bias, and the lack of any evidence for Preclassic occupation between 2.5 and 6km on the LaMAP Eastern Transect and at Hun Tun does not allow us to address Preclassic political relations within those communities (for Late Preclassic structures on the LaMAP East Transect see Sagebiel 2005:602-603).

At Medicinal Trail, evidence from Group A indicates that important ceremonial activities occurred there in the early part of the Late Preclassic in the form of A-Sub-1 & A-Sub-2. The round structure was a stage for these ceremonies, and the small "T-shaped" platform may have been utilized as a bench by the lineage-head to oversee the ceremonial activities. The importance of these features, and the space overall, is also suggested by the placement of three caches next to the platform at the time it was buried with fill, and two burials placed on the plaster surface to the east and west respectfully.

There appears to have been an event at Group A in which the individuals in Burials A-2 and A-3 and Caches 2-4 were all placed on the earlier Late Preclassic Floor 3 then buried and sealed, along with A-Sub-1 & A-Sub-2, with Floor 2. With the sealing of these features in the latter part of the Late Preclassic, the Northern Courtyard space became reorganized as residential space. Hyde (2011) argues that the burial of these features and reorganization of the space at Group A was a power shift within the Medicinal Trail Community. Group B was also occupied in the Late Preclassic, at the time that Group A's early ceremonial space is sealed and reorganized into a residential space. Hyde (2011) interprets the event at Group A as the moment in which community power was lost at this location and shifted over to Group B, where it likely remained until the community was abandoned.

The situation changed in the Early Classic, when La Milpa Center grew into a considerable ceremonial center (Zaro and Houk 2012) and its elite populations were associating themselves with other sites of the central Maya Lowlands, such as the powerful centers Rio Azul and Tikal in Guatemala (Hammond and Tourtellot 2003:42-43; Sullivan and Sagebiel 2003:29) and possibly Calakmul in Mexico (Hammond 2001:267). While there is plenty of evidence for Early Classic occupation in the ELMH, the relationship with La Milpa Center is not clear. There is a gap in Early Classic occupation on the LaMAP eastern transect

Figure 14. Features from the Late Preclassic Ceremonial Center, Group A, Medicinal Trail. Structure A-Sub-1 (a), Structure A-Sub-2 (b), Burial A-2 (c), Burial A-3 (e), Caches A-2 through A-4 (f).

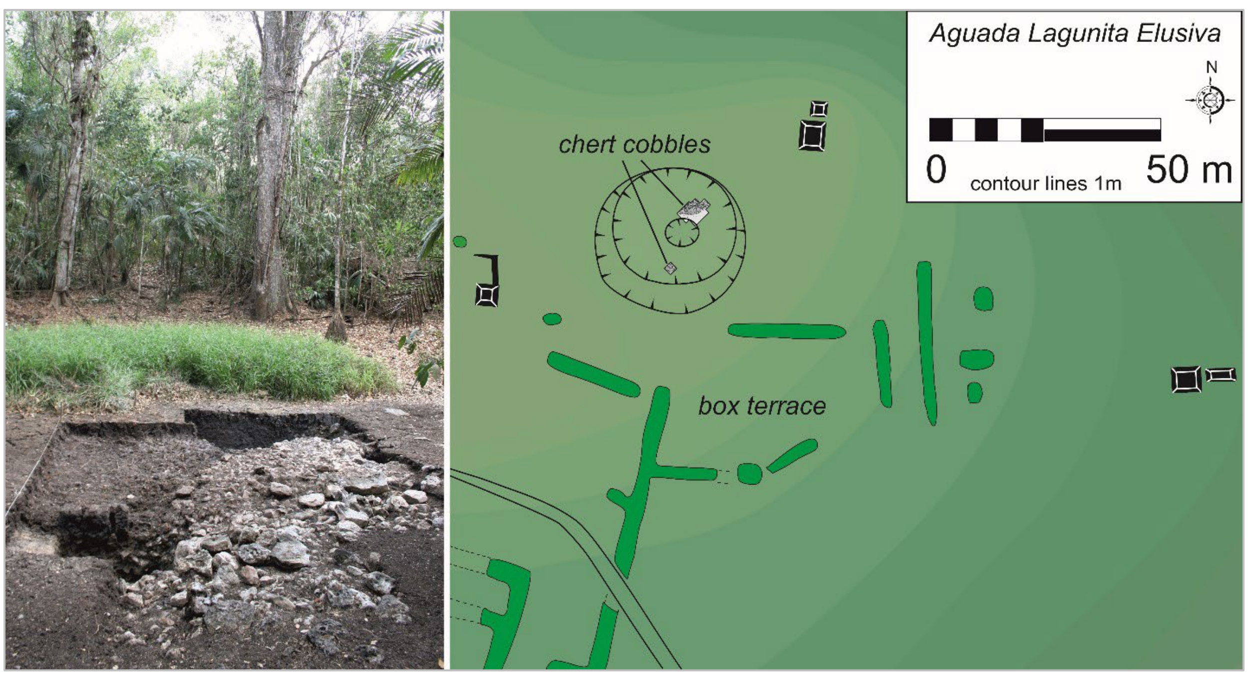

Figure 15. Photo (looking south) and map of Aguada Lagunita Elusiva (Photo and drawing: Estella Weiss-Krejci).

between 1.7 and 3km east of La Milpa Center (Everson 2003:304-315, 326; Sagebiel 2005:621). Such an incremental fall-off in settlement density from center to hinterland can be used to evaluate community boundaries (Levi 1993). This gap in Early Classic presence has led Everson (2003:326) to suggest that the hinterlands further to the east (and hence the area under discussion) were not under the control of Early Classic La Milpa Center but of another major center, although sampling bias must be considered.

Late Classic Socio-Political Community-Organization in the ELMH

While ELMH population density in the seventh-century CE seems to be lower than in the previous period (Sagebiel 2014: fig. 15), in the eight century CE monumental architecture at La Milpa Center was rebuilt repeatedly (Zaro and Houk 2012) and the entire ELMH became densely settled. La Milpa East grew into a middle-level center and many of the residential groups around LME were built or expanded during that time as well (Sagebiel 2005:667). Medicinal Trail was rebuilt and enlarged and Hun Tun first constructed. The questions that arise are: Did the ELMH, which were rich in water, agricultural products, chert, and clay, fall under the jurisdiction of La Milpa Center in the Late Classic? Did La Milpa East function as administrative center for the Medicinal Trail Community and Hun Tun or did the latter two function as entirely independent communities? How were these communities organized?

The settlement data from the Late Classic Medicinal Trail Community and Hun Tun suggest a corporate group organizational structure related to the control over the many terraces located throughout the community, and more importantly the finished products extracted from them. The corporate group is defined as a collective property or resource owning entity that exists above the level of household and below the level of community, and whose members need not be related by kinship or descent (Goodenough 1961). Corporate groups tend to develop in the hinterland and rural areas set apart from the overt control of centralized authorities of major cities (Hageman 2004). The function of a corporate group is to maintain an administrative and authoritative hierarchy and direct major decisions for the group. Corporate group heads may supervise, sponsor, and/or perform rituals. However, the most important function of corporate groups is controlling resources, such as social labor, arable land, and agricultural water (Hayden and Cannon 1983).

The largest households within the Medicinal Trail Community are Groups A and B, and these in turn are likely the leaders of the community – and corporate group heads. Similarly, Group A and D are likely the corporate group heads at Hun Tun. The Medicinal Trail settlement associated with the terraces consists of smaller, informally arranged, mounds located some distance from the Plaza Groups. Hyde (Hyde and Stowe 2015) believes these informal clusters represent landless residents of the community that worked the fields. In addition to the dense concentration of landscape modifications, Group F is made up of *chich* mounds located near the edges of *aguadas*. The group is located adjacent to Group C, a small semi-formal group. Hyde (Hyde and Stowe 2015) believes this is an area for the initial processing for the plants grown on the terraces, where the inhabitants of Group C oversaw the processing. If Group F was an area of initial processing, it is possible that the final stage of that processing is occurring at Group H, under the watchful eye and control of the Group I inhabitants. All of this in the shadow of Group B, the corporate group head.

Community Rituals

Another way to look at political relationships is through rituals. Hinterland commoners also contribute to complexity through local rituals that legitimized their claim to ancestors, land, and meaningful constructions of space (McAnany 1995). At Groups A and B of the Medicinal Trail Community, ritual behavior was identified in association with ancestral shrines, and the Late Preclassic ceremonial precinct. At Hun Tun, rituals were identified in the form of artifact caches, dedication and termination rituals, and monument procurement. While expected at a middle-level site such as La Milpa East, the presence of limestone monuments at a commoner site such as Hun Tun may point to an increasing political segregation of authority in the later parts of the Late Classic, especially in Late Classic III. This segregation may be connected to economic independence, although the monuments may also be associated to water rituals, as the stelae are positioned in relation to water depressions.

According to Tourtellot *et al.* (2003a), La Milpa East was incorporated into La Milpa Center's grand cosmological scheme, forming one of four hilltop centers located on each of the four cardinal points (La Milpa East, La Milpa North, La Milpa South and La Milpa West), all more or less equidistant from La Milpa Center and oriented towards it. However, like La Milpa North (Heller 2018), La Milpa East was not just a place of administration and pilgrimage but multivalent with a long history of occupation. La Milpa East's plaza fill was only constructed in Late Classic III and Stela 19 was probably erected at the time (Sagebiel 2005:694-696). The obvious tie that existed between La Milpa Center and La Milpa East may have formed very late in the site's history. The fact that La Milpa West was clearly unfinished (Hammond *et al.* 2014:89) suggests that the cosmogram was a work in progress when La Milpa Center was abandoned. Hence, in Late Classic III, the role of La Milpa East and power relations with the commoner sites in the ELMH could have undergone significant change.

A ritual component between water and architecture at La Milpa East is indicated at the apsidal structure in Depression A. These types of buildings, which are believed to be dedicated to the god of wind and rain, point to long distance relationships as they have been found in Guatemala, Mexico, in the coastal zones of Belize reaching as far south as the Sibun River Valley (Harrison-Buck and McAnany 2006). One such structure was also discovered at the Rosita Group of Blue Creek (Guderjan *et al*. 2010) which is located ca. 11km northeast of La Milpa East. McAnany (2007:220, 2012) considers the presence of these shrines not only as evidence for some type of connection with Chichen Itza and its Quetzalcoatl ideology, but as an expression of social tensions between the Classic Maya ruling class and other members of society whose heterodox beliefs and practices materialized in a new architectural form.

Conclusions

We have just provided an overview of the cultural and natural features in the region east of La Milpa Center. During the Late Classic, the hinterland sites Hun Tun and Medicinal Trail comprised of internally, socially stratified groups, which controlled resources and ritual ideology for their community. Although these communities were still tied to the large or middle-level centers such as La Milpa, the Late Classic hinterland communities likely possessed a certain amount of autonomy or independence. In this respect, the situation may have been similar to many other hinterland communities of the Three Rivers Region, which tend to be situated between larger centers.

Ancient Maya commoners contributed to complex society in numerous ways. Making up approximately 90% of the population, it was the non-elite members of society that produced most of the food. As discussed above, each of the hinterland communities reported on here have evidence for large-scale agriculture that likely produced surpluses. Non-elite members of society also contributed to the large, complex trade network, acquiring exotic materials, though obviously on a smaller scale than elite members. The end of the Classic period may have been a time during which different forms of political organization became possible "for persons who likely had limited life opportunities while living in the shadow of hereditary aristocracies" (McAnany 2012:130). La Milpa East's final rebuilding episode in the Terminal Classic, which took place not long before the entire region collapsed, may have been one last unsuccessful countermeasure to avoid growing political segregation in the hinterland.

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39 LANDSCAPES OF COMMUNITY: THE NEIGHBORHOODS OF WARI CAMP

Laura J. Levi

Mesoamerica's indigenous communities exhibit a range of socio-spatial arrangements that tend to be labeled neighborhoods. For archaeologists of the Lowland Maya, interest in identifying these arrangements has grown significantly over the past decade. To date, their investigations have produced an awareness that different ancient communities had vastly different neighborhood forms. Research findings from the site of Wari Camp suggest that we have much to learn about the lived experiences of Maya people by seeking the sources and consequences of this variation.

Introducing the Problem

Study of the ancient Maya community has been an enduring problem focus in Lowland Maya archaeology. From the first synthetic statements on the subject, variation was a key concern (see especially Willey 1956 and, again, Ashmore and Willey 1980). However, research on the nature and sources of community variation typically proceeded in piecemeal fashion due to the large settlement areas involved and the associated costs of systematic survey and excavation. It is significant, therefore, that the Rio Bravo Conservation and Management Area – supporting multiple projects on its 250,000 acres – is one of a very few Lowland localities where ancient Maya community variation can be explored and modeled across contiguous physical environments and with reference to a suite of interlocking historical processes.

There are discernable differences in patterns of settlement across the property that speak to variations in community scale and function. La Milpa, for example, is enormous, whether one considers its impressive monumental core, its large residential settlement, or its vast areal expanse extending a radial distance of roughly four kilometers from the core (Tourtellot et al. 2003). The size and complexity of settlement at La Milpa is a manifestation of its political clout in the Classic Period. Maax Na and Dos Hombres, on the other hand, have large precincts of monumental architecture yet their settlement areas seem quite small in comparison. Interestingly, both of these centers are argued to have possessed specialized market functions during the Classic Period (King 2021; Conley and Trachman 2019).

And then there is Wari Camp, with a compact core of monumental architecture that is nevertheless surrounded by dense residential settlement extending a radial distance of about three kilometers. Spanning a number of upland and wetland microenvironments, the site also evidences an abundance and variety of relic field systems. In all likelihood, Wari Camp was an important link in a chain of riverine centers dedicated to the production and transport of agricultural commodities (Krause et al. 2018). The organization of this nodal community has dominated archaeological investigations there for many years. Early fieldwork identified a distinctive residential signature that could be used to define its areal extent (Levi 2012). Subsequent research suggested the presence of an array of community subdivisions. This paper examines one particular kind of subdivision that conforms most closely to anthropological understandings of neighborhoods as places of face-to-face interaction and cooperation (Wernke 2019).

In the following pages I will provide a brief historical background to archaeological research at Wari Camp, and describe some of the principles that have governed investigations there for the past several years. In the process I hope to showcase the research strategies that facilitated detection of community subdivisions. Discussion next turns to the thorny problem of neighborhood archaeology in the Lowlands. Wari Camp is then used to illustrate why neighborhoods continue to confound while remaining an essential unit of analysis in community studies.

A Brief Background to Research at Wari Camp

Wari Camp spanned riverine wetlands associated with the Rio Bravo, a lower

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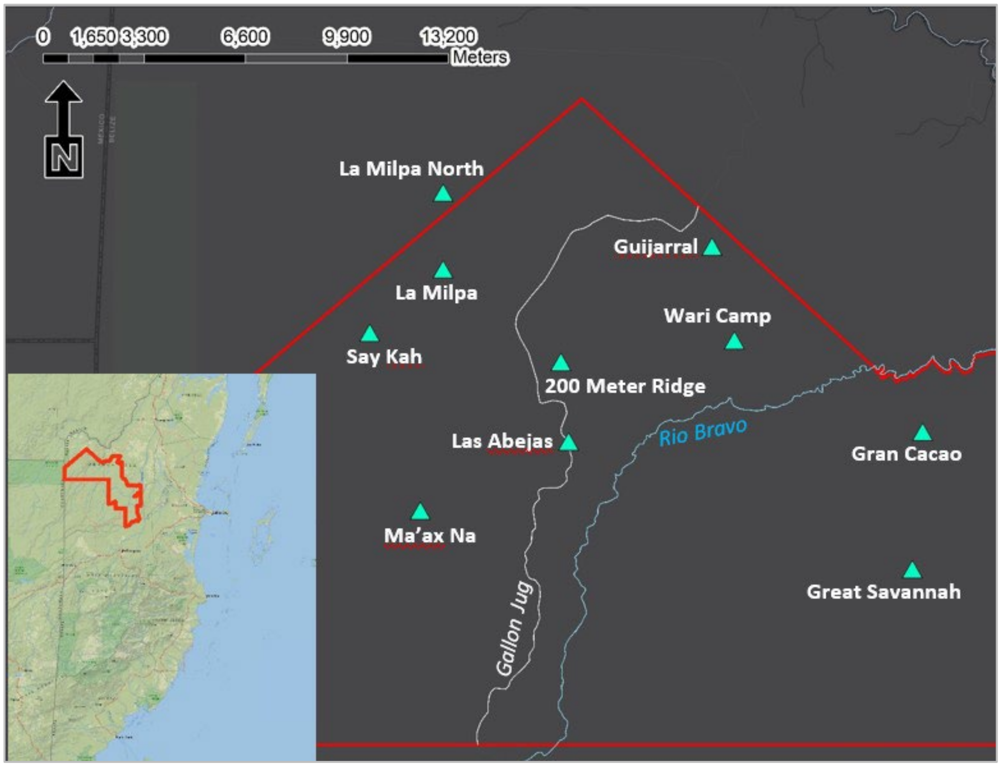

Figure 1. Wari Camp in the Rio Bravo Conservation and Management Area.

escarpment also dominated by wetlands, and an upper escarpment of karstic hills and valleys bisected by a vast drainage system (Figure 1).

Its central administrative precincts occupied an elevated ridgetop at the edge of the upper escarpment and consisted of six functionally distinct plazas (Figure 2a and 2b). Plaza A was an expansive public space that had three imposing range structures at its margins. Plaza C contained a ball court.

Both Plaza B and Plaza E supported temple architecture and, at one time, two stelae fronted Plaza E's eastern temple.[1] The tightly enclosed Plaza F, with its perimeter walls and comparatively small structures, would have offered a more secluded area for domestic activities. Plaza D, by contrast, appears to have been devoid of architecture. Spanning a low point between Plazas B and E, it was home to a small uncarved stela standing under a meter in height. Stelae of similar size are found elsewhere at Wari Camp as well as at other sites, and often signal the presence of crossroads – either physical or metaphorical, or both (Keller 2009, Levi et al. 2019).

Thomas Guderjan produced a map of Plazas E and F in the late 1980s (Guderjan et al. 1991). I mapped the administrative precinct's remaining plazas soon after initiating archaeological investigations at the site a decade later. However, the primary purpose of my research was to develop insights into how everyday life was organized across the ancient community. As a result, small structure architecture quickly became the focus of study. Fieldwork progressed in two stages. The first emphasized survey and mapping within a sample of settlement localities. Limited environmental mapping was conducted in conjunction with the survey, and included plotting both topographic contours and the distribution of modern vegetation suites. The second stage added excavation into the mix while targeting specific topographical, environmental, and archaeological features for additional survey. In 2017, LiDAR imagery supplemented these efforts to great effect. Combining small-scale, fine-grained pedestrian surveys with broad-based, coarse-grained distributional patterns enhanced understanding of Wari Camp's 1) community

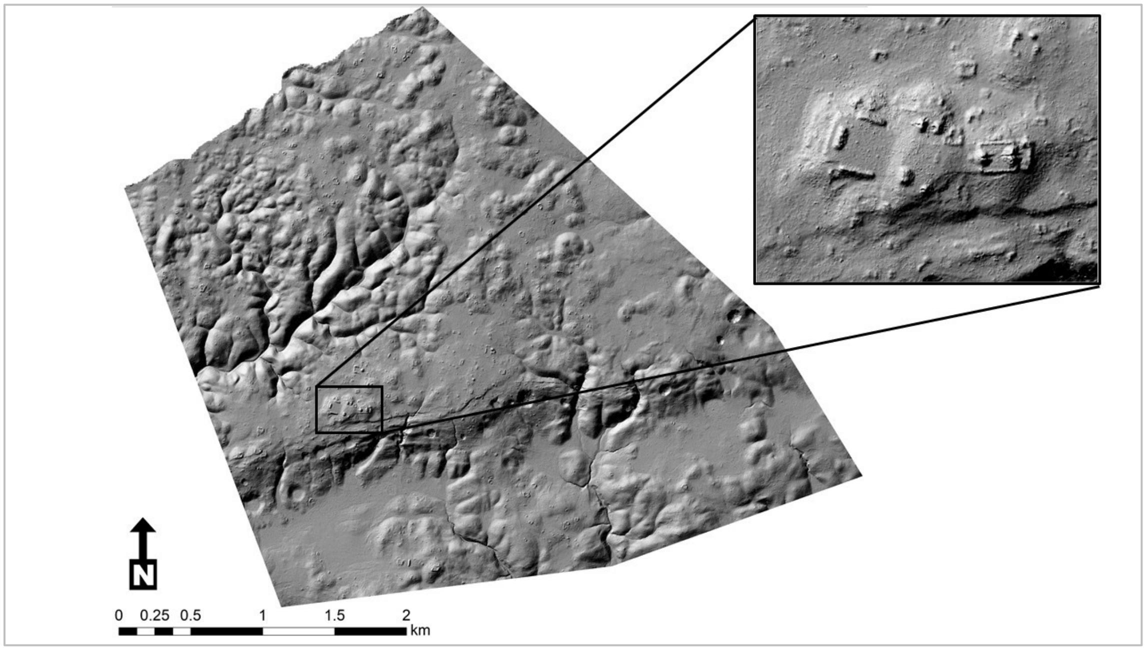

Figure 2a. LiDAR View of Wari Camp with Inset of Central Core of Monumental Architecture.

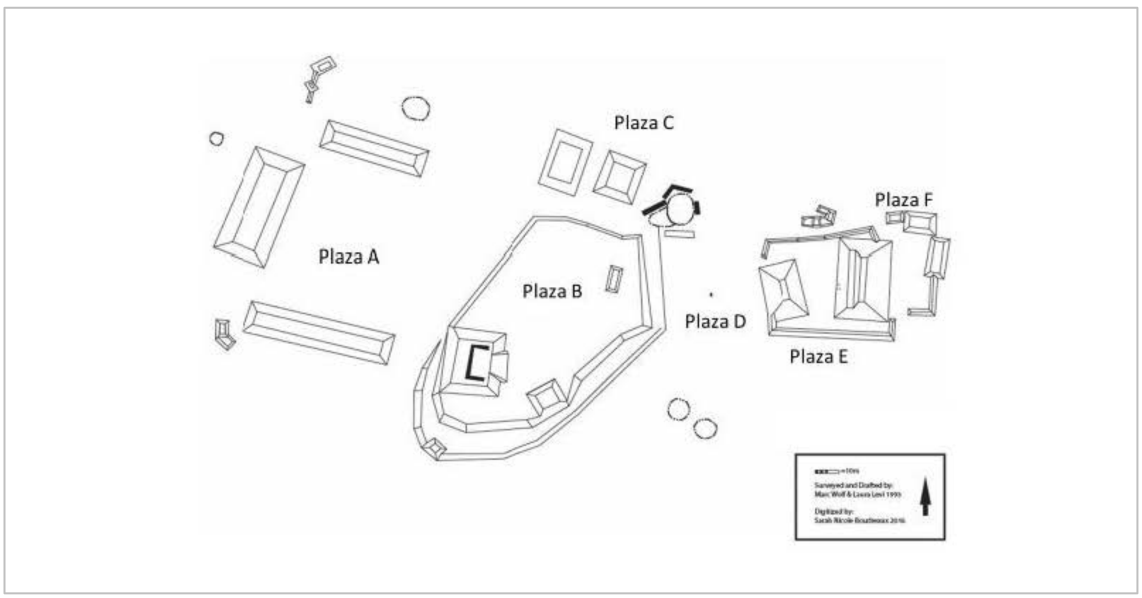

Figure 2b. Prismatic Map of Wari Camp's Central Core of Monumental Architecture.

subdivisions, 2) road networks, and 3) the ritual practices common to both (Levi 2018; Levi et al. 2019). LiDAR was particularly useful in training a bright light upon the large number of shrine groups scattered across the site. Possessing five-to-seven-meter-tall pyramidal platforms on their eastern or northern margins, shrine groups served a variety of functions.[2] A subset of these will be discussed in greater detail, below, because they help to expose a fundamental aspect of neighborhood diversity.

Orienting Principles and the Practicalities of Field Research

Research at Wari Camp proceeded from the understanding that human landscapes are socially produced spaces (Mitchel 1996 after Lefebvre 1991). The implications of this

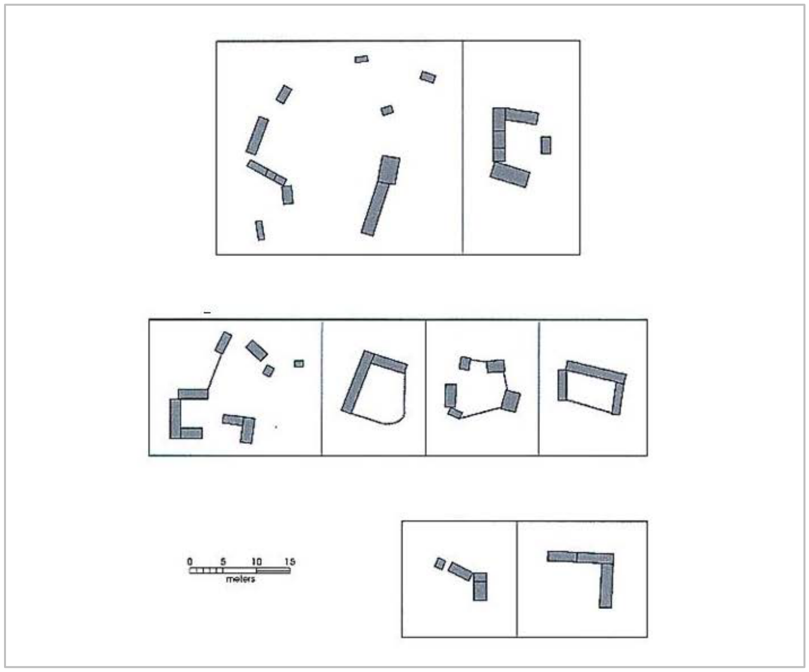

Figure 3. Composite Groups.

perspective are significant. First, as argued by Lefebvre (1991), space is not an entity unto itself but is constituted out of relationships among people, their things, and their products. As such, it has the emergent properties that give lived-in places their historical and experiential specificity (Massey 2005). Second, socially-produced spaces form through disparities that often are embedded in acts of affiliation (Allen 2003). These are some of the "difference producing set[s] of relations" that contribute to the heterogeneity of landscapes (Gupta and Ferguson 1992:11). As a result, there are few more complex arenas of study. Landscapes can be simultaneously generative and determinative of organization and experience, and they are replete with displays both of power and affect (Harris 2014).

Operationalizing this understanding and tailoring it to an archaeological study of an ancient Maya community proved challenging. In the end, certain landscape features were prioritized in order to explore a set of affiliative practices that would have been profoundly important to life and livelihood at Wari Camp. Terrain modifications and associated productive activities, while important considerations, became ancillary concerns. Additionally, Wari Camp's rulers were considered only indirectly, and their core architecture awaits more sustained archaeological study. Instead, research explored how relationships forged through co-residence received variable expression in the community's assemblage of domestic architecture. Across Mesoamerica, the salience of shared residence to the creation of relatedness is well documented by ethnographers and ethnohistorians (e.g., Nash 1985 [1970]; Restall 1998; Wilk 1991). It is equally striking how co-residence here activates political and economic rights and obligations that often take precedence over those based solely on descent or marriage or occupation (e.g., Acheson 1996; Carrasco 1976; Salovesh 1976). Unfortunately, neither ethnographers nor ethnohistorians have attended to the materiality of co-residential ties to any appreciable extent. At most, studies of contemporary households note numbers of structures occupied by a group and whether there are shared extramural living spaces (e.g., Hanks 2000, Wilk 1991).

Similarly, in any systematic assessment of a large body of data, the tendency is for archaeologists to investigate residential remains according to the economic wherewithal and political prominence of their onetime occupants. As a result, location, structure number, volumetrics, and the nature of adjoining activity areas have become the currency of "household archaeology" in the Lowlands. It is unlikely, however, that such well-studied attributes of residence offer a window upon affiliative relationships. To explore the latter, research at Wari Camp examined architectural features that the Maya used to mark inclusion within the co-residential group. In the case of multi-structure residences, simple proximity would have been the most basic mark of inclusion. Nevertheless, the occupants of these units frequently chose additional expressions of affiliation, such as well-defined plazas, structure abutments, connecting walls, and basal platforms. For example, the majority of Wari Camp's multi-structure units possessed plazas and one other architectural indicator of affiliation. By contrast, the most complex displayed at least three different indicators. Labeled Composite Groups, they were distributed across the community in pairs and announced the presence of neighborhoods (Figure 3).

The Neighborhood in Mesoamerica, Past and Present

Over the years, discussion of neighborhoods has been impeded by a sentiment prevalent among some Mesoamerican archaeologists that ancient Maya communities were unlikely to have sustained subdivisions of any sort. Myriad reasons have been offered in support of this position, but the argument rests at least in part on an insistence that Maya polities were characterized by fundamentally non-bureaucratic kinds of governance. Maya political organization is said to have had a quelling effect on mediating forms of collective action because it emanated from a central ruler through networks of "prestige-chain, patron-client, and marriage ties" (Feinman and Nicholas 2012:148). Specifically, all significant interactions between rulers and a community's domestic groups were supposed to be direct, individuated, and individualizing. Ties *among* domestic groups were rendered superfluous, as a result.

While this kind of political model is deeply entrenched in the lore of Mesoamerican archaeology, its corollary – an absence of Lowland Maya community subdivisions – finds abundant evidence to the contrary. Early Colonial Period documents clearly referenced the existence of a spatially complex township that possessed discrete residential zones headed by individuals who were subordinate to the ruler of the township as a whole (Restall 1997). The same pattern of subdivisions can be seen at several Maya centers dating back to the Postclassic and Classic Periods (e.g., Tourtellot et al. 2003; Hare and Masson 2012; Folan et al. 1983; Levi 2002, 2012). At Wari Camp these subdivisions are called wards to highlight their role in the administrative functioning of the ancient community (see Folan 1989:8). They are most readily identified by the presence of a hilltop temple complex that is often located next to a large, elite residential group (Figure 4).

But what about community subdivisions that functioned at smaller social and spatial scales – what Maya archaeologists are most likely to call neighborhoods? Most frequently described as loci of face-to-face interaction and cooperation, neighborhoods generally are considered to be supra-household affiliations established through the shared experiences of daily life (Smith 2010). On the ground, Maya archaeologists have had some difficulty with the construct. Nevertheless, several are convinced that neighborhoods were fundamental to prehispanic Maya community life. Some point to specific kinds of focal architecture in the form of elite residences or oratories or shrines (e.g., Hare and Masson 2012). Others note discontinuous distributions of settlement such as the residential clustering produced by topographic features (e.g., Arnauld et al. 2012). Some seek out neighborhoods by performing nearest-neighbor analyses (e.g., Richards-Rissetto and Landau 2014) while others closely scrutinize documentary sources (e.g., Okashi-Harada 2012).

By itself this diversity of approaches in Maya neighborhood studies is not a problem. But problems do arise when similar neighborhood forms cannot be identified across different ancient communities or when the workings of neighborhoods either cannot be determined or appear to have varied quite considerably. It is important to realize that these problems arise not because Maya archaeology's data sets are opaque. Ethnographers throughout Mesoamerica have foundered in similar ways over similar terrain. Their neighborhoods are many and

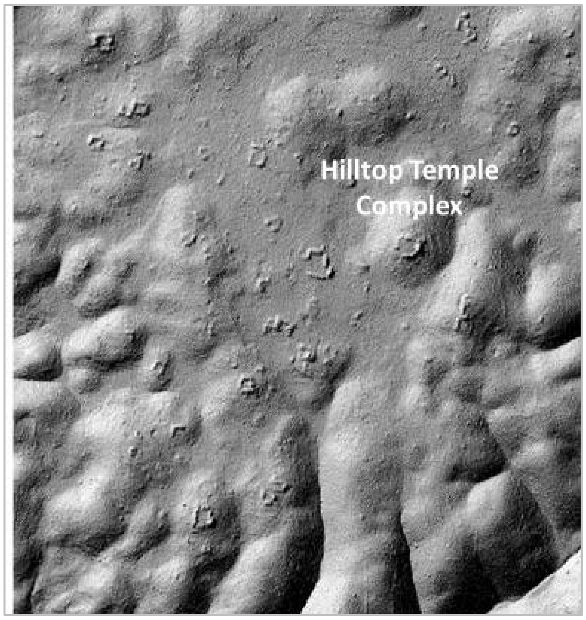

Figure 4. Ward 2's Hilltop Temple Complex.

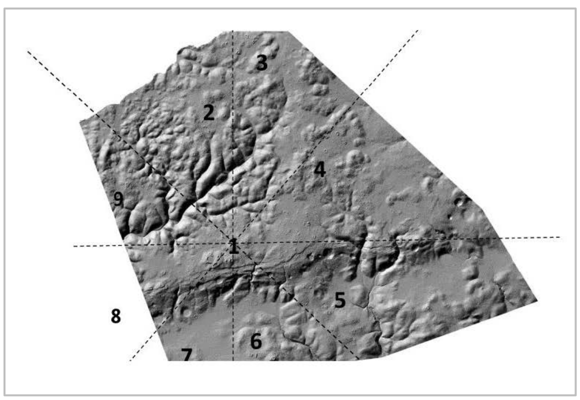

Figure 5. Wari Camp's Ward Structure.

varied and would seem to defy categorization. In a telling remark, Eileen Mulhare (1996) suggested that the core of the neighborhood problem in Mesoamerican ethnology was the Mesoamerican community. There is an incontrovertible logic here that is equally relevant to archaeology. How can ancient Maya neighborhoods possibly be understood absent an understanding of their broader community contexts?

The Neighborhoods of Wari Camp

In the paragraphs that follow, Wari Camp's neighborhoods will be described from the ground up. The process starts with an enumeration of the material traces of neighborhood affiliation. Since current LiDAR imagery lacks sufficient resolution for many important material traces, this discussion primarily references data gathered during pedestrian surveys that spanned four of Wari Camp's nine wards. Next to be addressed is how distinctive kinds of neighborhoods were assembled out of material differences. The picture of neighborhood variation that develops is framed against the backdrop of the wider Wari Camp community. Finally, the experiential dimension of neighborhood life also will be considered. Unfortunately, this issue cannot be treated with the depth and detail it deserves. More data is needed, especially excavation data. Bear in mind, however, that one of the principal objectives of ongoing research at the site is to understand what it meant to belong to one or another kind of neighborhood. The synthesis presented here represents a small step toward that goal.

Material Traces

Being a member of one of Wari Camp's neighborhoods activated an array of material engagements, many of which can still be detected today. People's neighborhood affiliations were realized through 1) the kinds of residential units they constructed, 2) the placement of their homes, 3) the disposition of their household items, 4) expressions of neighborhood leadership, 6) the actions of ritual specialists, and 5) neighborhood boundary marking behavior. Each of these will be considered separately, below.

Residential Arrangements. The affiliative indicators that distinguished kinds of residential units at Wari Camp – plazas, basal platforms, abutments, and walls – simultaneously served as the building blocks for different kinds of neighborhoods. That is to say, certain affiliative indicators were more prevalent in the residential units from some neighborhoods and less prevalent or completely absent from others.

Placement of Residences. A neighborhood affiliation often coincided with specific ecological affiliations, as well. Ruggedness of terrain, soil development, and patterns of inundation appear to have been particularly important in this regard. Nevertheless, slope, soil quality, and water retention did not dictate where homes could be built. Instead, membership in a neighborhood established the likelihood that some ecological circumstances would be more consequential to residence than others.

Disposition of Household Items. With an expanding body of excavation data, it is becoming increasingly apparent that neighborhood practices had a profound impact on artifact inventories. One startling finding pertains to the locations of domestic refuse. In some neighborhoods, refuse was allowed to accumulate in middens and was regularly incorporated into building construction. In others, barely a trace can be found. These latter instances suggest that refuse could travel some distance from its neighborhood of origin.

Expressions of Leadership. The existence of Wari Camp's neighborhoods came to light when it was recognized that an unusual type of residence – the Composite Group – was distributed in pairs across the survey area. The use of multiple kinds affiliative indicators in their construction suggests how important it must have been to mark inclusion into (as well as exclusion from) this kind of group. That alone might be sufficient to argue that their members occupied leadership positions in their respective neighborhoods. However, Composite Groups manifest other expressions of economic and political prominence. For example, they were volumetrically the largest residential units in their neighborhoods by more than a factor of two. In addition, many also were shrine groups with temples on their eastern or northern margins. These particular Composite Groups were home to some of Wari Camps most notable ritual practitioners who oversaw year-end and katun-ending rites (Levi et al. 2019). Their residences were aligned cardinally or inter-cardinally with hilltop temples, stela, other Composite Groups, or significant landforms. They marked the boundaries of wards or of the community as a whole. Six of these groups have been identified, each in a different neighborhood (Table 1), but others are known elsewhere from LiDAR.

Ritual Specialists. There were other important ritual practitioners across the Wari Camp community whose presence can be discerned from the fact that their residences also were distinguished by temple architecture. Many of these shrine groups overlooked Wari Camp's roadways. Others were aligned with the hilltop temple complexes of their respective wards. All had neighborhood affiliations but not all neighborhoods had shrine groups.

Neighborhood Boundary Marking. Initially, boundaries placed around neighborhoods were approximations only and were set by the distributions of Composite Group pairs. As a result, proximity to Composite Group pairs became the measure most frequently used to allocate other residential units into one or another neighborhood. As the analysis progressed, however, it became apparent that, in some instances, households at the margins of neighborhoods had engaged in boundary marking behavior by erecting house lot walls. More recently, close scrutiny of LiDAR suggests the presence of low-relief terrain modifications that may well have served as house lot and neighborhood boundaries.

Assembling Neighborhood Variation

Following Mulhare's recommendation, discussion of variation among Wari Camp's neighborhoods begins with the larger community as it appeared at the start of the Late Classic when it had reached its broadest areal extent. Community members at that time were distributed strategically across the area in a series of administrative wards (Figure 5). The largest of these, centered on the monumental core, also housed the accoutrements and personnel of community-wide governance. The administrative nodes in Wari Camp's subsidiary wards were much less elaborate affairs, and their greatly reduced suites of monumental architecture suggest a comparable diminution in function. Ward boundaries were variously marked by cardinal and intercardinal alignments of hilltop temples, crossroad stelae, and/or Composite Groups in possession of temple pyramids. It cannot be overemphasized, therefore, that just as Composite Groups were key to neighborhood formation, many with temples also were instrumental in establishing Wari Camp's ward structure. Finally, each of the four wards that was subject to systematic pedestrian survey possessed two or more neighborhoods. In addition to the occupants of Composite Groups, neighborhoods included several affiliated households.

A distributional assessment of the

Table 1. Surveyed Neighborhoods at Wari Camp.

Neighborhood Identification	Neighborhood Type	Ward Affiliation	Number of Composite Groups	Number of Composite Groups with Temples on the East or North	Number of Other Shrine Groups	Total Number of Residential Groups (excluding Composite Groups)
1	1	1	2	0	0	16
7	1	4	2	0	1	29
8	1	6	2	0	0	19
10	1	2	2	1	3	8
2	2	1	2	1	0	4
4	2	4	2	0	1	15
5	2	4	2	1	0	15
3	3	1	2	1	0	10
6	3	4	2	0	1	12
9	3	6	2	0	0	9
11	3	2	2	1	0	9
12	3	2	2	0	0	3
13	3	2	2	1	2	3

Table 2. Chi Square Statistic Exploring Affiliative Mechanisms Displayed by Residential Units in relation to Neighborhood Type (Composite Groups Not Included). p-value: 0.016

Neighborhood Types	Affilliative Mechanisms Used in Residential Groups				Row Totals
	Abutments	Basal Platforms or Walls	Plaza	None	
1	8	12	19	33	72
2	8	4	6	16	34
3	16	1	14	15	46
Column Totals	32	17	39	34	152

Table 3. Chi Square Statistic Showing Correlations between Environmental Setting (Where Known) of All Construction according to Neighborhood Type (Composite Groups Included). p-value: 0.019

Neighborhood Types	Environmental Setting			Row Totals
	Areas Prone to Inundation	Hillslopes-Broken Canopied Forest	High Canopied Forest	
1	11	38	30	72
2	3	15	22	40
3	17	20	19	56
Column Totals	31	70	67	168

Table 4. Chi Square Statistic Showing Correlations between Neighborhood Affiliation and Shrine Group Association (Composite Groups Not Included). p-value: 0.000.

Neighborhood Types	Number of Shrine Groups			Row Totals
	None	One	Two or More	
1	35	29	8	72
2	0	19	15	34
3	12	31	3	46
Column Totals	47	79	26	152

material elements involved in the production of Wari Camp's neighborhood landscapes points to the existence of three distinct neighborhood types. Each is described, below.

Neighborhood Type 1. The Composite Groups in Type 1 neighborhoods possessed a rough North-South orientation and only one was also a shrine group (Ward 2, Neighborhood 10's northern Composite Group). In the adjoining residential settlement, walls and basal platforms were frequently used to signal affiliation in multi-structure residential units. Structure abutments, on the other hand, were statistically rare. Construction occurred most often in areas of thin soil development that today characterizes sloping terrain and broken canopied forest. This was the only neighborhood type where trash appears to have been systematically removed from residences. However, in all known instances, these neighborhoods abutted extensive tracts of farmland as indicated by the presence of relic field walls (in uplands) and channelized fields (in wetlands). It is possible, therefore, that domestic refuse was collected for composting. Finally, it was extremely rare for the denizens of Type 1 neighborhoods to have any kind of shrine group in their midst (Figure 6, Tables 1 through 4).

Neighborhood Type 2. Type 2 neighborhoods also were characterized by North-South trending Composite Group pairs. Two of these were shrine groups (the southern Composite Group in Ward 1, Neighborhood 2, and the northern Composite Group in Ward 4, Neighborhood 5). In the nearby residential settlement, walls were not used as affiliative indicators and, instead, households relied on a random mix of plazas, basal platforms, and abutments. There was a high probability that these households shared their neighborhoods with two or more shrine groups, and all neighborhood households were associated with at least one such group. Finally, all types of construction – from Composite Groups on down to the lowliest of houses – tended to cluster in the well-developed soils of today's high canopied forest (Figure 6, Tables 1 through 4).

Neighborhood Type 3. Type 3 neighborhoods possessed Composite Group pairs aligned along an East-West axis. Three were shrine groups (an eastern Composite Group in Ward 1, Neighborhood 3, another in Ward 2, Neighborhood 11, and a western Composite Group in Ward 2, Neighborhood 13). Overall, the occupants of multi-structure units in the adjoining residential settlement used only the plaza or a plaza-abutment combination to signal group affiliation. Households were most likely to have a single shrine group in their neighborhoods. In addition, most neighborhoods were located at the margins of seasonal wetlands (Figure 6, Tables 1 through 4).

The Neighborhood Experience

The neighborhood attributes under discussion here are quite disparate. The pairing of focal architecture and its variable cardinal alignment; a diverse array of environmental circumstances; the discontinuous distributions of both unusual ritual architecture as well as everyday residential forms. Taken together, these attributes don't seem to add up to any one thing in particular. Yet that probably is the key to Maya neighborhoods. They were not one thing, but many.

First and foremost, they were complex expressions of the interplay of space, time, and history. The pairing of architectural units is widely recognized as a critical building block of Maya civic-ceremonial precincts (e.g., Ashmore 1991; Houk 2015), and their cardinal orientations have been argued to underpin regimes of rulership. Only recently have investigators begun to detect paired groupings in the residential settlement outside of monumental precincts. In the case of Copan, these pairs all seem to share north-south orientations (Landau 2015). The empirical referents and general semantics underpinning cardinality have been treated thoroughly in many other contexts of ancient Maya life, but cardinality's associations with time, movement, and destiny are worth repeating (Keller 2009). These were the perennial concerns of polity building and to witness them at scales as small as the neighborhood is suggestive of the interpenetration of powers between center and periphery. No less important to the experience of neighborhoods, however, was the duality implied by Wari Camp's paired Composite Groups. Dual divisions as a community organizational scheme are widespread across Mesoamerica today (Hunt and Nash 1967). They may take the form of moieties, where each division is responsible for

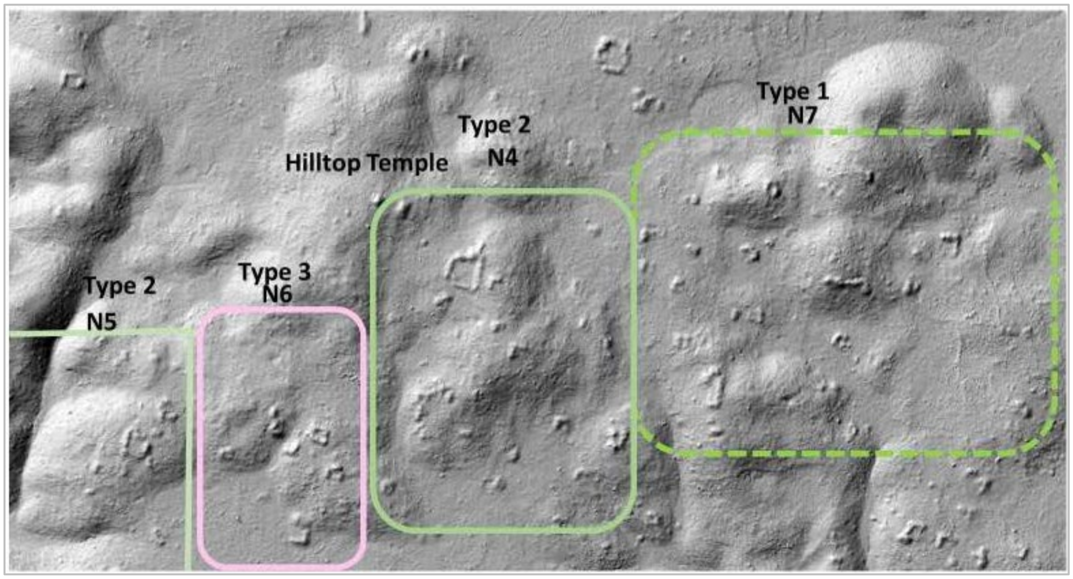

Figure 6. Ward 4's Neighborhoods.

populating offices in a community-wide cargo system (Sandstrom 1996). Or they may involve pairings of extended families, historically allied in relationships of ritual cooperation and mutual aid (Dow 1996). These examples point to two different but equally important postures in relation to the community, as a whole. One looks outward to the community and is more formal, more overtly specialized and ritualized. The other is inward-facing and more a part of daily life.

It is interesting to consider, therefore, how Wari Camp's neighborhoods may have fulfilled both kinds of functions. Some of the variation I have described relates specifically to the impact different kinds of neighborhood affiliations had on the day-to-day lives of their members. As is frequently observed in Mesoamerica today, different kinds of landforms require different agricultural inputs, and in the end, will have a decided influence on the organization of family labor, the presence of supra-family work groups, and the ways in which food and non-food resources are distributed across these units. Each of Wari Camp's neighborhoods had different ecological associations and each had clear differences in residential settlement. My expectation is that each also will have had different kinds of mechanisms for the distribution of productive resources, the organization of productive labor, and the fulfillment of tribute obligations (see Levi 2014).

Other aspects of neighborhood variation at Wari Camp were more directly tied to the role neighborhoods played within wards and in the wider community. I am referring specifically to the distributions of shrine groups. Living in neighborhoods with prominent ritual practitioners must have created a social context and a set of material and immaterial opportunities that differed substantially from life in neighborhoods that lacked such personages.

Concluding Comments

Clearly, there is still so much of value to be learned about Wari Camp's neighborhoods. However, from the foregoing it should be far more apparent why the study of neighborhoods in Lowland Maya archaeology, while exciting, remains such an uphill slog. First and foremost, it is unlikely that every ancient community had neighborhoods. This was surely the case with some of the hinterland communities distributed across the Programme for Belize property. But it may also have been the case at centers with ward structures comparable to Wari Camp's (e.g., Levi 2003). Second, if a community was organized into several neighborhoods, they did not have to look or function in exactly the same manner. We should anticipate that they all had both inward-facing and outward-looking aspects, and there may have been several underlying commonalities in function. But different neighborhoods also acquired different roles in historically contingent fashion. For example, the neighborhoods in Wari Camp's Ward 2 became far more prominent in community affairs as the fortunes of the ward improved dramatically during the Late Classic Period (Levi et al. 2018). Most important of all, the material practices of neighborhood members incorporated complex expressions of belief and value. While architecture has proven to be an important window onto this aspect of Wari Camp's neighborhood landscapes, there are still many more windows to open.

Notes:

[1] Temple architecture both within and outside of monumental precincts has been systematically looted at Wari Camp.

[2] Shrine groups with temples positioned along their eastern margins are known as Plaza Plan 2 Groups (PP2) in Becker's (1992) classification. As is true of Becker's PP2 units, a majority of Wari Camp's shrine groups incorporated a residential function. Becker (2003) argued that the residents of PP2 groups were crafters. I would suggest that at Wari Camp the majority were, first and foremost, ritual specialists.

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40 CONTEXTUALIZING HUMAN REMAINS IN THE THREE RIVERS REGION OF BELIZE

Angelina J. Locker and Stacy M. Drake

Approximately 150 human burials have been reported from excavations at 12 prehistoric Maya sites located within the Programme for Belize Archaeological Project (PfBAP). Of these, 115 are documented from residential settings. This dispersed sample of burials from varied Maya communities provides a unique perspective of scale, allowing for an assessment of household, community, and regional practices and customs, mortuary contexts, and cultural continuity. As a uniquely sustained research program, the PfBAP allows for inherently rich bioarchaeological research. This paper provides a brief overview of past work on human remains by PfBAP researchers, addresses recent and ongoing studies in the area, and assesses how bioarchaeological investigations can help to illuminate regional and temporal patterning among ancient Maya individuals from northwest Belize. Finally, we offer insight into the possibilities for future lines of inquiry involving this burial population.

Introduction

Studying human remains provides a multiscalar approach to investigations of past civilizations. Indeed, bioarchaeological studies illuminate ancient lifeways at individual, household, community, and regional levels. Historically, Maya archaeologists have prioritized investigations of elite site-cores and ritual centers, thereby limiting mortuary data of the ancient Maya to these same contexts and, consequently, Maya bioarchaeological studies (Wrobel 2014). Importantly, archaeological excavations through the Programme for Belize Archaeological Project (PfBAP) highlight smaller community sites and areas surrounding elite site-centers. Thus, burial data from non-elite contexts is robust within this regional research project. This shift in excavation focus has helped to improve overall sampling bias, allowing researchers to consider lifeways of ordinary Maya individuals. While the overall PfBAP mortuary database is still relatively small, ongoing excavations of northwest Belize continuously expand and diversify this data set, enabling an investigation of the many questions still surrounding everyday ancient Maya individuals.

The PfBAP Mortuary Universe

The following compilation of mortuary data was prepared using a multitude of publications and burial and site reports from 25 years' worth of excavations (for extensive compilations and summaries of these burials, please see Geller 2004 and Drake 2016). Of the 150 documented burials, detailed and comparative information is available for 123 individuals from 12 archaeological sites. Table 1 provides an overview of the PfBAP mortuary universe, listing the number of burials and minimum number of individuals (MNI) by site and general site type (based on Bullard 1960). The demographic breakdown for these 123 individuals is as follows:

Age at death: Age at death estimates were provided for a total of 115 individuals (Figure 1). Only 24 individuals are estimated to be subadults (defined as aged 18 years or younger), while the remaining 94 individuals are estimated as adults (aged 19 years and older). Overall, nearly half of the individuals (n=56) were young adults at the time of death (aged 19-35 years).

Biological sex: Osteological estimations of biological sex are noted for 73 of the 94 adult individuals (Figure 2). Forty-eight of these individuals are estimated to be male or possibly male, while the remaining 25 individuals are estimated to be female or possibly female.

Burials are most commonly encountered as simple, primary interments. Individuals are commonly placed in flexed positions, laying on the left side of the body (Geller 2004, 2011a, 2011b, 2012; Drake 2016). Additional overall patterns show that burials are most often oriented north to south with heads typically placed at the southern extent of the grave. Nearly 20% of all individuals from the PfBAP mortuary universe exhibited each of the six common interment characteristics: simple graves of single individuals placed in a flexed position on the left side with the body positioned north-south and

Table 1: Overview of mortuary data from ancient Maya sites located within the RBCMA.

Maya Period		Period Dates	Site Name	Site Type	Number of Burials	MNI
Preclassic	Middle	1000-400 BC	Medicinal Trail	Household	0	0
	Late	400 BC - AD 250	Medicinal Trail	Household	3	3
			Dos Barbaras	Minor Center	2	2
			Guijarral	Minor Center	0	0
			El Intruso / Gateway	Minor Center	0	0
			Dos Hombres	Major Center	2	9
			La Milpa	Major Center	4	5
Classic	Early	AD 250-600	Barba group	Household	1	1
			Medicinal Trail	Household	2	2
			Dos Barbaras	Minor Center	2	3
			El Intruso / Gateway	Minor Center	2	2
			Guijarral	Minor Center	0	0
			Las Abejas	Minor Center	0	0
			Dos Hombres	Major Center	1	2
			La Milpa	Major Center	2	2
	Late / Terminal	AD 600-800 / AD800-900	Barba group	Household	2	2
			Liwy Group	Household	1	1
			Medicinal Trail	Household	3	3
			Chawak But'o'ob	Minor Center	4	5
			Dos Barbaras	Minor Center	8	11
			El Intruso / Gateway	Minor Center	10	11
			Guijarral	Minor Center	5	5
			La Caldera	Minor Center	6	8
			Las Abejas	Minor Center	1	2
			Say Kah	Minor Center	4	4
			Dos Hombres	Major Center	15	18
			La Milpa	Major Center	15	16
Postclassic		AD 900-1502	La Milpa	Major Center	0	0
Unknown time period			Barba group	Household	1	1
			Medicinal Trail	Household	1	1
			Dos Barbaras	Minor Center	1	1
			Dos Hombres	Major Center	2	3
Total Burial and Individual counts					**100**	**123**

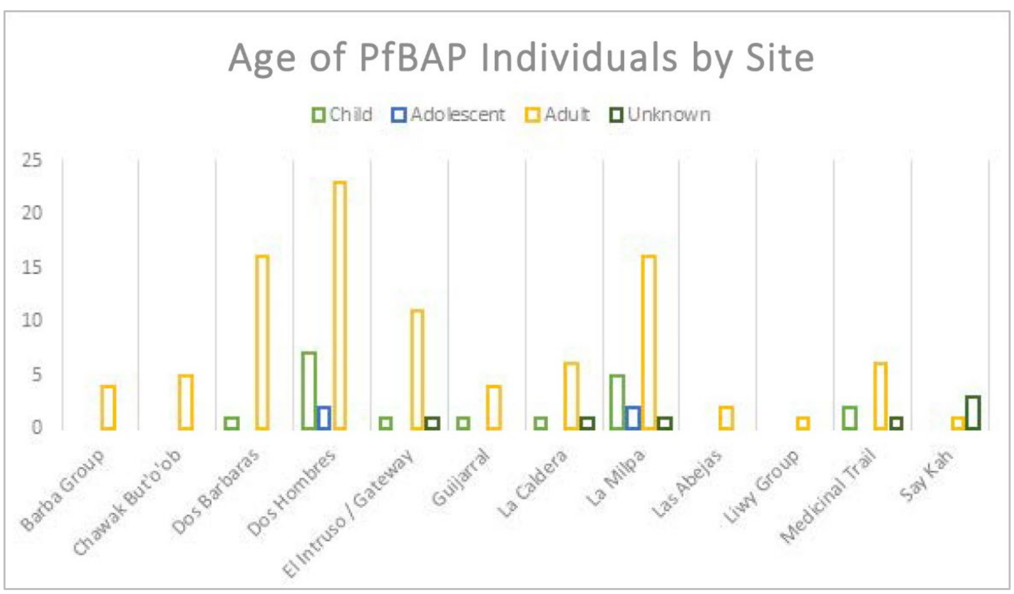

Figure 1: Age at death estimates for 115 individuals from the PfBAP. Individuals are broken down by age group and by site.

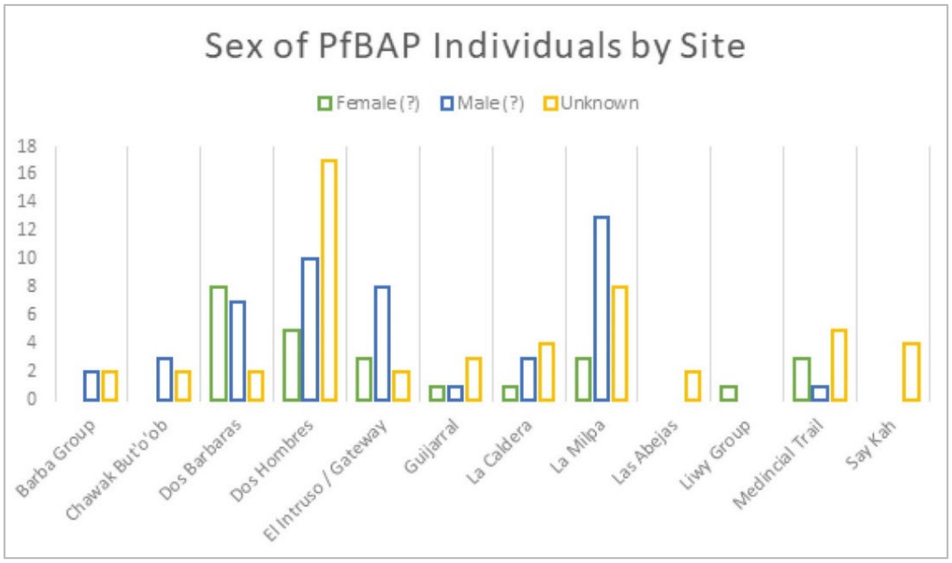

Figure 2: Osteological sex for 94 adult individuals from the PfBAP. Individuals are broken down by sex and by site.

head oriented south. Additionally, these general trends in mortuary treatment appear to transcend time, and are relatively consistent regardless of site, site type, or age and sex of the decedents (Drake 2016). The composition of such regional-based studies from northwest Belize and other regions of the Maya world illustrates that while the Maya did not practice a single mortuary tradition, possible preferences and significance can be identified by looking at small yet diverse datasets (Thompson 2005).

PfBAP Health and Disease

Bioarchaeological investigations of ancient health and disease rely on visual and molecular assessments of human remains, which are often inhibited by poor preservation conditions typical of northwestern Belize. Perhaps in part due to these poor conditions, investigations into ancient health and disease in the region is lacking. While occasional observations of pathological and traumatic conditions are documented for individuals within the mortuary universe, population-wide, regional assessments of community health are yet to be explored. Riegert (2018) begins to lay a foundation for regional assessments of ancient Maya health throughout in northern Belize by assessing geographic and temporal trends in linear enamel hypoplasia (LEH).

Horizontal disruptions of enamel deposition observed on teeth, described as LEH, serve as indications of stress experienced by the individual during childhood. The amount and location of lines within the enamel of certain teeth signal the severity and frequency of the insult and the age at which the insult occurred (Goodman and Armelagos 1985). Causative factors of LEH include various physical stressors such as disease or trauma, but can also include periods of malnutrition, hormonal changes, and psychological stress (*ibid*, Kreshover & Clough 1953, Pinborg 1970). By comparing temporal rates of LEH encountered at one large coastal occupation site (Colha) and two large inland sites (Dos Hombres and La Milpa, both investigated by the PfBAP), Riegert's analysis achieved two main goals:

1. To document the prevalence of LEH among individuals recovered from these three sites and develop a standard for LEH identification and data collection for future analyses, and;
2. To apply theories of societal or environmental change as possible influential factors into observed temporal trends in LEH prevalence.

Riegert found that rates of LEH are relatively consistent throughout populations of Colha, La Milpa, and Dos Hombres. Despite expected differences in daily diet and resource accessibility between inland and coastal sites, roughly 40-50% of each population exhibited

LEH. While geographic factors do not appear to have impacted LEH rates of these ancient Maya sites, Riegert did note a possible temporal influence. Comparing LEH prevalence rates at the three sites between the Preclassic, Classic (including Early and Late phases), and Terminal Classic periods, Riegert demonstrated a declining trend of LEH in individuals from the Preclassic to the Terminal Classic. Consistent with observations made for the Pasion region of Guatemala (Wright 1997), Riegert suggests these trends may correspond with population growth and decline during these periods. Sites in northern Belize experienced pronounced population growth and densification during the Early and Late Classic, with drastic population decline occurring in the Terminal Classic. Riegert, suggests that rates of LEH may mimic population densities: as occupation at sites expands and communities become more densely populated, byproducts of this stress are recorded in the body as increasing rates of LEH, but LEH prevalence decreases as people begin moving out of the region. As the first study of its kind involving the PfBAP mortuary universe, Riegert's research and data standardization set a framework for future studies into health and disease processes among populations of PfBAP sites.

PfBAP Individual and Group Identity

Within mortuary contexts, identity is derived from interpretations of body modifications, grave goods, ritualistic remains, and the built environment made visible through archaeological examination (Geller 2012b). While several categories relate to identity, here, we limit our discussion to gender, modifications, and ancestral veneration.

Symbols of Gender

Trachman and Valdez (2006) examine ancient Maya practices of engendering children as a means of social reproduction to help construct and organize social identities. These identities, they argue, are created, strengthened, and manipulated by establishing arrangements of domestic labor, sex, gender, and procreation. As indicated above, approximately 21% (n = 24) of the burial population are sub-adults. Trachman and Valdez (*ibid*) examined five of these children. Three sets of multiple burials were excavated between two Late-Classic structures at the Dancer Household Group, located 1.75 kilometers from the Dos Hombres ball court in the site center. One child was from burial episode 1, which dates to the Late Classic (AD 550/600 – 800). The remaining four were uncovered from episode 3, dating to the Late Preclassic (400 BC – AD 250). Both burial episodes were associated with drilled marine shell artifacts, which Trachman and Valdez suggest represent gender symbols that would have been worn around a young girl's waist or sewn directly to clothing (*ibid*: 86-90).

The association of shell ornaments with children has been identified throughout the Maya world. Trachman and Valdez (*ibid*) compare their data to child burials excavated from Cuello and Yaxuna, which are also associated with marine shell artifacts. The authors suggest this indicates a Maya tradition of using marine shells as a marker for a female gender in children, a practice that dates from the Preclassic through the Terminal Classic. These types of pelvic pendants are seen within ancient Maya iconography--the San Bartolo murals--and within Maya ethnohistoric data--Diego de Landa's *Relación de las Cosas de Yucatán*. Furthermore, they recount the use of a marine shell pelvic pendant on a single adult male from the Cuello burial population, and suggest it may have been used to identify a female gender for a biologically sexed male individual, acknowledging a possible third gender category for the community (*ibid*).

While some studies exist for the broader Maya (see for example Chase et al. 2008; Danforth et al. 1997; White 2005), gender identities remain understudied in the PfBAP mortuary sample. This line of research offers great potential for future scholars to complete a regional analysis of gender and compare it to external findings. An in-depth analysis of the remaining nineteen identified children should be completed, as well as an assessment of marine shell burial goods that have been associated with a pelvic provenience. We find the prospect of a potential third gender highly intriguing and recommend further inquiry into this avenue of research. Furthermore, an examination of

Table 2: Occurrence of shaped crania at centers from the PfBAP. From Geller (2011a).

Type of Cranial Shaping	Total (n=25)	% of total
Absent	4	16
Present	21	84
Unintentional occipital flattening	4	16
Unintentional postcoronal depression	1	4
Tabular erect	5	20
Possible tabular erect	1	4
Tabular oblique	2	8
Possible tabular oblique	0	0
Possible tabular	5	20
Possible cranial shaping	3	12

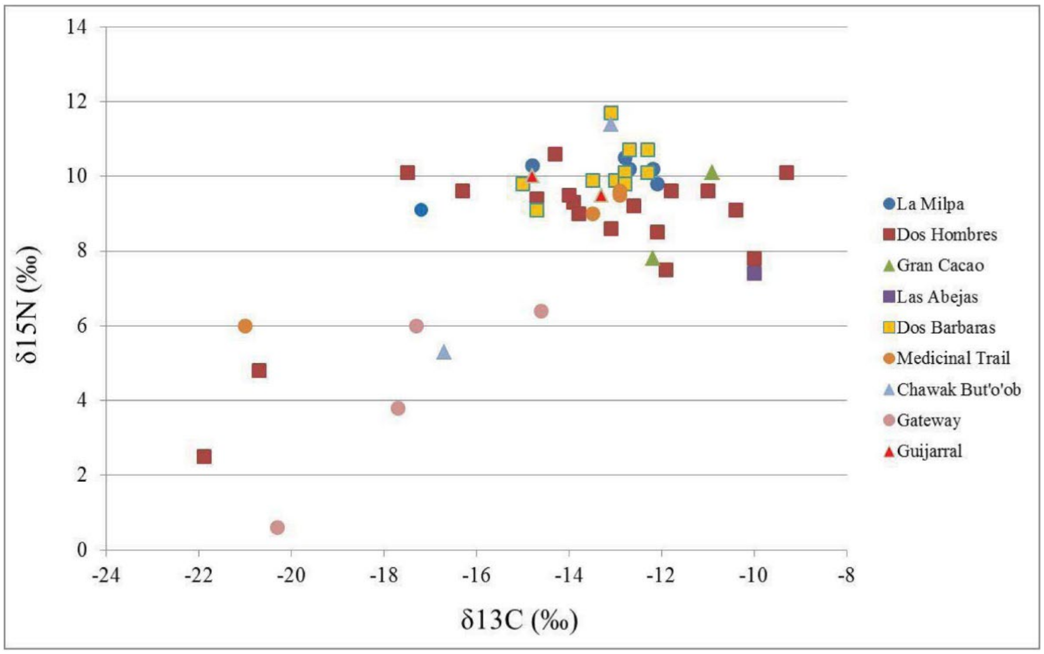

Figure 3: Range of Nitrogen and Carbon isotope delta values for the sampled PfBAP burial population. From Knisely (2013).

possible male gender markers will also be fruitful.

Cranial and Bodily Modification

Cranial modification was widely practiced by the ancient Maya and has been documented throughout ancient Maya history. Intentional shaping of the skull may have been used as a marker for gender, ethnicity, and/or regional and local identities (Geller 2011a). Of the full PfBAP burial sample, only 25 individuals provide an opportunity to examine cranial modification. Of these, 21 show cranial shaping; 16 have intentional modifications (Table 2), and all of them date to the Classic period (AD 250 – 900 (Geller 2011a). There are two main ways of modifying crania: (1) tabular, which consists of securing tablets to the head, and (2) annular, which consists of wrapping the head with bands. In the PfBAP region, tabular was the method of choice for modification. Since no individuals show annular shaping, it is likely that individuals within the region shared a shaping preference.

For the Maya more broadly, social status and biological sex do not appear to have influenced who had the ability to participate in cranial modification. However, in the PfBAP, while cranial modification is indeed found for both sexes, Geller (2011a) notes males have a higher propensity for cranial modifications than females. Indeed, males make up approximately 69% (n=11) of the individuals who show cranial shaping. Conversely, there does not appear to be a correlation between cranial shaping, socioeconomic status, and/or additional types of bodily modifications (e.g. dental filing or inlays).

Recognizing that this sample size is severely limited, we do think the examination of bodily modification holds much promise. The use of skulls is more limited, as many individuals do not have complete skulls or are missing their skulls entirely; however, an investigation of dental modification would also be useful. To assess how modification interplays with a more regional system, combining investigations of bodily shaping with research questions centered around gender, ancestral veneration, and kinship practices might be particularly beneficial.

Ancestral Veneration

The ancient Maya practiced ancestral veneration through texts depicting their ancestors, the display of skeletal remains, the reoccupation of ancestral households, and the interment of their dead in tombs and within the floors, walls, and courtyards of their households (McAnany 2013; Geller 2004, 2012a, 2012b). Furthermore, ancestors were often used to legitimize positions of power and authority within communities, create social identities of communities and individuals, and grant privileges to spaces and resources based on inheritability (McAnany 2013). Because 150 individuals have been recovered, researchers have been able to explore the construction of identities and ancestral veneration within individuals (Geller 2012a; Locker 2020), within and across households and communities (Geller 2012b; Hageman 2004; Locker 2020; Trachman and Valdez 2006), and regionally (Geller 2004).

Each person brings with themselves a unique identity; bioarchaeological research allows us to explore subtle nuances between individuals through an in-depth analysis of individual life histories. We agree with Geller (2012a; 2012b) that a humanistic analysis of those who inhabited ancient landscapes is vital to our understanding the mosaic of individual identities that would have filled these spaces. Nevertheless, we recognize that we have the ability to examine broader societal and regional underpinnings, such as the importance of ancestors to the Maya. Ancestral veneration was originally thought to be a practice limited to more elite contexts. In the PfBAP, 14% of the burial population were identified as ancestors through their interment within benches, often located in the main dwelling of a household, opposite the doorway. These structures marked the sitting/sleeping areas of ancestors and are thus prominent places for burials and cremations. Interring ancestors within benches, floors, and walls helps position lineage and longevity within household spaces (Gillespie 2000).

Importantly, ancestral veneration in the PfBAP was not limited to specific socioeconomic classes and can be seen across varying scales of households and communities (Geller 2012b). Additionally, Geller (2012b; 2014) and Locker (2020) point to instances of body partibility, where ancient Maya descendants removed pieces of their ancestors to rebury in new spaces as a means of creating generational kinship continuities. This type of continuity had the ability to link families to space and place and to legitimize positions of power within communities (Geller 2012b, 2014; Gillespie 2000; Locker 2020; McAnany 2013).

However, while ancestors and ancestral veneration are not particularly uncommon in the PfBAP region, it is important to note that they may be distinguished differently. There are two possible groupings for ancestors: *ordinary* ancestors who act as genealogical links for, perhaps, kin groups; and *original* ancestors who mostly likely represent noble or elite predecessors who are celebrated across various kin groups (Geller 2012b; Locker 2020). These subtleties are observed in the variances of ancestors and veneration practices throughout the region, where interred ancestors and veneration of those ancestors differs slightly individual by individual, household by household, community by community. These subtle differences allow us to examine particularities of how the living regarded, interacted with, and perhaps identified (with) their predecessors (Geller 2012a; 2012b; Locker 2020). Understanding that these variances are reflected in more personal and intimate ways allows for an examination of individual life histories, social memory, and place-making practices within a regional narrative. This then allows us to shed light on broader Maya cultural traditions, giving space for commoner narratives and practices that have been overshadowed by a focus on elite burials and traditions (Wrobel 2014).

PfBAP Bioarchaeological Isotopic Studies

Dietary Studies

Building upon established foundations, bioarchaeological research within the PfBAP is now also situated within biogeochemistry and genomics research. Denise Knisley (2013) explored PfBAP household, community, and regional dietary practices and food accessibility via carbon and nitrogen isotopic analyses. Knisely selected 82 individuals encompassing nine sites—La Milpa, Dos Hombres, Gran Cacao, Las Abejas, Dos Barbaras, Medicinal Trail, Chawak But'o'ob, the Gateway Site, and Guijarral. With the primary goal of assessing whether a regional diet existed for the PfBAP, Knisely sought to examine whether dietary differences existed between communities within the region or if differences might be related to other factors (e.g. migration, socioeconomic status, age, sex, etc.). In a research region full of varying micro-environments, understanding dietary practices can illuminate patterns of accessibility, trade and exchange, mobility, resilience, and adaptation to changing environmental conditions.

Generally, because plants differ in their photosynthetic pathways, carbon isotopes can be used to assess the types of plants individuals consumed, where C3 plants, and more negative carbon delta values, are often identified as trees and shrubs. Conversely, C4 plants, and more positive carbon delta values, are recognized as sedges and grasses (including maize, millet, and sorghum) (Knisely 2013; Wright et al. 2010). Nitrogen isotopes are used to examine differences in protein consumption and sources, where more positive nitrogen delta values are correlated to marine food source or excessive meat consumption, and lower nitrogen delta values to freshwater mollusks and terrestrial animals or minimal meat consumption (Knisely 2013; Wright et al. 2010). Furthermore, it has been noted, that while some differences exist in the amounts of meat consumption between elites and non-elites, this is generally limited to a select number of sites and is not representative of the Maya as a whole (Wright et al. 2010). Thus, variances in nitrogen delta values most likely reflect differences in the types and amounts of protein sources, but are not reliable indicators for the socioeconomic status of an individual.

Of the selected 82 individuals in Knisley's study, 49 yielded C:N ratios that showed no diagenetic alteration from the burial environment. An assessment of carbon isotope delta values showed no significant statistical difference between sites, indicating that the plant material composing much of the ancient Maya diet from the PfBAP was similar across communities, regardless of geographical location on the property, and regardless of individual socioeconomic status, age, or biological sex. However, nitrogen isotope delta values do indicate variability. Differences in protein sources occur between sites, where individuals at the Gateway site and Chawak But'o'ob, consumed more legumes and less maize and meat than individuals from the other sampled sites. Socioeconomic status, age, and biological sex do not appear to play any role in variability in meat consumption across sites or individuals included in this research study.

In sum, Knisley's findings suggest that maize made up approximately half of plant-based foods and terrestrial herbivores comprised the bulk of meat protein. At least 19 of the 49 individuals (38%) do not adhere to regional dietary practices (Figure 3) and these differences may be attributed to "either personal preference or kin-based dietary habits" (Knisley 2013: 95). Knisley cautions that the sample size for her study may not provide the most robust statistical groupings and recommends additional sampling and analyses be completed to further investigate dietary patterns and anomalies.

There is a wide potential to continue dietary investigations within the PfBAP burial population and to explore whether these trends shift as the sample size increases or whether more subtle nuances arise between communities or micro-regions within the PfBAP. Additional isotope analyses should be completed to investigate whether Knisley's (2013) results are representative of the total PfBAP burial sample.

Understanding more about the nuances in diet may help to zero in on instances of migration, community based dietary practices, socioeconomic differences, accessibility, and food (in)securities where communities may have adapted their diets to accommodate resource availability or micro-environmental distinctions. Additionally, it will be useful to complete paleobotany (e.g. pollen, phytolith, starch-grain, and macrobotanical analyses), faunal, and ceramic residue analyses across each of the sites to assess regional plant usages. Coupling these with the isotope data will not only shed light on the types of plants and amount of animal protein typical for the region, but will also elaborate on food types and variation, methods of food processing and preparation, and whether different communities engaged in varying feasting practices or if foodways were shared regionally.

Mobility and Migration

In addition to answering questions regarding diet, isotopic research can also explore human mobility. Locker's (2020) research investigates regional and temporal processes of mobility among the ancient Maya from the PfBAP area, using geochemistry data. With the permission of past and present field and project directors, 49 individuals were selected from burial population from the sites of Dos Hombres, La Milpa, Dos Barbaras, the Gateway site, and Medicinal Trail for strontium and oxygen isotopic analyses.

Strontium (Sr) and oxygen (O) isotopes are incorporated into tooth and bone chemical structures through basic trophic cycling and consumption of local meteoric waters (Wright et al. 2010). The isotopic ratios from human bone and dental enamel can therefore be used as geographical tracers to identify non-local decedents. In other words, local individuals will exhibit tooth enamel isotopic composition consistent with the local isotopic ratio, while non-local individuals will exhibit enamel isotopic ratios that fall outside of the local isotopic range.

In order to identify non-local individuals within a population, local isotopic variability must be understood. To characterize the local variability for strontium isotope ratios, Locker (2020) analyzed 16 local limestone bedrock samples and 10 local soil samples randomly collected from across the PfBAP. Data indicate a singular, regional identified local, where Sr isotope ratios are shared across the region, regardless of geographic location. Strontium baseline values from the PfBAP area are distinct from published baseline values from other Maya sites, although some overlap exists between overall ranges of the PfBAP, Peten, and southernmost Yucatan areas.

For oxygen, the determination of local has proven to be much more complex. Typically, non-local individuals are identified through statistical means, and while the literature suggests populations do not generally carry more than a 2‰ (per mil) difference, groundwater data suggests a much larger variability within the PfBAP local range for O isotope ratios (Locker 2020). Non-local individuals have been identified within the burial population; however, non-local is not solely defined as long-distance. Intraregional migration is evident from local water sources, where individuals dependent upon continual water reservoirs (e.g. groundwaters) differ in isotope delta values than individuals dependent upon unstable sources (e.g. depressions).

Researchers hypothesized that migration was instrumental to regional population growth and settlement expansions in the Late Classic (Adams et al. 2004); Locker (2020) suggests that settlement expansion and growth is most likely attributed to a growing internal population, environmental changes, and political restructuring taking place during this time, not migration from external areas. Immigrants were undoubtedly an important part of the landscape and are visible within the mortuary universe. Further research is needed to broaden our understanding of how migration shifted through time, whether mobility was constant or sporadic, and whether immigrants were integrated into or segregated within communities. We suggest coupling isotopic investigations of migration with dietary inquiries (isotopic and botanical) to examine whether we can link immigrants, as identified through bone chemistry, to practices made visible within preserved archaeological remains. Furthermore, ancient DNA research is a burgeoning and very promising field of research and will be instrumental to assessing populational changes which may not be visible at the individual level.

Conclusion

The PfBAP mortuary universe offers a rich source for furthering our understanding of ancient Maya lifeways. We have the ability to investigate individual, community, and regional burial practices, health, ancestral veneration, diet, mobility, and kinship. Current research builds on the foundations of osteoarchaeological research completed by F. Saul, J. Saul, Martin, Geller, Drake, and many others. Trachman and Valdez (2006) initiated a great avenue for potential research with their investigation of childhood identity and gender at the site of Dos Hombres. While the PfBAP burial population consists predominantly of adults, an in-depth analysis of the subadult population would prove itself extremely beneficial to our understanding of the children from this landscape, life histories of ancient Maya children, and possible weaning practices of the ancient Maya. Likewise, paleopathology, disease, and trauma are other avenues for future inquiry and expansion, using Reigert's (2018) work as a foundation. Isotopic research is relatively new to the PfBAP and only exists for a small subset of the population. Future research should incorporate more individuals to strengthen statistical parameters and to gain a better understanding of regional diet, mobility, and population shifts. Analysis of the remaining individuals will strengthen current interpretations, clarify why variation exists, and allow us to examine how populations changed through time. These scientific inquiries can then be used to further address and advance our comprehension of ancestral veneration and individual life histories and identities. This will help to enhance our understandings of the various aspects of individual experiences as they intersected with one another and populated these ancient landscapes.

Much of what has been explored only scratches the surface and acts as a platform for which future investigation can continue to expand across a broad spectrum of bioarchaeological research. The PfBAP provides the opportunity to examine the ancient Maya who inhabited these landscapes at the individual, household, community, and regional levels. A continuation of bioarchaeological research with this sample population has the potential to strongly compliment other lines of archaeological inquiry. Paleopathology and isotope analyses coupled with paleobotany and ceramic residue analyses can shed light on foodways, feasting practices, resource availability, resilience, and risk-management. Molecular research and isotope studies can be coupled with geoarchaeological research to examine how populations adapted to environmental and climate changes. Osteological investigations of bodily wear coupled with settlement data and material remains might shed light on site function. We have the ability to examine the ancient Maya from the individual to regional scale, fine-tuning our interpretations and enabling a holistic understanding of the complexity of ancient Maya *people* and civilization. The potential for the PfBAP burial sample is vast, and we are only just beginning to explore the gamut for mortuary and bioarchaeological lines of inquiry.

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41 THE INCORPORATION OF NON-INVASIVE GEOPHYSICAL TECHNIQUES IN NORTHWEST BELIZE

Patricia Neuhoff-Malorzo and J.N Stanley

As archaeological programs call for conservation and preservation the ability to detect the buried features of the archaeological record and conduct targeted excavations have been in greater demand. This demand coupled with developments in equipment and computing power have led to an array of technological advancements making geophysical survey more affordable and reliable. Geophysical techniques have been utilized at a varying rate on the global scale with frequency and overall use dependent on the region in which they are utilized. Across the realm of the ancient Maya, a number of remote sensing techniques have been employed with increasing success. Using ground based remote sensing techniques, one such location currently being investigated is that of Tzak Naab in northwest Belize. This site has been the recent subject of both magnetometer and ground penetrating radar surveys with good results. While this information pertains to only one site, it portends great promise for future surveys. The Tzak Naab case study showcases that the ever-increasing inclusion of geophysical survey allows for more in-depth analysis and faster data collection providing a framework for examination of sites where little to no investigation has taken place.

Introduction

Geophysical survey has a long history with archaeology dating back to 1938 in Williamsburg, VA (Bevan 2000). The various techniques, that encompass the entirety of geophysical survey, utilize physical methods at the surface to measure physical properties or anomalies occurring in subsurface levels, enabling identification and mapping of buried features in a non-invasive way. The acquired data can be used in a variety of ways. Data can be utilized to compare patterns and spaces between and within sites. The information gathered can be used to identify individual activity areas or for the mapping of buried remains across a landscape or settlement. Geophysical survey results can also be utilized to target specific areas for excavation and preservation. More recently, remote sensing and geophysical techniques have seen a resurgence in archaeology, as more programs call for conservation and selection in excavation coupled with general developments in equipment and computing power (Gaffney et al. 2002). These developments have led to a wide array of inexpensive technological advances, all of which have made these non-invasive techniques more affordable and reliable for a wider scope of archaeological programs and efforts. The detection of anthropogenic changes and their distribution are utilized by archaeologists to determine boundaries, stratigraphy and stratigraphic relationships, identify activity areas and features, and contribute to archaeological interpretation (Holliday 2004).

All of these elements create identifiable patterns that can be found across the prehistoric landscape. They can range from intra-site settlement patterns and signatures (Lohse 2004) to organization of settlements (Yaeger and Robin 2004). Specifically, the components of these patterns include all of the anthropogenic creations and natural accumulations that make up the built environment. These aspects comprise both the visible and the invisible archaeological record.

For the ancient Maya, the visible record consists of but is not limited to human-made plazas, courtyards, stone structures, and any landscape modifications. These visible remains are easily identifiable for mapping, analysis, and interpretation. The invisible portions of the archaeological record, those that that are buried beneath the soil, require a different approach. In order to identify and map the human-made portions of the unseen or buried archaeological matrix, archaeologists turn to geophysical survey. Geophysical survey being those methods and associated devices that can measure the variable physical properties that make up site formation processes and have the capability to map and analyze subsurface archaeological features (Lockhart and Green 2006). Comprised of the physical methods conducted at the surface to measure anomalies existing in subsurface levels, geophysical survey enables both mapping and analysis of buried features in a non-invasive way, using the geophysical results to “help explain aspects of ancient cultures that can be known in no other way” (Aspinall et al. 2008:45).

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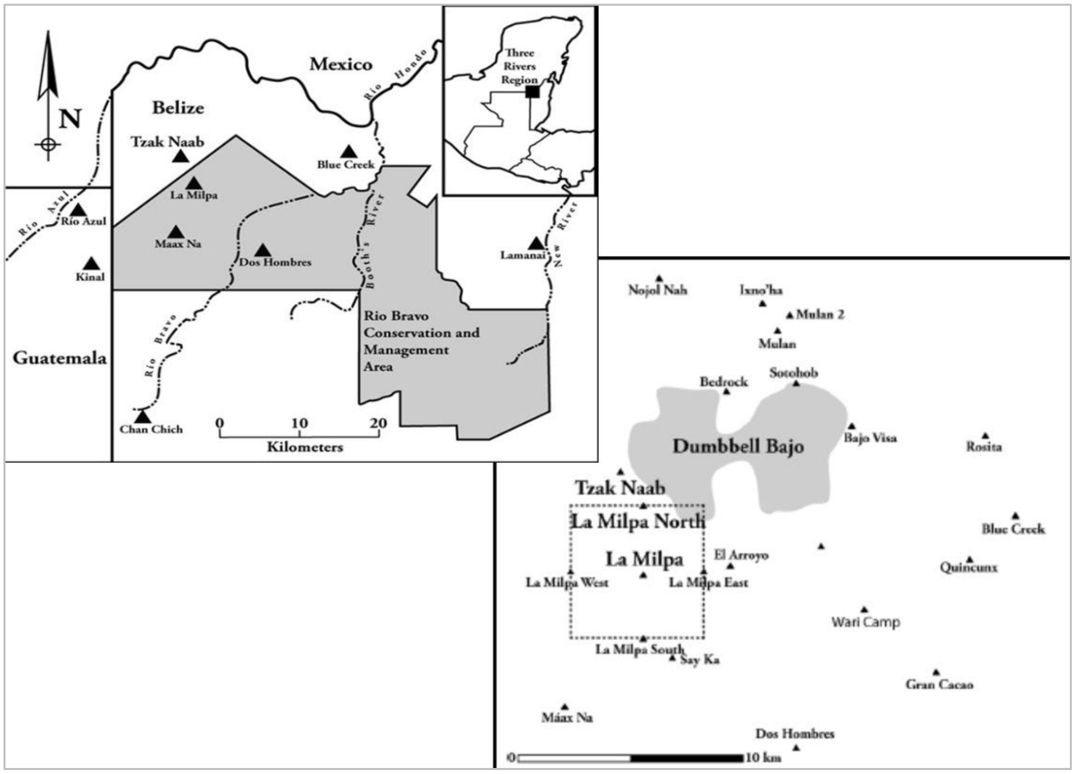

Figure 1. Map of major sites in NW Belize (top left), map of sites with relation to the Dumbbell Bajo (bottom right). RBCMA is indicated in grey (top left), Bajo indicated in grey (bottom right). Tzak Naab is identified for locational purposes.

Geophysical Survey

Geophysical techniques have been adopted and utilized at a varying rate globally in archaeology. Frequency and overall use of these non-invasive methodologies generally depends on the region in which they are employed. Analysis of the use of geophysics for archaeological research indicates that, while regularly employed across areas of Europe and the UK and used with increasing frequency in North American in the past fifteen years, these non-invasive methods have not been regularly employed in other regions. Increasing reliability in results and decreasing costs has led to the addition of remote sensing techniques and the data sets they can garner to more and more archaeological research programs. The addition of these datasets has enabled investigators to more fully evaluate the various attributes of past cultures (McKinnon and Haley 2017).

A number of remote sensing techniques have been employed with increasing success across the realm of the ancient Maya. While LiDAR (light detection and ranging) has been on the forefront in recent years and is responsible for the rediscovery of a number of ancient Maya sites, it can only reveal structural remains present on the surface. The integration of *ground based* remote sensing techniques into archaeological programs offer the ability to create detailed geospatial data sets of not only the visible surface remains but also those archaeological remains beneath the surface. Ground based geophysical survey efforts have been used with some success in different areas across the greater Maya landscape in Belize, and several techniques have been used in conjunction with research carried out in the northwest (Aitken and Stewart 2004a, 2004b; Aitken 2008; Daniels Jr 2014; Haley 2006; Keller 2012; LeCount et al. 2016; McAnany et al. 2004; Micheletti et al. 2016; Neuhoff-Malorzo 2022, in press-a, in press-b; Neuhoff-Malorzo and Stanley in press; Powis et al. 2017; Sweely 2005; Xu and Stewart 2002; Yaeger et al. 2009). The techniques utilized at these sites in the NW include magnetometry, ground penetrating radar, resistivity, and MASW (multi-channel analysis of surface waves – a

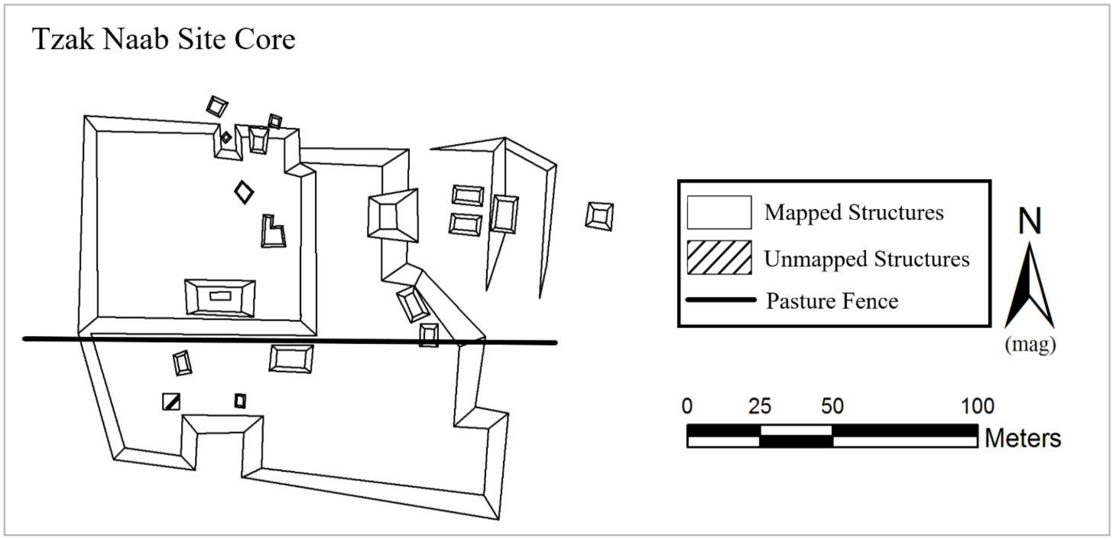

Figure 2. Map of Tzak Naab site core with pasture fence location indicated. Map adapted from Kotsoglou 2017, courtesy of PfBAP.

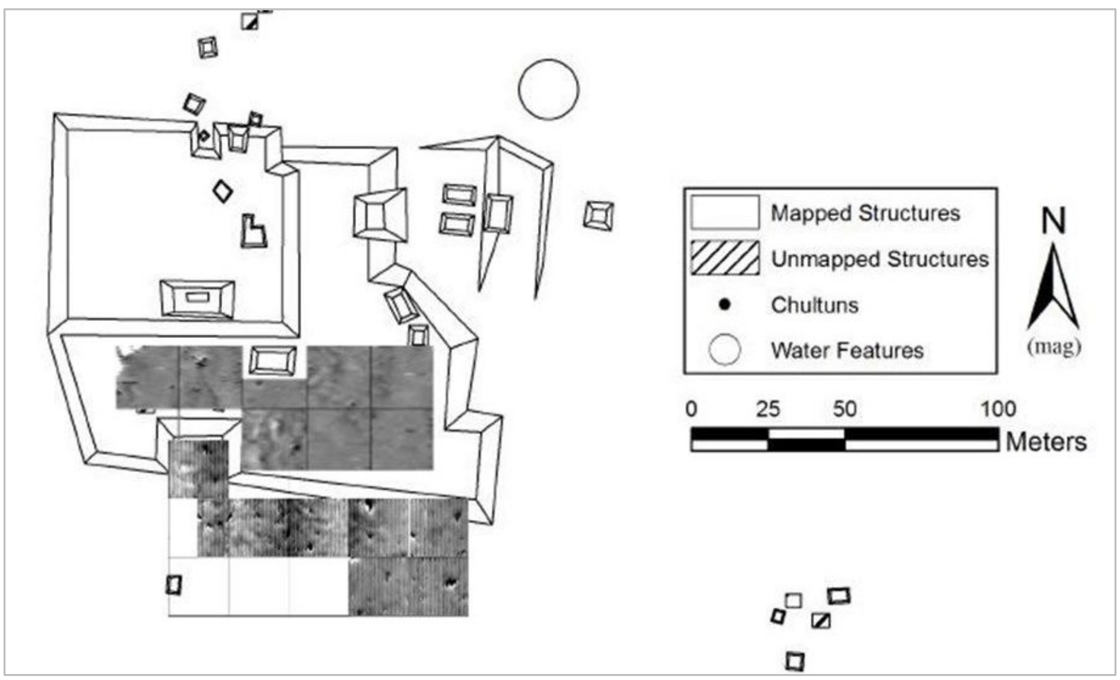

Figure 3. Map of Tzak Naab site core with magnetometer data overlay. Courtesy of PfBAP.

seismic survey technique). These techniques have been used to conduct non-invasive investigations at Chawak But'o'ob, La Milpa, Mulch'en Witz, and Tzak Naab. Single survey applications of resistivity and GPR have been conducted at La Milpa and Mulch'en Witz respectively. Complementary surveys of GPR and MASW have been used in conjunction at the site of Chawak But'o'ob, while Magnetometry and GPR have been used in concert at Tzak Naab.

Tzak Naab Case Study

One case study for the use of geophysical survey techniques is that of the non-invasive investigations conducted at the site of Tzak Naab (Figure 1). Tzak Naab sits just outside of the boundary of the Rio Bravo Conservation and Management Area in northwest Belize. It is situated roughly 6km north of the site of La Milpa and 3km northwest of La Milpa North. This site is located in a cleared area currently utilized for

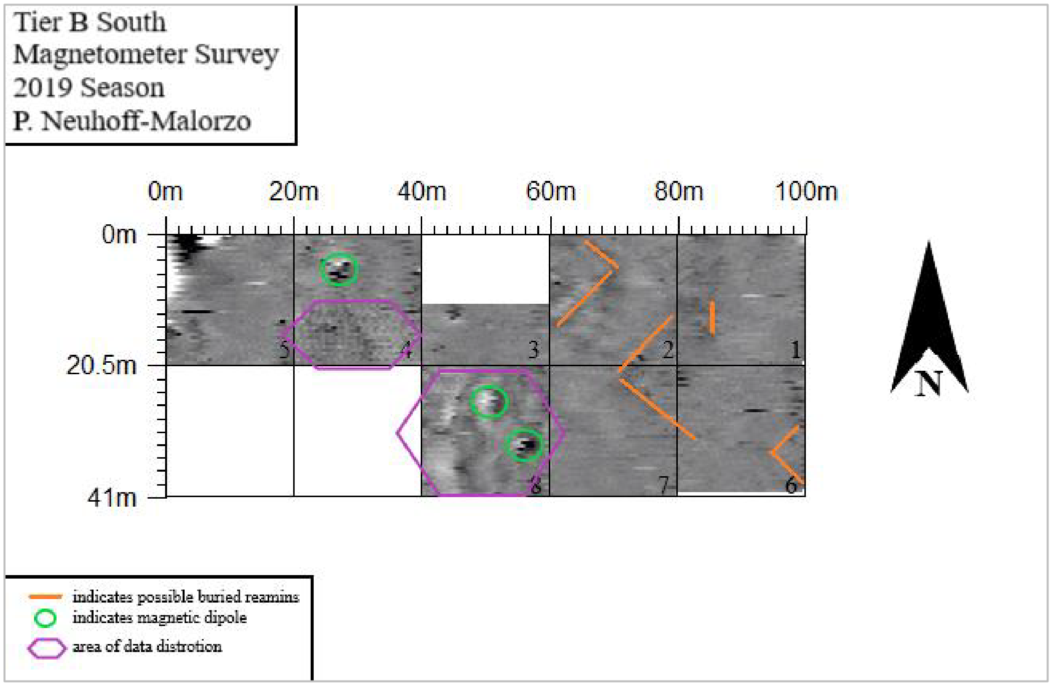

Figure 4. Annotated Magnetometer data for Tier B South.

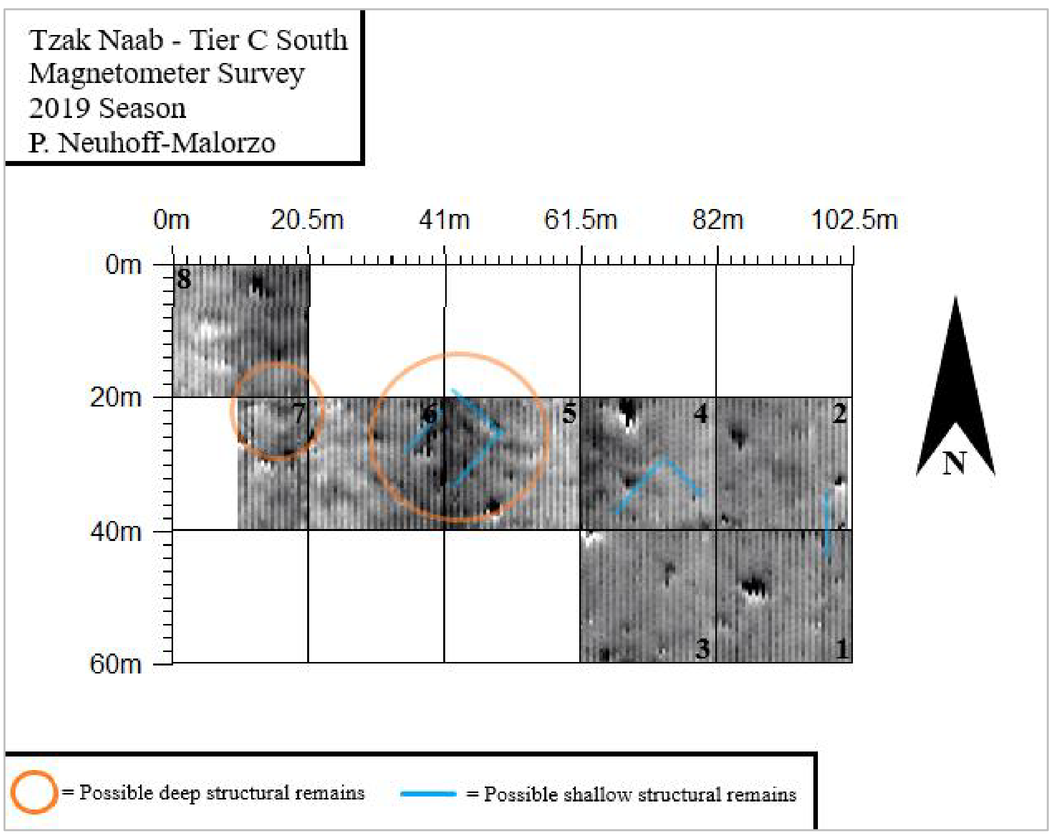

Figure 5. Annotated magnetometer data for Tier C South.

cattle ranching. It is set on a karstic hilltop and the surrounding expanse. The visible site core consists of three culturally modified tiers (Tiers A, B, and C) and the surrounding natural landscape (Tier D) (Figure 2). Tiers A and B are elevated approximately 2.5m in height per tier and are clearly humanly modified. Tier C has been modified to a certain extent but merges more organically into and up the hillside. Tier D, as stated above, is the surrounding non-modified natural landscape that flows into the adjacent bajo. The site overlooks and abuts the Dumbbell Bajo to the east. Visible structures exist on all three of the Maya created tiers as well as in the surrounding natural landscape. The observable site architecture indicates an east to west orientation, appearing to overlook the bajo to the east (Kotsoglou 2017, 2019). The site is divided by a barbed wire fence which runs east to west and stretches across the entirety of Tier B just south of Tier A structure A-1 (Figure 3). This site has been heavily looted. Each of the major structures of the site core has one to two looters trenches present. The only exception to this is Structure C-2, the only structure on any of the modified tiers without a looter's trench. The time period of habitation is currently defined as a Late/Terminal Classic. This site presented an opportunity for a large area, geophysical survey-based examination and analysis of a site due to its location and limited previous investigation. Since this site is located on privately held lands, with access rights obtained from the Colby Family and secured through Sunnyside Farms, there is no jungle cover present to prevent or hinder survey over large swaths of the site. There has been some excavation conducted in the northern pasture (Kotsoglou 2017, 2019) but none in the south. This work was restricted to the visible structural remains. Work completed in the southern pasture consisted of the mapping of some of the obvious surface structures. This surface mapping was the only investigative endeavor that had been conducted in this region of the settlement prior to the geophysical efforts which began in 2018. All geophysical prospection efforts are considered preliminary until further survey is conducted and where possible additional methods of investigation are employed for verification of the survey data in select areas. The techniques of magnetometry and ground penetrating radar were chosen for repeatability of the survey techniques and proven viability in the area. Both techniques were employed in order to generate complementary data sets to garner more detail of the buried remains.

Magnetometry

Initial geophysical survey efforts conducted during the 2018 field season focused on determining feasibility of the technique for the area. The 2019 field season focused on intensive survey and data acquisition. Geophysical data was collected for Tier B and Tier C south and supplemented with both intensive pedestrian survey and select area GPR survey. Eight 20x20m magnetometer grids were conducted across each tier and each set of grids was run twice to ensure data integrity. It is important to note that the some of the visible remains, across the entirety of the site of Tzak Naab, could have been affected by the clearing process employed to clear the area for farming and ranching purposes. Survey during the 2019 field season was conducted using the Geometrics G-858 cesium vapor magnetometer and processed using TerraSurveyor proprietary software. The survey grids on Tier B encompassed the entirety of Tier B south (Figure 4). One area indicated in the data was not surveyed due to safety hazards presented by the height and associated slope of the pile of remains present in that area. This area of heaped stones is indicated in the initial mapping data as structural remains, so the footprint of the structure base is assumed to correspond roughly to the rubble pile. More survey is needed to confirm results for the tier. The eastern edge of Tier C south was surveyed and extended across to the west along the northern conjunction of Tiers B and C (Figure 5). Future work plans include a re-survey of Tier B south and a complete survey of both Tier C and Tier D (eastern portion) in the southern pasture. Tier D survey will include the area from the fence line to the base of the slope which extends up the hillside into the eastern edge of Tier C. Future magnetometer surveys, for health and safety concerns due to heat, will use the Foerster Ferex 4.034 fluxgate magnetometer and processed using the Data2Line proprietary software.

Discussion: Magnetometer Data

There appear to be structural footprints visible in the Tier B data (Figure 4) that do not correspond with the visible surface structural remains. This discrepancy is most likely caused by the clearing methods used and is an expected variable. The remains in the north pasture are oriented with the walls of the structures corresponding to the cardinal directions. The orientation of the possible remains in the southern pasture, visible in the geophysical data, indicate both structures with walls oriented along the cardinal directions as well as structures with offset walls where the corners of structures are positioned on the cardinal points. Data gathered from Tier C indicates possible circular shaped remains and other remains which seem to extend under the human-made construction that is Tier B (Figure 5). This would indicate that remains present on Tier C predate the remains in both Tier B and Tier A entirely. All survey will be redone in future seasons and if possible, confirmation by targeted area excavation will be conducted. If the circular remains indicated by the 2019 magnetometry data are present in future seasons surveys and/or are identified through excavation, then earlier occupation would be confirmed, expanding the occupational history for the site.

Ground Penetrating Radar

GPR survey at Tzak Naab was a targeted area survey run to complement and supplement the data garnered from the magnetometer surveys. Grids for this survey were set across the area encompassing the two chultuns initially identified during the 2018 prospecting field season. The chultuns are located along the eastern edge of Tier C South and are situated directly north/south of each other. This area was chosen purposefully in order to generate complementary data sets and possibly connect visible surface remains with near-surface data from the magnetometry, and possible data generated through GPR including and stratigraphic indicators and/or possible remains indicated by the presence of the chultuns.

GPR survey was conducted using a 400 MHz analog antenna, connected by an 11.8m fiber optic cable to the data acquisition unit. Data was recorded using the SIR-4000. A model 620 survey wheel was used for tracking transect distance measurements and to encode time with distance during recording of data. The effective depth range for this antenna can be 2.5m to 3m depending on the associated landscape, bedrock, and soil matrices. All data was processed using the RADAN 7 processing software. The investigation area measured 30m north to south by 6m east to west. The intent of survey was four-fold. First intent was to see if the GPR survey could identify any shallow, non-visible surface remains in the area of the chultuns, that complemented or confirmed the data gathered through the magnetometer surveys. Second purpose for the GPR survey was to attain deep survey data. Third was to attempt to see if connectivity could be identified between these two features. Fourth, and final aim was, if possible, get an indication of possible size of the features within the designated survey boundaries. To date, three of the four goals have been achieved. There are a number of signatures present in the analyzed GPR data that indicate anthropogenic features or implicated voids, which is consistent with the presence of the chultuns.

The chultuns, as stated previously, are located on Tier C, directly north/south of one another in the southern pasture of Tzak Naab. Specifically, the GPS coordinates for chultun 1, the southern chultun, are 17°53’17.7”N and 89°03’40.1”W (UTM 45Q 718373mE 1979028mN). The coordinates for chultun 2, the northern chultun, are 17° 53’ 18.5”N and 89° 03’ 40.1” (UTM 45Q 718381mE 1979053mN). The base survey map (Figure 6) provides all general information for the GPR survey transects. The area of chultuns is specified by red hashed area and is not representative of actual size. All survey transects are marked (Figure 6). Arrow indicates direction run for each transect. Transect 001 was run south to north for a distance of approximately 30m and is located on the eastern edge of the survey. Transect 002, the wester survey boundary, was run from north to south for a distance of approximately 30m. A total of 7, 6m (approximate), transects were run from east to west at roughly 5m intervals. Two final 5m transects were run over the eastern edges of the chultun entrances, transects 10 and 11, and were run from north to south. GPR data has been processed and analyzed for all lines run during

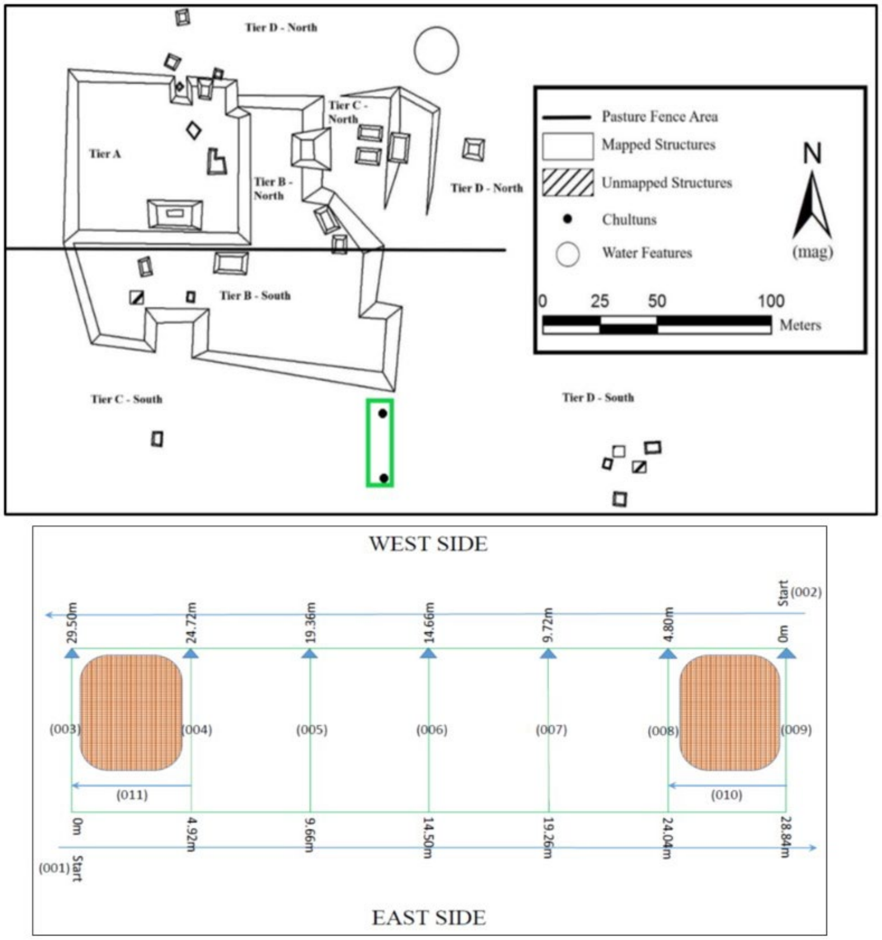

Figure 6. Map of site core of Tzak Naab, GPR survey area is marked in green with map of transect locations for survey. Map by Patricia Neuhoff-Malorzo, adapted from Kotsoglou 2017.

survey. Yellow dots (if in color) on annotated data sets indicate possible stratigraphic boundaries and features are marked with numbers where present. Overall, there is deep radar penetration at the perimeter of our grid and indications consistent with anthropogenic activity. This is indicated in the data gathered from survey Transects 001 (the eastern most survey transect, Figure 7) and 002 (the western most survey line, Figure 7), and Transects 010 and 011(Figure 8) which were run north to south over the interior edge of each chultun). Transect 003 (Figure 8, located at the southernmost end of the survey grid shows two possible features and two separate stratigraphic boundaries. These are similar signatures as would be made by the remains of a wall separated by a depression near the surface. This may correspond to some sort of support structure that was located near to the southern chultun. While there are stratigraphic boundaries and features identifiable in Transect 003 (Figure 8) in the south and stratigraphic boundaries indicated in Transect 009 in the north (Figure 8), Transects 004-008 show only shallow radar wave penetration. There appears to be a modified or preexisting surface that is visible in the data for Lines 001 (Figure 7), 004 and 007 (Figure 8). This data appears to indicate the remnants of an anthropogenic occupation, possibly a floor of some kind a Plaza surface. A future 3D grid would give us better insight to how these two cave features traverse into their respective areas of the hillside.

Discussion: GPR Data

The GPR data for the site of Tzak Naab indicates the possibility of a number of subsurface structural remains. The long survey

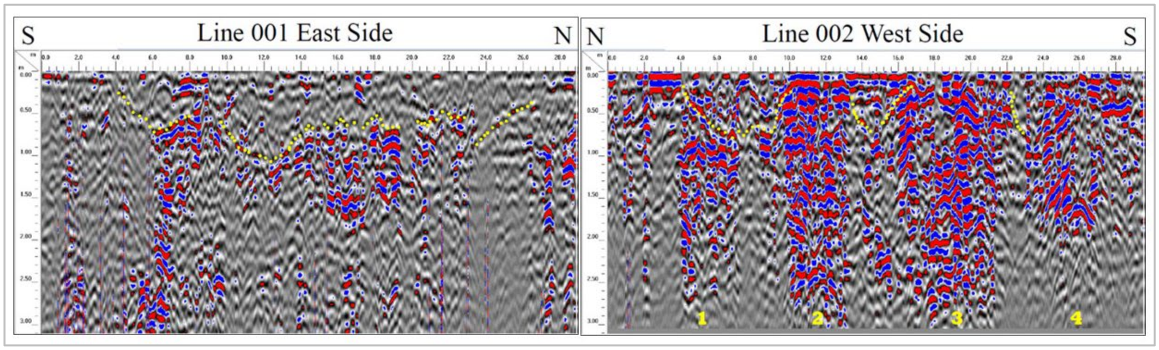

Figure 7. Transect 001, east survey line, and Line 002, west survey line. GPR survey by J.N Stanley and Patricia Neuhoff-Malorzo. Processing by J.N. Stanley. Dots represent a continuous horizontal reflector representing a potential stratigraphic boundary.

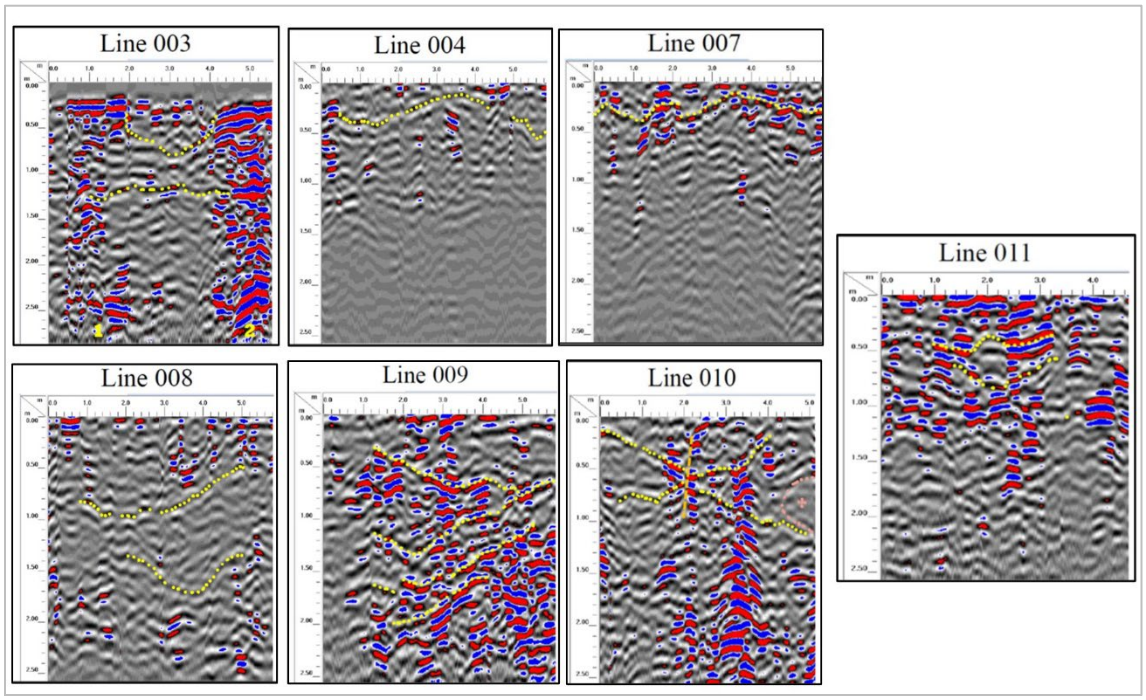

Figure 8. Line 003, 004, 007 008, 009, 010, 011. GPR survey by J.N. Stanley and Patricia Neuhoff-Malorzo. Processing by J.N. Stanley.

lines along the eastern and western edges of the survey area do show areas that indicate possible anthropogenic alterations. The east side traverse lines up with visible near-surface remains located in the middle of the transect and the lack of other visible activity corresponds with the visible bedrock, and the location of this particular transect along the far eastern edge of the tier. This edge of the tier slopes sharply downward with the rolling landscape and this line was placed purposefully along the eastern edge of these surface remains to confirm the pedestrian survey observations. The western transect indicates four possible areas for investigation identified in the areas of high amplitude reflection, that either correspond with subsurface features or areas that locally allow for deeper penetration. These four features give similar signatures to walls with scattered signatures that indicate voids or cavities, which could correspond to subsurface areas of the chultuns. Transects 003, and 009 do present some notable features which appear to indicate anthropogenically modified areas. The central transects of the GPR survey (Lines 005, 006, and 007) also show altered areas which could be a plaza area or other prepared surface such as a structural footprint. The final transects run across and in the area of the chultuns do present some interesting possibilities. These transects do indicate possible extensions of the chultuns into the hillside to the west. Many of the possible subsurface areas of interest indicated in the GPR survey correspond to areas of interest noted in the magnetometer data.

Tzak Naab Conclusions

Previous work at this site had indicated a short-lived occupation of the site restricted to the Late/Terminal Classic period for this location, however the 2019 geophysical survey data have possibly extended this timeline. The extension of this occupational time span is based upon interpretation of the geophysical data gathered from the magnetometry data collected from Tiers B and C south and the combined magnetometry and GPR data sets collected from South Tier C. The conjunction of the data from these two different techniques indicates that there is a great more activity present at the site of Tzak Naab than previously indicated or suspected. The use of these two complementary methods bodes wells for future data confirmation efforts. More data and further surveys are needed to confirm this conclusion but the preliminary results are good.

Conclusions

This information only presents one area in which non-invasive geophysical techniques have been utilized in association with work conducted in NW Belize. Analyzing the case study presented, it is clear that employment of non-invasive techniques provides data in a quick, non-destructive, effective manner. The complementary nature of the two techniques utilized allows for greater, more precise data acquisition within the target areas with the GPR serving to confirm the magnetometry and provide more detail relating to depth. The data collected to date has the potential, with further confirmation, to change the inhabited timeline for this settlement, expand its occupational area, and identify activity areas. Additionally, the ever-increasing inclusion of geophysical survey, especially at the site of Tzak Naab has allowed for a more in-depth analysis and faster data collection for a site that is actively under threat. This makes this data invaluable as this site is under threat of loss and degradation to a greater extent than the other sites being researched under the umbrella of the PfBAP, underscoring the importance of these quick and non-invasive methods for optimal data retrieval. This case study provides a framework for the examination of sites where little to no investigation has taken place, allowing for meaningful analytical anthropological insight that can be replicated at any number of locations.

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42 THE PFBAP IN NW BELIZE: THREE DECADES OF ARCHAEOLOGICAL PRACTICE

Debora C. Trein and Fred Valdez, Jr.

In this paper, we update La Milpa's settlement history using data produced during the course of the Programme for Belize Archaeological Project's (PfBAP) 15-year tenure (2007-present) at the central precinct of La Milpa, one of the largest urban centers in the eastern Maya lowlands. The research model employed at PfBAP is one that enables multiple research projects to run concurrently, allowing investigators to tackle complex questions of community organization from various research angles. Since 2007, ten different projects have run, sometimes concurrently, within the central precinct of La Milpa. Based on the information gathered from these projects, we propose a narrative for La Milpa's growth and contraction that is anchored on an understanding of urban space as a reflection and materialization of a community's relationships – across and through socio-political hierarchies – as well as its surrounding social, political, economic, technical, and ideological environment. As such, the use, development, and abandonment patterns observed in La Milpa's central precinct are used as proxy for La Milpa's community history.

Introduction and Purpose of the Special Section

Archaeological investigations concerning the ancient Maya of the NW Belize region (Figure 1) has seen significant effort and interest. One of the significant long-term projects in the region, the Programme for Belize Archaeological Project (PfBAP; Trein et al. 2019; Trein et al. 2017), has advanced efforts to understand ancient Maya communities for the past three decades. This Special Section provides a general review of archaeological research interests and accomplishments in NW Belize as indicated by the research of the PfBAP.

Maya research interests have often placed much emphasis at studying large Maya sites and the elite complex. Nevertheless, a significant interest of the PfBAP has been, and remains, a view of the entire society of ancient Maya civilization, encompassing both elites and non-elites, from the regional urban centers to the smallest settlements. The PfBAP has documented numerous Maya attributes including pyramidal structures, plazas, sacbeob, extensive systems of ditched fields as well as numerous small settlements and associated features (Beach et al. 2019; Cortes-Rincon et al. 2015, 2017; Hyde et al. 2019; Trachman 2017; Valdez 2016). We hold that we are much better informed about ancient Maya life by comparing and contrasting the material culture and interpreted behaviors that occurred between different socio-economic, political, and geographic contexts. Moreover, past activities such as trade, political activities, architectural construction, and religious rituals, among others, which are associated with a plethora of actors at various socio-economic and political levels, may be best understood when examined from a multi-scale, multi-location perspective that identifies the input of many group of agents – from laborers to merchants and rulers – at different stages of these activities. Although the exact structure of Maya civilization likely varied from region to region in its social, economic, and political form(s) (Scarborough and Valdez 2003), the research reported in this Special Section serves as an indicator of how Maya civilization may have functioned, both regionally and across regions.

Brief Overview of NW Belize Chronology

The PfBAP research has provided an insight into the long history of Maya activities extending from the Middle Preclassic through the Classic, and into the Postclassic. Ancient Maya pottery of the Middle Preclassic has been uncovered at several sites across the project area, but is always in a mixed context of later material (Sullivan and Sagebiel 2003). Thus, there must clearly have been a Middle Preclassic settlement in the region which has yet to be identified. The Late Preclassic is widespread in NW Belize and found at almost every site excavated. Significant Late Preclassic remains have been located at Medicinal Trail (Hyde and Atwood 2008) and La Milpa (Trein et al. 2017). While there are significant Late Preclassic materials in the region, there has yet to be an identified or defined

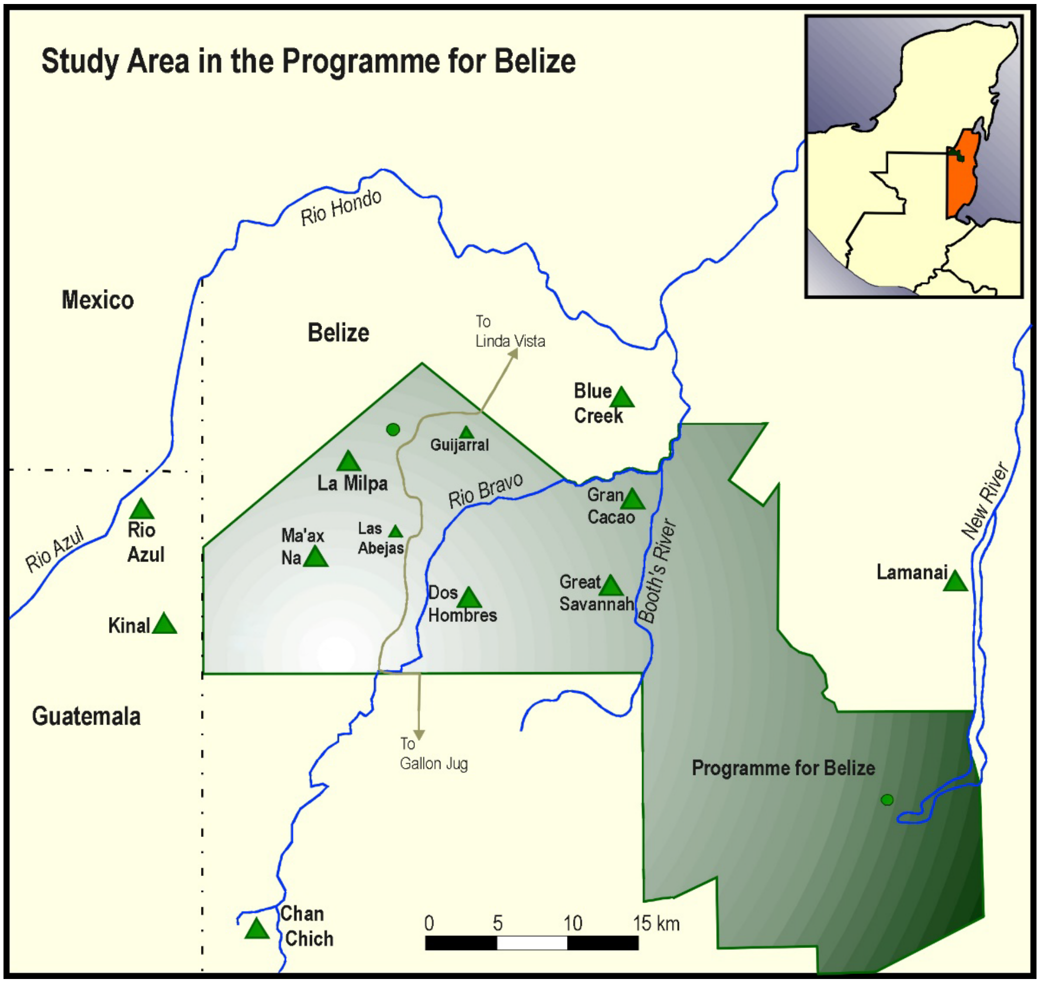

Figure 1. Map of the Programme for Belize property, adapted from R. Meadows.

regional center, although findings from La Milpa indicate that it may have served in such a capacity (Martinez 2013; Trein 2017; Zaro and Houk 2012).

The continuity of occupation from earliest Preclassic occupation to the Postclassic indicates the importance of the NW Belize region for its supply of resources as well as economic and political viability. The Early Classic sees the rise of several possible political (and/or economic) centers in the region including Blue Creek (Guderjan 2007), La Milpa (Trein 2016), and Dos Hombres (Houk 1996, 2015). By the Late Classic, La Milpa became the dominant center in the immediate NW Belize area. Many of the other smaller centers of the region, such as Blue Creek, Dos Hombres, Gran Cacao, Maax Na, Wari Camp, and Say Kah, were likely a part of the support network for La Milpa.

As the Maya Classic period comes to an end in NW Belize, we find that most sites are abandoned. Although Postclassic ceramics have been found at several sites in the region, the possible occupation represents a much smaller settlement in terms of population numbers and areal extent.

Much of the discussion from the papers in this section will focus on Maya Classic settlement and activities. The contributions herein contained, however, are generally representative of the kinds of research accomplished within the purview of the PfABP.

NW Belize - Physical Environment

The PfBAP research area, sometimes referenced as the Rio Bravo region, is within the defined Three Rivers Region (Adams 1995; Dunning et al. 2003; Houk and Lohse 2013) consisting of NE Petén, Guatemala and NW Belize. The research reported in this compilation are, however, contained within the NW Belize area. A brief background of the geographic and environmental features that the ancient Maya may have encountered are discussed.

The Three Rivers Region is located between 17° and 18° N latitude in the subtropical moist zone in the Holdridge Life Zone System (Brokaw and Mallory 2002), and temperatures fall within a defined tropical range – averaging approximately 26°C April through October, and 24°C November through March (Dunning et al. 2003). This area is also characterized by marked precipitation variation, experiencing acute annual cycles of rain and relative drought – a rainy season from May/June to December, and a dry season from January to April/May.

Habitats and geological features of NW Belize include the La Lucha Uplands; the Rio Bravo Terrace Lowlands and Highlands; the Rio Bravo Embayment; the Booth's River Upland; and the Booth's River Depression (Dunning et al. 2003 provide specific details). The broader NW Belize area has at times been referred to as the Bravo Hills (King et al. 1992), partly because the region is characterized by rugged karst hills also known as haystack hills. The geology of the Three Rivers Region is generally limestone-based and variability in soil make-up is largely associated to the local topography (Brokaw and Mallory 2002). The NW Belize research region is additionally characterized by many landscape features including aguadas, bajos, chultuns, and even small caves. The vegetation varies greatly as represented by areas of scrub brush, Cohune Palm forests, and upland forests of several canopies (Brokaw and Mallory 2002; Brokaw et al., this volume). These various vegetation areas are often referred to as micro-environments and one may enter-and-exit several of these micro-environments on any given research transect.

From the long and varied archaeological research in NW Belize, it is clear that the ancient Maya utilized these various environments for settlement (Guderjan 2013) as well as the resources available from each specialized landscape (Beach et al. 2019; Krause et al. 2021; Scarborough and Valdez 2003; Scarborough, Valdez, and Dunning 2003).

A Brief History of Archaeological Research in NW Belize and the PfBAP

Some of the earliest investigations in the region were by J.E.S. Thompson, who visited numerous sites in then British Honduras during the 1920s and 1930s. While Thompson focused most of his efforts at the site of San Jose (Thompson 1939), just south of the "defined" Three Rivers Region, he did travel to the site of La Milpa and record monuments found in the central precinct. In the 1970s and 1980s La Milpa was visited by members of the Department of Archaeology from Belmopan, Belize (Adams et al. 2004). A significant effort of archaeological interests was pursued as well in the late 1980s and early 1990s (Adams et al. 2004; Ford and Fedick 1998; Guderjan 1991, 2007; Valdez 2007).

In 1992, the Programme for Belize Archaeological Project (PfBAP) was established in parallel with the La Milpa Archaeology Project (LaMAP; Hammond and Tourtellot 1993), in the archaeological investigation of the Rio Bravo Management and Conservation Area (RBMCA). While LaMAP was primarily concerned with the examination of the archaeology of La Milpa and its immediate surroundings, the PfBAP research effort from 1992 to 2002 was focused on the survey and excavation of the larger RBCMA area (Adams and Valdez 1993).

The PfBAP is one of the longest running archaeological research projects in Belize, and indeed in the Maya region. The archaeological project has maintained a regional interest in the varied studies rather than a strict site-centric approach. During the initial field seasons, surveys and excavations were conducted at the sites of Dos Hombres (Houk 1994; 1995; Houk et al. 1993), Las Abejas (Sullivan 1997), Gran Cacao (Durst 1996; Lohse 1995), Chawak But'o'ob (Walling 2005), Dos Barbaras (Lewis 1995), Bolsa Verde (King and Shaw 2013), Guijarral (Hughbanks 1994, 1998, 1999), and Ma'ax Na (King and Shaw 2006, 2007), among many others (Adams and Valdez 1994; Brown 1995; Hughbanks 1999). The time depth researched by the PfBAP is representative of the entire Maya area extending from Paleoindian times through to the historic and contemporary periods (Table 1).

From 2005 onwards, research efforts in the RBCMA were conducted solely through

Table 1. Chronology for the archaeology of PfBAP.

Period	Time Range	Ceramic Spheres
Middle Preclassic	1000 – 400 BCE	Swasey
Late Preclassic	400 BCE – 250 CE	Chicanel
Early Classic	250 – 550/600 CE	Tzakol
Late Classic I	550/600 – 650/700 CE	Tepeu 1
Late Classic II	650/700 – 800 CE	Tepeu 2
Terminal Classic/Late Classic III	800 – 900 CE	Tepeu 3
Postclassic	900 CE to European contact	Incomplete Complexes

PfBAP (Adams and Valdez 1993; 1994; Trachman and Valdez 2009; Valdez 2007; Valdez and Houk 2011; Valdez and Hyde 2010). With the end of LaMAP in 2002, the research area of PfBAP grew to include La Milpa and the area immediately around the site, previously LaMAP's research property. As the sole permit holder for all archaeological projects taking place within the RBCMA, PfBAP hosts a number of research projects from numerous universities from North America and Europe every year, each with their own research goals and research area within the property. The resulting archaeological research that has been produced from these multiple projects is extensive and wide-ranging. PfBAP is geared towards providing, through collaboration, a regional picture of the socio-political and economic interactions that were present in this area in antiquity. As a result, a number of archaeological sites have been investigated, spanning from regional urban centers such as La Milpa (Aylesworth et al. 2011; Grazioso Sierra 2008; Hammond 1991; Hammond and Bobo 1994; Houk 2008; Houk and Zaro 2010; 2012; Lewis 2009; Martinez 2013; Riddick 2011; Sullivan et al. 2013; Trachman 2011; Trein 2016; Valdez and Scarborough 2013); to medium-sized urban centers such as Dos Hombres (Trachman 2010, 2017; Trachman et al. 2011), Chan Chich (Houk 2012), Say Kah (Houk et al. 2007; Jackson et al. 2010), and Ma'ax Na (King and Shaw 2006; 2007). Smaller satellite centers comprising of a few courtyards and groups such as Medicinal Trail (Hyde 2015, 2018; Hyde and Atwood 2008; Hyde and Casias 2011; Hyde and Valdez 2007), Guijarral (Hageman et al. 2008; Hageman et al. 2007; Hageman et al. 2010), La Milpa East (Weiss-Krejci 2008); La Milpa North (Heller 2018), Hun Tun (Arndt 2011; Dodge 2009; 2011; 2012; 2013; Dodge and Doumanoff 2010), Chawak But'o'ob (Walling 2011; Walling et al. 2007), Wari Camp (Levi 2009; 2011), and Lagunita (Weiss-Krejci 2008; Weiss-Krejci and Brandl 2011) have also received considerable archaeological attention. Early historical sites such as Qualm Hill (Cackler et al. 2007), and Holotunich (Ng 2007) have also been examined by PfBAP scholars.

Research protocols have generally followed archaeological developments in terms of standard recording practices – survey, mapping, excavation, material culture analysis (Hyde 2015; Sullivan et al. 2013; Trachman 2011), and bio-archaeology interests (Drake 2017; Locker 2020). Theoretically driven research across the region includes innovative approaches and techniques critical in Maya research. Some of the theoretical directions include studies of social structure, identity, gender, as well as power relations (Cortes-Rincon et al. 2017; Hyde et al. 2019; Jackson and Brown 2019; Lohse and Valdez 2004; Shaw and King 2015; Trachman and Valdez 2006; Trein et al. 2017; and Valdez and Scarborough 2013). During the tenure of the PfBAP, important technological developments have been applied with the archaeological interests including aerial methods, surface penetrating applications, and laboratory techniques. Among the innovative applications have been LiDAR, GPR (and other non-invasive, geo-physical methods), and isotope studies, among others (Beach et al. 2019; Locker 2020; Neuhoff-Malorzo 2022). Studies of the natural environment of the PfBAP and in particular the articulations between the Maya and the plants co-existing in the region, both past and present, is also of research interest to PfBAP (Aebersold 2018; Brokaw and Mallory 2002; Brokaw et al., this volume).

The PfBAP: Contributions and Considerations

This Special Section of the Research Reports in Belizean Archaeology (RRBA) covers a wide range of research interests and exemplifies an attempt to understand ancient Maya civilization in terms of relationships (for labor, products, trade, among others) between small and large centers. The findings of the PfBAP research are important for Maya-interest concerns, but also apply to other civilizations, in Mesoamerica and beyond. The PfBAP does not see or expect that a single model will likely explain the varied exploits and machinations of any complex society, but parts of a given model may prove useful in comprehending the inner-workings of ancient communities. In particular, the PfBAP hopes to contribute to those aspects best viewed from a regional perspective.

The research items reported here are a sample of the studies conducted in NW Belize by the PfBAP. The foundations of the regional approach for the Three Rivers Region and NW Belize in particular are found in the Ixcanrio Project (Adams and Valdez 2003); and a similar effort within the RBMCA by the Rio Bravo Archaeological Project (Guderjan 1991). Archaeological research in the Maya region has tended to be structured around a hierarchical model, which is defined as a research approach with priorities, questions, and methods guided mostly, if not completely, by a singular research design - some of the most notable examples being the early investigations of Mayapán, Uaxactun, and Chichén Itzá by the Carnegie Institution, and the University of Pennsylvania's work in Tikal (Weeks 2012; Weeks and Hill 2006). Although this model is still employed by many archaeological projects in the Maya Lowlands to this day, the research structure at PfBAP is nonhierarchical in that it enables the simultaneous investigation of multiple areas of La Milpa by concurrent projects. Each project is composed of different teams of seasoned scholars, specialists, and incoming graduate students, and they are consequently guided by different research questions, diversifying the types of datasets collected and approaches tested. As each project is relatively circumscribed in scale and duration, over the course of the past three decades multiple projects have rapidly produced a diverse range of published and unpublished information varying from the construction and use histories of particular buildings and plazas within a particular site, explorations of individual sites' positioning in the regional political landscape, to broad examinations of regional socio-political, economic, and ritual processes.

A review of the contributions herein contained include the environment in terms of vegetation as well as ethnobotanical and paleoethnobotanical research (Brokaw et al., this volume; Aebersold et al., this volume). Archaeological research from the large site of La Milpa is provided with several aspects of archaeological interest (Trein et al., this volume). Mid-to-small sized communities are discussed in terms of landscape, settlements, and community (Levi, this volume; Hyde et al., this volume). The bio-archaeology of the ancient Maya is discussed for the PfBAP region (Locker and Drake, this volume); as is the consideration of regional cultural material in the form of ceramics and lithics (Hyde and Sullivan, this volume), and the results from remote sensing efforts in the property (Neuhoff-Mallorzo and Stanley, this volume). Although not as not comprehensive in scope as all of the PfBAP archaeological interests, the combined contributions of this RRBA Special Section provide a glimpse into the research and interpretations for concerns of Maya civilization.

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43 COMMUNITY, AUTHORITY, AND SPACE IN THE HEART OF LA MILPA

Debora C. Trein, Brett A. Houk, Gregory Zaro

In this paper, we update La Milpa's settlement history using data produced during the course of the Programme for Belize Archaeological Project's (PfBAP) 15-year tenure (2007-present) at the central precinct of La Milpa, one of the largest urban centers in the eastern Maya lowlands. The research model employed at PfBAP is one that enables multiple research projects to run concurrently, allowing investigators to tackle complex questions of community organization from various research angles. Since 2007, ten different projects have run, sometimes concurrently, within the central precinct of La Milpa. Based on the information gathered from these projects, we propose a narrative for La Milpa's growth and contraction that is anchored on an understanding of urban space as a reflection and materialization of a community's relationships – across and through socio-political hierarchies – as well as its surrounding social, political, economic, technical, and ideological environment. As such, the use, development, and abandonment patterns observed in La Milpa's central precinct are used as proxy for La Milpa's community history.

Introduction

Since 2007, archaeological investigations at La Milpa, one of the largest urban centers in the eastern Maya lowlands, have taken place under the aegis of the Programme for Belize Archaeological Project (PfBAP). PfBAP employs a model that enables multiple research projects to run concurrently at the site, which allows for investigators to tackle complex questions of community organization from various research angles within a single urban landscape. Using the multiple datasets produced over the course of PfBAP's tenure at La Milpa, we present a narrative of La Milpa's community history using as proxy the use, development, and abandonment patterns observed in La Milpa's central precinct.

Location and Architectural Configuration

La Milpa is located in the Río Bravo Conservation and Management Area (RBCMA), a 1,012 km^2 reserve of protected forest located in northwest Belize, close to the border with Mexico and Guatemala. The RBCMA is in turn part of the Three Rivers Adaptive Region (TRAR), a large (5,140 km^2 area) environmental and cultural domain encompassing parts of northwest Belize, northeastern Guatemala, and southern Mexico. La Milpa is nestled between the Río Azul and the Río Bravo rivers on the La Lucha escarpment, the highest of three escarpments that define the eastern half of the TRAR.

The central precinct of La Milpa is defined here as the space designed, built, and used for activities relating to the ritual, administrative, economic, and political development and maintenance of the La Milpa polity as a whole – activities that concerned, directly and indirectly, not only the population that lived within its epicenter, but also the populations of its satellite periphery groups and presumably subservient urban centers. With a

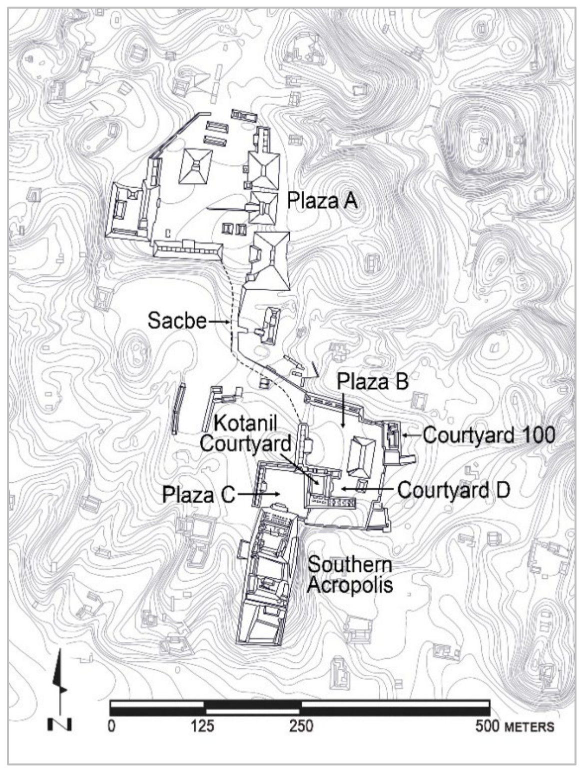

Figure 1. Map of the core structures of La Milpa, with architectural groups mentioned in the text identified by name. Modified from Hammond 1998:12.

central precinct area measuring approximately 9.2 hectares in its last construction phase and settlement extending to 5 km from the center of the urban core, La Milpa is one of the largest sites within the TRAR and the largest in northwest Belize (Houk 2015:171).

La Milpa's core architecture is arranged in a pronounced north-south configuration that can be divided into two large sectors connected by an intrasite sacbe (Figure 1). Plaza A, to the north, is the largest and principal plaza of La Milpa, encompassing 1.9 hectares of open space. It is located on a high limestone plateau overlooking the southern side of the core and surrounding regions. In its last construction phase, dated mostly to the second half of the Late Classic period (ca. 650 – 780-850 CE), Plaza A is characterized by a collection of monumental structures that include temple pyramids, range structures, and raised courtyards. These structures are distributed unequally in the Plaza A architectural environment: the majority of large temple pyramids and range structures are located on the southern and eastern sides of the plaza. Two ball courts and a large, free-standing temple pyramid are also present within the internal space of Plaza A.

The main access point into Plaza A is from the south, by way of a raised sacbe that connects the southeastern corner of Plaza A to the northwestern corner of Plaza B. Unlike Plaza A, which favors a layout characterized by open spaces and tall buildings of public-ritual character, the southern half of the site core is defined in its last construction phase by enclosed or semi-enclosed courtyards composed of multiple range buildings and few temple pyramids. The open spaces include Plazas B and C, Courtyard D, the fully enclosed Kotanil Courtyard, and Courtyard 100. The Southern Acropolis represents the southernmost area of the monumental precinct. It is a complex agglomeration of small but labyrinthine raised courtyards (Hammond et al. 1998). Small and isolated domestic courtyards surround the urban epicenter, extending outward for approximately 5 km (Hammond and Tourtellot 2004).

History of Archaeological Investigations

La Milpa became known to the archaeology community in 1938 as part of a reconnaissance effort led by J. Eric Thompson, who mapped the site and identified 12 of La Milpa's 23 known stelae (Hammond 1990; Thompson 1963). After a hiatus of four decades, Annabel Ford and Scott Fedick (1988), and Thomas Guderjan (1991) conducted two parallel surveys at La Milpa in 1988 following the establishment of the RBCMA. These surveys recorded the physical location of the site, mapped a total of 21 courtyards and 85 structures, assessed looting damage, and developed a preliminary chronology for La Milpa.

Sustained archaeological investigations at La Milpa started in 1992 with the establishment of the La Milpa Archaeological Project (LaMAP), which operated until 2004. The main objectives of LaMAP's campaign included mapping La Milpa's central precinct, as well as its surrounding urban and peri-urban settlement, and creating a site-wide chronology through surface collections and plaza-floor test-pitting in Plazas A, B, C, Courtyard D, and the Kotanil Courtyard (Hammond and Tourtellot 1993; Sagebiel 2005; Tourtellot et al. 1993). Part of LaMAP's research program at La Milpa also included extensive excavations of the Southern Acropolis, as well as preliminary soundings of Structures 1, 3, 6, 7, 10, and 11 in Plaza A (Hammond and Tourtellot 1993, 2004; Sagebiel 2005).

With the end of the LaMAP project, PfBAP initiated investigations at the site in 2007. PfBAP functions as an umbrella program that hosts research projects and field schools from many academic institutions every year, each with their own research goals and geographic areas of study within the property. Due to the large area of its central precinct and prominence in the regional socio-political landscape, La Milpa has accommodated 10 individual research projects since 2007. These projects have produced a diverse range of information varying from the construction and use-histories of particular buildings and plazas, to broad examinations of site-wide socio-political processes, and explorations of La Milpa's positioning in the regional political landscape (Table 1; Figure 2).

In this paper, we update La Milpa's settlement history using data produced during PfBAP's tenure at the central precinct of La Milpa in conjunction with data gathered by

Table 1. List of all projects in La Milpa core from 2007 to 2019 taking place under the PfBAP permit. LMCP operated under PfBAP's permit and utilized shared laboratory staff and facilities and is thus included in this article.

Plaza	Structure/Area	Field Director/Active Year	Project
Plaza A	Structure 3 and environs	Grazioso 2005; Trein 2010-2016	PfBAP
	Structure 4	Trachman 2008-2009	PfBAP
	Structures 6 and 7	Chatelain 2012-2013	PfBAP
	Courtyard 88	Martinez 2008-2013	PfBAP
	Plaza space west of Structure 7 (Resistivity Survey Area)	Aylesworth 2009-2012	PfBAP
Plaza B	Structures 20, 21, 22, 23, 24	Houk 2007-2011	LMCP
Courtyard D/Kotanil Courtyard	Structure 26, 27, and 28	Houk 2007-2011	LMCP
		Trein 2016-2017	PfBAP
Courtyard 100		Houk 2009-2011	LMCP

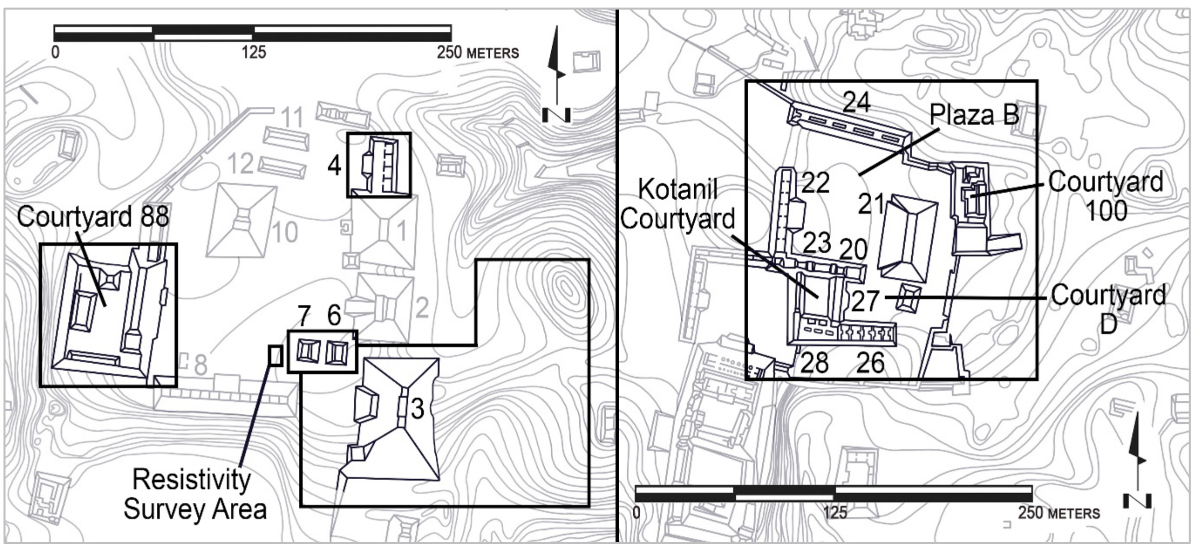

Figure 2. Locations of archaeological investigations at La Milpa under the PfBAP permit, with Plaza A on the left and the southern core on the right. Modified from Hammond 1998:12.

previous projects. We propose a narrative for La Milpa's growth and abandonment that is anchored on a framework that understands urban space to be a reflection and materialization of a community's social, political, economic, and ideological dynamics. There is little doubt that the architecture of ancient Maya urban centers conveyed explicit messages of hierarchy and social authority, and represented both the "arena and the instrument for the pursuit, expression, and maintenance of power" (Webster 1998:34). Nevertheless, we posit that the character of ancient Maya central precincts is also the result of the practices and priorities of non-elite community members across the socio-political hierarchy, who were involved in the construction, maintenance, and use of this space as part of everyday activities as well as extraordinary events – negotiations that could serve to support, transform, and even perhaps defy the position of elite groups as the rulers. In other words, ancient Maya urban spaces are the medium through which members of any given polity interacted with one another, created and reinforced community bonds, and negotiated changing conditions (Hendon 2010; Hutson 2010, 2016; Inomata 2006; Robin 2002). These practices in turn shaped cities themselves through architectural modifications, patterns of use, and abandonment, making urban space a reflection of the character of community processes taking place both within the city and beyond (Knapp and Ashmore 1999).

La Milpa's Built Environment through the Centuries

Late Preclassic Period (ca. 400 BCE – 250 CE)

Although it is suspected that occupation of La Milpa may have started in the Middle Preclassic period (Kosakowski and Sagebiel 1999:14), the first indications for the settlement of La Milpa date to the Late Preclassic period. LaMAP reported Late Preclassic ceramic materials in plaza floor test pits and within many of the Plaza A's main buildings, including the earliest construction episodes of the temple pyramids that would later define the eastern edge of Plaza A (Hammond and Tourtellot 2004; Sagebiel 2005:715-716). Building on these data, projects taking place during PfBAP's tenure at the site have uncovered previously unknown architectural and mortuary data that demonstrates that the Late Preclassic phase of La Milpa's central precinct was extensive.

In Plaza A, two thickly-plastered masonry platforms, one of which measuring at least 25 m in length, were found buried beneath a later plaza-raising construction phase in front of Structures 3 and 8 in the southeast corner of the plaza (Aylesworth 2012; Aylesworth and Suttie 2009; 2011; Trein 2016). One of the platforms is associated with a cached Late Preclassic ceramic vessel (Grazioso 2019 pers. comm.). To the west, excavations of Courtyard 88 revealed a Late Preclassic burial of a young adult male (18-25 years old) in a modified chultun in what became the physical center of Courtyard 88 in subsequent periods (Martinez 2013:267). This burial was reentered before the construction of an Early Classic floor, with the skull and femora being removed during this reentry (Martinez 2013:267). Excavations suggest that Late Preclassic

Figure 3. Photo of possible Late Preclassic phase of Structure 27, showing the east-facing staircase and the plaza floor. The possible Late Preclassic phase is distinguishable from later construction phases by its smooth plaster exterior. Photo by Brett Houk.

Courtyard 88, a prominent space due to its association with Plaza A, was open and its internal space visible from the lower Plaza A level.

Initial assessments of the Late Preclassic period component of La Milpa posited that the settlement was centered on Plaza A (Hammond et al. 1998). However, the discovery of a possible Late Preclassic building in Courtyard D indicates that Late Preclassic La Milpa may have been spread over a much larger area (Zaro and Houk 2012:148). The earliest identified construction phase of Structure 27 in Courtyard D consists of a smooth-plastered structure with rounded edges that was at least 2 m tall and furnished with a 6 m wide central staircase or tiered platform (Houk and Smith 2010; Trein 2016; Trein et al. 2017; Zaro and Houk 2012) (Figure 3). This phase was tentatively assigned to the Late Preclassic period based on architectural style, as no identifiable ceramics were encountered in test pits at the base of the structure (Houk and Smith 2010:115).

Early Classic (ca. 250 – 550/600 CE)

Work by LaMAP indicates that La Milpa's Late Preclassic ceramic traditions extended well into the Early Classic period, which initially created difficulties in establishing the presence of Early Classic construction episodes at La Milpa's central core (Sagebiel 2006, 330; Sullivan and Valdez 2006:78). LaMAP identified six Early Classic stelae as well as a possible royal tomb dating to this period (Sagebiel 2005:776-778), suggesting that the

Early Classic represented a period of relative stability for the site, although the rate of settlement growth in this period remains a topic of debate (Houk 2015:175).

Data gathered since 2007 indicate that the Early Classic period at La Milpa represented a time of substantial growth, as multiple structures throughout the central precinct were enlarged in this period. One of the most notable of these is Structure 3, which, in its Early Classic phase, was a west-facing pyramidal structure at least 5 m tall to its top landing, with a central staircase and a 3.5 meter deep top landing. Its summit was paved with a 25 cm thick layer of plaster and supported at least one masonry superstructure (Trein 2016). An AMS radiocarbon sample retrieved from below the summit floor of this building phase returned a 2-δ calibrated date between 436 to 601 CE (Trein 2016:112). An Early Classic construction phase was also identified at Structure 7 (Chatelain 2012), as well as at the low platform to the east of Structure 3, which doubled in height in the Early Classic period to over 1 m tall (Trein 2016:287). In Courtyard 88, the first sub-structures to Structures 13 and 15 were built, and the entire courtyard floor was raised and paved, an event that initiated the enclosing of Courtyard 88 and which was commemorated by the placement of a table altar or stela fragment at the northern end of the courtyard (Martinez 2013:474-5). Early Classic construction phases were also identified on the southern side of the site core in structures in Courtyard D and behind Structure 21 in Courtyard 100 (Houk 2015:175-176; Zaro and Houk 2012:149).

Late Classic I Period (ca. 550/600 – 650/700 CE)

Despite 25 years of archaeological excavations all around La Milpa's central precinct by both LaMAP and PfBAP, the first half of the Late Classic period (Late Classic I) remains opaque. LaMAP excavations reported one ashy layer between floors deposited between Late Classic I and II in Courtyard 88 (Sagebiel 2005:631), and PfBAP excavations uncovered one Late Classic I plaza floor replastering event in the same courtyard (Martinez 2013:480). No other signs of settlement growth or maintenance (such as construction events or stelae placement), or signs of destruction or abandonment (such as burning or ash layers, signs of building depredation and abandonment) have been reported for this period (Houk 2015:179).

Late Classic II Period (ca. 650/700 – 800 CE)

Data collected since 2007 support the interpretation proposed by LaMAP that the second half of the Late Classic period (Late Classic II) was transformative for this urban center (Hammond and Tourtellot 2004). All PfBAP and LMCP projects at La Milpa have reported the largest and most labor-intensive architectural construction and remodeling projects for this period. This included the expansion of already prominent public temple structures like Structure 3 (Trein 2016); the restructuring of older public spaces through the construction of new multi-tiered platform buildings with masonry superstructures, such as that observed in Courtyard 88 (Martinez 2013); and multiple renovations and expansions of range structures across the site (Chatelain 2012; 2013; Houk 2008; 2010; Houk and Zaro 2010; Trachman 2008; Zaro and Houk 2012).

It is at this time that a continuous plaza surface is built at Plaza A, burying Early Classic and Late Preclassic platforms and increasing the continuous surface space of the plaza area (Aylesworth and Suttie 2009; Trein 2016). Plaza levels are also raised, and in some cases multiple paving episodes are identified, as in Courtyard 88, Plaza B, and Courtyard D (Houk and Zaro 2010; Martinez 2013). Other major architecture and infrastructure projects in and around the site core were completed in this period, including the sacbe connecting Plaza A to the southern side of the site core, which was expanded and formalized in the second half of the Late Classic period (Trein 2016). In addition to eight stelae that were erected at Plaza A between the seventh and eight centuries (Hammond and Tourtellot 2004:295), an altar and possible stela were dedicated in Plaza B (Hammond et al. 2014; Zaro and Houk 2012; Houk 2008; Trein 2008). Two dedicatory caches arguably served to ritually integrate the buildings and spaces of Plaza B during this period as well (Houk and Zaro 2011).

In parallel to the large construction projects that greatly augment La Milpa's public monumental architecture, the second half of the Late Classic period is the first time evidence for activities not traditionally associated with the ceremonial aspects of Classic Maya urban life are observed in close association to public monumental spaces. These include a large (measuring as much as 500 m^2) elevated late-stage manufacturing and possible exchange area for chert tools and objects made with mother-of-pearl, pyrite, green stone, and bone; a possible agricultural terrace; and a limestone quarry, all within the immediate vicinity of Structures 2 and 3 at Plaza A (Trein 2016) (Figure 4). Importantly, the central precinct spaces were architecturally modified to accommodate these non-ceremonial activities in this period – the manufacturing debris was found in association with a single-construction-phase plastered platform, for instance – and all of these activities were restricted to the second half of the Late Classic, suggesting a diversification in the ways La Milpa's public monumental spaces were designed and used in this period (Trein 2016).

Terminal Classic (ca. 800 – 900 CE) and Early Postclassic Periods (ca. 900 - 1200 CE)

In regards to investigations conducted at La Milpa during PfBAP's tenure at the site, the periods of greatest expansion of our understanding of La Milpa are the Terminal Classic and Early Postclassic. LaMAP's investigations of the settlement indicated that La Milpa entered a brusque period of decline until its abandonment at the end of the Late Classic and into the Terminal Classic periods, inferred from multiple unfinished construction projects unearthed in the Southern Acropolis (Hammond and Tourtellot 2004; Hammond et al. 1998). Some of the data gathered during PfBAP's tenure at the site certainly support this interpretation: Structure 3, one the largest temple structures at the site and a cornerstone building of Plaza A's monumental architectural complex, was permanently abandoned at some point in the Terminal Classic following an extensive and multi-year termination event (Trein 2016). Structure 21 in Plaza B, one of the largest structures at La Milpa, was abandoned halfway through a new construction phase, also in the Terminal Classic (Houk 2015:177; Zaro and Houk 2012).

Nevertheless, while LaMAP's excavations intimated a collapse of La Milpa's settlement in the Terminal Classic period, investigations at La Milpa since 2007 show that the picture for La Milpa in the Early Postclassic period is much more complex. Work by LMCP and PfBAP researchers on Structure 27 in Courtyard D showed that continuous habitation, maintenance, and even new construction episodes in the southern plazas and courtyards of La Milpa continued well after the Terminal Classic period (Zaro and Houk 2012; Trein et al. 2017). A radiocarbon sample retrieved from the last landing floor of Structure 27, associated with a significant construction phase that may have enlarged the building by a third of its previous size and enclosed the Kotanil Courtyard in the process, returned a 2-δ calibrated date of 890 to 1030 CE (Houk and Smith 2010:119; Zaro and Houk 2012:49). The late occupation and expansion of the buildings of Courtyard D is further supported by the presence of a rich activity deposit in nearby Courtyard 100, which was found to contain peccary bone fragments that were dated to 2-δ calibrated dates between 890 and 1040 CE (Moats and Nanney 2011:28). Together, the data gathered since 2007 indicate that occupation of La Milpa – as represented by the habitation, maintenance, and expansion of masonry buildings in the southern half of the site – continued until possibly the eleventh century CE (Zaro and Houk 2012).

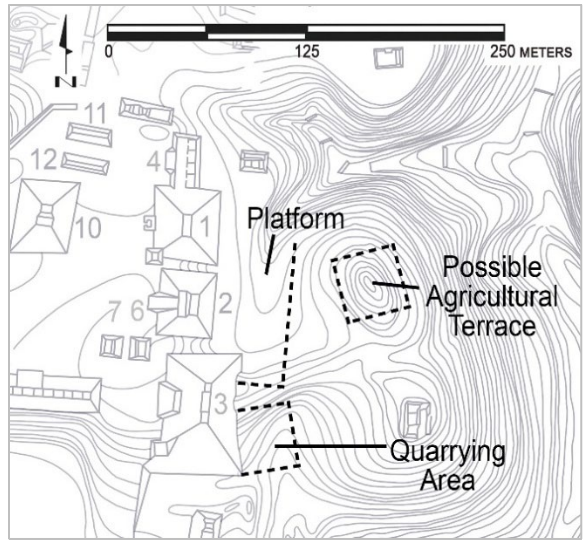

Figure 4. Location of non-ceremonial architectural modifications to the east of Plaza A, dating to the second half of the Late Classic period. Modified from Hammond 1998:12.

Community, Authority, and Space at La Milpa

Data gathered from investigations taking place under PfBAP's permit have helped to add nuance, fill some of interpretive gaps, and, in some cases, change initial understandings of the La Milpa community's ebbs and flows. Based on the information collected by the various projects under the PfBAP umbrella, the Late Preclassic period emerges as a time of growth for an already established settlement in the local political landscape. The discovery of the burial of an individual in the center of a freshly-established Courtyard 88 adjacent to Plaza A – around which this important courtyard grew over the next several centuries – and the discovery of substantial architectural investments in Plaza A and possibly in Courtyard D indicate the presence of an elite group empowered enough to marshal the community commitment and obligations necessary to build and maintain the architectural spaces of La Milpa's growing central precinct (Freidel and Schele 1988; Webster 1998).

Early Classic data support the view that La Milpa experienced prosperity, growth, and social cohesion, as exemplified by significant architectural expansion projects, in addition to the stelae-setting and elite burials identified by LaMAP. Nevertheless, while initial interpretations posited that La Milpa had entered into either a subservient or client relationship with a large central Petén polity like Tikal (Hammond et al. 1996; Sagebiel 2005; Sullivan and Valdez 2006), the present datasets do not allow for a more fine-grained perspective on Early Classic authority at La Milpa. Similarly, the work conducted during PfBAP's tenure to date has failed to shed more light on the nature of community dynamics in the first half of the Late Classic period. The almost complete lack of evidence for maintenance or expansion of monumental spaces alludes to instability about La Milpa's authority structures, possibly caused by the collapse of Tikal at the start of the period (Sagebiel 2006:333). It is unknown, however, how this instability materialized in the everyday life of the residents and larger community of La Milpa as there is no evidence for abandonment, terminations, or destruction of standing structures, which would signal political strife, civil unrest, or a failure in the maintenance program of public architecture – potential repercussions of a breakdown of authority structures and community relationships. The enigma of the first half of the Late Classic period at La Milpa is further compounded by the possibility raised by Sagebiel (2006:333) that Early Classic ceramics may have been used well into the first half of the Late Classic period, obscuring construction and maintenance episodes and population counts.

Data from excavation of standing structures dating to the second half of the Late Classic period since 2007 largely reflect the findings of LaMAP's investigations at the site. La Milpa grew in size and prominence as the population of TRAR swelled as much as fivefold from earlier periods (Sullivan and Sagebiel 2003:27). La Milpa's expansive monumental architectural program indicates that its leadership was able to secure the support of communities from both new and established surrounding settlements to access, mobilize, and direct the necessary labor and construction materials to enlarge existing structures and, in the case of Plaza A, reorganize its architectural configuration. As many of these settlements are located in areas close to important resources such as water, chert, and agricultural land, the development of close political and economic allegiances served to strengthen La Milpa's operational security (Houk 2003:63). The establishment and maintenance of these alliances, which so greatly benefited La Milpa, is likely to have been at least partially a product of the capacity of La Milpa's leaders to generate opportunities for its supporting communities, whether through their integration into regional trade networks, direct political sponsorship, access to rare or important resources, or through the hosting of unique religious and social events within the numerous large, open plaza spaces at the site. This is reflected in La Milpa's central precinct through its overhaul of La Milpa's ritual-political infrastructure and the purposeful development of architecture and other defined spaces to support activities that had not been detected in the central precinct until this period: workshop activities, exchange, agriculture, and limestone quarrying. These activities are considered to be non-ceremonial and oftentimes laborious in character, and involved the participation of a wide variety of community

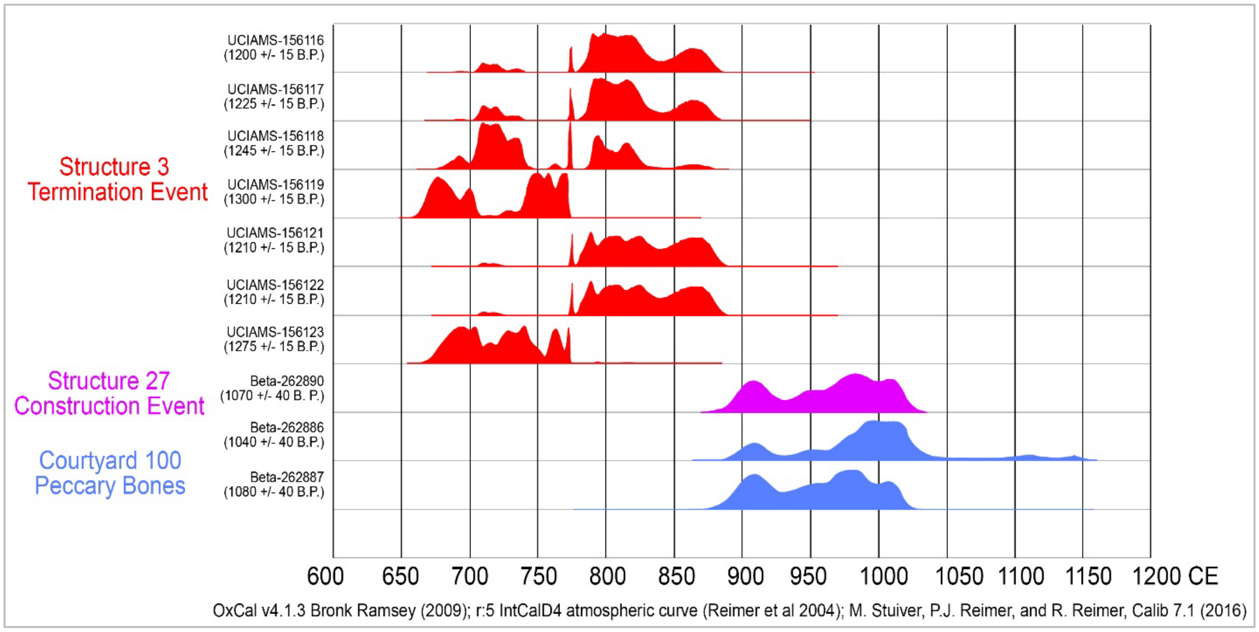

Figure 5. AMS dates for the termination of Structure 3, the Courtyard 100 deposit, and the last construction phase of Structure 27 in Courtyard D.

members from varying social and geographic backgrounds including people from the lower rungs of the ancient Maya social hierarchy (Hendon 1997; Lohse and Valdez 2004; Shaw 2012). Whether an attempt to cope with the explosion in the regional population, or to cement the position of La Milpa as a central node in the everyday lives of communities in the region (or both), the redesigning of some of the core spaces at La Milpa indicate a higher degree of community interaction between socio-economic ranks and higher visibility of non-ritual activities into the grander areas of La Milpa's central precinct, at the same time La Milpa rose to the top of the regional political ecosystem.

Finally, it is clear that the Terminal Classic represented a period of significant upheaval that affected the Classic-period operations of this regional center, as many significant central precinct buildings were either terminated and permanently abandoned, or were abandoned in the middle of a new construction phase. This strongly points to an irrevocable disruption to the Classic-era La Milpa community dynamics. This shift is reflected elsewhere in TRAR, where abandonment, neglect, and terminations of structures; depopulation; and breakdown of production chains are observed at various sites (Guderjan 2004; Guderjan and Krause 2011; Houk 1996, 2000, 2015; Sullivan et al. 2007). The drivers for these socio-political, economic, and demographic changes in the Terminal Classic period are unclear, as is the role of La Milpa in negotiating these challenges. Nevertheless, as the work conducted by LMCP and PfBAP shows, radiocarbon dates from construction and occupation layers in the southern half of the site core indicate that something of La Milpa's community structure persisted, as continued occupation, maintenance, and expansion of parts of La Milpa's central precinct endured until the eleventh century - centuries after prominent sections of the site were abandoned (Figure 5) (Zaro and Houk 2012).

The continued occupation and construction observed around Courtyard D and the Kotanil Courtyard into the Early Postclassic period indicates that La Milpa's stratified social structure and community obligations did not completely dissolve at the end of the Terminal Classic period. Rather, what we may be observing is the relocation of what was left of La Milpa's shrinking polity administrative operations to the southern side of La Milpa's central precinct, through the smaller-scale re-arrangement and aggrandizement of physical space to perhaps more closely resemble the spatial organization associated with authority structures that were previously seated in Plaza A, perhaps in Courtyard 88. This may have been undertaken in an attempt by the La Milpa leadership, many generations after the termination of the large temple structures of Plaza A, to maintain some sense of spatial and social order and manage political and environmental instabilities that affected urban and rural settlements throughout the Maya lowlands at this time, a decline that has been extensively discussed but not yet fully explained for this region.

Closing Thoughts

Using the data collected during the PfBAP's tenure at La Milpa, this site's urban spaces reveal a dynamic and complex trajectory over their long occupation. The narrative presented here proposes that La Milpa's urban spaces were variously designed, modified, and used throughout its history to mediate the establishment of incipient socio-political hierarchies, signal its prosperity and regional allegiances, provide a platform for building community cohesion, and strategize to cope with uncertain futures. This was accomplished through an adaptable architectural design process that may have been guided by an elite class, but was also defined by the multiple surrounding settlements that accessed and used La Milpa's central precinct, and who depended on the prosperity and stability of La Milpa as a community.

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