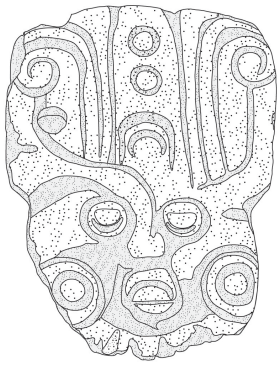
Investigations of the Belize River East Archaeology Project:
A Report of the 2016 and 2017 Field Seasons



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Preface and Acknowledgements

Eleanor Harrison-Buck

The Belize River East Archaeology (BREA) project was initiated in January 2011. In the last seven years of fieldwork, our investigations of the BREA study area—a 6000 km^2 region encompassing the lower half of the Belize Watershed—has proven to be an extraordinary research area rich with pre-Hispanic and Colonial history. This report details our survey, mapping, excavation, and analytical findings from three short field seasons that ran for three weeks in January 2016, four weeks in the summer of 2016 and another 3 weeks in January 2017. Despite the short seasons, our work in the lower reaches of the Belize River valley has been tremendously productive and, as usual, the results surpassed all my expectations, namely due to the perseverance and incredible expertise of our talented field crew.

I am indebted to the loyal group of BREA staff (aka. "the Dream Team") who have participated in the BREA project since its inception in 2011 and made season after season so successful over the last seven years. I wish to thank each of them—David Buck, Marieka Brouwer Burg, Brian Norris, Adam Keading, Satoru Murata, and Astrid Runggaldier. The incredible results of the BREA project are the result of their range of skills and expertise—from survey to excavation to lab analysis. We have also been fortunate in more recent years to have a talented new group of staff join our project as BREA continues to grow. I wish to acknowledge the contributions of Jessica Craig, Grace Dietz, Kelin Flanagan, Alex Gantos, Lori Phillips, Katie Shelhamer, and Mark Willis. Each of these staff members offered different areas of expertise—from survey and mapping to lab and excavation—and I am grateful for all their help.

All the staff did a superb job of training our undergraduate students in both field and lab techniques. Using our two Total Stations, Satoru Murata and Adam Kaeding produced beautiful topographic maps of Chikin' Chi' Ha', Chulub, and Ek'tok and trained our trained our students well. I am eternally grateful for their patience and persistence—the incredible results of which are presented herein. Digitizing and map-making in GIS was greatly facilitated by the masterful work of Dr. Marieka Brouwer Burg, our GIS specialist on the BREA project. I am truly grateful for the countless hours she has spent on numerous aspects of the BREA project, from digitizing to organizing all the digital files (GIS, photos, drawings, etc). We gained valuable assistance on the digitizing efforts from UNH student Katie Titus, who carefully digitized many of the excavation drawings presented in this report. During the summer season in Belize, Astrid, Lori, Alex, and Katie helped to keep us organized by processing and recording all our incoming artifacts, an enormous task in the lab. I am grateful to them for the endless amounts of time they spent processing countless numbers of artifacts with non-stop attention to detail, catching even the smallest of errors. Their diligence in the lab and artifact database organization has both short- and long-term benefits (as exemplified in their chapter in this volume!). This organization

has greatly facilitating our present and future artifact analyses conducted by students, staff, and specialists on the project.

I also want to thank the many interdisciplinary specialists who have joined the BREA project during the 2016-2017 seasons. Dr. James Stemp offered his valuable time and energy in analyzing the lithics from Crawford Bank and we greatly appreciate his expertise and valuable insights. Ms. Lori Phillips joined BREA as our faunal specialist and has begun a long-term study of the BREA animal remains as part of her dissertation research. We are happy to have her on board and grateful for the assistance of her mentors Dr. Erin Thorton of Washington State University and Dr. Kitty Emery of the University of Florida. During the summer 2016 season, we were happy to have Mr. Mark Willis join the BREA project. He generously provided his time and incredible skill, flying his drones over the vast wetland system around the Western Lagoon. Mark developed the beautiful maps presented herein andI am grateful for his time in the field and the endless amount of time spent post-processing the data for an area roughly 75% of the size of Manhattan!

I owe a large note of appreciation to the entire BREA staff for sharing their expertise and offering our students valuable training during both January field schools in 2016 and 2017. During the January 2016 season, seven undergraduate students from the University of New Hampshire (UNH)— Kaitlyn Carrior, Emily Ham, Madeline Moison, Katherine Shelhamer, Josephine Tarbell, Blake Wasson, and Sophia Willis—joined the BREA project as part of an "Archaeological Survey and Mapping in Belize" course. During January 2017, we offered this course again based this time in Crooked Tree. Nine undergraduate students—Caroline Aubry, Emma Berman, Riley Boss, Erin Hohorst, Jeremy Kassel, RoseAlaina Leone, Paul Lovely, Rebecca Philibert, and Katie Titus—joined the project and were trained by BREA staff in survey and excavation techniques. All of the student participants during 2016-2017 offered an enormous contribution to the field project and we thank them for their enthusiasm and participation on the BREA project.

I am particularly grateful to the two youngest members of the BREA team—my daughters Eliza & Natalie—who joined us during all three field seasons (despite missing a little bit of school). As usual, they climbed pyramids, helped wash artifacts, and, as always, provided much joy in our camp, making us laugh each day! Our work in Belize would not have gone so smoothly without the tireless efforts of our hosts at Banana Bank Lodge and at Tillett's Village Lodge. The Carr Family and all their wonderful staff took great care of us throughout the January and summer 2016 field seasons. Likewise, the staff at the Jungle Dome prepared delicious meals, getting up at the crack of dawn each day to prepare us breakfast and lunch. When we moved camps to Crooked Tree Village we were fortunate to find the Tillett Family, who welcomed us to their village and their home in Crooked Tree. Ms. Judy Tillett kept us well fed. We looked forward to her fabulous homecooked dinners each night and are grateful for their warm and friendly hospitality. Her sons, especially Sean Perriot, was a great source of support and helped make things run smoothly during our field seasons in 2016 and 2017. We are truly grateful for all their efforts and for making us feel right at home.

Our fieldwork was assisted by many local Belizeans. Our work in the middle Belize Valley was greatly facilitated by field assistance, including Chevon Flowers, Kenroy Moriera, Jimmy Martinez, Nelson Martinez, Raul Garcia, Marciano Kus, Victor Sub, Feliciano Vasquez (Chano), and Tony Martinez. In the lower Belize Valley, we were assisted in the field by Mr. Cardinal Baptist, Bruce Tillett, Dudley Tillett, Ruben Crawford, with additional assistance from Stanley Flowers, Sam and Walter Perriott, Susan Tillett, Cidella Tillett, Jaaziniah Wade, and Ravin Gillet. Judith Wade helped us wash in the lab and Marv Tillett helped us with excursions outside of Crooked Tree. We are grateful to these workers and all the residents of Crooked Tree who welcomed us and made us feel right at home. We are especially grateful for the support of the Crooked Tree Village Chairman, Mr. John Gillett, and to the entire Village Council who welcomed us and permitted us to map and excavate sites in and around their community. We look forward to coming back in the future!

None of the research conducted during the 2016-2017 seasons would have been possible without the generous support of the Alphawood Foundation and I am deeply grateful for their continued support. In addition, the University of New Hampshire (UNH) sponsored the BREA archaeological field school, which provided additional support for the project. Many individuals from UNH deserve a large note of thanks for their help in facilitating the logistics and finances of this research project, namely Cindy Corriveau, Angele Cook, Kay Cichon, Carol Main, Trisha Jennison, Angela Prescott-Bell, and many others in the Purchasing Department and Office of Financial Affairs at UNH. I also appreciated all the efforts and hard work of Jim Parson, who formerly served as the Director of the COLA Center for Study Abroad and managed a slew of wonderful programs sponsored through UNH, including this one. I am especially grateful to Carolyn Stolzenburg who provided continuous administrative support before, during, and after the three field seasons in 2016 and 2017. I also wish to thank Dr. Meghan Howey, the Chair of the Anthropology Department and a valued colleague and friend. She has supported the project over the years in various ways, including letting me borrow her Top Con Total Station every season – thank you! My permit for the BREA study area was granted by the Belizean Institute of Archaeology as part of the National Institute of Culture and History. I am grateful to the Institute staff, including Melissa Badillo, Delsia Marsden, Antonio Beardall, and especially the Director of the Institute, Dr. John Morris, for all his guidance, encouragement, and continued support for my BREA project.

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Edited by Eleanor Harrison-Buck

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Section III: Analytical Investigations

Chapter 1

BREA 2016-2017 Seasons: Investigations in the Middle and Lower Reaches of the Watershed

Eleanor Harrison-Buck

The Belize River East Archaeology (BREA) study area encompasses the watershed of the eastern half of the Belize River Watershed, between Belmopan and Belize City, and represents an area measuring roughly 6,000 sq. km (**Figure 1.1**). This report of the BREA project documents our most recent archaeological investigations from three different field seasons that were conducted in the course of roughly a year and a half, between January 2016 and July 2017. The four field seasons reported on here include a three-week January 2016 season, which extended from January 1-23. Fieldwork continued during a four-week summer season from May 28 to June 27, 2016. A third season reported on herein extended from January 1-23, 2017 and a fourth and final season reported herein occurred during a short, two-week field season from May 26 to June 11, 2017 followed by a lab season held from June 27-July 11, 2017. While each of these field seasons was relatively brief, they were all incredibly productive. In the last seven years of fieldwork, the BREA team has devoted most of its time to documenting the archaeology in the middle reaches of the Belize River Valley, between Banana Bank and the confluence with Labouring Creek (**Figure 1.2**). Beginning in 2015, the BREA project shifted downriver and since 2017 we have devoted our time exclusively to investigating the easternmost part of the Belize River Watershed, which comprises a low-lying coastal zone with numerous small creeks and tributaries along with sizeable tracts of perennial wetlands and lagoons (refer to **Figures 1.1** and **1.2**). This report details the results of our survey, mapping, excavations, and analytical studies that were undertaken between 2016-2017.

Background to the Research

Over the course of seven years (2011-2017), our investigations of the BREA study area have identified a dense occupation and a long history of settlement in the middle and lower Belize River Watershed (**Figure 1.2**), extending from Formative to Colonial times, ca. 900 BC-AD 1900 (Brouwer Burg, Harrison-Buck, Rung 2014; Brouwer Burg, Harrison-Buck, and Runggaldier 2015; Brouwer Burg, Runggaldier, and Harrison-Buck 2016; Harrison-Buck, ed. 2011, 2013, 2015a, 2015b; Harrison-Buck, Brouwer Burg et al. 2015, 2016; Harrison-Buck, Craig, and Murata 2017; Harrison-Buck, Kaeding, and Murata 2013; Harrison-Buck, Murata, and Kaeding 2012; Harrison-Buck, Willis, Walker 2016; Runggaldier et al. 2013). Between 2011-2017, the BREA project has identified roughly 2500 Maya mounds representing nearly 100

different sites in the middle and lower Belize River Watershed, the majority of which were not previously reported or documented archaeologically. These sites range in size, from small house lots to larger centers with ballcourts and pyramidal architecture. We have mapped a number of these sites, including some of the larger centers (Chikin' Chi'Ha; Kaax Tsaabil, Saturday Creek, Hats Kaab, Ma'xan, More Tomorrow, Jabonche and Ek'tok) and a number of the smaller plaza groups (Hum Chaak, Ik'nal, Ta'as Mul, and Ma'tunich, and Chulub) using a Total Station (refer to **Figure 1.1**). In addition, these sites have been recorded with a handheld GPS unit and sketch mapped. All site data has been inputted into our master BREA GIS database.

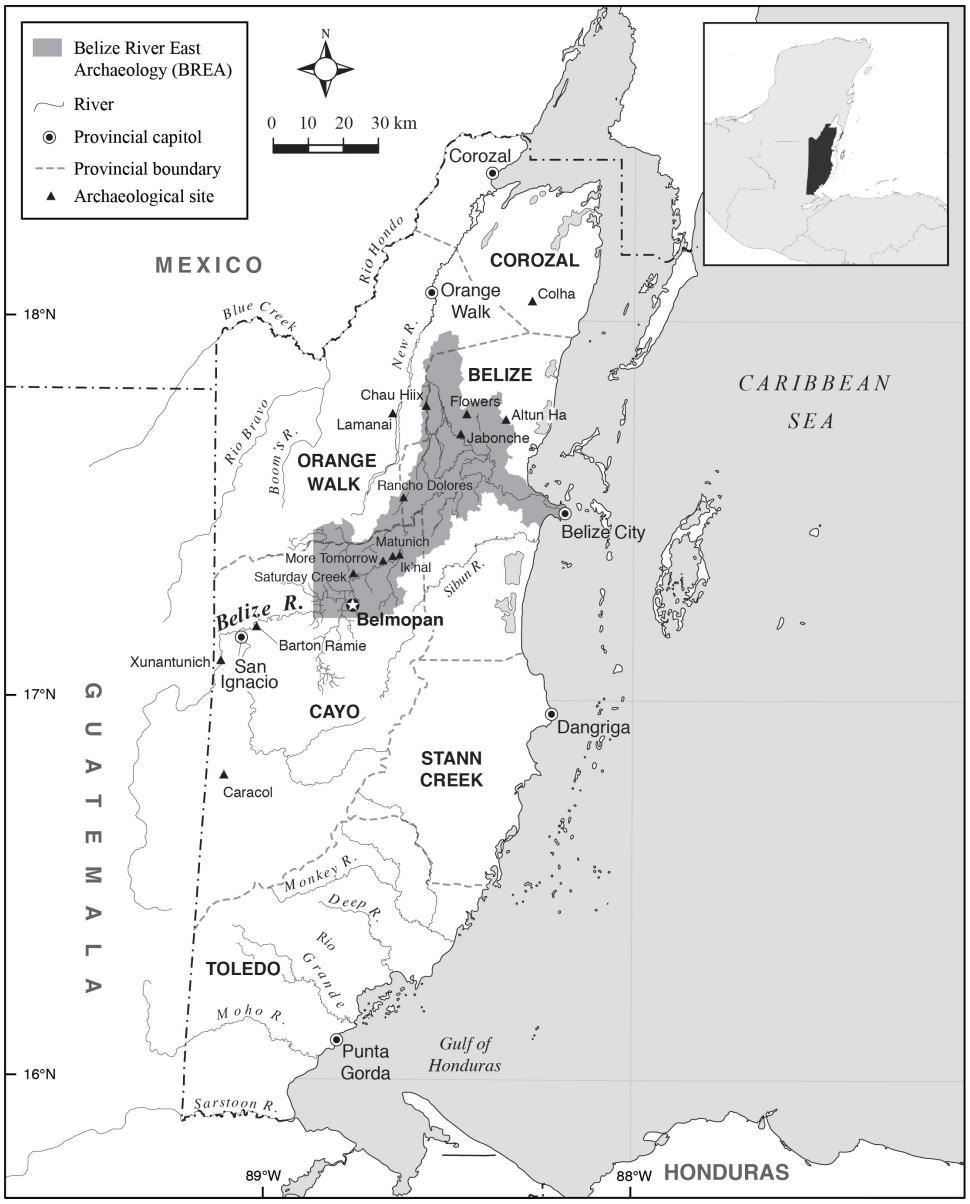

Figure 1.1 Map of Belize showing BREA study area (map prepared by M. Brouwer Burg).

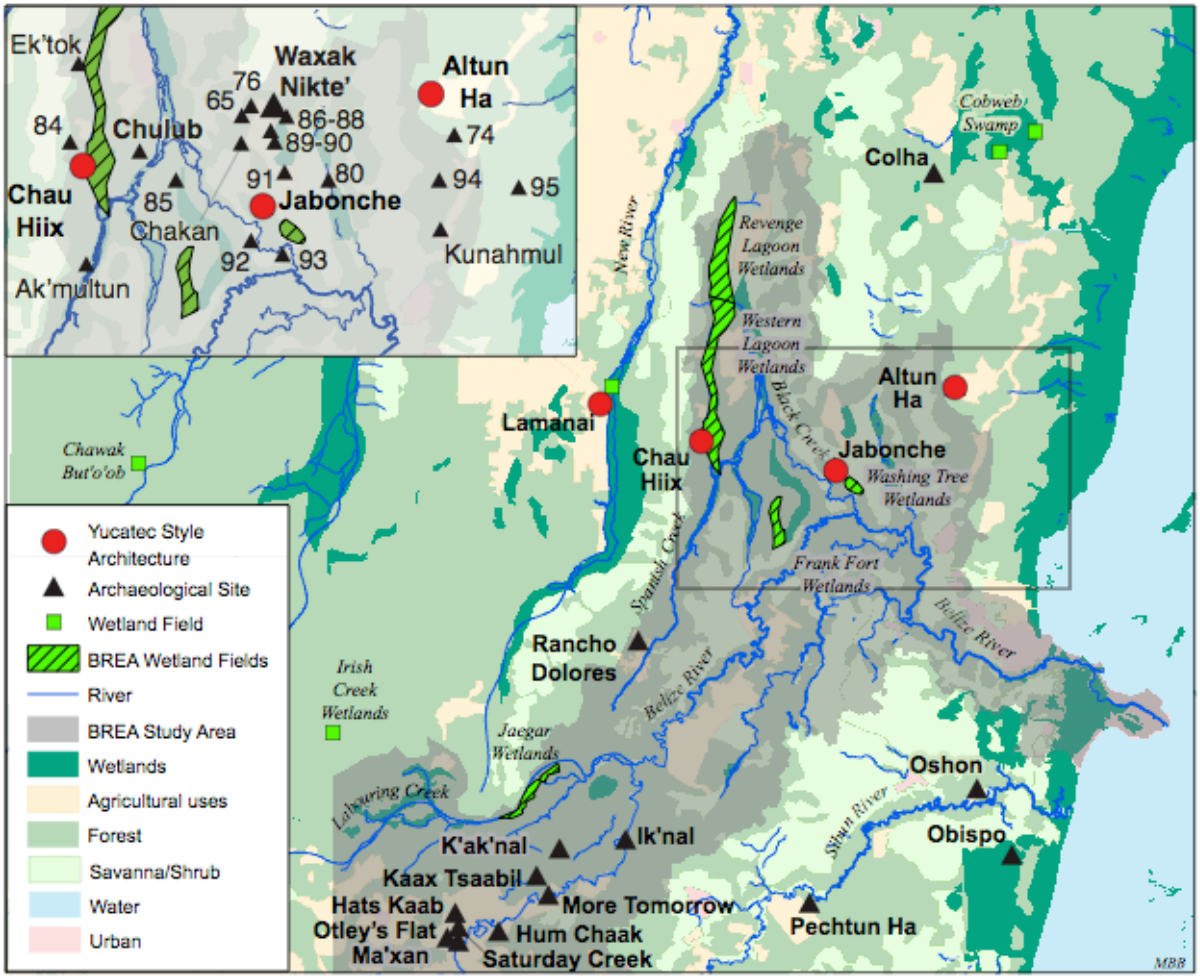

Figure 1.2 BREA study area showing Maya sites in the middle and lower Belize River Watershed (map prepared by M. Brouwer Burg).

The sites are primarily located along the main trunk of the Belize River, but some sites also have been found along tributary creeks and lagoons to the north and south of the river. For instance, the sites of Ek'tok and Chulub are located along the seasonally inundated lagoon and wetland systems in the Crooked Tree area (see **Figures 1.1 and 1.2**). In recent years, our reconnaissance has focused on the lower part of the Belize River Watershed, specifically along an east-west transect between Altun Ha and Chau Hiix, the two largest Maya sites in this part of the BREA study area. The latter is situated along the Western Lagoon Wetland, the largest inland wetland in all of Belize. Between 2016-2017, BREA conducted archaeological survey in the areas between the centers of Chau Hiix and Altun Ha (see inset on **Figure 1.2**). Unlike the uplands, we have found that settlement in the coastal zone is situated in relatively isolated pockets of higher ground. For instance, Jabonche—one of the largest sites that we identified and

mapped between Chau Hiix and Altun Ha—is positioned on one of the few areas of high ground found along Black Creek, a tributary of the Belize River (Harrison-Buck, Brouwer Burg et al. 2016). The areas around Jabonche and other neighboring sites, such as Chulub, Ek'tok, Chakan, Waxak Nikte', and Kunahmul are surrounded by marginal land inadequate for farming. For this reason, I have argued that these sites were heavily reliant on the wetlands for agriculture, building ditched and drained fields (visible in satellite imagery), while also relying on these biologically-rich environments for hunting and aquaculture (Harrison-Buck 2014).

2016-2017 Field Work

This report is divided into three main sections detailing the fieldwork conducted during the 2016-2017 seasons. The chapters in "Section I" discuss fieldwork involving our archaeological survey, mapping and reconnaissance efforts. Chapters in "Section II" report on our site investigations carried out in the middle and lower Belize River Watershed. Finally, the chapters in "Section III" present the analytical investigations that were carried out by our staff and specialists on the BREA project. Below, I provide an overview of each of these three sections and the chapter contributions included therein.

Section I: Survey, Mapping and Reconnaissance

Reconnaissance in the Middle Reaches of the Belize Valley

During January and summer 2016, we continued to perform reconnaissance around the middle reaches of the Belize River Valley (**Gantos and Buck, Chapter 2**). This included several attempts to locate an elusive ancient Maya site in the Logwood Caye area where reportedly there is a sizeable center north of Freshwater Lagoon, also known locally as Whitewater. This area is just south of Jaeger Wetlands, where modified ditched and drained fields have been recorded in satellite imagery (Harrison-Buck 2014). Although multiple reconnaissance efforts failed to locate the site, the BREA team has narrowed in on the location and will continue searching in future seasons. The BREA reconnaissance team also continued the settlement survey on the property known as Meditation (now owned by Green Tropics of Santander). Here, the team recorded a string of ancient Maya settlement distributed in a linear fashion along the high ground between Labouring Creek and the Belize River stretching in a north-northeasterly direction from Colorado Lagoon in the direction of the Logwood Caye area (see **Gantos and Buck, Chapter 2**). To the north of this settlement, the modified wetlands of the Jaeger wetlands system are visible on Google Earth satellite imagery and may have been what dictated the placement of this string of Maya settlement, which contain material culture suggestive of primarily a Terminal Classic date.

Mapping the Site Core of Chikin' Chi'Ha

During the January 2016 season, we continued the survey, mapping, and excavation of select sites in the middle reaches of the BREA study. We devoted three weeks in January 2016 to mapping the southern complex of Chikin Chi'Ha, a minor ceremonial hilltop center located roughly 2 km north of the Belize River along the west side of the Colorado Lagoon (**Murata, Norris, and Gantos, Chapter 3**). The site consists of two pyramidal structures in the main plaza that are built up onto the natural slope of the hilltop. Using a Total Station and GPS, the BREA team was able to record detailed topographic information for the site core and more accurately tie in the site to our existing GIS map of the BREA study area.

Chikin Chi'Ha is part of a larger ceremonial complex that includes another plaza group on an adjacent hilltop owned by Mr. Jose Gallardo. We refer to this sizeable mound group as the "North Complex." It is visible from a dirt road that in 2015 was cut through the middle of the saddle between the north and south hilltop complexes (Gantos 2015; **Figure 1.3**). The BREA team sketch-mapped the structures on the North Complex and additional settlement located on the intervening low-lying areas just west of Colorado Lagoon in 2011 and 2014 (Gantos 2015; Kaeding and Murata 2011). Ultimately, we were prohibited by the land owner from fully mapping this area with a Total Station during the January 2016 field season and only have a partial map (see **Murata, Norris, and Gantos, Figure 3.4**).

Figure 1.3 Photo of the North Complex of Chikin Chi'Ha (photo by A. Gantos).

Reconnaissance between Chau Hiix and Altun Ha and the Mapping of Ek'tok

Beginning summer 2016 and continuing through 2017, our reconnaissance focused almost exclusively on the lower Belize River Watershed in an area between Chau Hiix and Altun Ha, continuing an effort begun by Norris, Nigro, Murata, and Robinson (2015) to reveal ancient Maya and historic settlement in this low-lying coastal zone (**Murata, Kaeding, Gantos, and Buck, Chapter 4**). Here, dense household settlement was recorded along the lagoons and tributaries of the lower Belize River Watershed with reconnaissance conducted by horseback and by vehicle along the Northern Highway in the area around Biscayne (see inset on **Figure 1.2**). North of Chau Hiix, the secondary center of Ek'tok was recorded and in January 2017, the BREA team began mapping the site with a Total Station (see **Murata, Kaeding, Gantos, and Buck, Chapter 4**).

Drone Mapping the Western Lagoon Wetlands

Our efforts to investigate the perennial wetlands in the BREA study area continued in 2017. Examining satellite imagery publicly available on Google Earth, BREA detected a large network of water features in the form of ponds or wells connected to a series of long, linear canals in the adjacent Western Lagoon wetlands, which we believe were constructed by the ancient Maya possibly to function as fish weirs. During the summer 2017 season, we carried out an expansive mapping project of the wetlands using drones (**Willis and Murata, Chapter 5**). We have shown elsewhere that drone mapping is a very efficient and cost-effective means of mapping large-scale archaeological landscapes (Harrison-Buck, Brouwer Burg et al. 2015; Harrison-Buck, Willis, and Walker 2016; Willis and Walker 2015). One of the largest and longest canals in the Western Lagoon wetlands extends east from the site center of Chau Hiix and stretches across the Western Lagoon wetlands and bisects the southern tip of Crooked Tree island just south of Chulub (**Figures 1.5**). The geospatial mapping with drones offered an efficient and cost-effective means of mapping a huge area of the wetlands in a short amount of time. In less than a week, our drone operator Mark Willis mapped over 10,000 acres of the Western Lagoon wetlands that is an area over 40 km^2. To put this into perspective, the aerial extent mapped is equivalent to 75% of Manhattan. A close-up of the longest canal extending from Chau Hiix across the Western Lagoon wetlands reveals the channel and other subtle topographic details that the drone was able to detect.

Mapping Chulub and its Water Features

During January 2017, we devoted most of the season to surveying and mapping with a Total Station the site of Chulub, located on the southern end of Crooked Tree island **(Murata, Kaeding, and Gantos, Chapter 6)**. Chulub consists of one formal plaza in the center of the site that appears to be residential. It consists of an enclosed plaza lined with a series of low platform

structures. Aside from this plaza group, most of the mounds at Chulub are isolated or configured in linear arrangements and lack any formal plaza configuration. In between some of the mounds are a number of water features, some of which appear to be ancient. These include linear canal features and several retaining ponds. The distribution of water features combined with the configuration of the mounds suggests the site may be predominantly a production locale, perhaps related to fisheries or some other form of aquaculture.

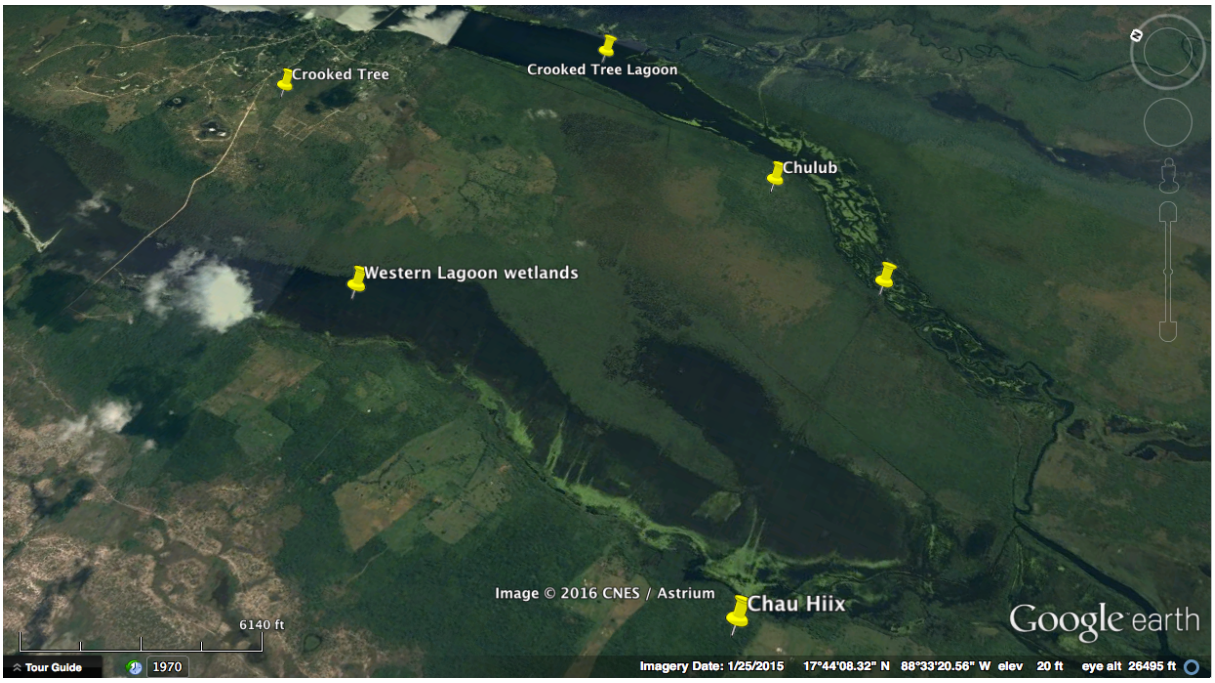

Figure 1.5 Satellite image showing linear channels in Western Lagoon Wetlands in the foreground, including one that appears to connect Chau Hiix with Crooked Tree Lagoon to the east and Chulub just to the north.

Section II: Site Investigations

During the field seasons from 2016-2017, BREA carried out an extensive program of test excavations at four sites, three of which we mapped with a Total Station during 2016-2017. Sites that were investigated include Saturday Creek, Chikin' Chi'Ha, Chulub, and Crawford Bank. The findings from these excavations are presented in the chapters in this report and are summarized below.

Further Excavations at Saturday Creek

One of our goals during the 2016 season was to further refine our understanding of the late history of Saturday Creek. Our previous excavations in the Southwest Plaza group (Operations 23 and 24) during 2015 revealed a late occupation in this portion of the site

beginning in the Terminal Classic and continuing through Late Postclassic times to the time of Spanish Contact (Harrison-Buck and Flanagan 2015; Kaeding and Harrison-Buck 2015). Operations 23 and 24 exposed a series of Contact period cache deposits in the southeast and northeast corners of Structure 11, an east-west platform located adjacent to a Postclassic radial shrine (Structure 10). During the January 2016 season, Operation 24 was expanded to expose the center portion of Structure 11 and another excavation (Operation 29) was placed at the far west end of the structure in an effort to expose other potential Contact period caches in the southwest and northwest corners of the structure. Investigations revealed similar Contact period architecture and a cache deposit in the southwest corner of Structure 11 that consisted of a chipped stone spear point that is possibly historic in date (**Kaeding and Harrison-Buck, Chapter 7**).

Investigating an Eastern Shrine at Chikin' Chi'Ha

We devoted a substantial amount of time carrying out test excavations at the site core of Chikin Chi'Ha. During the January 2016 season, in addition to mapping the South Complex we placed a test excavation on the eastern structure of the site's main plaza group. Excavation of Operation 30 identified a platform structure with several different phases of construction (**Craig, Harrison-Buck, Runggaldier, Chapter 8**). In an earlier phase, the building consisted of a low 40 cm high basal platform that supported a room with a low bench to the rear, characteristic of other C-shaped structures found elsewhere in the Maya Lowlands dating to the Classic-Postclassic transition (Bey et al. 1997; Schwarz 2013). In a later phase of construction, the low basal platform appears to have been reused but the bench was rebuilt and shifted back and to the south slightly. In its final (Postclassic) phase, a low step covered most of the exterior of the 40cm high basal platform on its (front) west side. Underneath this low step a burial feature was partially exposed in the final days of the January 2016 season. A small, black slipped bowl with incising characteristic of Terminal Classic period San Pablo Gloss wares (sometimes referred to as Achote Black) was found associated with the burial deposit. During the summer 2016, the BREA team returned to expand the Operation 30 excavation and exposed a burial of an adult individual, likely a male, with two associated ceramic vessels and three infant burials surrounding the primary interment, all dating to the Terminal Classic period (ca. A.D. 830-950). Although a full ceramic analysis has not yet been completed for Operation 30, a cursory inspection suggests that the bulk of the structure dates to the Terminal Classic period with a final phase dating to the Postclassic period.

Excavations at Chulub

During the January 2017 season, our investigations in the lower Belize River Watershed included a series of excavations at the small site of Chulub (**Figures 1.1** and **1.5**). While mapping was underway, the BREA team conducted several excavations including one on

Structure 5, an all-stone building in the southwest corner of the main plaza. Prior to excavation, it was thought to represent a circular shrine similar to those found elsewhere in the BREA study area (Harrison-Buck 2011, 2013). However, Operation 32 (a roughly 6 x 8 m unit) revealed a poorly preserved Postclassic shrine structure (**Harrison-Buck, Chapter 10**). The building appears to have been constructed with upright slab construction, similar to other Postclassic shrine buildings, and may be similar in configuration to Structure 10 at Saturday Creek, a Postclassic radial shrine with stairs on all sides (Harrison-Buck and Flanagan 2015).

The most substantial platform (Structure 1)—what has been interpreted as the main elite residence—is located along the northern side of the main plaza. Operation 33 comprised two 1 x 2 m units that were focused around the east and north sides of Structure 1 (**Shelhamer and Craig, Chapter 11**). These excavations were aimed as exposing midden deposits along the side and back of the structure, with the goal of better understanding the occupation, diet, and resource-use of the inhabitants over time. The third area of excavation (Operation 31) was a 2m x 10 m excavation unit positioned on an outlying mound to the north of the main plaza, located adjacent to one of the water features (**Flanagan, Chapter 9**). The goal of the excavation was to better understand the function of these pond and canal-like features found in between these outlying structures. One hypothesis that we wanted to test was whether these water features, which become seasonally inundated but retain some water throughout the year, were used by the Maya for aquaculture. The excavation revealed an intact terrace wall and yielded a high density of lithic material, including a number of specialized tools, such as polished axes which suggest wood-working. One possibility is that this area was used for making carved wooden products, such as bowls or handles for hafted tools or perhaps larger goods, such as carved dugout canoes and that the canal features facilitated the movement of these goods from the workshop to the open lagoon waters, creeks and riverine networks.

Testing a Pond Feature in the Western Lagoon Wetlands

Chulub is located adjacent to the Crooked Tree Lagoon and the nearby Western Lagoon Wetlands and several of the canal features identified in the site center may connect to these neighboring waterways. Here, modified wetland features have been recorded (Pyburn 2003) and our own inspection of satellite imagery has revealed much more substantial wetland modification than previously known, with extensive canals, ditched fields, and hydrological features that will be the focus of future BREA investigations (for a review see Harrison-Buck 2014). A series of linear canal features often connected to a pond or catchment have also been identified throughout the Western Lagoon Wetlands, visible in publicly available satellite imagery (Harrison-Buck 2014 [**Figures 1.5** and **1.6]**). During summer 2017, the BREA team carried out a small test excavation of a pond feature positioned along the main axis of one of the largest linear channels that crosscuts the Western Lagoon Wetlands and appears to run from Chau Hiix east across the southern tip of the Crooked Tree island to where it connects with the Crooked Tree Lagoon (see **Figure 1.6**). Operation 34 is a small 1 x 2 m unit placed on the western edge of the pond feature

(**Craig and Harrison-Buck, Chapter 12**). We hypothesized that this feature may have been used as a fish weir by the ancient Maya. However, aside from a piece of chert debitage, our excavations yielded virtually no other cultural material, only mud and organic material.

Figure 1.6 Map showing a portion of Western Lagoon Wetlands with linear canal and pond features with red box designating location of pond and Operation 34 (courtesy of Google Earth).

Revealing Preceramic Occupation at Crawford Bank

The Crawford Bank site is located on the east side of the island on the property of the Crooked Tree Lodge adjacent to the Crooked Tree Lagoon, over 7 km north of Chulub (see **Figure 13.1**). Operation 35 was excavated during the summer of 2017 (**Harrison-Buck, Craig, and Murata, Chapter 13**). The unit comprises a narrow 1 x 12 m strip trench with the long axis running east-west that revealed the remains of an eroded outcrop of limestone bedrock running along the eastern shoreline of the Crooked Tree island. The excavation revealed a midden deposit consisting of a heavy density of lithics and *Pomacea* shell with no evidence of ancient Maya ceramics. Just below the ground surface, closest to the standing water of the lagoon, a barbed Lowe Point was recovered. Together, the evidence suggests a dense preceramic occupation at Crawford Bank and exploitation of freshwater Mollusca by the early inhabitants.

Section III: Analytical Investigations

Following the four field seasons in 2016 and 2017, BREA held a laboratory season from June 27-July 11, 2017. During this time, artifacts were washed, processed and entered into the BREA Filemaker Pro datatabase. This system has evolved and adapted over time and a review of our protocols is outlined in this report (see **Runggaldier, Phillips, and Brouwer Burg, Chapter 14**). This chapter describes the collection management framework that the BREA lab team has devised and the laboratory methods used for inventorying artifacts and other finds collected in the field by the BREA project.

During 2016-2017, BREA zooarchaeologist Lori Phillips continued classifying all faunal remains recovered in wetland and settlement excavations (**Phillips, Chapter 15**). We anticipate finding a heavy representation of locally acquired wetland-fidelic species from our excavations at sites like Chulub that are located proximate to the perennial wetlands in the lower Belize River Watershed. This was a primary goal of our test excavations at Chulub in January 2017 where we targeted residential structures with associated midden (trash) deposits containing faunal remains (see **Flanagan, Chapter 9**; **Shelhamer and Craig, Chapter 11)**. Phillips is writing up the faunal analysis as part of her doctoral dissertation at Washington State University in Pullman.

During the summer 2017 field season, BREA excavations revealed a wealth of lithic material from the Crawford Bank site that appears to date to the preceramic period (**Harrison-Buck, Craig, and Murata, Chapter 13**). The Institute of Archaeology granted the PI of the BREA project permission to export the assemblage to Dr. James Stemp at Keene State College in New Hampshire. Stemp performed an analysis and write-up of his findings that is included in this report (**Stemp, Chapter 16**). Stemp's chapter analyzes the 946 stone artifacts from Crawford Bank in terms of raw material, technology, and use-wear. In addition to the barbed Lowe Point, Stemp identified 16 other formal tools in the assemblage, including both bifacial and unifacial tools, blade and blade fragments, a drill/perforator and a hammer stone. From his use-wear analysis, Stemp concludes that much of the evidence points to wood-working, consistent with sawing, scraping, planning and polishing wood. It is worth noting that woodworking also appears to be evident from the tools found at Chulub (see **Flanagan, Chapter 9**). The evidence for woodworking in the logwood swamps of Crooked Tree island, so named for their valuable source of durable hard wood, may indicate a much deeper history of exploitation for this indigenous species than was previously known, dating from preceramic times onward.

Conclusions

This report offers a comprehensive look at the results of our year and a half of field and lab work on the BREA project from 2016-2017. The results presented here are a testament to the strength and breadth of our research, which ranges from reconnaissance and mapping to material

culture studies. In my final chapter of this report, I discuss our future directions and goals of the BREA project, both long-term and immediate plans for the upcoming season, which will build upon our work from 2016-2017. While we do not plan to hold a field school in January or summer 2018, we plan to carry out a short excavation season with some reconnaissance during January and some artifact processing and analysis in summer 2018, and will continue to expand our investigations of the lower reaches of the Belize River Watershed.

Our research is revealing a deep history of the middle and lower Belize River Watershed, which begins in the Preclassic and continues through Colonial times (Brouwer Burg et al. 2014, 2015, 2016; Harrison-Buck, ed. 2011, 2013, 2015a, 2015b; Harrison-Buck et al. 2012, 2013, 2015, 2016, 2017; Runggaldier et al. 2013). Given the continual occupation, this area offers an ideal context in which to review the changes taking place during periods of significant cultural transformation in Maya history—first during the Preclassic-Classic transition, then later during the so-called Classic Maya "collapse" period, and finally during the Spanish and British Colonial periods from the sixteenth through the twentieth centuries. Through our continued investigations in the eastern half of the Belize River Watershed, we aim to expand our understanding of the social, political, and economic changes that occurred in this area through time and reveal the rich cultural and environmental diversity that this area has to offer.

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Section I

Survey and Mapping

Chapter 2

The Search for the Elusive Logwood Caye Site and Other Reconnaissance in the Middle Reaches of the Belize Valley

Alex Gantos and David Buck

Introduction

During the 2015 and 2016 field seasons the BREA reconnaissance team continued survey of the Meditation area continuing the work conducted during the 2014 season (including McRae area) (Gantos 2015). Our goals of this prior survey work were twofold: to continue to record the location of cultural artifact loci and collect samples from sites currently being destroyed by agricultural development; and to continue to record site presence-absence along the north-south overland route that, according to Spanish accounts, reportedly extended from the mid-section of the Belize River to the headwaters of the New River to the north (Harrison-Buck et al. 2015, 2016). Our working hypothesis, based on a GIS Least Cost Path analysis by Marieka Brouwer-Burg et al. (2014), has been that one possible overland route came from the north across the pine ridge (*pinal*) that runs parallel to New River Lagoon and reached Labouring Creek at a point further east than the historic travertine natural bridge crossing (Buck et al. 2013). The southern extent of this pine ridge enters Labouring Creek at a point just north of Logwood Caye, a forested elevation between Labouring Creek and Whitewater Lagoon. When this information is linked with with the results of the 2014-2016 pedestrian survey to the SW we predict that a significant settlement node might exist near the crossing point of the creek (**Figure 2.1**).

Objectives

The primary objectives of the 2015/16 pedestrian survey and reconnaissance were:

1. To record ancient Maya and Colonial settlement and associated surface artifacts within the area called Meditation which have recently been cleared for sugar cane agriculture. Cultural remains are now considered to be at high risk of destruction.

2. To expand reconnaissance eastward into Logwood Caye area to test the hypothesis that a significant Maya settlement lay on the overland route at the crossing of Labouring Creek.

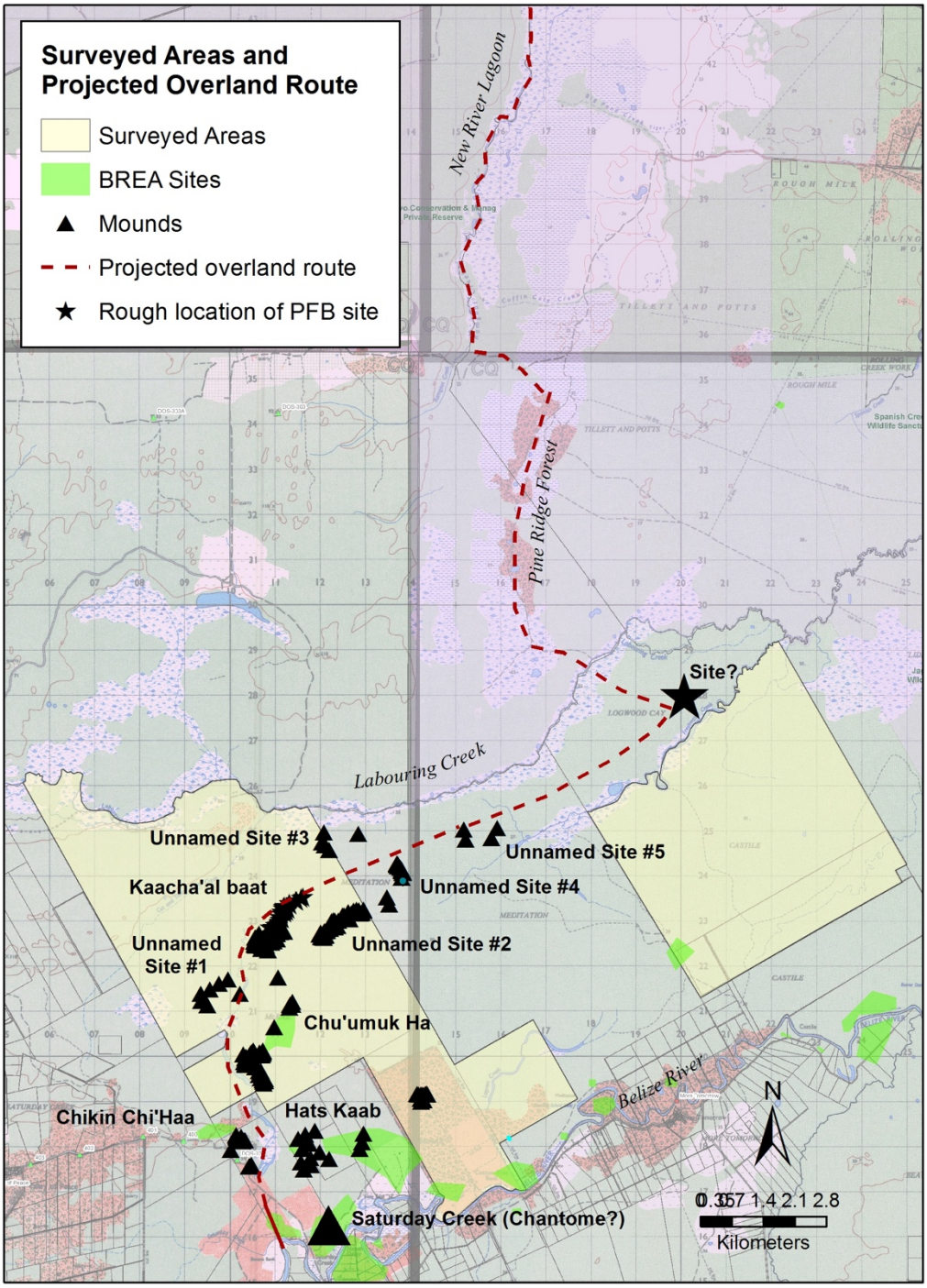

Figure 2.1 Map showing the McRae/Meditation survey area showing projected overland route with mounds and locations of platform/elite groups mapped with GPS and probable location of Logwood Caye PFB site (Map prepared by M. Brouwer Burg)

Settlement in Meditation

In 2015/16 the BREA recon team returned to the northeast area of Meditation to continue the pedestrian survey. In 2014 reconnaissance of Unnamed Site #2 had not yet been completed due to time constraints, but at the time it was noted that mounds continue to the north and northeast of the site plaza. When we returned in 2015 to complete the recording of the mounds of that site we found that the entire northern area had been bulldozed flat and was undergoing water management construction that left the area under water thus preventing the team from accessing the extension of Unnamed Site #2.

To the east of Unnamed Site #2 we continued the pattern of systematic survey. We covered an area of about 4 sq. kilometers that extended our coverage in the area another 3 kilometers to the northeast, or to about the boundary between Meditation and Logwood Caye. Our coverage included fieldwalking all plowed land at 10-meter intervals in order to report with confidence on presence-absence data. While surface visibility was very good the repeated plowing and flattening of the landscape has removed all surface relief (**Figure 2.2**). No mounds were visible but artifacts and construction stone fills identified the locations of destroyed mounds.

Figure 2.2 Surface visibility in recently planted cane fields at Unnamed Site #3. Note absence of surface relief due to bulldozed and leveled mounds (photo by A. Gantos)

Survey began just to the east of Unnamed Site #2 and ranged north to the tree line of the Jaeger wetlands of Labouring Creek and south to bajo areas of the drainage to Whitewater Creek. After an interval of about 1 kilometer ENE of Unnamed Site # 2 the team (including for the day Josue Ramos of the IA) encountered large rock piles at the edge of the road and along the tree line.

Figure 2.3 Michael Martinez and Josue Ramos (r.) display material removed from destruction of mounds, including mano and metate fragments (photo by A. Gantos)

These fist-sized to large limestone rocks mark the locations where farmers clear plow-damaging stones from their fields. These rock piles represent cues that cultural material may be nearby especially since the nearest limestone outcrops to quarry are located about 5 kilometers away (**Figure 2.3**). True to form, included among the stone piles were numerous granite mano and metate fragments. In one pile alone, we counted more than 50 large fragments.

In this area we also encountered cultural artifacts mixed with stones on the flat surface of the plowed fields. This concentration of destroyed mounds we identify as Unnamed Site #3 (**see Figure 2.1**). We were only able to record 24 distinct concentrations of artifacts but it is quite possible that some of the more ephemeral low-artifact work surfaces have been completely erased. In addition, there were some scatters of about 30 meters E-W and 80 meters N-S. This elongated distribution is caused by the direction of the plow which drags elevated mound materials across long distances. It is even quite possible that the debris from several mounds are included in each of these large scatters. In some cases, these wide areas of artifact scatter might represent the multiple structures of a plaza or patio group. The artifact assemblage was abundant and broad comprising ceramics including numerous rim and base sherds, groundstone with

manos, metates and pounders, obsidian blades and cores, chert biface points and tools, chert debitage, greenstone beads, and also small amounts of animal bone and freshwater shell (**Figure 2.4**)

Figure 2.4 Typical artifact assemblage from Unnamed Site #3 (photo by A. Gantos)

While it was often difficult to identify individual mounds, the size and artifact types at each scatter followed a pattern observed in 2014 at sites Chu'umuk Ha, Kaac al Bat, and Unnamed Site #2 where each distinct settlement group had a large plaza group with a nearby large patio group in the midst of several many smaller groups and single mounds all distributed in a linear pattern along a SW to NE axis. In addition, there are several smaller scatters that appear to represent more elite or special use workshops. One patio group had a dense distribution of most artifact types including a ground greenstone bead (**Figure 2.5**) and nearby a cache of five obsidian cores (although in the plow zone they were found within a two-square meter area) (**Figure 2.6**). Along with the cores this scatter included two further broken obsidian cores and numerous obsidian blades and bladelets.

Travertine is another curious artifact type that has been found throughout the sites in the McRae-Meditation area (**Figure 2.7**). Obvious concentrations of this material appear to be limited to the large plazas and patio groups. We initially identified the travertine as speleothems but consequently have come to understand that they are accretionary travertine limestone nodules and tubes that were quarried at Unnamed Site #1 (Gantos 2015), located 4.5 kilometers to the southwest. At Unnamed Site #3 travertine shows up in quantities within the debris scatter that has been identified as the likely plaza center of the site.

Figure 2.5 Drilled greenstone bead (photo by A. Gantos)

Figure 2.6 Cache of obsidian cores (photo by A. Gantos)

Figure 2.7 Quartz quarried from Unnamed Site #1 (4.5 km to SW) (photo by A. Gantos)

The cluster of scattered artifacts representing Unnamed Site #3 ended abruptly although similar surface visibility continued to the north and east. To the south the fields dip down to waterlogged bajo conditions where there was no visible evidence of settlement.

In 2016 the recon team returned to the area to continue the survey eastward toward Logwood Caye and the Jaeger wetlands where ancient Maya modified raised fields have been reported (Harrison-Buck 2014). The surveyed area consisting of previously cleared land had been under corn cultivation but had recently been converted to sugar cane production. The large earthmoving equipment used for flattening the fields (destroying ancient Maya platforms and mounds) and digging numerous drainage ditches in preparation for planting cane had fully eradicated all surface relief and consequently no mounds were initially visible.

Figure 2.8 Plowed and Flattened mounds at plaza of Unnamed Site #4 (photo by A. Gantos)

By systematic field-walking the team again was able to identify the stone and artifact scatters that were all that remained of ancient settlement (**Figure 2.8**).

Moving eastward from Unnamed Site #3 we moved across fields having no evidence of cultural material until after about 900 meters we again encountered the stone and artifact rich clusters of destroyed mounds. This settlement, called Unnamed Site #4, was bisected by an E-W consolidated limestone access road and also N-S by a deep drainage canal and heaped excavated soil. The canal and heaped soil completely destroyed a 22-meter-wide swath through the center of this settlement. Of the 10 scatters on the west of the canal we were able to identify differing types of artifact categories. For instance, some scatters had more slipped ceramics while others had more coarseware ceramics mixed with groundstone mano/metate fragments and lithic debitage. The close proximity of some of these mounds might suggest different live/work areas of a patio group, which was in evidence during the previous 2014 survey area (Gantos 2015) where they had not yet been flattened. A typical artifact assemblage from Unnamed Site #4 includes slipped and coarse ceramic sherds, chert biface tools and debitage, obsidian blade fragments, groundstone mano and metate fragments, and some freshwater shell (**Figure 2.9**)

Figure 2.9 Typical artifact assemblage from Unnamed Site #4 (photo by A. Gantos)

East of the canal there were artifact scatters recorded on the south side of the road (and limited time prevented the team from fully recording the scatters visible on the surface to the east although they could be seen extend several hundred meters eastward. North of the road and parallel to the canal, however, was an extensive dense scatter of artifacts extending N-S about 150 meters and E-W about 80 meters. The distribution was not even but instead there were large distinct clusters of stones and artifacts distributed to form a large rectangle oriented on cardinal directions. This plaza had what appeared to be long range-type mounds on the west, very large north and south mounds (pyramids?), a northeast structure and one wide scatter intruding onto the SE plaza area. The assemblage at the southern scatter had a high density of slipped ceramic wares (**Figure 2.10**) as well as a wide range of chipped and groundstone tools and celts as well as obsidian blade fragments (**Figure 2.11**).

This plaza group, in keeping with the plaza groups identified throughout the survey of Meditation area, also contained numerous fragments of those accretionary travertine limestone nodules and tubes (quarried at Unnamed Site #1 located 6.5 kilometers to the SW) suggesting that this material (see **Figure 2.7**) was not only quarried and transported some distance but that it was perhaps reserved for the construction of the large plaza groups of this entire area. This might suggest some overarching control of the location and establishment of each of these settlement cores.

Figure 2.10 Rims and bases from southern scatter of the plaza (photo by A. Gantos)

Figure 2.11 Lithic Assemblage from southern scatter of the plaza (photo by A. Gantos)

About 500 meters to the southeast of this large plaza are several large platform groups initially discovered and recorded by Satoru Murata and Adam Keading during an assessment survey in 2011 (pers. communication). Subsequently these have been plowed annually and have now also been almost entirely flattened including a road cutting directly through the center of the largest group. It is as yet unclear if they are to be linked with Unnamed Site #4 or represent an entirely separate settlement. They are only separated by less than 500 meters. If they all belong together this settlement would be very large, covering an area of about 1 km N-S and 1 km E-W. With its multiple platform groups, it shares characteristics with Chu'umuk Ha which is located on the Colorado Lagoon and possibly connected with the acropolis of Chikin Chi'Haa. The concentration of larger plazas and patio groups of the Unnamed Site #4 could be understood as the outskirts of a large center reported to exist in the area of Logwood Caye.

Search for the Logwood Caye site

The reconnaissance to find the site on Logwood Caye began in 2015 and was followed in 2016 with two teams trying different routes to access this particularly remote area. The BREA team was first informed about the site by local informants who had either been in the area hunting or cutting timber. They reported having seen two large pyramids in the forested area between Labouring Creek and Whitewater Lagoon. Subsequently we learned of a Management Plan for White Water Lagoon and Spanish Creek Area published in 2000 conducted by Program For Belize that reported "several structures ranging from small to 13 meters high" in the broadleaf forest to the northwest of Whitewater Lagoon (Program For Belize 2000). In their

report they propose a protected archaeological zone and marked a 1/2 km square on their map of the overall Protection Zone of White Water Lagoon (**Figure 2.12**). This report allowed the team to target those particular coordinates to begin survey of the area.

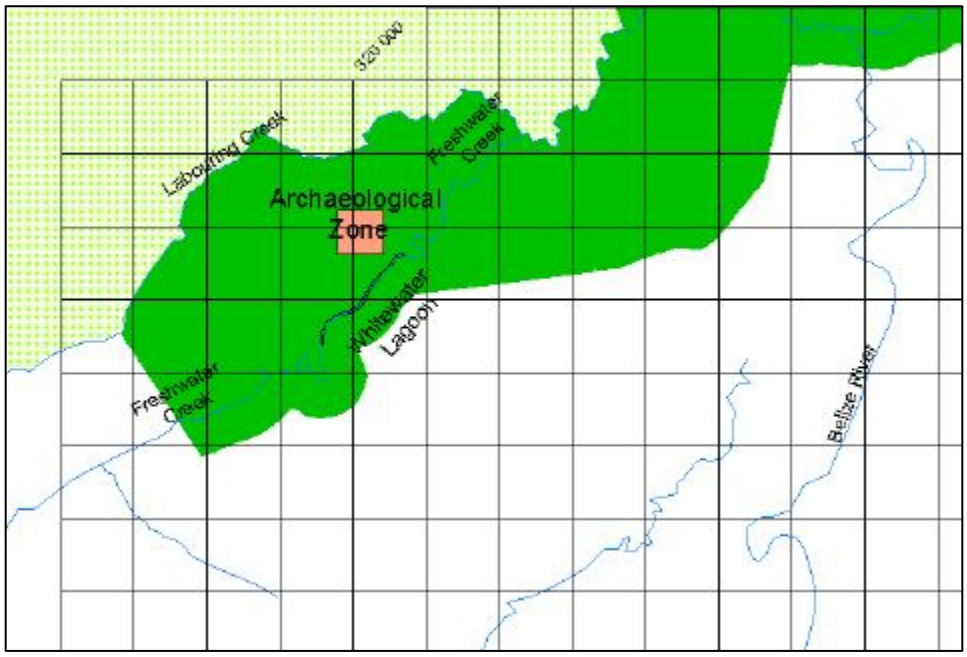

Figure 2.12 Detail from the PFB Protection Zone map (map by Program For Belize 2000)

The Program For Belize report seemed to confirm our hypothesis that a large site would be situated at or near the point where the pine ridge from the north meets Labouring Creek along a proposed overland route outlined in a Least Cost Path GIS analysis (Brouwer Burg et al. 2014). Based on the data collected subsequent to the analysis, this path might continue SW across the area of Meditation to the large sites of Saturday Creek and Chikin Chi'Ha (see **Figure 2.1**). In following a SW direction from Logwood Caye to Saturday Creek the route would pass through the sites Unnamed Site #4, Unnamed Site #3, Unnamed Site #2, Kaac al Bat and Chu'umuk Ha that are distributed in a line along high ground between Labouring Creek and the Belize River. To the north of this settlement, a string of modified wetlands are visible on Google Earth satellite imagery (Eleanor Harrison-Buck, pers. Communication, October 2018). These are an extension of the Jaeger wetlands previously reported by Harrison-Buck (2014).

In June 2015 a team (Alex Gantos, Josue Ramos, and Michael Martinez) embarked on a canoe trip to Labouring Creek upriver from Logwood Caye with the intention of working our way through the mangrove swamp to the stream then paddling downstream through the raised agricultural fields in the Jaeger wetlands (as seen on satellite imagery) to a point on Logwood Caye where we would investigate the higher elevation areas. Unfortunately, heavy rains just before departure caused heavy flooding across the entire area around Labouring Creek (**Figure**

2.13). The access road was washed out as the water level had risen more than 1.5 meters the previous night.

Figure 2.13 Flooding and washed out roads south of Labouring Creek (photos by J. Ramos)

Nevertheless, we entered the Jaeger wetlands of Labouring Creek as planned through a drainage canal but immediately encountered contrary currents and channels (**Figure 2.14**). The water, continuing to rise, had overflowed the banks of Labouring Creek and caused a reversal of the drainage with the current flowing inland. This prevented the team from following the currents through winding channels through the mangrove. After more than 20 hours of continuous paddling and retracing paths, we had not yet found the channel of Labouring Creek and were forced to return to camp.

Figure 2.14 The team departs by canoe along drainage canal towards Labouring Creek (photos by A Gantos (l.) and J. Ramos (r.))

In January of 2016 David Buck, along with Feliciano "Chano" Vasquez took advantage of the dry season to travel by canoe to White Water Lagoon and Logwood Caye (**Figure 2.15**). They successfully reached the lagoon by approaching from the south through the sugar cane fields, using a wide drainage canal to gain access to Freshwater Creek and Whitewater Lagoon. From their upstream entry point the team traveled downstream to a point on the bank of Logwood Caye closest to the Archaeological Zone identified on the Program For Belize map (see **Figure 2.12** and **2.16**). They had difficulty traversing the low swampy shoreline area but they did finally reach the center point of the zone. After systematic reconnaissance of the area, however, no evidence of the site was found.

Figure 2.15 David Buck and Feliciano "Chano" Vasquez paddling to White Water Lagoon (photos by D. Buck).

Figure 2.16 White Water Lagoon January 2016 (photos by D. Buck).

The area delineated on the Program For Belize map did not quite accord with their description of its location on higher ground to the northwest of the lagoon, and until we receive confirmation from them or their exact coordinates we will consider that the site is in some nearby location that the report did not to reveal as a protective measure.

During the summer field season, at the end of June 2016, the recon team once again set out to find the elusive Logwood Caye site. The strategy this time was to approach the lagoon by traveling upstream on Labouring Creek then entering White Water Lagoon through Freshwater Creek, a right bank tributary of Labouring Creek.

Figure 2.17 Members of the June 2016 trip to Logwood Caye (right to left): Alex Gantos, Denton Moody, Selvyn Flowers, and Cardinal Baptiste (photos by A. Gantos)

The team consisted of Alex Gantos, Denton Moody (boat owner and guide), Selvyn Flowers (informant), and Cardinal Baptiste (guide) (**Figure 2.17**). We departed Isabella Bank in Moody's power boat, proceeded up the Belize River and entered Labouring Creek without issue, but Labouring Creek earned its name due to the many trees that had fallen across the stream requiring frequent pauses to chainsaw a passage. Many of the trees appear to have fallen as a result of Hurricane Richard in 2010. We entered Freshwater Creek, a right-bank tributary of Labouring Creek and followed it upstream towards White Water Lagoon.

Before we could reach the lagoon, however, we encountered a recent earthen dam across Freshwater Creek diverting the outflow from White Water lagoon inland to irrigate the sugar cane plantations (**Figure 2.18**). The dam had been breached and we were able to portage the boat over that low point where we encountered no further delays in reaching White Water Lagoon.

On Logwood Caye we intended to follow David Buck's route by systematically surveying from his endpoint but could not land the boat close enough to dry land. We beached upstream and began a transect towards Buck's last point. Our informant, who had been a woodcutter in the area some decade earlier, could not easily identify any landmarks leaving us to continue to cut transects through the cohune palm ridge (**Figure 2.19)**.

We observed that the area that Program For Belize had identified was generally low in elevation and probably prone to flooding so we moved in a northern and northwestern direction until we reached low-lying areas of the banks of Labouring Creek. We did locate an overgrown plantation road, recognized by Flowers, that had several rusted iron truck or machine parts in several spots but it did not have a clear terminus at either end. During the course of the investigation we found no evidence of ancient Maya cultural remains.

Figure 2.18 The earthen dam blocking flow from White Water Lagoon to Freshwater Creek and diverting it to irrigate sugar cane fields to the south (photo by A. Gantos)

Figure 2.19 White Water Lagoon with the cohune palm ridge along the southern bank of Logwood Caye (photo by A. Gantos)

Conclusions

Our investigation into settlement in the areas of McRae and Meditation from 2014-2016 have given us a clear picture of the settlement in that area. We have mapped the locations of the platforms and mounds of five separate settlement clusters in this area and are confident that through systematic field-walking we have identified all of the settlement. We have been able to show that in topographically low areas (*bajos*) there is an absence of mounds and artifacts, and that there is a clear drop-off at the end of one settlement and the beginning of the next. Each of these five settlements: Unnamed Site #4, Unnamed Site #3, Unnamed Site #2, Kaac al Bat and Chu'umuk Ha (from NE to SW) have numerous shared characteristics. Each of them has a large raised plaza area with structures on all sides and each has large elite patio groups near to the plaza. They all have a distribution of smaller mounds and mound groups that stretch in a linear manner from SW to NE all distributed in a line along the higher elevations of McRae/Meditation area. The linear distribution appears to mirror the modified ditched and drained wetlands immediately to the north, which are part of the Jaeger wetlands that run along Labouring Creek. The character of the pottery and other artifacts was also similar with many categories of artifacts represented including much obsidian. There may have been some organizing force behind the construction of the plazas of each settlement as we can see in the material transported in to build these centers. Some of this material, found in all of the plaza fills but not anywhere else, is the accretionary travertine limestone nodules and tubes, perhaps derived from Labouring Creek where natural beds of travertine have been observed. Analysis of the artifact samples collected will give a more diachronic understanding of the broader settlement patterns but at this time much of the material remains point to a general Terminal Classic date.

Our multiple reconnaissance trips to the Logwood Caye area have not yet produced the results of the city center that informants have told us about but we will continue to survey this area in the future to further narrow down its location. We have been able to eliminate areas through systematic reconnaissance and continue to learn more about the topography and ecology of Logwood Caye which is valuable and informative as we continue to study this area. In the future it may be best to approach Logwood Caye from the north. Residents from Rancho Dolores are reported to use the pine ridge to access Labouring Creek, White Water Lagoon, and Logwood Caye for hunting and fishing. In addition completing the NE-most part of the Meditation settlement survey will connect this area with the part of Logwood Caye that has the highest elevation as well as proximity to the raised fields of the Jaeger wetlands.

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Program For Belize
2000 *White Water Lagoon and Spanish Creek Management Plan*. Sustainable Development of the Belize River Valley Communities Project funded by World Bank. http://web.worldbank.org/archive/website00967A/WEB/OTHER/BE30A380.HTM?OpenDocument

Chapter 3

Survey and Mapping the Site of Chikin Chi'Ha

Satoru Murata, Brian Norris, and Alex Gantos

Introduction

During the inaugural BREA season in January, 2011, Kaeding and Murata (2011) first documented what they thought was the "center" of Chikin Chi'Ha, a fairly substantial ancient Maya settlement in the low-lying pasture on the western shore of Colorado Lagoon. This lagoon system consists of a series of three water bodies that run north-south and is roughly two kilometers north of the Belize River and the Maya site center of Saturday Creek (see **Figure 1.1**). Designated the Maya name Chikin Chi'Ha ("West Rim"), the "center" that was surveyed and sketch-mapped by Kaeding and Murata on the western shore of the Colorado Lagoon consisted of an eight-meter-high basal platform supporting a plaza group, along with several smaller surrounding structures, and another smaller plaza group, accompanied by a series of small-scale house mounds and plaza groups extending westward therefrom along an east-west running ridgeline (see Kaeding and Murata 2011:Figs. 6.3, 6.4). This part of Chikin Chi'Ha is located on pasture, but, in the subsequent years, portions of a hill to the south of this area was cleared by the landowner, Mr. Jose Gallardo, exposing an even more sizeable group of mounds, including a pyramidal structure at its highest point (see **Figure 1.3**). Partly because these newly exposed structures displayed evidence of recent looting, and recent roadwork had carved out a significant portion of this hill (and thus, the site), our initial intent in January 2016 was to map with a Total Station this group of structures on Gallardo's hilltop, along with those documented in 2011 in the low-lying pasture area, to generate a more precise and accurate map of Chikin Chi'Ha.

Negotiation for BREA to access Mr. Gallardo's land for mapping, however, fell through almost immediately after mapping was initiated in January 2016 and therefore not all of this area was mapped in January 2016. Fortunately, we found that the site continues farther south into the bush on another hilltop to the south, where we identified a group of mounds comparable in scale, including two pyramidal structures. This portion of the site is on the land of a different owner—Mr. John Carr of Banana Bank—who kindly granted us permission to map and excavate the site in 2016. We refer to this hilltop owned by Mr. Carr as the "South Complex" of Chikin Chi'Ha, whereas the hilltop site to the north on Gallardo's land is referred to as the "North Complex." Below we describe the results of our survey and mapping of this sizeable site during January 2016, which focused primarily on the South Complex of Chikin Chi'Ha.

Objectives

The overall objectives of the program changed. Initially, the goal was to map the North Complex and settlement in the low-lying pasture of Gallardo's land but only a small portion of this site was ultimately mapped. When access became prohibited, the objectives were realigned as follows:

1. To partially survey the extent of the South Complex;

2. To carry out at least the minimum required clearing on and around located mounds and intervening areas (Unlike the North Complex, the South Complex of Chikin Chi'Ha was/is still in bush); and

3. To map the cleared areas of the complex with a total station (while training UNH undergraduate field school students).

Methods

Following standard BREA procedure, we first established a fixed point (Station 1) on the landscape, assigning it UTM coordinates as accurate as possible to be used as the basis for the entire map. Since our original intent was to map the North Complex, a steel rebar was placed on the summit of the main structure thereof to serve as Station 1. The UTM coordinate of Station 1 was measured with a Trimble GeoXH GPS unit to a displayed error range of less than 25 cm. Another steel rebar was placed around 830 m to the east, where the newly cut east-west road makes a 90 degree turn to the south (**Figure 3.1**), where another set of UTM coordinates was similarly measured. This second rebar was used as a backsight point (BACK) for Station 1 to measure the angle (azimuth) only. With an assumed maximum combined error of less than 50 cm (25 cm for Station 1 and 25 cm for BACK) over 830 m, the assumed maximum angular error is around 0.035 degrees. Therefore, a map based on these measurements becomes sufficiently accurate for our purpose (see Murata 2012). The measured altitude (by the GPS) for Station 1 was rounded to 80 m (AMSL), which was used as the basis for all elevation data at the site.

After spending two days beginning the mapping of the North Complex, we were required to move out of Mr. Gallardo's land; we quickly set Stations 5 and 6 along the newly cut road (see **Figure 3.1**), which were used to set up stations within the South Complex. The rest of the season was spent mapping the latter complex.

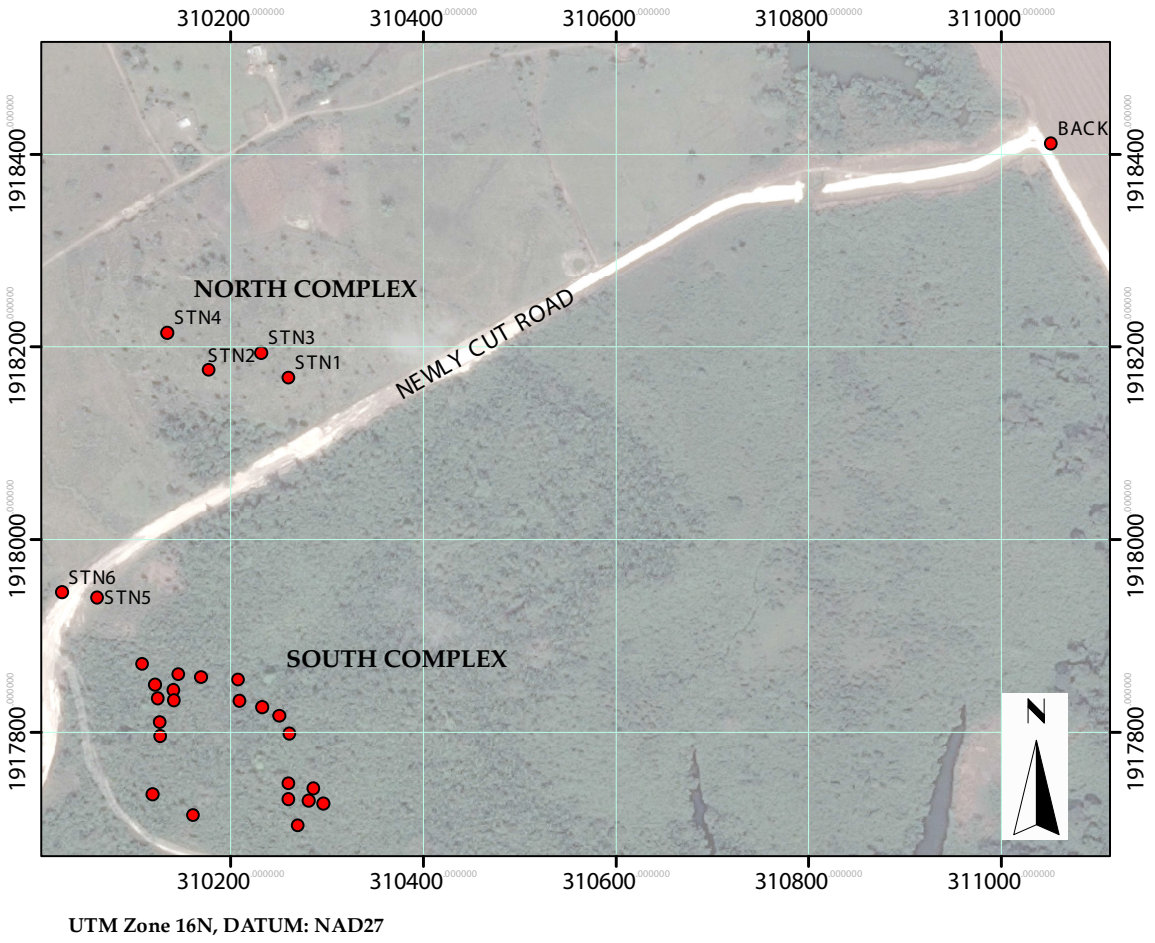

Figure 3.1. Map showing locations of stations (metal rebar with associated geographic coordinates) placed in the site of Chikin Chi'Ha, layered on satellite imagery from Google Maps (prepared by S. Murata)

The mapping of the South Complex was carried out by two teams, led by Murata and Norris, each instructing two field school students at a time, who were provided with basic training on the operation of the total station and accompanying data collector. Norris's team worked primarily on a Topcon total station connected to a TDS Ranger running Carlson Software SurvCE, and Murata's team on a Nikon NPL-352 connected to a Trimble Nomad running TDS Survey Pro. At the end of the season, the data from the two total stations were combined into one Microsoft Excel spreadsheet, which was then used to create a topographic map in Golden Software Surfer, the output of which in turn was imported into ESRI ArcGIS to produce the final maps shown herein.

One problem arose during the course of mapping. Due to constraints in equipment availability, some of the first several stations (specifically, Stations 7 to 12) set within the South Complex were placed using only a total station, without a data collector. This, in turn, contributed to human error, whereby somewhere along the way, a rather substantial angular error was introduced; the effect of this error can be seen in the layout of Operation 30, which is off-cardinal by about 14 degrees (see Craig, Harrison-Buck, and Runggaldier, Chapter 8). This is because the unit was laid out using the total station to be cardinally oriented, under the assumption that there was no error. Unfortunately, excavation was already well underway when we recognized the error, and we decided that the costs outweighed the benefits of attempting a fix. Such an error, however, must be rectified for a mapping project, and fortunately, this was not such a difficult task.

It was clear that the error was introduced somewhere between Stations 7 and 12. Therefore, we returned to and set up the total station on Station 5, backsighted to Station 6, and began retracing our steps. For better or for worse, we soon found that the error was introduced early, between Stations 7 and 8; the measured distance between the two points was accurate, but there was a large deviation between the measured and recorded XY coordinates for Station 8 (of about six meters). We concluded that, when "shooting" and recording Station 8 from Station 7, the total station was rotated after taking the shot, but before the coordinates were recorded on paper. Such a situation would result in an XY coordinate for Station 8 that is accurate in terms of distance from Station 7, but having an angular error (corresponding to the amount that the total station was rotated before the coordinate was recorded). This angular error can easily be calculated from the coordinates of Station 7, the erroneous Station 8 coordinate, and the "correct" Station 8 coordinate, using the law of cosines; the calculation resulted in an angle of 14.23 degrees, closely resembling the angular error visually observed at Op. 30.

What the above meant is that this angular error probably occurred only once, and was propagated to *all* of the points recorded after Station 8 (i.e., all of the points recorded for the South Complex by both total stations up until that point). This angular error of 14.23 degrees is an error in relation to Station 7; in other words, for any given point P recorded after Station 8, its recorded coordinate (Xp, Yp) is a point on a circumference of a circle having Station 7 as its center, which has been rotated (in this case, counterclockwise) 14.23 degrees from its true coordinate (Xp', Yp'). Therefore, in order to correct all the errors, one simply needs to take all of the points recorded after Station 8 (including Station 8) and rotate them 14.23 degrees about Station 7 in the opposite direction (i.e., clockwise, **Figure 3.2**). Fortunately, as with most survey software, the software loaded on our data collector (TDS Survey Pro) has a function to carry out precisely such a rotation transformation, by entering three parameters: the center of rotation (Station 7), and two points from which the rotation angle can be calculated—in our case, the erroneous Station 8 coordinate and the correct Station 8 coordinate. We carried out this operation, corrected all the points collected thus far, and carried on with our mapping program.

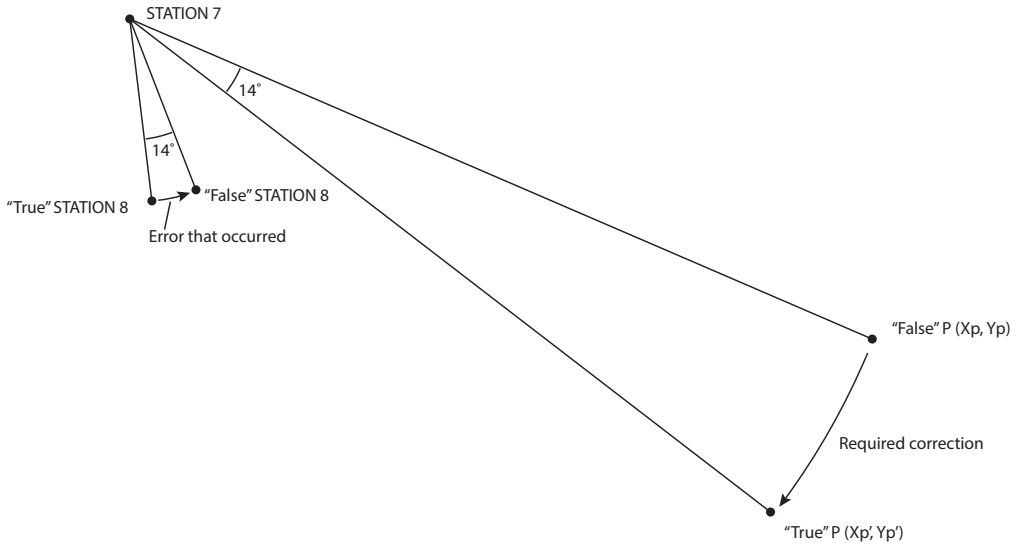

Figure 3.2. Diagram illustrating the initial angular error that occurred, and the rotation operation required to correct it.

In general, Norris's team worked on the western half of the South Complex, including the two pyramidal structures of Plaza A and structures to their north and south, while Murata's team worked on the eastern half, including Plaza B and architecture to its south and east. Plaza C, located on the highest point of the complex to the southeast of Plaza B (and at a higher elevation by about 12 meters) was determined to be an ideal area for the end-of-term exam for the field school students; therefore, the data for Plaza C are accumulated data collected by all students.

Interpretations and Conclusions

The resulting map of Chikin Chi'Ha is shown below (**Figure 3.3**). This overview map shows the topographic map produced with a Total Station of the South Complex and the portions that the BREA survey team was able to mapof the North Complex in in January 2016. Also demarcated with yellow triangles is the settlement in low-lying pasture surveyed and sketch-mapped in 2011 by Kaeding and Murata (2011), which they designated at the time as the "center" of Chikin Chi'Ha.

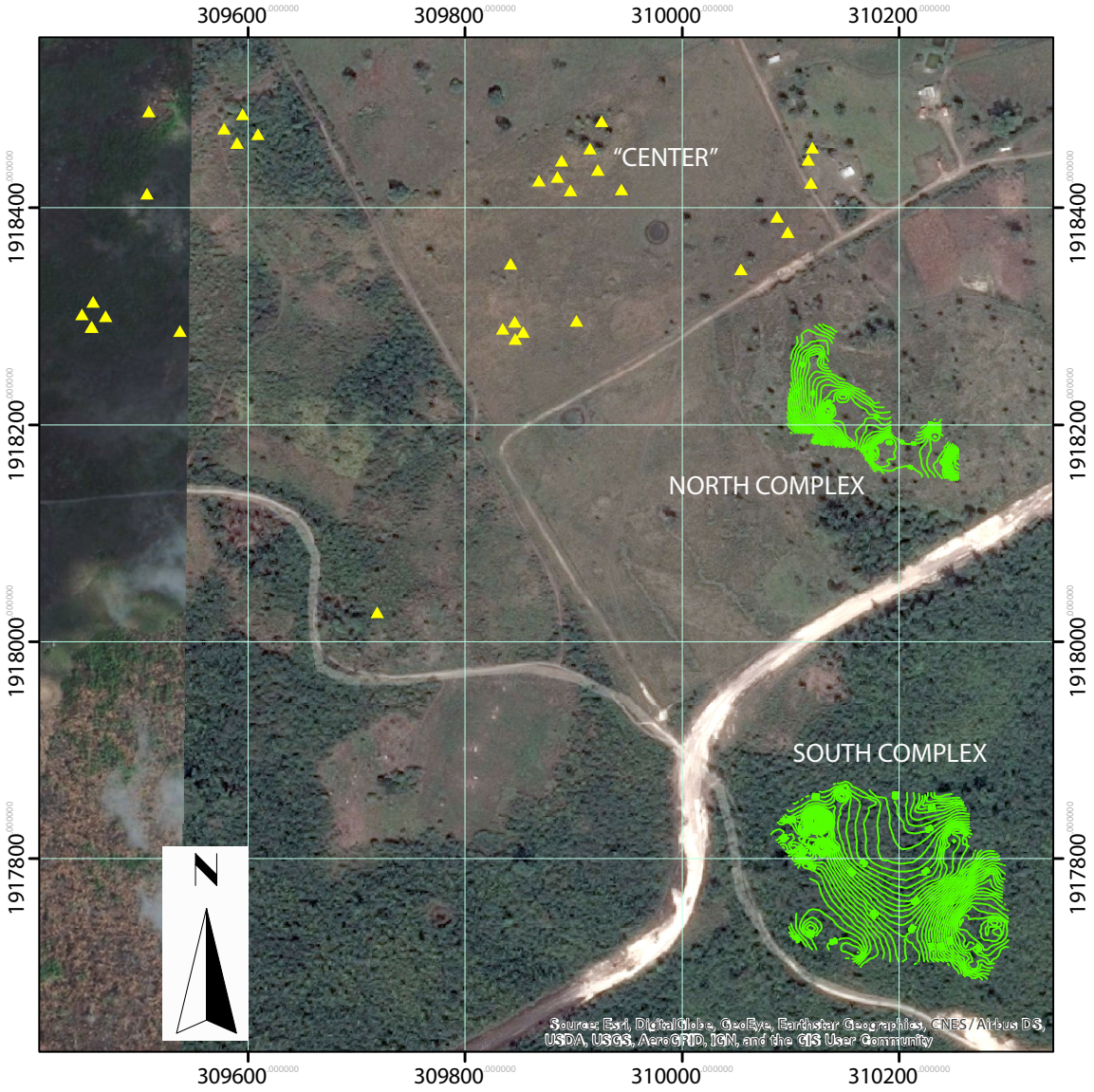

Figure 3.3 Map showing the two generated maps for the North and South Complexes, together with locations of other mounds in the site collected by GPS during 2011 (prepared by S. Murata)

North Complex (incomplete)

The North Complex is built on a natural hill. Central to the complex is a pyramidal structure at the summit of the hill, rising 8 meters above the plaza floor, oriented cardinally. The

natural hill was terraced into at least two levels to the west and northwest of the main plaza, with several structures built atop each (**Figure 3.4**).

Structure 24, which is the main pyramid, has several looters' trenches, and Str. 27 also has a major looters' trench dug into the western side. Structures 29 and 30 on the lower terrace are arranged parallel to each other, suggesting a possible ballcourt, although the spacing between the two structures seems narrow; the depression between the two high points simply may be later disturbance in what was originally a single structure.

Due to issues in land access described above, this is the extent to which we could map the North Complex.

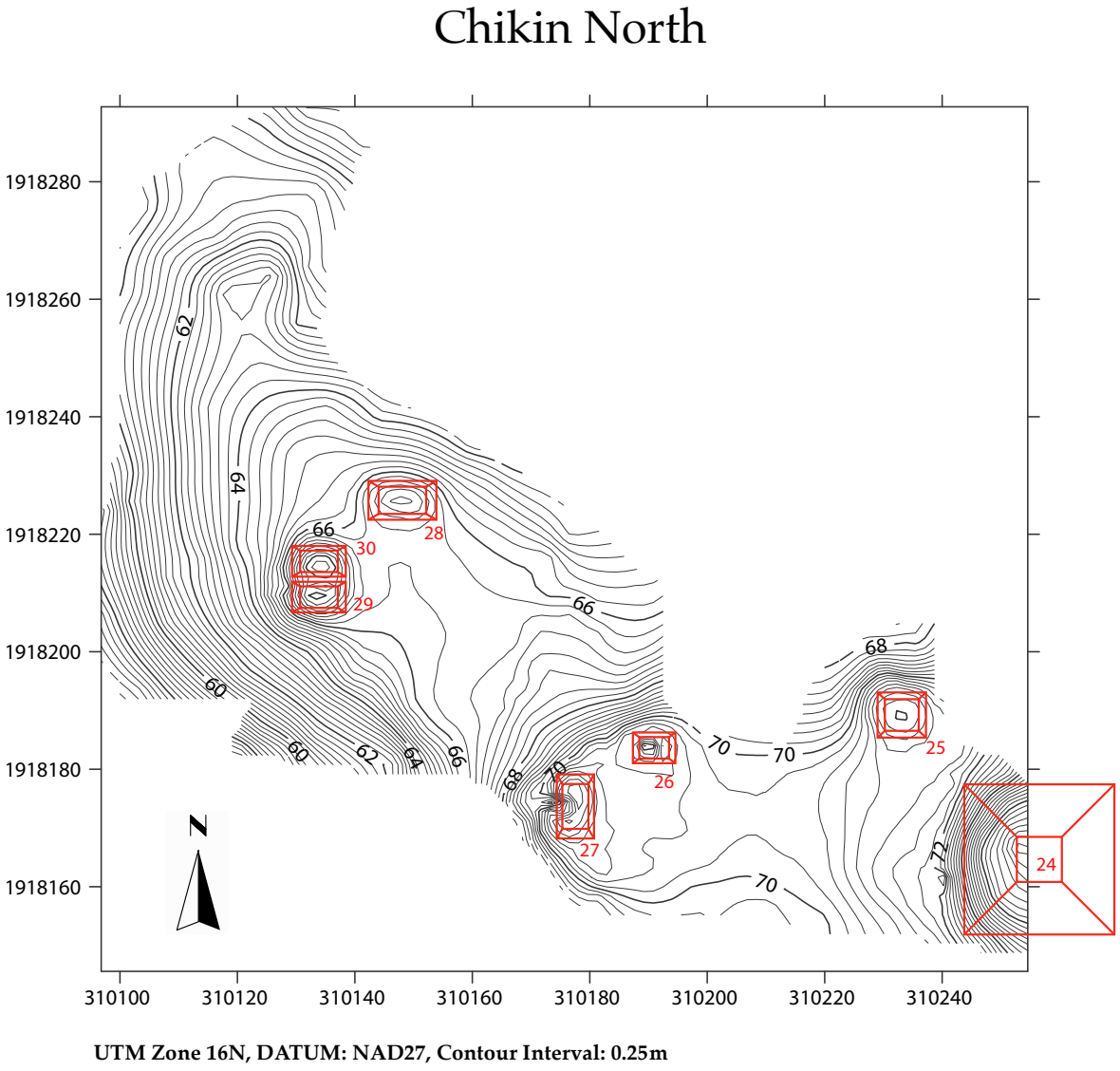

Figure 3.4 Contour map of the North Complex, overlain with a rectified map of structures. The red numbers adjacent to structures are structure numbers (prepared by S. Murata)

South Complex

The South Complex consists of three plazas and peripheral structures (**Figure 3.5**). Structure numbers are given in a separate image to avoid visual clutter (**Figure 3.6**). Plaza A has two large structures, one of which (Str. 1) is clearly pyramidal, rising a little over 8 m from the plaza floor, making it comparable in size to Str. 24 in the North Complex. Structure 1 also has a deep looters' pit dug vertically down from the summit, presumably connecting with a looters' tunnel that has been excavated from the southeastern corner. The accompanying Structure 2 to the south, about 4 m in height, also has a looters' pit at the top, and a looters' trench on the eastern face. Both Structures 1 and 2 have appended architecture (Structures 3 and 4) extending to the west, although Structure 4 is off-cardinal. We found a low mounded feature to the south of Str. 4, running parallel to the structure, with a dimension of around 2 m in length and 50 cm in width, and stones seemingly surrounding portions of the outer perimeter thereof; there is the possibility that this feature is a more recent burial. Structure 5 to the northeast of Str. 1 also featured a large looter's trench on the north side, and the low, long range structure / platform to its east featured a well-preserved arrangement of stones, especially all along the southern side.

If Structures 1 and 2 were ceremonial in nature, Plaza B laid out atop a platform (Structure 9), seems to have been primarily residential, which is one reason we placed Operation 30 on Structure 12 (see Craig, Harrison-Buck, and Runggaldier, Chapter 8). The platform appears to have an inset staircase on the central axis facing west. The platform itself appears to be grafted onto the natural hill on the east side, or, the entire area of the plaza was terraced by modifying the natural topography, much like what we saw in the North Complex. The southeastern corner of the plaza is slightly elevated, possibly indicating some type of activity area (Structure 13), although this may be the result of natural topography.

Plaza C, arranged on a platform (Structure 16), was constructed atop the hill at the southeast corner of the complex, over 10 m above Plaza B, clearly functioning as a residence. This is one of the highest points in the immediate surrounding, making the plaza an acropolis of sorts. The elevation at the top of the northern structure (Structure 17) is just over 72 m, approaching the highest point in the North Complex (the top of Structure 24), and, when cleared of trees, would have provided clear views across the landscape in all directions. Structure 17 had a methodically excavated looters' trench running east-west starting from the eastern side, around 50 cm in width and 4 meters in length, with perfectly vertical sidewalls. At the bottom of the western end of the trench was a tunnel that extended further west into the structure, possibly close to the center. The methodical nature of the trench suggests that the looters were aware of, and tried to emulate, archaeological excavation techniques.

The other structures of the complex were distributed variously across the area, neither forming plaza groups nor conforming to a cardinal orientation. Rather, the peripheral structures appear to have been placed in strategic locations, on slopes surrounding a plaza (Structures 14, 15, 22, 23), or atop local high points (Structures 7, 8), oriented in conformity to the shape of the natural slope. These structures likely would have served as additional vantage points,

particularly looking out toward the west and the south. On top of Structure 7 is a survey marker (DOS 320), which could be used to correct / realign the site map to conform with Belize Department of Survey records.

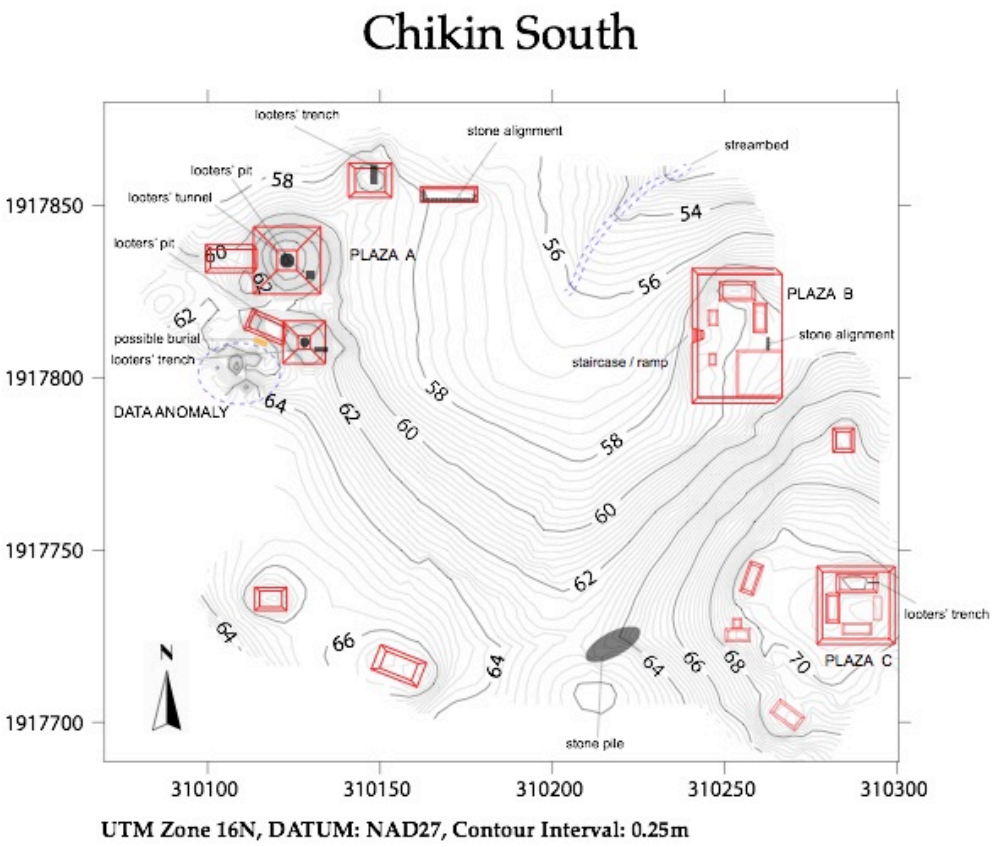

Figure 3.5. Contour map of the South Complex, showing rectified structures and various features (prepared by S. Murata)

The area between Plazas A and B, spaced apart by about 120 m, was originally thought to be relatively flat and thus to form a large plaza floor. Upon mapping and further investigation, however, it was found to gradually slope down near the center by nearly 2 m. The depression became pronounced toward the north, and, while found dry during the January 2016 season, formed a dry streambed flanked by large boulders. It is unclear if this feature is natural or man-made, although the general topography of the area seems to suggest the former. On the final day of mapping, a pile of stones was mapped at the southern end of the complex, considered to be a possible structure; however, as can be seen in the map, the stone pile was inclined from northeast to southwest, which seems to preclude the possibility.

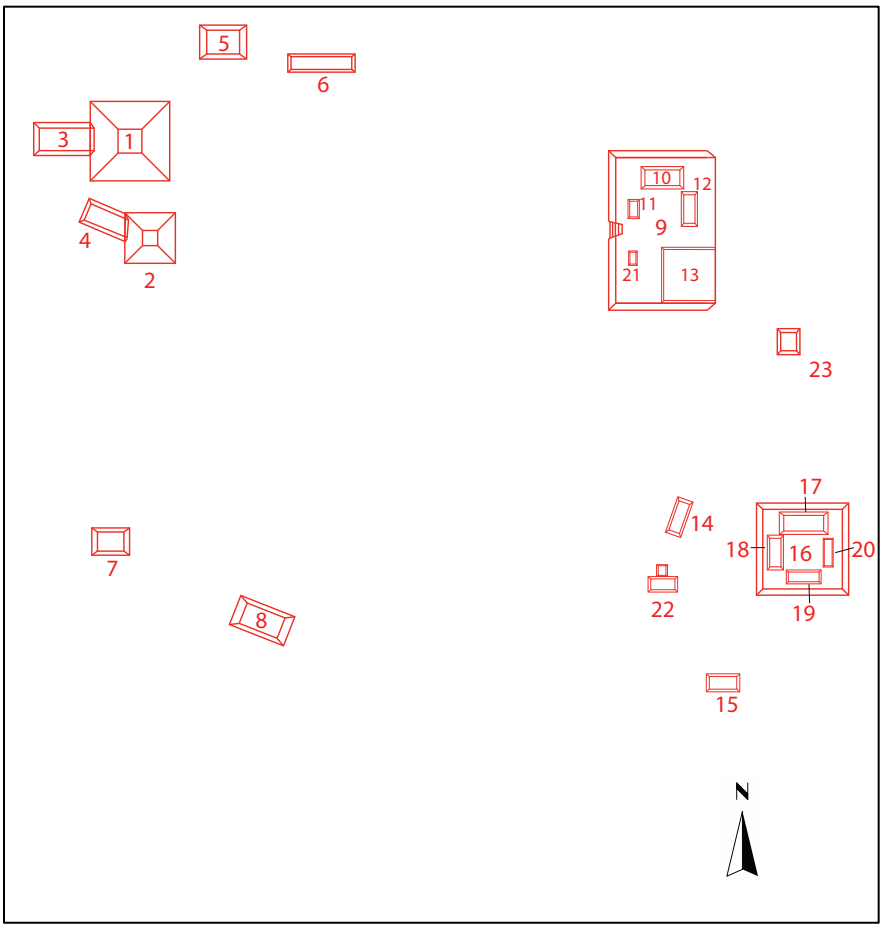

Figure 3.6. Diagram illustrating the structures and their associated structure numbers of the South Complex (prepared by S. Murata)

Future Work

The mapping of Chikin Chi'Ha can hardly be considered complete. Ideally, the North Complex as well as the "Center" and structures extending west therefrom should be included in the site map, although this may be difficult with the current landowner. Although we have mapped the South Complex much more thoroughly, there are areas that would benefit from further survey and mapping, particularly the southwestern quadrant of the complex (shown as "Unmapped" in **Figure 3.7**), and the slopes just outside of the mapped area to the west, south, and east, in order to attain a better grasp on the site's limits. In addition, there is a significant amount of data anomalies to the southwest of Structure 4. Since the anomalies consist of points that are abnormally higher and lower than their immediate surroundings, they are likely the result of operator error at the time of data collection; it would be prudent to recollect data in this region to rectify this situation.

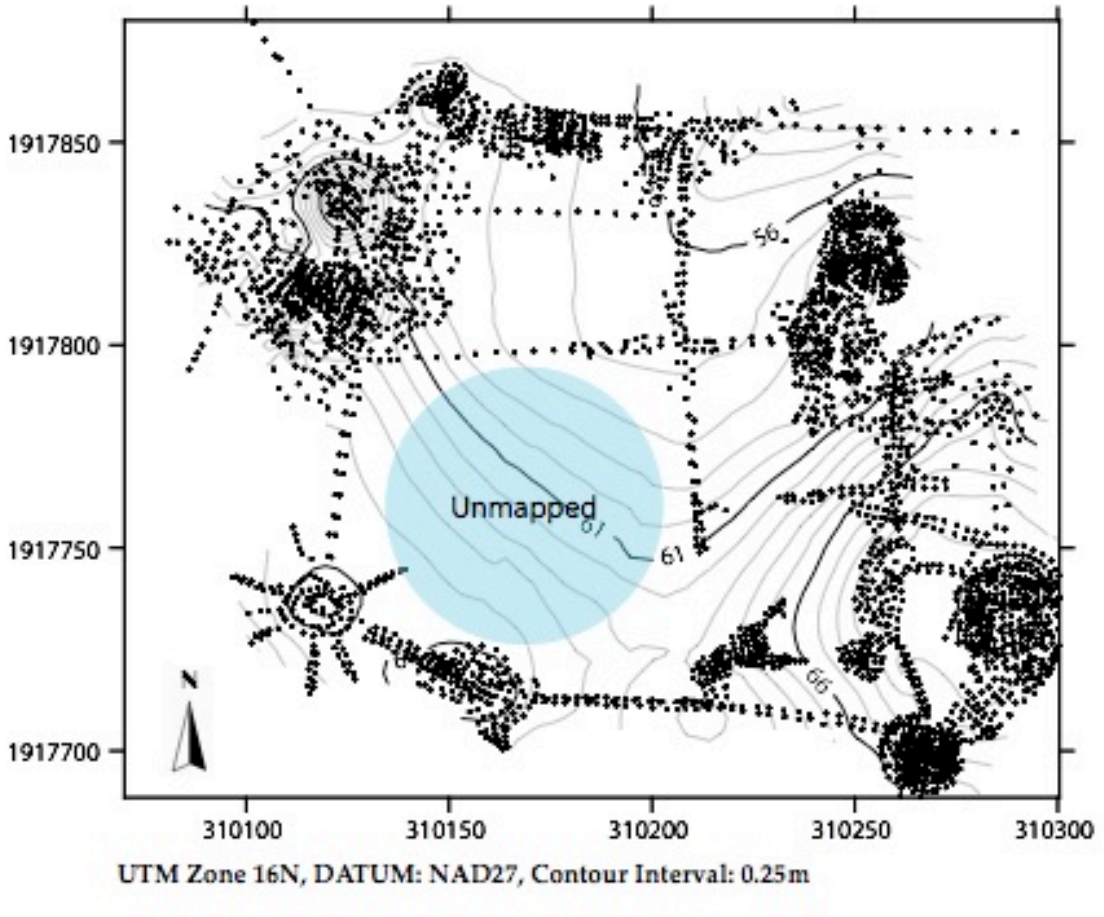

Figure 3.7. Contour map of the South Complex, overlain with total station data points; each dot represents one data point, and areas devoid of points represent unmapped areas (prepared by S. Murata)

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Kaeding, Adam and Satoru Murata
2011 Sites Near Colorado Lagoon: Chumu'uk Ha, Chikin Chi'Haal, and Hats Kaab. In *Surveying the Crossroads in the Middle Belize Valley: A Report of the 2011 Belize River East Archaeology Project*, edited by Eleanor Harrison-Buck, pp. 35-42. Occasional Paper No. 5. Durham, New Hampshire

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Chapter 4

Mapping Ek'tok and Reconnaissance of other Nearby Settlement in the Lower Reaches of the Belize River Watershed

Satoru Murata, Alex Gantos, Adam Kaeding, and David Buck

Introduction

In summer 2016, as part of an effort to expand our research area, a portion of the BREA team established a satellite camp in the town of Crooked Tree, located within the Crooked Tree Wildlife Sanctuary, to conduct reconnaissance and survey in the lower reaches of the Belize River Watershed. Over the course of several weeks, we located numerous sites, both historic and ancient, several of which have become the basis for subsequent intensive research. This chapter describes the initial reconnaissance program in summer 2016, as well as total station mapping at one of the identified sites, Ek'tok, during January 2017.

Objectives

1. Search for new sites along the Northern Highway and other arteries, in continuation of work by Norris et al. (2015)
2. Search for sites, both historic and ancient, in and around Crooked Tree and its two adjacent lagoons
3. Map with a total station as much of the newly located site of Ek'tok as possible (while training UNH undergraduate field school students)

Methods

Reconnaissance along the Northern Highway was carried out primarily opportunistically, driving along the road and "popping in" whenever mounds and/or promising-looking landscape could be visually observed. Sites found along the dirt road to May Pen and the Old Northern Highway were shown to us by various informants. Locations of obvious mounds were recorded with a Trimble GeoXH GPS unit, sometimes accompanied by GPS data collected by a smartphone running Avenza Maps (formerly PDF Maps), and sketched, whenever possible, in Rite-in-Rain field notebooks. The recon team primarily consisted of Murata and Gantos, sometimes accompanied by local workers, and students from the US as well as Belize.

Mapping of Ek'tok was carried out following standard BREA procedure (see Murata 2011 as well as Chapter 3, this volume); Station 1 was placed on a low range structure on the east side of the main plaza, and a backsight point was set around 290 m to the south, resulting in an assumed angular error of less than 0.1 degrees. The measured altitude (by the GPS) for Station 1 was rounded to 25 m (AMSL), which was used as the basis for all elevation data at the site.

The mapping was carried out by two teams, led by Murata and Kaeding, each instructing two field school students at a time, who were provided with basic training on the operation of the total station and accompanying data collector. Since the mapping of Ek'tok was carried out during the last several days of the season, only the main plaza and one more mound to the southeast could be mapped by the total station. A small, residential plaza group ("*plazuela*") was mapped by field school students as part of their end-of-term exam; therefore, the data for this group are accumulated data collected by all students.

Reconnaissance

Godfrey Smith

Since our mapping and excavation at the site of Jabonche in 2015, Mr. Godfrey Smith, who acted as our foreman, had cleared a piece of his land to the north of his house located on the Northern Highway in Biscayne, to reveal a small cluster of mounds thereon. With his permission, we documented these (**Figure 4.1**). The group primarily consists of a small plaza group with five structures, placed atop a slightly (~ 70cm) elevated platform, oriented c. 30˚ east of north. We noticed two, linear stone alignments to the north and west of the eastern structure, not conforming to the 30˚ east-of-north orientation of the platform, which may suggest a differently oriented earlier construction.

Walton Glen Harris

We noticed the presence of mounds across the Northern Highway from Godfrey Smith's land, clearly constituting a part of the same site. With the permission of the landowner, Mr. Walton Glen Harris, we documented these (**Figure 4.2**). Mounds near the Northern highway were distributed without clear arrangements or orientation. There was a group of mounds arranged into a small plaza configuration toward the back of the property.

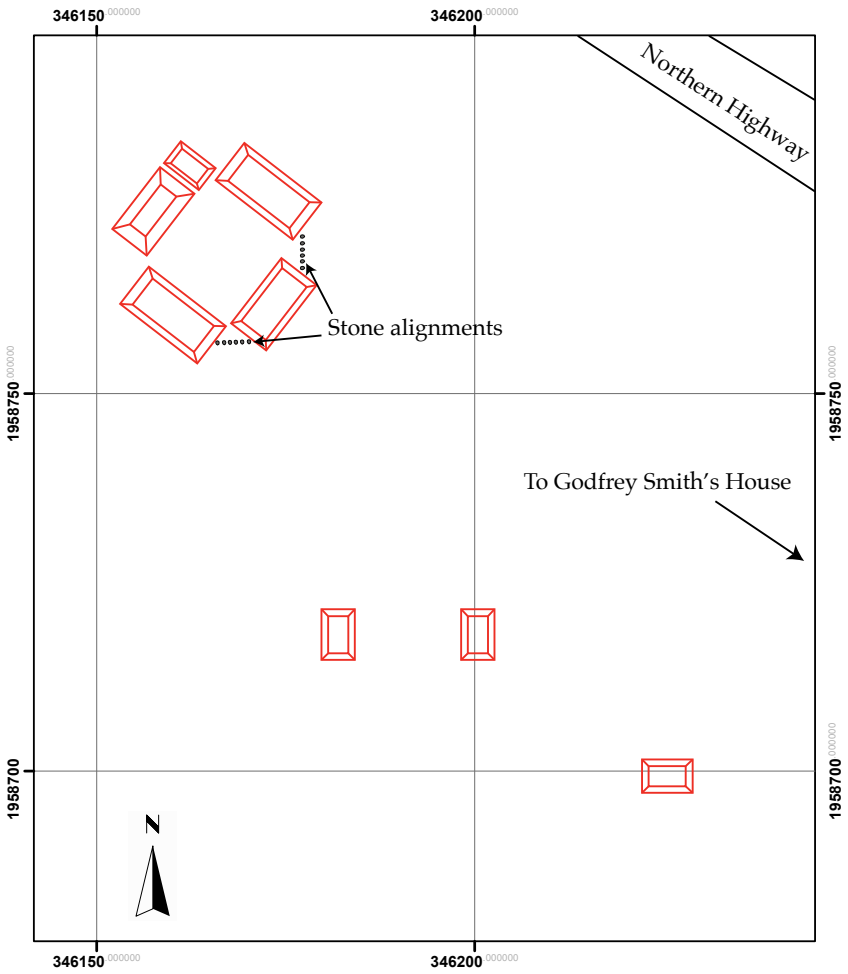
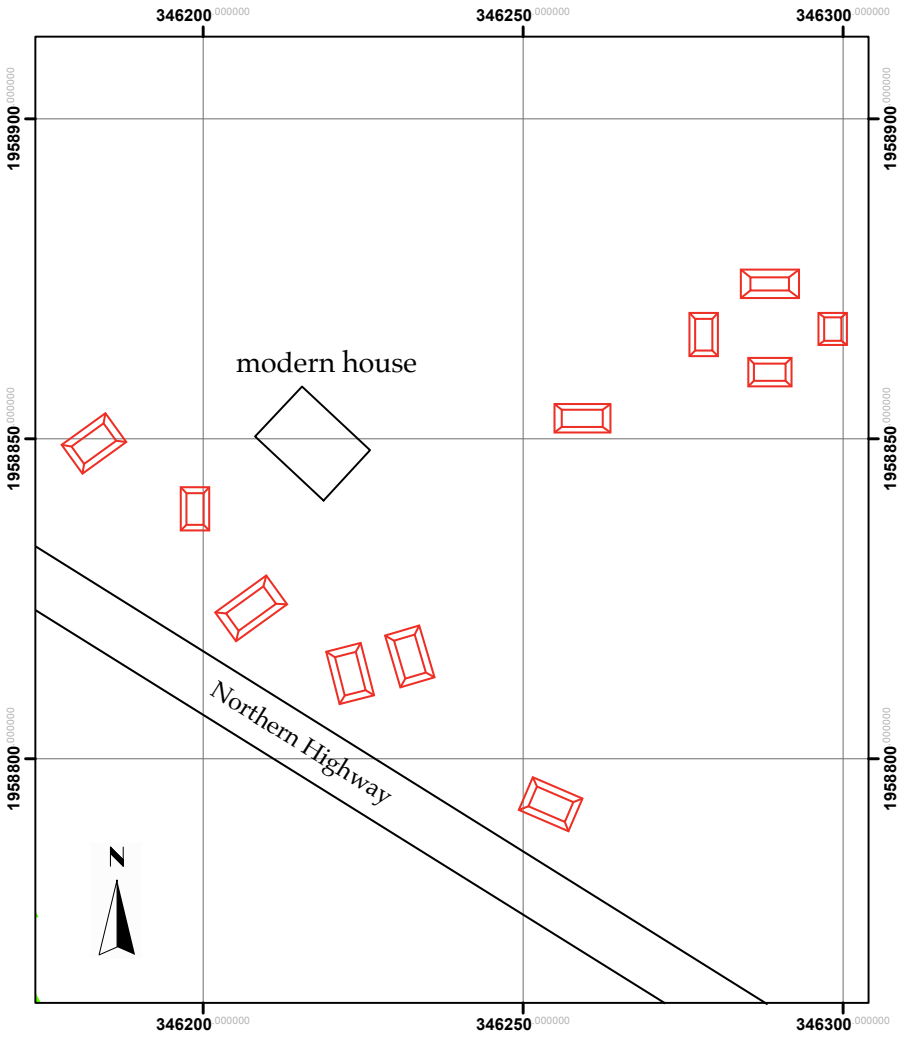


Figure 4.1 Rectified map of Godfrey Smith site (prepared by S. Murata)

Charles Wade

Around 2.5 km north of the site at Godfrey Smith's and Walton Glen Harris's lands, we noticed multiple mounds in a pasture adjacent to the Northern Highway on the east side of the road. We went on a dirt road heading east from the highway and came to a gate with a sign reading "Lloyd Wade Beneficiary Farm"; however, no one was present to open the gate, or answer a call made to the telephone number printed on the sign. A few hundred meters north of this access road was another driveway heading east. At the end of this access road was the house of Mr. Charles Wade, a brother of Lloyd, who showed us mounds located on his property. Incidentally, Mr. Wade is the father of Kenroy Wade, who has worked with the BREA project in the past at Jabonche.



UTM Zone 16N, NAD27

Figure 4.2 Rectified map of Walton Glen Harris site (prepared by S. Murata)

The mounds on Mr. Wade's property were identified as three groups, two of which comprising a set of mounds arranged in a formal plaza configuration (Figure 4.3). Although the orientations of the intervening mounds were hard to discern, the two plaza groups appeared to be oriented off-cardinally by about 30 - 40 degrees east of north, resembling the orientation of the plaza group on Mr. Smith's land described above. One mound near the northwest corner of the property was placed on a raised platform or causeway (*sacbe*) extending to the northeast. As most of the mounds away from the modern structures were located in bush, the roughly 200 m space separating each of the groups, is likely to be the product of the lack of visibility, rather

than that of mounds. Since many more mounds were found in the adjacent property to the northwest (see below), the site is likely to extend farther, at least to the west, north, and south; future work should include contacting Lloyd Wade to access his land.

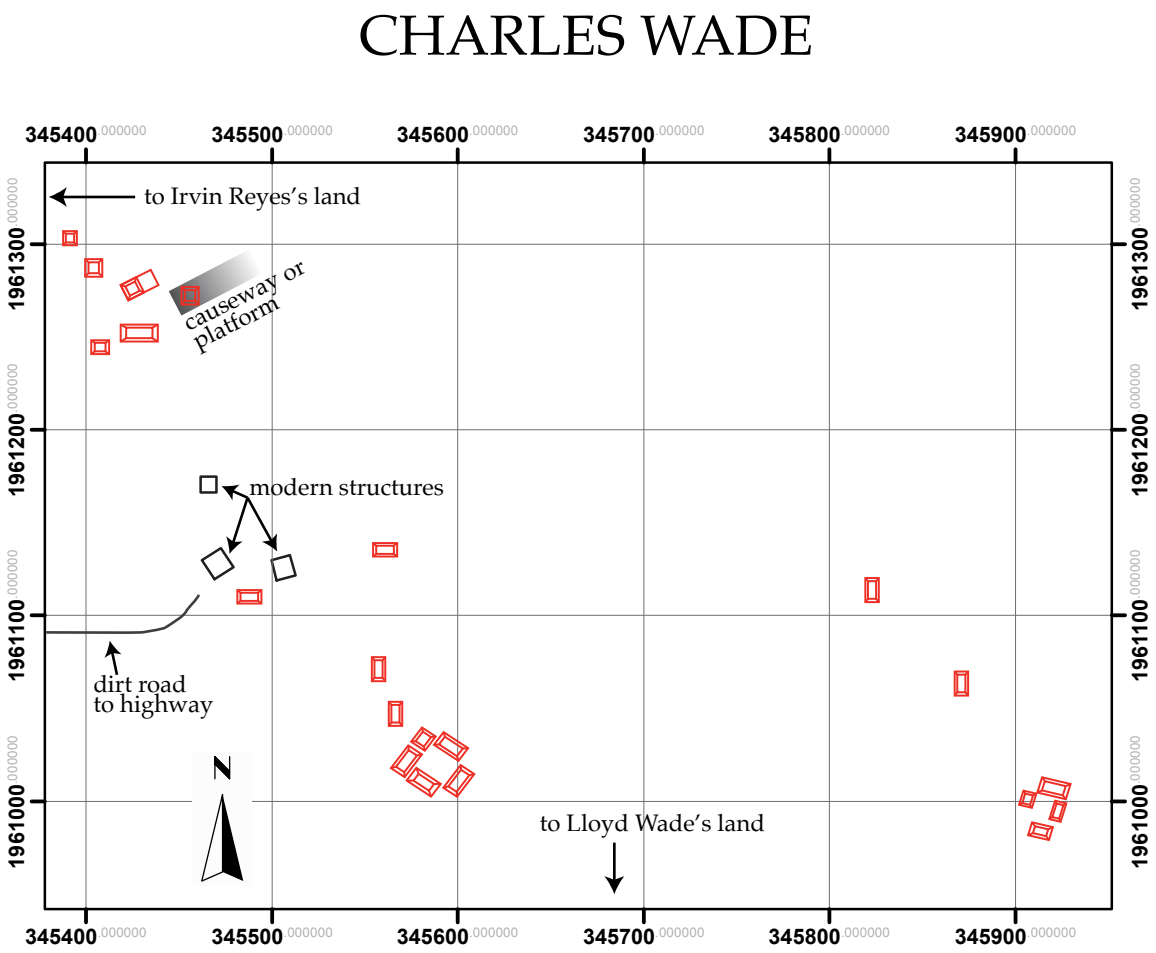


Figure 4.3 Rectified map of Charles Wade site (prepared by S. Murata)

Irvin Reyes

The property northwest of Charles Wade's belongs to Mr. Irvin Reyes. As was expected, numerous mounds continued into Mr. Reyes's land, which was much less forested, contributing to greater visibility, and likely to more mounds being identified. This portion of the site consists primarily of irregularly distributed small house mounds, along with two low platforms, each with several superstructures not arranged in a formal plaza arrangement (**Figure 4.4**). Two structures

along the southern end of the property were relatively large in size, with at least one reaching a height of about 4.5 m. Two features resembling some type of road extended west and east from the southern platform; it was not clear if they were of ancient origin. Considering the density of structures, the pieces of land to the south and north should be investigated in the future.

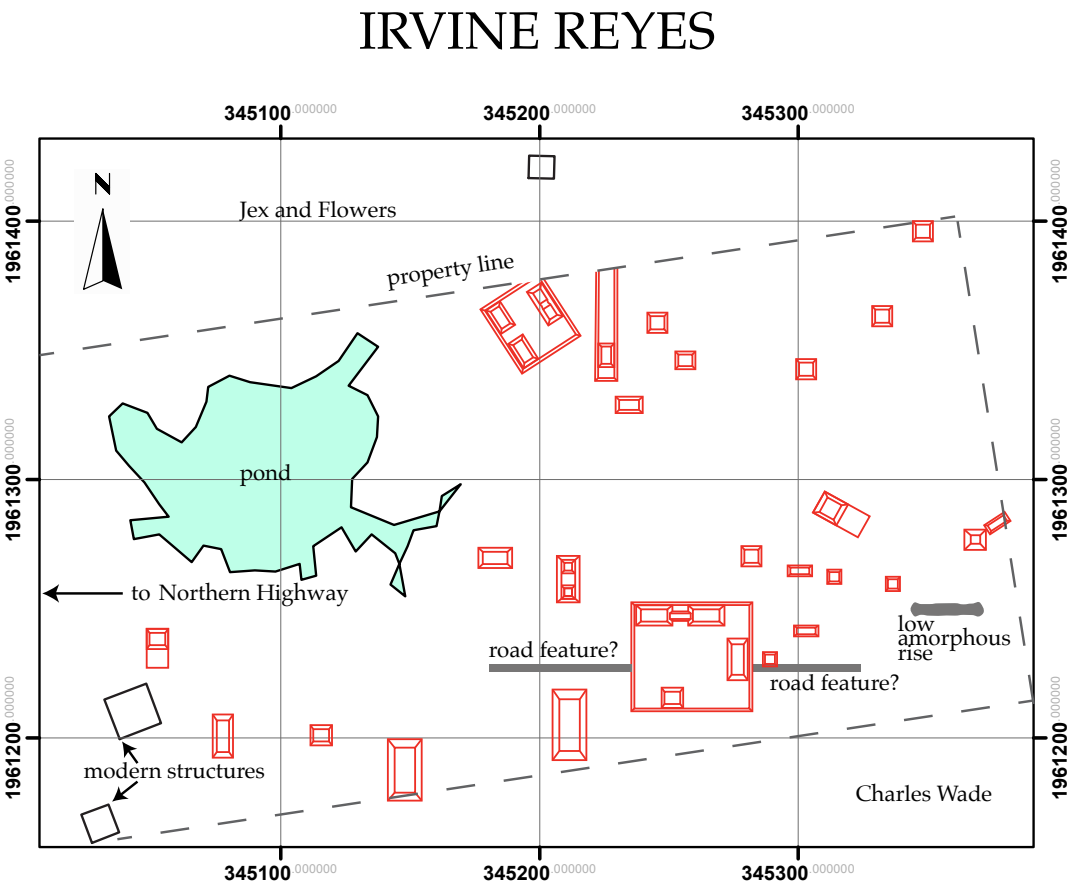


Figure 4.4 Rectified map of Irvine Reyes site (prepared by S. Murata)

Mexico Lagoon

In January of 2015, we located around 14 mounds on the west side of Jones Lagoon, noting that they resemble salt production mounds documented at the site of Wits Cah Ak'al (Murata 2011) and other salt production sites in Belize, and suggested further research in the vicinity (Norris et al., 2015). Mr. Carl White, who lives in Grace Bank, and who worked with the BREA project for the reconnaissance of Jones Lagoon in 2015, introduced us to Mr. Shaun Faber, who lives in Biscayne, and who, according to Mr. White, knew of some more mounds on

the western side of Mexico Lagoon immediately north of Jones Lagoon. While we accessed the Jones Lagoon site by boat (launching from the southern tip of the lagoon) in 2015, the creek that connects the two lagoons becomes impossible to navigate by boat during the dry season; therefore, we accessed Mexico Lagoon by land from the Northern Highway to the west (**Figure 4.5**).

We identified eleven total mounds roughly forming a string from the northwest to southeast. All of the identified mounds shared the same characteristics:

- Red, loess-like sediment constituting an earthen mound
- Amorphous shape
- Lack of stone architectural elements

These characteristics are consistent with mounds identified at Wits Cah Ak'al, which Murata (2011) concludes are the products of both salt production and pottery production.

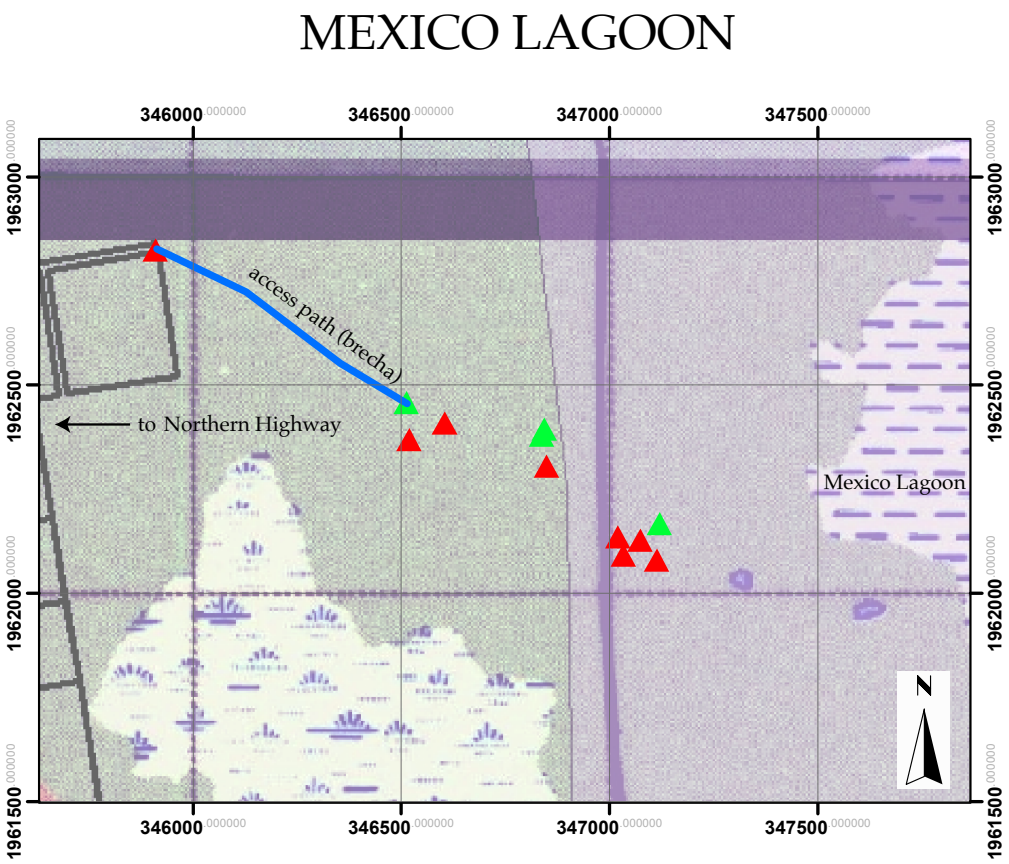


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Figure 4.5 Map showing the mounds on the western side of Mexico Lagoon and the approximate access route (blue line). The red triangles denote mounds logged with the Trimble GPS, and the green triangles represent those logged with an iPhone (prepared by S. Murata).

Considering the cluster of similar mounds around 4 km to the south, there is a chance that, at least the west side of these two lagoons has many more, making this one of the largest salt (and/or pottery) production areas in Belize. In addition, unlike the case at Wits Cah Ak'al, there are multiple sites along the Northern Highway within easy walking distance from these production locales, from which at least some of the producers likely came (FIG. 4.6). Further research, including both survey and excavation, should provide valuable information. It should be noted that the mounds are not rectified in the figure, as the mounds are not thought to contain architecture therein. In addition, the mounds represented by the green triangles represent points taken with an iPhone and PDF Maps (Avenza Maps), since the Trimble GPS, due to satellite reception issues, could not provide GPS fixes during a portion of the survey day. Hence, the accuracy of these points is expected to be lower.

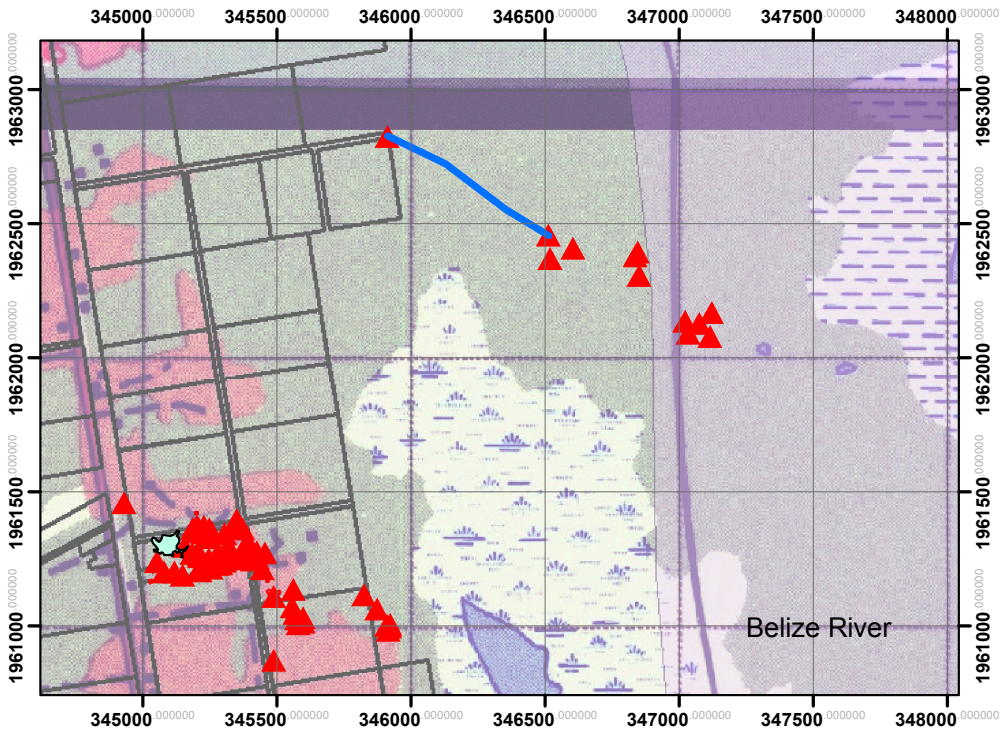

Figure 4.6 Map showing the Mexico Lagoon mounds in relation to sites along the northern highway; the cluster of triangles in the bottom left of the figure represent the Irvine Reyes and Charles Wade sites (prepared by S. Murata)

Charlie Canton

In January 2015, we documented numerous mounds at the Canton Farm located along the Old Northern Highway, owned by Mr. Gillie Canton (Norris et al. 2015), when Gillie, his wife Pandora, and cousin Matt provided us with much information in addition to permission to

reconnoiter their land. With a suggestion by Matt, in 2016, we visited Gillie's brother, Charlie, who lives around 500 m down the highway, and who guided us to two different sites he knew of within the BREA research area, and which we had not documented in 2015.

Site 1

The first site was accessed by a logging road that extends east from the Old Northern Highway, at around the 8 km (5 mile) mark from the Northern Highway (**Figure 4.7**). According to Mr. Canton, the road used to be well-built and maintained, at one point allowing the passage of ten-wheeler logging trucks. While large-scale logging is no longer taking place, the road remains fairly well-maintained, due to the use by illicit loggers, according to Mr. Canton. The road was easily travelable by a 2WD truck in June, 2016.

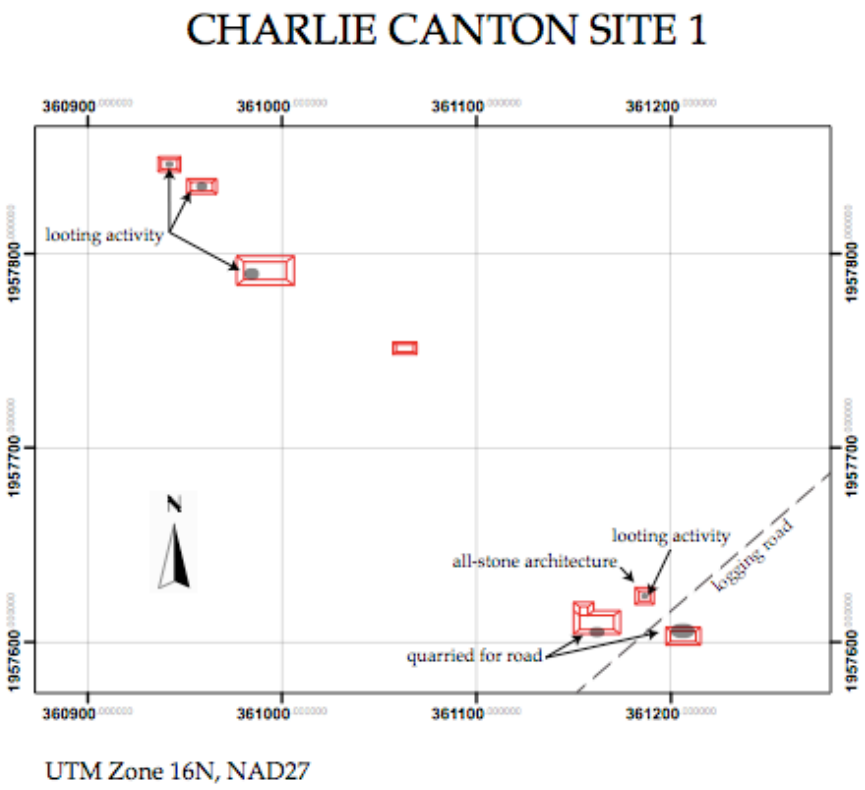

Figure 4.7 Rectified map of Charlie Canton site 1 (prepared by S. Murata)

After passing two "cohune ridges," both of which, according to Mr. Canton, contain Maya mounds, we reached the site about 4 km from the split-off from the Old Northern Highway. The logging road passes between two large structures, both of which have been

heavily damaged. According to Mr. Canton, the destruction on the south side of the western structure and the north side of the eastern structure is due, not to looting, but to quarrying for construction of the logging road. This appeared to be the case, as the destruction did not take the form of a lotters' pit on the top or a trench to the side, but rather seemingly haphazard destruction and removal of construction material. The destruction to the structure on the east was particularly extensive, removing a large chunk of almost the entire northern half of the building, revealing what appeared to be internal walls and rooms. Four other structures displayed signs of more traditional looting activity in Belize, where looters attempt a vertical pit down from the top of the mounds. A relatively small structure between the two large mounds in the southern portion of the site was an all-stone structure with dimensions suggesting a near-square, or possibly circular, configuration.

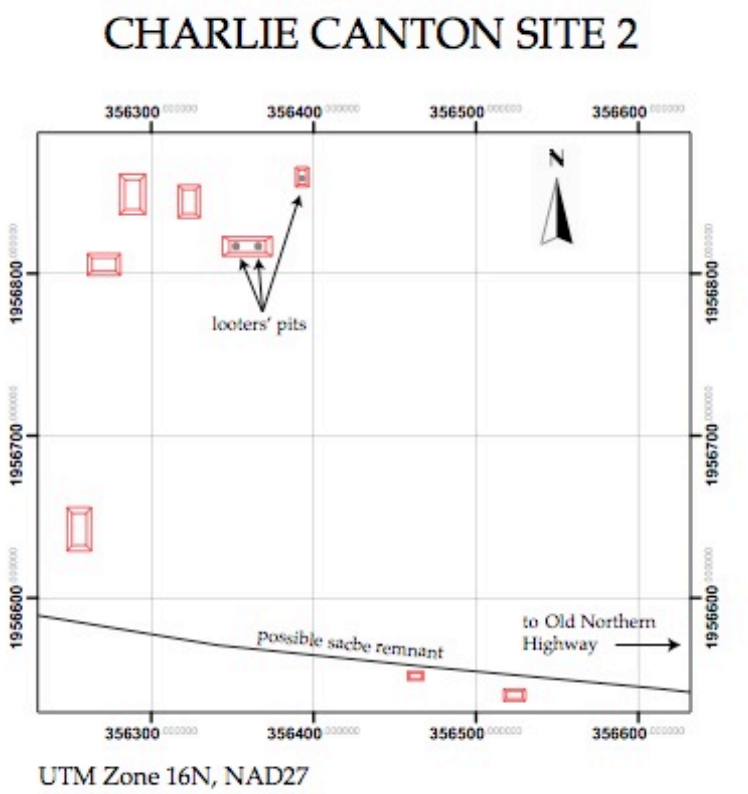

Figure 4.8 Rectified map of Charlie Canton site 2 (prepared by S. Murata)

Site 2

The second site shown to us by Mr. Canton was accessed from the Old Northern Highway at around the 6.2 km (3.9 mile) mark. The identified portion of the site consisted of six mounds, all of which were relatively low (1-2 m tall), although two were of considerable size in terms of area (**Figure 4.8**). There was some looting activity on two of the mounds. In addition

to these six obvious mounds, we identified two more low rises along an access path that extends east-west. The path appears to have been a truck path in the past, possibly used for logging, but we noticed in several locations that the path is paved with stone. There is the possibility that the path is also a vestige of an ancient *sacbe.* Mr. Canton informed us that there are more mounds continuing to the west, in the direction of Jones Lagoon. Considering that this site is around 10 km south of the large center of Altun Ha, and a little over 5 km east of Jones Lagoon, it would be interesting to investigate how the site relates to these two areas of local importance.

May Pen

May Pen is a settlement adjacent to the Belize River, which used to be a well-populated village until a major flood in 1979 drove many of the villagers out to villages adjacent to the Northern Highway, such as Biscayne and Gardenia. We were informed in Crooked Tree that one of the few villagers who still live in May Pen, Mr. Denton Moody, knows of several Maya sites in the area, including a fairly large site referred to as "Indian Hill" (not to be confused with Chau Hiix, also referred to by the same name). We visited Mr. Moody on two occasions, and were shown four different sites, including Indian Hill as well as May Pen Sites 2, 3 and 4 described below.

Indian Hill

We drove our 4WD vehicle from Mr. Denton Moody's property north for about 6 km on the eastern edge of what appeared to be a seasonal wetland (which was mostly dry in June, 2016). We rode horses for the last 1 km or so, where we had to cross the northern end of this wetland, where it was still wet, and not conducive to travel by vehicle (**Figure 4.9**). We arrived at an area known locally as "Indian Hill" that is slightly elevated compared to the surrounding, containing numerous mounds. In total, we recorded 35 mounds in an area of about seven hectares (**Figure 4.10**). The mounds at Indian Hill were not arranged into formal plaza groups, or appear to have clear orientations, with the exception of possibly one plaza group, reminiscent of Chulub (see Murata, Kaeding, and Gantos, Chapter 5). In addition, many, if not all, of the mounds appeared to be earthen and amorphous, somewhat reminiscent of the salt production mounds at Wits Cah Ak'al and Jones / Mexico Lagoons (see above), although smaller in size. It is possible that the site represents some form of production and/or processing site, but the lack of a larger body of brackish water similar to Jones Lagoon seems to preclude salt production.

Considering the nature of the mounds at Indian Hill and that the site is surrounded by a seasonal / perennial wetland, likely not conducive to agriculture, perhaps other forms of production involving wetland products was the focus of production. Mr. Moody informed us that the lower areas surrounding the site has many catchment basins for fish, which may suggest that the Maya were here to procure (and perhaps process) fish. It is possible that the site is related to the site of Chulub (see Murata, Kaeding, and Gantos, Chapter 5; Flanagan, Chapter 9),

which is in a similar type of wetland environment. Chulub is only 2 km away to the northwest, and only a little over 1 km away from the eastern bank of Crooked Tree Lagoon (Northern Lagoon) which is proximate to Chulub. It should also be noted that the site of Umbrella Hill, accessed directly from Crooked Tree Lagoon by David Buck in 2017 is only 700 m to the north, where he also noted about a dozen amorphous earthen mounds (see **Figure 4.9**).

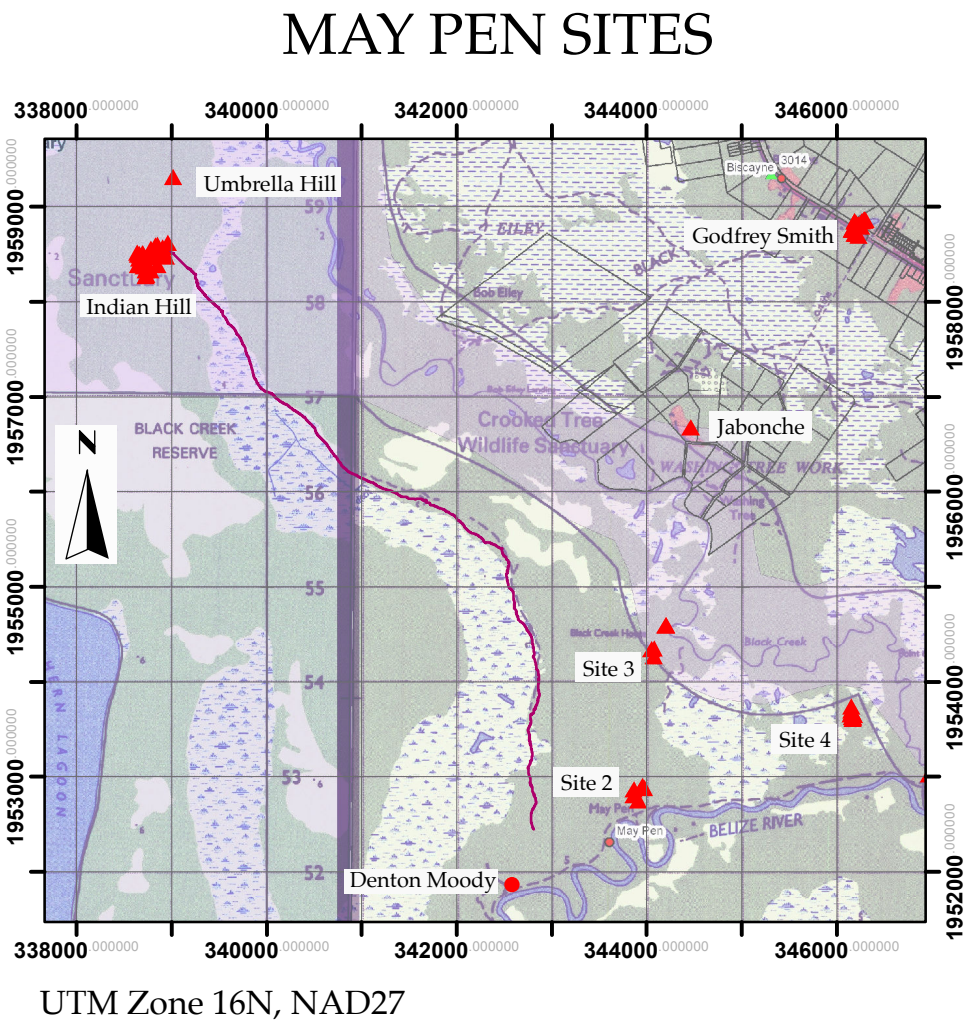

Figure 4.9 Map showing an overview of the May Pen sites, as well as the route taken to access the Indian Hill site (red line) (prepared by S. Murata)

The three other sites around May Pen were referred to by several names, including Lime Hill; however, the accounts of which sites were which varied depending on the informant. Therefore, these three sites are referred to here arbitrarily as May Pen Sites #2, #3, and #4 (**Figures 4.9** and **4.11**).

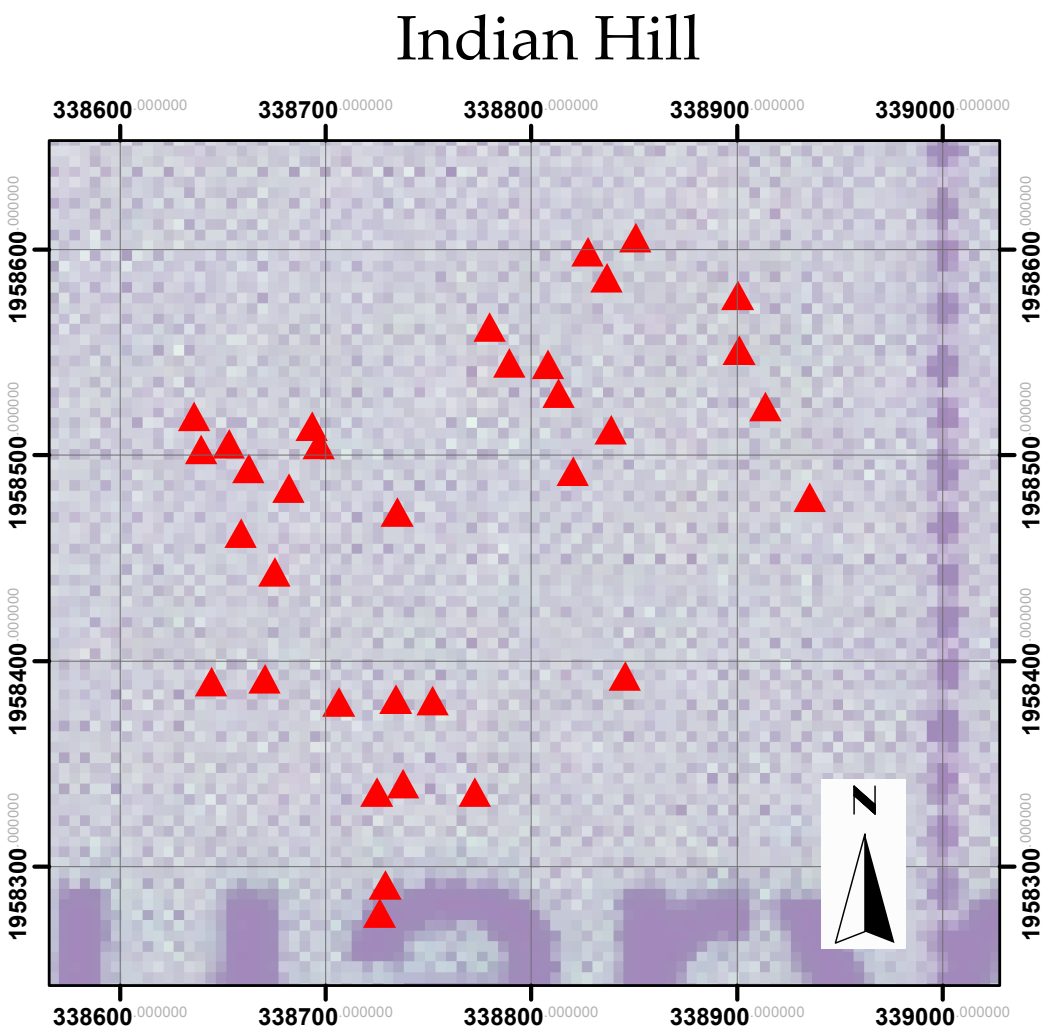

Figure 4.10 Map of mounds at the Indian Hill site (prepared by S. Murata)

Site 2

Site 2 was accessed by foot directly from the May Pen road, and consisted of several small to medium-sized mounds and platforms, at least some of which appeared to be arranged in a plaza configuration (see **Figure 4.11**).

Site 3

Site 3, which is located about 1.5 km north of the May Pen road and Site 2, was accessed by horse. We noted one low mound that appears to be cultural in this location (**Figure 4.11**).

Site 4

Site 4 is about 700 m north of the May Pen road, around 2 km northeast of Site 2 (**Figure 4.11**). We also accessed this site by horse. We identified ten mounds, consisting of house mounds, range structures, and platforms, arranged more or less along a N-S line. Since this line likely represents our walking line, it is likely that the site expands more in the E-W directions. Considering that Black Creek is only 600 m to the northwest and 500 m to the east, it would be interesting to investigate this site further to see its relation to the creek as well as nearby larger sites, such as Jabonche, which is a little over 3 km away, but would have been easily accessible via Black Creek.

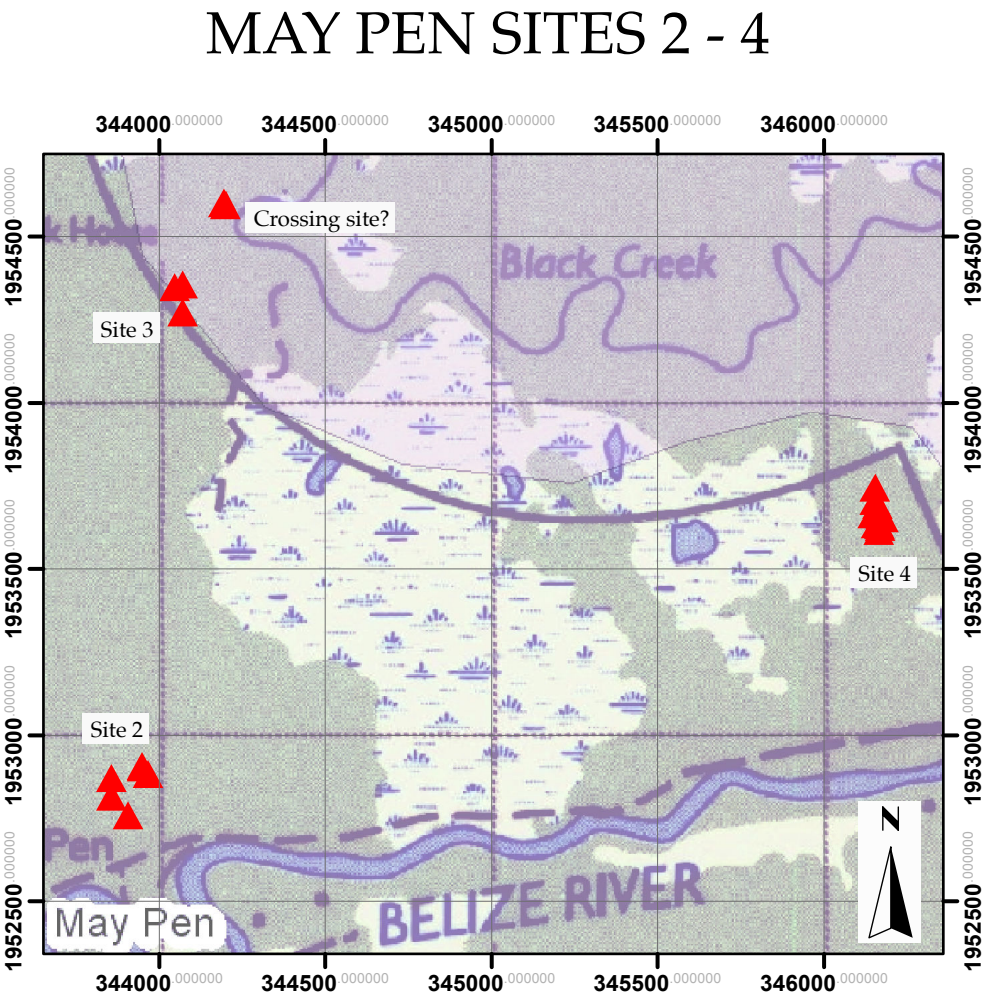

Figure 4.11 Map of mounds at May Pen sites 2, 3 and 4 (prepared by S. Murata).

Crossing

On a separate occasion, we were informed that there used to be a crossing point on Black Creek, a few hundred meters northeast of Site 3, where there stood a house until recent times (**Figure 4.11**). While we could not relocate the site, such a spot is likely to have functioned in the same manner in the more distant past, and thus this area may benefit further research in the future.

Revenge and Backlanding Waterside

Revenge is a settlement that was inhabited until around 50 years ago, about 8 km north of Crooked Tree. We were informed by Mr. Steve Tillett and Mr. Valentine Young at the Audubon Society in Crooked Tree that children in the village would take canoes to cross the Western Lagoon and land at Backlanding Waterside, then (presumably on foot) cross the savannah to reach the village of Backlanding on the eastern side of New River Lagoon to attend school. We asked Bruce Tillett of Crooked Tree to guide us to the now-abandoned village of Revenge on horseback, to identify its location and any recognizable features therein.

After traveling north from Crooked Tree on horseback and crossing a creek immediately west of what is locally referred to as Alligator Pond, we reached a location thought to be Revenge. We identified the location of the village well, and also an area of several tens of meters on a side dominated by one ornamental plant, which Bruce assumed demarcated a cemetery (**Figure 4.12**). No tombstones, crosses, etc., were found. In January 2018, this plant was identified by Mr. Hugh "Dudley" Tillett, Mr. Richard Dawson, and Mr. Ruben Crawford to be the snake plant (*Sansevieria trifaciata*), locally called "mother-in-law's tongue." Mr. Dudley Tillett confirmed that the plant was formerly used as grave markers in earlier times, when tombstones, crosses, and other types of grave markers were not used or available, and that it could be found in abundance at old cemeteries in Revenge as well as Backlanding. Since the native habitat of the plant is tropical West Africa (Wikipedia contributors 2018), it would be interesting to further research the history of the introduction of this plant to this region, as well as the origin of the custom of using it in mortuary practice.

On a separate occasion, we crossed the Western Causeway onto the pine ridge savannah, and traveled on a N-S road in the savannah to reach the western bank of the Western Lagoon at a location marked Backlanding Waterslide (likely a typo for "Waterside") on our map. We identified a circular pond, which we learned later to be locally referred to as Little Alligator Pond, and which is connected to (Big) Alligator Pond by a creek. This pond and creek connect the western side of the Western Lagoon to the Crooked Tree Lagoon, presumably allowing travel by boat even during the dry season when the Western Lagoon dries up (**Figure 4.13**). Since Crooked Tree Lagoon ultimately drains to the Belize River via Black Creek, and Backlanding Waterside is only about 2 km to Backlanding Creek, which drains into the New River, this route

Figure 4.12 A leaf of a snake plant (photo by S. Murata)

(New River -> pine ridge savannah -> Little Alligator Pond -> Alligator Pond -> Crooked Tree Lagoon -> Black Creek -> Belize River) would represent one of the most cost-effective ways of traversing between the two major river valleys (New River and Belize River), requiring only 2 km of overland travel. Therefore, we can expect that the ancient Maya also would have utilized this route, and indeed, it is possible that this creek, connecting the two ponds in a straight northwest – southeast trajectory, is a channel that was originally constructed by the Maya. To that extent, we should look for a Maya site near Little Alligator Pond, and indeed, according to satellite imagery, there appears to be some mounds on a nearby pasture, around 750 m to the northwest of the pond. We are in talks with the landowner, Mr. Denal Tillett, regarding access and reconnaissance on his land in the future (**Figure 4.13**).

Chulub

We actively looked for Maya mounds on the "island" of Crooked Tree, to no avail, until we came across some at the southeastern corner, on cleared pasture full of acacia plants referred

to locally by the Crooked Tree community as "Hole-in-the-Wall." We tentatively named the site "Acacia" and recorded the locations of over 40 mounds, some of which were arranged in a plaza configuration. We also noticed numerous depressions between mounds, which were retaining moisture even at the tail end of the dry season in June 2016. Our hypothesis is that these are water features excavated by the ancient Maya inhabitants of the site for some type of production and/or processing activity. We returned to this site for mapping and excavation in January 2017. Details of the mapping program therein are reported in the following chapter (see Murata, Kaeding, and Gantos, Chapter 5).

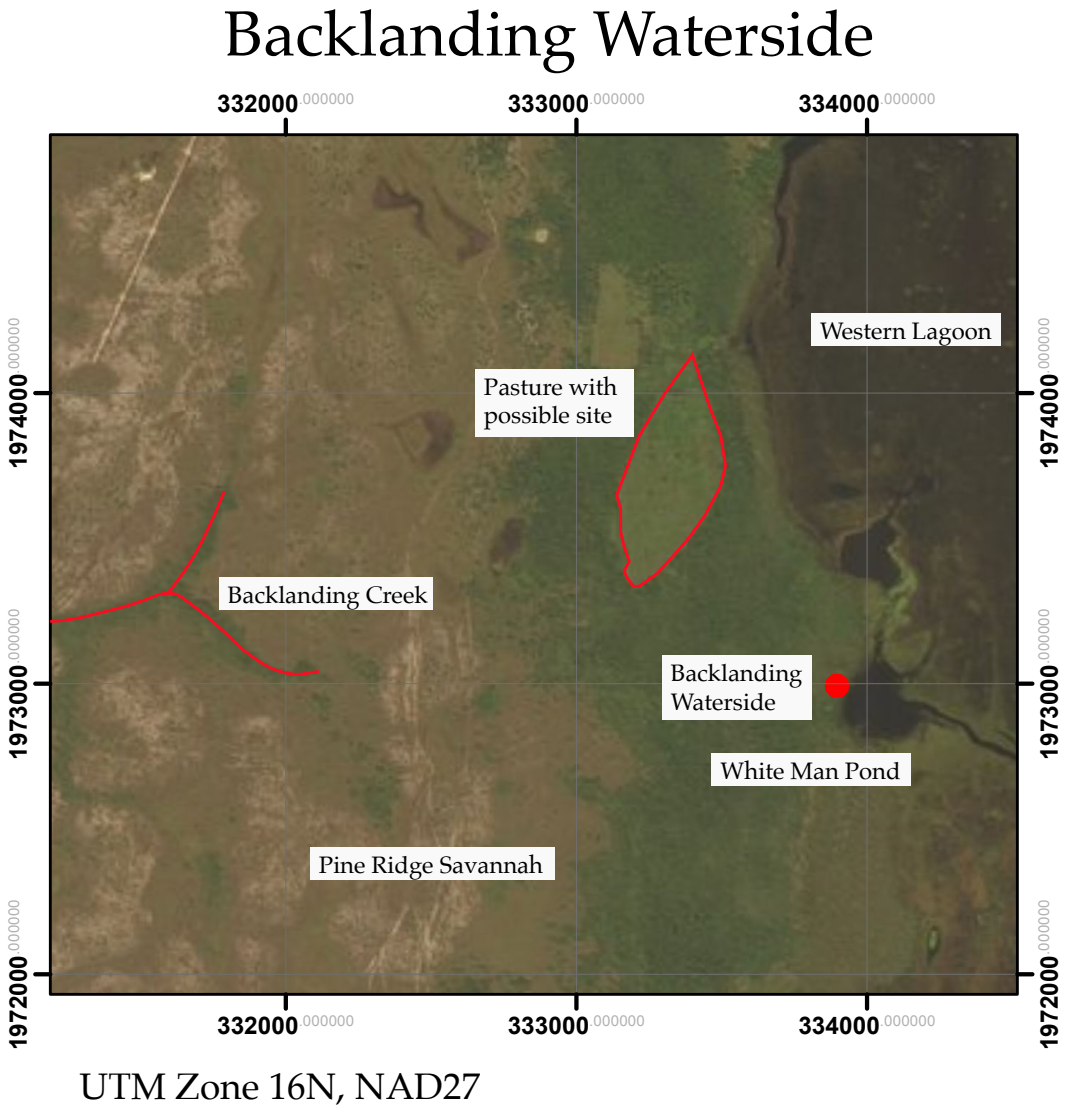

Figure 4.13 Map showing the relationship between Backlanding Waterside, Backlanding Creek, Western Lagoon, and Mr. Denal Tillett's pasture, with possible mounds.

Ek'tok

In June 2016, we were told by several informants from Crooked Tree that there is a sizable Maya site to the north of Chau Hiix, located on a then-recently cleared pasture, owned by Mr. James Dawson. The site is referred to by the villagers as Black Burn, which is also the name of a much larger area on the west side of the Western Lagoon, an area that also includes Chau Hiix. With Mr. Dawson's permission to access the land, we asked Mr. Cardinal Baptiste to guide us to the site in the summer of 2016.

Mr. Dawson's pasture is located about 6 km south of the Western Causeway and can be accessed from the N-S road in the savannah, as is the case with many of the pasture lands owned by Crooked Tree residents. The land to the north and south of the road is owned by Mr. James Dawson, while another piece of land farther to the south is owned by his cousin, XXXX Dawson. The site core is on the north side of the road, consisting of a large (~ 10 m) pyramidal structure and a smaller (~ 5 m) platform arranged north-south, and a small range structure to the east, all of which are placed on a basal platform (Plaza A, Figure 4.14). We used the Trimble GPS to record around 40 structures in an area of about 0.25 square km. Noting the significance of the site, the fact that a large portion of it is already cleared for pasture, and the fact that it appeared that, at least the large structures in Plaza A were not included in the site map of Chau Hiix prepared by K. Anne Pyburn (2003), we decided to spend the last remaining week of the January 2017 season to start mapping the site using the total station.

We established a fixed point (Station 1) on the low range structure to the southeast of the main pyramid (Structure 3), assigning it UTM coordinates as accurate as possible to be used as the basis for the entire map. The UTM coordinate of Station 1 was measured with the Trimble GeoXH GPS unit to a displayed error range of less than 25 cm. Then, we established a temporary backsight point around 300 m to the south of Station 1 (we did not place a rebar there for several reasons, one of which being a shortage of steel rebars) following our standard procedure (see Murata 2012), to placed two permanent backsight points (Stations 2 and 3) within Plaza A.

Students who had been mapping the site of Chulub during the first two weeks of the January 2017 season were relocated to Ek'tok to start the mapping program there. Since we had, by this time, only a few days that could be spent on mapping, we were only able to map Plaza A, a small plaza group to its northeast (Plaza B), and a 4 m tall mound on a platform around 180 m southeast of the main pyramid. Separate from the mapping program, we found a small plaza group atop a basal platform around 370 m east of Plaza A, with four low cardinally arranged superstructures (Plaza C); we chose this area as the traditional end-of-term exam for the field school students; therefore, the data for Plaza C are accumulated data collected by all students. The rest of the provisional map for Ek'tok is based on GPS points and corresponding notes collected in summer 2016 (**Figure 4.14**).

As can be seen in the provisional map, the site consists of several plaza groups arranged on platforms. Most of the construction material at the site is chert, and even the pyramid

(Structure 1) had very little limestone/facing stones apparent on the surface. The looters' tunnel and the large looters' trench on the two largest structures (Str. 1 and 2) did not seem to be recent excavations.

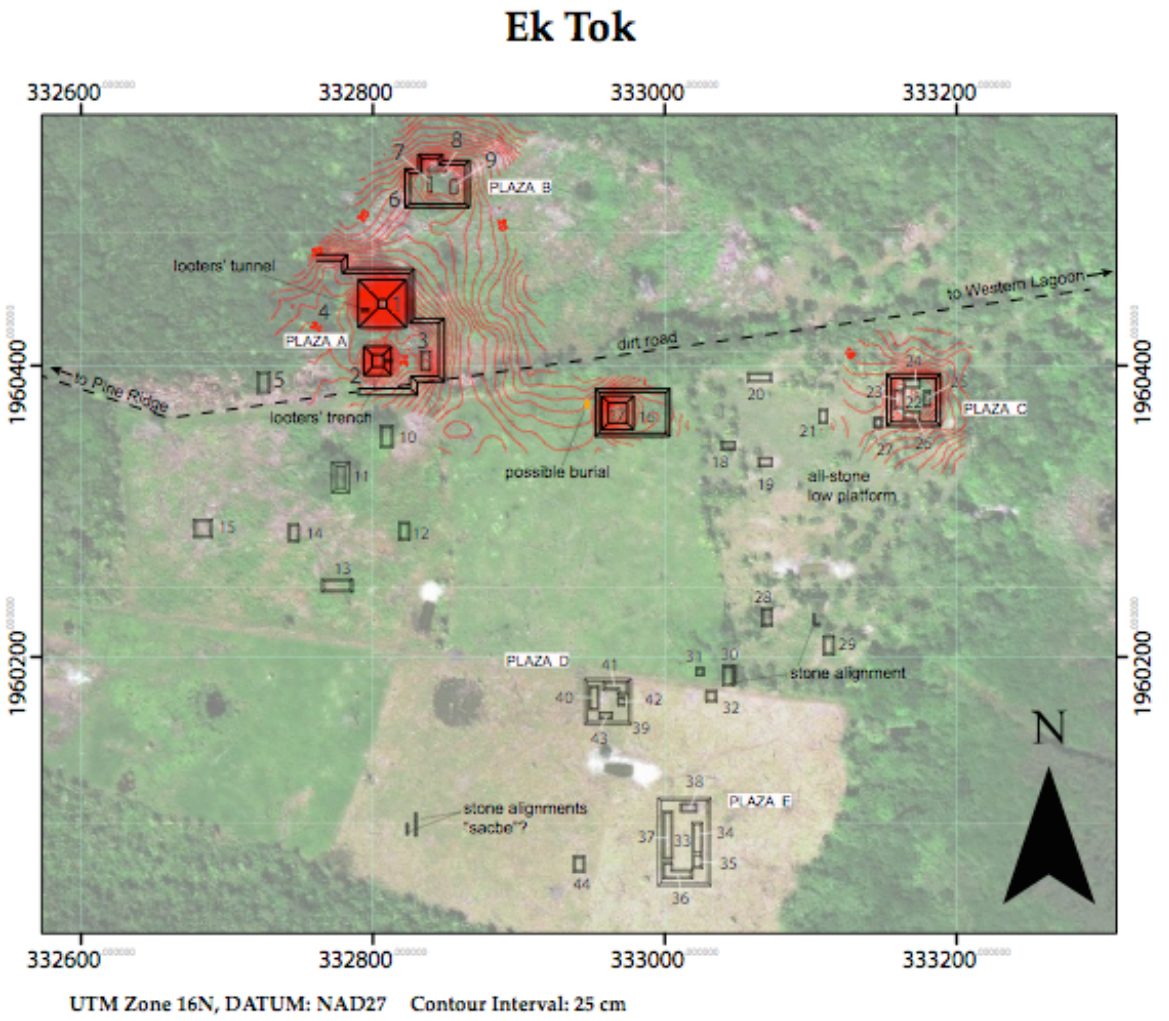

Figure 4.14 Rectified map of Ek'tok (prepared by S. Murata)

The site seems to have quite a deep history judging from surface artifacts, where we found Early Classic flanged dish potsherds in Plaza B, Terminal Classic potsherds in Plaza E, and what appeared to be Colonial Period olive jar fragments on and around Structure 17. There also was a small mounded feature to the west of Str. 17 that may be a more recent burial.

When Pyburn's map of Chau Hiix is overlain to match in scale with our provisional map of Ek'tok, several of the structures to the south of Plaza A seem to overlap in the two maps (**Figure 4.15**). The north and eastern portions of the site, however, have not been surveyed by Pyburn's team (to the north and east of the dotted line in **Figure 4.15**). It is debatable whether or not Ek'tok can be distinguished as a separate site from Chau Hiix; however, considering the significance of the structures and plazas not yet mapped, it would be prudent to finish the

mapping program initiated in 2017, at least of the structures currently exposed on pasture. The exposed nature of the site also should be conducive to excavation, especially for what may be colonial period remains around Structure 17.

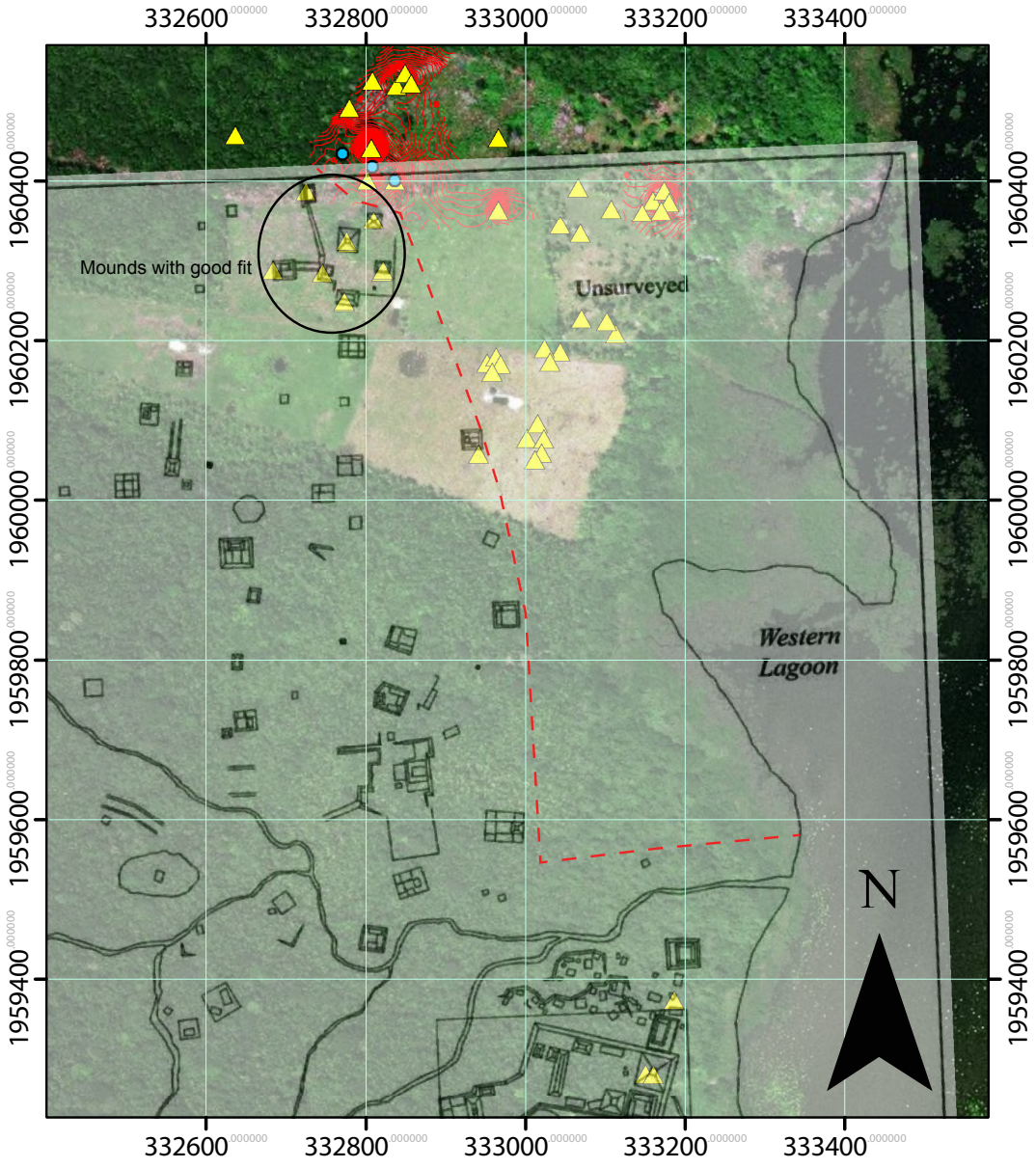

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Figure 4.15 Ek'tok mounds with an overlay of K. Anne Pyburn's map of Chau Hiix (reprinted from Pyburn 2003); note the encircled six mounds, showing a good fit between the BREA GPS points (yellow triangles) and Pyburn's structures. No structures are to the north and east of the red dotted line on Pyburn's map, indicating unsurveyed areas (prepared by S. Murata)

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Chapter 5

Mapping Chulub and its Water Features

Satoru Murata, Adam Kaeding, and Alex Gantos

Introduction

During the summer season of 2016, BREA reconnaissance efforts continued to change focus from the middle reaches of the Belize River Valley to the lower reaches in the region of Crooked Tree Village. In accordance with standard BREA methodology, the first stage in this shifting focus is the reconnaissance of the research area which is comprised of thorough review of maps, aerial photographs, satellite imagery, and any other available material as well as inquiry among local communities. This approach identified several potential research avenues including a site located on the eastern shore of the Crooked Tree island proximate to the Crooked Tree (Norther) Lagoon in an area known locally as "Hole in the Wall" (presumably a reference to a relatively rare and maintained opening in the otherwise impenetrable mangrove that lines the lagoon). Chulub is set back roughly 350 m from the shore of the lagoon. Accessing the site during the summer of 2016—when the lagoon's water levels are receding from their seasonal apex—several characteristics were observed that warranted a more thorough and detailed investigation the following field season in January 2017. The most immediate of these characteristics was the main plaza which included the ruins of a mound on its southwest corner that shared aspects with other circular structures that have been one of the primary focus of BREA research efforts since the inception of the project (e.g., Harrison-Buck 2013). The other characteristic that caught the attention of the BREA reconnaissance team was a series of subtle topographical prominences stretching to the north of the main plaza. Since reconnaissance efforts had been specifically focusing on the lower reaches of the river valley, several areas have been identified that suggest the region had hosted a suite of landscape modification practices designed specifically to alter wetland areas to meet cultural and economic ends. The larger suite of archaeological data referring to these wetland modification and water management practices are categorized as "water features". Because of the prominence of these potential water features at this site and its local moniker, BREA team members assigned it the name "Chulub," Yucatec Mayan for "water reservoir."

Objectives

During the January season of 2017, the BREA team returned to Chulub to further investigate the site. Efforts were focused on the detailed mapping and subsurface investigation

of several areas within or directly adjacent to the main plaza (Harrison-Buck, Chapter 10; Shelhamer and Craig, Chapter 11) along with the subsurface investigation of one of the more prominent areas identified as a potential water feature (see Flanagan, Chapter 9). The remainder of this chapter will discuss the strategy, methods, results, and interpretations of the reconnaissance survey and detailed mapping of Chulub.

Initial Reconnaissance

Though this chapter will focus primarily on the more comprehensive 2017 efforts, this section will summarize the means by which BREA team members initially identified Chulub and some preliminary interpretations.

Site Identification

During the summer season of 2016, BREA team members dedicated a portion of their efforts to the reconnaissance survey of the lower reaches of the Belize River Valley including Western Lagoon where a number of substantial sites have been identified and further investigated (see Murata et al. Chapter 4; Willis and Murata, Chapter 6, and Craig and Harrison-Buck, Chapter 12). During the course of this reconnaissance, team members identified what was interpreted to be a linear feature manifesting in a fashion akin to a channel traversing across the Western Lagoon during its lowest seasonal water level (see Willis and Murata, Chapter 6, for more discussion on these linear features). Noticing what appeared to be an elevated area along the eastern extension of this feature (**Figure 5.1**), we attempted to penetrate east from the eastern shore of the Western Lagoon; however, the dense stands of logwood proved difficult to navigate through, and we stopped after progressing around 400 m. We did not find any Maya mounds in (**Figure 5.2**).

Having temporarily given up an approach from the west, we then sought an approach from the north; i.e., traveling south from the southern end of Crooked Tree village and arriving at an extension of the west-to-east trajectory described above. A route along the western bank of the Crooked Tree Lagoon proved fairly easy to drive south, at least at the end of the dry season, and, after a little navigating around mangrove trees, we came across Chulub and its multiple Maya mounds situated in a relatively open pasture. Although the mounds were much farther north than we had anticipated (by over 1 km), the site was immediately deemed of importance, not only because of the number of mounds, but also because the site was, and still is today, the only Maya site with unambiguous mounded architecture we have discerned on Crooked Tree "island" (refer to **Figure 5.2**).

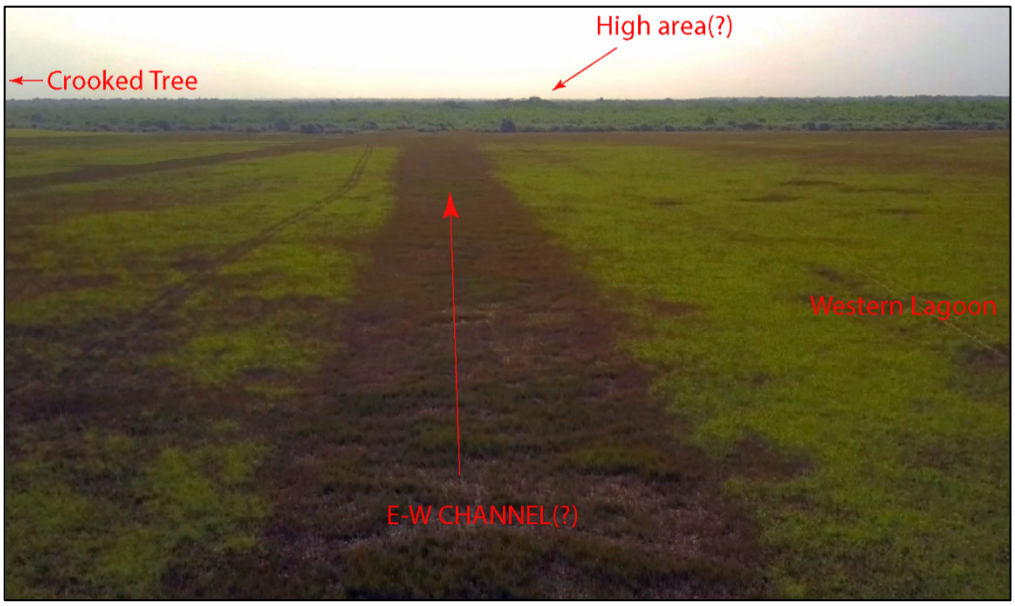

Figure 5.1 Western Lagoon east-west channel.

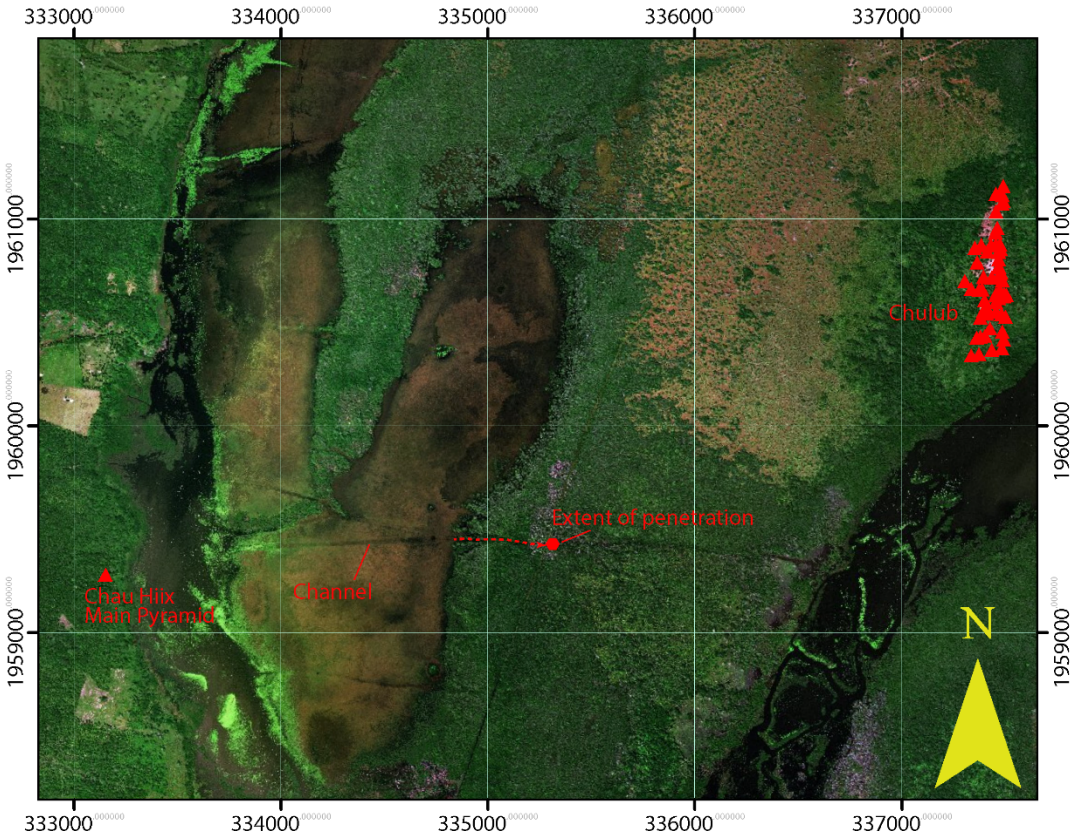

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Figure 5.2 Western Lagoon and Chulub.

Initial Extensive Site Survey

Upon reaching the site, the standard BREA reconnaissance methodology was applied. This involves three primary components:, the systematic coverage of the area by BREA team members in order to identify all above-ground features observable with relatively minimal vegetation clearing; the sketch mapping of the arrangements, geospatial relationships, and general characteristics (height, orientation, visible elements, associated diagnostic surface artifacts, etc.) of all mounds identified; and the recording of the location of each of these mounds or reasonable reference points using a handheld Trimble GPS unit with submeter accuracy. An initial rough map of the site was created based on field notes and sketches, as well as the recorded GPS coordinates (**Figure 5.3**).

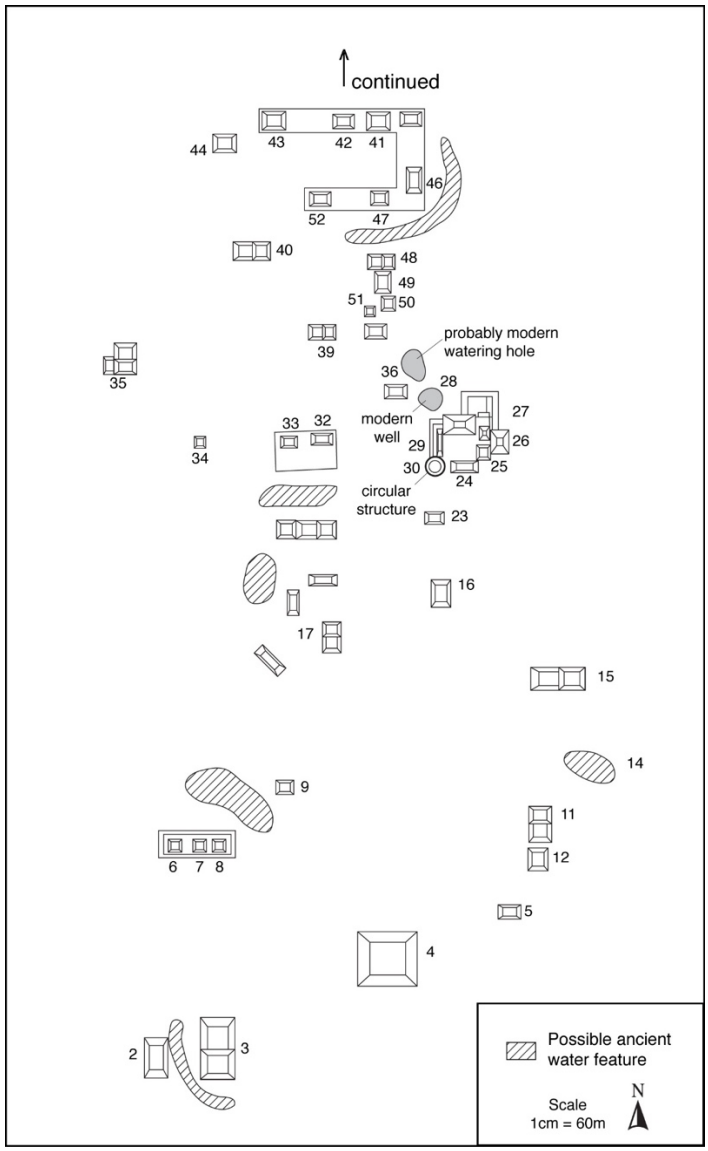

Figure 5.3 Initial Chulub Sketch Map

As a result of this initial reconnaissance survey, the site of Chulub was understood to include a main plaza with at least three medium-sized mounds and one larger mound (on the north end of the plaza), several smaller mounds located west of the main plaza, and a series of mounds seemingly arranged in east-west alignments north of the main plaza along the general north-south axis of the site. While the main plaza was observed to fundamentally match the nearly-ubiquitous Maya plaza arrangement (an interior quadrangular patio area ringed by mounds on each of its sides) there were several characteristics that appeared to be somewhat unique. For example, following initial reconnaissance survey, it was believed that the structure that should be bounding the plaza on its southern side was absent while on the eastern side there appeared to be two individual structures. Even upon first observations, then, this appeared to be an unorthodox plaza, but the most significant deviation from the standard model was on the western side. Instead of a relatively low range structure running along the majority of the western side, the Chulub plaza featured a mound of large stones arranged in a generally circular distribution with little indication of any separate construction fill material. Similar characteristics define a class of circular architecture that have been identified elsewhere in the Maya area and have served as one of the major points of focus in the BREA research design (Harrison-Buck 2011, 2013). However, as we will see, the structure was ultimately not round (see Harrison-Buck, Chapter 10).

Another interesting observation was that some of the low areas between the generally E-W oriented mounds were so low as to retain standing water, even at the driest time of the year (i.e., at the end of the dry season). We considered these to be potentially artificially modified "water features" that were utilized for some type of activity, such as aquaculture. The site, nicknamed by BREA as the "Acacia Site" after the abundance of the plant was ultimately given the name Chulub or "water reservoir" in Yucatec Mayan.

Potential Research Avenues

Based on the initial observations recorded by the BREA reconnaissance team, Chulub was interpreted as possessing the potential to inform several research questions. One of these was the larger BREA question regarding the distribution of circular structures throughout the project area (but see Harrison-Buck, Chapter 10). A second topic of interest was regarding general subsistence practices among the occupants who resided immediately adjacent to the wetland/lagoons of the lower Belize River Watershed. Certainly, residents of a place like Chulub would be intimately involved with the wetland resources of their surrounding environment, but the BREA team was interested in learning more detail about exactly what those relationships might be like and, accordingly, how they might have helped drive site location selection (see Shelhamer and Craig, Chapter 11). Finally, based on the initial reconnaissance survey, it was suspected that some of the water features located north of the main plaza appeared to have been deliberate constructions and modifications rather than natural pond features. The

BREA team wished to investigate these to see if their specific functions could be determined, the efforts toward which are discussed by Flanagan (Chapter 9). Each of these research goals could only be appropriately addressed at the scale of not only the excavations conducted for each, but also at the scale of the entire site itself. To that end, a detailed topographic map augmented by depictions of surface observations and survey results was prepared for the entire Chulub site.

Detailed Site Mapping

As is standard practice for the BREA project, all locations that are selected for intensive archaeological investigation are mapped in detail using total stations. This approach allows the BREA team to precisely document the locations of all excavation units and provides a platform by which to directly compare the data recovered from these units with relation to other data including their topographical settings. This section will detail the specific methods used to conduct the comprehensive mapping of the site of Chulub during the January 2017 season and present the results this effort achieved.

Methods and Strategy

Normally, we prefer to establish a fixed point (Station 1) on one of the main structures of the site to be mapped; however, we did not have a good line of sight from the main plaza, so we placed a temporary reference point on a low platform structure to the south of the main plaza by about 140 m, assigning it UTM coordinates as accurately as possible to be used as the basis for the entire map. The UTM coordinate of this point was measured with the Trimble GeoXH GPS unit to a displayed error range of less than 25 cm. Then, we established a temporary backsight point around 260 m to the northeast of this point, following our standard procedure (see Murata 2012). Finally, we used these two points to establish Station 1 in the northwest corner of the western structure of the main plaza, followed by Station 2, to function as the main backsight point, in the southeast corner of the plaza floor.

The BREA mapping team then split into two crews each with their own total station. The two crews were split according to their respective goals: one crew was primarily dedicated to the mapping of the main plaza and its immediate surroundings, while the other crew immediately started toward the north to document the water features that extend in that direction from the main plaza.

The crew investigating the main plaza used Stations 1 and 2 as the bases to first map the main plaza, and then extended their scope to the west and then to the north to meet with the northern crew. The northern crew established a baseline of semi-permanent control points of known coordinates stretching north from the main plaza along a low linear rise extending north from the main plaza. This spine of control points stretched north 200 m from the main plaza allowing for the collection of precise observation data reaching as far as 300 m from the center

of the main plaza. Due to this environmental constraint on the survey strategy, the furthest northern control point unfortunately reflects the accumulation of all the minute error introduced in the placement of each of the control points to the south. In acknowledgement of this cumulative error effect, the control points were set extremely carefully and checked and re-checked often. Due to these quality control efforts and based on the frequent rechecking, it appears that any introduced error was kept minimal.

Results

The result of the combined efforts of the two mapping teams is a detailed topographical map showing in detail the features of the main center of the site. This map is shown in **Figure 5.4** below.

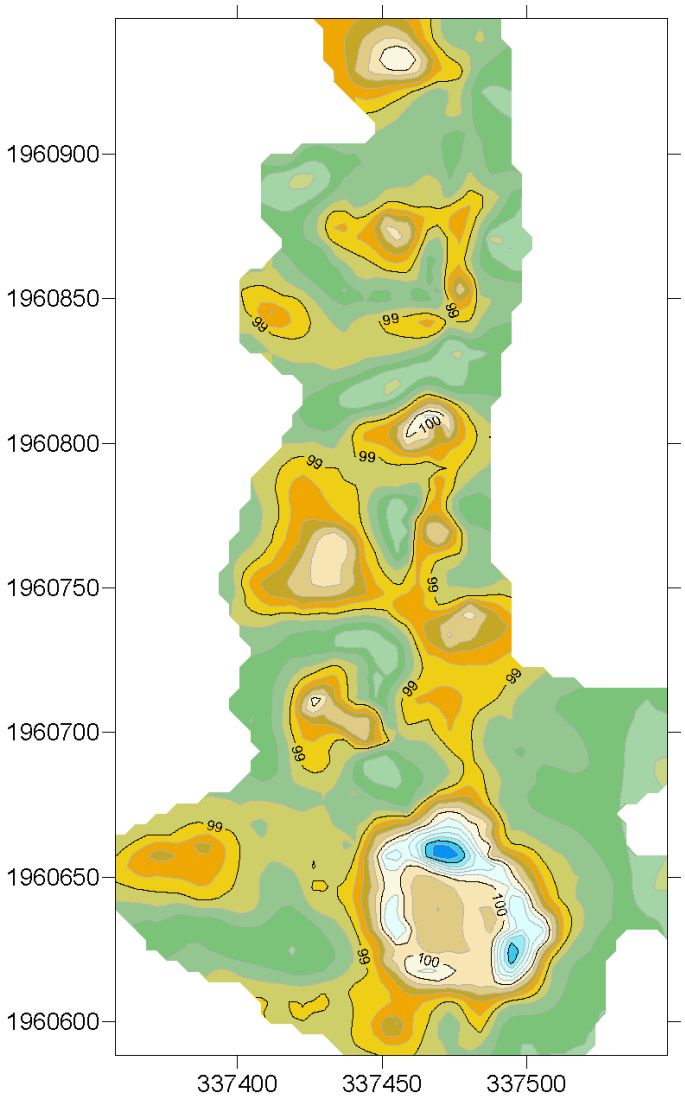

Figure 5.4 Chulub Elevation Profile

Figure 5.5 below shows a rectified map based on the topo map, although many of the structures away from the main plaza are low and thus their configurations and orientations are less reliable than those of the main plaza.

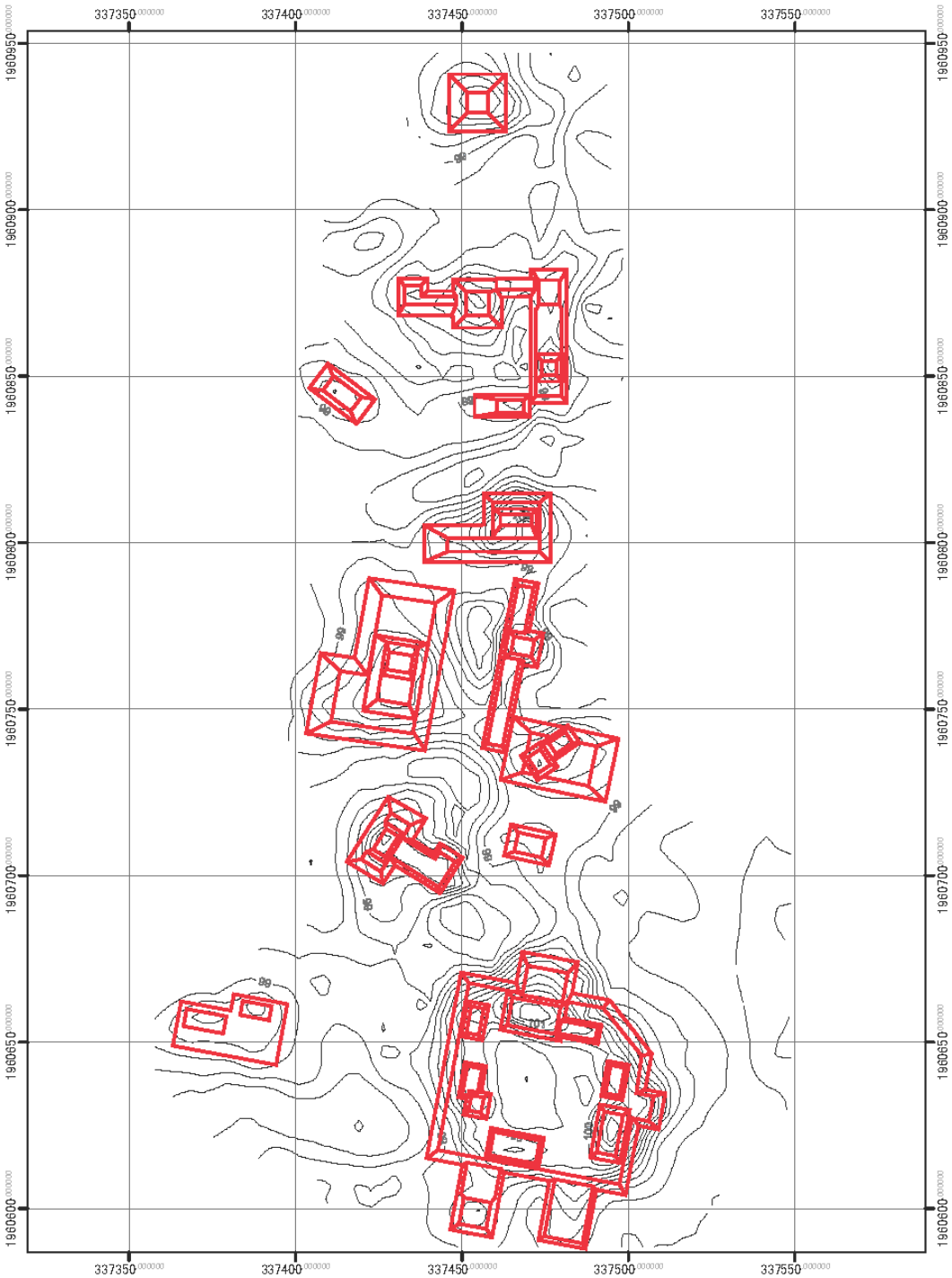

Figure 5.5 Chulub Combined Site Map (map prepared by S. Murata and A. Kaeding).

Interpretations and Conclusions

Aside from the primary objective of contextualizing excavation data, the mapping efforts also provide additional information that aids in the interpretation of the site more generally. Two such categories include a greater understanding of the site orientation and the distribution of potential water features.

Site Orientation and Architecture

As can be seen in the site maps of **Figures 5.4** and **5.5**, much of Chulub is not oriented exactly to the cardinal directions that would be expected from a standard Maya site, but rather offset by about 10 degrees east of north. This applies to both the overall site as well as the main plaza. Although several hypotheses may be conceived of regarding the reason for this deviation, conformation with the shoreline of Crooked Tree Lagoon, which also has a generally SSW to NNE orientation around this area, is one possibility (**Figure 5.6**). It should be noted that the relatively straight N-S orientation of the eastern end of the site map to the north of the main plaza is primarily the product of land clearing, or rather the lack thereof to the east; there is a good chance that the site extends farther east, if only a little. In the meantime, we did confirm the lack of mounds to the east of the main plaza, which protrudes farther east than the N-S oriented line described above. We were able to capture the protrusion because of the clearing that we conducted in order to map the entire plaza group. The lack of structures to the east can likely be attributed to low elevation—the area between the main plaza and the western bank of the Crooked Tree Lagoon is mostly low and swampy, and at least partially inundated during the rainy season.

Water Features

Our understanding of the water features stretching to the north of the main plaza is informed from excavation data (as discussed in greater detail in Flanagan, Chapter 9). However, the distribution of these features provides further information. The primary takeaway is the simple impression that these features are artificially modified if not entirely manufactured. This is largely an anecdotal assessment but two means of testing it provide some further, if minimal, support. First, chapters in this volume present the results of other survey efforts within this region and sites surrounding the lagoons (see Murata, Gantos, Kaeding, and Buck, Chapter 4). None of these survey efforts have revealed any additional linear features of this nature. Because this survey sample was not collected through the deliberate application of a systematic approach, the utility of this observation as a control dataset is limited. Nevertheless, it stands to reason that, if these features were natural in origin, BREA survey team members would likely have encountered similar manifestations through their efforts in equivalent environmental settings

throughout the area. Since this has not occurred, it is a reasonable interpretation to suggest that these features correlate specifically with Chulub and its many other features that are also not exactly replicated elsewhere along the lagoon.

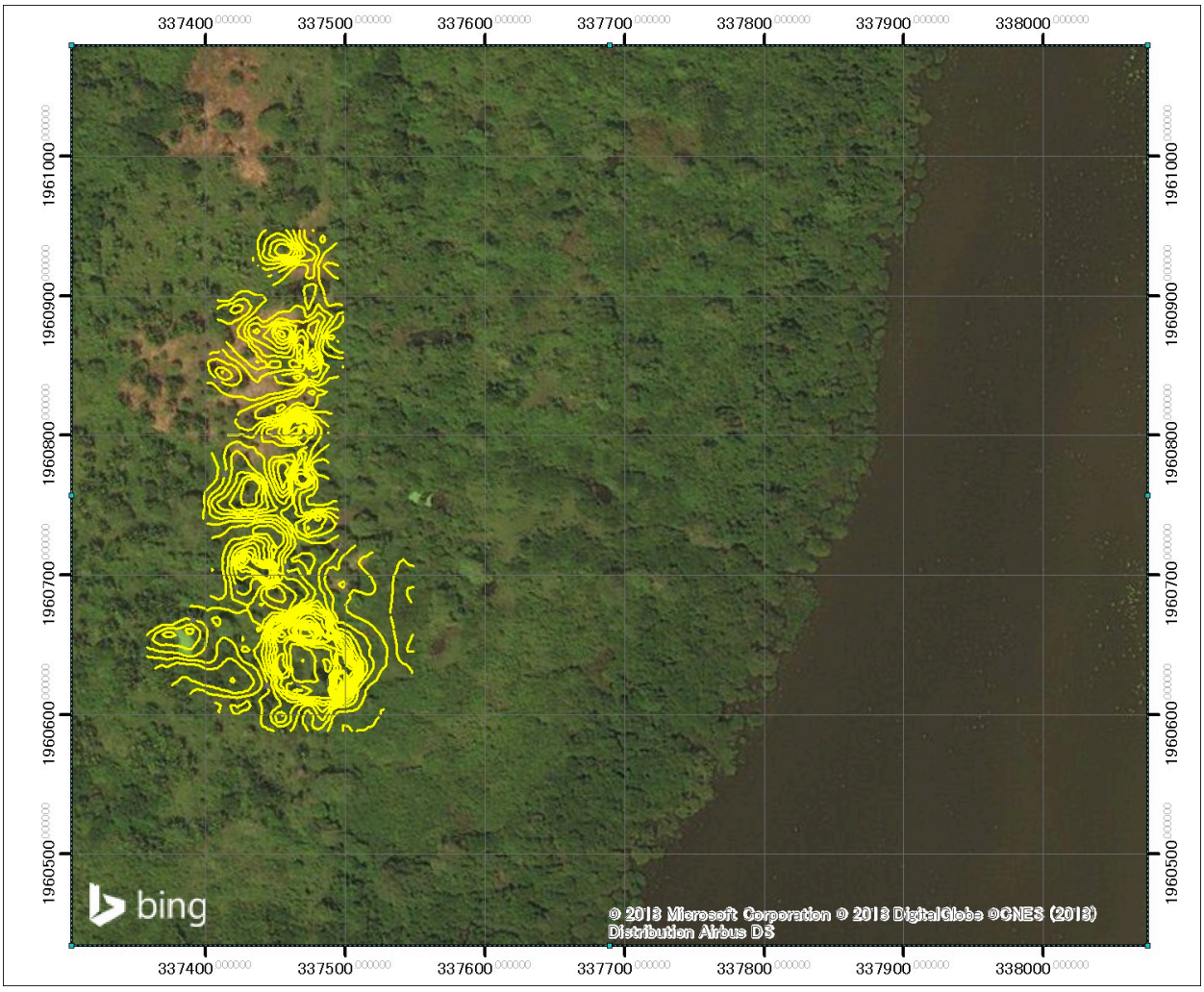

Figure 5.6 Chulub with Crooked Tree Lagoon

A second, but weaker source of evidence to suggest that these linear features are constructions is their distribution. Specifically, the distances between the topographical prominences rising above the low inundated areas seem non-random. The reason this is a weaker argument is simply because of the low sample set available at this time. Only four of the east-west raised areas were captured in the Chulub mapping exercise, establishing only three opportunities to measure between them. That dataset, however, is internally consistent with these distances measuring 22, 17, and 34 m (mean:24.3; standard deviation: 8.7) moving north from the main plaza. Similarly, the widths of the raised areas themselves are consistent: 27, 27, 22 and 16 m (mean 23; standard deviation: 5.2) across each when measuring the average width of each. Again, the small sample set denies the ability for robust statistical interrogation of the

degree of randomness, but they do suggest a level of uniformity that would be unexpected as a result of natural processes in this notably volatile landscape prone to flooding. This assessment is further bolstered by anecdotal personal communications between BREA team members and residents of Crooked Tree Village. During the course of field work, one of the local members of the team, Cardinal Baptiste, shared his knowledge of traditional agricultural practices applied in similar wetland settings. This practice centered on the creation and maintenance of "tasks" — long, linear raised agricultural beds. The tasks were necessarily maintained at a certain width in order to maximize the growing surface while allowing for the necessary soil drainage. The creation of such tasks would reasonably be expected to result in the distribution of long, linear raised areas of a consistently internal width particularly along the higher portions as demonstrated with this sample.

Conclusions

After two weeks of mapping at Chulub, weather conditions allowed us to cross the Western Lagoon to initiate mapping at the site of Ek'tok (see Murata, Gantos, Kaeding, and Buck, Chapter 4). Because Ek'tok is a site with promise in terms of future excavation work as well as containing optimal areas to be used for instruction and examination of the students' mapping skills, combined with the fact that the remainder of Chulub, to the south of the main plaza, lacked well-defined architecture and architectural groups (see **Figure 5.3**), we decided that resources would be better utilized at Ek'tok; thus, the two mapping teams relocated there for the final week of the January 2017 season.

As with any unfinished map of a site, Chulub beckons us to return; although the relatively low return-on-investment ratio may dissuade any further effort. In 2016, the landowner was clearing the area, which at the time appeared to have had been unattended in recent years. If further clearing has since taken place, it may be possible to complement the map with high-altitude drone mapping in the future. Obviously, LiDAR mapping of the area would be optimal from a technical point of view

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Chapter 6

Mapping the Western Lagoon Wetlands with Drones

Mark Willis and Satoru Murata

Introduction

The Western Lagoon is a wetland area located west of Crooked Tree, Belize in Belize District. This low-lying area, about one meters above sea level, is seasonally flooded during the monsoon season and dries out to varying degrees during the dry season. The lagoon covers 21 km north/south and approximately 600 m in width at most places. When viewed from above, many unusually straight lines are visible that cut across the lagoon floor. These linear features are slightly lower that the surface of the lagoon. It is unclear if these features are natural, modern, or archaeological in nature. There are also ponding areas along some of these features which may have acted as prehistoric fish weirs or are in some other way associated with aquaculture (see **Figures 1.6** and **6.1**). In order to understand the phenomenon better, detailed 3D modeling of the southern two-thirds of the lagoon via drone aerial modeling was conducted. This chapter describes the techniques and equipment used to map the area. Although post-processing and analysis is still ongoing, we conclude with a brief overview of the preliminary results of the geospatial mapping of the wetland areas.

Figure 6.1 Aerial image showing close-up of pond feature and location of Op. 34 test excavations in June 2017.

Methodology

Two types of aerial mapping platforms were used during this project: multi-rotor and fixed-wing style drones. Both platforms work in the same way in that each carries a digital camera into the air and facilitates photographing the project area from above. The multi-rotor style drones are similar to helicopters and have a series of propellers that push air beneath the aircraft to attain flight. Because the multi-rotor drones fly slow and close to the ground, they are best suited for very low altitude missions where minute photographic details are the priority. Fixed-wing drones are an airplane-shaped platform that flies through the air by using the aerodynamics of the wings for lift. These drones must fly higher and faster than multi-rotor drones to maintain lift. The fixed-wing, therefore, is best suited to mapping large areas but at slightly lower resolution than multi-rotor drones. The level of photographic detail captured by both platforms far exceeds the resolution available from any publicly available imagery captured by manned aircraft or satellite.

Prior to field activities, several photography missions were planned using proprietary mission planning software. This software provides an interface that allows the user to draw a series of polygons that define photo survey areas. The software then plots the most efficient fights needed to photograph the area using a series of overlapping and parallel fight transects. This digital plan is saved as a flight mission. Once in the field, the drone is assembled and the missions are loaded into the drone's autopilot system. The camera is placed into the drone. The fixed-wing drone is then launched by physically throwing the machine into the air while the multi-rotor takes off from the ground in a hover. Once aloft, the autopilot takes command of the aircraft and begins flying the mission and taking photographs at set distance intervals. During this process, the aircraft is monitored both visually and electronically. The drone can be called home or flown manually, should the need to override the autopilot arise. When a mission is complete, the drone lands itself, the operator retrieves it and downloads the photographs from the camera. Once fresh batteries and additional memory cards are replaced, the drone is ready for another mission. At the end of each day, all telemetry data are retrieved from the drone. These data document when and where the drone flew during a mission. The telemetry information is merged with digital photographs to provide GPS locations for each photo. Having the GPS locations for the photos allows the imagery to be georeferenced within the Structure from Motion (SfM) software, discussed in greater detail below.

The areas mapped are regulated by permit through the Belizean Public Utilities Commission. Among other rules, the permit requires that the aircraft be flown 200 feet or less above ground level and within Visual Line-of-Sight (VLOS). The drone operator has extensive experience of the use of drones within Belize (Harrison-Buck et al 2015; Harrison-Buck et al. 2016; Sandrock and Willis 2014; Willis 2016; Willis and Walker 2015).

Equipment

We used a fixed-wing Strat3D Mapper, ready-to-deploy light-weight drone, weighing 1200g, with a wing span of 120cm. This unit has an on-board system comprising a Ricoh GR 12-megapixel digital camera, a GPS, and a radio receiver, which is controlled by a ground-based computer (semi-rugged laptop) via a 2.4GHz radio modem for data transfer. In addition to the Strat3D Mapper, aerial mapping was augmented with a DJI Mavic Pro multi-rotor drone (**Figure 6.2**). The Mavic is also a safe and lightweight machine that also carries a FC220 camera. The Mavic, which is made of aluminum and plastic, measures 30cm in diameter and weighs 734 grams.

Figure 6.2 Mark Willis flying the DJI Mavic Pro multi-rotor drone over Western Lagoon Wetlands. Note the rise is Chau Hiix in the background (photo by E. Harrison-Buck).

The drones, also known as Unmanned Aerial Vehicles (UAVs), all peripherals, and the ground-based computer can be stored in a single carrying case. Flyovers of landforms and possible cultural features include multiple, overlapping passes at different elevations. For high-resolution mapping, the goal is to generate a very dense digital elevation model (DEM) and to provide stereo-images for highly detailed architectural mapping and mound volume measurements. The first stage of data acquisition is accomplished through a digital process called photogrammetry.

Photogrammetry extracts 3D data from a series of overlapping stereo-pair images, very much like a pair of human eyes. One image is photographed from a "right-eye" perspective and another from the "left-eye" with approximately 70 percent overlap between the two. Computer software compares the overlapping area from the photographs and then recreates the topography of the region. Traditional photogrammetry requires fairly rigid control over the way photographs are taken. The spatial relationship between the photographs also must be known. In order to achieve this, the camera-mounted UAV is programmed with a flight pattern that uses a fore-and-aft overlap of 70 percent to minimize the influence of wind and to guarantee 100 percent stereo overlap for the area of interest. Spatial controls are established by control points marked with aerial photo targets placed across the site prior to flight.

The output includes a series of digital photographs that are processed using commercial photo-merging SfM software. The software merges individual photographs by common points relative to the location of the camera (Willis et al. 2016). The software then uses the estimated camera positions with the tiled images to derive a 3D polygonal mesh of the ground surface. It ortho-rectifies the image series to establish a uniform scale, remove any distortion and produce digital orthophotos and DEMs that can be used in any GIS (Geographic Information System) or 3D mapping software. Quality Control (QC) processing was performed each day in the field. Data was processed at a GIS laboratory in the States.

Results

A total of thirty-two flights of the fixed-wing drone were flown over and area of approximately 48 square kilometers (18.5 square miles) (**Figure 6.3**). For reference, the area mapped at Western Lagoon was roughly 80% the surface area of the City of Manhattan. This is one of the largest areas mapped anywhere in the world to date. In total, 12,030 images were collected and combined to create a DEM with a 15cm resolution. This means that for every 15 cm of surface area across the 48 square kilometers an elevation data point was generated. This resulted in more than 2.4 billion data points in the DEM. The DEM helps reveal subtle changes in elevation along the linear anomalies. **Figures 6.3** and **6.4** shows the pockets of higher elevation in red. For instance, along the southwestern edge of the drone survey area the red areas mark the ancient Maya site center of Chau Hiix.

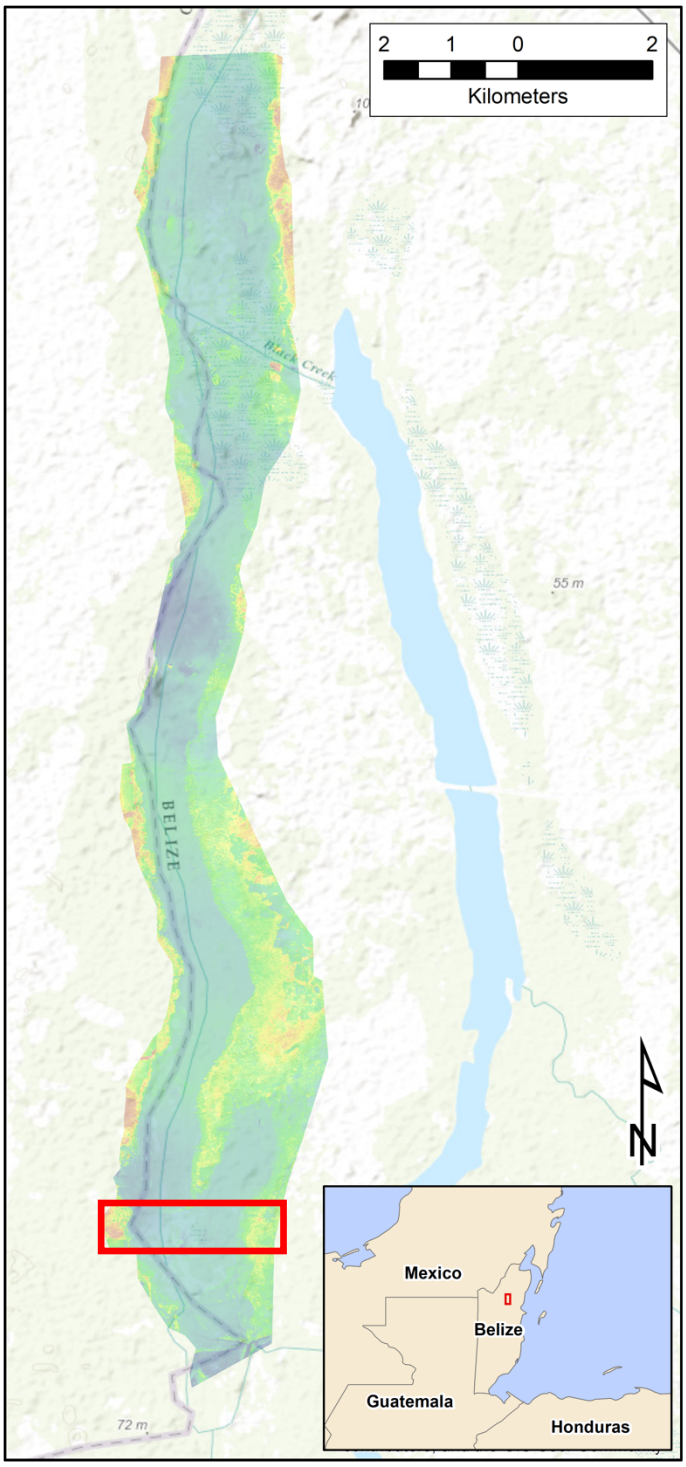

Figure 6.3 Project location and extents. Multicolored area represents the elevation model of the area mapped with the drones. Note red box is close-up shown in Fig. 6.4 (map produced by M. Willis).

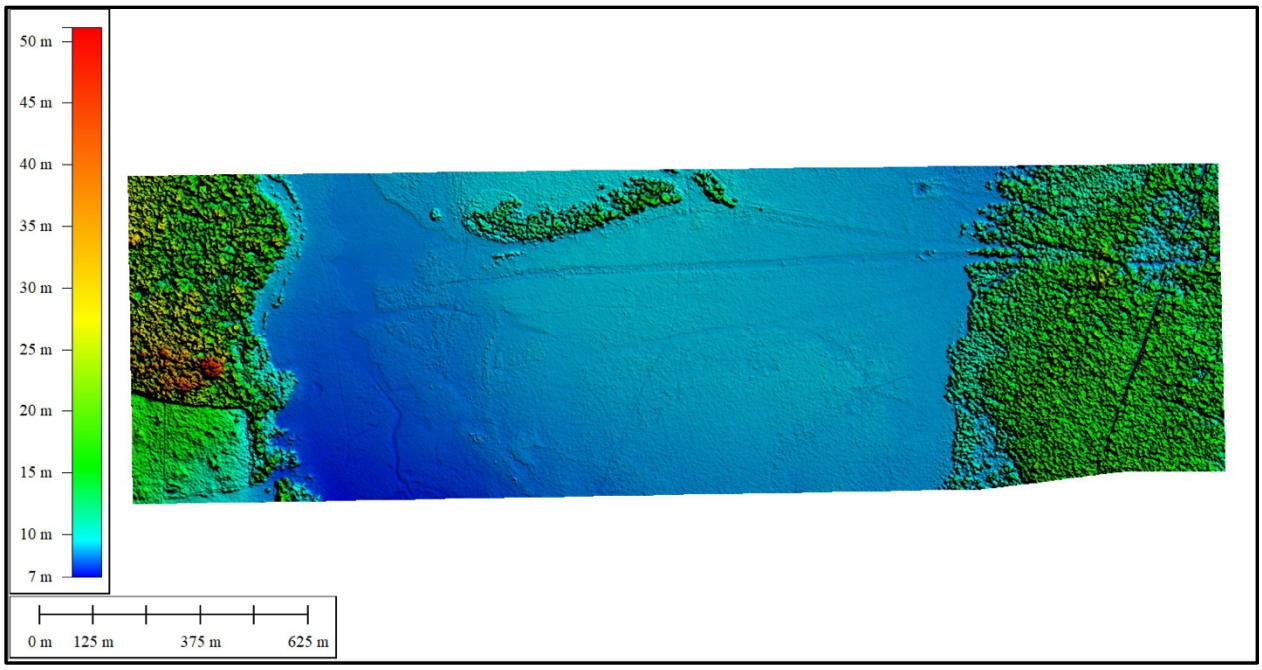

Figure 6.4 Close-up of major linear channel cross-crossing Western Lagoon Wetlands, extending from Chau Hiix to a pond feature where Operation 34 was carried out. Multicolored area represents the elevation model of the area mapped with the drones. Note red area bottom left is the main pyramid at Chau Hiix (map produced by M. Willis).

The area around Western Lagoon wetland is generally low-lying and BREA reconnaissance has demonstrated that settlement is dense in the small pockets of higher ground that exist in this area (Harrison-Buck, Brouwer Burg et al. 2016; Harrison-Buck, Craig, and Murata 2017). Therefore, it is likely that future reconnaissance in the areas of red will reveal additional ancient settlement.

The linear features identified in **Figures 6.4** and **6.5** extends from the east across the wetland lagoon, intersects a ponding area that might be a weir, and terminates at the ancient Maya site center of Chau Hiix. The configuration of these linear features strongly suggests that they have ancient origins although further investigation is necessary to confirm this. A selection of some of the other linear features in the area are highlighted in **Figures 6.5 and 6.6**. A conservative estimate of the total length of the linear features which criss-cross the lagoon is 45.3 km. At this stage of research it is unclear how these features may relate to the surrounding archaeological landscape.

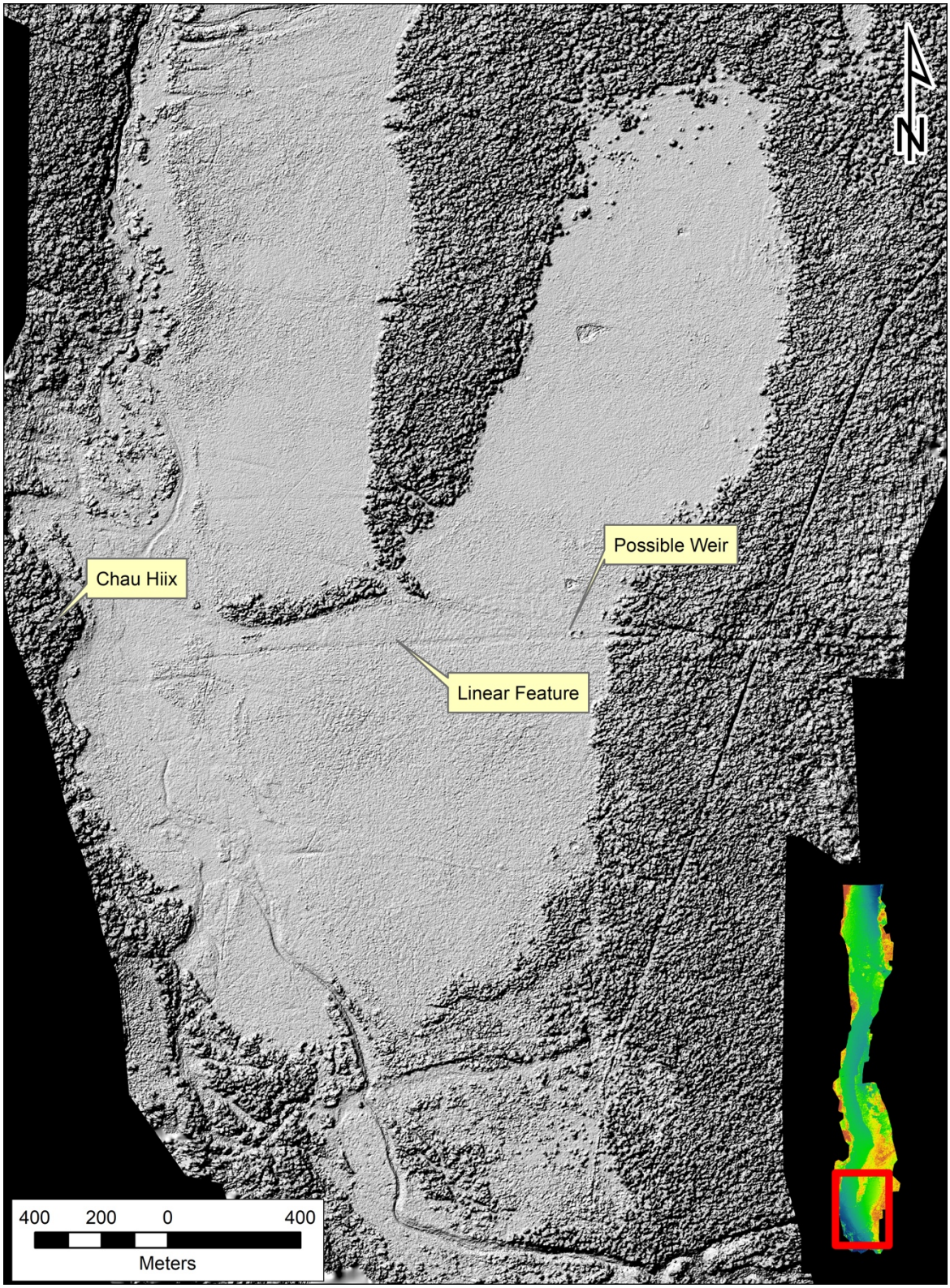

Figure 6.4 Detailed elevation model of the southernmost portion of the lagoon with the site of Chau Hiix, the linear anomaly, and potential fish weir noted (map produced by M. Willis).

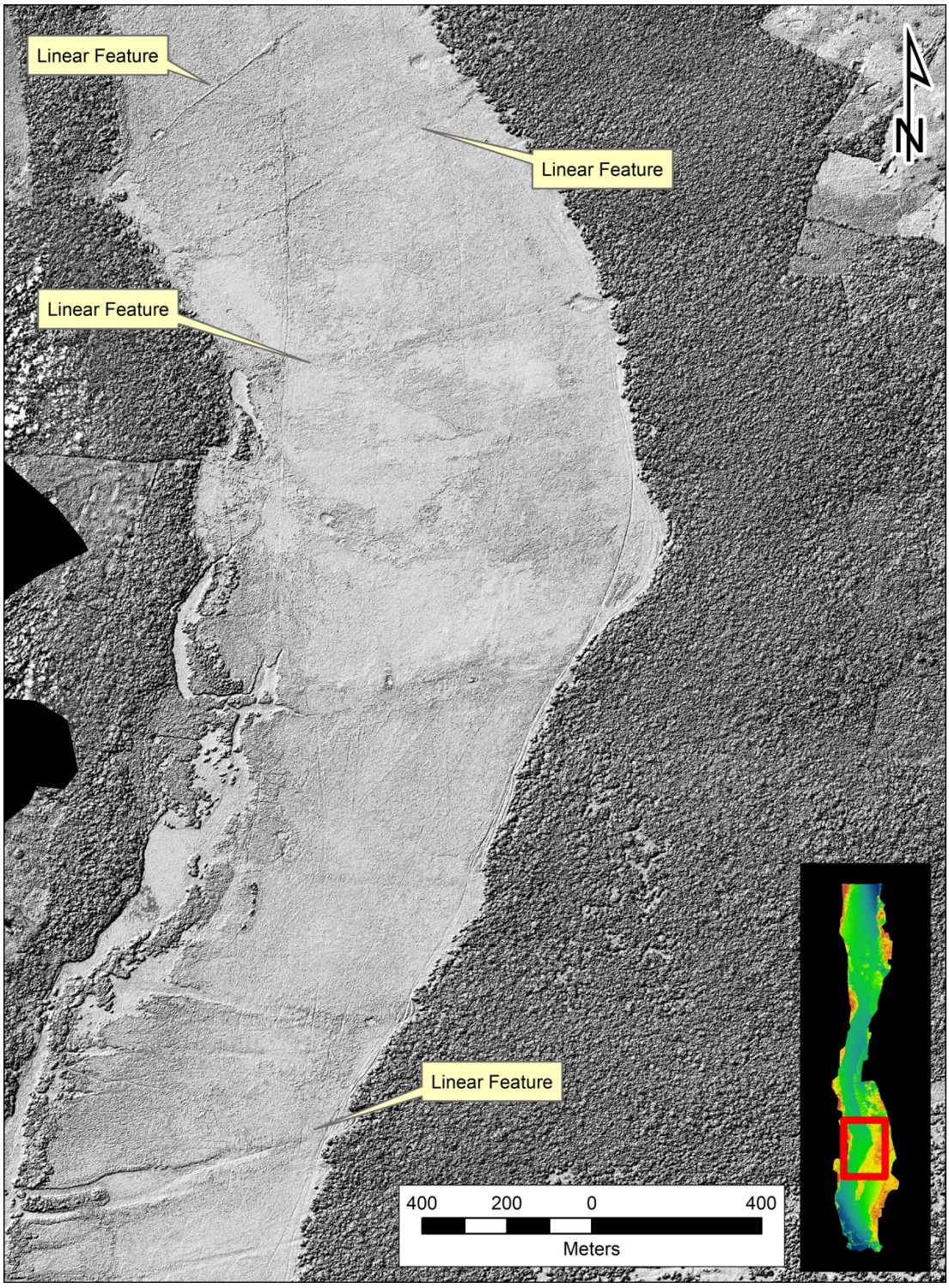

Figure 6.5 Detailed elevation model of the central portion of the lagoon with linear features noted (map produced by M. Willis).

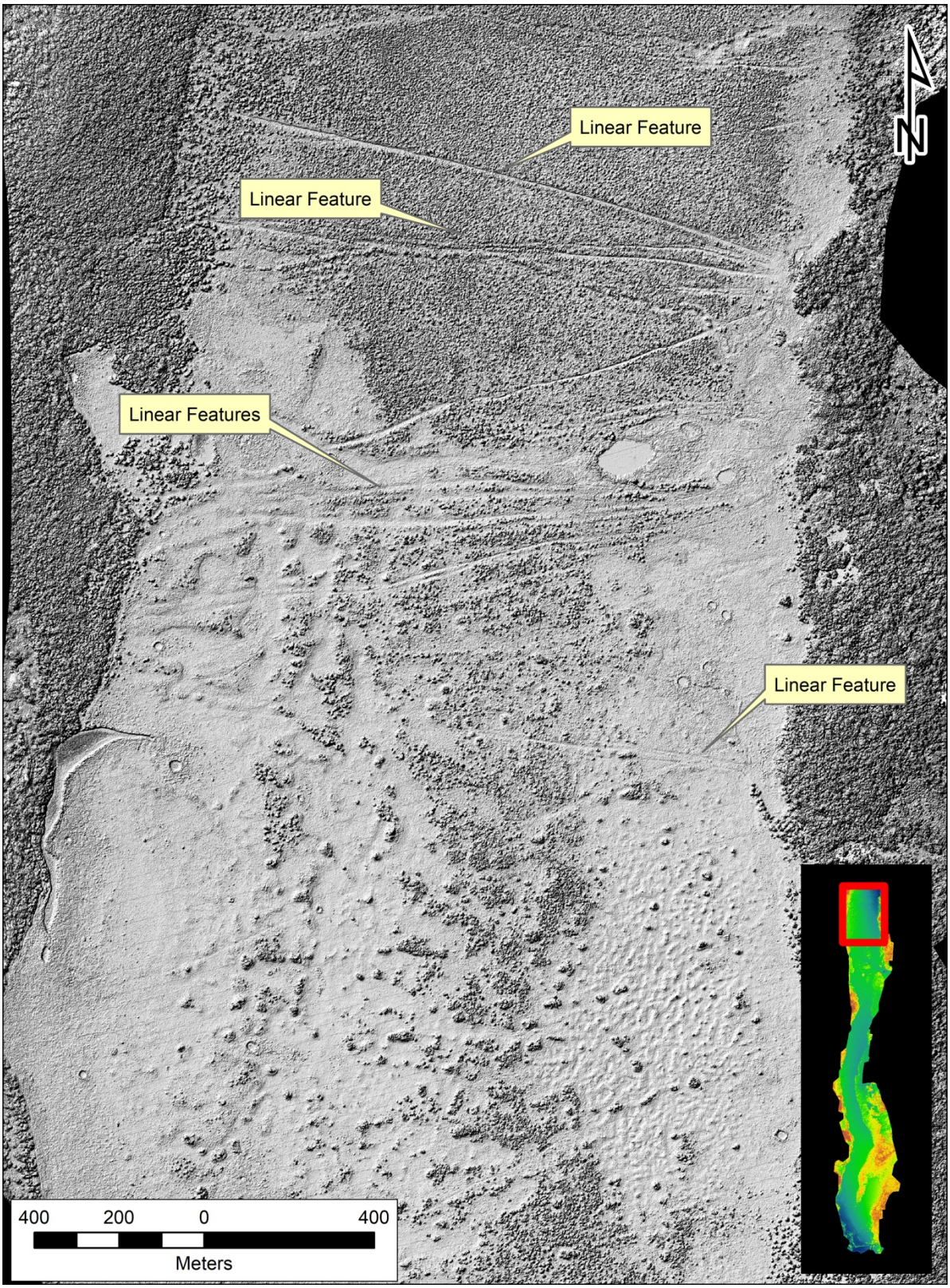

Figure 6.6 Detailed elevation model of the northern portion of the lagoon with linear features noted (map produced by M. Willis).

Conclusions

The aerial mapping and photogrammetry work at Western Lagoon was successful in recording high resolution elevational data across most of the landform. These data provide an insight into the locations and shapes of the anomalies that criss-cross the entire extent of the wetland. With additional ground truthing, excavation, and survey it may be possible to determine if these features are archaeological in nature and if so, the dates of their construction. The DEM and other mapping data created for this area is an important first-step and should help facilitate this research in the future.

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Section II

Site Investigations

Chapter 7

Further Investigations of Structure 10 at Saturday Creek (Operations 24 and 29)

Adam Kaeding and Eleanor Harrison-Buck

Introduction

During the January 2016 field season, the BREA team expanded their investigation into a complex of structures located in the Southwest Plaza of Saturday Creek, just west of the site's southern pyramid (**Figure 7.1**). Unlike the surrounding Late Classic monumental architecture, the Southwest Plaza appears to date to the Postclassic and the size and scale of the structures are much more diminutive by comparison. Previous investigations of Operation 23 in the Southwest Plaza during the 2014 summer field season focused on Structure 11, a small radial pyramid, and exposed the southeast corner of Structure 10. Here, BREA revealed a corner cache (Special Deposit 13) that included an anomalous crystal artifact (Harrison-Buck and Flanagan 2015). One of the primary research objectives of the BREA project has been to recover data from the early Spanish colonial presence in the river valley. Given the nature of this artifact and its specific context, this crystal object was the best evidence of that time period the BREA project had yet encountered. Accordingly, the team returned to the same plaza in January of 2015 and expanded our excavations (Operation 24) around the eastern end of Structure 10, this time employing methodology specifically designed to maximize the potential to recover early colonial data from the immediate area (Kaeding and Harrison-Buck 2015). The team was successful in its goal. Initial efforts improved the team's understanding of the late Postclassic/early historic style Maya architecture and its rather rudimentary construction. Our more focused attention on the very latest phase of architecture led to the early identification and cautious excavation of another cache, Special Deposit 14, located in the northeast corner of Structure 10. Special Deposit 14 again including a crystal artifact (see Kaeding and Harrison-Buck 2015 for more detailed discussion of Operation 24 and the early colonial presence and potential significance of these crystal artifacts).

Objectives

Building upon the prior successes of our excavations in Operations 23 and 24 at Saturday Creek, the BREA team expanded our investigations and placed Operation 29 on the far western end of Structure 10. The following objectives guided our excavations in January 2016:

1. To further expand our understanding of the Early Colonial Period at Saturday Creek, Operation 29 targeted a distinctive cobble and boulder construction visible on the surface on the western side of Structure 10 that was found associated with the Early Colonial period caches on the eastern side.
2. To expose additional corner caches on the west side of Structure 10 that may date to the Early Colonial Period.
3. To clarify the time depth and construction sequence of Structure 10 in the Southwest Plaza.

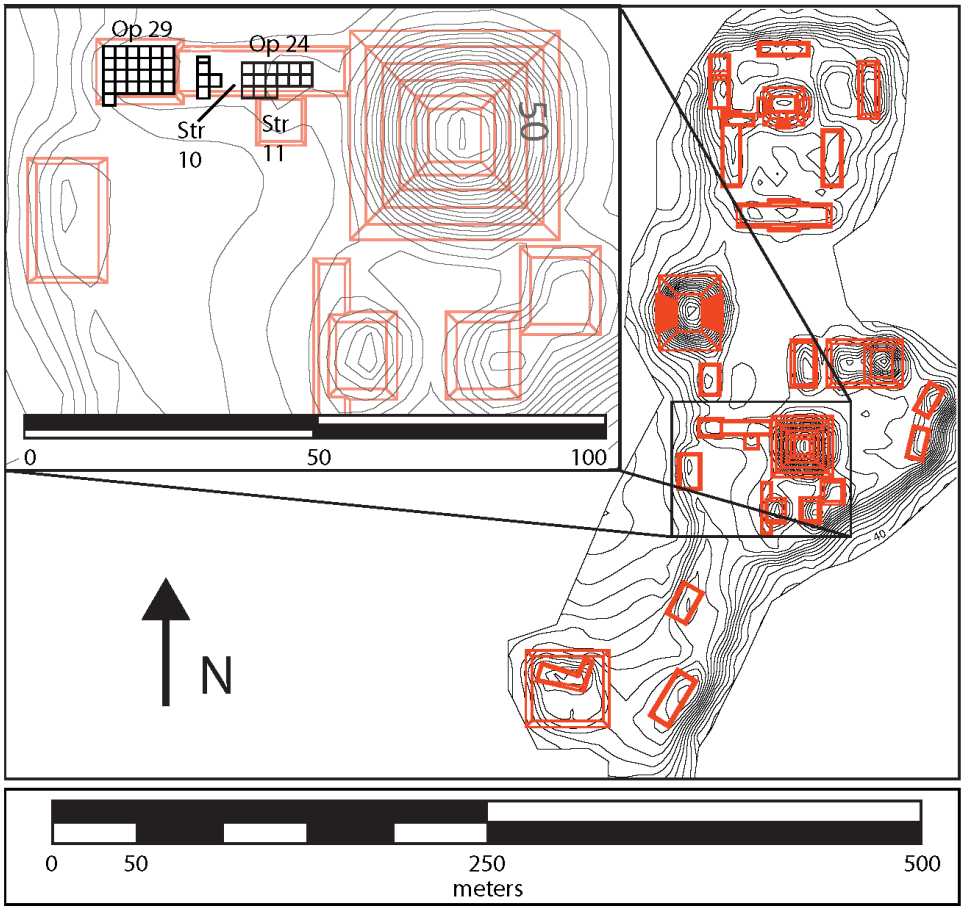

Figure 7.1 Saturday Creek Plaza Map with Op 24 and Op 29

Operation and Unit Placement Rationale

The discovery of Special Deposit 13 in Operation (Op.) 23 was not the result of an excavation strategy specifically designed to recover early colonial data (Harrison-Buck and Flanagan 2015; Kaeding and Harrison-Buck 2015). Instead, the unexpected recovery of the initial crystal artifact – a bottle stopper – occurred as a component of Op. 23, which was designed to investigate a Late Postclassic radial shrine structure. When returning in 2015 and

2016, however, the research objectives and methodology were specifically designed to recover data from this Early Colonial Period occupation. This shift in research directive primarily meant a shift in the specific locations targeted for excavation. Excavation location, as always, is guided by research questions. Generally speaking, however, excavation in a Maya plaza in the shadow of a tall Maya pyramid might target intact floors, structures with recognizable form and inferable function, or identifiable elements such as staircases or wall braces. In our effort to expand our understanding of the rather ephemeral Early Colonial signature in this location, we were not able to rely on such architectural cues. In this way, our methodology had to be altered to embrace more of an exploratory and survey mentality than might generally be the case in this archaeological setting.

Expanding on the discovery of Special Deposit 13 was the primary factor in the placement of Op. 24 in 2015. The cache containing the crystal bottle stopper was identified near the northeastern corner of Op. 23 which barely clipped the edge of a low east-west linear platform identified as Structure 10, which contains low walls on the far eastern end representative of a superstructure. A detailed understanding of the construction sequence that defined Structure 10 and contextualized Special Deposits 13 and 14 would only evolve during the course of further excavation. The combination of the 2014 data and a sufficiently large initial excavation grid across the eastern end of Structure 10 made Op. 24 a successful investigation of the Early Colonial Period occupation. Courtesy of that effort, the BREA team was armed with more information as they selected the location for the next effort with Op. 29 in January 2016. The additional insights gained from Op. 24 that guided the placement of Op. 29 came primarily in two forms: (1) the layout and relationships of structures within the Southwest Plaza and the caches within the eastern superstructure of Structure 10; and (2) the non-standard architectural and construction features, namely large cobble and boulder limestones associated with the Early Colonial caches on the eastern end of Structure 10 that were also visible on the surface on the far western end of the structure.

BREA excavations generally reflect a strategy that employs wider and deeper exposures in order to better understand the interplay between sites and between architectural features within sites, and to better understand the chronological development of sites. In that regard, the primary operation described in this chapter (Op. 29) with its deliberate intention to target corner cache deposits does not align with standard BREA practices. In this case, however, the deviation from standard practice was guided by previous archaeological results and the specific research questions directing the methods of excavation. The placement of excavation units for Op. 24 introduced above was guided by a different understanding of where Early Colonial evidence would be found. Based on the results of investigations carried out at sites within the Xibun River watershed, it was expected that the locations where the base of structures met the plaza floor would provide the highest potential for such data (Morandi 2010). Excavation of Op. 24 was initiated accordingly, but no such evidence was located. Having found no evidence of the Early Colonial Period at the interface of plaza floor and Structure 10, excavation was extended over the lower portions of the structure and, eventually, after gaining a better understanding of the

architectural sequence, identified the Special Deposit 14 corner cache. Without repeating all of the details that can be found elsewhere (Kaeding and Harrison-Buck 2015), this process suggests two conclusions that were crucial in guiding the corner-targeting strategy of Op. 29: (1) the plaza did host Early Colonial activity with a distinct archaeological signature, and (2) perhaps more importantly, none of this activity was represented in what might be considered more mundane deposits such as general refuse, middens, or sweep-zones on the plaza floor. In other words, based on all evidence available, it appeared that Early Colonial activity in this area was restricted to the caching events. It stands to reason, then, that the Early Colonial occupation consisted of visitation rather than consistent occupation of the Southwest Plaza and that the search for early colonial evidence would be best served by identifying additional caches.

Layout of Southwest Plaza

Prior to any BREA excavation within the site of Saturday Creek (as is the practice for all BREA sites) the survey and mapping team mobilized with GPS units and total stations to create a detailed topographical map of the area. **Figure 7.1** shows the rectified topographical map of the Southwest Plaza with the locations of Ops. 23, 24, and 29. The superstructures on the far eastern and western ends of the Structure 10 platform are visible in the topographic map. As mentioned above, extensive investigation of Structure 11 and the Southwest Plaza area yielded no early colonial evidence (Harrison-Buck and Flanagan 2015). Rather, the archaeological signature relating to that time period could reasonably be associated exclusively with Structure 10.

The Early Colonial cache deposits were located at the northeastern and southeastern corners of the eastern superstructure of Structure 10. The prevailing interpretation of the crystal artifacts and their contexts suggests that these deposits were created early in the process of cultural contact between the local Maya communities and recently arrived, transient Spaniards (Kaeding and Harrison-Buck 2015). The objects themselves are understood to have been brought in by the Spaniards and then acquired by Maya individuals during some nature of Contact period encounters. The objects were then broken and interred at the Saturday Creek site in a ritual act characteristic of the Maya. In accordance with this theory, it stands to reason that the principles that guided such ritual activities prior to the arrival of the Europeans may also have guided the events that included both Maya and Spanish artifacts in Special Deposits 13 and 14. Courtesy of archaeological research elsewhere in the Maya area, we understand that symmetry and complementarity are among the principles that might be factors influencing caching activities. With that in mind, excavation of Op 24 specifically targeted the western corners of the poorly constructed superstructure atop the eastern end of Structure 10.

Expanding upon those concepts of symmetry and complementarity from the scale of the eastern superstructure of Structure 10 itself to the wider plaza offers a second interpretation. The eastern superstructure of Structure 10 marks the northeast corner of the plaza. At its highest point the eastern superstructure rises only slightly above the basal platform of Structure 10 that runs west across the entire north side of the plaza. Marking the northwest corner of the plaza,

Structure 10 features another, western superstructure. The western superstructure is considerably higher than its eastern counterpart, raised roughly 50 cm above the Structure 10 platform at its highest point. As this complex collectively establishes the northern boundary of the plaza, the platform and its superstructures are all referred to as components of Structure 10. While an argument could be made that the eastern and western superstructures are different enough to be analyzed independently, they are undeniably linked; at least physically if not also conceptually. Adjusting the analytical view from the eastern superstructure alone to the scale of the entire Structure 10 complex then, the predicted location for any symmetrical or complementary caches would not, in fact, be on the western side of the eastern superstructure, but on the western side of the western superstructure. This assessment was one of the theories that helped guide the placement of Op 29.

Architectural Affinities

Other characteristics defining the contexts for Special Deposits 13 and 14 also helped identify the far western end of Structure 10 as the appropriate place to test for additional Early Colonial Period data. These additional characteristics were unusual elements of construction. While almost every site and excavation context will present certain quirks and idiosyncrasies that will challenge the preconceptions and expectations of even experienced excavators, the construction matrix of Structure 10 was essentially defined by such anomalies. The uppermost register, presumably the latest episode of construction, was characterized by poorly arranged stone alignments, poorly faced wall stones, a thick cobble matrix apparently constituting surfaces as well as construction fill, and large, boulder-like stones. The underlying walls of the structure largely conformed with more standard and predictable construction techniques, which lead to an initial assumption that the poor construction may have been a result of preservation circumstances and exposure. The excavation of Op 24, however, provided evidence suggesting otherwise. Specifically, an expansive layer of shattered but mendable ceramics and a clear indication of the intrusive pit in which Special Deposit 14 was placed suggest that this poor construction layer was the backdrop for the caching activity in question (Kaeding and Harrison-Buck 2015).

Across the plaza on the far western end of Structure 10, one of the first features of note is a linear arrangement of large boulders running east to west demarcating the northern side of the superstructure. While these large boulders do not conform to any other construction materials in the plaza, they do bear a considerable affinity to the boulders at the northeast corner of the Structure 10 eastern superstructure. Very little in the way of intact stone alignments other than the boulders were apparent on the surface prior to excavation. While this certainly could be the result of any number of factors, it also aligns well with the lack of high quality walls at the uppermost layers of construction as was seen on the eastern superstructure. Finally, as would become even more evident as excavation got underway, the surface of the structure was composed of a dense cobble matrix. Both the boulder construction and cobble surface that are

characteristic of the final phase of the eastern superstructure are also found on the western superstructure of Structure 10. Along with the plaza arrangement, this assessment helped to guide the placement of Op 29.

While excavating Op 29, it became evident that a better understanding of the slightly lower platform supporting the eastern and western superstructures of Structure 10 might be useful to best contextualize the data recovered from either side. In order to explore this basal platform, a series of excavation units was laid out running north to south over the entire width of the platform. Because of their location within the area covered by the original grid laid out for Op 24 in 2015, these additional units were numbered in sequence as a continuation of that 2015 operation. The specific location for this extension of Op. 24 exploring the lower platform was guided by a stone that suggested the possibility of a small staircase, though this turned out to be a misinterpretation (see Op. 24 discussion below).

The following section presents summary of the excavations for Op. 29 and the 2016 extension of Op. 24. As mentioned above, the overarching mentality guiding excavation was one of survey and exploration – a necessity called for by the poor construction and preservation of these structures and the poorly understood nature of these Early Colonial Period signatures. Accordingly, the excavation approach was intentionally fluid; changing quickly along with our understanding of the contexts in question. As a result, a sequentially accurate narrative account of the specific details of excavation would necessarily be disjointed and non-linear. The section below, therefore, is written as a summary that best presents our overall understanding of the construction sequence of the structure, the context of what seems to be the most significant data recovered, and the methods by which we obtained those results. More fine grained understanding of much of the data recovered awaits further analysis of the artifacts and samples recovered. As that analysis is completed, it may affect the sequencing presented here.

Operation 29

As detailed above, the placement of Op. 29 was guided by a number of factors to target the areas identified as most likely to yield additional evidence from the Early Colonial Spanish Contact Period. Accordingly, the initial excavation grid was laid out in a fashion that allowed us to target all potential structure corners as could best be determined based on surface features. Because of the size of the western superstructure of Structure 10 and the state of preservation and visibility at the surface, this meant the initial layout of a 10 meter (m) by 8 m grid comprising twenty 2 x 2 m squares (A-T). As is customary BREA project practice, the grid squares were lettered starting with "A" in the northwest corner and ran through to Square T ultimately in the southeast as depicted in **Figure 7.2**. Like Op. 24, circumstances likely related to poor construction and preservation created difficulties in convincingly identifying walls and corners. In fact, the Op. 29 area was characterized by even worse preservation than Op. 24 as it had recently been subjected to more intensive banana and cocoyam plantings; some of which were

still extant during excavation. This called for an expansion of the grid by 2 m to the west and an additional 10 m to the south. This added squares U through Y also displayed on **Figure 7.2**.

The intentional result was a considerably larger grid than we could reasonably excavate in the time available or should reasonably need to excavate in order to meet our research objectives. This approach provided maximum flexibility to follow features as they were observed and, thereby, provided us our best chance to recover evidence of architecture and associated cache deposits similar to Ops. 23 and 24. Accordingly, 10 of the total twenty-five 2 x 2 m squares were never excavated. All other squares were excavated at least from the overburden, but the levels at which the excavation of these squares were terminated varied depending on archaeological observations and our evolving research strategies. The narrative of this process is presented below. This narrative attempts to simplify the archaeological sequences by focusing on zones and zone groupings while intentionally minimizing the discussion of squares where possible.

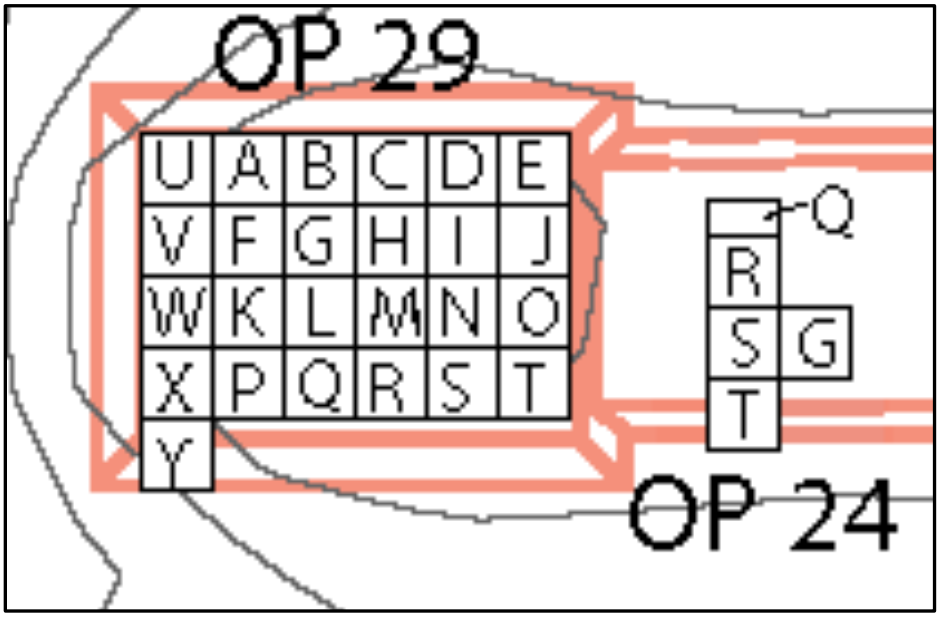

Figure 7.2 Saturday Creek Op. 29 and Op. 24 Excavation Grids.

Zone 1

Zone 1 is the general overburden covering Structure 10. It was primarily composed of a soil matrix characterized by a 7.5YR 3/2 clay to silty clay. It also contained a great deal of leaves, evidence of recent burning, remnants of fairly recent barbed wire fence and now removed fence posts, some river cobbles, and a light artifact density. Excavation of Zone 1 generally revealed a layer of dense cobbles. The thickness of the zone was uneven across the mound but averaged 10.51 cm.

Zone 4

Zone 4 was an alignment of boulders disjointed and unevenly spaced, but running distinctly east to west on the northern edge of the Structure 10 western superstructure. The boulders themselves range in size from roughly 20-70 centimeter (cm) diameter along their longest axes, but all were considerably larger and more irregularly shaped than the stones we see as construction materials in the other structures of the plaza. Especially given the architectural affinity between this Zone 4 line of boulders and the materials defining the latest phase of construction in Op. 24, this was the zone that primarily guided our excavation strategy. Excavation was initiated with the removal of Zone 1 surrounding the Zone 4 boulders in Squares A, B, and E, which seemed the most likely locations in which to identify corners. Again, based on Op. 24 results, it was expected that removal of the Zone 1 over burden would quickly reach a layer of dense cobble fill, invasive intrusions into which would be the most likely early indication of corner caches.

Zones 2 and 3

As expected, removal of the Zone 1 overburden did reach a layer of dense cobbles. Zone 2 was the cobble layer north of the Zone 4 boulders, and Zone 3 was the cobble layer south of the same. These were initially interpreted as exterior (Zone 2) and interior (Zone 3), with the Zone 4 boulders considered to signal a wall as they had in Op. 24. The soil matrix for both Zones 2 and 3 were dominated by 7.5 YR 3/2 silty clay with some areas of 7.5 YR 4.2 silty clay. Generally the artifact recovery from these zones was light to medium throughout the operation.

Zone 5

Based on the expectations established by Op. 24, the cobble layers of Zones 2 and 3 (especially Zone 3 as the presumed interior) should be interrupted by voids in the density of the cobbles. Such voids would signal intrusive pits and should be identifiable in or near the structure corners. Within the expected northeast corner of the structure located in Square E, exactly such a void in the cobbles was identified. This was immediately designated Zone 5 and was documented and excavated as a pit feature presumably containing a cache deposit. The Zone 5 pit extended about 34 cm deep and was characterized by 10YR 3/2 silty clay fill. The fill contained a light density of debitage, but no artifacts of particular note and certainly no evidence of a preserved cache deposit. Though the expected cache was not encountered, there is little doubt that this zone represented an intentional intrusion into the construction fill of the structure, rather than natural tree disturbance. While it may represent some sort of perishable cache, it seems more likely it is the remains of a pulled fence post or more recent disturbance.

Zone 10

On the western side of the western superstructure in Square A, a similar void in the cobbles was initially interpreted as a potential pit. This feature was strictly noted by the absence of cobbles and so the fill was identical in color to the 7.5 YR 3/2 silty clay of the zone into which it presumably intruded. After about 10 cm, the looser alluvial soils reached a more compact layer of the same colored soil distinguished by white flecks. Excavation of Zone 10 was terminated at this point having yielded almost no artifacts. If there were a cache in this void, the cached materials were perishable and no longer exist. Alternatively, this is a natural void in the cobbles caused by tree disturbance or the result of modern fence posts that once intruded into this area and have been observed elsewhere in this part of the site.

Zones 5 and 10 were the first of several voids observed within the cobble matrix or other fill material in similar locations upon the structure in what appeared to be potential corner areas (see **Figure 7.3**). We separated these zones with a similar archaeological approach, presuming them to be intrusive features potentially containing corner caches. They all yielded similar results—scant artifacts, and no clear evidence of a cache deposit. These features range in depth from about 10 to 30 cm. Their functions are not fully understood and may be best interpreted as possible pulled fence posts or tree disturbance. In the interest of minimizing this repeated narrative, **Table 7.1** presents all of these non-cache pit features along with their specific locations and characteristics.

Table 7.1 Zones Representing Non-Cache Pit Features

Zone	Square	Soil Matrix		Contents (Density: Artifact Classes)
		Color	Texture	
5	E	10YR 3/2	Silty Clay	light: ceramic and debitage
10	A	7.5 YR 3/2	Silty Clay	very light
12	T	7.5YR 2/2	Silty Clay	light: ceramic
13	T	7.5YR 2/2	Silty Clay	none
18	C	10YR 10/4	Silty Clay	light: ceramic
19	C	10YR 10/4	Silty Clay	light: ceramic and debitage

Though these intrusions did not yield the cache deposits that were the target of Op. 29, they did often reveal architectural features that aided in the understanding of the construction sequence of the western superstructure of Structure 10. To simplify the description, the construction sequence can be best understood as a central basal platform flanked at least on the north and south by lower extensions (terrace/wings), and abutting a lower platform that continues to the east. This interpretation of the construction sequence is discussed in greater detail below. For now, this understanding is critical only in order to understand the grouping by which the specific zones are presented. Rather than continuing in sequential order or attempting to

reconstruct the chronological order of their excavation, exposure, or identification, these zones are presented in terms of the retaining walls, construction fill, surfaces, and tumble associated with the central structure and the terrace/wings. Again, courtesy of the poor construction and/or preservation of Structure 10, zones were often identified, numbered, and documented as separate manifestations until it became clear later in the process that they represented single construction features. These are now being grouped back together descriptively, though the artifact recovery from each will be maintained as separate to allow for the scenario that ongoing laboratory analysis calls for another round of reassessment.

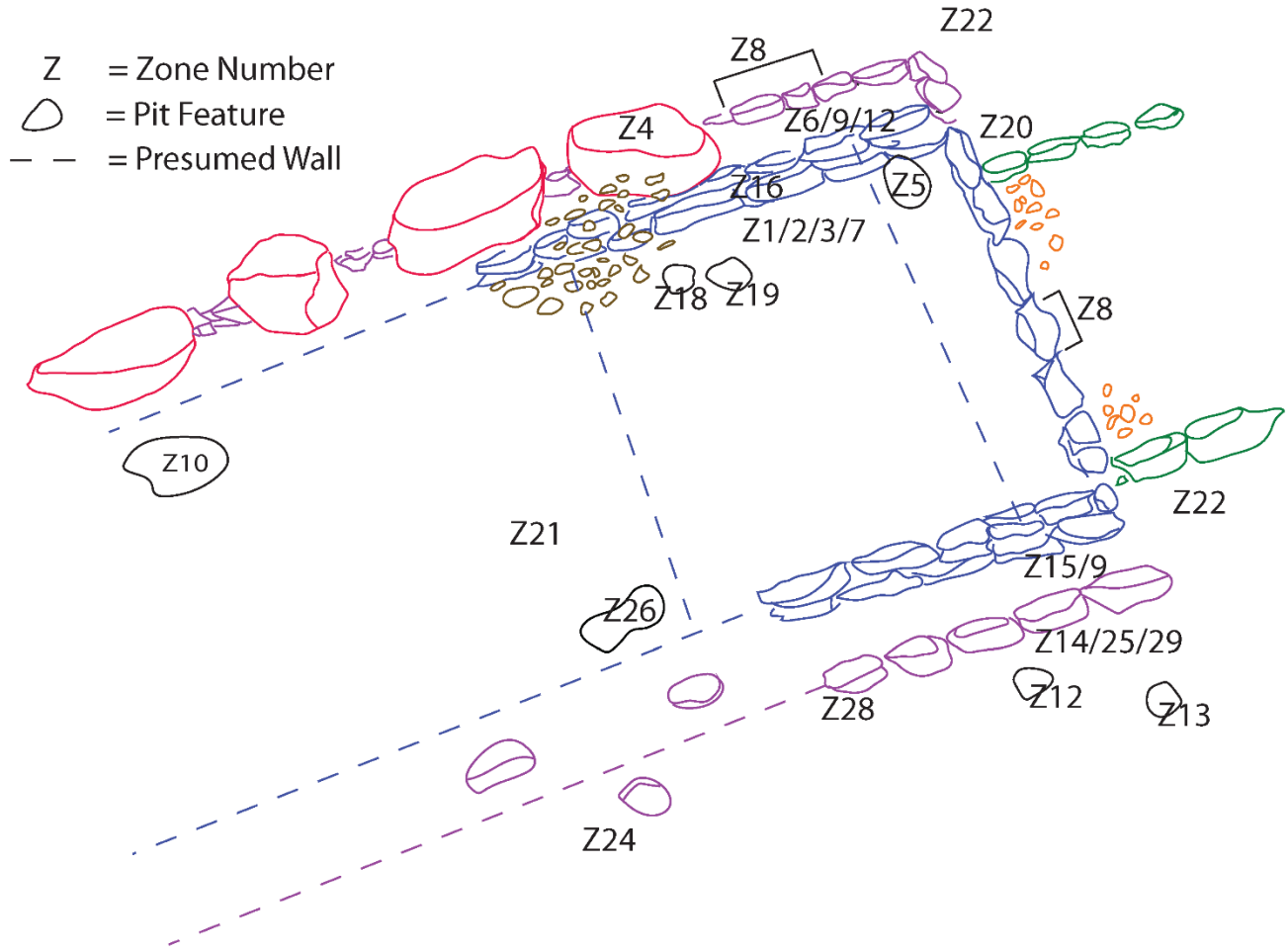

Figure 7.3 Idealized Rendering: Planview of western end of Structure 10 with general zone locations (drawing by A. Kaeding).

Zone 26

While none of the pit features described above contained any noteworthy archaeological materials, the Zone 26 pit feature in Square Q did yield a notable cache (**Figures 7.3** and **7.4**). Designated Zone 26, this feature was identified in Square Q during the final days of excavation.

Its context is difficult to discern but it does appear to be associated with the final phase of construction and therefore may, in fact, date to the Early Colonial Period. However, unlike the Special Deposits 13 and 14 in Ops. 23 and 24 on the far eastern end of Structure 10, the Zone 26 Special Deposit did not yield any obvious historic artifacts. Instead, the noteworthy finds included an intact bifacial spearpoint deposited with a heavily burned deposit of animal remains. The location of the deposit coupled with the heavily burned animal remains resembles the contents of Special Deposit #13 in Op. 23 which included heavily burned fauna, possibly marine shell (see Harrison-Buck and Flanagan 2015).

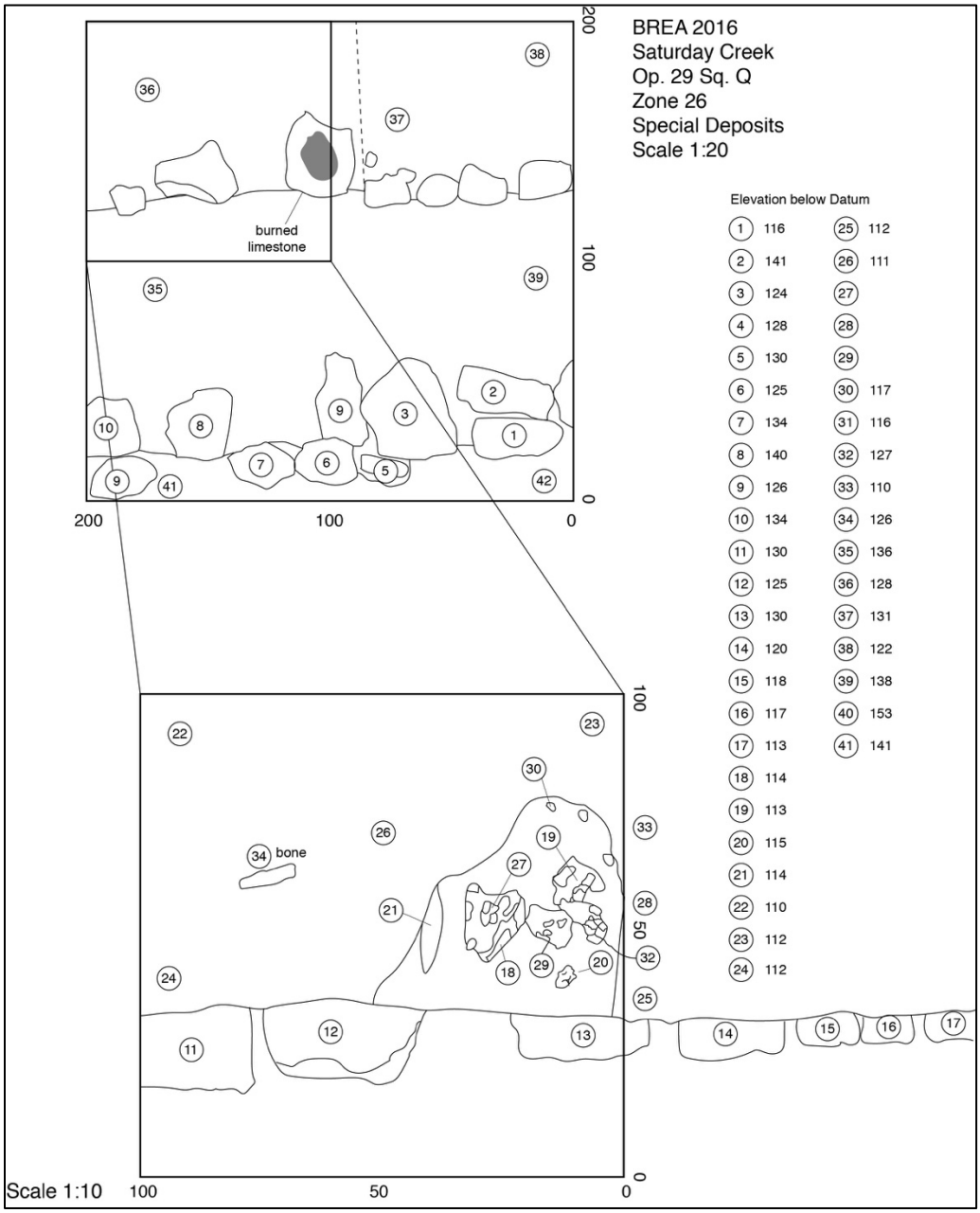

Figure 7.4 Zone 26 Cache deposit in Operation 29, Square Q.

Zone 9

Prior to addressing each of the remaining architectural components according to the zone designations, it is important to address Zone 9. This zone represents essentially the final zone of excavation prior to our exposure of the central platform structure, northern and southern terrace/wings, and the eastern platform extension. As a result, this zone was identified in many different locations across the structure and was later changed to better reflect the specific contexts identified. Fortunately, Zone 9 was only actually excavated from Square T where its contents can be reasonably associated with Zone 15 for analytical purposes as necessary (see below).

Table 7.2 Association/Mixed Context for Zone 9

Square	Zone	Description	Excavated
E	6/17	tumble above and construction fill of the northern terrace/wing retained by the Zone 8 wall	no
C & D	17	tumble above and construction fill of the northern terrace/wing retained by the Zone 8 wall	no
T	15/ 2	tumble above southern terrace/wing; interior and exterior	yes

Zones 16, 27, and 7

This zone complex comprises the primary structure of the western superstructure of Structure 10. As described throughout this chapter, the multiple zone numbers introduced here reflect the evolution of our understanding of the structure itself in different squares and at different times. In this case, following the excavation of Zones 2, 3, 5 and portions of 4, an underlying retaining wall was identified running north/south along the east side of Structure 10. This was identified at different times and in different squares throughout the structure and so was designated Zone 8 originally (see below). It was later discovered that this Zone 8 wall represented the outer terrace/wing on the northern side of the structure and the wall actually retaining the fill of the main structure was then designated Zone 16 (See **Figure 7.3** and **Figure 7.5**). Zone 16 appears to be at least three courses tall and was exposed along its north side through excavation into the northern terrace/wing. Zone 16 was exposed, but not removed or excavated. Especially on the eastern side of the structure, this feature was very poorly preserved and disturbed by bioturbation associated with the banana trees planted in that area. The Zone 4 line of boulders seems to have been placed on top of and in line with Zone 16, though this alignment was not perfect, of course, since the materials were so mismatched in shape and size.

Zone 27 is the southern complement to the Zone 16 northern wall of the primary Structure 10 western superstructure. This wall was also poorly preserved with portions missing where it was identified in the southeast corner of the structure (Squares Q and T). It also had fewer courses either initially or, at least, preserved. That said, it was identifiable as a wall in this corner and excavation further west in Square Q was able to re-identify the feature and confirm its continuation across the structure. This wall was exposed but not excavated.

The Zone 16 and 27 walls retained the construction fill making up the bulk of the primary central structure. This fill was designated as Zone 7 and was excavated in several locations across the structure in the effort to identify structure corners. Though it manifested slightly differently in different locations it was generally characterized by dark fill and cobbles underlain by the yellow clay construction fill presumably from an earlier construction phase. This zone had a light density of associated artifacts comprised of small sherds, non-pottery ceramic, and some debitage. Most of the excavation of Zone 7 was a means by which to further explore or better define wall features (Zones 16 and 7 are depicted in **Figures 7.3** and **7.5** below).

Figure 7.5 Final Plan View of Op 29, Squares C and D and a half of Sq. E to the east.

Zones 8 and 17 (9)

As mentioned above, the first wall assigned a zone number was a north-south alignment of stones on the eastern end of the western superstructure of Structure 10. This was first identified and better understood in profile during the excavation of the Zone 5 pit feature. Initially, this wall was understood to be the retaining wall for the overall structure itself, but was later discovered to retain fill that was lower and external to the main central structure. This has been interpreted as a terrace /wing feature; essentially a step down off of the northern side of the primary structure. The collapse/tumble material on top of the terrace/wing feature was removed as Zone 6 to the level of the top course of the Zone 8 retaining wall (discussed below). The surface and fill of the terrace/wing was ultimately designated Zone 17, was excavated in the northeast corner of the structure, and was characterized by 10YR 3/2 silty clay soil and a light concentration of artifacts – mainly small ceramic sherds. Like the other zones in this portion of Op. 29, Zone 17 showed considerable disturbance from the banana trees growing here. **Figure 7.5** shows the features of the northern terrace/wing and how they coordinate the features of the primary structure in Squares C and D. Zone 17 was briefly identified as Zone 9 until the nature of the retaining walls was better understood. No excavation of Zone 9 took place in this portion of the site until that better understanding was achieved and the zone numbers were reassigned.

Zones 28 and 15 (9 and 2)

The northern terrace/wing comprised of Zones 8 and 17 has a southern complement. Like the southern features of the primary structure, this terrace/wing was also more difficult to identify either because it was initially a less substantial feature or due to any number of potential taphonomic processes effecting preservation. The southern terrace/wing's southern wall was designated Zone 28. It was first identified in the southeast corner of Structure 10 and later re-identified and confirmed with continued excavation in Square Q. The Zone 28 wall was exposed, defined, and documented at several locations in Op 29, but it was not excavated. The fill retained by the Zone 28 wall was ultimately identified as Zone 15. Zone 15 was excavated in Square T and was characterized by a 7.5 YR 3/2 silty clay matrix surrounding dense cobble fill. This fill was initially identified as Zone 2 and later switched to Zone 9. Because the southern wall was particularly poorly preserved, excavation continued in what would have otherwise been distinguished as interior and exterior contexts. As a result there was some mixture of content between all three of these contexts (Zone 2, 9, 15) into recovery from Zones 2 and 9. The majority of the material recovered was recovered from the interior deposit so the association with Zone 15 (especially among the Zone 9 recovery) is reasonable if necessary for further understanding of these contexts. Artifact recovery was light density and mainly consisted of small ceramic artifacts and some animal bone.

Zones 6, 11, and 24

As is often the case, the state of preservation of the western superstructure of Structure 10 left it initially appearing mounded rather than showing any particularly distinct indication of a central structure with north and south lower terrace/wings. This, of course, is a result of the process by which higher levels collapsed, tumbled, and settled over time onto the lower areas. Because the fill material of the lower terrace/wings and at least the most recent episode of construction of the central structure were identical, it was difficult to distinguish where some of the latter may have collapsed and came to rest on the former. In order to maintain control of these separate contexts, the material on top of the lower terrace/wings and "inside" the lower terrace/wing walls but "outside" of the retaining walls of the central superstructure was excavated separately from the tumble until reaching the top of the highest course of the outside walls of the lower terrace/wings. Zones 6, 11 and 24 represent this tumble material; Zone 6 was segregated and recovered from the northeast corner of the structure (Square E), Zone 11 from the southeast (Square T), and Zone 24 from further west along the southern wall (Square Q). The soil matrix surrounding the tumble material for both of these zones was generally a 10YR 3/1 silty clay and none yielded many artifacts. The little material that was recovered was primarily ceramic sherds. The zones comprising tumble ranged from 5 to 15 cm in depth.

Zones 14, 20, 21, 22, and 25 (surfaces)

Excavation through the contexts described above either by intention or as a result of continued exploration of wall features encountered convincing, intentional surfaces in several locations. In each of these locations the surfaces appeared at slightly different times or elevations, or manifested different characteristics and so were assigned different zone numbers. Generally speaking, all of the surfaces were identified by their level of compaction relative to the overlying matrix appearing across a relatively even plane and usually characterized by white flecks of marl, smears, or limestone pebbles embedded in the packed clay soils. Two of these surface zones – Zones 20 and 22 – were identified on either the north or south sides of the platform connecting Ops. 29 and 24; both observed east of the western superstructure of Structure 10. Based on their interfaces with other zones, it appears that this is the surface upon which the Structure 10 was built. Having not removed or excavated beyond the deepest courses of the Structure 10 walls in most areas (as our research objectives did not warrant deeper soundings), earlier underlying construction phases remain generally unknown in Op. 29. The sole exception is discussed below in reference to Zone 29.

Zone 21 was a possible surface identified near the center of the western superstructure (Squares L and M). Given the differences in elevation and architectural context, Zone 21 certainly does not represent any sort of contiguity with Zones 20 and 22, regardless of their similarities in appearance and characteristics. It is possible however, that all of these zones do

represent similar surface preparation methods and construction materials and were possibly constructed around the same time.

Zone 14 is the terminal debris overlying Zone 25, which appears to be another possible surface. This zone was recognized after removing the tumble of Zone 11 that extended south of the southernmost retaining wall (Zone 28) of Structure 10. The collapsed stones above Zone 14 seemed to lift from roughly the same resting elevation and at that level a rather dense deposit of flat lying sherds, patches of plaster, and other artifacts were revealed within a general matrix of 10YR 4/2 clay soils. The objects were carefully documented, photographed, and removed as part of Zone 14 and appear to represent terminal debris dating the use of the surface. The surface underlying Zone 14 was identified as Zone 25, which matches in description to Zones 20, 21, and 22.

Zone 23

A slightly lower, narrower platform connects the western superstructure of Structure 10 with the eastern superstructure. A portion of this lower, narrower platform was exposed in the initial Op. 24 excavations in 2015 (Kaeding and Harrison-Buck 2016). This platform was investigated further during the 2016 season as an extension of Op. 24 and is described separately below, however a small portion of the platform also was exposed in the eastern edge of Op. 29. Where the platform was encountered in Op. 29, its upper cobble fill/surface was designated Zone 23. While this surface/fill was probed in Square E in order to better understand the easternmost north-south retaining wall of Structure 10, no cultural materials were collected.

Zone 29

The objective of Op. 29 was to locate and investigate any additional archaeological signatures dating to the Early Colonial Period. As such, it was not necessary to incorporate any concerted effort to reach particular deep elevations or particularly early phases of construction. However, in the interest of tying the Op. 29 data into the general chronological sequence of the site, one area was selected for a targeted deeper sounding. In Square T southeast of the southeast corner of Structure 10, excavation was continued through the plaza surface (Zone 25) and down into the underlying construction fill. This underlying fill was designated Zone 29. The fill is characterized by a grayish brown matrix with some limestone inclusions.

Results

In summary, Op. 29 revealed a construction sequence for the western superstructure of Structure 10 and yielded a single cache deposit (Zone 26) that may coordinate with the Early Colonial Period cache deposits identified in Ops. 23 and 24. The construction sequence is represented in the idealized renderings of **Figures 7.3** and **7.6** as well as **Figure 7.7** which is a

diagram of how the excavated zones coordinate. While this diagram is presented in the fashion of a Harris matrix, it does not conform directly to the specifics of that system. In general, the diagram shows the sequence of the archaeological features with the lower registers representing archaeological components that were created earlier than those above them. The zones are grouped and coded according to the narrative description above.

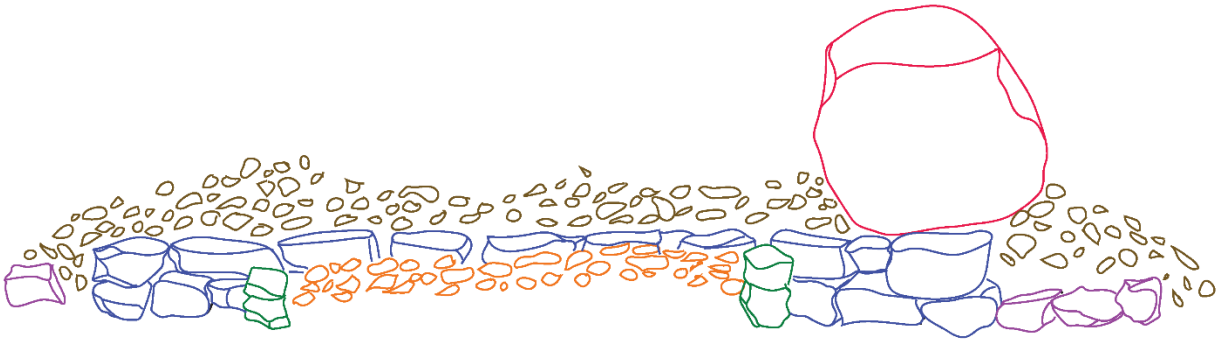

Figure 7.6 Idealized Rendering: Structure 10 West End Profile

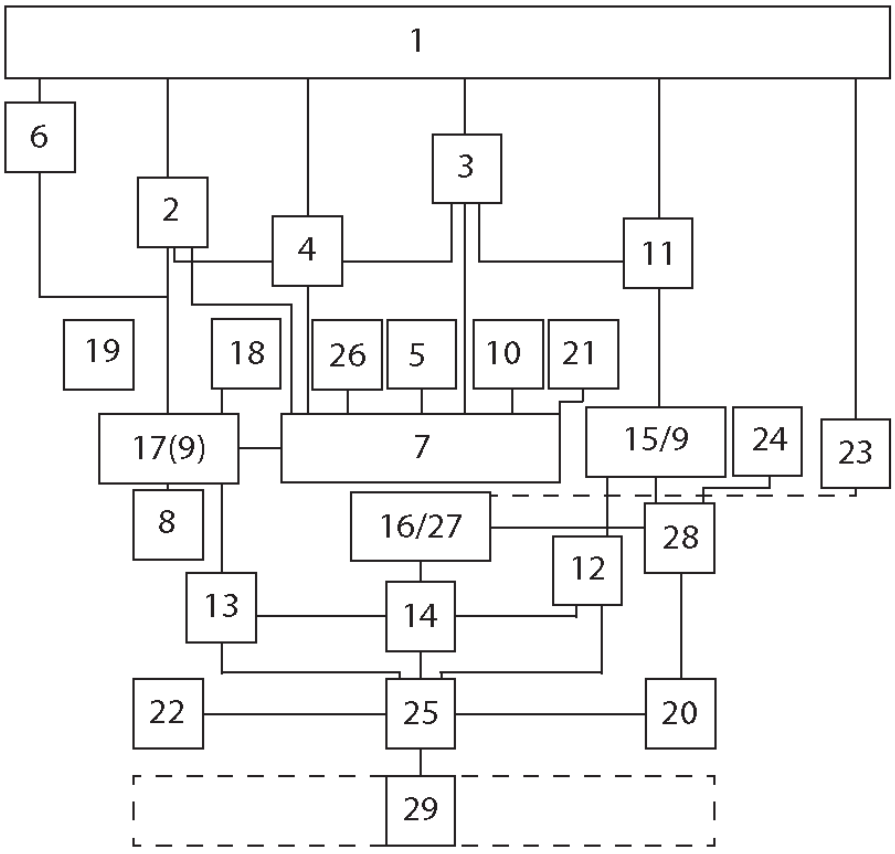

Figure 7.7 Operation 29 Harris Matrix Style Representation.

Operation 24 Extension

Op. 24 was initiated in 2015 to further explore the Early Colonial Period signature within the Southwest Plaza (Kaeding and Harrison-Buck 2015). In 2016, a small component of the Op. 24 excavations continued at Saturday Creek, targeting the low platform connecting the eastern and western superstructures of Structure 10 to better understand the relationships between all of these architectural components. Because the placement of the excavation units targeting the lower platform put them within the original excavation grid of Op. 24, these explorations were documented as an extension of that earlier operation. Four 2 x 2 m units and one 1 x 2 m extension were laid out to allow for flexibility as the excavation evolved. These squares continued the numbering sequence according to the grid established in 2015. While the topzone was removed from all units in order to better assess the architectural features, further excavation was conducted only in Squares G and T. The zones encountered in this continuation of Op. 24 are presented below.

Zone 1

The topsoil and dense leaf litter was removed as Zone 1 throughout most of the squares laid out as the extension of Op. 24, including Squares G, Q, R, and T. This Zone 1 is the same context as Zone 1 from the previous year's initiation of Op. 24. It is also the same context as the Zone 1 in Op. 29.

Zones 2-17

As this was a continuation of Op. 24 initiated in the previous year, and in the interest of avoiding the unintentional mixture of content from distinct contexts, new zones were assigned during 2016 even though they likely represent the same archaeological/architectural elements as features identified and designated as lower zone numbers during the 2015 excavations (see Kaeding and Harrison-Buck 2015). Each time the coordination between 2016 and 2015 zone numbers is clear, it is noted within the description of each zone below. In the transition from 2015 to 2016, one number was skipped in the consecutive zone numbering sequence; therefore, Zone 17 was not assigned.

Zone 18

The removal of Zone 1 revealed, as expected, a dense layer of cobble fill. This coordinates directly with construction sequence observed in earlier Op. 24 excavations in the eastern superstructure of Structure 10 as well as the sequence expected and observed in the concurrent Op. 29 investigations of the western superstructure. As this was the top layer of cobbles underneath the Zone 1 topsoil, it was identified as a surface with the underlying

construction fill identified as a separate zone. The distinction is somewhat arbitrary however, as the construction fill was largely indistinguishable from its highest manifestation here identified as the Zone 18 surface. This zone coordinates with Zone 23 from Op. 29.

Zone 19

Removal of the Zone 1 topsoil revealed a darker circular stain within the Zone 18 cobble fill. The presence of a circular arrangement of cobbles surrounding the stain was interpreted as an indication that the feature was likely the result of a tree having grown here (and dislocated the stones as it expanded). This stain was designated Zone 19 and excavated separately. Its excavation allowed some additional insight into the construction sequence of the platform, but did not yield any further indication that it was an intentional, culturally relevant pit.

Zone 20

The fill of the platform itself was identified as Zone 20. It was defined by the same characteristics as Zone 18 that was identified as the surface only because it was on the top. Zone 20 was constituted by unevenly distributed cobbles among a mixture of 7.5YR 2/2 and 3/2 silty clay. This zone of construction fill is most likely the same architectural feature as that identified as Zone 9 in the 2015 Op. 24 excavation.

Results

Excavation of the Op. 24 extension into the platform connecting the eastern and western superstructures yielded some additional understanding of the construction sequence of the overall Structure 10 complex. Generally speaking, there were no real surprises within the Op. 24 extension, nor were there any particularly significant or diagnostic artifacts recovered. One particular stone visible on the surface was identified as an indication of a potential small staircase. Further exposure of this stone proved that this was not the case. Finally and perhaps most importantly, none of the excavation within this connecting platform has to date yielded any indication of multiple phases of construction. This might suggest that the connecting platform was a later manifestation predating potentially earlier underlying structures at the eastern and western superstructure. Considering that the research design for Ops. 24 and 29 drove an excavation strategy focused near surface deposits, limited effort was dedicated to deeper exposures to directly address the potential for earlier construction phases. Additional excavation and continued laboratory analysis could certainly call this interpretation into question.

Interpretations and Conclusions

The excavation of Op. 29 offered some insight into the nature of the western superstructure of Structure 10 as well as some further suggestions regarding the use/reuse/revitalization of this site during the Early Colonial Period. Continued analysis of recovered materials including potential radiocarbon samples may yet shed additional light; the section below provides some of the primary interpretations resulting from fieldwork.

Architectural Construction Sequence

The first goal of Op. 29 was to try to better understand the architectural construction sequence for the western superstructure of Structure 10. This was a means by which the corners and, therefore, the potentially corner caches would be identified. Guided by the objective of isolating corners, a full understanding of the specific construction sequence – specifically the nature of any earlier underlying structures – was not attained. That said, a better understanding of the later phases of construction has been achieved. The specific zone-by-zone details are presented above.

Figures 7.3 and **7.6** show an idealized rendering of the particular elements represented at this western end of Structure 10. This is not a technical drawing reflecting the structure's exact manifestation during excavation but an amalgam of those observations distilled to a more easily understandable model. As mentioned frequently throughout this chapter, the state of preservation and relatively poor construction of the latest phase of the structure mean that an exact representation of the characteristics modeled in **Figures 7.3** and **7.6** would be very difficult to discern.

Early Impressions of Artifacts

The general recovery of artifacts from excavation throughout Op. 29 was unremarkable. Outside of the ubiquitous lithic debitage and small ceramic sherds, there were only a handful of chipped stone tools, a limited collection of obsidian blades, and a relatively small sample of animal bone. As artifact analysis continues, these artifacts could help ground some basic chronology for the structure, but likely nothing suggesting a particularly long or nuanced sequence. The one exception to this general impression is the cache from Zone 26. The Zone 26 pit feature in Square Q yielded a notable cache (**Figures 7.3** and **7.4**). As noted above, the context of Zone 26 is difficult to discern. It appears to be associated with the final phase of construction and may mark the southwest corner of the western superstructure, but this remains speculative until . Although the cache in the western superstructure did not yield any obvious historic artifacts, but the intact bifacial spearpoint was associated with a heavily burned deposit of animal remains. The location of the deposit coupled with the heavily burned animal remains

resembles the contents of Special Deposit #13 in Op. 23 which included heavily burned fauna, possibly marine shell (see Harrison-Buck and Flanagan 2015).

Early Colonial Artifact Presence

The primary objective of Op. 29 was to try to identify additional evidence from the Early Colonial Period. Unfortunately, no diagnostic artifacts dating clearly and decisively to that period were recovered. Certainly, any of the non-diagnostic materials incorporated into the construction fill could have been deposited at that time – either as contemporary refuse or as redeposited materials moved during the Early Colonial Period from their primary contexts in the immediate area – but none are conclusively colonial. Again, as above, the Zone 26 cache presents the most likely potential exception.

The very existence of a cache on the western end of the western superstructure of Structure 10 in association with the architectural characteristics observed on the eastern end of the structure, suggests at least a potential association with those eastern caches. Because those eastern caches are convincingly if not definitively colonial, it is reasonable to assume that the western cache may be as well. However, the primary artifact from the Zone 26 cache – the spear point – is not necessarily exclusively diagnostic of the Early Colonial Period. As with the rest of the material recovered from Op. 29, there are no characteristics of this object or its context that suggest that it could *not* have been interred during this period, but there is also no definitive evidence that it *must have* been. The one remaining avenue that might shed additional light on this question is the other defining characteristic of the Zone 26 cache – the faunal remains, which were heavily burned similar to the other southeastern corner cache identified on the eastern end of Structure 10 in Op. 24. These burned faunal remains provide an option for radiometric dating that may ultimately help establish the timing of the event.

Articulation with Operation 24

Because of the lack of diagnostic artifacts described in the section above, much of the potential significance of the materials recovered during Op. 29 rely on the association of those materials with the Special Deposits from Op. 23 and Op. 24. This chapter has sufficiently described the relationship between these different areas of investigation within the Structure 10 complex and the architectural characteristics that they share. **Figure 7.8** is another idealized rendering of some of those architectural elements and how they likely coordinate, this time at the scale of the entire Structure 10. An earlier phase of Structure 10 (shown in green on Figure 7.8) exposed in our prior excavations of Op. 24 revealed that the original building may have consisted of a simple basal platform with may have , we The eastern portion of **Figure 7.8** is derived from the similar rendering presented in the report detailing the results of the initial Op. 24 excavations (Kaeding and Harrison-Buck 2015).

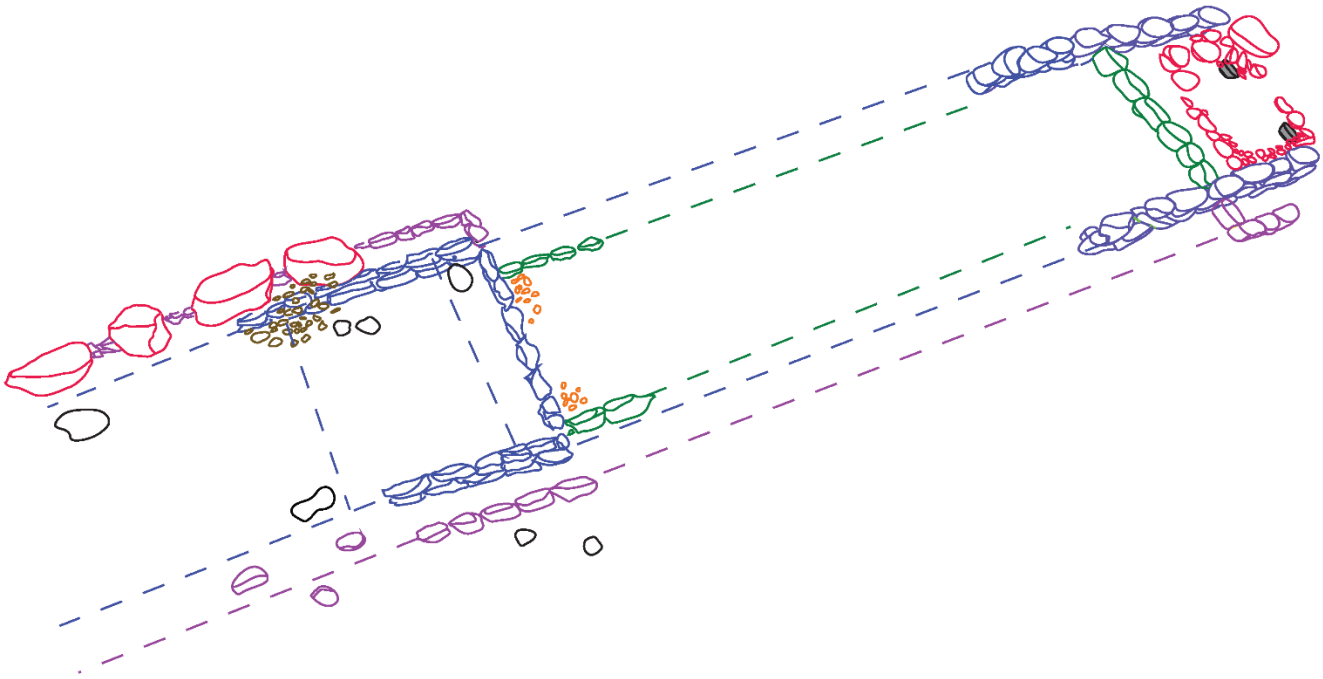

Figure 7.8 Idealized rendering of Structure 10 basal platform and its east (right) and west (left) superstructures (drawing by A. Kaeding).

As is the case with all of these renderings, this understanding of the construction sequence and the relationship between architectural elements may be proven inaccurate with further investigation (excavation or laboratory analysis). **Figure 7.8** does, however, represent our best current understanding. As such, **Figure 7.8** displays the potential relationship between the caches of the eastern superstructure and the Zone 26 cache in the western superstructure. Arguably the most problematic element concerns the lack of an obvious north-south wall to establish the corner for the Zone 26 cache. However, based on the size and orientation of the eastern superstructure in its final phase and the placement of the corner caches, we believe that Zone 26 may mark the southwest corner of the western superstructure. If this is the case, we might predict that the northwest corner of the superstructure exists in Square G, which was not fully excavated in 2016. If correct, another cache may exist in this location. Although the surface of the western superstructure was obscured by stands of banana trees, the proposed layout is supported by the location of the highest points of the mound, which was observed in Squares H, I, M and N.

The contents of the Zone 26 feature itself awaits further analysis and consideration. Its context, however, does suggest further confirmation of the pattern identified in Op. 23 and Op. 24. It is possible that evidence of the Early Colonial Period may be best identified in these types of ritual activities – corner caches with directional significance in otherwise underwhelming structures at larger precontact sites. It is at least equally possible that this is a very isolated practice unique to this particular site and location. The obvious recommendation then is that

researchers seek to identify similar settings as a component of future research and test similar locations. Should similar deposits be identified, their contents should be analyzed with consideration of their potential interpretation as early colonial caches in otherwise unoccupied sites.

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Chapter 8

Excavations of an Eastern Shrine at Chikin Chi'Ha (Operation 30)

Jessica H. Craig, Eleanor Harrison-Buck, and Astrid Runggalider

Introduction

Chikin Chi'Ha is a minor ceremonial center located roughly 2 km north of the Belize River along the west side of the Colorado Lagoon (Gantos 2015; Kaeding and Murata 2011). Chikin Chi'Ha is located on two adjacent hilltops and the intervening low-lying areas just west of Colorado Lagoon. The South Complex was the focus of investigation during the January and summer 2016 field seasons. This sizeable hilltop ceremonial center consists of several plaza groups containing pyramidal architecture and an eastern shrine group, which was the focus of excavations reported herein. During the January 2016 field season, the site was being mapped with a Total Station (see Murata, Norris, and Gantos, Chapter 3). During the January season, a test excavation (Operation 30) was carried out on the eastern structure at Chikin Chi'Ha, which we reopened and expanded during the first half of our summer season in 2016 to complete a burial excavation.

We placed Operation 30 on the western side of the easternmost platform in this eastern shrine group (see **Figure 8.1**). Six squares (A-F) were dug during excavations at Op. 30 (**Fig. 8.2**). Squares A, B, and C were 2 m squares that comprised a 6 x 2 meter trench running (roughly) east-west. (It should be noted here that due to a problem with the total station the excavations at Op. 30 are not cardinal and are in fact oriented 19 degrees east of north.) Square A is the easternmost square, located on the eastern edge of a patio surface associated with a large plaza. The goal of these excavations was to expose the structure and the associated patio floor. Here, we identified a platform structure with at least four different phases of construction. These investigations began in January of 2016 and were continued in June of 2016 after a burial was identified in Square B at the end of the January season. Squares D, E, and F were opened in June of 2016. Square D measured 3 x 2 m with a small 50 cm expansion at the NE corner of the square. Square E measured 2.5 x 3 m and Square F measured 2.5 x 1.5 m. All three squares were opened to better understand the associated structure in which the burial was deposited.

The burial deposit cut into a lower floor surface and was probably interred when a new construction phase was being built. The burial was interred when a 50 cm thick fill layer was being added, which was topped by a plaza floor (Zone 6) and a three-course high basal platform (Zone 5) that was 40-50 cm thick. This is a fairly substantial construction for the Terminal Classic and suggests Chikin Chi'Ha was an active settlement during this so-called "collapse" period (ca. A.D. 800-930). The basal platform covering the burial deposit supported at least three later construction phases, including a final bench that may date to the Late Postclassic

based on the construction technique and associated Late Postclassic terminal debris found on the surface. A full ceramic analysis, however, has not yet been conducted, but is planned for future seasons and will help to refine the construction sequence.

Below we provide an overview of the excavation by individual zones grouped by the four construction phases (I-IV). A brief discussion of the burial deposit is provided, but a full osteological analysis is still underway by Dr. Gabriel Wrobel of Michigan State University where the remains have been exported with permission from the Institute of Archaeology.

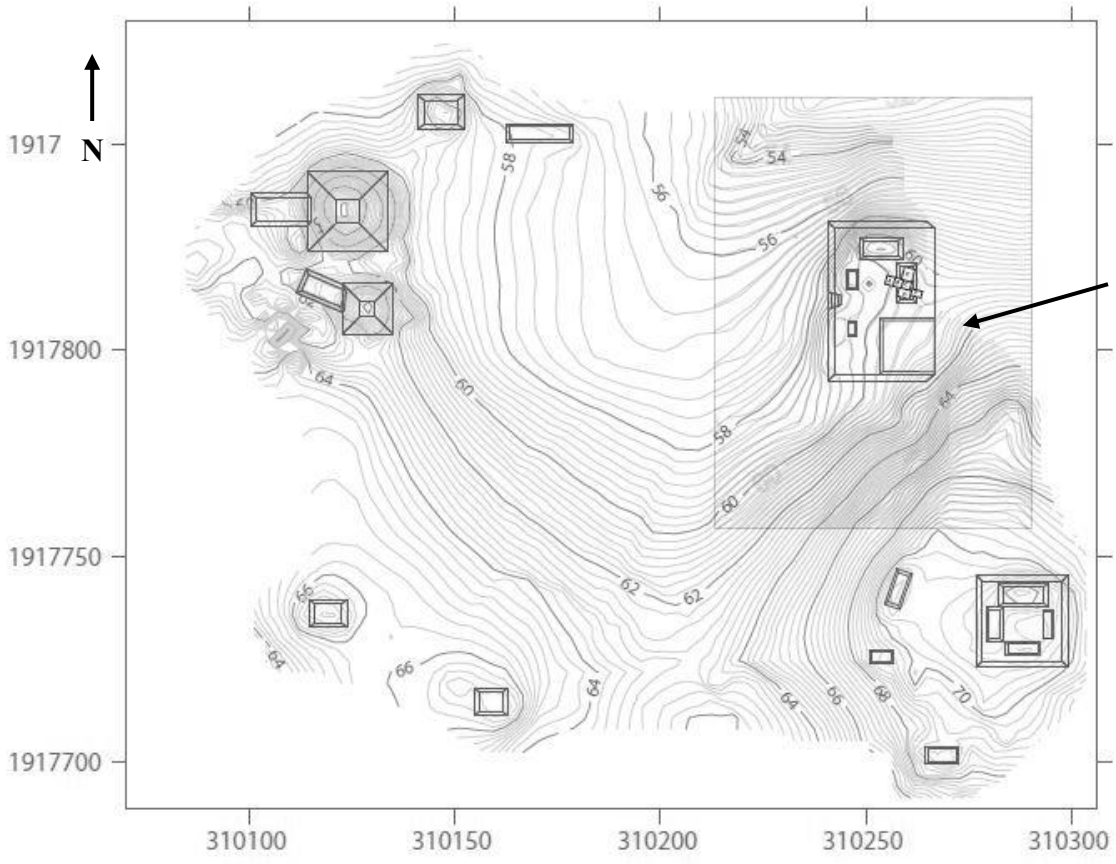

Fig. 8.1: Chikin Chi'Ha Site Map. Note area of excavation denoted by arrow (map prepared by S. Murata and B. Norris).

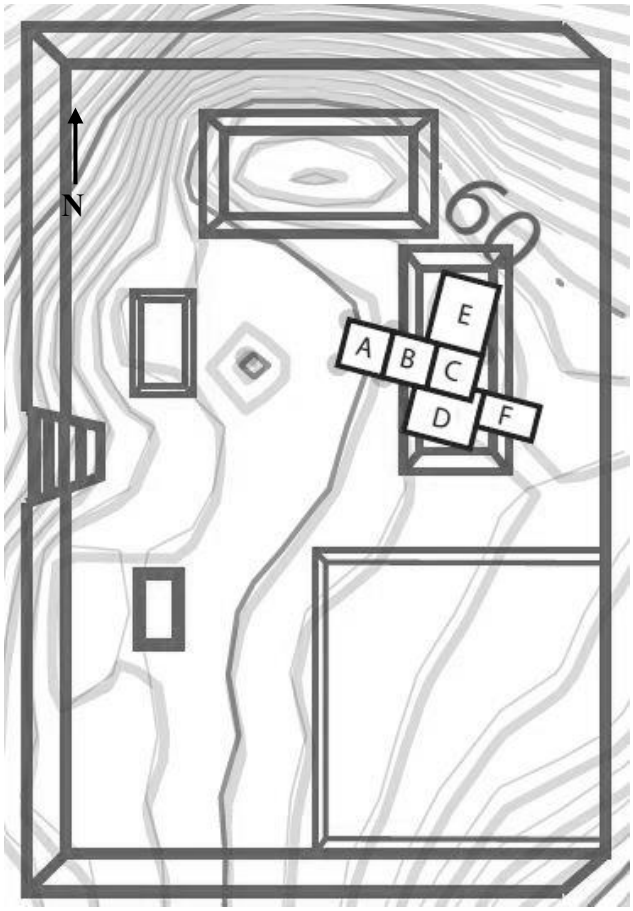

Fig. 8.2: Op. 30, Squares A-F

Zone 1

Zone 1 is a thin layer of topsoil that was removed across Squares A-F. The soil is dark (10YR 2/1) and rich with organic content. Closer to the patio surface in Sq. A the top zone is about 5cm thick, but as one moves up the mound (Squares C, D, and E) Zone 1 is very thin (2-3cm) and architectural debris is visible protruding from the surface.

Zone 2

Zone 2 is the collapse of the final phase of the building was also found across Squares A-F. It is comprised of stones that vary in size, from baseball sized to larger cut stone. The collapse was most evident in Squares B, C and F, where it rested directly on intact walls and platforms. Very little collapse was recovered off mound in Square A. Zone 2 is semi-compact and dark grey (7.5 3/2) and contains a moderate amount of artifacts, including debitage and sherds.

Op 30 Architectural Phases

Excavations indicate that a minimum of four distinct architectural phases are represented from excavations at Structure 1. During Phase I the earliest platform was constructed at this locale. Phase I predates any of the burials recovered during excavations. During Phase II one adult male individual and three infants were interred and buried under a layer of fill capped with a plaza floor. A multi-tiered platform was constructed atop this floor surface. Phase III represents a major remodeling event when much of the older architecture was buried and a long, N-S basal platform was constructed. A terrace and series of upper platforms were constructed on top of it. At least two individuals were interred within the fill of this remodeling event. Phase IV is the final construction event when much of the Phase III architecture was reused and a somewhat crude bench-like feature was constructed. Phases will be discussed from most recent to oldest below, in the order in which they were excavated.

Fig 8.3 Phase IV overview showing bench and reuse of earlier features (Squares B and C).

Phase IV

This phase represents the final architectural phase at Structure 1. This phase is best characterized as the modification and reuse of the preceding phase. According to elevation data, much of the earlier (Phase III) phase was exposed at this time, including a small platform (Zone 7) and a terrace (Zone 17), both of which will be discussed in more detail below (**Fig. 8.3**). The

most significant changes we see at this time are the addition of a bench along the east wall of the Phase III structure and the addition of fill and a wall to connect the bench to the earlier architecture.

Zones Relevant to Phase IV

Zone 12
Zone 12 is 2.5 x 1 m N-S feature that runs along the eastern edge of the structure. The feature is present in Squares C, D, and E at an elevation of 30-62 cm below datum. The west wall of this feature corners on the north (in Sq. E) and south (in Sq. D) ends suggesting it is some kind of bench. The bench is crudely constructed and consists of just 1-2 courses of stones (**Fig 8.3**). This bench is the most significant change that was made to Structure 1 during Phase IV.

Zones 15
Zone 15 represents surface and underlying fill that was laid down to connect the Zone 12 bench to the earlier Zone 7 platform (**Fig. 8.4**). Zone 15 is located only in Sq. C in the space between these two architectural features from an elevation of about 60-71 cm below datum. This zone was heavily damaged from a Coroso Palm situated directly in the center of it (as were some of the architectural features underneath Zone 15). As such, it is possible that this zone begins a bit higher than 60cm BD and was mixed with the Zone 2 collapse. The soil is semi-compact (10YR 3/1) with limestone inclusions and a moderate amount of artifacts, mostly sherds.

Zone 20
This zone is comprised of a cluster of sherds that were found on the northern end of the bench in Sq. E at 69 cm below datum. The sherds were found in a dense silty-clay matrix (10YR 3/2). The proximity of the sherds just off the corner of the bench strongly suggests that they were placed there as some kind of offering (**Fig**. **8.5**).

Zone 25
This zone represents the top 2 or 3 courses of stones on a N-S wall that was found in Sq. F, at an elevation of 36-72 cm below datum. These courses were added onto the original wall (discussed further below in Phase III) to connect it to the Zone 12 bench and to retain the Zone 15 fill (**Fig. 8.4**). These added courses are comprised of stones that are largely uncut and are of varying size and shape, in contrast to the large-sized and more uniform stone of the earlier courses (**Fig. 8.6**).

Fig 8.4 Plan of Op. 30 excavations showing Phase IV zones.

Fig 8.5 Possible offering in association with northwest corner of latest bench.

Fig. 8.6 Phases of N-S wall in Square F.

Phase III

A series of major construction events occurred at Structure 1 during Phase III. During this time, a massive N-S platform (Zones 32 and 41) was built off of the north and south ends of the earlier Phase II platform. Atop this basal platform was a terrace (Zone 17) that led up to a small central platform (Zone 7) flanked by two "wings" on its north and south side (Zones 8 and 24). Due to the fact that these wings partially covered the central platform we suggest that they were built sometime after the platform, but that these architectural features are relatively coeval. During this time at least two, and likely three, individuals were interred within the construction fill.

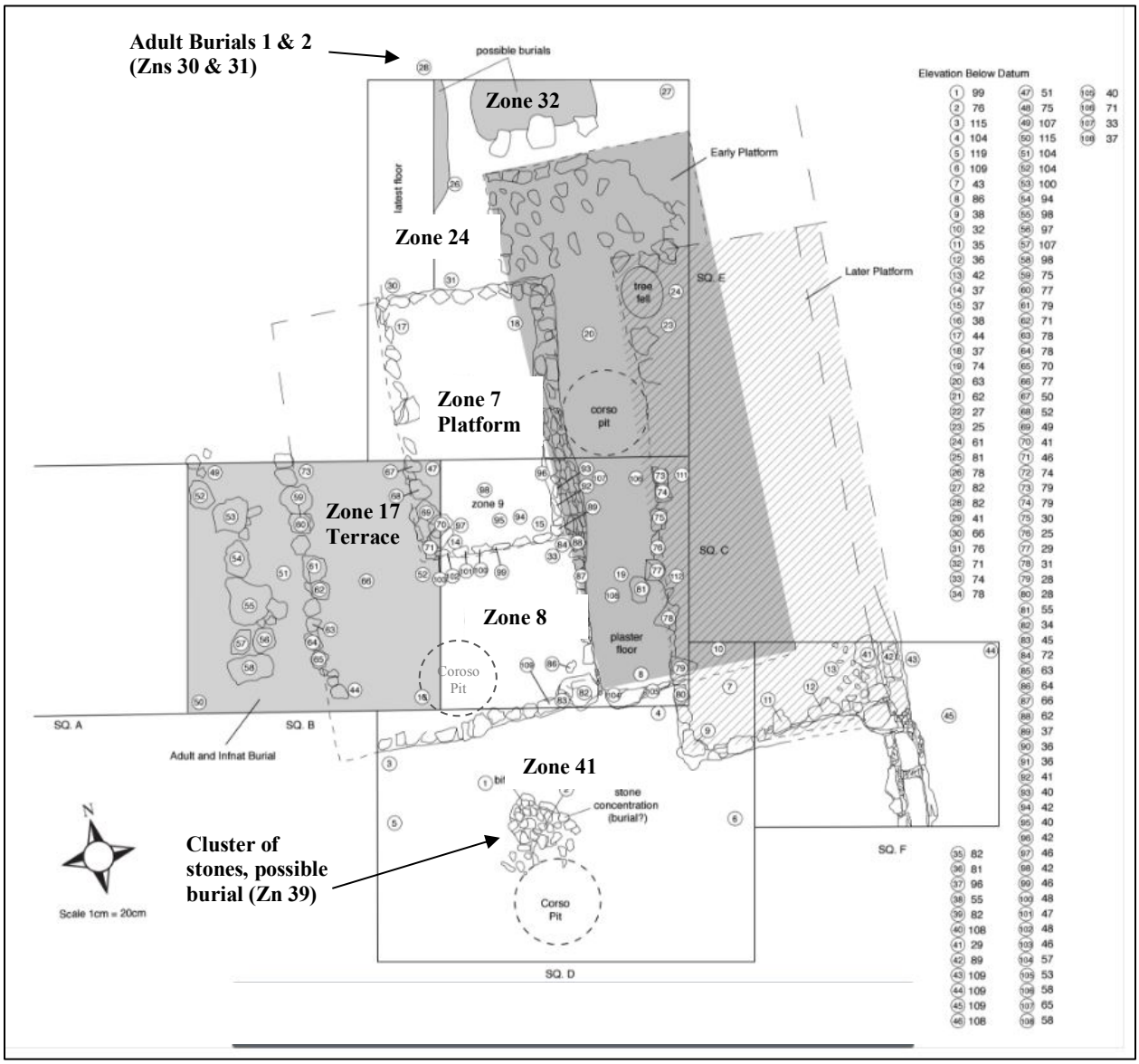

Fig 8.7 Plan of Op. 30 excavations showing significant zones associated with Phase III (drawn by E. Harrison-Buck, digitized by M. Brouwer Burg).

Zones Relevant to Phase III

Zone 3

Zone 3 is a resurfaced patio floor (Patio Floor 1) found at 112cm BD in Squares A and B (**Fig. 8.8**). It abuts the Zone 4 step in Sq. B. It is a very eroded plaster surface that is detectable only by the presence of a gravel ballast mixed with dark soil. The surface is very level, varying on by 1-2 cm across the two squares. Significantly, Patio Floor 1 was not found Squares D or F even though we reached this elevation in both squares. As such, this floor was localized to the patio side of Structure 1 and is best characterized as a resurfacing of the previous floor (Plaza Floor 2 – see Phase II).

Zone 4

Zone 4 is a step up to the Zone 17 terrace (**Fig. 8.8**) that is present from 104-145cm BD in Sq. B. The step is comprised of 1-2 courses of large stones with aligned (N-S) with the terrace above. This feature was covered with Zone 2 collapse, but was clearly distinguishable from the tumble. Patio Floor 1 runs up to and partially covers this step.

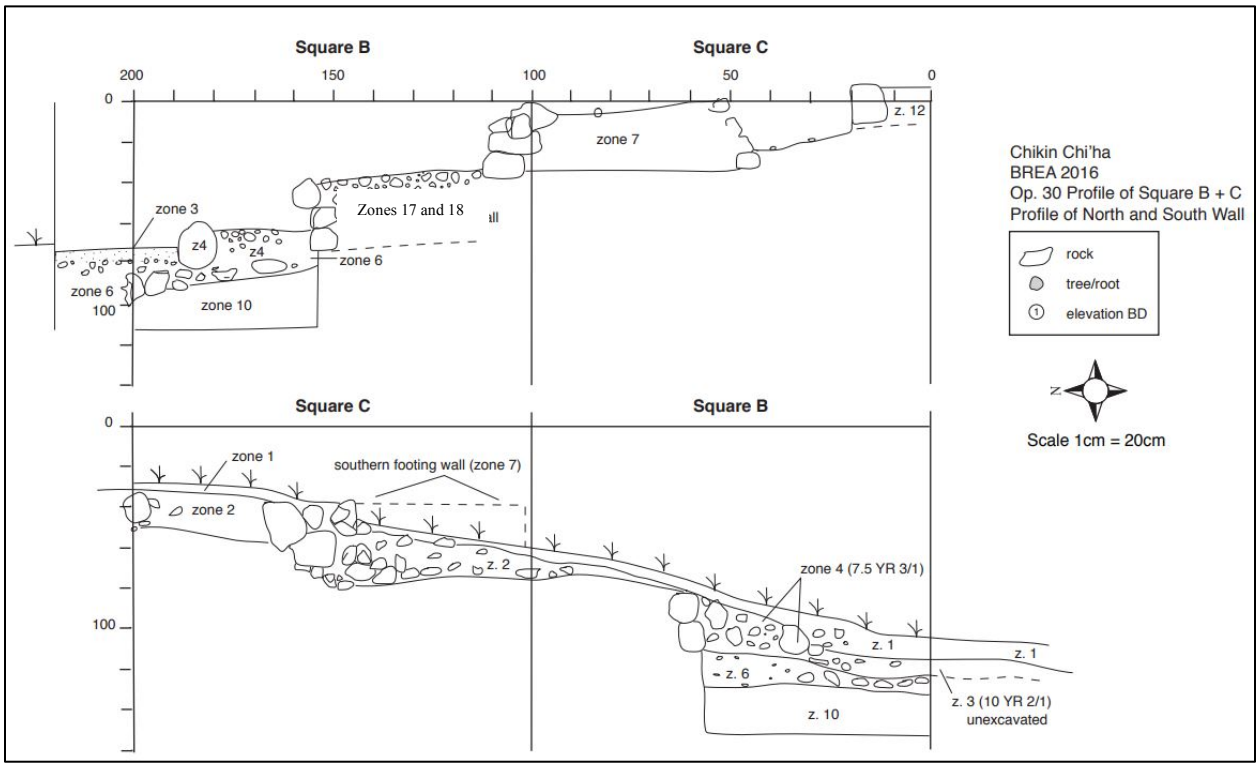

Fig. 8.8 North profile showing Phase III zones of Op. 30 (drawn by E. Harrison-Buck, digitized by M. Brouwer Burg).

Zone 7

Zone 7 is a raised platform found at an elevation of 40-71cm BD (**Figs. 8.7, 8.8 & 8.9**) in Squares C and E. It is comprised of uniformly-sized stones measuring 10-20 cm across. This feature is arguably the focal point of this phase of construction at Structure 1. It is centrally located and would have been the highest point on the building at this time. It is also significant that the platform continued to be visible in the subsequent phase (see above). As such, we speculate that one or more individuals could be interred within this platform.

Fig. 8.9 Zone 7 platform looking south.

Zone 8

Zones 8 represents the southern addition that was added onto the Zone 7 platform (also see Zone 24). Zone 8 was found at an elevation of 62-71cm BC. It is present in Squares B, C, and D. It should be noted that in Sq. C some of this platform was removed during the excavation of Zone 7. Due to damage done by a Coroso Palm the west wall of this addition was largely destroyed, but can be seen in the cross section of Sq. B. Based on the elevation of the Zone 8 walls it is evident that the additions (both Zone 8 and Zone 24) would have covered the bottom 20cm of the Zone 7 and thus must have been built sometime after the platform itself. However, the architecture Zone 8 clearly mimics that of the Zone 7 platform (**Fig**. **8.10**). As such, we feel confident that these additions (Zone 8 and Zone 24) were also constructed during Phase III.

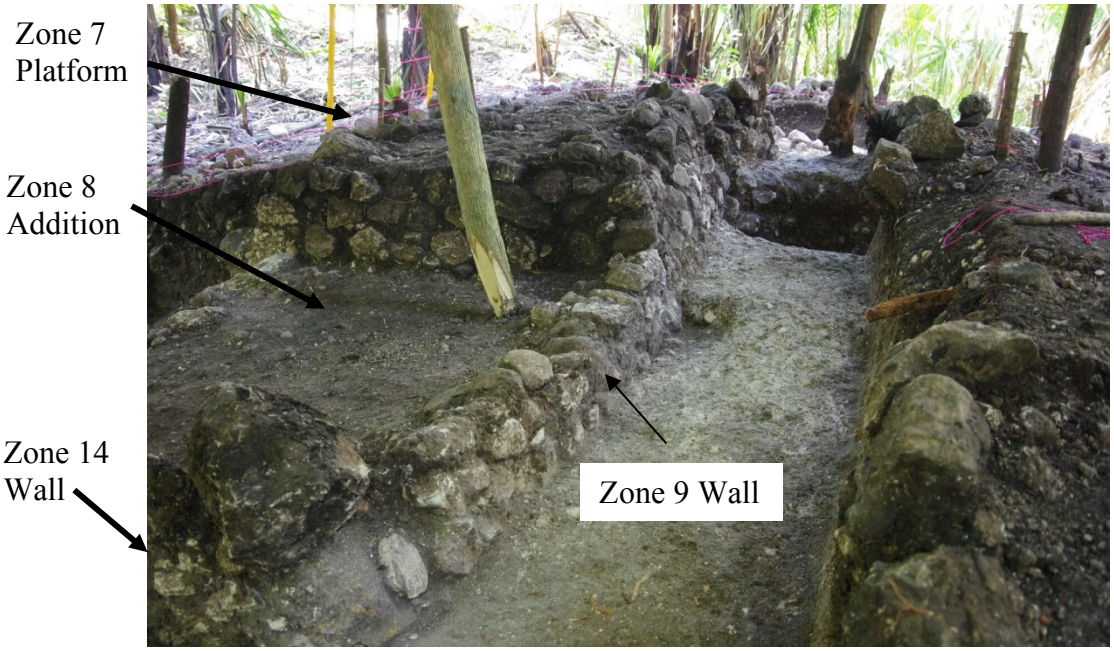

Fig. 8.10 Zone 7 platform and Zone 8 addition.

Zone 9

Zone 9 is the eastern wall of the Zone 8 platform and is present only in Square C at an elevation of 62-71cm BD. As discussed above, this wall illustrates clear continuity along the east wall of Zones 7 and 8 (**Fig. 8.10**). The top the Zone 9 wall averages an elevation of 64 cm, again suggesting that this addition partially covered the Zone 7 platform.

Zone 14

Zone 14 is the southern wall of the Zone 8 platform. It is present at the border of Squares C and D. This wall comes up somewhat higher than the Zone 9 wall, with some upper elevations at 45 cm BD. This wall was very poorly preserved and it is difficult the state with certainty whether these upper stones were collapse or part of the original architecture.

Zone 16

Zone 16 represents a thin layer (72-76cm BD) of earth directly on top of Zone 17 in Sq. B. We decided to separate this zone to avoid possible contamination. This upper portion of the terrace had been exposed and walked over for 6 months (since it had been exposed in January) so the context could have been comprised during that time.

Zone 17

Zone 17 is an addition onto a pre-existing terrace located on the west side the Zone 7 platform. The addition is comprised of one course of stones at an elevation of 76-92cm BD. Zone 17 is present only in Square B. Some kind of plaster surface is present at the base of Zone 17 (**Fig.**

8.11), which supports the assertion that this terrace has two distinct phases (Zones 17 and 18). The surface is only preserved in the central area of the square.

Fig. 8.11 Plaster surface at the top of Zone 18 terrace.

Zone 24

Zone 24 represents the north addition off the Zone 7 platform that mirrors the southern Zone 8 platform (**Fig. 8.7**). Zone 24 is also present at an elevation of 62-71cm BD. It was only found in Sq. E. It should be noted that during initial excavations on the east side of Sq. E (before Zone 32 directly below Zone 24 was well defined), Zones 24 and 32 were mixed. On the west side of Sq. E, however, the separation between the two zones in is well defined. It should be noted as well that initially Zone 24 was broadly assigned to the zone below the Zone 2 collapse, which varied in elevation somewhat across the operation. Once the architecture of the Phase III platform was better understood it became clear that Zone 24 was in fact platform fill that was isolated to Sq. E. As such, Zone 24 in Sq. D was reassigned as Zone 41 (see below) as these represent distinct architectural features.

Zone 25

Zone 25 represents the original N-S wall that is present in Square F (the wall that was added onto during Phase IV). This wall is comprised of 1-2 courses of medium to large stones atop a basal molding. Zone 25 sits directly on Plaza Floor 2 and was found at an elevation of 72-116cm BD. This phase of construction is clearly distinguishable from the later phase (see Zone 25 in Phase IV), particularly the basal molding, which is comprised of large, faced cut stones. This wall was

constructed to retain Basal Platform 1. Although we only excavated this wall in Sq. F we can assume it ran at least the entire length of the east side of the Phase III building.

Zone 30

Zone 30 is an assemblage of human remains (Adult Burial 2) that were found at 81 cm below datum in the northwest corner of Square E underneath a cluster of stones (**Fig. 8.7**). In total, 19 human teeth and abundant cranial fragments were recovered from the east profile of the square. Due to time constraints, the excavation was not expanded to investigate whether the burial is complete or partial. It is clear that this burial was interred within, but at the beginning of the Zone 32/41 filling event (see below) and could be a dedication to this new architectural program at Structure 1.

Zone 31

Zone 31 is a second potential burial (Adult Burial 3) found adjacent to Adult Burial 2 along the northern profile of Sq. E (**Fig**. **8.7**). The remains were found underneath a cluster of stones and dark stain (10YR 4/2). Upon removing the stones and probing into the stain, small flecks of bone were exposed. We opted once again to not investigate this potential burial further. This burial was found at the same elevation as Adult Burial 2 (81 cm below datum) suggesting that these two individuals were interred at the same time.

Zone 32

Zone 32 is the fill of the north end of Basal Platform 1 (**Fig. 8.7**), the N-S platform on which Zone 7 and its associated wings were constructed (also see Zone 41). It was built onto the surface created by the Zone 17 terrace. Zone 32 was found at an elevation of 71-82 cm below datum. The soil is semi-compact (10YR 3/1) with small limestone inclusions and a moderate amount of artifacts, mostly sherds. Zone 32 is located in Sq. E - it is into this fill that the two burials (Zones 30 and 31) were placed.

Zone 34

Zone 34 represents the floor and associated subfloor fill on which Basal Platform #1 sits – it was found at an elevation of 82-100 cm below datum. At the base of this zone we found a concentration of sherds that were localized to the area just south of the Zone 14 wall (**Fig. 8.12**). The zone was comprised of compact silty soil (10YR 3/1) and contained a heavy concentration of sherds.

Zone 35

Zone 35 represents the fill between Zone 34 and Plaza Floor 2 (Plaza Floor 2 is the earlier surface onto which the Phase III architecture was built – see Phase II below). Zone 35 was found only in Sq. D at an elevation of 100-115 cm below datum. It was comprised of compact silty soil (10YR 3/1) and contained moderate amount of artifacts.

Fig. 8.12 Concentration of sherds at the bottom of Zone 34.

Zone 39

Zone 39 is a cluster of stones located in the central portion of Sq. D at an elevation of 76-115 cm below datum (**Fig. 8.7**). Given the association of human remains and stone clusters that was identified in Sq. E, the assumption was made that another burial could be located within Zone 39. As such, the stones were left in place as excavations continued down in Sq. D. If Zone 39 is a burial, there were a total of three individuals interred in association with the construction of Basal Platform 1– we suspect that further excavation within this phase of Structure 1 could have exposed yet more burials.

Zone 41

Zone 41 represents the southern end of Basal Platform 1 (also see Zone 32). It is located only in Sq. D and was found at an elevation of 71-82 cm below datum. The soil is semi-compact (10YR 3/1) with small limestone inclusions and a moderate amount of artifacts, mostly sherds. It should be noted that during excavations this zone was originally assigned to Zone 24, but was later determined to be distinct from the Zone 24 platform addition.

Phase II

Phase II represents a significant time during which massive amounts of construction fill was used to elevate entire area so that a small platform could be built on top. The first event was the dismantling of the Phase I platform (see below). Subsequently, four individuals were interred (Zones 23, 26, and 33). Our investigations yielded a complex burial feature that comprised an adult flanked by three infants all under the age of two years old. An intrusive pit was dug into the Phase 1 cobble surface and an adult male was buried with an infant adjacent to his feet (**Fig. 8.13**). Two more infants were interred east of the adult burial. A preliminary analysis indicates that the main interment is likely a young male adult who is seated in a reclining position with legs crossed at the feet, head to the east and feet to the west (Wrobel personal communication, June 2016).

Three infants flank the adult, two to the east and one to the west of the main interment. Infant #1 (Zone 13) to the west was poorly preserved, but the teeth indicate an age estimate of around 6 months old. Infant #2 (Zone 26) to the east has yet to be analyzed but is most certainly under the age of two. Two Spondylus shell beads were found around the head of Infant #2 and may have formed a necklace that adorned the infant. Infant #3 (Zone 23 in the wall) also to the east is 18 months old. This individual is a little more difficult to make out in planview but is clearly visible in the profile (see **Fig. 8.15** below). Age estimations are based on dental eruption of the deciduous teeth (Wrobel personal communication, June 2016). This infant was the most well preserved overall, perhaps due to its slightly more advanced age as compared to Infant #1 or due to its positioning, which appears to be seated with legs flexed. Infant #3 had a fairly intact mandible where the canine 1st and 2nd deciduous teeth can be seen erupting.

Immediately following the burial of these four individuals, the area was raised up (Zones 10, 19 and 21), a basal platform (Zone 18), and a two-tiered smaller platform (Zones 27 and 36) were constructed. We suggest that these events were coeval because no floor or surface covered the main burial pit, indicating that construction occurred immediately following the internment event. Below we detail the results of each zone excavated as part of Phase II.

<u>Zones Relevant to Phase II</u>

Zones 6, 22, and 40

Zones 6, 22, and 40 all represent Plaza Floor #2. Zone 6 is in Sq. B, Zone 22 is in Sq. F, and Zone 40 is in Sq. D at an elevation of 115-116 cm below datum in all three squares (excavations did not go deep enough in Squares A, C, or E to reach this surface).

Zones 10

Zone 10 represents the fill directly below Plaza Floor #2 in Sq. B on the west side of the terrace (**Fig**. **8.15)**. It is this Zone 10 fill that created a base for the Zone 18 (and later Zone 17) terrace at Structure 1. It is comprised of a silty-clay, dark grey (10YR 3/2) matrix containing an abundance of sherds. It is within Zone 10 that a cluster of stones (Zone 11) was found

immediately above Adult Burial #1. The stones were left in place as excavations removed the Zone 10 fill down to the cobble surface (Zone 28 – see below) into which the burial was intrusively placed. This zone continues from Plaza Floor #2 to the Phase I Zone 28 cobble surface (115 – 153 cm below datum).

Fig. 8.13: Phase II Burials

Zone 11

Zone 11 is a cluster of stones that was found within the Zone 10 fill (**Fig. 8.15**). It is located within Sq. B both directly underneath and immediately to the east of the Zones 17/18 terrace and is situated directly above the cranium of the individual in Adult Burial #1. It is comprised of small to medium-sized stones and a loose matrix of soil (10YR 3/3). Zone 11 also continues from Plaza Floor #2 to the Zone 28 cobble surface (115 – 153 cm below datum).

Fig. 8.14 Zone 11 cluster of stones above Adult Burial #1.

Zone 13

Zone 13 a thin layer of fill at 150-153 cm below datum that is directly on top of the intrusive burial pit to the west of Zone 11 in Sq. B. Zones 11 and 13 were likely laid down simultaneously, but they were arbitrarily separated due to the presence of the stones. Bone flecks became visible at 150 cm below datum in this zone. An Achote Black vessel, which was placed in the central portion of Adult Burial #1, was recovered during the removal of this zone. This vessel is clearly part of the internment and should be considered part of the Zone 33 burial (see below).

Zone 18

Zone 18 represents a basal platform that was built onto Plaza Floor #2 (in Sq. B). It is comprised of two courses of medium to large stones. After the burials were interred in an around the Zone 28 cobble surface, a large filling event occurred (Zones 10, 19 and 21) and a platform was constructed (from 115-92 cm below datum). A smaller platform (Zone 36 – see below) was then built on top of the Zone 18 terrace.

Zone 19

Zone 19 is located directly beneath the Zone 18 platform is also restricted to Sq. B. Zone 19 represents the fill from below Plaza Floor #2 down to the level of the top of the Zone 11 stones (115-124 cm below datum). This zone is comprised of loose grey fill (10YR 4/2) with a moderate amount of sherds. A C14 sample was recovered from this zone. Zone 19 correlates

with the upper portion of the Zone 10 fill, but was separated because it is below the terrace and because these two zones were excavated during different field seasons.

Zone 21

Zone 21 represents the fill from Zone 19 down to the Phase I Zone 28 cobble surface (124-153 cm below datum) into which the burials were interred. It is very similar in composition to Zone 19 in terms of the soil make-up (also 10YR 4/2) and contained a heavy concentration of sherds along with some lithic material and shell. A C14 sample was also collected from Zone 21.

Zone 23

Zone 23 is the Infant Burial #3, which is located in the east wall of Sq. B at 134 cm below datum (**Fig. 8.15**). This infant was about 18 months old based on the teeth and was interred into the Zone 21 fill about 20cm above the Phase I Zone 28 cobble surface. An abundance of large sherds were found in association with the remains, suggesting that the infant may have been interred in a seated position with the vessel over the head. This inverted painted bowl contains nubbin feet.

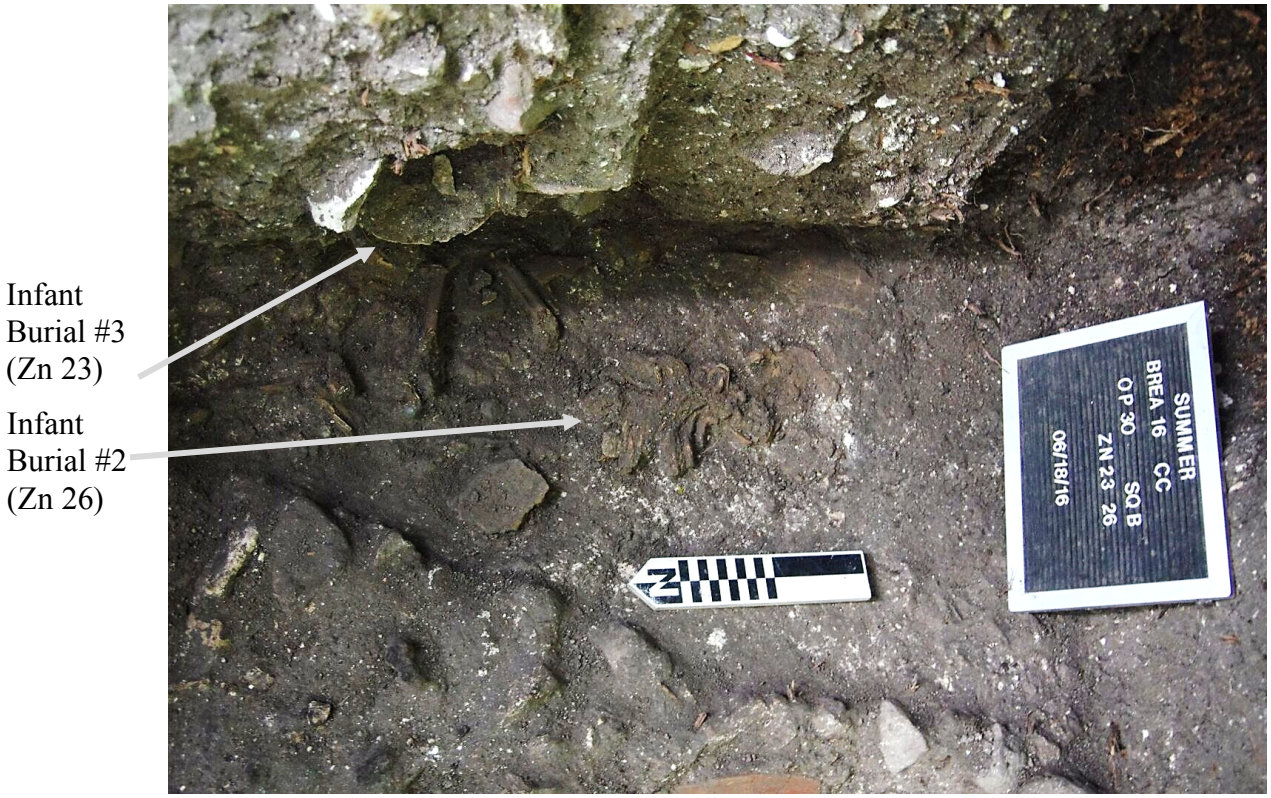

Fig. 8.15 Infant Burials 2 and 3.

Zone 26

Zone 26 represents Infant Burial #2, which is located just east of the main internment (Zone 33) in Sq. B (**Fig. 8.15**) within the scar left by a dismantled platform (see Phase I, Zone 38). The individual was also placed within the 21 construction fill. This infant was likely about 6 months old based on the teeth recovered, namely the identification of an incisor that had not fully erupted. As noted above, two Spondylus shell beads were found associated with this burial.

Zone 27

Zone 27 is the upper level of the Zone 36 platform (see below) and was found at an elevation of 62-71 cm below datum. Evidence for this zone was only found in Sq. E, which is why we suggest that the Zone 36 platform had an upper tier. The clearest evidence for this platform can be seen in Sq. E (see **Fig. 8.9** - the upper tier is located directly to the west of the photo board). Significantly, the upper tier of the platform would have continued to be visible during Phase III.

Zone 33

Zone 33 is the main internment of Phase II and was also found in Sq. B. The burial contains an adult male (Adult Burial #1) and a 6 month old infant placed just south of the adult's legs. The adult individual was interred face up on his back with his arms resting on his pelvis and his legs folded up at the knee (**Fig. 8.16**). An Achote Black (San Pablo Glossware) vessel was placed south of his pelvis over the left arm and an inverted Daylight Orange: Darknight Variety dish covered his head. Based on the continuity of the burial pit, it is evident that the infant and the adult were interred together at the same time. As stated above, this pit was cut into the Phase I Zone 28 cobble surface and there was no new surface or cap placed over the pit. As such, the large burial program of Phase II at Structure I, which entailed a massive filling event (Zones 10, 19, and 21), the laying down of Plaza Floor #2 (Zones 6, 22, and 40), and the construction of a platform (Zone 18) that served as the base for a smaller platform (Zone 36 – see below) all occurred very soon after these four individuals were buried.

Zone 36

Zone 36 is a small platform built on top of the Zone 18 platform. Based on the elevation data, it has both an upper (Zone 27) and lower (Zone 36) tier. Evidence for the Zone 36 lower tier was found at 71-82 cm below datum. It is clear that some of the Zone 36 platform was dismantled in antiquity, likely in order to construct the massive Basal Platform #1 in Phase III.

Zone 37

Zone 37 is an E-W wall that was found at an elevation of 82-115cm BD at the interface of Squares C and D. We suggest that this is the south wall of the Zone 18 basal platform and that it slopes downward somewhat from east to west, which is why we see a 10 cm elevation difference between the two features. This wall suggests that this lower platform was not cardinal, as it can be seen angling away from the cardinally-oriented Zone 14 wall (**Fig. 8.17**).

Fig. 8.16 Adult Burial with Daylight Orange vessel.

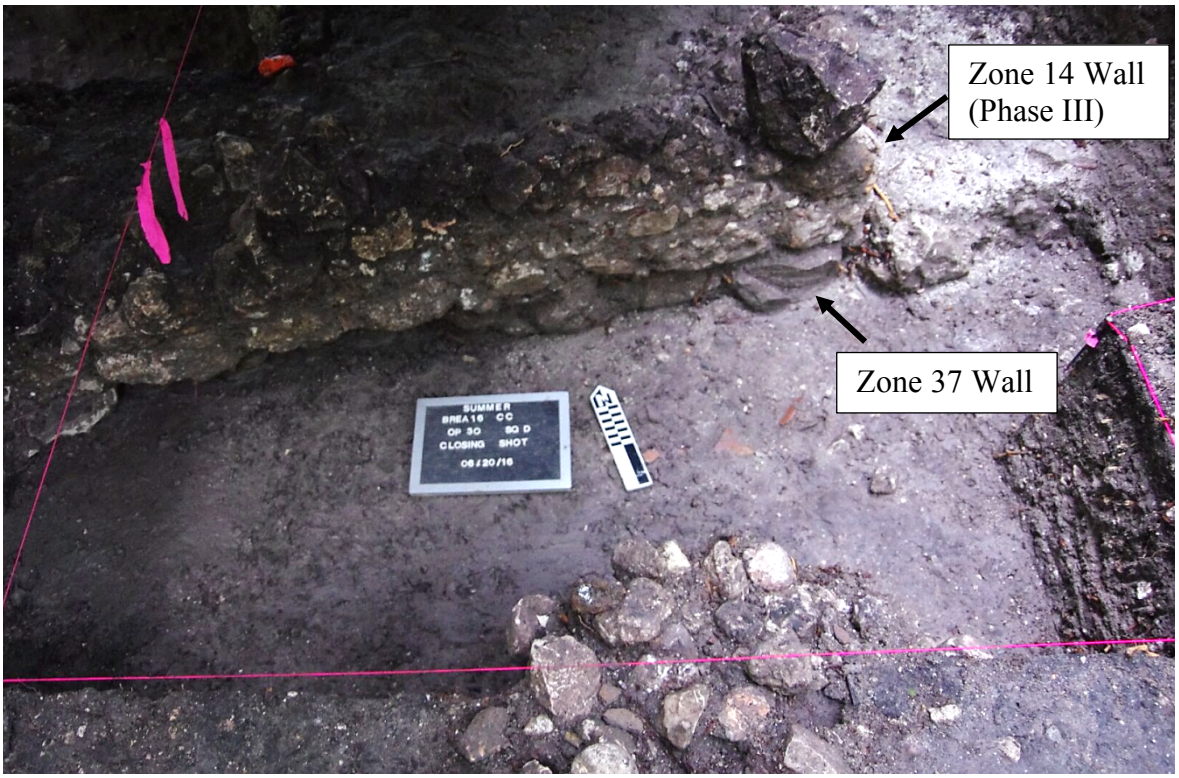

Fig. 8.17 Zone 37 wall.

Phase I

Phase I is the earliest phase we have evidence for based on the excavations at the structure. It is comprised of a surface of baseball-sized cobbles (Zone 28) and a scar (Zone 38) left by the remains of a NE-SW platform. This suggests that this early platform was dismantled to construct the subsequent building (during Phase II).

Fig. 8.18 Cut in Phase 1 surface.

Zones Relevant to Phase I

Zone 28

Zone 28 is the cobble surface associated with the earliest platform that was found during excavations at Structure 1 (**Fig. 8.18**). Zone 28 is present in Sq. B at an elevation of 158 cm below datum. This surface is uniformly present across the square with the exception of Zones 29 and 38 (see below). It is comprised of a dense layer of small cobbles in a matrix of semi-compact dark grey (10YR 4/2). This surface was not excavated.

Zone 29

Zone 29 is an area along the west wall of Sq. B where the cobble surface is not present. The area is darker (10YR 2/1) than the surrounding soil possibly made by the breakdown of organic matter in this area. Given the presence of human remains at this level, we probed within Zone 29, removing the top 10cm of the stain and recovered several sherds but no bone or teeth. A sample was collected for botanical analysis. The darker soil discontinued at 10cm below the cobble surface.

Zone 38

Zone 38 is the cut in the Zone 28 surface that provides evidence for a dismantled platform. We suggest this platform was dismantled as part of the subsequent (Phase II) internment event. The platform was not cardinal, as the scar indicates that it was oriented NE-SW.

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Chapter 9

Investigating a Structure Associated with a Water Feature at Chulub (Operation 31)

Kelin Flanagan

Introduction

Operation 31 explored Structure 48 within the prehistoric Maya site of Chulub. Chulub is located south of the village of Crooked Tree, Belize, within the Audubon Wildlife Sanctuary in the Western Lagoon. Research questions for this Operation include: What surface was the structure built upon? Did they build the structure atop limestone? Did they create a foundation of stone? Was the structure built for a specific purpose? What artifacts will be present? When was the structure built? Was it built in a single phase or multiple phases? The BREA team selected this structure to help answer these questions due to its proximity to water features scattered around this wetland environment. The placement of the excavation was decided based on two aspects of the location – the low elevation of the southern side of the structure (likely inundated during the wet season) and because the area was dry at the time of excavation. This allowed us to examine the foundations of the structure without flooding the excavation units. This chapter reports on the methods and results of the Operation 31 excavation carried out during January 2017.

Objectives

1. To define the relationships between the architecture and the water features present at the site of Chulub. How does the structure relate to the adjacent canal and pond features?
2. To identify, through architectural features, the final form of the structure and its relationship to earlier forms.
3. To recover diagnostic artifacts to date the building phases and determine the use(s) of the structure. Are they building up for residential, production or subsistence purposes?

Description of the Research and Methods Used

A 2m (E-W) x 10m (N-S) trench was placed off-center (to the east) on the southern side of the structure. This trench was originally delineated into four squares (A, B, C, and D) each

with 2m x 2m dimensions with A in the north, and the subsequent squares aligned directly south, in alphabetical order. A fifth, 2m x 2m square was added on the southern end of the trench, as Square E, on 1/9/17. Excavators began in Square D and worked from the south to the north to locate the exterior of the structure first. Excavations then proceeded into the architecture to look for earlier phases. The squares were placed intentionally east of the center to hit as many architectural features as possible. Squares C, D, and E were excavated into 20 distinct zones during the 2017 January BREA field season. All elevations were measured as centimeters below a single datum (Datum A) with an elevation of 194.3 cm. Excavation equipment included spade and square shovels, pick-axes, trowels, and geological hand-picks. All screened soils were processed through ¼" mesh. The Operation Director for this excavation was Kelin Flanagan (KEF). Other excavators include Jeremy Kassel, Grace Dietz, and Katie Titus along with local assistance from Mr. Dudley Tillett.

Excavations revealed a single, four-course, stone terrace wall. The rest of the height of the mound was earthen fill with some chert and limestone cobbles concentrated in the eastern sides of Squares C and D. The water table was encountered at 180 cm below datum (bd) A, at the base of the structure. A 1m x 1m probe was dug into the west side of the terrace platform, north of the terrace wall, to search for diagnostics and to further clarify the construction style. There were large boulders and cobble fill that faded with increasing depth. This terrace wall rested on an uneven, sandy-clay matrix speckled with decaying charcoal and ceramics (Zones 11, 18 and 19) that exists between 150 and ~170 cm bd A. The base of the wall sloped deeply towards the west. Excavation of the pit within the terrace halted 5 cm above the known water level (175 cm bd A) to avoid filling the unit with water. A surface containing terminal debris lips up against the second course of the terrace wall as well (Zone 9). Below I provide a more detailed overview of each zone excavated in Operation 31 at Chulub.

Zone 1

Zone 1 was present in Squares C, D and E. Context changes for this Operation tended to follow the sloping characteristics of the mound, therefore the elevations recorded for this zone are higher in the north than the south for each square. The first zone (0-20 cm) of this Operation was composed of a loose silty-clay humic layer (7.5YR 3/1) filled with leaves, roots, grass and other organic material. It was also characterized by a sparse density of artifacts. Most artifacts were lithics, but ceramics and faunal bone were also present.

Within Zone 1 of Square C, fifty percent of the buckets were screened. The matrix (7.5YR 3/1) was susceptible to sun-baking, therefore its texture and color changed throughout the day. Zone 1 in Square C was drier than the Zone 1 contexts in Squares D and E. This is likely due to the higher elevation of this square and the slope of the mound. It was a grey matrix filled with tiny limestone inclusions and very few artifacts – debitage, pottery sherds and animal bone. The zone ended with a color change in the northern half (at 50 cm bd A). The color

change was gradual and not clearly visible in the southern portion of Square C. Therefore, the zone ended arbitrarily in the South at 70 cm bd A.

Excavations in Square D began with the humus removal across the entire square and all buckets were screened. The matrix was a dark silty-clay (7.5 3/1) with high density of root bioturbation and a light artifact density [debitage, pottery sherds, animal bone and fire-cracked rock, non-pottery ceramic (n=2 [**Figure 9.1**]). Excavation of this zone and square began on 1/5/17 and ended on 1/11/17. An alignment of three stones (east to west) was identified within Square D. The line of stones turned out to be a four-course terrace wall (Zone 6). In the northern half, especially in the eastern corner of the square, the soil quickly changed to a lighter grey with limestone inclusions (88 - 90 cm bd A). This contrasted with the southern portion (especially south of the exposed stones) where the soil remained black. The southern elevations for this zone (100-106 cm bd A) extend deeper than the platform created by the stone wall (88 cm bd A). There is evidence of burning with some charcoal and fire cracked chert in this zone as well.

Figure 9.1 Op. 31 non-pottery ceramics, bottom to top: Unfinished punctured ceramic disc from Sq. D, Zone 1 (D1); Ceramic disc with puncture hole from D19; Ceramic net-weight from D6; perforated ceramic fragment from D14 (photograph by E. Harrison-Buck).

Excavation of Zone 1 in Square E began on 1/9/17 and ended on 1/12/17. This Square had a light artifact density [debitage, pottery sherds, animal bone, and marine coral (n=5)] and a semi-compact clay matrix (7.5 YR 2/5 – slightly darker than Squares C and D) with a light density of fine limestone inclusions. Fifty percent of buckets were screened. This top-zone was a muddy silty-clay filled with the roots of Spiny Palm (*Bactris major* var. major) and Cohun (*Attalea cohune*) trees. There were a few limestone cobbles and just as many large chert cobbles in the matrix. Due to heavy rain and the low depth that the southern half reached, we arbitrarily bisected the square into northern and southern 1m x 2m units. This allowed us to continue working within the square while the southern bisection dried up. An old leaf-cutter ant ("wee-wee" ant) mound was found in the southwestern quadrant of the southern bisection. This bioturbation is common within this region, causing a lens of white colored matrix (10YR 5/1), that is often thick in the center and thins away from its center point.

Zone 2

The second zone of this Operation was present in Square D only, north of the line of stones (terrace retaining wall – Zone 6). Therefore, Zone 2 elevations only describe the area north of the line of stones. It was composed of a semi-compact, silty-clay matrix (10YR 3/2). Artifact density increased as elevation below datum increased. About 2% of the inclusions were tiny clear stones that look like silica or quartz pebbles. Large and small limestone inclusions, worked and unworked chert cobbles, fire-cracked rock, faunal bone, and ceramics were all found in this matrix. A few medium-sized limestone cobbles in this collapse/fill context were in the northern half of Square D. A large piece of marine coral was also found at the interface of Zone 2 and Zone 3, in the northwestern quadrant of this square (n=1; 90 cm bd A). Zone 2 ended arbitrarily approximately 3 - 5 cm above the predicted terrace surface. Excavation of this zone and square began on 1/6/17 and ended on 1/11/17. All buckets were screened.

Excavation of this zone further exposed the top course of the terrace wall running roughly east to west in the southern edge of Square D. A concentration of worked chert, ceramics and limestone were present at a higher elevation than the other Zone 3/Zone 14 context in the northeast quadrant. This concentration was removed as Zone 4, although it can be included within this same context. Originally this zone was considered "collapse", but it's possible that a more accurate description would be construction fill. No superstructure was identified during this year's excavation, however. This makes it hard to assess whether Zones 2, 3 and 4 were collapsed material or fill or silty overburden from periodic inundation. It was likely construction fill piled behind the retaining terrace wall (Zone 6). A dark stain was present at 88 cm bd in the northwest corner of the square also. I believe this was an old Cohun root-ball stain (Zone 20) that pushed the cobble and ceramic construction fill up as it grew, causing the higher elevation of Zone 4. Ceramics were sitting up on their edges all throughout this level and do not lay flat anywhere to indicate a surface. Their elevations followed the upward slope of the mound to the north. Excavation of this zone was halted between 88 and 95 cm.

Zone 3

Zone 3 of Operation 31 was an arbitrary zone of the 3 to 5 cm above the predicted surface of the terrace platform. This zone exists only north of the terrace wall within Square D. The matrix was composed of a silty-clay (10YR 3/2) with a medium artifact density [debitage, ceramic body and rim sherds, chipped tools, marine coral (n=17)]. Excavation of this zone and square began on 1/7/17 and ended on 1/12/17. All buckets were screened. The surface was predicted based on the top of what appeared to be the most well-seated stones of the line of stones present in Square D. However, some of the sherds encountered at the bottom were still sticking straight up through the "surface", so ultimately this zone is considered construction fill along with Zones 4 and 14. The excavation halted at the same level as a well-seated stone of the top/fourth course of the terrace wall (88 cm bd A).

Zone 4

Zone 4 of Operation 31 was a concentration of limestone and chert cobbles within a semi-compact, silty-clay matrix (7.5YR 3/1) with a heavy artifact density (lithic cores, flakes and debitage, pottery sherds and rims) in the northeast quadrant of the square. Excavation of this zone and square began on 1/7/17 and ended on 1/10/17. All buckets were screened. About 2% of the matrix was tiny silica inclusions. Ceramic to chert to limestone ratios were 3:3:1. This context began at a higher elevation than the rest of the surface fill. It is possible the fill spilled out from a superstructure feature that is no longer present or perhaps the terrace wall originally was built higher but had since decayed. It may also be construction fill pushed up by a Cohun tree (*A. cohune*) root-ball. A dark soil stain (Zone 20) in the northeast corner may be evidence of this old tree root-ball. Artifacts cluster just south of this stain within Square D (seen in the Eastern Profile – **Figure 9.2**) and north of the stain in Square C. The zone ended arbitrarily at same elevation as Zone 3 (~88 cm bd A).

Zone 5

Zone 5 of Operation 31 was an earthen layer located within Squares D and E, below Zone 1 (top-zone), above Zone 9 (surface), and south of the terrace wall (Zone 6). This earthen layer was composed of a dense, light yellow-grey, silty-clay matrix (7.5YR 3/1) with tiny limestone inclusions and a light artifact density, including debitage, pottery sherds, faunal remains and one chipped stone axe that is a possible tranchet adze (**Figure 9.3**) collected from the interface of Zone 9 and Zone 5. This matrix also had a higher moisture level than Zone 1 and may be the initial wash of collapse that slopes off the mound. The terrace stones of Zone 6 appear to have fallen on top of this earthen debris in the southwest corner of Square D. Excavation of this zone and square began on 1/12/17 and ended on 1/14/17. All buckets were screened. In Square D, this zone appears only in the southern portion, south of the terrace stones. This was likely a layer of overburden mixed with slumped construction fill resting on the Zone 9 terminal surface context.

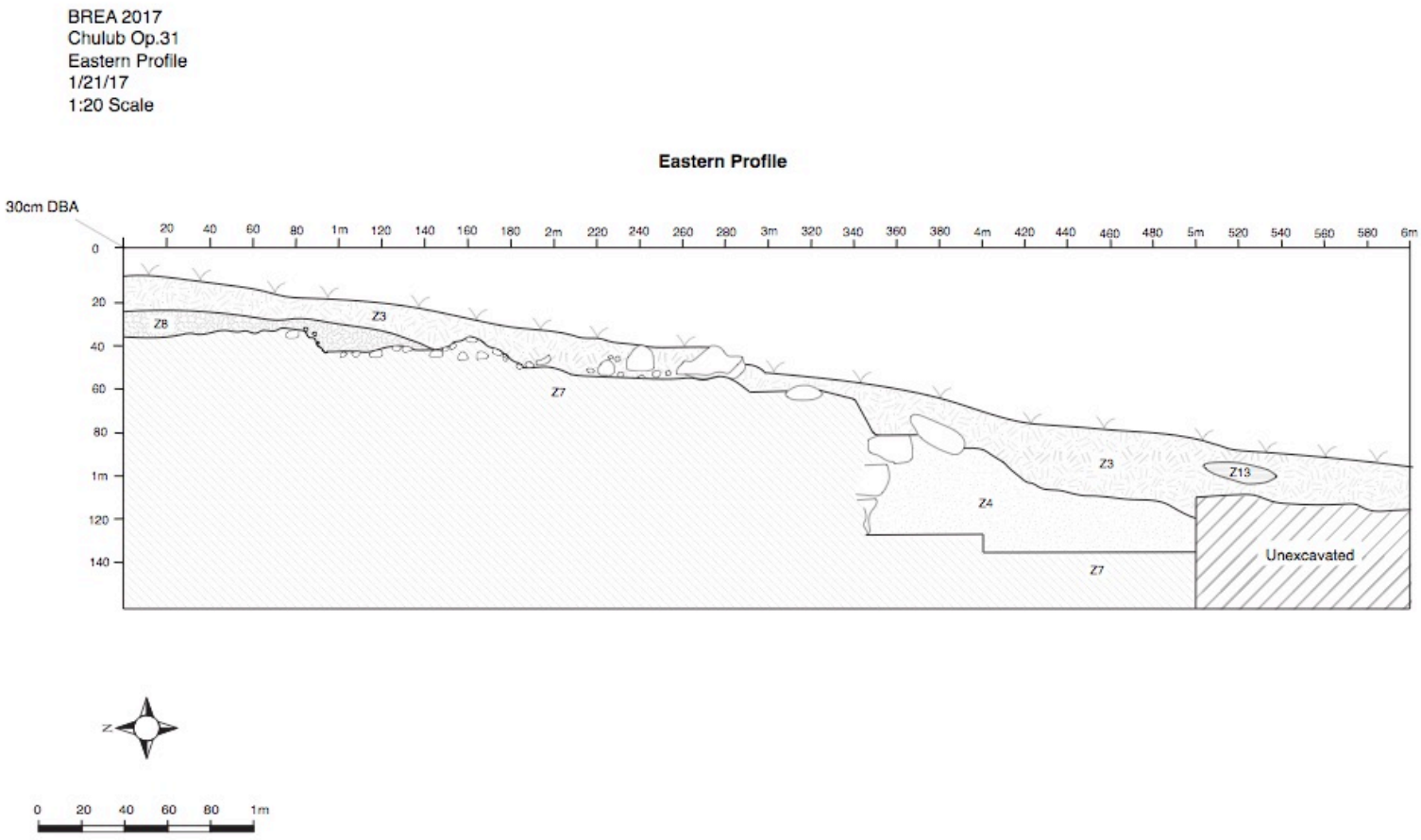

Figure 9.2 Eastern Profile of Operation 31
(drawn by K. Flanagan; digitized by K. Titus and M. Brouwer Burg).

Figure 9.3 Chipped-stone axe from Zone 9, Square D (possible tranchet adze, a tool used for wood-working) (photograph by E. Harrison-Buck)

Zone 5 in Square E had a light artifact density (pottery sherds, marine coral (n=2), debitage and faunal remains) with a silty-clay matrix (7.5YR 3/1). Excavation of this zone and square began on 1/11/17 and ended on 1/21/17. All buckets were screened. The matrix was a tough dense clay, lighter in color than Zone 1, and filled with tiny limestone speckles. This was an earthen layer just above Zone 9 (surface). In Square E, this zone is only present in the northern half and slopes dramatically downward as it moves southward. It then disappears into Zone 7, which had a darker matrix but also existed above a terminal debris surface like Zone 9. A soil sample was taken from the top of this zone in Square E.

Zone 6

Zone 6 of Operation 31 was the terrace wall within Square D and the matrix around and between those stones (**Figures 9.6** and **9.7**). Excavation of this zone in Square D began on 1/13/17 and ended on 1/21/17. All buckets were screened. The matrix consisted mostly of limestone and chert cobbles with a dark black soil in between. This silty-clay matrix [(7.5YR 2.5/1) contains five large stones visible in Square D, which served as the top course of the wall that had slipped out of place and a medium artifact density, including debitage, pottery sherds, rim sherds, and faunal remains. This zone contained special artifacts, including a non-pottery ceramic net weight (n=1) found at an elevation: 110 cm bd A (see **Figure 9.1**) and a chipped stone tool that appears to be a lithic oval biface agricultural implement (n=1) found at an elevation: 88 cm bd A. In addition, a worked marine shell artifact was recovered from Zone 6. This gastropod shell contains three holes drilled in it and appears to be a pendant. It is likely these artifacts were either sitting on top of the platform surface and fell to this location during the

partial collapse of the Zone 6 wall or were originally part of the construction fill used to create the platform. A soil sample was taken by scraping the bottom of the zone with a trowel within Square D. Once the slumped fill context of Zone 6 was removed from the western end of the terrace, Zone 9 "floor" surface was exposed beneath. **Figure 9.4** shows the top course of Zone 6 before removal.

Figure 9.4 North facing photo of the top course of the retaining terrace wall (Zone 6), Square D. Note the large collapsed boulders or top course of Zone 6 (photograph by K. Flanagan).

Zone 7

Zone 7 of Operation 31 was a mucky, black, sticky, clay (10YR 2/1) earthen layer in the southern half of Square E that was a mix of topsoil and collapse debris sloping off of the structure (see **Figure 9.2**). The muckiness of the zone was due to its close proximity to a low-lying pond feature immediately to the south of the unit. The zone had an extremely light artifact density, including debitage, a chipped tool (n=1), and ceramic sherds found only at the bottom of the zone. Therefore, only fifty percent of buckets were screened. Excavation of this zone and square began on 1/13/17 and ended on 1/17/17. Due to frequent rain, this portion of the pit often flooded, and excavators had to bail water out of the excavation. Excavator boots disturbed this

layer, mixing top-zone from outside the excavation boundaries. This zone ended when excavators hit a layer of terminal debris resting on what appears to be a floor surface (Zone 9). The dark soil remained in the southern half of Square E while the soil transitioned to a lighter grey (like the Zone 9 context in Square D) in the northern half which is farther on mound. The transition was gradual and slight, making it difficult to detect a clear contact. Most of the artifacts collected were from the bottom of the zone and are likely terminal debris sitting on the Zone 9 floor surface. Zone 7 was similar in context to Zone 5 collapse debris.

Zone 8

Zone 8 of Operation 31 was a silty-clay, earthen layer (7.5YR 4/1) below Zone 1 in Square C. It could be considered similar in context to Zone 2. The matrix was densely packed with speckled limestone and very few artifacts – most were faunal remains and a few were debitage and pottery sherds. A very large deer long bone came out of this zone and square. Unfortunately, we were not able to point plot it because we were using a pick axe. Fifty percent of soils were screened. Excavation of this zone and square began on 1/13/17 and ended on 1/21/17. After bisecting Square C into western and eastern halves, excavation of this zone began on the eastern side and ended in the western side. The goal was to locate more architecture - a possible superstructure, second terrace wall, or step. However, no other architecture was found this season. The zones were tricky to excavate due to the sun drying the clay and baking it, which altered soil colors. Also, in the western profile, an intriguing pattern was identified. The undulating shape of the stratigraphy—a pattern that one of our local excavators called "potato holes"—may suggest the mounding effects of soil accumulation in wetland environments (see western profile of Op. 31 in **Figure 9.5**). There was some mixing between Zones 1 and 8 within Square C, due to this undulating stratigraphy that was only visible in the western profile. Curiously, this undulating pattern does not appear in the eastern profile. Chert and limestone cobbles were concentrated in the southern portion of the eastern bisection of Square C and are visible in the plan view (**Figure 9.6**). The dark stain with no inclusions first found in the northeast quadrant of Square D extended into this southeastern edge of Square C. This stain was not given a zone, nor was it excavated separately. A soil sample was taken from Zone 8. Soils were collected by scraping the bottom of the zone across the whole square with a trowel.

Zone 9

Zone 9 of Operation 31 was identified as a terminal use surface that was poorly preserved and difficult to discern other than a lighter gray silty-clay (10YR 4/1) matrix and artifacts lying flat on its surface. The zone is located south of the terrace retaining wall (Zone 6) and is associated with the top two courses of the four course-high retaining wall. The top (fourth) course of the wall is mostly collapsed. The Zone 9 matrix lies directly below the Zone 5 collapse debris and directly above the Zone 10 construction fill. A lithic agricultural or woodworking tool (the possible tranchet adze in **Figure 9.3**) and a broken stemmed macroblade (see top left artifact in **Figure 9.7**) were found in Square D lying flat in front of these stones at roughly the

same elevation as faunal remains found in both Squares D and E and a concentration of flat-lying ceramics in Square D (approximately 136 cm bd A). A carbon sample was collected 5 cm due east of this lithic tool fragment at the same elevation. This zone ended somewhat arbitrarily after 10 cm and was switched to Zone 10, defined as the associated fill of the Zone 9 surface (see below).

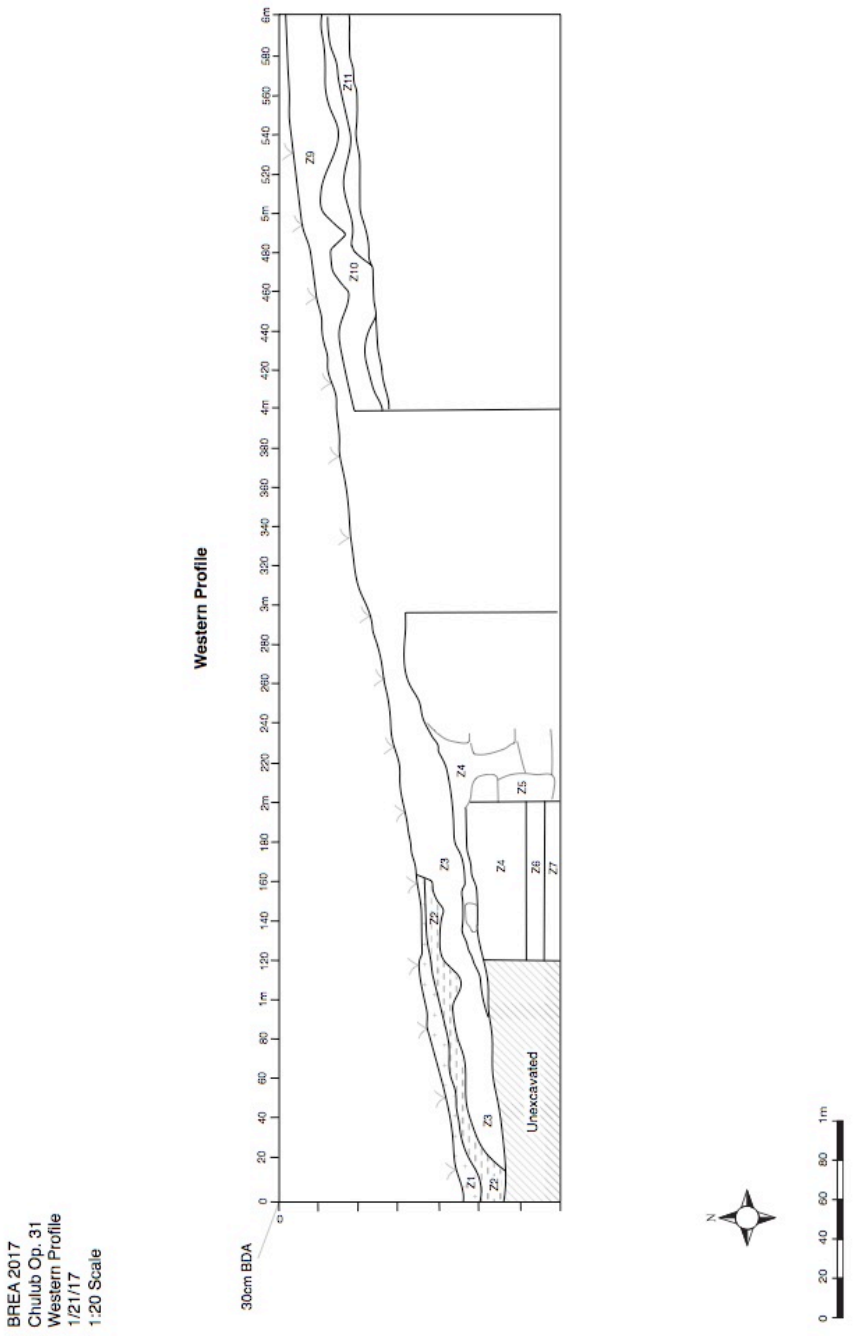

Figure 9.5 Western Profile of Operation 31
(drawn by K. Flanagan; digitized by K. Titus and M. Brouwer Burg).

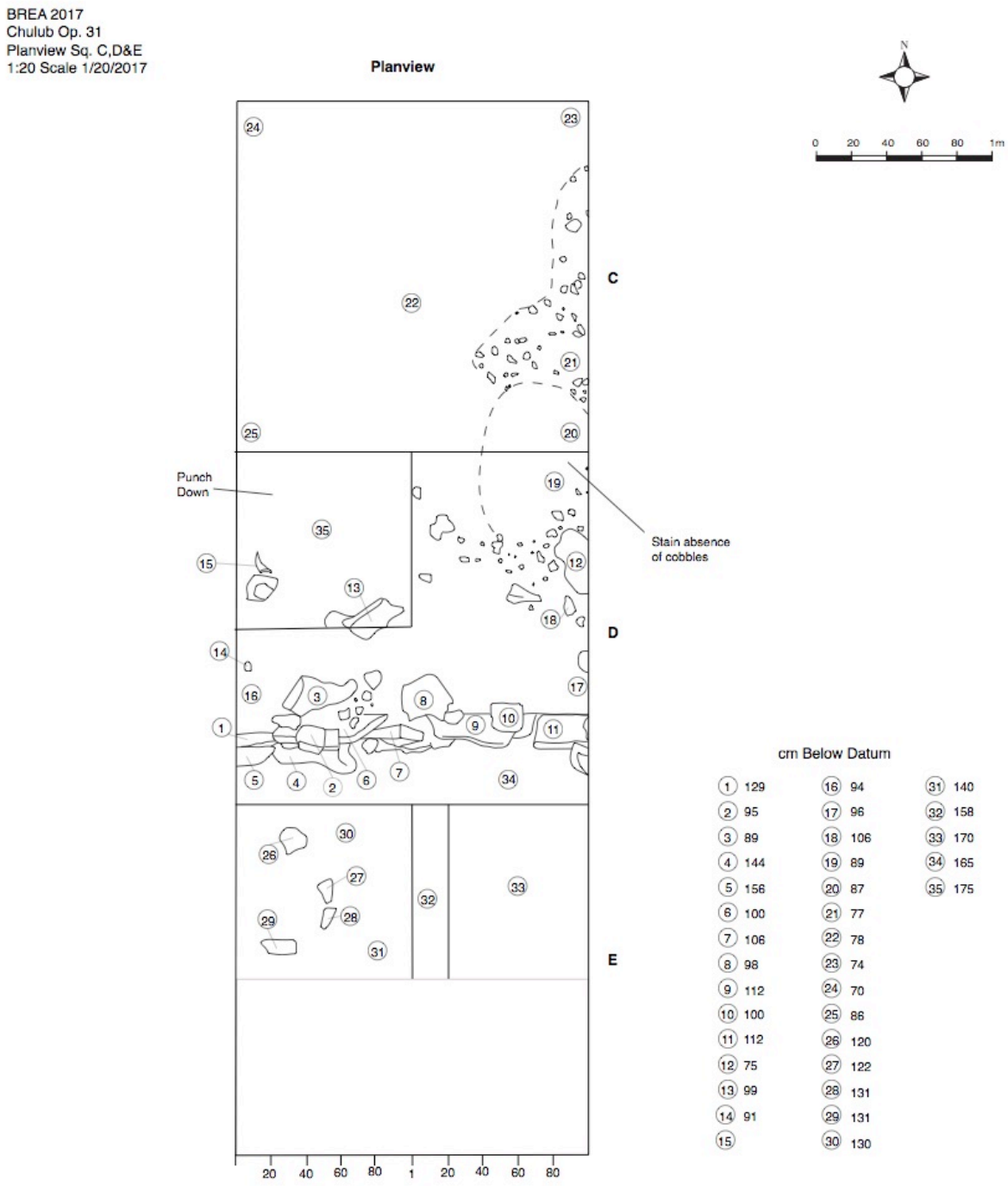

Figure 9.6 Plan view of Operation 31 at completion of January 2017 field season (drawing by K. Flanagan; digitized by K. Titus and M. Brouwer Burg).

Figure 9.7 Chipped stone tools within Zone 9, Square D (photograph by E. Harrison-Buck).

This poorly preserved floor surface (which upon further investigation may in fact turn out to be a midden deposit) was defined within Square D by a heavy artifact density, including debitage, pottery sherds, chipped stone tools (n=9), ground stone tool (n=1), animal bone, fresh water snail shell, and a radiocarbon (C-14) sample. Excavation of this zone and square began on 1/14/17 and ended on 1/21/17. All buckets were screened. This zone contained a mix of tiny limestone inclusions, charcoal, and orange flecks in the matrix with abundant whole and fragmentary freshwater shells. The Zone 9 context was notably different than the collapse debris

of Zone 5 above it. There were many more artifacts and limestone inclusions. Also, a lot of charcoal was scattered within this matrix. Two faunal bones were discovered within the southwest corner of this zone in Square D, plotted on a sketch map, and collected (D2 was from 136 cm bd A and D3 was from 137 cm bd A). Soil samples were taken from Zone 9 within Square D for water screening so as to collect a sample of micro-faunal remains from this midden-rich fill. Samples were created by scraping the across the middle of the entire zone (approximately 136 cm bd A) with a trowel.

This same zone within Square E also had a heavy artifact density, including debitage, pottery sherds, body sherds, rims, chipped stone tools (n=4), a ground stone tool (n=1), marine shell and animal bone. The soil is a silty-clay matrix (10YR 4/1). Excavation of this zone and square began on 1/18/17 and ended on 1/21/17. All buckets were screened. Due to the sloping collapse, Zone 9 was below Zone 5 in the northern half of the square, and below Zone 7 in the southern half of Square E. We bisected the square into eastern and western halves and only continued to excavate down in the eastern half to look for another earlier surface – the one that all terrace stones rested upon at the same, even level. The zone ends arbitrarily after 10 cm. A soil sample was also recovered from this zone in Square E as well. The same method of trowel scraping was used, but Square E's sample was taken from the top of the zone in this square (approximately 130 cm bd A). Zones 9, 10 and 17 had similar matrices and artifact assemblages and may be considered as part of the same context.

Zone 10

Zone 10 of Operation 31 was an arbitrarily delineated 10 cm earthen layer. It appears to be the construction fill of the Zone 9 surface directly above it. The zone consists of a heavy artifact density (debitage, fresh water snail shell, pottery sherds, and animal bone). It is a silty-clay matrix (7.5YR 4/1) like Zone 9, and it was removed to locate the surface that the structure's terrace wall sat upon (Zone 11). Excavation of this zone and square began on 1/19/17 and ended on 1/21/17. All buckets were screened. This zone was only present in southern portion of Square D – south of the terrace wall – and the northeastern quadrant of Square E.

Zone 10 within Square E also had a heavy artifact density (debitage, chipped stone tools (n=2), fresh water snail shell, faunal remains, marine shell, pottery sherds) with a silty-clay matrix (7.5YR 4/1). Excavation of this zone and square began on 1/19/17 and ended on 1/19/17. All buckets were screened. Zones 9, 10 and 17 had similar matrices and artifact assemblages and it is possible that further investigation will reveal they are in some way part of the same construction phase.

Zone 11

Zone 11 is located south of the terrace retaining wall within Squares D and E. The zone consists of an earlier "floor" surface associated with the initial phase of the platform structure (at least the first two courses of the retaining wall were built at this time). Zone 11 is directly below Zone 10 (construction fill of Zone 9 surface) and is above the Zone 13 sterile earthen layer. This

zone has a similar elevation and matrix as the Zones 18 and 19 platform fill excavated within the 1m x 1m square excavated inside the platform construction just behind (north of) the terrace retaining wall stones (see **Figure 9.5**).

Zone 11 within Square D has a medium artifact density (debitage, animal bone and pottery sherds) with a sandy-clay matrix (7.5YR 4/1) and tiny white limestone and orange decaying ceramic inclusions with charcoal flecks. Excavation of this zone and square began on 1/19/17 and ended on 1/21/17. All buckets were screened. The zone halted at a context change after 7 cm in the east and 16 cm in the west. A lens of white marl (2.5Y 6/1; Zone 13: 157 cm bd A) was identified in the east as the surface (Zone 13) that the stones were placed on. This lens was absent in the west, however, and the bottom of the furthest western stone ended at the water table (180 cm bd A). The "surface" the structure was built upon, therefore, was not level and sloped deeply towards the west.

Zone 11 in Square E had a light artifact density (debitage and pottery sherds) with a sandy-clay matrix (7.5YR 4/1). Excavation of this zone and square began on 1/19/17 and ended on 1/21/17. All buckets were screened. The matrix was like Zone 9 and 10 but darker, sandy and more compact. It is most similar in context to Zones 18 and 19. Limestone, charcoal, shell fragments and decaying ceramic inclusions are speckled throughout the matrix. Faunal bones were also collected from this Zone (E11 = 154 cm bd; E12 = 154 cm bd; E13 = 157 cm bd; E14= 162 cm bd). Excavators only removed soils in the northwest quadrant of Sq. E (80 cm x 1 m), creating a 20 cm baulk on the west side of this quadrant. This demonstrated the zone/surface changes between Zones 9, 10 and 11, and allowed for zone comparison.

Zone 12

Zone 12 is construction fill layer underlying the terrace retaining wall (Zone 6). These small and medium limestone cobbles were removed to clearly see the start of the first course of the retaining wall. This zone was only present in Square D (not shown in **Figures 9.2** and **9.5**). This zone contains a medium artifact density (faunal remains, debitage and pottery sherds) with a minute amount silty-clay between the cobbled matrix (7.5YR 4/1). Excavation of this zone and square began on 1/19/17 and ended on 1/121/17. All buckets were screened. The cobbles appear to sit on Zone 13 sterile earthen layer and suggest this was the initial construction fill to be laid down with the construction of the Zone 6 retaining wall and Zone 11 floor surface. Many of the stones were not removed because the larger wall stones were sitting on top of them. This suggested that they were part of the construction fill, possibly thrown down before the first course to prevent the wall from sinking into the soft mud (like it did in the west).

Zone 13

Zone 13 is a 10 cm thick, sterile lens just above the water table on the eastern half of Squares D and E (**Figure 9.8)**. The matrix was a white and gray mottled, soft, sticky, silty-clay (2.5Y 6/1). This zone was found on 1/20/17 and left unexcavated in Square D. All buckets were screened.

The portion of Zone 13 within Square E that was excavated also yielded no artifacts. Excavation of this zone and square began on 1/19/17 and ended on 1/21/17. All buckets were screened. The only artifacts found were located at the interface of Zones 11 and 13 and ultimately collected as part of Zone 11. Excavators used a post-hole digger to punch down 10 cm into this zone and it filled with water (see **Figure 9.5**). The water level was recorded at 180 cm below Datum A. Zones 13 and 19 had similar sandy-clay textures to their matrices, similar elevations close to the water table, and might be considered the same "sterile" context on which the Maya constructed their living surfaces and platform structures.

Figure 9.8 North facing image of the retaining wall (Zone 6) and the "sterile" matrix (Zone 13) that it was built upon (photograph by K. Flanagan).

Zone 14

Zone 14 is 10-15 cm thick and included the terrace surface and the fill just below it. Excavators removed a 1m x 1m square on the northwest side of the terrace wall (Zone 6) to look for diagnostic artifacts to date the construction of the platform and to clarify the nature of its construction. It is similar in context as Zone 3 and Zone 4 - dark, densely packed, silty-clay matrix (10YR 3/1) filled with small to medium-sized cobbles (approximately 50%, cobble density increased as the depth increased), with a heavy artifact density (faunal remains, marine faunal (coral n=4), debitage, chipped tools, pottery sherds, and a possible ceramic net weight (see **Figure 9.1**). Elevations followed context changes and were deeper in the north and shallower in the south. This zone was only located within Square D. Excavation of this zone and square

began on 1/20/17 and ended on 1/21/17. All buckets were screened. The zone ended when the soil color lightened and cobble density increased. Cobble assortment was a 1:1 ratio of chert to limestone.

Zone 15

Zone 15 is a construction fill context located directly below Zone 14 and contains a heavy artifact density, including animal bone, debitage, chipped stone tools (n=2), ceramic sherds, and ceramic rim-sherds. The fill is a dark-brown clay matrix (10YR 3/2). Excavation of this zone and square began on 1/20/17 and ended on 1/21/17. All buckets were screened. A context change was seen at a higher elevation in the north and lower in the south, demonstrating the influence of the slope on construction. This zone was 4 cm thick in the north and 13 cm thick in the south. The zone ended with a context change (Zone 16) characterized by lighter soil color, and increased size of construction fill, medium-sized boulders and large-sized cobbles of limestone and chert and initially a lighter density of artifacts (but see below). The Zone 16 construction fill was approximately 75% chert and limestone cobbles. The chert to limestone ratio remained about 1:1.

Zone 16

Zone 16 cobble fill north of the terrace wall and directly below Zone 15 was taken down in an arbitrary 20 cm thick level. The zone ultimately yielded a high artifact density (special sherds, rim-sherds, debitage, daub, chipped tool fragments and obsidian) with a dark grey, silty-clay matrix (10YR 4/2). Excavation of this zone and square began on 1/20/17 and ended on 1/21/17. All buckets were screened. Darker soils existed deeper in the south than the north. The zone ended arbitrarily but was still slightly sloped due to the lumpy, cobbled nature of the fill. The matrix was mostly limestone and chert cobbles and boulders (approximately 80%). A large Sibun Redneck rim-sherd was found standing vertically within this zone. The zone was changed arbitrarily to Zone 17 at the bottom of the rim-sherd.

Zone 17

Zone 17 is located directly below Zone 16 and is approximately 20 cm thick. The zone consists of a silty-clay matrix (10YR 4/1) with a medium artifact density, including debitage, chipped stone tools and fragments (n=7), and pottery sherds. Excavation of this zone and square began on 1/20/17 and ended on 1/21/17. All buckets were screened. The high density of large cobbles and artifacts suggested this was still fill context. Cobbles were larger than previous zones and the ratio of chert to limestone was still about 1:1 . The zone ended when cobble density abruptly lightened. There may be some mixing of artifacts between Zones 17 and 18, due to an excavator error (went about 5 cm too deep in the southwest corner). The western and eastern profiles continued to demonstrate a downward slope - cobbles ended at a higher elevation in the north. The bottom of Zone 17/top of Zone 18 revealed a context change that included limestone speckles and charcoal.

Zone 18

Zone 18 is earthen layer directly below Zone 17 that is approximately 15 cm thick. The matrix is similar in color, texture and inclusions to Zone 11m suggesting that this was the fill associated with the construction of the platform and that Zones 11 and 18 may have been a surface on which the platform was initially built (the eastern profile shown in **Figure 9.2** shows the retaining wall of the platform sitting on the Zone 11 surface, more clearly than the western profile shown in **Figure 9.5**). Although the profile drawings do not reflect this equivalence, the beginning elevation of Zone 18 matches the top elevation of Zone 11 at ~150 cm below Datum A. This zone had a light artifact density (debitage, chipped tool fragments, and pottery sherds) and a sandy-clay matrix (10YR 3/1) with tiny white limestone and orange decaying ceramic inclusions with charcoal flecks. Excavation of this zone and square began on 1/21/17 and ended on 1/21/17. All buckets were screened.

Zone 19

The nineteenth zone within this Operation was an earthen layer below Zone 18. This zone had a light artifact density (pottery sherds, debitage, and a non-pottery ceramic including a possible net weight (see **Figure 9.1**). Zone 19 consisted of a more compact, darker, sandy-clay matrix (10YR 3/1) than Zone 18. This zone also had fewer inclusions than the previous zone. It was a darker clay with mottling of the white matrix found in Zone 13 (2.5Y 6/1) at the bottom. The fall off of artifacts also resembled the sterile matrix of Zone 13. The soil abruptly became loose and wet at about 175 cm below Datum A. Excavators stopped digging at this elevation to avoid water infilling the unit. Excavation of this zone and square began on 1/21/17 and ended on 1/21/17. All buckets were screened.

Zone 20

Zone 20 was the unexcavated dark soil found straddling Squares C and D.

Interpretations and Conclusions:

Further investigation of Structure 48 would help to better understand its architectural construction sequence and its association with the nearby pond features. Based on this season's excavation, however, we can surmise that it was likely a rectangular platform created by four exterior retaining walls (between 80 and 100 cm in height) that was infilled with soil, limestone, chert and re-deposited midden.

All context changes followed a downward slope toward the southwest, suggesting mucky and un-even occupation and construction surfaces. The retaining wall was built upon a sandy matrix [occasionally marked by a sticky "sterile" lens (Zone 13) of white matrix] just above the water table. A large quantity of soil was piled high above the final course of the terrace wall in the center of the platform. There was no secondary retaining walls or superstructures identified

this season. The persistent slope of this platform may have assisted with water management in this wetland environment. The artifacts associated with this structure suggest fishing (net weights), wood-working (chipped-stone tools) and animal processing (chipped-stone knife and faunal remains) occurred at this location.

The Zone 6 retaining wall consisted of at least four courses in its final phase, although the courses were not well defined due to irregularities in size, shape, material and the alignment of the stones (**Figure 9.9**). The bottom course exposed in Square D was composed of five larger, uncut and unshaped stones. They do not appear to rest on a level surface (Zone 11). The first course of the retaining wall sat at the interface of Zones 11 and 13 (160 cm bd A), which indicates that this wall was built upon the Zone 13 surface - a 5 cm thick, white (2.5Y 6/1) sandy-clay lens on which the Zone 12 fill was first laid down, then the wall, and then the Zone 11 floor. The Zone 13 lens was not seen in the western half of the square before the water table was encountered (at 180 cm bd A). Instead, a dark grey sandy-clay (10YR 3/1), similar to the Zone 11 matrix, was present at the western base of the retaining wall. The foundation stones either sank into the wetland muck over time or they were laid in an uneven fashion. Within the 1m x 1m excavation behind the terrace wall, the bottom of Zone 19 had white and dark soils mottled together at 175 cm bd A. Excavations halted 5 cm above the water table in Zone 19. The evidence suggests that this structure was built up out of the swamp, with foundation stones directly above the water table.

A second course of large boulders sat atop the bottom course, but these stones were more nicely faced. The third course exposed in Square D consisted of one large, seated, semi-faced stone and four large, un-faced stones (slipped out of place); and two small, seated stones. The top course was mostly collapsed, however, its existence was proven by the fourth retaining wall stone seen in the eastern profile (see **Figure 9.2**). This top course appeared as poorly faceted as the bottom course.

To further understand the platform construction, a 1 m x 1 m "punch-down" was excavated at the southwest corner of the platform. Zones 14, 15, 16, and 17 were composed of construction fill contexts. Their matrix compositions were mostly chert and limestone cobbles and boulders, accompanied by lithic and ceramic fragments. Zones 18 and 19 were composed of a similar matrix as Zone 11. Although Zone 18 begins at a slightly higher elevation, it is possible that this platform began as a natural rise in this transitional wetland-riparian environment that was reinforced with the retaining walls by the builders of this structure. This could also explain the general southwest sloping of the stratigraphy throughout the excavation.

Figures 9.10 and **9.11** show the southern profiles (photographed and drawn) of the "punch-down" within the terrace. The Zone 16 cobble construction fill is a distinct break from Zones 14 and 15 above and suggests that possibly Zones 16, 17 and 18 and the 11 surface represent an earlier phase of construction built over top of what appears to be a natural "sterile" matrix (Zones 13/19). Zones 11, 13, 18 and 19 had similar sandy-clay matrices and may be considered the primary surface and fill on which the platform structure was built (see **Figure**

9.5). If this is the case, it is possible that Zones 9, 10, 14 and 15 represent a later phase of construction, which added two top courses onto the Zone 6 retaining wall of Structure 48.

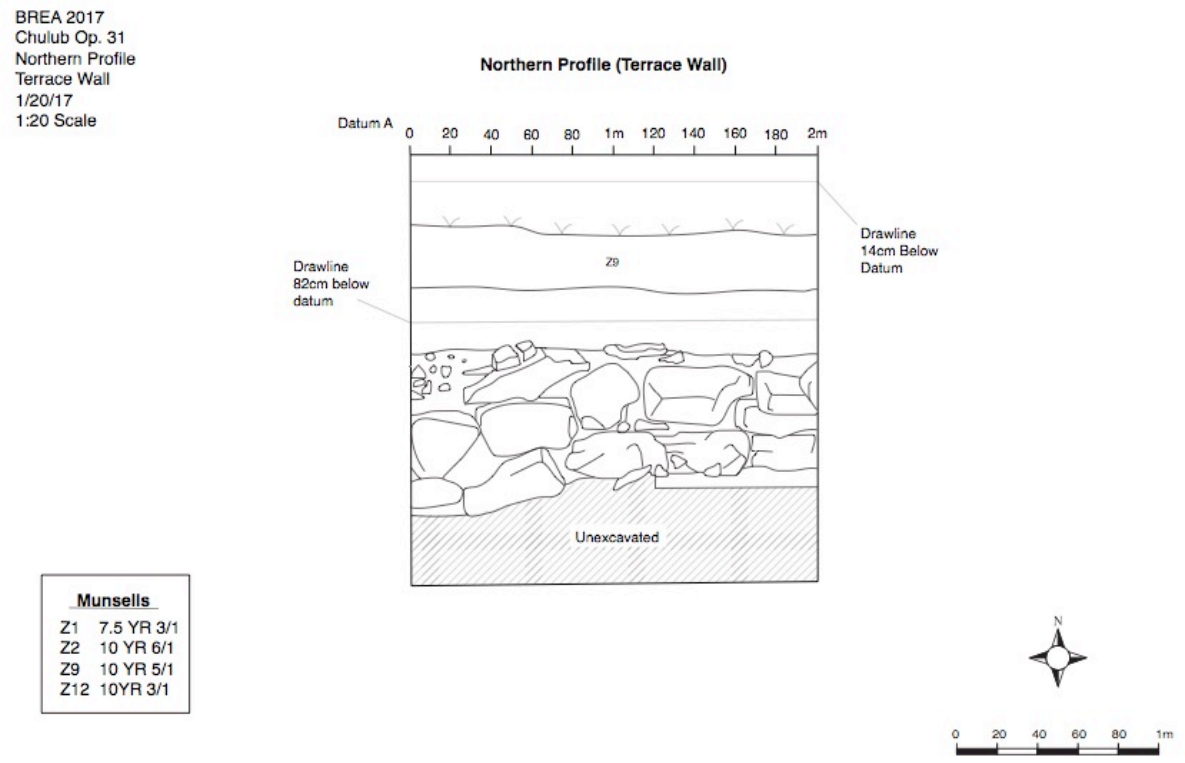

Figure 9.9 Northern profile of Square D and cross-section of the retaining wall (drawing by K. Flanagan; digitized by K. Titus and M. Brouwer Burg).

Zone 9 could be considered the terminal surface context, although it is possible it is the remains of a midden heap. This zone was dense with artifacts, including lithic debitage, animal bone, pottery sherds, and shell, along with many chipped stone tools (10 tools found in Zone 9 Squares D and E and 7 found in Zone 17 Square D). At least two formal chipped stone tools (tranchet adze and stemmed macroblade), and one smashed ceramic were found lying flat at the top of this zone, suggestive of a floor surface. However, the surface is undulating and slopes downward to the south (see **Figures 9.2** and **9.5**). It is possible that the retaining wall was originally composed of more courses that have since collapsed. It is also possible that there was originally a superstructure that has since been destroyed. Another possibility is that another course does exist, but this year's excavations did not find it. The mounding may also have been an intentional element of construction. A constant slope encourages adequate drainage of a mound.

Clues as to the purpose, use and date of the structure are found in the artifacts present. A total of four non-pottery ceramics, three ground stone tools, 32 chipped stone tools, 29 fragments

of coral, and 1 piece of daub were recovered from this structure. The various formal tool types that are present may reflect economic specializations within Maya sites (Chiarulli 2016: 246).

BREA 2017
Op. 31 Chulub 1/21/17
Sq. D Southern Profile
Punch down

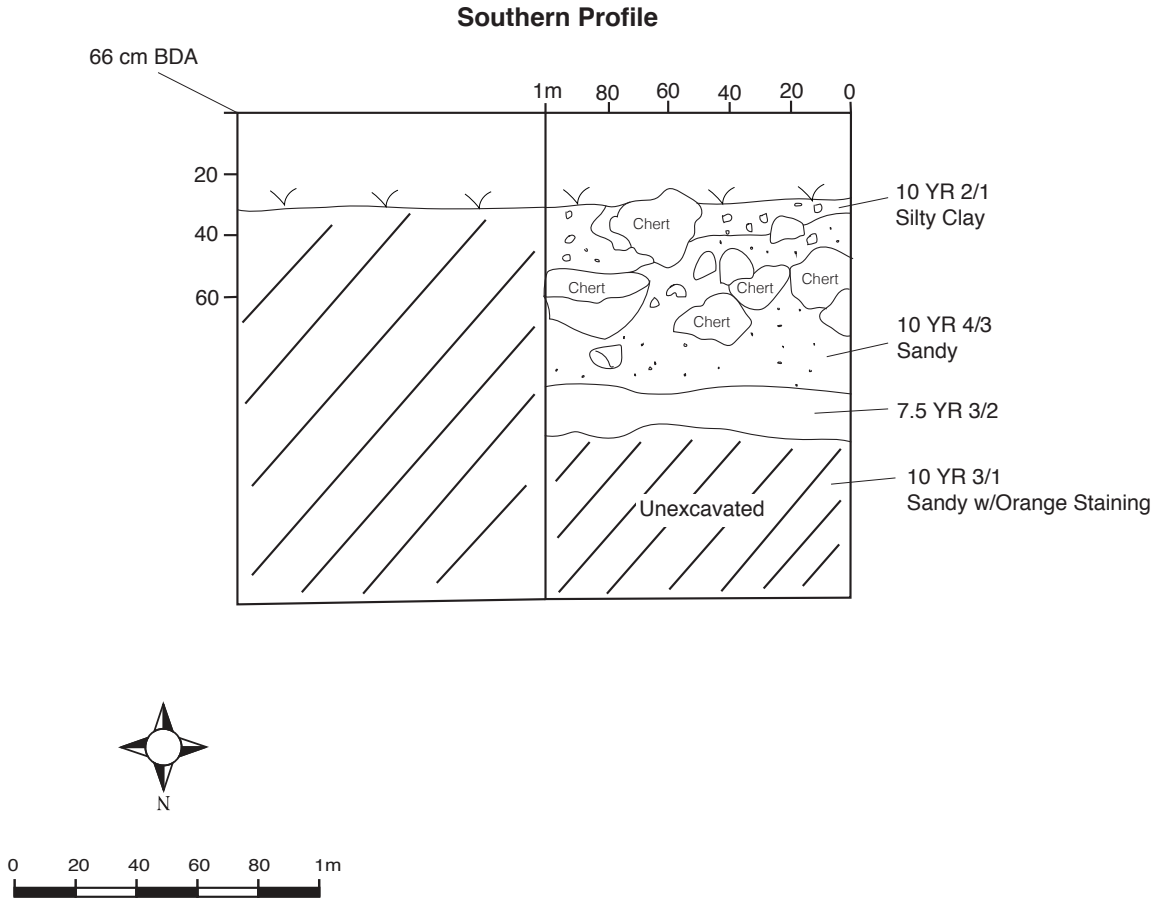

Figure 9.10 Southern profile of the Punch-down into Structure 48's terrace; Square D (drawing by K. Flanagan; digitized by K. Titus and M. Brouwer Burg).

Figure 9.11 Southern punch-down profile (photograph by K. Flanagan).

The recovery of one lithic tranchet adze (interface of Zones 5 and 9: **Figure 9.3**) and two oval bifaces (Zone 3 and Zone 6) suggest agricultural or woodworking practices at this location. The stemmed macroblade and 31 other chipped stone tools recovered suggest cutting or sawing activities. Most of the chipped stone tools were recovered from Zone 9 (N=13; **Figure 9.7**) and Zone 17 (N=7; **Figure 9.12**). Similarities in artifact type and density is intriguing and may point to a contemporaneous relationship between these two zones, but this requires dating with closer analysis of the diagnostic artifacts. Parallels between the interior and exterior construction at higher elevations than the structure foundation may suggest a gradual building of the retaining wall over time. One possibility is that as wetland site water levels rose, the builders added new courses to the wall to further elevate the platform.

Marine coral was also located within the fill of the platform. Coral could have been used for sanding rough surfaces. It could also be a ritual item. The Maya cosmos generally associate marine resources with the Primordial Sea and the Underworld (Guderjan 2007:26). Although the coral did not appear intentionally placed, it did appear to be burned slightly. These marine resources would have taken three days to arrive at this location by canoe via the Western

Lagoon. They were likely valuable economically if not also ritualistically. At least one of the non-pottery ceramics was identified as a fishing net weight (from Square D, Zone 6). Although more analysis is required, the circular discs with perforations could be identified as a type of net weight. Their presence suggests fishing activities (**Figure 9.1**).

Figure 9.12 Chipped stone tools within Zone 17, Sq. D (photograph by E. Harrison-Buck).

Faunal remains were also found in relative abundance at this location compared to other operations at Chulub excavated during January 2017 (see Harrison-Buck, Chapter 10; Shelhamer and Craig, Chapter 11). Again, further analysis is required to determine the species and number of individuals, but a preliminary examination suggests the presence of deer, turtle and gastropod remains. The conch shell (*Strombus gigas*) pendant or bead from Zone 6 was also an exciting find. The presence of the marine shell supports the possibility of trade activities between this site and sites closer to the coast. While most of the artifacts recovered from this locale point to production activities, this piece suggests personal adornment was also important to its occupants. Based on the artifact assemblage, we can assume subsistence activities occurred in this location. Woodworking, fishing, agriculture, and animal processing were likely supported by the proximity of Structure 48 to the water features and it resources. The so-called "logwood swamps" of the surrounding lagoons hold abundant sources of logwood, a valuable hardwood species that would have been well suited as hafting for spears, knives, and other implements, which would have enabled all of the aforementioned subsistence activities (Harrison-Buck, personal communication, November 2018).

It is interesting to note the high volume of lithic material that was recovered from Operation 31. Because this area is a wetland, limestone outcrops are not as readily available as

they are in the upland regions. However, chert is much more readily available. The Northern Belize Chert-Bearing Zone (NBCZ) extends from the northern parts of Belize (around Colha) and run south, forking on either side of the island of Crooked Tree. Therefore, chert may have been secured from the quarries in one or both of these locations, either from quarries in the riparian forests along the shores of the Western Lagoon area (in the direction of Chau Hiix) or from quarries that likely exist to the east (in the direction of Altun Ha). The finest chert, however, from the NBCZ comes from the area of Colha. The site of Colha was known to mass-produce and export formal tools from the Late Preclassic into the Classic period (Chiarulli 2016:246). Specifically, oval bifaces, tranchet adzes and stemmed macroblades, were produced by Colha and consumed by sites within close proximity of Chulub. For instance, Lamanai, Altun Ha, and Chau Hiix were among the consumers of these "imported" products (Chiarulli 2016:243). These three sites are relatively close to Chulub. A subsequent analysis of the lithics recovered this season should be conducted to determine if these tools were imported or made on-location. The heavy volume of chert material, including large chert boulders, might suggest that this was a workshop location. The limited number of formal tools makes such a theory questionable, however. Although the sample size is small, the presence of these tools creates a certainty of specific activities and at least hints at the possibility of trade or pilgrimage to surrounding chert bearing sites such as Colha and Altun Ha. Further study, including use-wear analysis of the tools would help to refine our understanding of the activities that took place at Chulub around Structure 48.

Although further analysis of the ceramics recovered from Structure 48 is necessary for more accurate dating of these contexts, a preliminary date may be determined by the presence of a Sibun Redneck jar rim-sherd found within the construction fill of the terrace (Zone 16). Sibun Redneck ceramics are described by Lucero as "[…] large storage jars with a thin red slip applied to the neck and tan paste, as well as everted rims" (2013:42). This description matches the rim sherd recovered from Zone 16 exactly. Sibun Redneck styled ceramics only appear in the Terminal Classic and are most common in households within the Sibun Valley (Harrison-Buck 2007:254-55). This suggests the structure was built during the Terminal Classic or later. It may also suggest trade or pilgrimage between the Sibun Valley and this site.

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Chapter 10

Excavations of a Postclassic Shrine in the Main Plaza at Chulub (Operation 32)

Eleanor Harrison-Buck

Introduction

Chulub was the focus of several excavations during the January 2017 field season (see also Flanagan, Chapter 9; Shelhamer and Craig, Chapter 11). Chulub is an unusual site in that the main plaza where Operation 32 is located is the only area of the site that appears to be a formal residential plaza unit (**Figure 10.1**). All other mounds surrounding this main plaza consist of densely packed structures positioned around a series of linear pond features and appear to be production-oriented rather than residential locales (see Flanagan, Chapter 9 for an example).

The site core of Chulub is mostly cleared cattle pasture, making it easy for the surveyors to map the extent of these mounds (see Murata et al, Chapter 5). Fortunately, the creation of the pasture involved mostly non-mechanized clearing. With the exception of one area that was dug up for a well and a water hole for cattle just north of the main plaza, the site has not been heavily disturbed by bulldozing or other destructive activities. Furthermore, unlike most other sites in the BREA study area Chulub does not show signs of any looting.

Operation (Op.) 32, presented here, was primarily focused around Structure (Str.) 5, an all-stone, square platform (**Figures 10.1** and **10.2**). A high density of stone material was visible on the surface prior to excavation and resembled several other all-stone buildings found at Hum Chaak and Ik'nal, two small sites in the BREA study area (Harrison-Buck 2011 and 2013). These buildings were circular in shape with a single interior room and dated to the Terminal Classic period (ca. AD 780-950). In contrast, excavations of Str. 5 at Chulub revealed a square platform constructed of stone masonry, which appears to date to the Postclassic period (ca. 950-1450). Unlike the structures at Hum Chaak and Ik'nal, the final phase of the square platform at Chulub is somewhat similar to the configuration of Str. 11 found at the site of Saturday Creek in the middle Belize Valley (see Harrison-Buck and Flanagan 2015).

Str. 5 is poorly preserved. It consists of upright slab stone masonry construction that is in a state of collapse. This has created a kind of domino effect with the slabs slumped forward one on top of the other, making it difficult to discern the exterior facing walls from the interior fill of the building. This made excavation and documentation particularly challenging. Despite the poor preservation, at least three phases of construction were tentatively identified for Str. 5. On the top of the square platform there were remnants of a possible one-course high masonry

superstructure, which is defined as the final phase of construction. It is oriented differently than the two earlier phases and is poorly preserved, making it very difficult to follow out, even after the structure was cleared down. No such superstructure was found on top of Str. 11 at Saturday Creek, although a large gaping looters pit had disturbed this building and would have obscured any remains of a one-course high superstructure.

Although some differences appear, the main configuration of the intermediate phase of Str. 5 may be similar to the final layout of Str. 11 at Saturday Creek, which consisted of a radial structure with stairs on all four sides (see Harrison-Buck and Flanagan 2015: Fig. 12.1). In the case of Structure 5 at Chulub, the west, east and south sides of the platform showed hints of what may be the outset stairs of a radial structure oriented roughly 20 degrees west of north. This was designated as the second (intermediate) phase of construction. The earliest phase of construction may represent a cardinally oriented platform. However, excavations mostly focused on broad horizonal exposure of the final phases of construction and excavations generally did not extend to any depth so our understanding of this earlier occupation is more limited.

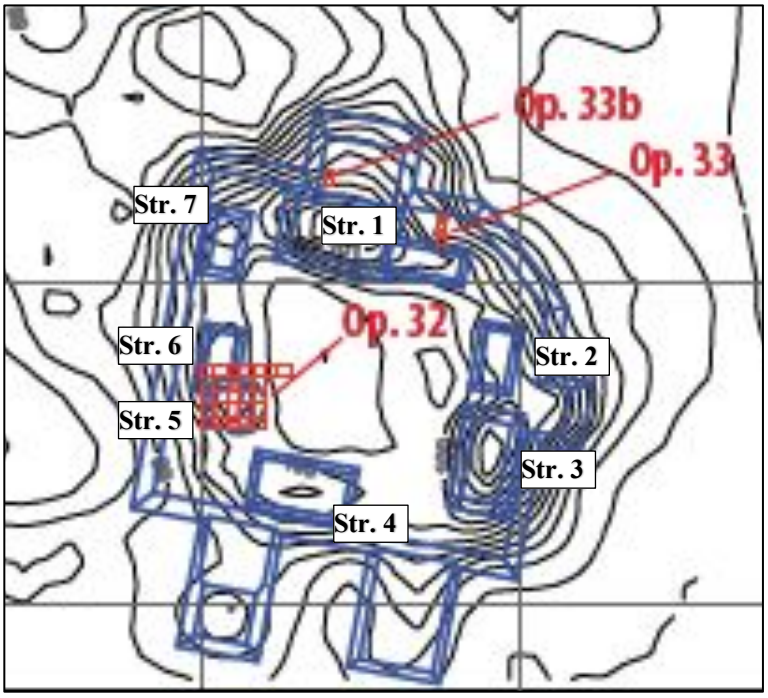


Figure 10.1 Main plaza group at Chulub showing locations of Ops. 32 and 33 (Map by S. Murata and A. Kaeding).

Ceramic analysis is ongoing, but preliminary studies of the material culture suggest the final phase of Str. 5 dates to the Postclassic period. We recovered some fragments of a partially intact Postclassic censer, found smashed and scattered along the northern side of Str. 5 in Sq. H, suggesting a ritual function (**Figure 10.2**). In contrast, a dense deposit of smashed and scattered Late Postclassic censers were found associated with the final phase of Str. 11 at Saturday Creek (see Linseman and Harrison-Buck 2015). While most of the excavations (Ops. 33-35) conducted

at Chulub suggest a final occupation primarily dating to the Postclassic period, Op. 32 excavations associated with the earlier phases of construction in the plaza area showed definitive evidence of a Terminal Classic occupation in earlier layers beneath Str. 5.

Figure 10.2 View of partially excavated Str. 5 at Chulub, looking south with censer fragment defined in the yellow circle in Sq. H (photo by E. Harrison-Buck).

Objectives of the Op. 32 Excavation

1. To determine the architectural layout of Str. 5.
2. To identify the final form of this structure and any earlier phases of occupation.
3. To obtain ceramic and/or carbon samples from each construction phase for use in chronological analysis of the building's development.
4. To collect any associated faunal remains from Str. 5 to identify wetland taxa and assess any changing procurement patterns from Classic to Postclassic times.

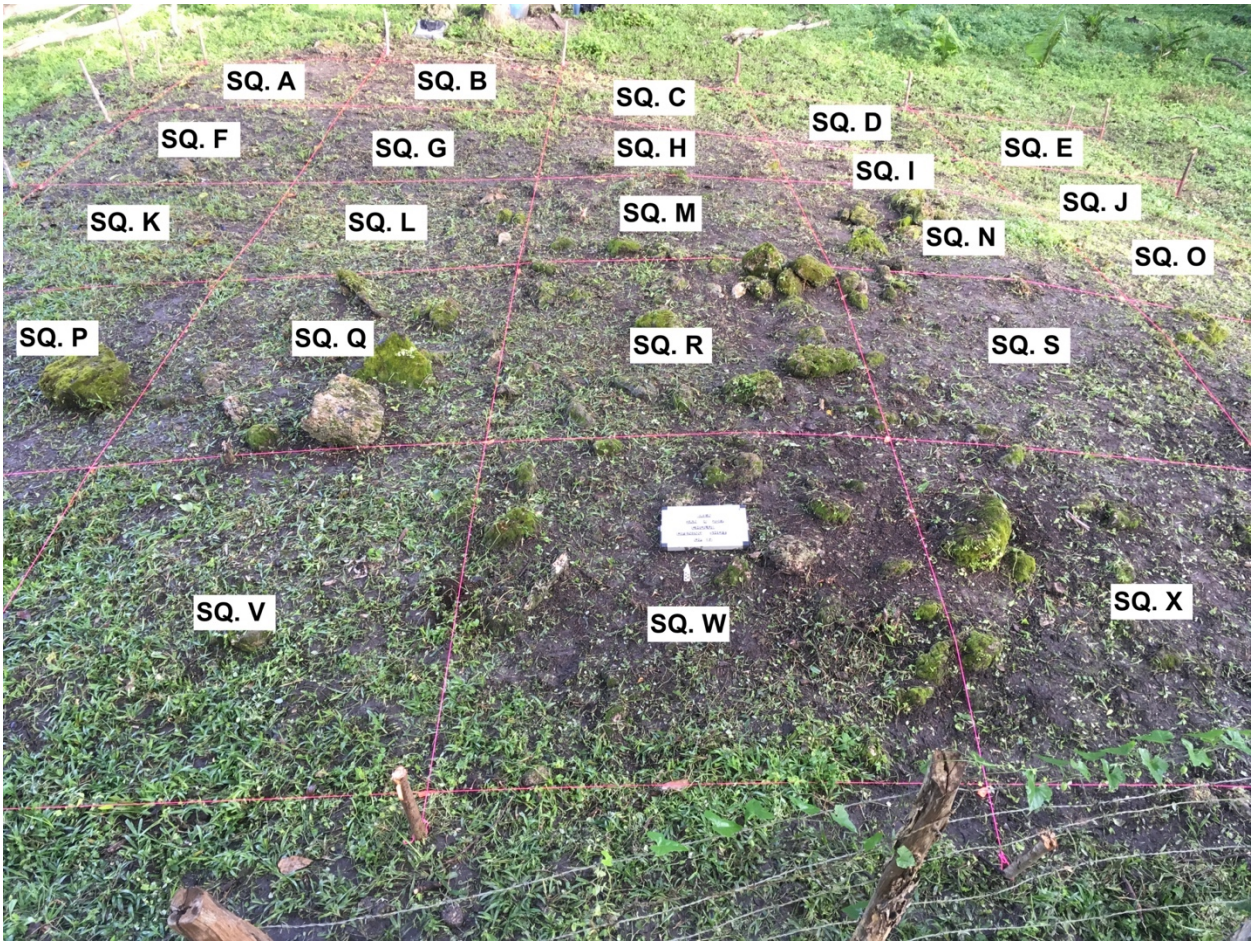


Figure 10.3 Opening shot of Op. 32 (looking north) showing lay out of the squares. Note the large stones visible on the surface prior to excavation (photo by S. Murata).

Description of Operation 32

Op. 32 is a large, cardinally-oriented unit that measures 10 m east-west by 10 m north-south and was divided up into twenty-five 2 x 2 m squares (A-Y) (**Figure 10.3**). A final 2 x 2 m square (Sq. Z) was opened up to the east of Sq. E, bringing the total to 26 squares. Of these 26 squares, a total of 16 (Sqs. A-G, K, P-S, and U-X) were not excavated during the January 2017 field season due to time constraints. Of the 10 remaining squares, seven 2 x 2 squares were fully excavated (Sqs. H, I, M, N, O, T, and Y) and only portions of Sqs. J, L, and Z were excavated during the 2017 season (see **Figure 10.4**).

All of the squares that were excavated were located on mound. The one exception is Sq. Z, a 2 x 2 m extension east of Sq. E, that was positioned partially off mound in the plaza area to the east of Str. 5. The goal of this unit was to expose the plaza surface and to test if there was a deposit of smashed censers similar to the deposit found in the plaza area adjacent to the Str. 10

radial platform excavated at Saturday Creek, as noted above. A secondary goal of Sq. Z was to punch down and expose earlier occupation levels below the latest plaza floor. In hindsight, it may have been helpful in defining the outer edges of Str. 5 to have more exposure of the plaza area off mound. It was extremely difficult to discern intact architecture from collapse debris because the building was in such a poor state of preservation. Because of the slumped architecture, portions of the eastern wall and outset staircase in Sq. O were partially dismantled.

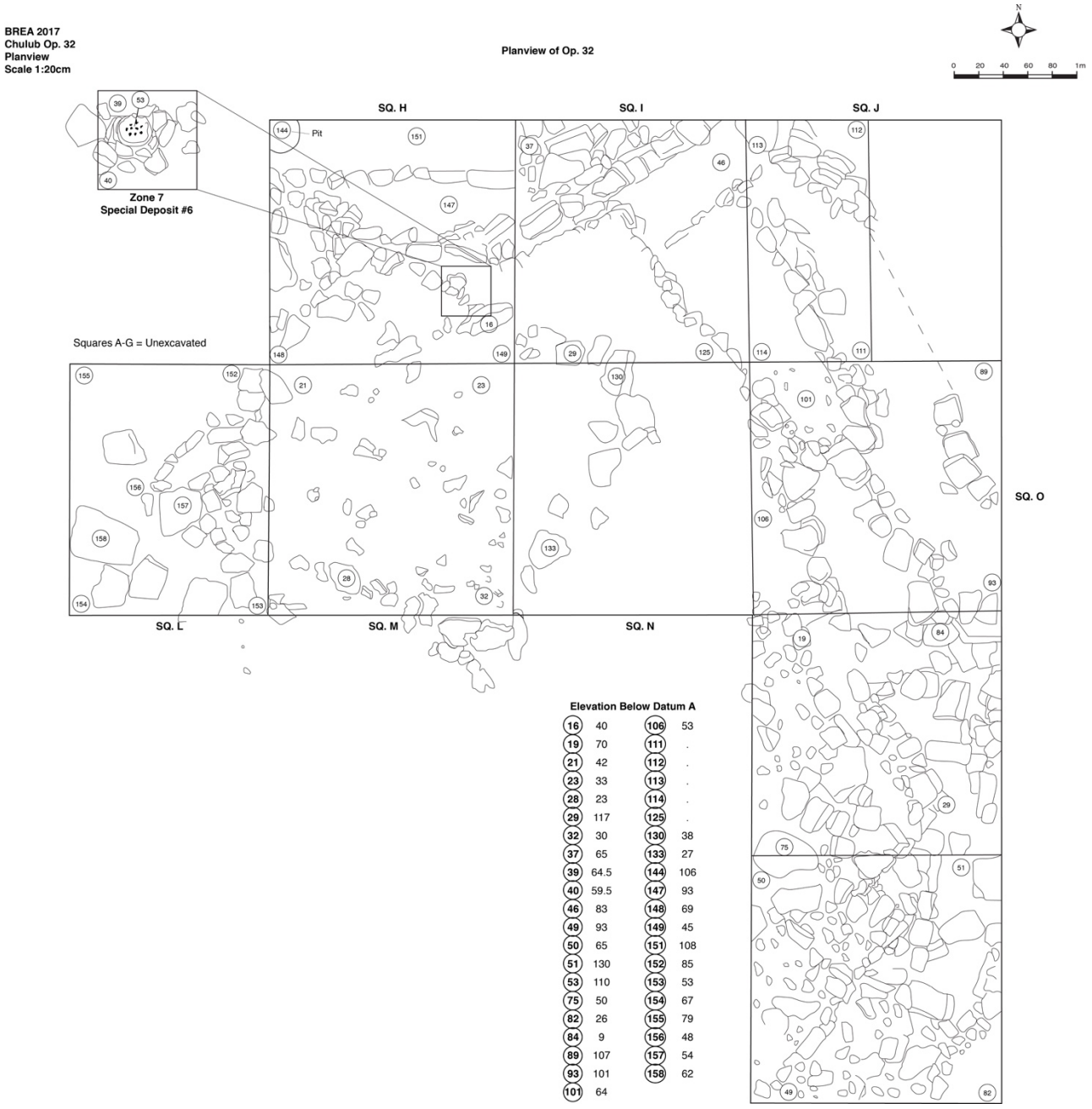


Figure 10.4 Final planview of Op. 32 showing the squares that were excavated (drawn by E. Harrison-Buck, digitized by K. Titius and M. Brouwer Burg).

It eventually became clear that Str. 5 was a square platform, not a circular building. However, it took longer to determine that we were possibly dealing with a radial structure with a series of outset staircases. This was more difficult to discern because of the collapsed slab construction, as noted above. Excavations exposed the northern and eastern sides of Str. 5, its north and southeastern corners, and a portion of the top of the platform (**Figure 10.4**). Excavations on the eastern side of Op. 32 revealed a small area of the plaza, primarily exposed in Sq. Z, a 2 x 2 m extension east of Sq. E (not shown in **Figure 10.4**). Adjacent to Str. 5, just to the north of the platform is Str. 6 (see **Figure 10.1**). A portion of Str. 6 may have been exposed along the northern edge of Op. 32 in Sq. H. This appears to be the southern wall of this platform (see **Figures 10.4** and **10.5**).

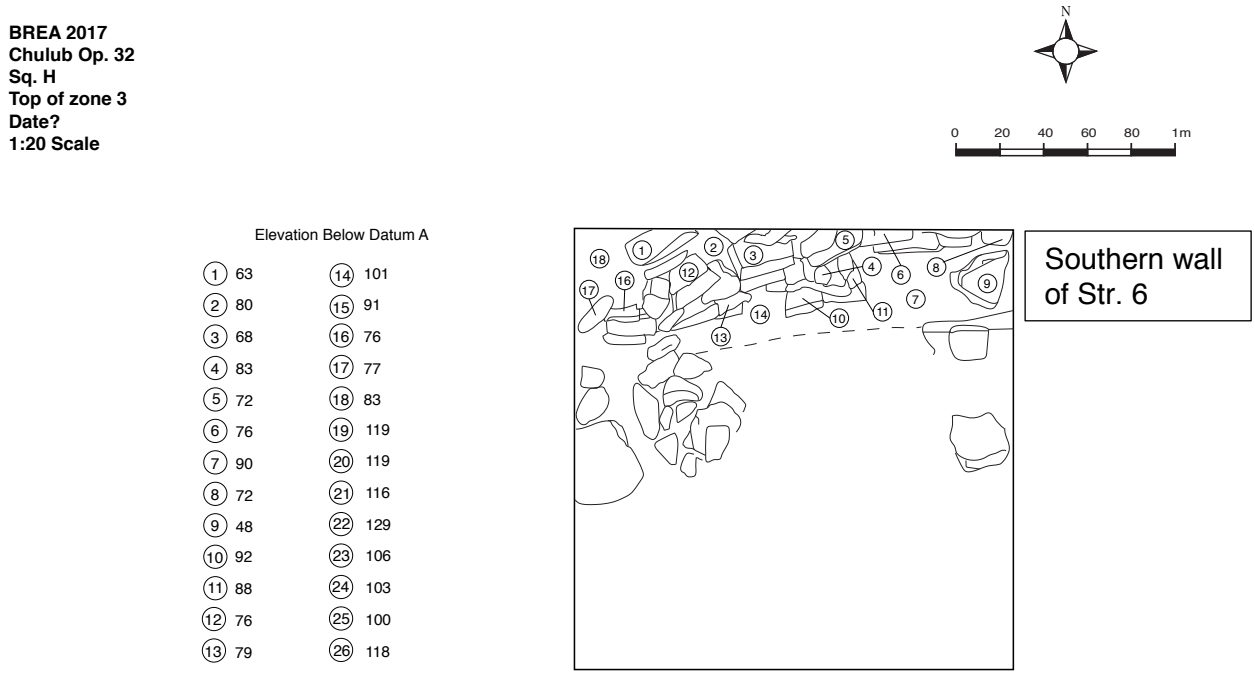


Figure 10.5. Planview of Sq. H showing what appears to be the southern wall of Str. 6 (drawn by E. Harrison-Buck, digitized by K. Titius and M. Brouwer Burg).

Excavation Methods

All vertical measurements throughout our excavations were taken from a single temporary datum point (Datum A), which ultimately was logged as an absolute elevation with the Total Station. We also used the Total Station to map the final plan view of the structure (**Figure 10.4**). For excavation, buckets measuring 5 gallons in volume were used to remove all soil, rocks, and other material from the unit. Zones were separated either arbitrarily at ~20cm

depths or when a color or texture change was noted. In most cases, 100% of all dirt was screened through a ¼" mesh screen, but in some cases where artifact density was exceedingly low only 50% of the dirt was screened. Picks and shovels were used to remove the overburden and trowels were used to define architecture and *in situ* artifacts. Below I review the details of this excavation by zone, our smallest unit of excavation.

Description of the Excavation

Zone 1 - Topsoil

Zone 1 is a thin, dark, organic, humic layer mostly filled with small, medium and large rocks, which appears to be the remains of tumble from Str. 5. This zone was removed from all ten squares (H-J, L-O, T, Y, and Z) that were excavated in 2017. Some root disturbance is present across Zone 1 in all squares, as well as some disturbance from modern fence posts. In addition, red ant presence and tunneling is abundant in Zone 1.

In Square J, excavation was restricted to the western half of the square (1 m east-west x 2m north-south), aimed at exposing the eastern side of Str. 5 and remains of front (plaza) facing steps. Likewise, Sq. L was not a full 2 x 2 m square. In Sq. O, excavations of Zone 1 yielded slightly more artifacts compared to other squares. Portions of an outset staircase appears to have been partially removed in Squares O and T and removed as tumble (see Zone 2 below).

In Sq. T, the southeast corner of Str. 5 was defined at the base of Zone 1, although the preservation made this difficult to discern with any certainty. Likewise, portions of what appear to be an outset staircase were found just to the south in Sq. Y toward the base of Zone 1 and into Zone 2 (see **Figure 10.3**).

Overall, the artifact density was quite light. Some small sherds were found in Zone 1 with very few lithic tools present. A Terminal Classic period ceramic sherd was found in Sq. O, but the vast majority of artifacts recovered from Zone 1 appear to be Postclassic, suggesting a later date for this all-stone structure. A notable artifact found on the surface of Sq. N (which was not formally excavated during 2017) was a side-notched arrow point diagnostic of the Late Postclassic (**Figure 10.6**).

Zone 2 – Collapse Debris

The matrix of Zone 2 consists of a lighter marl-filled soil with a high density of cobble and cut stone collapse debris. This zone was removed from nine squares (H-J, L-O, T, and Y; Sq. Z was separately excavated – see further below). The soil was filled with medium and large rocks, most of which are chert boulders, rather than limestone. Artifact density increased in Zone 2 with mostly ceramic sherds that range in size from small to medium fragments as well as lithic debitage. Larger chunks of lithic with cortex were noted but not collected. These

fragments are likely part of the construction material rather than tools or debitage from tool-making. The ant presence and tunneling was minimal in Zone 2, however, some root disturbance continues. For instance, there is disturbance in the northwest corner of Sq. I that is both the remains of a tree and an old post hole from a cattle fence. At the base of Zone 2 a square all-stone structure that is oriented roughly 20 degrees west of north was further exposed, which has been identified as a possible radial structure and is referred to as such throughout.

In both Sqs. H and I, tumble is dense across this zone with a gray marl matrix representing eroded limestone and plaster. The northern side of a square platform was exposed at the base of Zone 2 in Sq. H that appears to be part of the "radial" structure. Some of the facing stones contain remnants of plaster facing. In Sq. I, the northeast corner of the "radial" structure was exposed at the base of Zone 2. Some of the facing stones contain remnants of plaster facing in this area as well. None of the walls, however, were found well perfectly intact.

Zone 2 in Sq. L is filled with large cut stone which represents the remains of collapse from the western side of Str. 5 and may be the remains of a western facing staircase which was part of the "radial" structure. Due to time constraints, excavations did not continue below Zone 2 in Sq. L.

Excavations of Zone 2 in Sqs. O and T removed portions of what may have been a poorly preserved outset staircase for the "radial" structure on the east side of Str. 5, which had since slumped forward. This was recognized mid-way through Zone 2 and excavations ceased removing what was thought to be collapse debris and attempted to define the remains of any intact architecture (see **Figure 10.4**).

In Sq. Y, two walls of different orientations were exposed at the base of Zone 2. One is associated with the intermediate Phase II "radial" structure oriented 20 degrees west of north and the other may be part of the earlier phase of construction, which appears to be cardinally oriented.

Figure 10.6 Side-notched point found on the surface of Sq. N in Op. 32 (Photo courtesy of the BREA project).

Zone 3 – Collapse Debris

Zone 3 is the collapse debris surrounding the exterior of the all-stone structure below the Zone 2 tumble. It is slightly lighter gray-tan marl-filled matrix with a high density of collapsed stone, including many cut stone blocks with remnants of plaster on the facing. At the base of Zone 3 several poorly preserved walls were exposed that appear to be part of the "radial" platform with a series of outset stairs possibly on all four sides. The best preserved area was the northeast corner in Sq. J (**Figure 10.7**).

Figure 10.7 Northeast corner of Str. 5 in Sq. J, showing remains of what appear to be an outset stair on the eastern side of the structure (Photo by E. Harrison-Buck).

Zone 7 – Special Deposit 6

Zone 7 is a smashed censer found close to the surface in Sq. H of Op. 32. It was given its own zone number to separate it from the other surrounding contexts. It was found almost directly below the Zone 1 topsoil. Excavations continued around the deposit in an effort to fully expose the context of Special Deposit 6. One possibility is that it represents a corner cache

associated with the "radial" structure. However, given is surface location proximate to the one-course high wall, it may have been a surface deposit left on top of the latest phase of the platform. This one-course high superstructure does not align with the intermediate phase and therefore seems to be a separate construction associated with the final occupation of Str. 5.

Figure 10.8 Close-up of the censer deposit in Sq. H of Op. 32 (Photo by E. Harrison-Buck).

Square Z Extension

Sq. Z, a 2 x 2 m extension east of Sq. E (not shown in **Figure 10.4**). **Figure 10.9** shows how this square articulates with the rest of Op. 32. Only half of Sq. Z (1 m north-south x 2 m east-west) was excavated with the aim of exposing the plaza surface and to test for artifact deposits, including smashed Postclassic censers similar to those found on the plaza in front of the radial structure at Saturday Creek. Excavations in Sq. Z on the eastern side of Op. 32 revealed a platform extension (Zone 5) that appears to be part of the "radial" structure. The Zone 5 structure sits on a plaza floor (Zone 6) with preserved remains of plaster. Although no

Postclassic censer deposits were found, earlier Terminal Classic occupation levels below the latest plaza floor were identified in Sq. Z. Below I describe the details of these excavations. Zones 4, 5, 6, 8, and 9, presented below, were defined and excavated exclusively within Sq. Z.

Figure 10.9 Overview shot showing Sq. Z in the foreground in the rest of Op. 32 in the background (Photo by E. Harrison-Buck).

Zone 1

Zone 1 is similar to the topsoil that was removed from other squares throughout Op. 32. This dark humic layer is visible in cross-section in **Figure 10.9**.

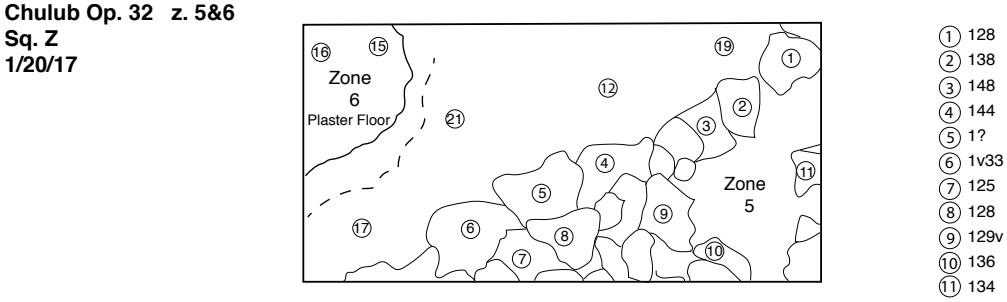
Zone 4

Zone 4 lies directly below the Zone 1 topsoil and consists of collapse debris. Zone 4 is similar to the Zone 2 collapse debris that was removed from other squares throughout Op. 32. At the base of Zone 4, a wall feature (Zone 5) and remnants of plaster floor (Zone 6) were defined (see **Figure 10.9**). These features were photographed (**Figure 10.10**) and drawn (**Figure 10.11**).

Figure 10.10 showing Zone 5 wall and Zone 6 plaster floor in Sq. Z of Op. 32 (Photo by E. Harrison-Buck).

Zone 5

Below the Zone 4 collapse debris, a wall was defined that appears to be part of the "radial" structure as it shares the same orientation. The wall cuts diagonally through the cardinally-oriented 1 x 2 m square. The low wall consists of at least one course of roughly hewn stones and may have a second course (see **Figures 10.9-10.11)**. Zone 5 was excavated with the goal of determining the date of the construction.



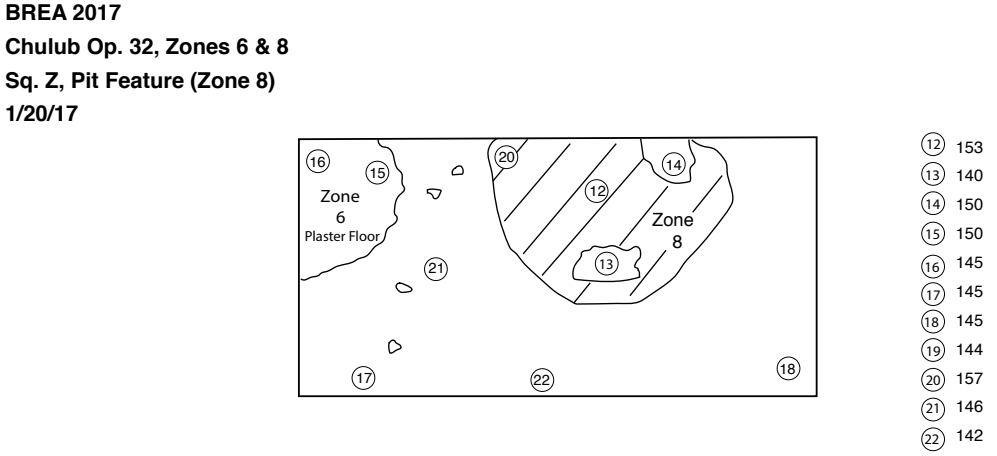


Figure 10.11 Plan views of zones uncovered in Sq. Z of Op. 32 (drawn by E. Harrison-Buck and digitized by K. Titus).

Zone 6

Zone 6 is a portion of a poorly preserved plaster floor that likely represents the remains of the plaza surface (see **Figures 10.10** and **10.11**). It was found preserved in the western side of Sq. Z. The floor was not found intact farther to the east because an intrusive pit feature had been dug into the floor and was never capped (see Zone 8 below).

Zone 8

Zone 8 is a discrete pit feature that consists of a darker matrix that appears to be cutting into the plaster floor surface (**Figure 10.11**). The pit was more fully exposed once the Zone 5 wall feature was removed. The wall feature that is thought to be associated with the Postclassic "radial" structure partially covered the pit feature, suggesting that the wall post-dates the Zone 6 floor and Zone 5 pit feature. Ceramic analysis is ongoing, but Terminal Classic sherds were noted in these earlier contexts.

Zone 9

The Zone 6 plaster floor was not removed, but a posthole was excavated down into the floor and went down about 25 cm in depth. The goal was to see if further phases of construction exist and to collect any diagnostics from these earlier contexts. Ceramics that appear to date to the Terminal Classic period were recovered.

Interpretations and Conclusions

While most of the Op. 32 excavation entailed broad horizontal exposure, Sq. Z provides a snapshot of some earlier phases of occupation dating at least as early as the Terminal Classic period (ca. AD 800-950). Another area of excavation that probed a bit deeper was in Sq. H where as many as three phases of architecture were possibly identified in association with Str. 5. **Figure 10.12** attempts to discern these seemingly discrete construction phases with different colored lines. All of the walls are poorly preserved except for the initial phase (highlighted in green), which is a cardinally-oriented structure that underlies the "radial" structure (highlighted in red). The final phase is a one-course high superstructure situated on top of the Str. 5 platform that does not align with any of the previous orientations. It is so ephemeral that it is a tentative assignment, but the censer deposit does appear to be associated with its "northern" facing (**see Figure 10.4**). The southern edge of Str. 6 can also be made out along the bottom of **Figure 10.12**.

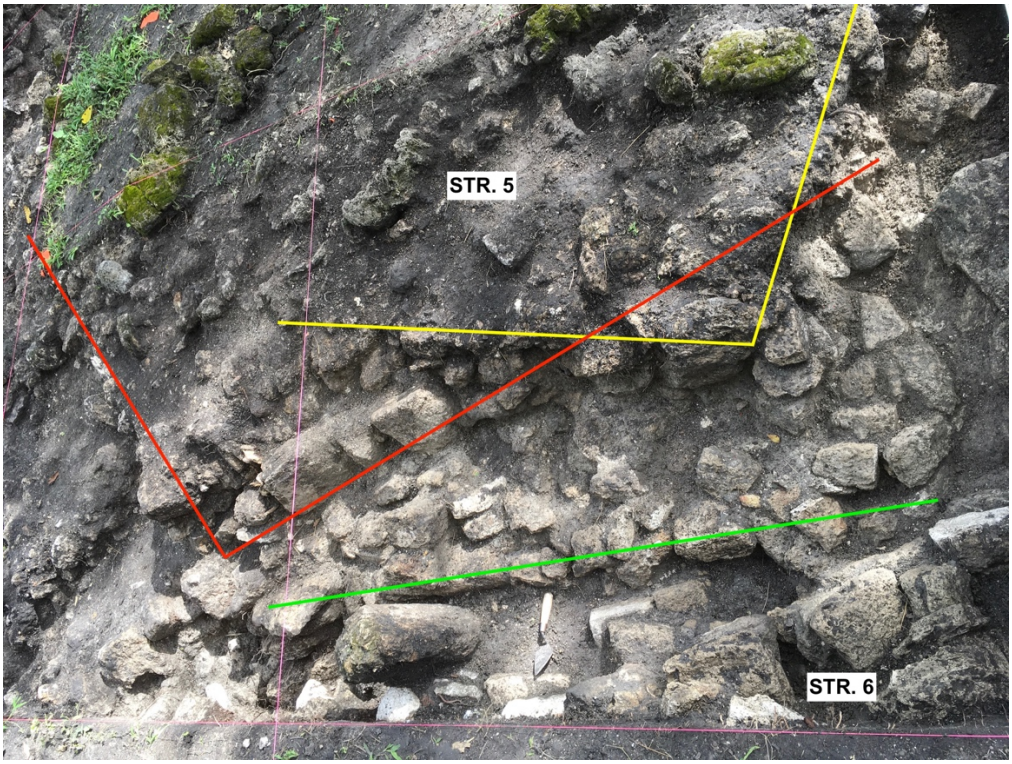


Figure 10.12 Photo of Str. 5 showing three "walls" that appear to be oriented differently, suggestive of three discrete phases of construction (photo by E. Harrison-Buck).

A cross-section drawing also delineates these three proposed construction phases for Str. 5 (**Figure 10.13**). If the intermediate Phase II of Str. 5 is similar in configuration to Str. 11 at Saturday Creek, it would suggest that this building comprised a Postclassic radial structure with outset staircases on all four sides. The use of upright slab construction also bears some resemblance to the building style of Str. 11 and is characteristic of this late time period. However, Str. 11 is much better preserved, probably because it is situated on an elevated acropolis and was not subject to repeated flooding. Chulub, on the other hand, is located on the southern tip of the Crooked Tree island and is surrounding by lagoons and wetlands. The plaza area where Str. 5 is located is only slightly elevated above this low-lying area, which was partially inundated and muddy when we worked at the site in January 2017 at the very end of the rainy season. This periodic inundation over the years likely undermined the slab construction and led to the slumping of the upright stone construction and poor preservation that characterizes Chulub today.

BREA 2017
Chulub , Op32
Profile of
Northern Facing Wall
Showing Earlier and
Later Phases Above
and Below
Squares H, I, & L
1/22/17
Scale 1cm = 20cm

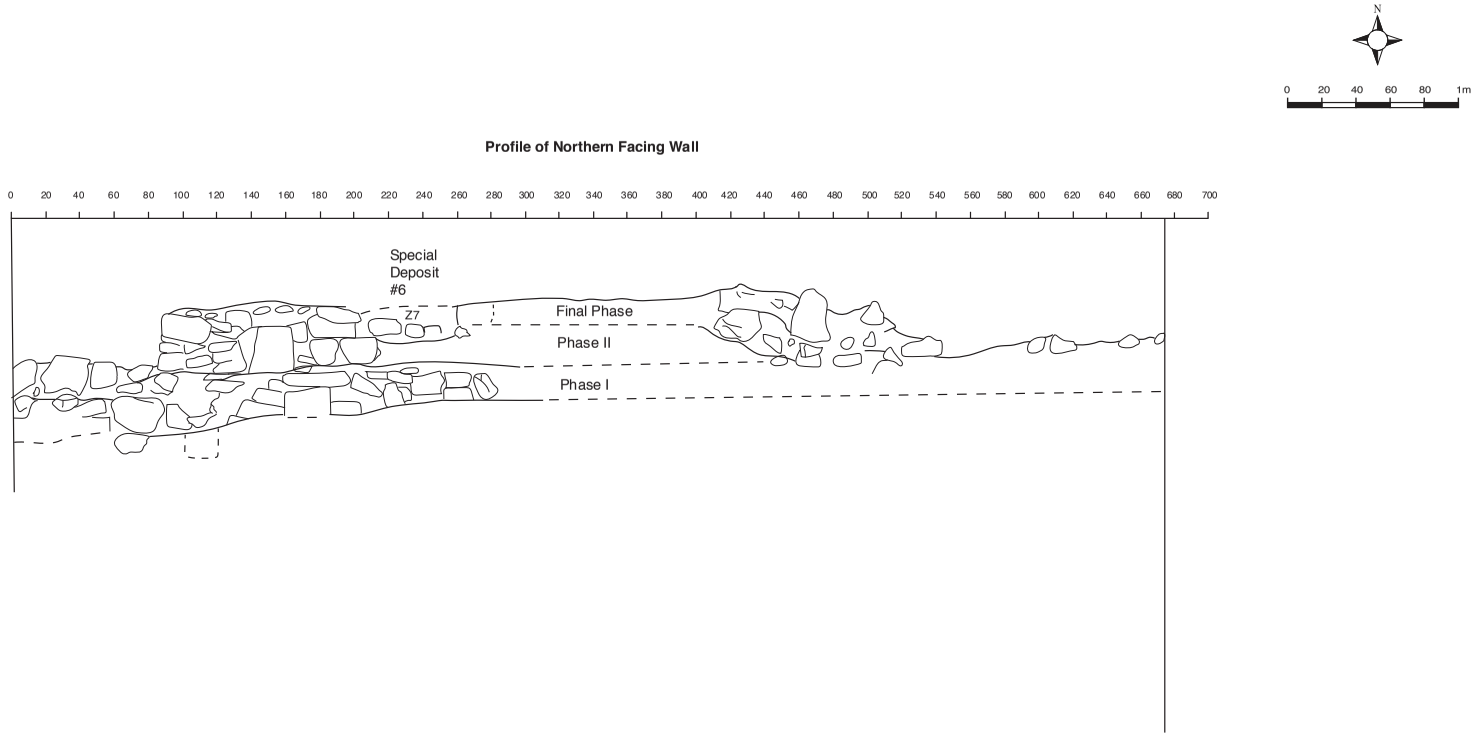


Figure 10.13 Profile looking south, showing three proposed phases for Str. 5 (drawn by E. Harrison-Buck and digitized by K/ Titus).

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Chapter 11

Testing for Midden Deposits around Structure 1 at Chulub (Operation 33)

Katherine Shelhamer and Jessica H. Craig

Introduction

Operation 33 at Chulub consisted of two separate 1 x 2 m excavation units oriented with the length of the units running north-south. Both units were located on the exterior edges of Structure 1 in the hopes of locating midden (trash) deposits (**Figure 11.1**). The two units are hereafter referred to as Op. 33a and Op. 33b. These non-contiguous units were considered the same operation because they had the same objectives and were both oriented around Structure 1. These excavations were aimed at:

1) recovering faunal remains for dietary and environmental analyses in a wetland context;
2) collecting diagnostic ceramic and lithic materials to date the site contexts.

In order to place our excavation units in the location most likely to contain a midden we conducted a series of shovel test pits off the eastern side of Structure 1. The series helped us to identify an area that contained a spike in cultural material thought to represent a midden and helped us choose the location of Op. 33a. The location for Op. 33b was chosen based on an exterior platform on the northern side of Structure 1 that we felt confident was a production or cooking area. Such an area would presumably contain large amounts of faunal remains and/or ceramics.

Methods

Paleoenvironmental data suggests there was a prolonged drought during the Terminal Classic period (ca. AD 800-900), following a much wetter period in the Late Classic (ca. 600-800). It has been hypothesized that wetland regions may have been somewhat buffered from the effects of this environmental change. A theory proposed by Emery and Thorton (2012, 2013) suggests that if drought impacted these environments we would expect to see a dramatic decrease in remains of small water-bodied animals in the archaeological record. Because of Chulub's proximity to the Western Lagoon Wetland this theory was used to guide our excavation objectives, including the focus on collecting faunal remains via a midden context.

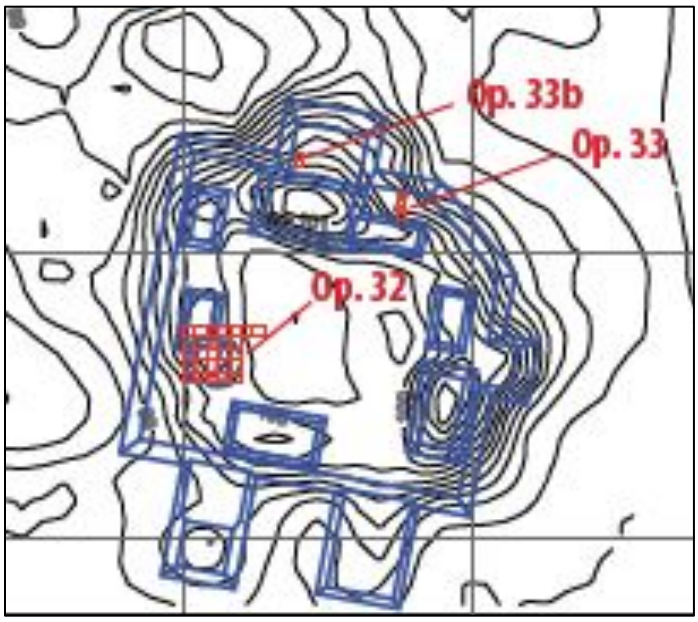

Figure 11.1 Topographic Chulub site map showing location of excavations (map prepared by Satoru Murata and Adam Kaeding).

As previously mentioned, we used a series of test pits to determine the location of Op. 33a. This is a method that had been successfully used in past BREA excavations at the site of Jabonche (Flanagan et al. 2015). Using the total station, we first created a 1m grid across a 6x6 meter area on the east side of Structure 1 (**Figures 11.2** and **11.3**). All test pits were dug using a posthole digger. Once the top soil was removed the post holes were dug until one of the following occurred:

- Cultural material was recovered.
- Architectural stone was encountered.
- The water table was found.

Zones were not used for the test pit series. Each post hole was assigned a discrete number and materials were collected and bagged according to that number. The location of Op. 33a was decided based on the post holes that uncovered the highest density of midden-like cultural material.

Figure 11.2 Shovel Test Pit Series 005 (photo by Jessica Craig).

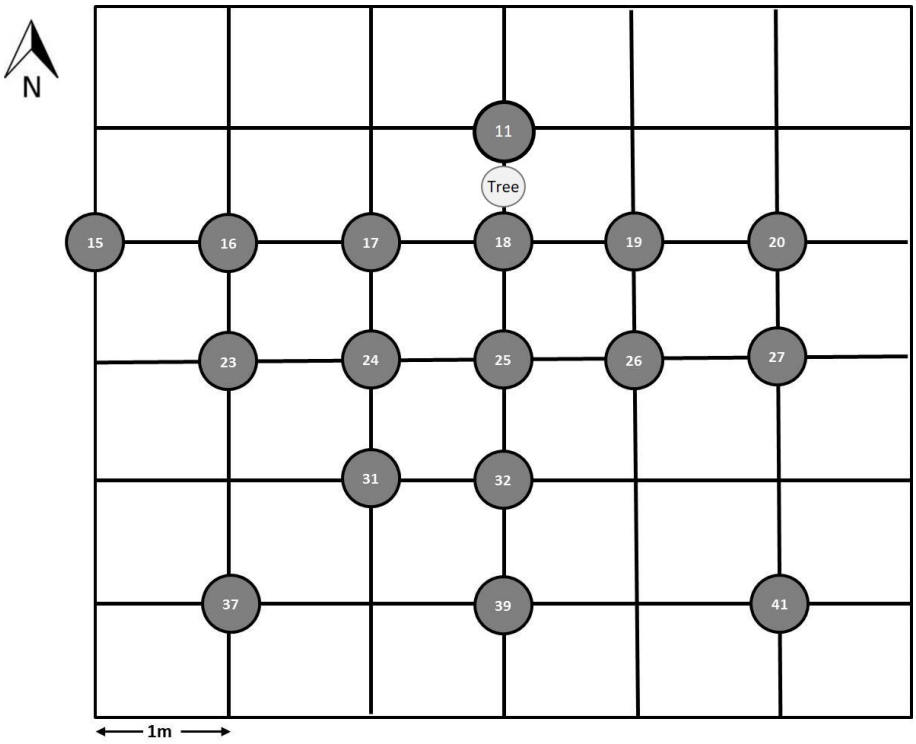

Figure 11.3 Shovel Test Pit Series 005 Grid (created by Jessica Craig).

Shovel Test Pit Series 005

The goal of the Shovel Test Pit Series 005 was to identify the location of a midden associated with Structure 1. Shovel test pits began with the area on the east side of the building. In the discussion that follows, only post holes that recovered significant finds will be described

in detail. The post holes are not discussed in number order, but in the order that they were excavated. The location of each post hole can be found in **Figure 11.3** above. All elevations were measured in centimeters below Datum A (cmbd) unless otherwise stated. Elevation data and the reason for stopping each post hole excavation can be found in **Table 11.1** below.

From the cultural material and elevation data recovered during the digging of STP Series 005, a pattern emerged that suggested some density of cultural material was present on the eastern slope of Structure 1. The top of this deposit was recovered across 1x2 m area in the center of the slope at 153-168 cmbd. This deposit consisted of ceramics, animal bone (deer, turtle, fish and other unidentifiable species), and chert debitage. The soil matrix was not particularly ashy, but some charcoal was recovered. The deposit was densest in STP # 18 and seemed to lessen in density in the areas to the west (STP #17) and south (STP #32). Based on this information, a N-S 1x2 meter trench (Operation 33a) was excavated, which incorporated the areas where the densest cultural material was recovered (STP #'s 18 and 25).

Table 11.1 STP 005 post holes listed in order of excavation (created by Jessica Craig).
Note: "Stone" refers to large architectural stones, either collapse or intact architecture. "Cultural deposit" was consistently comprised of sherds, animal bone, and lithic material.

STP #	Starting elevation (cmbd)	Ending elevation (cmbd)	Findings
25	114	218	Cultural deposit at 168 cmbd
23	83	175	Stone hit a 156 cmbd
27	140	247	Water table hit at 247 cmbd
39	81	96	Stone hit a 89 cmbd
37	64	149	Stone hit at 141 cmbd
41	107	132	Stone hit at 126 cmbd
32	107	172	Cultural deposit hit at 165 cmbd
31	90	149	Stone hit at 137 cmbd
24	98	180	Stone hit at 180 cmbd
26	125	160	Stone hit at 157 cmbd
20	142	215	White marl layer hit at 215 cmbd
19	133	180	Chert nodules at 160 cmbd
18	116	153	Cultural deposit at 153 cmbd
17	92	180	Cultural deposit at 162 cmbd
15	78	151	Stone hit at 151 cmbd
16	86	162	No stone or deposit encountered
11	43	88	Cultural deposit hit at 88 cmbd (Datum B)

STP 005 #25

The first post hole dug was STP #25 – this point was located in the very center of the grid. Based on its position and the slope of the mound this area was determined to be a likely location for a midden deposit. A light grey soil (10YR 3/1) was encountered at 5 cm below the top soil. Very little cultural material was recovered until 168 cmbd, where a concentration of cultural material (sherds, shell, animal bone, and chert debitage) was encountered. To determine the thickness of the deposit, the material was removed and collected – the deposit was approximately 20 cm thick. Excavations continued down to sterile soil, which consisted a white clay marl layer (7.5 YR 5/1). It was decided to move out radially from STP #25 in 2 meter intervals to see if a similar deposit could be found at a depth of 168 cmbd. A similar deposit was not found in any of these post holes (STP #'s 23, 27, 39, 37, and 41) (**Table 11.1**).

STP 005 # 32

The next set of post holes were dug radially 1m from STP #25. The first was STP #32, located 1m south of STP #25. A dense cultural deposit comprised of ceramics, animal bone, and some lithic material was found at 165 cmbd in this post hole (approximately the same elevation as the deposit found in STP #25). We removed some of the material to be sure that we were really seeing a dense deposit and not a scatter – we found that it continued down at least 7cm, so we stopped digging here. Some pea to quarter size pieces of charcoal were found, but the matrix was not as grey and ashy as one might expect for a midden deposit. In the next five post holes dug (STP #'s 31, 24, 26, 20 and 19) the cultural deposit was not found (**Table 11.1**).

STP 005 # 18

A cultural deposit similar to that found in STP #'s 25 and 32 was found at 153 cmbd. However, this deposit appeared to be considerably denser than the others found at this depth, in that there was an absence of soil present. What could be seen in the post hole was a layer of packed large sherds. None of the deposit was removed.

STP 005 # 17

A deposit more like that found in STP #'s 25 and 32 was found at 162cmbd in this post hole. Digging stopped at this elevation.

STP 005 # 11

This post hole was excavated much later than the rest, after we had already started excavating Squares A & B. STP #11 was not originally opened because of its location at the

base of a tree. We decided to excavate it later on to determine if the midden deposit being excavated in SQ A could be found continuing to the north. The same dense deposit of sherds found in STP #18 was also found at 88 cmbd (measured from Datum B because the nearby tree restricted use of Datum A). None of the deposit was removed.

Operation 33a

As previously mentioned, Op. 33a consisted of a single unit oriented cardinally, 2m (north-south) x 1m (east-west). The unit was laid out over STP's #18 and #25 based on the dense concentration of cultural material recovered from these test pits. Op. 33a contains two 1m x 1m squares, designated Squares A and B. All elevation data was measured from Datum A.

The midden deposit we uncovered was thinner than anticipated (15-20 cm) and was mainly dominated by ceramic material. The lack of any significant amount of faunal remains and relatively shallow depth leave it unclear if this truly represents a trash heap. The location of this site in a wetland area with perennial flooding leads us to question if natural water processes could have affected the deposition of this layer. Other forms of natural disturbances like tree and ant bioturbation were noticeable while excavating and can be easily seen in the distinct color changes of the western profile (**Figure 11.4**). Despite the lack of significant faunal remains, the large amount of ceramic material recovered from this layer helped fulfill the second of our excavation objectives.

Zone 1

The first zone in Op. 33a consisted of topsoil across Squares A and B (112-120 cmbd). No stones were visible in this zone and some modern trash was uncovered. The soil was a very dark silty-clay (10YR 2/2) with few limestone inclusions. Little archaeological material was found and most of the zone was excavated with a pick.

Zone 2

Zone 2 consisted of a distinctly different earthen layer directly below the topsoil in Squares A and B. This zone varied from 5-10 cm in depth and was ended due to a transition to darker soil (10YR 2/1) that may have been the result of root action and organic breakdown associated with the tree directly to the north of SQ A. Artifact density was still extremely light throughout this zone.

Figure 11.4 Op. 33a western profile, Squares A & B (photo by Jessica Craig).

Zone 3

Zone 3 is another earthen layer that existed across Squares A and B with the same silty-clay texture. This is where we started to see the artifact density increase. Zone 3 encompasses the area between the color change noted in Zone 2 and the elevation at which the unexcavated sherd density (presumed to be the top of a midden) was found in STP #18 (128-141 cmbd). As the zone was excavated the concentration of artifacts seemed to be sloping down from SQ A into SQ B.

Zone 4

Zone 4 starts at the density of sherds that represent the beginning of the midden deposit (141 cmbd). This zone consists of several centimeters of increasingly dense sherds with some animal bone, debitage, and freshwater shell mixed in. Several other interesting artifacts were recovered from this zone, including a lip plug and carved stone fragments (**Figures 11.5** and **11.6**). In SQ A, this zone clearly represents the area directly above the midden deposit and the material removed as part of this zone was largely done in an attempt to better define the top of the deposit itself. The nature of Zone 4 in SQ B was less clear. Because it appeared that the

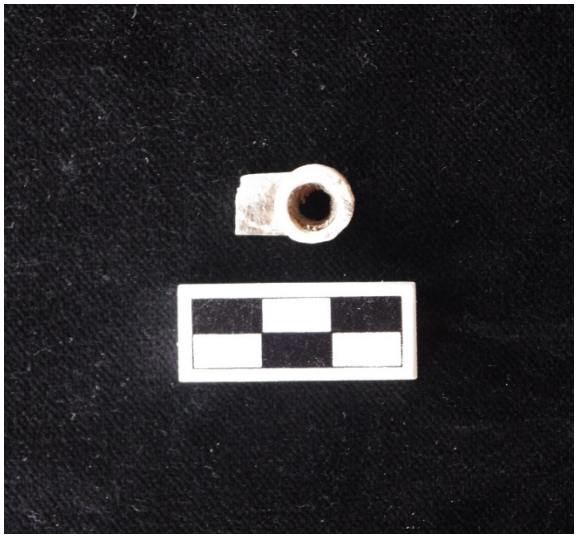

Fig. 11.5 (left) Carved stone fragments (photo by Eleanor Harrison-Buck).

Fig. 11.6 (right): Lip plug (photo by Eleanor Harrison-Buck).

Figure 11.7 Ant disturbance between Squares A & B at the top of Zone 4 (photo by Jessica Craig).

deposit was sloping down in the southern direction from SQ A to SQ B it was thought that we might not have been deep enough yet in SQ B to hit the same dense concentration. Zone 4 in SQ B likely actually represents some artifact scatter just south of the midden itself. In Zone 4, along the interface between Squares A and B, there was an area much lighter in color with a lighter density of artifacts (**Figure. 11.7**). This light grey area was determined to likely have been a natural disturbance in the form of leaf-cutter ants that reside in the area. This may explain the sharp drop off of the southern edge of the midden deposit in SQ A and why we didn't see it continue into SQ B. In this lighter area we did find a large animal bone, determined to be deer, but little other material was recovered.

Zone 5

Zone 5 strictly exists in SQ B and was created due to a lack of the pottery concentration that was found at the same elevation in SQ A. This zone was created when it became apparent that we were no longer in contact with the midden, but actually outside of it. Because there were no apparent soil changes we continued excavating the zone until reaching the base of three large chert cobbles that were uncovered in the southern end of SQ B (**Figure 11.8**). These cobbles (158 cmbd) formed a rough semi-circle and represent the bottom of Zone 5. We continued this zone until reaching the base of the cobbles in order to determine if they were sitting on a surface, but they appeared to be collapse from nearby architecture that we did not expose with our unit. This zone contained a moderate density of artifacts, but nothing as dense as that found in SQ A.

Zone 6

Zone 6 is a largely undefined area that consists of material excavated from the southern edge of the midden as we attempted to define its sharp, sloping profile. This zone is completely within SQ A and only exists in the southern most area of the square. Because Zone 6 was largely a "clean-up" zone it may contain artifacts from both earlier and later contexts that were collected together as we tried to define the profile. All artifacts in this zone are assumed to be associated with the midden deposit.

Zone 7

Zone 7 represents the top 5cm of the midden deposit. This zone was ended arbitrarily in an attempt to avoid potentially mixing contexts as the midden was excavated. Zone 7 consisted mainly of tightly packed ceramics as there was a noticeable lack of debitage and animal bone (**Figure 11.9**). What little soil was present between artifacts was extremely dark. Several soil samples were taken in order to determine if any more faunal remains, such as fish bone, would be found when fine-screened. While excavating this zone an extremely dark, nearly sterile area in the northeast corner of SQ A became evident. This intrusion was designated as Zone 9.

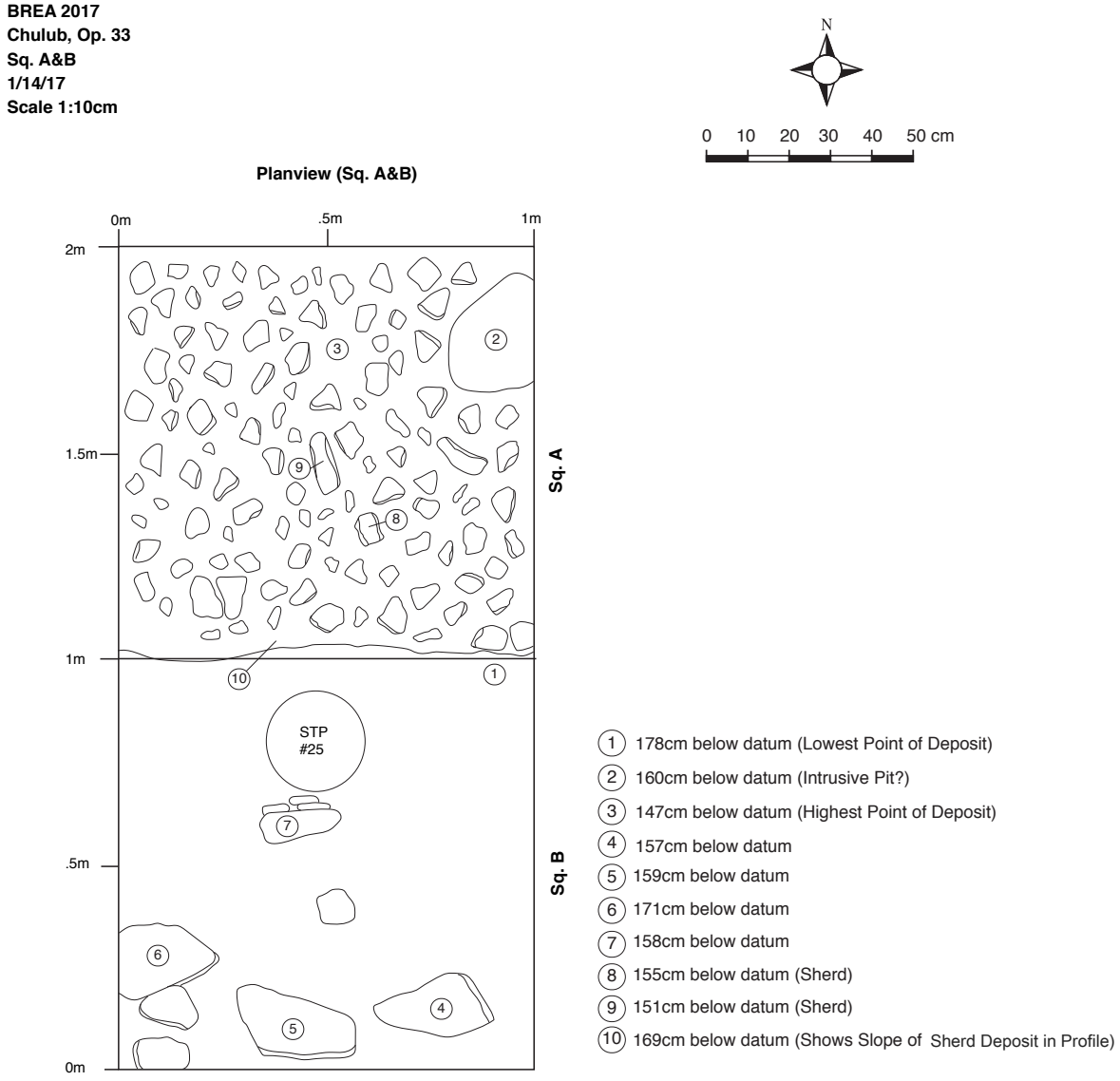

Fig. 11.8 Op. 33a Squares A & B plan view (drawn by Jessica Craig, digitized by Katie Titus).

Fig. 11.9 Top of midden deposit (top of Zone 7, bottom of Zone 4) (photo by Jessica Craig).

Zone 8

Zone 8 represents all of the remaining portion of the midden beneath Zone 7. This zone was originally going to be an arbitrarily separated 5cm section, but as it was being excavated the density of artifacts began to lessen and it was determined that we were actually nearing the bottom of the midden. Thus, we continued Zone 8 until all of the midden was removed (about 5cm). At the bottom of this zone the dark intrusion in the northeast corner of SQ A (Zone 9) was still visible.

Zone 9

Zone 9 was a dark (7.5 YR 2.5/1) intrusive feature discovered in the northeast corner of SQ A (see #2 in **Figure 11.8**). This zone consisted of dark, fluffy soil that was almost completely devoid of artifacts. It was originally thought to either be an intrusive pit, root disturbance, or post hole. This intrusion had significant depth (20cm) and a fairly small diameter (10-15cm). It was determined to most likely be a modern post hole due to the way it cut through Zones 7, 8, and 10, and the fact that the area surrounding Op. 33 was still being used as cow pasture at the time of excavation.

Zone 10

Zone 10 is a 20cm deep earthen layer located beneath the midden deposit. This zone consisted of dense, lighter grey soil (10YR 3/1) which represents the interface between the bottom of the midden and the soil heap beneath. It contained some charcoal and minimal artifacts, which can likely be associated with the bottom of the midden deposit. Several small limestone cobbles were found surrounding the root disturbances in this zone. As it was excavated there were no soil changes to prompt a new zone and therefore Zone 10 was continued until level with the base of the chert cobbles in SQ B (bottom of Zone 5).

Zone 11

Zone 11 is an earthen layer in SQ B that begins beneath Zone 5. Zone 11 and Zone 12 were split along the interface between Squares A and B based on a somewhat indistinct soil color change. The separation between these two earthen layers was originally determined using a distinct color change noticed in the western profile of SQ A, but the change was less visible on the floor of the excavation unit. Zone 11 was excavated at the same depth and pace as Zone 12. Zone 11 was ended after 5cm when no significant density of artifacts was recovered and we were certain that the chert cobbles uncovered at the top of the zone were definitely not sitting on a surface. The bottom of this zone represents the end of Op. 33a in SQ B (**Figure 11.10**).

Zone 12

Zone 12 was the earthen layer beneath Zone 10. Zone 12 was less dense and slightly more speckled than the adjacent Zone 11. As previously mentioned, the interface between Zones 11 and 12 was originally determined by the distinct color change noticed in the western profile of SQ A. Zone 12 was excavated at the same rate as Zone 11 in the adjacent square. It appeared as though Zone 12 may have continued to slope deeper down and further into SQ B. The zone was ended after 5cm when no significant density of artifacts was recovered. The bottom of Zone 12 represents the bottom of Op. 33a in SQ A (**Figure 11.10**).

Zone 13

Zone 13 is the continuation of STP #25, which was present in the middle of SQ B for the entirety of excavation. This continuation was dug with the posthole digger and considered Zone 13 in order to represent the separation between what was found in the shovel test pit before the unit was opened and what was recovered later on. This zone was focused on punching down beneath the elevation of Zone 12 in order to determine if any significant cultural material was present further under the surface. The zone started at 201 cmbd and became sterile white clay at 215 cmbd. This zone was ended after another 15 cm once we hit the water table. Nothing in

Zone 13 appeared to be culturally significant as no artifacts were found below the start of the white clay. Because we did not find any significant cultural material this zone helped inform the decision to end Op. 33 in Squares A and B.

Fig. 11.10 Closing shot of Op. 33a (photo by Katherine Shelhamer).

Operation 33b

Op. 33b consisted of a single unit oriented cardinally, 2m (north-south) x 1m (east-west). The unit was laid out on a platform off the northern side of Structure 1, believed to be a production or cooking area. We set up the unit partially on the exterior slope of Structure 1 and stretching out to the north onto the platform in an attempt to catch both the structure and the platform itself. Op. 33b contains two 1m x 1m squares, designated Squares C and D. All elevation data was measured from Datum C.

This unit was excavated aggressively in the last several days of the field season in an attempt find the surface of the platform as quickly as possible. It was inferred that if this was a

production area and we found the platform surface we would also find significant cultural material, possibly even another midden, that would help fulfill our excavation objectives. We believe we did indeed find the platform surface (Zone 16), but much of the faunal material recovered above it was determined to likely be modern. Because this unit was excavated at the end of the field season we did not have the time to fully excavate the platform surface or investigate the context of the pit (Zone 17) that was uncovered. We did recover a significant amount of artifacts from this excavation (including coral and a spear point) despite having to stop after only five zones.

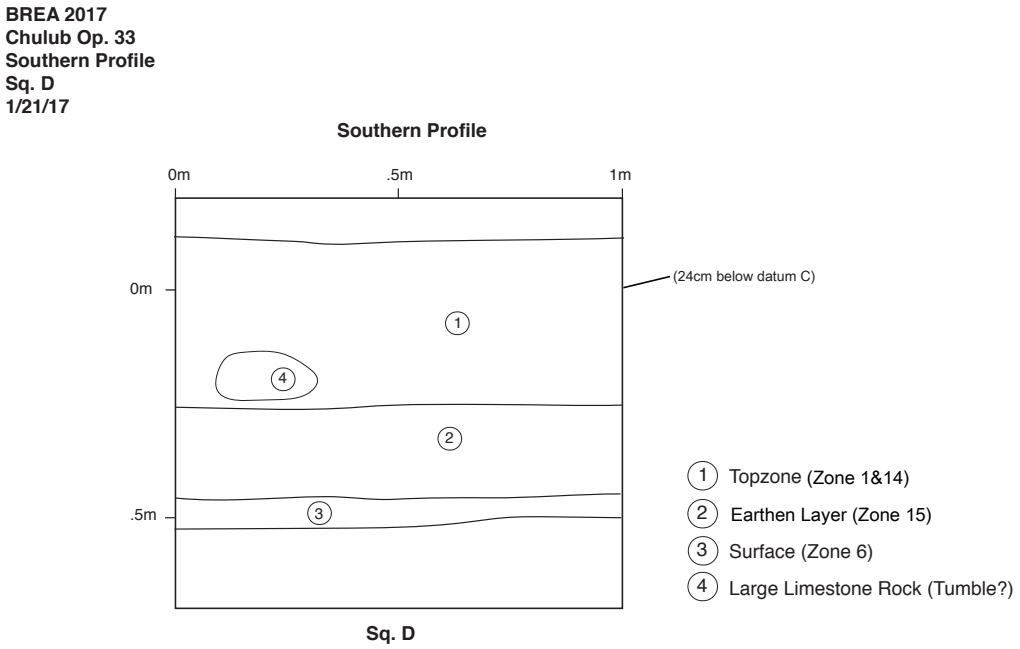

Fig. 11.11 Op. 33b southern profile (drawn by Katherine Shelhamer, digitized by Katie Titus).

Zone 1

Zone 1 in Op. 33b is the same dark topsoil as found in Op. 33a. This is the only zone that was reused between units because it was obviously the same modern context. This zone contained minimal archaeological material and a large amount of modern trash. This layer was ended arbitrarily after 10 cm because there was no visible variation in the dark topsoil. Minimal artifacts were recovered from SQ D, and only modern animal bone was recovered from SQ C. Most of this zone was excavated with a pick. SQ C was closed after Zone 1, while we continued to punch down in SQ D based on the larger concentration of artifacts found there.

Zone 14

Zone 14 is the second zone in Op. 33b and only exists in SQ D. We jumped from Zone 1 to 14 in order to avoid any possible mixing of contexts since the two units in Op. 33 were not conterminous. This zone consisted of the same extremely dark (10YR 3/1), dense soil layer as Zone 1. This zone was extremely thick (20-30 cm) as it was continued until there was a slight soil color change. The color change occurred at the same elevation as a dense layer of faunal remains in the western half of SQ D. This soil change and bone layer were also level with the base of a large limestone rock that was uncovered in the southeast corner of SQ D (see #4 in **Figure 11.11**). As this zone was being excavated it was thought that we were coming down on a surface and these were the faunal remains of an ancient work area. We later discovered that they are more likely modern faunal remains based on the presence of crocodile and cow bone, as well as reports that local people like to camp in this area while on hunting trips. The layer of bone was taken out in groups as Zone 14 and the zone was ended after the square was made level at the soil color change.

Zone 15

Zone 15 was an earthen layer beneath the base of the large limestone rock and bone concentration found in SQ D. This zone started at the soil color change mentioned in Zone 14 and was continued until a different speckled soil layer was uncovered throughout the square (10-15cm). Zone 15 had a light artifact density of poorly preserved ceramics and some debitage, with the artifact density increasing as we went deeper.

Zone 16

Zone 16 consists of the previously mentioned speckled layer. This lighter, speckled soil was much different than the dense, dark layer that came before it. In this zone the artifact density increased significantly with many more ceramics, debitage, and even small amounts of coral. Several large chunks of charcoal were present and some of the ceramics were lying flat in this zone. While Zone 16 was being excavated, a dark speckle-less patch of soil was discovered along the northern section of SQ D. This intrusive dark patch was designated as Zone 17. Zone 16 was ended arbitrarily after 5cm due to the end of the field season. All evidence leads us to believe this was a surface.

Zone 17

As previously mentioned, Zone 17 was a dark, speckle-less patch along the northern edge of SQ D. We believed this to be a pit feature of some kind and therefore excavated it separately from Zone 16. As we excavated this zone, using the speckle change as a guide, it started to gain

a distinctly rounded shape (see #1 in **Figure 11.12**). Few artifacts were found in this zone, although there were ceramics lining the edges of the pit. When fully excavated the pit was 20cm deep.

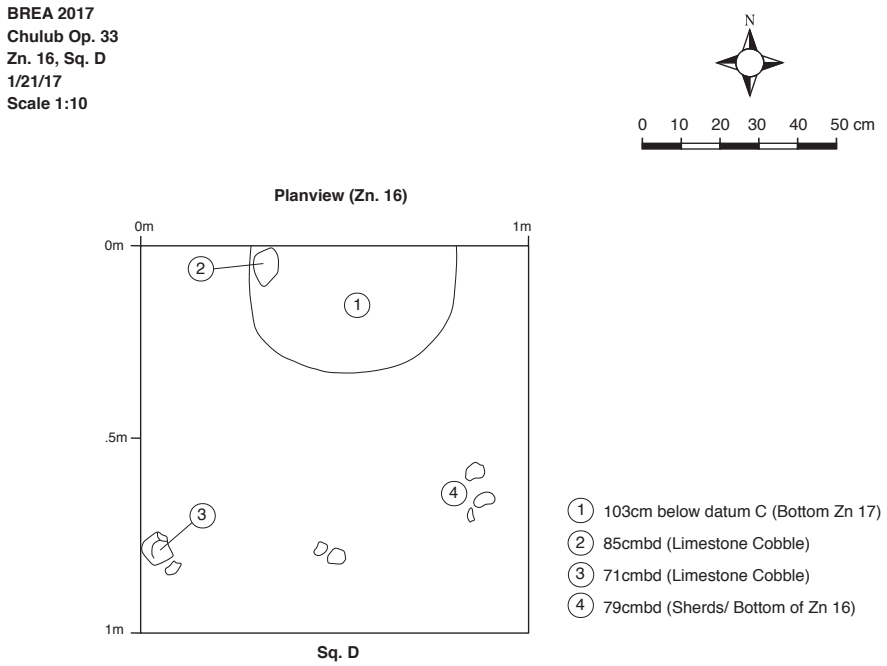

Fig. 11.12 Op. 33b Square D plan view
(drawn by Katherine Shelhamer, digitized by Katie Titus).

Conclusions

Use of the shovel test pit method successfully helped us locate a spike in cultural material, but it is still unclear if the deposit found in Op. 33a truly represents a midden based on the overall lack of faunal material. The portion of the deposit we uncovered in excavation sloped dramatically down to the southeast and appeared to continue out of our excavation unit to the north. Unfortunately, we did have to work around the tree that was located just north of the excavation unit (see **Figure 11.3**). We need to keep in mind that this tree and its root system that extended into Square A could have disrupted the stratigraphy of the midden deposit where we were excavating. Further investigation of this deposit to the north and northwest would have been useful in understanding its full extent.

Fig. 11.13 Closing shot of Op. 33b (photo by Katherine Shelhamer).

Further investigation of both Op. 33a and 33b's relationship to the surrounding architecture would likely have helped us better understand what we were looking at. We did not uncover any intact architecture in our excavation units, only several large limestone and chert rocks assumed to be collapse. Based on the assumption that midden material often collects along the edges and corners of structures, it would be easier to determine if the material we found in Op. 33a was truly a midden if we knew its specific relationship to Structure 1 and other buildings.

The end of the field season cut our excavation of Op. 33b short, just as we had reached what was presumed to be a surface (Zone 16). In this zone we started to see a larger density of interesting artifacts including diagnostic ceramics, a small spear point, and coral. Further excavation of the platform that this unit was located on could be valuable to better understand its function. Unfortunately, much of the faunal material recovered from this unit was deemed to be likely modern in preliminary analysis. This is fairly unsurprising as it is located in an area often used by modern day campers and hunters.

Future analysis of both the ceramic and faunal material recovered from these excavations is planned. Several soil samples were taken from Op. 33a and 33b that will undergo flotation and analysis in future field seasons. Through use of a fine mesh screen we will hopefully be able to locate any smaller faunal remains that were not originally noticed during excavation. The large number of diagnostic ceramics that were recovered from Op. 33a will also be analyzed to help us date these contexts.

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Chapter 12

A Test Excavation of a Pond Feature in the Western Lagoon Wetlands (Operation 34)

Jessica H. Craig and Eleanor Harrison-Buck

Introduction

Western Lagoon Site #1 is a 10 meter wide circular depression located due east of Chau Hiix in the Western Lagoon. The size of the depression along with its proximity to Chau Hiix indicates that it could represent an ancient fish weir. Slight variations in the topography and vegetation suggest that the depression was situated on a canal that ran west across the lagoon in the direction of Chau Hiix.

Fig. 12.1 Western Lagoon Site #1 showing location of Op. 34 (Note Chau Hiix in the Background)

Objectives

1. Test the hypothesis that the depression is an ancient fish weir.
2. Recover any faunal remains, net sinkers, or other cultural material that might aid in the testing of this hypothesis.

In order to determine whether or not the depression represents a fish weir, a 2 x 1.5 meter trench (Square A) was placed on the west side of the depression. The trench encompassed both the grassless depression itself as well as higher ground, the goal being to look for any change between the two contexts.

Operation 34, Square A

Zone 1

Zone 1 continues from the depression surface (44cmbd) to 61cmbd. It was arbitrarily defined to remove the topsoil from Sq. A. The soil is very dark, rich with clay, and contains mineral inclusions and plenty of snail shell. No artifacts were recovered from this zone. Tiny live eels were found while screening the soil from this zone, a first for this excavator.

Zone 2

Zone 2 is a layer of sediment between 61-71cmbd. It is also rich with mineral inclusions, speckled limestone, and pieces of limestone ranging from 1-6cm in diameter. At 71cm below surface we encountered a lens of gray sediment across the square. No artifacts were recovered from Zone 2. For the sake of time and because very little cultural material had been recovered thus far in the excavation, we subdivided the square at the bottom of Zone 2. Excavations continued down only on the eastern half (1 x 1.5 m) of Sq. A.

Zone 3

Zone 3 is a sterile layer of sediment from 71 – 95 cmbd. At 95 cmbd we hit what we assumed to be the water table and changed zones (to Zone 4). No artifacts were recovered from this zone.

Zone 4

Zone 4 is a thin sterile layer from 95-99 cmbd. This zone was really more of a levelling surface to be sure that the water table had been found across the entire square. No artifacts were recovered from this zone.

Fig. 13.2 Operation 34 Closing Shot.

Conclusions

Excavations of Operation 34 did not yield any evidence to support the hypothesis that this depression was used as a fish weir. This could certainly be a function of preservation. The depression itself as well as its location directly across the lagoon from Chau Hiix suggest that this could have been a good location for a weir. Only through future investigations might we be able to confirm this.

Chapter 13

Investigating a Preceramic Occupation at the Crawford Bank Site, Crooked Tree (Operation 35)

Eleanor Harrison-Buck, Jessica H. Craig, and Satoru Murata

Introduction

Crawford Bank is located on the eastern shore of the island of Crooked Tree (**Figure 13.1**). The Crooked Tree island is surrounded by the Western and Southern Lagoons, which drain into the Spanish Creek and Black Creek tributaries of the Belize River. These lagoons are seasonally inundated and form a vast system of perennial wetlands that represent the largest inland wetland in Belize, measuring just under 20km^2. The Crooked Tree wetland and lagoon system become seasonally inundated during the rainy season at which time Black Creek, which normally flows from Spanish Creek into the Belize River gets backed up due to high floodwaters and the current of Black Creek becomes reversed. This causes an annual infilling of the Southern and Western Lagoons, partially submerging shoreline sites like Crawford Bank, making them only accessible during the dry season when the waters recede.

Figure 13.1 Aerial view of Crawford Bank site showing location of Operation 35.

Operation 35 at Crawford Bank on Crooked Tree island was excavated during one of these dry periods at the beginning of June during the summer of 2017 when the shoreline was fully exposed (see **Figure 13.1**). The excavation comprised a narrow 1-x-20 m strip trench with the long axis running east-west so as to bisect the shoreline where an eroded limestone feature was visible on the surface prior to excavation (**Figure 13.2**). The unit was divided up into ten 1-x-2 meter squares (A-J), but in the end only Sqs. A-E and I and J were excavated. Only a thin layer of topsoil covered the pockmarked limestone surface, which appears to be the remains of an ancient eroded shoreline. Despite the shallow depth of the unit, the strip trench excavation at Crawford Bank revealed dense concentrations of material culture. Only a light density of historic material was identified, but a plethora of ancient freshwater *Pomacea* shell in direct association with prehistoric lithic tools and debitage was recovered, most lodged in the pitted surface of the eroded limestone. At the interface of Squares I and J, the undulating limestone surface sloped downward to the east toward standing water. Here, the highest density of shell and lithic artifacts was found, which appears to be a preceramic midden deposit heaped up against the sloping edge of the natural limestone feature (**Figure 13.3**). This report details the excavation of Operation 35 and records the findings, which suggest a large preceramic site once existed on the shores of Crawford Bank on the Crooked Tree island.

Figure 13.2 Operation 35 (looking east) showing limestone feature on surface (photo by E. Harrison-Buck).

Figure 13.3. Operation 35 (looking west) in Square J, showing preceramic midden deposit prior to excavation (photo by E. Harrison-Buck)

Objectives

The objectives of Operation 35 at Crawford Bank were to:

1) investigate the limestone feature visible on the surface
2) test for a colonial period commissary that reportedly existed somewhere on the eastern side of Crooked Tree island that serviced logging camps in the area
3) document the historic and/or prehistoric occupation of this area by obtaining material culture from different time periods

Overview of the Excavation

The Crawford Bank site is located on the east side of the island on the property of the Crooked Tree Lodge overlooking the Southern Lagoon, which is locally referred to as the

Crooked Tree Lagoon (**Figure 13.2**). The property was formerly owned by Mr. Rudy Crawford who ran a lodge known as the Paradise. The present owner of the lodge, Mr. Mick Webb, a former member of the British Army, granted BREA permission to excavate. The owner showed us a concentration of historic artifacts in front of the lodge that had been collected from the shore. Here, an eroded limestone outcrop could be discerned on the surface, running north-south parallel to the shore of the Crooked Tree Lagoon. We were curious about the limestone feature and associated historic material and decided to place an excavation unit in the hope of identifying an historic site. We initially wondered whether the limestone could be an historic feature as there were sizeable concentrations of historic artifacts found in this vicinity, including glass bottles, ceramics, and clay pipes (**Figure 13.4**). While most of the material appeared to date to the nineteenth and early twentieth centuries, there were two intact bottles that the owner showed us that our British colonial specialist, Dr. Dan Finamore, identified as dating to the mid-to-late eighteenth century and were among the earliest historic material we had seen anywhere on the island so we decided to test the area for historic remains (**Figure 13.5**)

Figure 13.4 Historic artifacts on the surface around Crooked Tree Lodge property (photo by E. Harrison-Buck)

We placed a narrow 1-x-12 m strip trench with the long axis running east-west so as to bisect the limestone feature and divided up the unit initially into six 1-x-2 meter squares (A-F). We started to remove the thin layer of topsoil several cm deep that covered the limestone surface and found only a handful of historic artifacts, but a plethora of *Pomacea* shell and lithic debitage mixed with a few chipped stone tool fragments. With so much lithic material we started to wonder whether the limestone feature was an ancient Maya feature, but noticeably absent were any Maya ceramic sherds. We decided to extend the excavation unit another 8 m (Squares G-J)

to the east in the direction of the shoreline to catch the eastern edge of the limestone feature, which we did in Square J. It was here that we found some of our most exciting finds, including a barbed Lowe Point (**Figure 13.6**). This and other diagnostic tools were a clear indication that this was not an historic feature nor a pre-Hispanic Maya site, but something much earlier dating to the preceramic period. Below we describe the results of each zone excavated in Operation 35.

Figure 13.5 Historic bottles reportedly from around the Crooked Tree area (photo by S. Murata)

Excavation Results

Zone 1 Topsoil

Zone 1 is a thin layer of topsoil consisting of a light gray soil with a sandy-silt texture that covers a natural bed of limestone, which extends north-south along the shoreline. The loose matrix consists of several centimeters of organic matter, including grass and some rootlets and a high density of small limestone inclusions and small smooth river pebbles, locally referred to as "water stones" that represent eroding remains of the limestone surface below. The zone was only 1-2 cm deep and was removed from all squares that were excavated in Operation 35, which includes Squares A-F and I-J (Squares G and H remained unexcavated in 2017).

Zone 1 in Square J was excavated deeper than other squares as the compact limestone surface was only detected in the far western end of the square. In the rest of the square underlying Zone 1 was a light gray sandy undulating surface (Zone 3) that interfaced with the

eastern edge of a limestone feature (Zone 10). In the far eastern end of Square J, at the interface of Zones 1 and 3, a barbed Lowe Point was found at 33 cm below Datum 2, which was photographed and drawn (**Figure 13.6**).

At the base of the zone in Squares A-I an undulating limestone surface (Zone 10) was exposed, eroded and pitted presumably due to water action over time, which perhaps increased when the shoreline was cleared of natural vegetation in more recent historical times. A light density of historical artifacts were found throughout Zone 1, but a greater density of lithic debris and freshwater *Pomacea* shell were found. At the base of Zone 1, the pitted features that held pockets of soil were excavated separately as Zone 8, as often these deposits contained high densities of artifacts, provisionally characterized as "terminal debris" (see below).

Figure 13.6 Ruben Crawford holding the Lowe Point that he found at the base of Zone 1 in Square J of Operation 35 at Crawford Bank (photo by E. Harrison-Buck).

Zone 8 Terminal Midden Debris on Bedrock

Zone 8 lies directly below Zone 1 in Squares A-F and I (Squares G and H were not excavated in 2017). This resembles midden-like terminal debris mixed with a semi-compact light yellowish-brown clay matrix that has been trapped in the pitted portions of the undulating limestone bedrock surface. Square E yielded the highest density of terminal midden debris.

Abundant lithic debitage was removed in the central part of Square E in both Zones 1 and 8, including two tool fragments and a hammer stone. The tool fragments were point-plotted with the Total Station and drawn in planview (Maps #9 and #10). Some Pomacea was collected, but less than what was found in the midden heap in Square J. Zone 8 in Square D also yielded abundant chert flakes and some *Pomacea* was recovered, primarily in the eastern half of the square. The western half of Square D is largely exposed bedrock with little artifact material. A dark area (10YR 3/2) with some charcoal was found in association with the density of artifacts in the eastern half of the square (see Planview #3). Significantly less material culture was recovered from Zone 8 in Squares A-C, F and I. The majority of terminal debris in these squares was removed as part of Zone 1 and no obvious formal stone tools were noted in either Zones 1 or 8 in these squares, but all lithic debitage defined in situ was point-plotted with the Total Station and drawn in planview. Many small limestone inclusions were removed as we scraped into the surface of the limestone bedrock (Zone 10) encountered at the base of Zone 8 throughout the unit.

Zone 10 Limestone Bedrock

Zone 10 is the limestone bedrock that likely underlies the entire shoreline of the Crooked Tree island. In 2017, BREA excavated a small 1-x-1 m area of bedrock in the eastern half of Square E. This small portion of the limestone bedrock was visible on the surface prior to excavation and was excavated 40-50 cm down in Zone 10. The zone contains a very light density of artifacts (debitage) that was likely remnant material from Zones 1 and 8 directly above it. This surface ranges in texture from hard, impenetrable rock to a soft, weathered clay matrix that is more easily excavated.

Zone 2 – Midden (Square J)

Zone 2 is the top portions of a midden disturbed by a tree in the western half of Square J. Zone 2 is a dark, organic-rich matrix that appears to be the remains of a burnt Bullet tree stump with shallow roots that are also heavily burnt. The tree stump is still partially visible and represents modern disturbance with roots that partially intrude into a midden deposit (see Zones 5 and 7 below). Therefore, Zone 2 was drawn and photographed (see **Figures 13.7** and north wall of Figure **13.8**). Because the tree stump partially intrudes into the midden, Zone 2 was removed separately to avoid mixing with the ancient material. This was also the rationale for separating Zones 5 and 7 (see below). The dark organic matrix of Zone 2 contains large chunks of burnt wood. Although several large charcoal samples were collected, they likely are not representative of the ancient occupation at Crawford Bank. Zone 2 overlies Zone 5, which is the top portion of the midden deposit (see below). The burnt roots also intruded into a portion of the Zone 3 light gray sandy strata, described below.

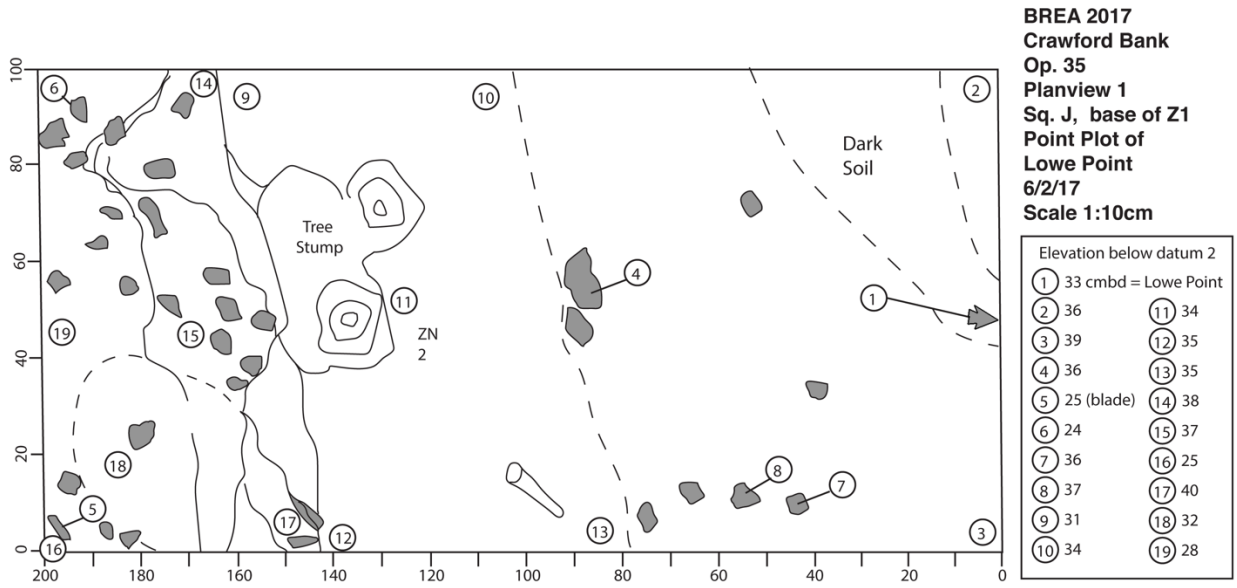

Figure 13.7 Planview #1 showing Square J of Operation 35 at Crawford Bank (drawn by E. Harrison-Buck, digitized by K. Titus).

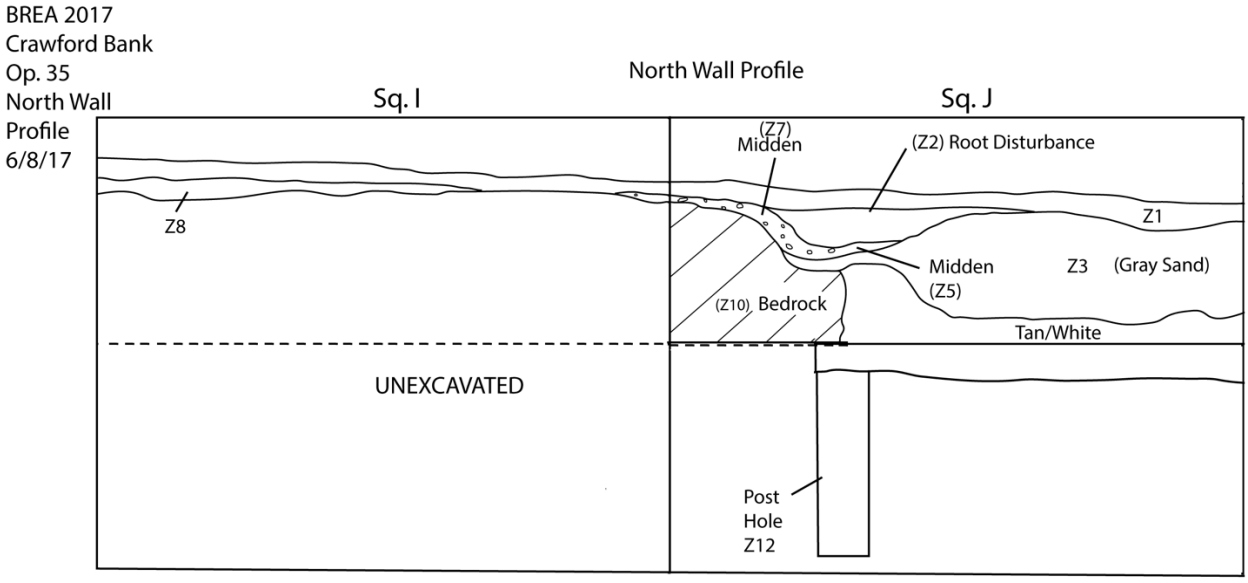

Figure 13.8 Cross-Section #2 of north wall profile of Square J at Crawford Bank (drawn by E. Harrison-Buck, digitized by K. Titus).

Zone 5 – Midden (Square J)

Zone 5 underlies Zone 2 and is a disturbed portion of the midden deposit found in the western half of Square J. The midden was partially burnt and disturbed by the Zone 2 modern tree roots. This disturbed portion of the midden is darker than the rest of the midden and was therefore removed separately as Zone 5. The zone consists of a dark, organic-rich matrix that is filled with lithic debitage and a high density of *Pomacea* shell heaped up against the compact limestone bedrock material, which consists of soft, weathered limestone and small limestone pebbles ("water stones").

Zone 7 – Midden (Square J)

Zone 7 is the intact remains of a midden deposit found only in the western half of Square J. It consists of a thin layer of dense midden debris heaped against the eastern edge of the bedrock "shelf" that is a compact matrix with small limestone inclusions that represent remnants of the eroding limestone bedrock on which sits the midden. Zone 7 is part of Zone 5, but the latter is a somewhat disturbed portion of the midden (see above). Like Zone 5, Zone 7 contains a high concentration of preceramic artifacts, including lithics and whole *Pomecea* shell. One hundred percent of the matrix that was collected in both Zones 5 and 7 were water-screened back in the lab to recover 100% of all cultural material. The Zone 7 midden was mottled with two colors (10YR 2/1 and 10YR 5/4 yellowish brown). Most of the top couple centimeters of the midden deposit was a dark black matrix, likely due to the modern burning of the Bullet tree.

Zone 3 – Earthen Layer (Square J)

Zone 3 is a light gray undulating sandy matrix found only in Square J. Zone 3 dips down sharply in places due to the Zone 2 tree disturbance. The Zone 2 organic-rich matrix fills these dips. Zone 3 in Square J is bounded on the west side by the midden heap, which comprises a more compact fill with a high density of *Pomacea* shell, lithics and small limestone pebbles and marl, as well as the small, smooth pebbles or "water stones" (see Zone 5 below). The midden deposit appears to sit on top of Zone 3. This fine-grained sugary sand is interpreted as an earthen layer and if water levels were lower in the preceramic it is possible it represents an ancient preceramic "living surface" as many artifacts were found associated with this strata and the midden heap, which appears to have built up during its use. Altenatively, these artifacts may represent preceramic refuse that washed down from the ancient shore during seasonal rains and inundation and therefore represent artifacts that are not in situ, but translocated over time. For a more accurate reconstruction, geomorphological and paleoclimate studies are necessary to determine how much environments have changed over time. **Figure 13.7** shows the location of the midden heap to the west and the artifacts that were found lying on this surface to the east, including fragments of worked slate, debitage, and the Lowe Point, which were all removed as

part of Zone 1. Most artifacts were found around the interface of Zones 1 and 3. Only a few artifacts were found in the earthen layer below Zone 3 (see Zones 4 and 12).

Zone 4 – Earthen Layer (Square J)

Zone 4 is a sandy gray earthen layer that lies directly below Zone 3 in Square J. Only a few artifacts were found in the earthen layer below Zone 3. The change from Zone 3 to Zone 4 was somewhat arbitrary. There is a slightly lighter, clayey matrix with flecks of limestone, first observed in the southern edge of Zone 3, which appears to be the remains of a highly weathered undulating limestone "bedrock" outcrop that was further exposed throughout the square lower down in Zone 4. Zone 4 ended when a yellowish, clay-rich layer was encountered with flecks of orange-yellow, which appeared to be mineral inclusions. Zone 4 also underlies the midden deposit. A few higher areas of lighter tan soil were observed and defined at the bottom of Zone 4 and further defined in Zone 6.

Zone 6 – Earthen Layer (Square J)

Zone 6 is an earthen layer that lies directly below Zone 4 in Sq. J. This sandy clay matrix has a stickier consistency than Zones 3 and 4 directly above it. The matrix is much more yellow-orange in color due to the presence of yellow-orange flecks that appear to be mineral inclusions. Some debitage artifacts were found in Zone 6. As noted above, there were a few areas of undulating lighter tan soil that were observed and defined at the bottom of Zone 4, which appear to represent weathered and highly eroded limestone bedrock. This lighter tan bedrock contains a few small, smooth pebbles ("water stones") and appears to be a sterile matrix so it was removed with Zone 6. The zone was excavated roughly 15-20 cm in depth and then the zone was ended arbitrarily and the zone was changed to Zone 9 (see further below). A light density of lithic material continues to be recovered in this yellowish-orange-tan, clay-rich matrix.

Zone 9 – Earthen Layer (Square J)

Zone 9 is an earthen layer that lies directly below Zone 6 in Square J. It is a clay-rich yellow-orange-tan matrix that was initially thought to be weathered bedrock, but was found to contain a light density of lithic artifacts scatted throughout. Two pieces of sizeable lithic debitage, for instance, were found at the base of Zone 9 in the center of the zone (at 81 cm below Datum 2). No limestone inclusions were observed in the Zone 9 matrix. After a little less than 10 cm, the zone was ended arbitrarily and Zone 11 was excavated (see below) in an effort to identify a sterile lens.

Zone 11 – Earthen Layer (Square J)

Zone 11 is an earthen layer directly below Zone 9 in Square J. The zone break was arbitrary to determine if lower down was sterile. This undulating natural surface is essentially a continuation of Zone 9 and comprises a compact, yellowish-clay matrix. Some lithic artifacts were recovered from this strata that appear to be preceramic in date, suggesting that it is not sterile. This clayey matrix appears to continue to the west into Square I, running underneath the limestone bedrock (Zone 10) and is the reason it was thought to represent soft, weathered bedrock. The presence of artifacts is somewhat confusing but must mean that the bedrock in Square J has eroded to such an extent that clays have infilled the area, perhaps due to repeated inundation, allowing artifacts to translocate down. After a little less than 10 cm, the zone was ended arbitrarily and a posthole (Zone 12) was excavated.

Zone 12 – Earthen Layer (Square J)

Zone 12 was a posthole that we excavated into the lowest natural earthen layer exposed in Square J. The posthole was positioned about 50 cm east of the western edge of Square J in the center of the unit. The posthole extended over 100cm in depth and exposed a compact yellowish clay matrix that appears to be a continuation of Zone 11. The matrix appears to be sterile at this depth, but further testing might reveal sporadic translocated material.

Discussion

While the sandy-clay soils of the Crooked Tree island, with its mix of logwood swamp and pine savanna, is not conducive to horticulture, it is rich in other edible resources, such as freshwater *Pomacea* snail, waterfowl, and fish. The seasonal inundation of the Crawford Bank site may explain the lack of animal bone, but the abundance of *Pomacea* shell in direct association with lithic material suggests this was an important edible resource that the early inhabitants of Crooked Tree may have relied on. Still today, *Pomacea* shell is abundant in the surrounding lagoon and wetland systems. Other investigations of preceramic populations in cave and rock shelters in southern Belize have revealed stratified midden deposits of freshwater shell. Keith Prufer and colleagues (2017) have documented stratified contexts with riverine jute shell middens and barbed points similar to the Lowe point found at Crawford Bank. Based on a large series of radiocarbon dates from these stratified deposits they have convincingly argued that the barbed points may date as early as the Paleoindian period, rather than the Early Archaic as has been previously suggested. They conclude that by at least 10,500 B.C. the exploitation of nearby stone tool resources and the processing of freshwater snail were a major part of the preceramic use of the rock shelter (Prufer et al. 2017:321).

Like the rock shelters of southern Belize, Crawford Bank not only has a rich source of freshwater snail, but also abundant stone tool resources. The "Northern Belize Chert-bearing Zone" (NBCZ) extends across central-northern Belize, circumscribing the Crooked Tree island and its expansive wetland-lagoon system. The NBCZ contains naturally occurring chert nodules of high quality and inhabitants of Crawford Bank had ready access to a range of lithic source material. Jon Lohse and colleagues (2006) present a chronological framework for the preceramic period in Belize and compiled a timeline corresponding to the Archaic period with associated diagnostic lithic forms (**Figure 13.9**). At Crawford Bank, we seem to have most of the assemblage rendered in the figure produced by Lohse and colleagues (2006:217), which they suggest is Early Archaic, dating between 3500-1900 B.C (**Figures 13.6** and **13.10**). Similar lithic forms from Crawford Bank include the barbed Lowe point, pointed unifacial tools, constricted unifaces, macroblades, small blades, bifacial celts, and hammer stones (Stemp et al. 2018; Stemp, this volume).

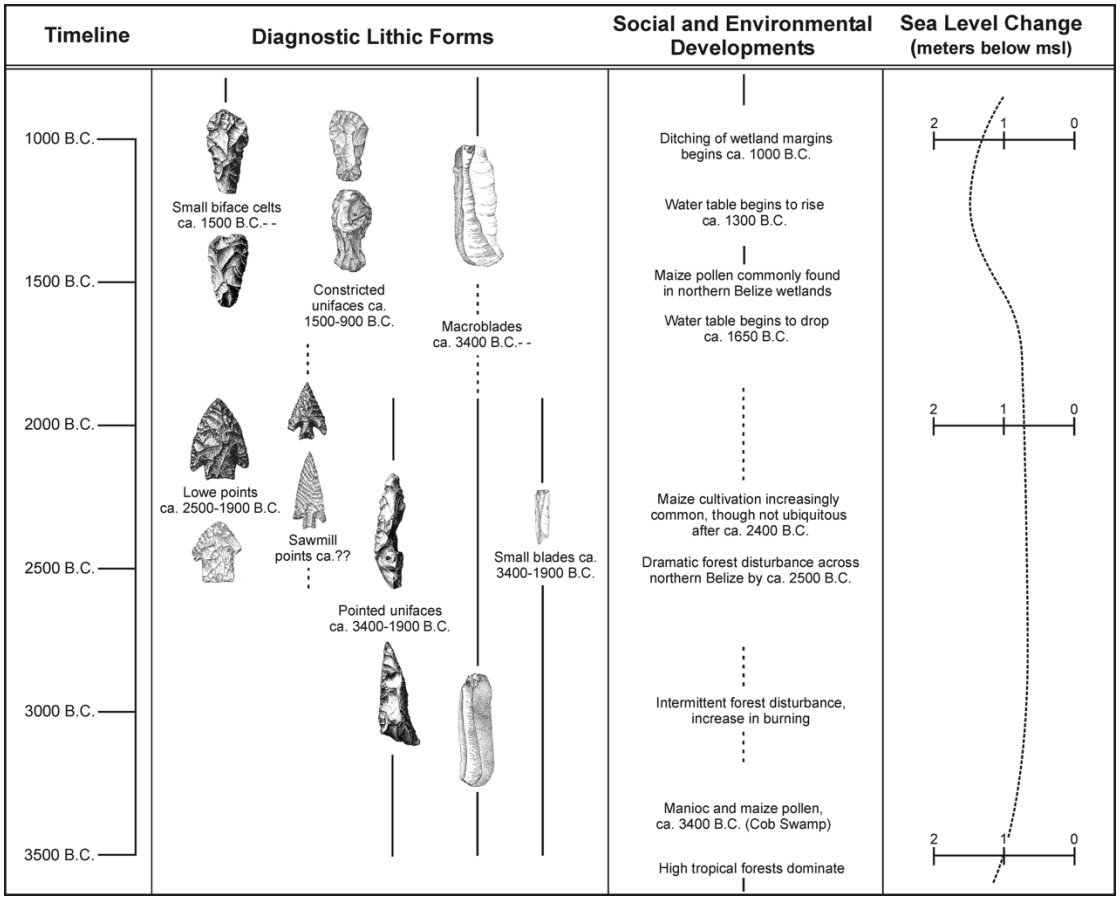

Figure 13.9 Diagnostic lithic forms of the preceramic (*after* Lohse et al. 2006: Fig. 8)

Figure 13.10 Diagnostic lithic forms from Operation 35 at Crawford Bank (Photographs by E. Harrison-Buck).

Conclusions

Jon Lohse and colleagues (2006) note that a solid chronological sequence for the preceramic period has been hindered by a lack of stratigraphic contexts and very few radiocarbon dates in direct association with these preceramic deposits. The investigations by Prufer and his team in southern Belize are helping to clarify the occupation, specifically in the uplands of Belize proximate to riverine environments. Lohse and colleagues (2006:221) observe that many early preceramic sites also may exist in "perennially wet environments" but their seasonal inundation "[poses] severe logistical challenges to researchers." This is the certainly case at Crawford Bank where the site is seasonally inundated by the rising waters of Crooked Tree Lagoon during the rainy season. By conducting our 2017 investigations at the tail end of the dry season during the first week of June, we were able to expose deposits that are covered by the lagoon for much of the year. However, our understanding of the preceramic deposits from wetland sites like Crawford Bank is hindered by a lack of well-preserved artifacts, namely bone

and charcoal that can be radiocarbon dated. Our deposits at Crawford Bank were completely devoid of any organic material, other than freshwater shell which cannot be accurately dated.

Future research should be aimed at investigating potential areas of the Crawford Bank site that are not seasonally inundated and may have deeper, stratified deposits with datable material culture, such as locations farther inland from the shoreline. While the full extent of this site remains unknown, local informants indicate that the limestone outcrop extends the length of Crawford Bank. Further testing may find that the preceramic occupation follows the bedrock outcrop and extends several kilometers, making it the largest preceramic site in Belize.

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Section III

Analytical Investigations

Chapter 14

Lab Methodology for the Belize River East Archaeology Project

Astrid Runggaldier, Lori B. Phillips, and Marieka Brouwer Burg

Introduction

This chapter describes the collection management framework and process of laboratory methods for the artifacts and other finds of the BREA Project. The goals of the BREA laboratory have been to create a system that allows for artifacts to be recovered in the field and processed in a laboratory environment allowing for a growing collection, and for a laboratory setting that moves with the moving geographical focus of the project research areas. The overall objective of the initial set-up was to create an easy to find inventory, both digitally and physically, in preparation for detailed material analysis by specialists joining the project at any point in its long-term development. With these goals in mind, the BREA laboratory protocols were adapted from the Xibun Archaeological Research Project (XARP) (McAnany, Harrison-Buck, and Morandi 2004), and the recording system was developed in collaborative discussion with the Chan Chich Archaeological Project (see Houk 2012, and Nettleton 2013). The BREA lab protocols rest on two interconnected systems: Field Collection Bags (FCBs) and Lab Collection Bags (LCBs). Both FCB and LCB inventories are databased in FileMaker Pro (FP).

The BREA system was devised by the first author in 2011, with input from Adam Kaeding for what concerns the XARP system, and from Satoru Murata for the establishment of relational categories and forms in FileMaker Pro and Go to be used respectively in the lab and in the field. Since 2011, Marieka Brouwer Burg has joined the lab and run operations in addition to her other duties and research interests, including artifact drawing and photography, and the maintenance of the GIS database. More recently, Lori Phillips, working on zooarchaeological research (see Phillips, Chapter 15), and having experience with lab processes on the Chan Chich Project (Phillips 2014), has also joined the BREA staff and run our processing system at a satellite lab when we have had to split the laboratory facilities into multiple locations while working in different sectors of the BREA research area.

Since 2011 the BREA system has proven to be flexible enough to grow with a rapidly growing project, exhaustive enough to address all the needs we have had so far, and inherently consistent enough for additional lab staff and students to step in and out of the process without all members of the lab present in each field season. As a result of this, we have not had to change systems over different seasons, store information in separate databases, nor change software over the years except to upgrade versions. We additionally maintain a BREA Project DropBox system of folders that includes all current and archived lab databases and is accessible to all members of the project. However, in the field, the lab staff processes materials and other

needs entirely offline, and later updates all new data from lab computers to the cloud-based storage and backup system.

In what follows, we outline the objectives of the system we use, and then describe in detail the process and purpose of each step in our protocol. This chapter, while not a complete manual of operations (which necessarily changes regularly with each software update), still serves as the basic explanation of the framework that we use to address the laboratory needs of a project that covers a large geographical area and has all historical periods of occupation included in the research design, from archaic, to ancient Maya, Spanish, and British Colonial periods.

Beyond usefulness for those working in the lab, the explanations included in the next pages should be a useful introduction to the system for the following: 1) all students involved in excavation, reconnaissance, or survey in the field, in order to understand the context-tracking system and why it is important to maintain accurate recording and artifact-collecting practices; 2) all new members of the project who need an overview of practices for both lab and field, 3) specialists who may visit for a short time to carry out analytical research and need a rapid introduction to how materials are stored and where to find them; and 4) any other archaeological projects who wish to compare and share information on the methodologies of their material culture and data collection practices.

Objectives

1. To collect all materials recovered in the filed through the FCB system to maintain accurate records of all contextual information.
2. To reduce contamination of context by indexing FCBs on a daily basis, so accidental mixing of contexts can be reduced to a minimum, and potentially compromised materials can be separated without affecting the overall context of an archaeological layer (ie, provenience or "zone" in BREA project nomenclature).
3. To process all recovered artifacts into lab categories that are databased according to a number of variables searchable through FP.
4. To separate and store all processed materials according to material class first, and provenience second, with the goal of making artifact classes easily accessible for analysis by specialists.

Description of the Process and Methods

Recording Provenience, Collecting Artifact in FCBs, and Processing LCBs

Op. Zn. Sq. Context Tracking

Our project maintains an inventory of all excavations, reconnaissance trips, and survey areas in Filemaker Pro, because this software allows the creation of relational databases with hierarchies of information. We maintain a single database, regularly archived for backup, for all field and lab activities since the inception of the project in 2011, and now encompassing approximately fifteen field seasons.

Our BREA database in FP starts with a Site Record at the highest level of the hierarchy, which includes the name and brief description of each site that has been the focus of excavations in the overall research area under BREA. This is followed by a record of all Operations, or discrete units of excavation, of which there may be one or more per each site in the Site Record.

For each excavation undertaken by the BREA Project, a running list of Operation numbers (Op. #) is created, beginning with Operation 1 at the inception of the Project in 2011, and successive numbers are added without repeating them, regardless of the date and location within the broad geographical expanse of the BREA research area. For example, Operation 1 refers to the excavations conducted in 2011 at the base of Structure 1 at Ma'xan, Operation 9 was excavated at Hats Kaab in 2012, and Operation 19 excavations focused on Structure 25 at Saturday Creek in the January and June field seasons of 2014. The advantage of this system is that discrete areas of research are easily identifiable in the FP database by their Op. number.

Excavations get their own Operation number regardless of size, from an individual 1 m x 1 m test pit unit, to, for example, a sprawling polygonal shape draped over an entire mound and measuring an area roughly 16 m x 20 m. In the latter case, the Operation is subdivided into sections denominated "squares" (regardless of whether they are square or rectangular) and labeled with letters. For example, in **Figure 14.1**, the hypothetical Operation 35 is a 5 m E-W x 5 m N-S excavation unit, with 9 squares, four of which are 2 x 2 m sections and three are 1 m E-W x 2 m N-S (Squares C, F, and I). Within Operations, each depositional layer or stratigraphic level is identified as a "zone." Further spatial definition to an artifact's find spot within a zone is given by the "square" or section of gridded space within the Operation. The resulting provenience record for each collected artifact carries the designation of Operation, Zone, and Square, and in our Field Collection Bags, or FCBs, would look like this: Op. 35, Zn. 2, Sq. C, or in the FP lab database simply by the short-hand 35.2.C.

The entire Operation is laid out on the ground, strung with mason line, and recorded with a total station so its precise location can be tied into the GIS. Perhaps not every one of the squares will be excavated, but as long as they are contiguous with the rest of the unit, they are part of the same Operation, and can be "opened" at any time in the same or subsequent field seasons. If extensions are needed, they are part of the same Operation only if contiguous with at least one square side; if not, a separate excavation unit is set up and assigned a new Operation number.

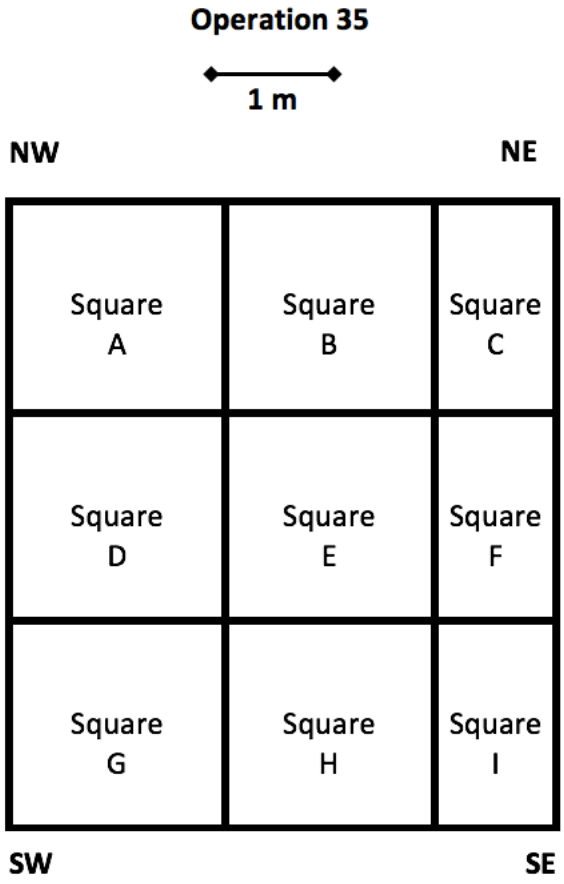


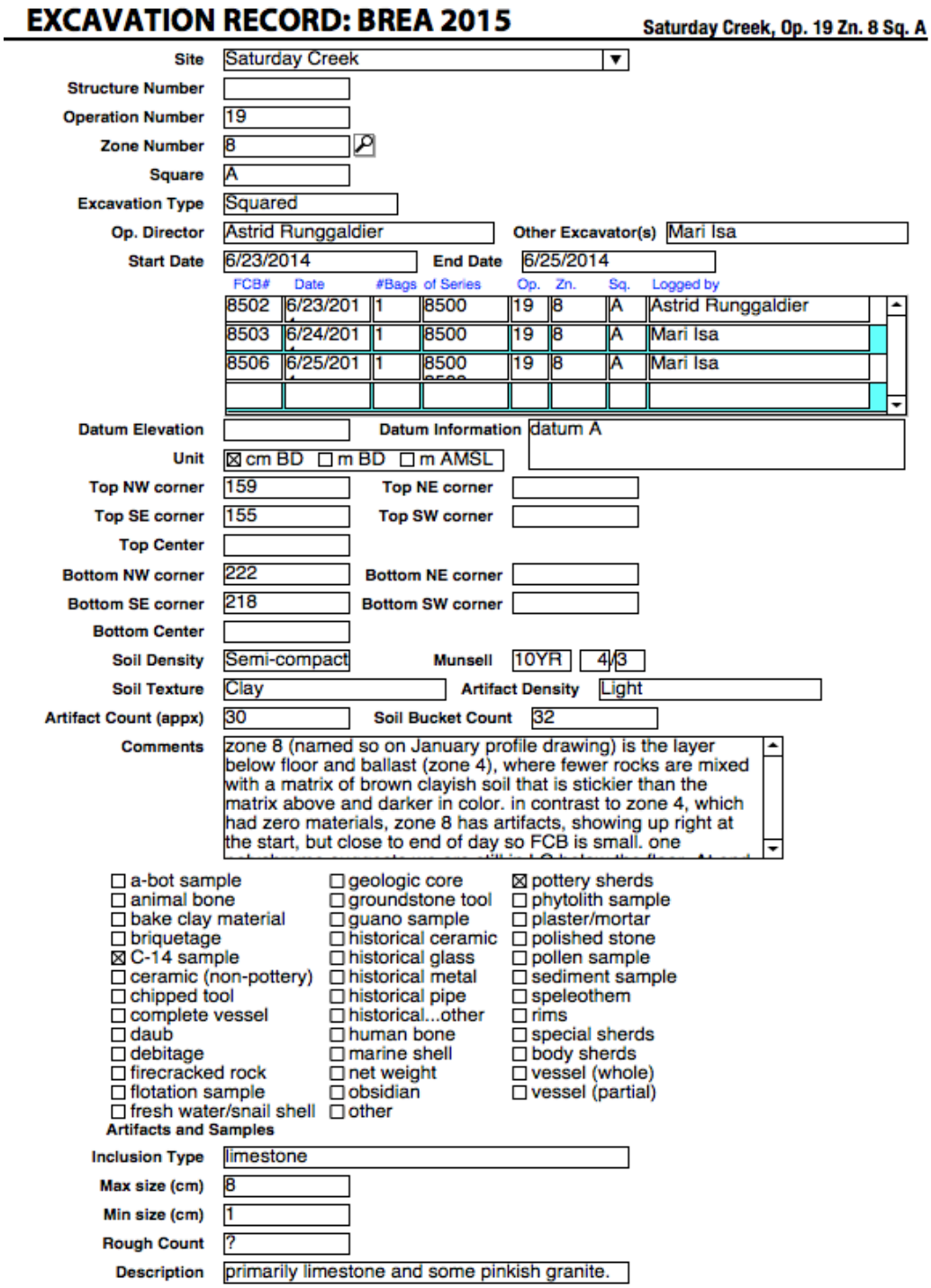
Figure 14.1 Schematic layout of the hypothetical Operation 35 with Squares A through I (drawing by A. Runggaldier).

Depositional Layers, or "Zones"

Because depositional layers can cross-cut squares, it follows that any identified and numbered zone can extend to multiple squares. For example, Zone 1 is typically the most recent depositional layer, or topsoil, and can be expected to exist in all squares — that is, A through I in the example in **Figure 14.1**. A collapse layer of tumbled stones, for example designated as Zone 2, may be present only in Squares A, D, and E. The sequence of Zones is listed in the FP Zone Record, below the hierarchy from Site Record and above the Excavation Record, which is specific to each Square.

Excavation Record Forms

The Op. Zn. Sq. designation, and all related information is recorded in the field on iPads using the mobile version of FP, and entered in the BREA basic excavation form called an Excavation Record (**Figure 14.2**). Excavation Record forms provide the space for descriptive



EXCAVATION RECORD: BREA 2015 — Saturday Creek, Op. 19 Zn. 8 Sq. A

Site: Saturday Creek
Structure Number:
Operation Number: 19
Zone Number: 8
Square: A
Excavation Type: Squared
Op. Director: Astrid Runggaldier
Other Excavator(s): Mari Isa
Start Date: 6/23/2014
End Date: 6/25/2014

FCB#	Date	#Bags	of Series	Op.	Zn.	Sq.	Logged by
8502	6/23/201	1	8500	19	8	A	Astrid Runggaldier
8503	6/24/201	1	8500	19	8	A	Mari Isa
8506	6/25/201	1	8500	19	8	A	Mari Isa

Datum Elevation:
Datum Information: datum A
Unit: ☒ cm BD ☐ m BD ☐ m AMSL
Top NW corner: 159
Top NE corner:
Top SE corner: 155
Top SW corner:
Top Center:
Bottom NW corner: 222
Bottom NE corner:
Bottom SE corner: 218
Bottom SW corner:
Bottom Center:
Soil Density: Semi-compact
Munsell: 10YR 4/3
Soil Texture: Clay
Artifact Density: Light
Artifact Count (appx): 30
Soil Bucket Count: 32
Comments: zone 8 (named so on January profile drawing) is the layer below floor and ballast (zone 4), where fewer rocks are mixed with a matrix of brown clayish soil that is stickier than the matrix above and darker in color. in contrast to zone 4, which had zero materials, zone 8 has artifacts, showing up right at the start, but close to end of day so FCB is small. one

Artifacts and Samples

☐ a-bot sample	☐ geologic core	☒ pottery sherds
☐ animal bone	☐ groundstone tool	☐ phytolith sample
☐ bake clay material	☐ guano sample	☐ plaster/mortar
☐ briquetage	☐ historical ceramic	☐ polished stone
☒ C-14 sample	☐ historical glass	☐ pollen sample
☐ ceramic (non-pottery)	☐ historical metal	☐ sediment sample
☐ chipped tool	☐ historical pipe	☐ speleothem
☐ complete vessel	☐ historical...other	☐ rims
☐ daub	☐ human bone	☐ special sherds
☐ debitage	☐ marine shell	☐ body sherds
☐ firecracked rock	☐ net weight	☐ vessel (whole)
☐ flotation sample	☐ obsidian	☐ vessel (partial)
☐ fresh water/snail shell	☐ other	

Inclusion Type: limestone
Max size (cm): 8
Min size (cm): 1
Rough Count: ?
Description: primarily limestone and some pinkish granite.

Figure 14.2 Example of an Excavation Record form in FileMaker Pro used to record data in the field on iPads running the mobile version FileMaker Go (designed by Satoru Murata).

notes, and a number of other variables from position below Datum, to Munsell colors, and soil densities. The Excavation Records are specific to both each Zone and each Square. Any depositional details within a Square are described in the Excavation record. If unique depositional features, like caches, postholes, middens, or burials are found, they warrant their own Zone number.

Among the most important aspects of the Excavation Record form, in particular for artifact processing in the lab, is the record of FCBs, which includes FCB number, date of collection, number of bags if more than one, series number it belongs with, Op. Zn. Sq. context, and name of the excavator. This information is entered directly into the Excavation Record form, and will automatically populate the records of the FCB Log, linked to a number of other records in FP relationships. The above information is also recorded in Sharpie on the label of the Field Collection Bag itself.

Artifact Tracking in FCBs

FCBs are Field Collection Bags, typically cloth soil sample bags with a tag for labeling, and are collected and brought back to the lab on a daily basis. The first goal of this practice is to avoid leaving bags at the excavation at the end of a field day, even if the context (zone and square) is still "open," so as to reduce any chance of artifacts going astray. The second is to reduce chances of contamination from different zones and squares in the context of a research project with an active field school, in which students might rotate in and out of excavations and may not have finished excavating a zone by the time they are assigned to a different training location. The third goal is to have materials brought in to the lab for processing on a regular basis throughout the field season, rather than all at once towards the end.

Daily Creation of FCBs

The practice of creating new Field Collection Bags daily for each open context (ie., each zone and square still under excavation) necessarily results in a high number of FCBs, but because they are given discrete numbers, the system is open-ended and allows for potentially infinite numbers of FCBs, with each new zone that is opened warranting the creation of a new FCB as soon as the first artifact from it is uncovered.

Overall this system is one that privileges "splitting" over "lumping", but the distinct advantage of splitting contexts into the smallest units possible, down to the individual days, is that one bag, compromised because of an error, can simply be separated from other ones with the same provenience, and preserve the integrity of the rest of the context. This detail is particularly helpful for lengthy excavations of architectural contexts with a focus on determining chronological sequences by using the pottery types present in each depositional zone, or building phase.

All Classes of Materials Collected Together in FCBs

One important characteristic of an FCB is that all materials are collected in the same bag, regardless of material class. There are no separate FCBs for pottery sherds, chert, obsidian, etc. Aside from packaging fragile artifacts in tinfoil packets or small Ziploc bags (like charcoal samples, and shell), all types of materials from the same context are collected in the same bag. It is the work of the lab processing stages to sort artifacts with the same provenience by material classes to be stored separately. This practice reduces the need or demand on excavators to make interpretive decisions in the field. Sometimes, especially when working in the rainy seasons, muddy sherds have been virtually indistinguishable from rocks, and vice versa. When in doubt, the sorting can be done in the lab, once the artifacts have been washed.

If in a single day a large number of artifacts is uncovered, as for example when excavating a midden, a single FCB number will be assigned to multiple bags, and each will be labeled as bag 1/x, 2/x, etc., where x is the total number of bags for that day.

FCB Series Numbers

An Excavation Record form in FP a single context–that is the record for a single zone and square in any given Operation–can have multiple FCB numbers, each corresponding to a different date (see **Figure 14.2**). To reduce accidental doubling of numbers, the lab assigns each Operation a number "series" for FCBs (for example the 3000 series or the 4500 series). These are determined ad hoc to allow plenty of numbers for each Operation, and to prevent other excavations occurring in different parts of the BREA research area at the same time from accidentally giving the same number to an FCB, which could lead to a mixing of contexts. Most FCBs from a single Operation are sequential numbers in a particular series, but if at any point additional FCBs need to be created, including in later seasons, any number will do, as long as it is not concurrently used elsewhere on the project.

Checking In and Logging FCBs for Lab Processing

FCBs, which are brought back on a daily basis to avoid end-of season accumulation, are logged into lab check-in sheets and all artifacts in the bags are washed, dried, and returned to the FCB to await processing once a context is "closed." A closed context means that excavation of a zone is completed and no additional artifacts from the same context can be expected, so the lab can start processing the total number of finds for that particular Op., Zone, and Square.

Laboratory Processing of LCBs

Once artifacts have been brought to the lab from excavation, reconnaissance, and survey, they are processed into Laboratory Collection Bags or LCBs, which are plastic bags that are then stored in stackable lidded bins.

The process of going from FCBs to LCBs is not a direct one-to-one transfer from cloth field bags to plastic lab bags. Rather, the artifact assemblage from each individual context, grouped together into FCBs, is sorted into separate classes by material and sub-categories of materials (**Figure 14.3** and **14.4**). In this way, processed artifacts comprise various categories, like pottery, chert, obsidian, jade, shell, animal bone, human bone, etc. and are bagged by individual contexts – that it, by Op. Zn. Sq. – which are then stored with other like materials.

Figure 14.3 Lab processing to sort materials from single-context FCBs (cloth bags) to LCBs (plastic bags) for each material class, while recording information in FileMaker Pro (photo by A. Runggaldier).

LCB Tag Information and Associate Digital Records

Each plastic bag carries a label with the BREA season of excavation by year, the site name, and the Op. Zn. Sq. provenience, followed by material type, count, and LCB bag number. Any of these variables key into the FB database of information that is recorded at the lab processing stage, and which includes the information from the label, in addition to weights, type of provenience (whether excavation or other), date (Julian date of collection if from reconnaissance/survey and calendar date of processing if from excavation), and any useful comments (on the artifact itself, or associated drawings and photos) (**Figure 14.5**).

Figure 14.4 Example of materials from one FCB that are separated in the lab into three LCBs by material categories (one for Partial Vessel, one for Jade, and one for Other–in this case glass crystal) (photo by A. Runggaldier).

BREA Database Master_2015-06-22

2740 Records | 4279 Total (Sorted) | Show All | New Record | Delete Record | Find | Sort

Layout: Artifact Record | View As: | Preview

Artifact Type	Count	Weight	Operation	Zone	Square	Provenience Type	Julian/Calendar Date	LCB Number New	Site Name	Comments
rims	9	122.3	25	2	A	excavation	6/10/15	6994	More	
body sherds	2	11.0	25	0	0	surface	6/10/15	6992	More	
animal bone	1	0.4	25	0	0	surface	6/10/15	6993	More	
body sherds	12	21.9	25	2	B	excavation	6/10/15	7004	More	
chipped tool	1	6.5	25	2	B	excavation	6/10/15	7005	More	
debitage	3	23.8	25	2	B	excavation	6/10/15	7006	More	
historical metal	2	1.3	25	2	B	excavation	6/10/15	7007	More	
other	1	.2	25	2	B	excavation	6/10/15	7008	More	shotgun shell
rims	1	14.5	25	2	C	excavation	6/10/15	7009	More	
body sherds	13	27.3	25	2	C	excavation	6/10/15	7010	More	
debitage	2	18.7	25	2	C	excavation	6/10/15	7011	More	
obsidian	1	2.5	25	2	C	excavation	6/10/15	7012	More	
rims	1	7.3	25	2	E	excavation	6/10/15	7013	More	
special sherds	1	1.4	25	2	E	excavation	6/10/15	7014	More	
body sherds	4	8.6	25	2	E	excavation	6/10/15	7015	More	
bake clay material	1	11.2	25	2	E	excavation	6/10/15	7016	More	
obsidian	1	0.7	25	2	E	excavation	6/10/15	7017	More	
debitage	2	2.6	25	2	E	excavation	6/10/15	7018	More	
animal bone	1	0.4	25	2	E	excavation	6/10/15	7019	More	jaw
rims	2	18.0	25	4	A	excavation	6/10/15	7021	More	
special sherds	1	2.4	25	4	A	excavation	6/10/15	7022	More	
body sherds	6	9.3	25	4	A	excavation	6/10/15	7023	More	
bake clay material	1	4.8	25	4	A	excavation	6/10/15	7024	More	
debitage	3	8.3	25	4	A	excavation	6/10/15	7025	More	
obsidian	3	7.6	25	4	A	excavation	6/10/15	7026	More	
special sherds	1	2.3	25	8	D	excavation	6/10/15	7035	More	
special sherds	35	330.3	25	2	A	excavation	6/10/15	6995	More	several refits from
body sherds	81	272.0	25	2	A	excavation	6/10/15	6996	More	
debitage	5	21.8	25	2	A	excavation	6/10/15	6997	More	
chipped tool	1	6.2	25	2	A	excavation	6/10/15	6998	More	
historical ceramic	2	6.4	25	2	A	excavation	6/10/15	6999	More	one rim, one body
other	1	0.4	25	2	A	excavation	6/10/15	7000	More	white plastic
obsidian	4	5.4	25	2	A	excavation	6/10/15	7001	More	
bake clay material	4	12.6	25	2	A	excavation	6/10/15	7002	More	
C-14 sample	2	21.8	25	2	A	excavation	6/10/15	7003	More	weight with foil
body sherds	5	4.8	25	3	A	excavation	6/10/15	7020	More	
rims	10	99.8	25	4	B	excavation	6/10/15	7027	More	
special sherds	2	13.8	25	4	B	excavation	6/10/15	7028	More	
body sherds	62	179.9	25	4	B	excavation	6/10/15	7029	More	
debitage	10	33.3	25	4	B	excavation	6/10/15	7030	More	
obsidian	1	1.0	25	4	B	excavation	6/10/15	7031	More	
special sherds	1	12.8	25	10	A	excavation	6/10/15	7042	More	
body sherds	6	14.6	25	10	A	excavation	6/10/15	7043	More	
obsidian	1	3.8	25	10	A	excavation	6/10/15	7044	More	one whole blade
other	1	3.0	25	10	A	excavation	6/10/15	7045	More	plastic shotgun
rims	1	66.4	25	9	A	excavation	6/10/15	7036	More	
special sherds	2	26.7	25	9	A	excavation	6/10/15	7037	More	one refit
body sherds	4	28.3	25	9	A	excavation	6/10/15	7038	More	one refit
debitage	3	45.0	25	9	A	excavation	6/10/15	7039	More	
groundstone tool	1	147.2	25	9	A	excavation	6/10/15	7040	More	axe/mono fragment
other	1	0.3	25	9	A	excavation	6/10/15	7041	More	a plastic button
Rims	1	13.5				surface	6/10/2011	1814	Kuch	
Ceramic (non-	5	23.3				surface	6/10/2011	1815	Kuch	potential whistle
Freshwater/snail	5	21.8				surface	6/10/2011	1816	Kuch	

Figure 14.5 Section of the Artifact Record lab database in FileMaker Pro showing categories of recorded information (image prepared by A. Runggaldier).

To illustrate the above, a search by LCB number will pull up the specific information and content of that individual plastic LCB bag. For instance, one LCB bag might contain materials labeled under the FP category of "historical ceramics" (**Figure 14.6**). A search by the Op. Zn. Sq. on the label will pull up all other materials associated with the historical ceramics and from the same context. Alternatively, a search for historical ceramics then sorted by site will show the occurrence of the same type of material across all contexts at the same site and beyond.

Figure 14.6 Historical ceramics recovered in by BREA excavations at the McRae site (Operation 6) (photo by A. Runggaldier).

Storing of LCBs – Bags and Bins

The plastic bags for LCB processing are sturdy 2 mm-thick, with zip tops, and a white stripe that is labeled with Sharpies, and contain the artifact as well as a metal tag inscribed with the same context information. These specifications ensure that stored bags do not rip, that labeled information does not wipe off, and that if it does, a second provenience label is also inside the bag. The LCBs are then stored in sturdy, lidded, stackable plastic bins by like materials in, so that that pottery sherds are grouped with pottery sherds, and obsidian with obsidian (**Figure 14.7**). When artifact classes are bulky, like ceramics, material type bins are further sub-divided by Operation. When artifact classes occupy limited space, like obsidian, all LCBs of obsidian are stored in the same bin regardless of Operation or site.

Figure 14.7 Stackable bins in lab storage containing LCBs sorted by material class (photo by A. Runggaldier).

Accessing Artifacts by Material Class

The primary goal here is to envision the use of the stored materials in the future: beyond processing and storage, these artifact assemblages are and will continue for years to be used for analytical research. Given that analytical specialization is by material class, a ceramicist, a lithic specialist, zooarchaeologist, and human osteologist will be interested in quickly finding and retrieving all the materials of their specialization, without needing to dig a small bag of obsidian blades out from several bags of ceramics, chert tools, and animal bones. If it is necessary to see what else was found with the obsidian blades, a quick search in FP can identify all other materials associated with any one particular artifact.

Artifact Categories and Sub-Categories

Other efforts expedite the ease with which a specialist can access lab materials and the excavation information recorded for them, including the kinds of categories and sub-categories into which lab processing protocols sort, after washing and drying, the contents of FCBs that

come in from the field (see first column in **Figure 14.5**). An example are the categories of ceramics, which are separated into three pottery sub-categories: "rim" pottery sherds; "special" sherds, comprising diagnostic features like distinctive Type:Variety surface treatments such as impressions, polychrome surfaces and the like, or morphological parts that aid in the identification of the vessel, such as bases, handles, defined necks, supports, flanges, etc.; and the third category of body sherds (**Figure 14.8**).

Figure 14.8 Ceramics from a single Op. Zn. Sq. being sorted into the sub-categories of Pottery–Rims, Pottery–Specials, and Pottery–Body Sherds (photo by A. Runggaldier).

Ceramics are additionally separated in the case of whole and partial vessels, and historical ceramics (several of our excavations have included historical artifacts including glazed ceramics and stoneware). Other are sorted for non-pottery categories, like figurines and figurine fragments. We do not use the category of "small finds" in our FP database, as it tends to quickly become a catchall category (we only use the category for the storage bins to group together small and fragile items, like obsidian, worked and unworked shell, figurine fragments, and the like). If artifacts cannot be sorted into one of the pre-defined categories in the Artifact Record database, we use the category "other" with a column for notes specifying the nature of the unusual artifact (for example, the polished fragment of crystal glass in **Figure 14.4**).

Other Material Categories and Analytical Samples

Other examples of categories include materials from both pre-Hispanic and historical times, or collected for scientific analysis. For instance, chert, separated into chipped tools and debitage, groundstone tools, freshwater shell, marine shell, and worked shell, historical pipes, glass, and metal, speleothems, and lumps of baked clay material and daub (**Figure 14.9**).

Figure 14.9 Example of baked clay material from a single context, separated from other materials and counted, weighed, and stored in LCB bags (photo by A. Runggaldier).

Other Artifact Record categories include the samples collected for later analysis, like archaeobotanical, flotation, phytolith, pollen, sediment, and C-14 samples. In this sense the FP laboratory database, though called "Artifact Record," in in fact a master database of all materials recovered in the field research, whether artifact, or ecofact occurring in association with human activities of the past.

Conclusions

To summarize the protocol of going from field to lab, or from FCBs to LCBs it is useful to think of field collection as a process of splitting contexts by day into small units (individual FCBs) to minimize errors that could compromise the understanding of provenience and chronological change. In contrast, the lab collection lumps back together all FCBs regardless of collection date into context units of provenience defined by the Op.Zn.Sq. designation. It then

spits each context into material classes to be store separately for easy access by analytical specialists. Because the FCB and LCB systems are different in concept and purpose, they run entirely separate number series. An artifact with an LCB number does not correspond to the FCB number that the artifact was collected under. If fact, because of the separate LCB material categories, there are many more numbers used in the LCB system than there are in the FCB system: for each FCB bag of pottery sherds, chipped tools, and other finds, multiple LCB bags result after processing the collected artifacts in the lab.

Once the lab has processed materials, the LCB number remains the important identifier to retrieve all associated information. The FCB numbers that the artifacts were collected through can be discarded. The provenience information of the Op.Zn.Sq. is sufficient to pull up both the information processed through the lab and stored in the FB Artifact Record, as well as the information about the context recorded during excavation and stored in the FP excavation record.

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Chapter 15

Faunal Analysis from Sites in the Middle and Lower Belize Valley: Methods and Preliminary Findings

Lori B. Phillips

Introduction

During the 2016-2017 field seasons, in-field preliminary faunal analysis continued following methods and procedures outlined in Phillips 2015. This chapter reports on the faunal assemblage from the site of Jabonche and provides an updated taxonomic identification of turtle remains from BREA sites as a whole.

Methods

Only faunal materials that were cataloged and given an LCB number were considered in this analysis. Identification includes taxonomy, element, side, age, sex, natural modifications, and cultural modifications. Taxonomic identification to the genus or species level was attempted when possible, but the majority of faunal elements could only be identified into categories such as Large Mammals (deer, peccary, or tapir sized), Medium Mammals (dog or raccoon sized), Small Mammals (agouti, paca, or armadillo sized), Fish, Turtles, Birds, etc. When preservation permitted, taxonomic identification was aided by Gilbert's *Mammalian Osteology* and Olsen's *An Osteology of Some Maya Mammals* (Gilbert 1990; Olsen 1982). A total of 743 faunal remains were analyzed from the site of Jabonche. A subset of faunal remains were exported to the Florida Museum of Natural History in Gainesville, Florida and were analyzed using the extensive Mesoamerican comparative collection under the advisement of Dr. Kitty Emery and Dr. Erin Thornton. The number of identified specimens (NISP) was recorded following Lyman's methods and percent NISP (%NISP) was calculated by dividing the NISP of each taxon by the total site NISP (Lyman 2008). NISP was utilized over the minimum number of individuals (MNI) due to the problems associated with determining turtle and fish MNI from fragmentary turtle carapace and isolated fish vertebrae, but the author is aware of the problems associated with this quantitative method of taxonomic abundance.

Results

A total of 743 faunal remains were analyzed in-field from the site of Jabonche (Table 15.1). Overall, Jabonche follows the pattern of previously analyzed sites where aquatic (both freshwater and marine) outnumber terrestrial species (Phillips 2015). This is abundantly clear with turtle remains, although the reader should remember the use of NISP for fragmented turtle carapace and plastron is likely overinflating the actual number of turtles present. If turtles are removed, the pattern of aquatic to terrestrial fauna still holds with aquatic taxa making up the majority of recovered fauna.

Table 15.1 Total Faunal Remains from Jabonche (NISP, %NISP)

Taxa	Count (NISP)	%NISP
Fish	71	9.6%
Turtle	416	56.0%
Marine Shell	16	2.2%
Sand Dollar	11	1.5%
Freshwater Shell	72	9.7%
Large Mammal	55	7.4%
Medium Mammal	3	0.4%
Small Mammal	7	0.9%
UID Mammal	46	6.2%
Bird	1	0.1%
Terrestrial Shell	9	1.2%
UID	36	4.8%
Total	743	100.0%

When broken into operations (Table 15.2), the midden associated with Structure 24 (Operation 28) had the highest number of recovered fauna, representing 48% of all Jabonche fauna. A complete turtle shell representing one turtle was recovered from this unit and when the total number of carapace and plastron fragments from this turtle are removed, Operation 28 has an NISP of 108 for turtle remains and maintains the overall pattern of BREA faunal materials. Operation 27, the likely redeposited midden as a fill layer associated with Structure 26, follows Op 28's pattern of turtle and aquatic taxa domination. Of note is the large quantity of freshwater shell recovered from a posthole dug into a floor (Zone 9; Flanagen et al. 2015). This zone was completely comprised of freshwater clam (*Nephronaias* sp.) and three turtle carapace fragments. No other context had a similar quantity of freshwater clams. Operation 26, the columned

structure, had the lowest faunal count but is unique in the recovery of 11 sand dollars (Figure 15.1). Two of these were recovered in Zone 1 topsoil while the remaining nine were recovered in Zone 2 collapse debris. The author is unaware of the specific genus or species but their presence indicates a connection to the coast since this organism is only found in marine environments.

Table 15.2 Jabonche Fauna by Operation (NISP)

Taxa	Op 26	Op 27	Op 28
Fish	1	35	35
Turtle	10	157	249
Marine Shell	12	4	0
Sand Dollar	11	0	0
Freshwater Shell	3	64	5
Large Mammal	32	11	12
Medium Mammal	1	2	0
Small Mammal	5	2	0
UID Mammal	2	9	35
Bird	0	0	1
Terrestrial Shell	5	3	1
UID	1	19	16
Total	83	306	354

A subsample of the BREA faunal material was exported to the Florida Natural Museum of History (FLMNH) at the University of Florida for detailed taxanomic analysis using the Mesoamerican comparative collection housed there. I analyzed the turtle remains in the summer of 2017, with the results reported below.

Figure 15.1 Sand dollars from Operation 26 Zone 2.

Based on this subsample, it appears Hicatee (*Dermatemys mawii*) and mud turtles (*Kinosternon* sp.) were preferentially procured out of the freshwater species that would have been available. Kaax Tsaabil, Saturday Creek, and Jabonche have both *Kinosternon* sp. and *Dermatemys mawii* present, Ik'nal has only *Dermatemys mawii*, and two sites (Huum Chaak and Ma'xan) have only *Kinosternon* sp. present. Two sites, Hats Kaab and Otley's Flat, do not have any turtles remains. The two represented species are riverine turtles, indicating and further supporting the importance of freshwater systems in Maya subsistence. Turtles were also important in ritual and ceremonial contexts as described by Taube (1988) and Miller and Taube (1993), so it is possible these two species were sought out for ritual as well as subsistence purposes.

Discussion and Conclusion

The results from Jabonche and the updated turtle analyses support my earlier claims that aquatic species played an important role in the subsistence strategies of the ancient Maya (Phillips 2015). This pattern of aquatic to terrestrial faunal use will be further investigated through the analysis of a larger proportion of BREA fauna using the FLMNH comparative collection.

Acknowledgements

I would like to thank my BREA family for their continued support throughout my research and analyses. This analysis would not have been possible without the support and direction of my advisor, Erin Thornton, as well as Kitty Emery's guidance while I was at the Florida Museum of Natural History.

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Chapter 16

Analysis of Chipped Stone Artifacts from the Crawford Bank Site, Crooked Tree: Raw Materials, Metrics, Technology, and Use-wear

W. James Stemp

Introduction

This report summarizes the results of the analysis of the chipped stone tools excavated from Squares A-J, Operation 35 at Crawford Bank, Crooked Tree, Belize, by the Belize River East Archaeology (BREA) Project in 2017. In all, 946 stone artifacts were analyzed in terms of raw material, technology, and use-wear. The lithic artifacts were recovered from aceramic contexts and are, thus, believed to date to the preceramic period before the Maya. It is important to note that there are no dates reported from the excavations yet, so an identification of the artifacts as preceramic is based on the absence of pottery and the presence of some tool types similar to those recovered from other preceramic contexts in Belize (see below). The recovery of one Lowe point (see below and Stemp et al. 2018) in Square J also supports the proposed dating of the deposits[1] (**Figure 16.1**).

Figure 16.1 Lowe point from Square J, Operation 35, Crawford Bank, Crooked Tree, Belize (photo by E. Harrison-Buck).

[1] The calculations of raw materials, tool types, and use-wear from the 2017 BREA excavations discussed in this report do not include the Crawford Bank Lowe point.

Raw Materials

The lithic artifacts from the 2017 BREA excavations at Crawford Bank consist of 938 (99.2%) cryptocrystalline silicates (chert or chalcedony) and 8 (0.8%) slate fragments (**Figure 16.2**). Of the 938 cryptocrystalline silicate chipped stone artifacts, 245 (26.1%) were identified as chert from the Northern Belize Chert-bearing Zone (NBCZ) based on its fine texture and characteristic banding and/or mottling and colors ranging from yellow/gold, honey brown, grayish brown, tan, to gray (Hester and Shafer 1984:164; Mitchum 1994:54; Shafer and Hester 1983:521; see McAnany 1989:334). This high quality chert is distributed throughout Northern Belize in what were once called the 'flint bearing soils' (Wright et al. 1959) of central Northern Belize, but is typically referred to now as the 'chert-bearing zone' (Shafer and Hester 1983; Hester and Shafer1984:158-159; also see Cornec 1985) at Colha and other lithic workshops nearby (e.g., Chicawate, Kunahmul, Maskall, and Sand Hill). In addition to Colha and neighboring workshops, NBCZ chert has been found at many Maya sites throughout mainland Northern Belize, as well as on Ambergris Caye, in the form of finished tools and debitage (e.g., Dockall and Shafer 1993; Hult and Hester 1995; Lewenstein 1987; McAnany 1989; McSwain 1991; Mitchum 1991; Mock 1997; Shafer 1983; Speal 2006, 2009; Stemp 2001, 2004; Stemp and Graham 2006). A number of preceramic bifaces and constricted unifaces have also been made from NBCZ chert, in addition to cores and flakes at preceramic sites (see Iceland 1997; Lohse 2010; Rosenswig et al. 2014; Stemp et al. 2016, 2018).

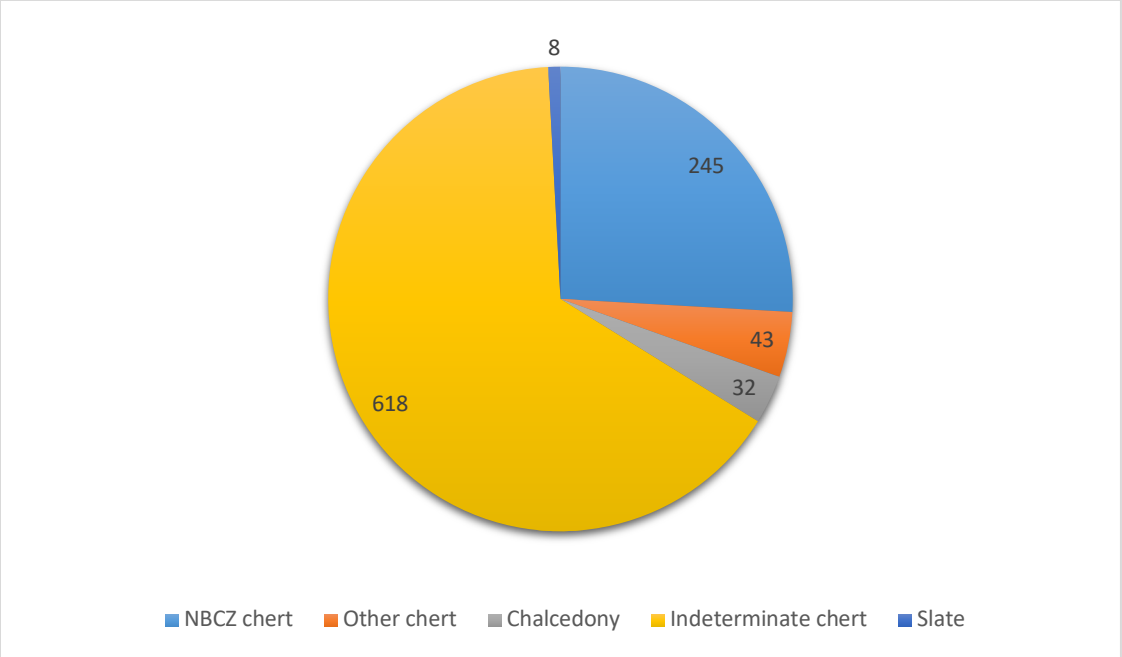

Figure 16.2 Number of lithic artifacts by raw material type from Operation 35, Crawford Bank, Crooked Tree, Belize. Note: Numbers do not include the Lowe point.

In addition to NBCZ chert, 43 (4.6%) chipped stone artifacts were made from medium- to coarse-grained cherts that were primarily brown and gray in color, a few of which were banded. They tended to have variable amounts of microvoids and small inclusions. It is not known where these cherts originate, but minimally they can be differentiated from the better quality NBCZ material. It is suspected that these are local cherts from the Crooked Tree area. It is possible that some may have come from further afield. Some of the coarser-grained cherts may be from around Northern River Lagoon (Mock 1997), Rocky Point (Kelly 1982), Midwinter Lagoon (Stemp 2001), Saktunha/Cabbage Ridge (Speal 2006, 2009), or near Laguna de On (Masson 1993, 1997; Oland 1999).

A small quantity (32 or 3.4%) of chipped chalcedony was also recovered during the 2017 Crawford Bank excavations. The chalcedony artifacts possessed a whitish-gray, porous cortex and the stone itself had a fibrous texture and was variably translucent brown/honey and light yellow/light gray in color. The chalcedony recovered from these sites may have come from the limestone facies north of the NBCZ, across the Freshwater Creek and New River faults (Hester and Shafer 1984:158), near Orange Walk Town (Hester and Shafer 1984:160), or around Laguna de On (Oland 1999:105, Table 1).

The majority of the chipped chert or chalcedony artifacts (618 or 65.9%) were classified as "indeterminate" due to the significant burning (**Table 16.1**) and/or patination of the raw material. Burning changed both the internal and external structures and the colors of the stone with pink, gray, red, white, and black variously occurring (based on the intensity and/or degree of burning). Burnt chert was also recognized based on one or more structural changes of the raw material, including fracture into angular chunks, potlids, crazing, calcination, and a change in luster to a greasy/shiny 'gloss' (Luedtke 1992: 97, 106; Mandeville 1973: 183; see Clemente-Conte 1997; Purdy 1974). The patinas that developed on the tools included 'black' patination/oxidation, glossy patination, and white patination based on the specifics of the chemical interactions with the environment in which they were found (Cackler et al. 1999; Glauberman and Thorson 2012: Howard 2002; Hult and Hester 1995; Lévi-Sala 1986: 230, 240, 1993; Luedtke 1992: 99-100; Plisson and Mauger 1988; Purdy and Clark 1987: 232; Rottländer 1975; Stapert 1976: 12; Stemp 2001: 28-29; Thiry et al. 2014). Patinas altered the surface color and/or surface textures of the artifacts. Artifacts with white patinas possessed variably porous microsurfaces and yellowish-white to white coloration. Those with 'black' patinas tended to range from glossy to matte and smooth in surface textures (**Table 16.2**). Glossy patinas created very smooth and lustrous surfaces, but did not, in and of themselves, alter the surface coloration of the cherts. Artifacts with glossy patinas do not seem to develop white or 'black' patinas.

The small quantity of slate artifacts from the site were thin fragments pieces of semi-reflective metallic gray, foliated stone with visible bedding planes, including the perforated example described in **Appendix A**. The closest sources of slate in Belize come from the Maya Mountains and the river systems that flow away from them (Cornec 1985; Graham 1987; Jackson et al. 1995; also see Healy et al. 1995).

Table 16.1 Number of burnt lithic artifacts by Square from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Square A	Square B	Square C	Square D	Square E	Square F	Square G	Square H	Square I	Square J
Burnt	7/11 (63.6%)	42/48 (85.7%)	15/17 (88.2%)	140/227 (61.7%)	200/291 (76.3%)	15/24 (62.5%)	-	-	6/16 (47.5%)	191/304 (62.8%)

Table 16.2 Number of 'black' patinated lithic artifacts by Square from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Square A	Square B	Square C	Square D	Square E	Square F	Square G	Square H	Square I	Square J
'Black' patination	0/11 (0%)	8/48 (16.7%)	3/17 (17.6%)	26/227 (11.5%)	81/291 (27.8%)	5/24 (20.8%)	-	-	10/16 (62.5%)	196/304 (64.5%)

No obsidian was recovered from the 2017 BREA excavations at Crawford Bank. Obsidian is notably absent from preceramic contexts in Belize; however, Prufer (2016, pers. comm.) has reported the recovery of obsidian from preceramic levels in Southern Belize. Obsidian is known from preceramic sites in Mexico, Guatemala, and Honduras (Brown 1980; Bullen and Plowden 1963; Coe 1960; Di Peso 1955; Gaines et al. 2009; Gruhn et al. 1977; Joyce and Henderson 2001, 2007; Longyear 1948; Méndez Salinas and Lohse 2010; Robles Ortiz 1974; Sanchez 2001; Santamaría 1981; Scheffler et al. 2012; Stross et al. 1977).

Tool Types and Production Technology

Of the 938 chipped chert or chalcedony artifacts excavated from the site in 2017, 17 (1.8%) were classified as 'formal' tools. The 'formal' tools consist of 2 small biface/celt fragments, 3 edge fragments from small bifaces/celts, 2 possible small biface/celt preforms (or possibly just bifacial/discoidal flake cores), 1 constricted uniface or trimmed macroblade fragment, 1 macroblade fragment, 5 unifacially retouched macroblade fragments, 1 whole blade, and 2 blade fragments (**Figures 16.3b-g** and **16.4**; **Table 16.3**). Some of these artifacts are described in detail in **Appendix A**. Many of these tools (6 or 35.3%) were made from NBCZ chert; however, the majority (11 or 64.7%) of the tools were so badly burnt and/or patinated that a raw material source was not discernible with certainty. It is strongly suspected that all 17 of the formal tools were made from NBCZ material. Also recovered from the 2017 BREA excavations at Crawford Bank was a whole Lowe point (**Figures 16.1**, **16.3a**) (Stemp et al. 2018; see Kelly 1993). Like the other formal tools above, it is suspected that the Lowe point was also made from NBCZ chert, but it is heavily patinated (Stemp et al. 2018: 394). Many of the tool types in this

report are similar to those described by Lohse et al. (2006: 222, Fig. 8) for the Archaic period in Belize. It seems unlikely that the formal tools were made at Crawford Bank based on the debitage recovered (see below). Specifically, few bifacial thinning flakes, and no macroblade or blade cores were recovered during the 2017 excavations. Evidence for macroblade and blade production in the preceramic is known from sites in Northern Belize (Hester et al. 1996; Iceland 1997).

The remaining 921 (98.2%) chipped stone artifacts are debitage of various kinds (**Table 16.4**). Most pieces have not been modified into specific types of tools (see Iceland 1997 for lack of retouched tools in the preceramic of Northern Belize); however, 4 unifacially retouched flakes were recovered as was a tertiary flake with a retouched point that was likely used as a drilling or perforating tool (see Appendix A). The edge angles of three of the four retouched flakes are generally acute (<45º). The retouch only occurred on the dorsal surfaces on all of these flakes. In addition to the retouched flakes, there were 667 (72.4% of all debitage) hard-hammer flakes (**Figure 16.5**).

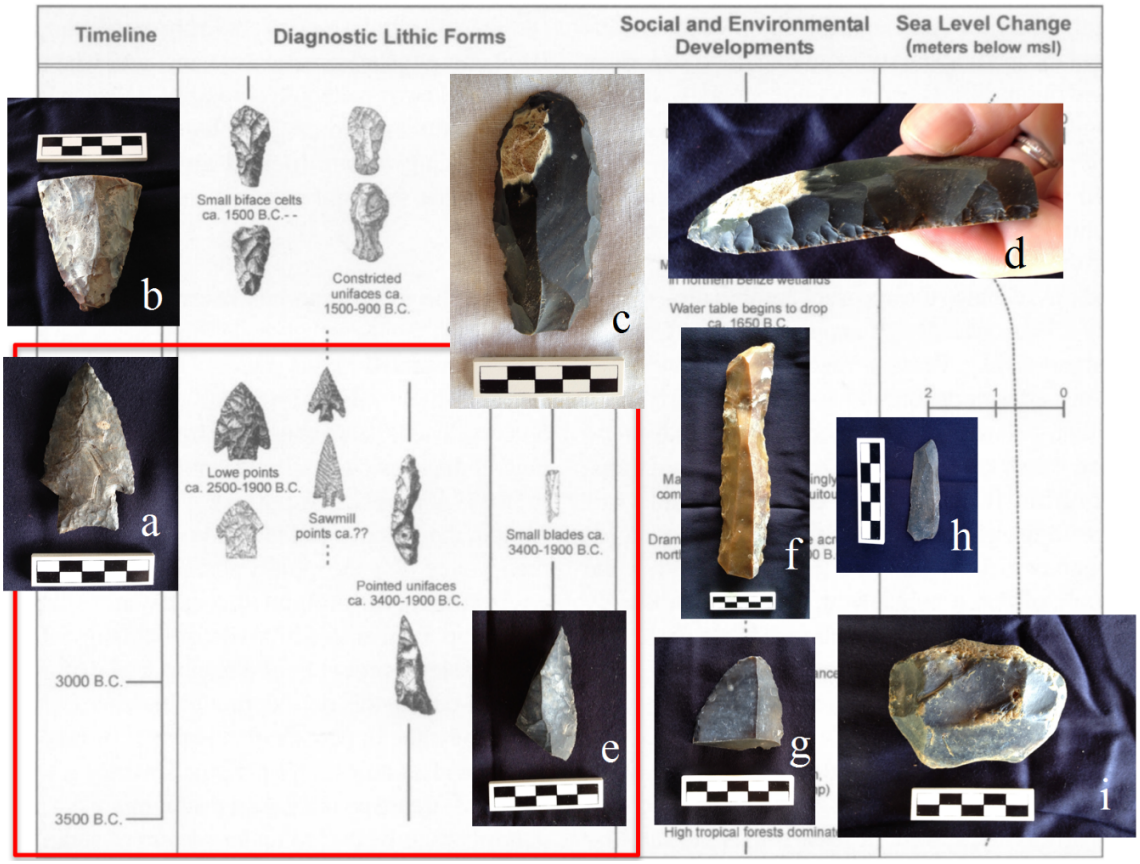

Figure 16.3 Tools from Operation 35, Crawford Bank, Crooked Tree, Belize compared to preceramic typology developed by Lohse et al. (2006: fig. 8): a - Lowe point, b - proximal biface fragment, c and d – distal fragment of a constricted uniface/trimmed macroblade, e-f – retouched macroblade fragments, h – blade, i – water-rolled flake core recycled into hammerstone.

Table 16.3 Formal tools by raw material types from Operation 35, Crawford Bank, Crooked Tree, Belize.

Tool type	NBCZ chert	Other chert	Chalcedony	Indeterminate chert
Bifaces/celts	1	0	0	1[b]
Biface edges	1	0	0	2
Biface/celt preforms	2[a]	0	0	0
Constricted unifaces/trimmed macroblades	0	0	0	1[b]
Macroblades	0	0	0	1[b]
Retouched macroblades (unifacial)	0	0	0	5[c]
Blades	2	0	0	1
Total	**6**	**0**	**0**	**11**

[a]Possibly bifacial/discoidal flake core fragments.

[b]Possibly NCBZ chert; difficult to determine based on patination and/or burning.

[c]Two are possibly NCBZ chert; difficult to determine based on patination and/or burning.

Table 16.4 Informal tools by raw material types from Operation 35, Crawford Bank, Crooked Tree, Belize.

Tool type	NBCZ chert	Other chert	Chalcedony	Indeterminate chert
Flakes – 100% cortex	2	1	1	5
Flakes - >50% cortex	14	2	3	37
Flakes - <50% cortex	50	5	8	117
Flakes – 0% cortex	118[a]	20	5	279[a]
Bifacial thinning flakes - >50% cortex	0	0	0	1
Bifacial thinning flakes - <50% cortex	2	0	0	5
Bifacial thinning flakes – 0% cortex	15	2	1?	19
Bifacial thinning pressure flakes – 0% cortex	0	0	1	2
Retouched flakes (unifacial) - >50% cortex	0	0	0	1
Retouched flakes (unifacial) – 0% cortex	2	0	0	1[b]
Macroflakes - >50% cortex	0	0	0	0
Macroflakes - <50% cortex	1	0	1	2
Macroflakes – 0% cortex	0	0	0	2
Retouched macroflakes (unifacial) - <50% cortex)	1	0	0	0
Drills/perforators on flakes – 0% cortex	0	0	0	1
Simple flake cores	11	2	2	21
Bifacial/discoidal flake cores	0	0	1	0
Bifacial/discoidal flake cores/hammerstones	1	0	0	0
Simple flake cores/hammerstones	2	0	0	1
Blocky fragments	20	10	7	58
Potlids and burnt fragments	0	1	2	55
Total	**239**	**43**	**32**	**607**

[a]One flake is from a biface/celt; but it is not a bifacial thinning flake.

[b]Possibly part of a thin biface fragment.

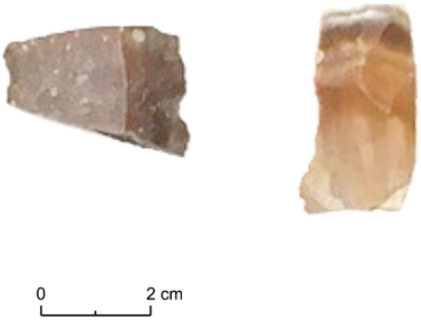

Figure 16.4 A medial blade fragment (left) and a proximal blade fragment (right) from from Operation 35, Crawford Bank, Crooked Tree, Belize. Note: The proximal blade fragments is burnt.

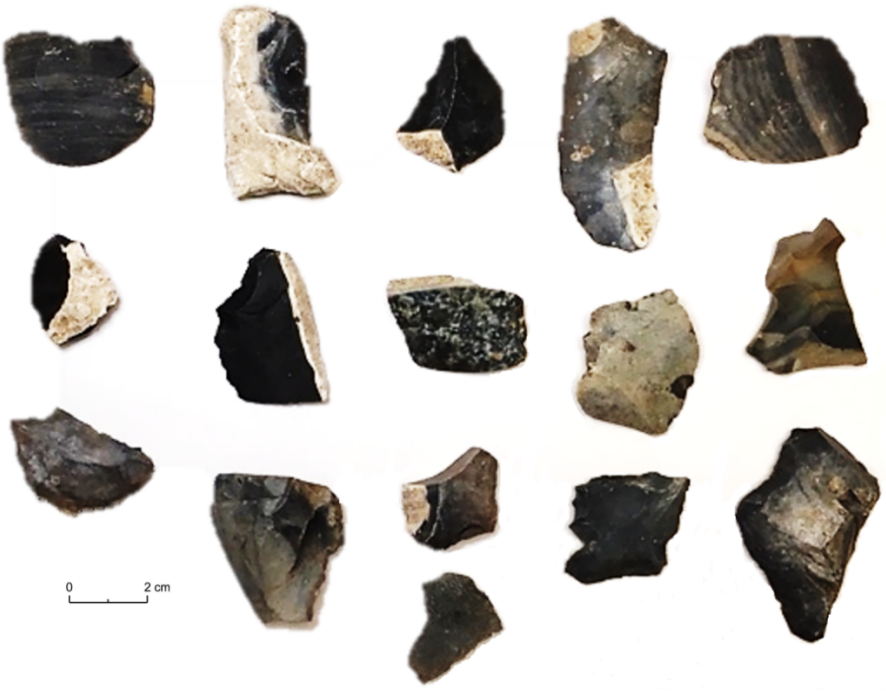

Figure 16.5 Debitage from Square J, from Operation 35, Crawford Bank, Crooked Tree, Belize. Note: Black patination and burning on many artifacts.

The hard-hammer retouched flakes and non-retouched flakes were mostly made from 'indeterminate' chert (441 or 65.7%). There were also 186 (27.7%) NBCZ chert flakes, 28 (4.2%) other chert flakes, and 17 (2.5%) chalcedony flakes. The numbers of cortical and non-cortical flakes varied by raw material type, but there is a full range of reduction debitage for all raw materials (**Figure 16.6**). There was proportionally more early stage reduction debitage for the chalcedony and more later stage reduction debitage for the other chert, but there are far fewer other chert and chalcedony artifacts. Based on the percentages for NBCZ and 'indeterminate'

cherts, there are no statistically significant differences in the numbers of cortical versus non-cortical flakes, suggesting that similar reduction processes are represented. This would make sense if a majority of the 'indeterminate' chert was, in fact, originally NBCZ material.

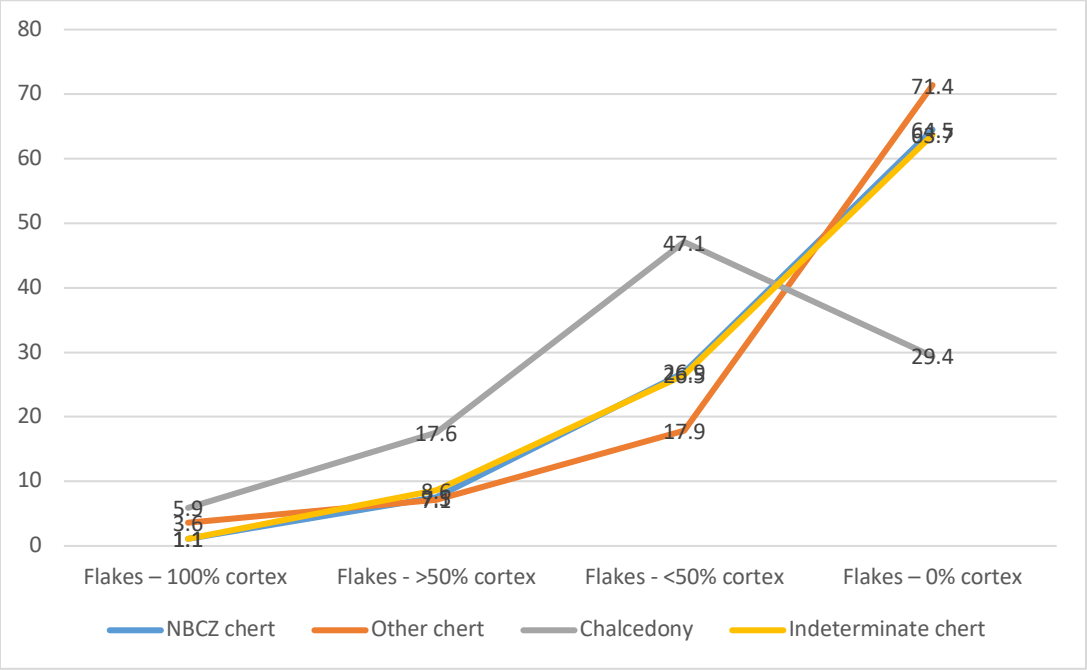

Figure 16.6 Percentages of cortical and non-cortical flakes by raw material type from Operation 35, Crawford Bank, Crooked Tree, Belize.

The percentages of cortical-to-non-cortical flakes, as well as the presence of cores, core fragments, and blocky fragments indicate that *ad hoc*/expedient flake production occurred in the Crawford Bank area. The fact that there are cores and/or cores fragments of NBCZ chert, other chert, and chalcedony provides evidence for local reduction of these three types of raw material here (**Figure 16.7**). The recovery of some cortical and non-cortical marcoflakes of NBCZ chert (2), chalcedony (1), and 'indeterminate' chert (4) demonstrate that at least some chert and chalcedony cores/nodules of reasonably large sizes were available to the Crawford Bank people for flaking. The sizes of the flakes (**Table 16.5**) indicate a fairly wide range, but at least some cores were quite large. Most flake reduction was the result of hard-hammer percussion given the flat and cortical platforms observed on the whole flakes and proximal flake fragments (**Table 16.6**). The high number of hinge terminations on the whole flakes and distal flake fragments also supports hard-hammer percussion of expedient flakes (**Table 16.7**).

Figure 16.7 Two large flake cores from Operation 35, Crawford Bank, Crooked Tree, Belize. Note: Chalcedony core (left), patinated NBCZ chert core (right).

Table 16.5 Metrics (mm) for whole flakes from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Square A[a]	Square B	Square C	Square D	Square E	Square F	Square G	Square H	Square I	Square J
Max. length	18.0	42.7	29.4	51.8	57.1	60.1	-	-	63.1	81.2
Min. length	18.0	10.5	10.1	19.0	22.6	23.5	-	-	19.5	12.3
Mean length	18.0	30.1	20.5	35.7	40.5	38.8	-	-	43.0	43.3
Max. width	26.9	30.2	29.8	51.9	56.1	59.5	-	-	61.8	64.1
Min. width	26.9	16.9	15.4	19.6	33.1	24.9	-	-	21.6	20.8
Mean width	26.9	23,3	24.7	48.6	50.3	42.7	-	-	38.6	38.8
Max. thickness	3.9	29.2	8.0	24.8	25.1	29.9	-	-	21.0	27.4
Min. thickness	3.9	3.4	1.8	4.8	5.9	8.7	-	-	4.1	3.5
Mean thickness	3.9	14.0	5.3	11.9	12.8	12.9	-	-	11.5	13.9

[a]Only one whole flake.

The bifacial thinning flakes from the 2017 Crawford Bank assemblage represent mostly end stage flaking and biface repair (**Figure 16.8**). Overall, there are relatively few of these flakes (45 or 4.8%) and most are non-cortical (37 or 82.2%), which suggests that biface production was not occurring here (**Figure 16.9**). However, two possible NBCZ chert biface/celt preform fragments were recovered (**Table 16.3**). It is difficult to determine whether these were aborted

bifaces or simply bifacial flake cores. The majority of the flakes (42 or 93.3%) are NBCZ chert and 'indeterminate' chert [of which most is suspected to be NBCZ chert]. This is consistent with the assumption that most, possibly all, of the bifaces excavated at Crawford Bank in 2017 were NBCZ chert. Two different types of bifacial thinning flakes were identified at Crawford Bank based on thickness, morphology, and platform type. The first type includes 'harder'-hammer percussion flakes (Callaghan 1979; Hayden and Hutchings 1989:249) that usually have beveled or lipped and beveled striking platforms. These flakes tend to have cone-like fractures and more pronounced bulbs of percussion. (Shafer and Hester 1983:524, Fig.6a, c-e; Shafer 1991:40). The second type of bifacial thinning flake typically has a lipped striking platform, a flatter and more diffuse bulb of percussion, and often tends to widen near the distal end (Callaghan 1979; Hayden and Hutchings 1989:246, Fig. 6, 247; Shafer and Hester 1983:531, Fig.6b, f). For both types of flakes, many of the striking platforms are facetted to variable degrees (28 or 70.0%), and most are lipped (31 or 77.5%) (**Table 16.9**). In all, 21 (46.7%) of the flakes are consistent with 'harder'-hammer percussion, while 13 (28.9%) are the result of 'soft'-hammer percussion. For the remaining bifacial thinning flake fragments (11 or 24.4%), there is not enough production evidence to determine hammer type. Most whole bifacial thinning flakes and distal bifacial thinning flake fragments end in feather terminations (**Table 16.10**).

Table 16.6 Platforms for whole flakes and proximal flake fragments from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Cortical	Cortical/flat	Flat	Flat/lipped	Dihedral	Facetted	Facetted/lipped	Linear	Crushed
NBCZ chert	6 (4.4%)	26 (19.3%)	85 (63.0%)	4 (3.0%)	5 (3.7%)	3 (2.2%)	0	1 (0.7%)	5 (3.7%)
Other chert	0	5 (27.8%)	13 (72.2%)	0	0	0	0	0	0
Chalcedony	1 (11.1%)	4 (44.4%)	2 (22.2%)	0	0	0	0	0	2 (22.2%)
Indeterminate chert	6 (1.9%)	49 (15.6%)	200 (63.7%)	8 (2.5%)	9 (2.9%)	10 (3.2%)	2 (0.6%)	11 (3.5%)	19 (6.1%)

Table 16.7 Flake termination types on whole flakes and distal flake fragments from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Feather	Hinge	Step
NBCZ chert	21 (24.7%)	63 (74.1%)	1 (1.2%)
Other chert	4 (26.7%)	11 (23.3%)	0
Chalcedony	2 (100%)	0	0
Indeterminate chert	63 (34.4%)	117 (63.9%)	3 (1.6%)

Table 16.8 Metrics (mm) for whole bifacial thinning flakes from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Square A	Square B	Square C[a]	Square D	Square E	Square F	Square G	Square H	Square I	Square J
Max. length	-	41.6	30.1	43.4	45.0	47.8	-	-	-	49.8
Min. length	-	22.9	30.1	19.7	19.3	20.7	-	-	-	18.2
Mean length	-	30.4	30.1	30.1	28.2	34.3	-	-	-	28.3
Max. width	-	26.0	25.5	24.1	30.3	34.6	-	-	-	34.6
Min. width	-	19.7	25.5	20.5	18.9	20.2	-	-	-	17.6
Mean width	-	23.4	25.5	21.4	24.6	27.4	-	-	-	24.9
Max. thickness	-	5.1	5.0	5.2	4.9	5.6	-	-	-	5.0
Min. thickness	-	2.4	5.0	2.2	2.5	2.4	-	-	-	2.1
Mean thickness	-	4.2	5.0	3.8	4.0	4.0	-	-	-	3.9

[a]Only one whole flake.

Table 16.9 Platforms for whole bifacial thinning flakes and proximal bifacial thinning flake fragments from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Cortical	Cortical/flat	Flat	Flat/lipped	Dihedral	Facetted	Facetted/lipped	Linear	Crushed
NBCZ chert	0	0	1 (5.9%)	2 (11.8%)	0	1 (5.9%)	12 (70.6%)	0	1 (5.9%)
Other chert	0	0	0	0	0	0	1 (100.0%)	0	0
Chalcedony	0	0	0	0	0	0	0	0	0
Indeterminate chert	0	0	0	4 (18.2%)	0	2 (9.1%)	12 (54.5%)	0	4 (18.2%)

Table 16.10 Flake termination types on whole bifacial thinning flakes and distal bifacial thinning flake fragments from Operation 35, Crawford Bank, Crooked Tree, Belize.

	Feather	Hinge	Step
NBCZ chert	5 (83.3%)	1 (16.7%)	0
Other chert	1 (100%)	0	0
Chalcedony	1 (100%)	0	0
Indeterminate chert	9 (90.0%)	1 (10.0%)	0

Figure 16.8 Bifacial thinning flakes from Operation 35, Crawford Bank, Crooked Tree, Belize. Note: White patination, black patination, and burning on some of the artifacts.

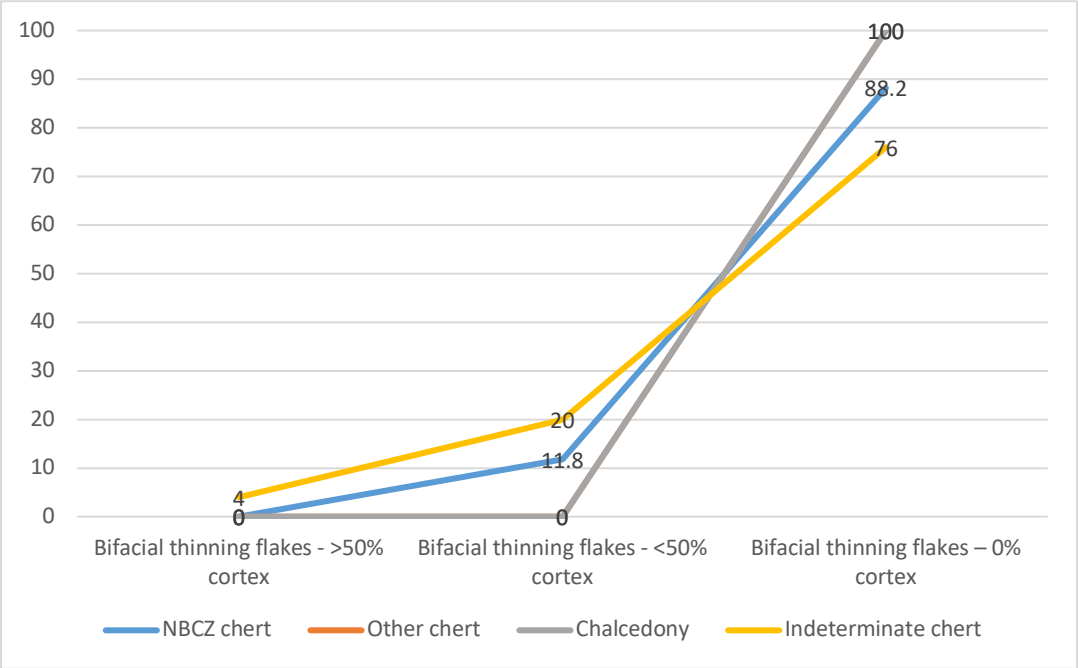

Figure 16.9 Percentages of cortical and non-cortical bifacial thinning flakes by raw material from Operation 35, Crawford Bank, Crooked Tree, Belize. Note: The percentages for chalcedony and other chert are the same.

Use-wear Analysis

Method and Equipment

The protocol for cleaning the stone tools and observing and recording the use-wear on the lithic artifacts is essentially the same as that previously used by Stemp et al. (2010, 2013, 2015, 2018; also see Stemp 2001) for chipped chert and chalcedony tools. Cleaning of the stone tools involved a series of steps involving chemical solutions. Prior to examination for use-wear, artifacts that were not severely damaged due to post-deposition (see below) were washed in a warm, liquid detergent solution and then rinsed in warm water. Once rinsed, they were placed in a warm solution of 15% hydrochloric acid (HCl) for a period of 15 minutes. The stone tools were then transferred from the acid solution bath to a container of cold water in which they were rinsed. The stone tools were next bathed in a room-temperature solution of 20% sodium hydroxide (NaOH) for 15 minutes. Finally, the artifacts were removed from the basic solution bath, rinsed in cold water, and laid out to air dry.

A metallurgical microscope [Unitron MS-2BD] was used to locate and identify use-wear features at both low- (40x) and high-power (100×, 200×, 400×) magnification under angled and incident light. Photomicrographs of the tools' worn surfaces were taken using a Steindorff DCM 130 (1.3 MPX) digital microscope camera. The identification and interpretation of the use-wear on the chert and chalcedony artifacts was based on the previous experimental use-wear analysis programs conducted by Stemp (see Stemp 2001, 2004, Stemp et al., 2010 for full descriptions of experimental use-wear feature categories and damage criteria). The use-wear characteristics were also considered in terms of the experimental and archaeological work of other use-wear analysts, specifically Aoyama (1995, 1999, 2007, 2009), Aldenderfer et al. (1989), Keeley (1980), Lewenstein (1987), Odell (1977), Rots (2010); Sievert (1992), Tringham et al. (1974), van Gijn (1989), and Vaughan (1985). The analysis included observation and documentation of edge-damage (microflaking), striations, surface polish on the artifacts. As in previous use-wear analyses, used areas on the stone tools were recorded using an independent use-zone (IUZ) method (Stemp 2016; Stemp et al. 2010, 2013, 2015, 2018; see Aoyama 2009; Vaughan 1985).

Problems due to Post-deposition

The use-wear analysis of the chipped stone tools from the 2017 BREA excavations at Crawford Bank were significantly hampered by the conditions of the artifacts. The damage to the tools due to post-depositional forces meant that only a comparatively small percentage of the entire assemblage was in good enough shape to be examined under the microscope. Only 204 (21.7%) of the 938 chipped chert and chalcedony artifacts were deemed to be worth examining for traces of use-related wear.

The myriad issues posed by post-deposition are summarized and explained below. By far, the most problematic source of post-deposition was burning. Burnt cryptocrystalline silicates not only changed color (see above), but also suffered from potlid fractures and heat crazing, which damaged the tool surfaces. Burning made tool edges more prone to flaking, could make the worn surface appear more 'glossy', and may have contributed to non-use-related edge rounding. Moreover, burning sometimes left non-use-related residues on stone tool surfaces that rendered observation of use-wear on stone tools impossible (see Luedtke 1992; Olausson 1983; Sievert 1992). Mildly to severely burnt artifacts were generally evenly distributed throughout the sub-assemblages in the excavation units that had stone tools (not Squares G and H) (**Table 16.1**).

Different types of patination presented their own series of problems for use-wear analysis. Well-developed white patination creates a porous microsurface that destroys surface polishes and striations. The porous surface structure also scatters incident light from the microscope objective, which makes observation of surface microfeatures very difficult (see Anderson-Gerfaud 1981; Glauberman and Thorson 2012; Keeley 1980; Luedtke 1992; Rottländer 1975). Well-developed white to yellowish-white patinas have been well documented of chert artifacts from preceramic sites in Northern Belize (see Hester et al. 1982) 'Black' patination/oxidation not only changes the color of the stone tool surface, but seems to mute or lessen the brightness of polishes. Use-wear polishes and striations are still observable, for the most part, but more developed 'black' patinas make it more difficult to observe polishes under incident light. The relative percentages of tools with black patination tended to be higher in Squares I and J of the 2017 BREA excavations (**Table 16.2**). Glossy patinas produce shiny or lustrous surface due to the dissolution and then re-precipitation of the silica on the artifacts' surfaces (Glauberman and Thorson 2012; Howard 2002; see Lévi-Sala 1986; Luedtke 1992; Stapert 1976).

In addition to the physical and chemical problems created by burning and patination, there were series of physical/mechanical issues that altered the edges and surfaces of the chert and chalcedony artifacts. Mechanical damage can either obliterate existing use-wear on stone tools or introduce non-use-related wear (see Lévi-Sala 1996; Pevny 2012). Some of the artifacts were water-rolled (**Figure 16.3h**), which caused the blunting of tool edges, the smoothing of flake scar arises, and the addition of non-use-related (typically multi-directional) striations (Burroni et al. 2002; Donahue and Burroni 2004; Lévi-Sala 1986; Shackley 1974). In many cases, distinguishing use-related edge chipping from post-depositional edge chipping was difficult because fracture scars along edges could mimic use-related edge flaking. Many artifacts from Crawford Bank have these microscars that indicate movement in the soil, trampling, or some other force application that was "perpendicular to the ventral surface plane" (Donahue and Burroni 2004: 145; see Tringham et al. 1974) of the flakes. This flaking occurs on either the ventral or dorsal surface of flakes and is typically unifacially, rather than bifacially, distributed, suggesting force application from one direction. This pattern would not be expected on tools used for longitudinal motions like cutting or sawing.

In other instances, microchipping along a tool edge was recognized as post-depositional because it had sharp margins and either intersected the surfaces with white or 'black' patinas or cut through polished regions of stone tool surfaces (see Donahue and Burroni 2004: 143, Fig. 15.2B). Edge damage, surface abrasion/mild particulate polishing, and striations may have also been caused by tool movement in the soil due to other actions, such as trampling (Asryan et al. 2014; Chu et al. 2015; Donahue and Burroni 2004; Driscoll et al. 2015; Eren et al. 2010; Keeley 1974, 1980; McBrearty et al. 1998; McPherron et al. 2014; Pargeter and Bradfield 2012; Pevny 2012; Pryor 1988; Schoville 2010, 2014; Shea and Klenck 1993; Tringham et al. 1974). The movement of chert and chalcedony artifacts in the soil, possibly causing contact friction with stones or other lithic artifacts created 'bright spots' on some of the chipped stone tools from the Crawford Bank excavations. The bright spots appeared as localized or spatially clustered highly reflective flat polish, often, but not exclusively, on the higher microtopography of the artifacts' surfaces (see Lévi-Sala 1986: 231).

Lastly, many of the artifacts were scratched by the aluminum tags with context information written on them that were placed in the bags along with the stone tools. Although the use of these metal tags is a better option than paper context cards that will deteriorate over time, the metal tags left very bright silver-colored linear traces on the stone tools' surfaces. The metal residue is the product of adhesive wear (Donahue and Burroni 2004: 144). Luckily, these linear traces are quite bright and distinctive; however, they can cover or alter possible use-related wear. It is recommended that aluminum tags be inserted into their own plastic bags before being placed in the bags with the lithic artifacts.

Use-wear Analysis Results

In the preceramic period of Belize, there are extremely few use-wear studies of chipped stone artifacts. Of these, most have focused on two types of formal tools – constricted unifaces/adzes (Gibson 1991; Hudler and Lohse 1994; Iceland 1997: 227-228; Lohse 2007) or stemmed bifaces (Stemp et al. 2016). The main reason why there are so few use-wear analyses of chipped stone tools from the preceramic is likely due to the conditions of the artifacts; many of which are heavily damaged due to post-deposition (see above). In addition to the examination of the 17 'formal tools' (see Appendix A), 187 pieces of debitage, mostly hard-hammer flakes, were also examined for microscopic use-wear traces.

In all, 81 of the 204 (39.7%) chipped chert and chalcedony artifacts possessed some use-related wear. This percentage seems a little high, but it represents the examination of the chipped stone artifacts that had the least amount of post-depositional damage. It is by no means a random sample. Therefore, it is highly likely that the percentage of used artifacts in the total assemblage excavated from Crawford Bank in 2017 is lower. Not surprisingly, most of the artifacts with use-related wear were identified as NCBZ (45 or 55.6%) chert; whereas, fewer other chert (5 or 6.2%), chalcedony (3 or 3.7%), or 'indeterminate' chert/chalcedony (28 or 34.6%) tools had identifiable use-related wear. However, if the numbers of artifacts with use-wear are considered

in terms of all of the chipped stone tools excavated in 2017 by BREA then the total percentage of used tools would only be 8.6%. By raw material type, 45 of the 245 (18.4%) NBCZ chert artifacts, 5 of the 43 (11.6%) other chert artifacts, 3 of the 32 chalcedony 9.4%), and 28 of the 618 (4.5%) 'indeterminate' chert artifacts were used. Most of the used 'indeterminate' chert artifacts had 'black' patination and were not burnt.

There was a total of 92 IUZs on the 81 stone tools with use-wear traces (**Table 16.11**). Most of the used stone tools only possessed one IUZ (71 or 87.6%); however, there were 9 (11.1%) that has two IUZs, and one (1.2%) that had three IUZs. Seven of the 9 tools with two IUZs were bifacial thinning flakes that had use-wear on their dorsal surfaces and/or near their proximal ends/striking platforms that was the product of use while they were still attached to bifaces and use-wear that was associated with their use as *ad hoc*/expedient tools after having been detached from the bifaces (see below).

The use-wear on the chipped chert and chalcedony artifacts from the 2017 BREA excavations at Crawford Bank is mostly consistent with adzing/chopping, cutting/slicing, sawing, scraping/planing, or whittling wood (51 IUZs or 55.4%) (**Figure 16.10**; see **Appendix A**). Far fewer tools were used to work other materials, such as bone or antler (3 IUZs or 3.3%), dry hide (1 IUZ or 1.1%) (**Figure 16.11**), meat/skin/fresh hide (2 IUZs or 2.2%), meat/skin/fresh hide and bone (1 IUZ or 1.1%); plants (1 IUZ or 1.1%) (**Figure 16.12**), unidentified soft materials (9 IUZs or 9.8%), unidentified hard materials (17 IUZs or 18.5%) (**Figure 16.13**), some indeterminate materials (3 IUZs or 3.3%), and one example of hafting (1 IUZ or 1.1%).

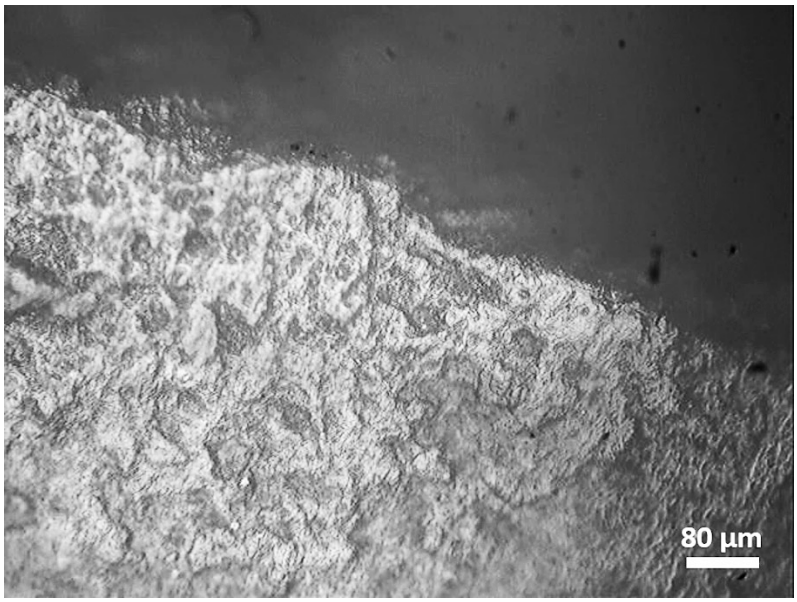

Figure 16.10 Photomicrograph of a retouched 'other' chert flake used to whittle wood (200x). Polish is bright, reticular, and partially domed on the right of the edge and further away from the edge. There is mild edge beveling beginning on the left side of the edge. The flake is minimally burnt.

Table 16.11 Number of IUZs on chipped stone lithics from Operation 35, Crawford Bank, Crooked Tree, Belize.

IUZs	Constricted unifaces/trimmed macroblades	Retouched macroblades/ macroflakes	Macroflakes	Flakes[c]	Bifacial thinning flakes	Blocky fragments
Bone/antler						
saw	-	-	-	2 (2.2%)	-	-
scrape/plane	-	-	-	-	-	1 (1.1%)
Dry hide						
scrape/plane	-	1 (1.1%)	-	-	-	-
Meat/skin/fresh hide						
cut/slice	-	-	-	1 (1.1%)	1 (1.1%)	-
Meat/skin/fresh hide and bone						
scrape/plane	-	-	-	1 (1.1%)	-	-
Plant						
cut/slice	-	-	-	1 (1.1%)	-	-
Soil						
dig/hoe	-	-	-	-	3 (3.3%)	-
Wood						
adze/chop	1[a] (1.1%)	-	-	1 (1.1%)	3 (3.3%)	-
cut/slice	-	-	-	5 (5.4%)	1 (1.1%)	-
haft	-	1 (1.1%)				
saw	-	1[b] (1.1%)	1 (1.1%)	24 (26.1%)	3 (3.3%)	1 (1.1%)
scrape/plane	-	2 (2.2%)	-	3 (3.3%)	-	-
whittle	-	-	-	5 (5.4%)	-	-
Soft						
cut/slice	-	-	-	7 (7.6%)	1 (1.1%)	-
scrape/plane	-	-	-	1 (1.1%)	-	-
Hard						
adze/chop	-	-	-	-	1 (1.1%)	-
cut/slice	-	-	-	1 (1.1%)	-	-
saw	-	-	1 (1.1%)	10 (10.9%)	-	-
scrape/plane	-	-	-	3 (3.3%)	-	-
whittle	-	-	-	1 (1.1%)	-	-
Indeterminate						
saw	-	-	-	-	1 (1.1%)	-
indeterminate	-	-	-	1 (1.1%)	1 (1.1%)	-
Total	1	5	2	67	15	2

[a]Also has evidence of digging in soil.
[b]Also traces of possible bone polish along the very edge.
[c]Includes retouched flakes

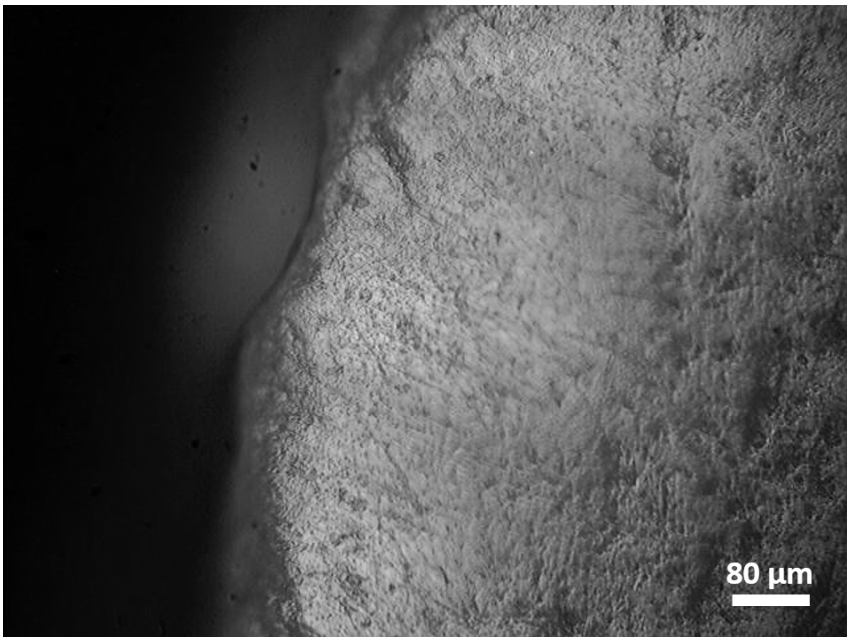

Figure 16.11 Photomicrograph of a unifacially retouched NBCZ chert macroflake used to scrape dry hide with abrasives (possibly soil) (200x). Well-developed polish is matte and rugose with many transverse and diagonal striations to the edge. Flake edge is well-rounded.

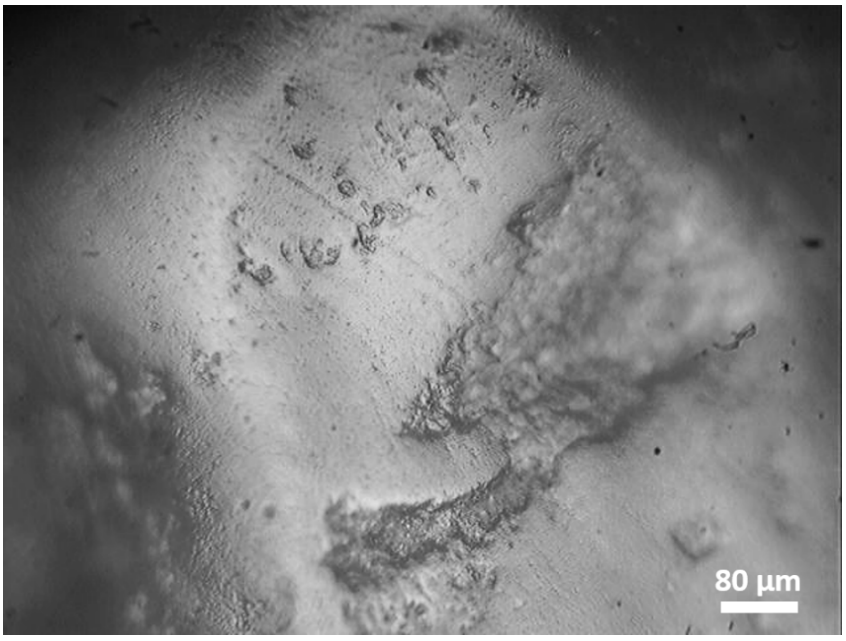

Figure 16.12 Photomicrograph of unretouched NBCZ chert bifacial thinning flake[dorsal surface] used to chop/adze grass, fronds and/or wood (200x). Well-developed bright, 'liquid'-looking, inflated, in-filled polish. Striations transverse to the edge. Some edge rounding and striations due to abrasive contact with soil. The use-wear is associated with the flake when it was still attached to a biface.

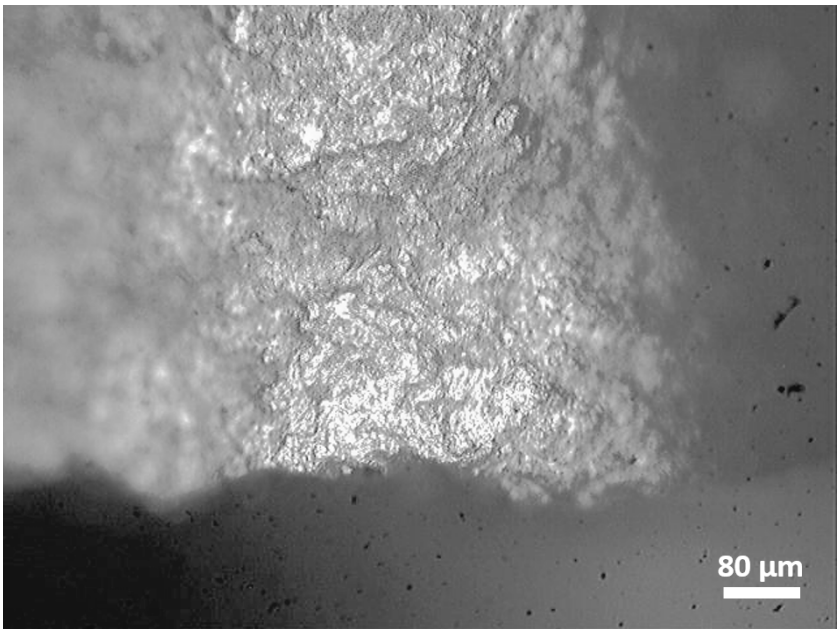

Figure 16.13 Photomicrograph of an unretouched 'other' chert flake used to saw an unidentified hard material (200x). Bright, flat polish (with the beginning of a reticular pattern). The flake is partially burnt.

Some artifacts were used to dig in soil (3 IUZs or 3.3%) and others also show what is likely evidence for soil contact within their polishes produced while working other materials. The few examples of use-wear consistent with working meat/skin/fresh hide, plants, and other soft materials is surprising given expectations about hunting and gathering behavior of preceramic peoples.

Nevertheless, the use-wear data clearly demonstrate that wood was an important resource for the people at Crawford Bank. The types of motions associated with the wood polishes could represent tasks such as making handles for hafted weapons, supports for perishable structures, making wooden tools or containers, forest clearance, or firewood). Because wooden artifacts were not found at Crawford Bank, the use-wear on the stone tools serves as secondary evidence of a reliance on wood. The bone- or antler-sawing wear and the meat/skin/fresh hide-cutting wear point to possible hunting activity. Whether objects were made from bone, antler, or hide cannot be known for certain, but it is interesting that only two examples of scraping/planing or whittling motions are associated with these materials. Other kinds of soft and hard materials may have been used by the Crawford Bank inhabitants, but they cannot be identified based on use-wear.

Overall, there is minor evidence for tasks associated with transverse motions (17 IUZs or 18.5%), like scraping/planning or whittling, which may be due to the generally low edge angles of most of the flakes and the few retouched flakes, macroblades, or macroflakes. Scraping/planing or whittling wood was very rarely observed on tools that did not have relatively steep edges. The use-wear data also reveal that *ad hoc*/expedient flake technology was an important source of tools for the people of Crawford Bank. These used flakes may be the first

direct evidence for the use of expedient stone tool technology by preceramic people in Belize. Although lithic debitage has been recovered at other preceramic sites in Belize (e.g., Brown et al. 2011; Griffith and Morehart 2001; Griffith et al. 2002; Hester et al. 1980, 1996; Lohse 2006; Lohse and Collins 2004; Pohl et al. 1996; Iceland 1997; Shafer et al. 1980), there has been no detailed, large-scale microscopic use-wear analysis performed on preceramic debitage, to my knowledge (see Rosenswig et al. 2014 for utilized flakes).

Discussion and Conclusions

Most of the identifiable lithic raw material recovered at Crawford Bank by BREA in 2017 was chert from the NBCZ. There is relatively little chert that can be identified as not coming from CBZ. However, a substantial amount of the chipped stone artifacts were classified as 'indeterminate' in terms of source due to burning and patination. Nevertheless, it is suspected that much of the 'indeterminate' material is likely NBCZ chert given its fine grain and generally high quality. All of the 'formal' tools from Crawford Bank are essentially the same as those from other preceramic sites in Belize, specifically Northern Belize (see Hester et al. 1996; Iceland 1997; Kelly 1993; Lohse et al. 2006; Pohl et al. 1996; Rosenswig et al. 2014; Rosenswig 2015; Stemp and Awe 2013; Stemp et al. 2016). All of the 'formal' tools with a recognizable raw material were made from NBCZ chert. The 'formal' tools were most likely not made at Crawford Bank given the limited production evidence - the two possible biface preform fragments, the relatively small quantity of bifacial thinning flakes, and the absence of macroflake, macroblade, and blade cores. Ratios of all flakes and bifacial thinning flakes to bifaces/possible biface preforms (179:1) also provides a strong argument against biface production at Crawford Bank (see Whittaker et al. 2009: 147, Fig. 9).The import of finished formal tools, specifically constricted unifaces/adzes, has also been suggested by Iceland (1997: 230-231) and Rosenswig et al. (2014: 318-319; see Rosenswig 2015). The fact that many of the bifacial thinning flakes have use-wear on their dorsal surfaces suggests biface repair/refurbishing rather than biface production. In addition to tool resharpening, other evidence of tool curation is provided by the biface fragments and core fragments that were reused as hammerstones/pounding tools (see Hult and Hester 1995; Stemp 2001, Stemp and Graham 2006). Aside from a few retouched flakes and the flake drill/perforator, there were no other flake tools, such as scrapers, burins, or denticulates, in the assemblage. The Crawford Bank inhabitants had access to nodules of NBCZ chert, chalcedony, and other chert based on the cores, and core fragments, cortical flakes (specifically the flakes with 100% cortex, >50% cortex), and the striking platforms that are cortical or partially cortical. Based on flake types, platform types, and termination types, the NBCZ chert and other chert were similarly reduced using hard-hammer percussion. Chalcedony was also used to produce simple hard-hammer flakes, but with proportionately fewer non-cortical flakes.

The use-wear clearly indicates a reliance on expedient technology to complete tasks (also see Rosenswig et al. 2014: 318; Rosenswig 2015: 139 for utilized flakes). Many tasks involve

wood (see Acosta Ochoa 2010: 2; Pérez 2009), but tools were also used on animals as well. Surprisingly, there is very little securely identified use-wear consistent with non-woody plants, but some of the unidentifiable soft material use-wear may be the product of working plants. The few tools with evidence for digging in soil (i.e. the constricted uniface/trimmed macroblade fragment and a few of the bifacial thinning flakes) provide indirect evidence for possible horticultural activities that would correlate well with the starch grains on some stone tools from Northern Belize (Rosenswig et al. 2014: 316, Table 2; Rosenswig 2015: 140; see Jones 1994; Jacobs 1995; Pohl et al. 1996 for pollen; see Pérez 2009 for starch grains in preceramic Mexico).

It is suspected that the full range of activities performed using stone tools is not represented by the use-wear. The use-wear overwhelmingly consists of contact with hard materials (wood, bone/antler). Use-wear consistent with meat/skin/fresh hide and non-woody plants is almost totally absent. There are two hypotheses for the use-wear pattern distribution observed at Crawford Bank. Either the activities involving animals (meat/skin/fresh hide) or plants (other than wood) were only being minimally performed with the stone tools recovered from Crawford Bank or the use-wear traces associated with contact with these materials were disproportionately altered or eliminated by post-deposition. Because some much of the assemblage was burnt, it is noteworthy that Clemente-Conte (1997: 533) observed that bone and wood polishes survived exposure to burning better than polishes associated with soft contact materials (i.e., meat, fat, sinew, etc.). Given a full consideration of the use-wear patterns and the significant post-deposition damage to the artifacts, the second hypothesis is believed to be more likely correct.

Post-depositional evidence, specifically edge microchipping, surface abrasion, and burning, suggests that these tools are a collection that accumulated on the shore as a result of secondary deposition of some kind. There was movement of these artifacts at some point in the past, possibly due to water action, along the shoreline. The lack of refits would tend to support this interpretation (see Iceland 1997). The water that periodically covered the stone tools, especially in Squares I and J, likely also accounts for the high percentages of 'black' patination/oxidation of the chert in this part of the site (see above).

As more preceramic lithic assemblages are examined and use-wear analyses completed, archaeologists working in Belize will develop a better sense of how stone tool technology was made and used by the people who pre-dated the Maya civilization.

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Appendix A: Lithic Analysis of Chipped Chert Artifacts from the 2017 BREA Excavations at Crawford Bank, Crooked Tree, Belize - Artifacts for Return to Belize

1. Perforated slate piece

Context information: BREA ’17, CRB, Op. 35, Zn. 1, Sq. J, LCB 9431

Length: 42.3 mm, Width: 34.9 mm, Thickness: 2.6 mm

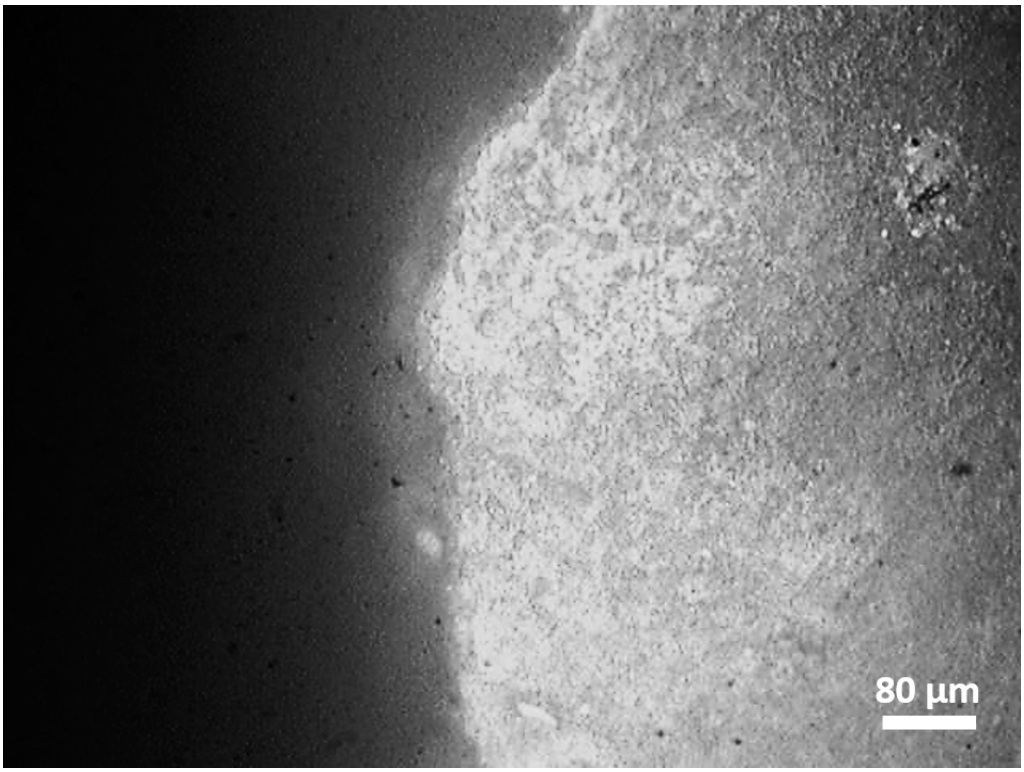
Description: A thin piece of foliated stone with bedding planes visible. It is semi-reflective metallic gray in color. It is likely slate, but the friability of the stone and the ease of separation along the bedding planes is similar to shale. In Belize, sources of both slate and shale are present in the Maya Mountains region and are found in the river systems that flow away from the Maya Mountains (Cornec 1985; Graham 1987; King et al. 2004). The artifact is not burnt. There is some damage around the edges. There is one drilled biconical hole (roughly 1mm diameter), with damage removing part of the artifact near the edge. A second possible drilled hole (roughly 1 mm diameter) occurs along the other edge of the slate artifact. The second hole has edge damage rendering it difficult to determine if it was deliberately drilled. The holes were examined at 40x magnification using a reflected light metallurgical microscope (Unitron MS-2BD). The two holes are in-line with one another at opposite ends of the artifact’s longest mid-line.

2. Retouched macroblade

Context information: BREA ’17, CRB, Op.35, Zn. 8, Sq. D, LCB 9455

Length: 178.8 mm, Width: 40.4 mm, Thickness: 22.5 mm

Description: A distal fragment of a long, narrow unifacially retouched chert macroblade. The chert is fine-grained, and yellow/honey and brown banded. It is consistent with chert from the Northern Chert-Bearing Zone (NCBZ) (Hester and Shafer 1984). The artifact is neither burnt nor patinated. The unifacial retouch extends down the both lateral margins and the distal end of the artifact. The retouch is primarily restricted to the dorsal surface and was accomplished using hard-hammer percussion. The retouched distal end edge angle measures roughly 60 degrees. However, a few flakes have been removed from the left lateral margin on the ventral surface. Cortex is present along the left dorsal surface of the artifact extending from the proximal end break to the distal end. The artifact was examined under high magnification (200x) using the Unitron MS-2BD microscope. Use-wear on the distal end of the artifact is consistent with scraping/planning wood (bright, domed, reticular polish). Additionally, there is a slight rounding at the very end of the tool edge and the appearance of a thin polish bevel.



3. Bifacial flake core/biface preform

Context information: BREA ’17, CRB, Op. 35, Zn. 11, Sq. J, LCB 9472

Length: 92.7 mm, Width: 69.2 mm, Thickness: 36.1 mm

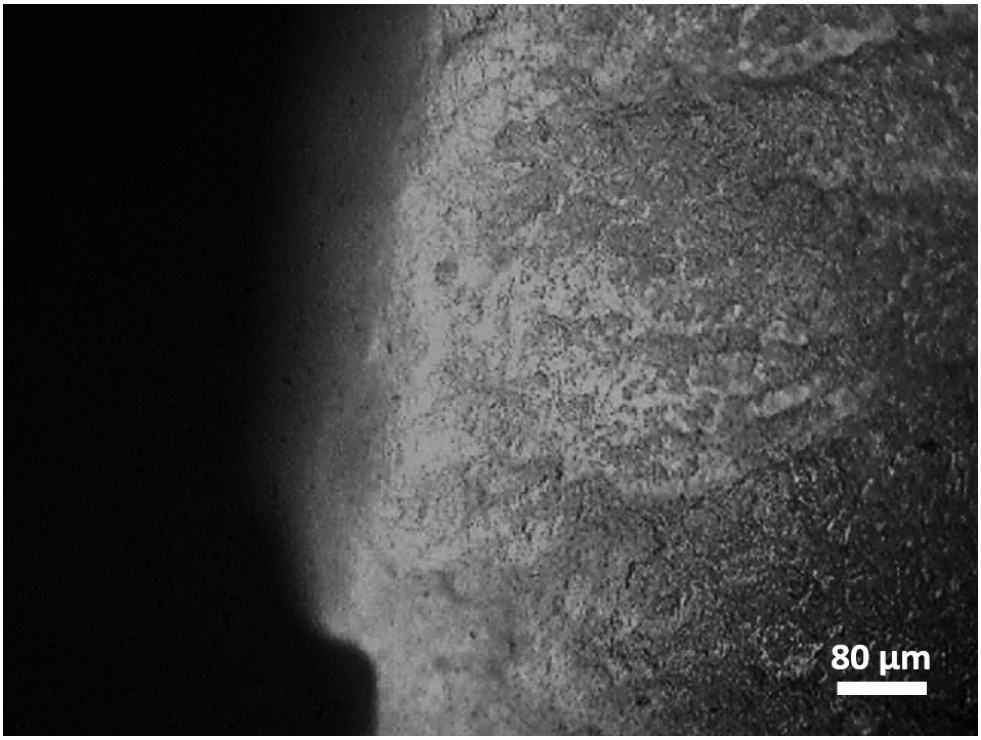
Description: A bifacially flaked chert core. The chert is fine-grained and brown banded. It is consistent with chert from the Northern Chert-Bearing Zone (NCBZ). The artifact is neither burnt nor patinated. Flakes were removed from both faces of the artifact all the way around the margins of the core. The flake characteristics and few ring-cracks remaining on its surface indicate hard-hammer percussion. There are two patches of cortex remaining on one face of the artifact. It is possible the artifact originated as a biface preform, but was abandoned; it may have been damaged/broken during the reduction process. Aside from the edge crushing, no use-related wear was observed on the artifact.

4. Retouched macroflake/macroblade

Context information: BREA ’17, CRB, Op. 35, Zn. 1, Sq. E, LCB 9414

Length: 48.6 mm, Width: 46.1 mm, Thickness: 12.5 mm

Description: The distal fragment of a chert macroflake/macroblade. The chert is fine-grained. The artifact is completely black in color, possibly cause by manganese-iron oxidation due to submersion in salt/brackish water (Hester et al. 1982; Shafer and Hester 1990; Stemp 2001: 28-29) or due to a weathering process of alternating or periodic wet-dry conditions, in which the artifact was repeatedly submerged in water and then exposed to a dry environment (Cackler et al. 1999). Among the elements responsible for the oxidation may be manganese, aluminum, and iron (Cackler et al. 1999: 87). The artifact is not burnt. The chert may be from the Northern Chert-Bearing Zone (NCBZ), but this cannot be determined with certainty. There is no cortex on the artifact. There is a bending fracture on the proximal end. The distal end has in a hinge termination. The pronounced ripples (Hertzian cone) on the ventral surface indicate the artifact was produced using hard-hammer percussion. The retouch along the left margin of the artifact only occurs on the dorsal surface. The retouch is due to pressure flaking. The artifact was examined at 200x magnification using the Unitron MS-2BD microscope. Use-wear on the edge with the retouch is consistent with sawing a hard material – most likely wood. On this artifact, the brighter, rounded/domed, reticular polish with few to no striations that formed on the higher microtopography of the surface away from the edge is consistent with sawing wood. However, some areas within the polish closer to the tool edge are consistent with sawing bone. Bone polish is usually more restricted to the very edge of tools used in longitudinal motions. Perhaps the artifact was used to cut/saw both bone and wood. The black patina appears to dull the brightness of the polish, making interpretation more difficult.



5. Macroblade

Context information: BREA ’17, CRB, Op. 35, Zn. 1, Sq. E, LCB 9414

Length: 48.7 mm, Width: 40.6 mm, Thickness: 14.9 mm

Description: The proximal fragment of a chert macroblade. The artifact is completely covered in a white patina (Hester et al. 1982; Rottländer 1975). The artifact is not burnt. However, post-depositional damage to the right lateral margin reveals a fine-grained, brown chert. This artifact is likely made from Northern Belize Chert-bearing Zone (NBCZ) chert. There is no cortex on the artifact. The striking platform is flat and measures 28.2 mm in width and 10.9 mm in thickness. The macroblade was produced using hard-hammer percussion. The break at the distal end is a bending fracture. Similar macroblades occurred at Colha (see Iceland 1997: 122, Fig. 3.7). Due to the white patina, no use-wear could be reliably observed on the artifact.

6. Retouched flake tool/perforator

Context information: BREA ’17, CRB, Op. 35, Zn. 1, Sq. J, LCB 9427

Length: 22.1 mm, Width: 17.8 mm, Thickness: 3.9 mm

Description: A unifacially retouched chert flake or flake fragment. The artifact is heavily burnt with two potlid scars on the dorsal surface. The chert is fine-grained and dark gray, likely due to burning. It is not possible to determine the artifact’s original chert color. It is mildly patinated. There is no cortex on the artifact. The unifacial retouch occurs on the proximal end of the flake or flake fragment on both lateral edges, narrowing it to a projection. The retouch only occurs on the dorsal surface and is accomplished using pressure-flaking. The retouch produces a narrowing of the proximal end into a projection/point. The projection/point is 7.9 mm long, 4.6 mm wide, and 2.9 mm thick. The very tip of the projection/point has broken off in a bending fracture. It appears that the flake or flake fragment was modified into a perforator of some kind. Under low magnification (40x) using the Unitron MS-2BD microscope, a snap fracture of the tip can be observed. There is also a single long, thin cone-initiation flake scar that ends in a step termination on the ventral surface along the right lateral edge. This tip damage suggests the artifact was pushed into material. There is no use-wear evidence of rotation of the artifact’s tip. Due to the burning and patination, use-related wear could not be reliably observed under high (200x) magnification.

7. Bifacial flake core/hammerstone (pounding stone)

Context information: Brea ’17, CRB, Op. 35, Zn. 8, Sq. E, LCB 9458

Length: 73.3 mm, Width: 55.0 mm, 32.5 mm

Description: A bifacially chipped chert core. The chert is dark gray, brown and banded. The artifact has been severely water rolled resulting in a very smooth surface and the smoothing of flake scar arises on over the artifacts entire non-cortical surface. The artifact is not burnt. A large patch of white porous cortex is present on one face. It is difficult to determine the type/source of the chert. Flakes were removed from the core using hard-hammer percussion. At some point after flake removal, the artifact was used as a hammerstone or pounding stone as demonstrate by significant surface crushing around almost the entire margin of the artifact. Water rolling occurred after use as a hammerstone or pounding tool given the smoothing of the crushed margin surfaces. Aside from the crushing of the artifact's edges, no other wear evidence was observed. The water-rolling affected the surfaces of the artifact such that abrasive wear that might have been use-related could not be isolated from post-depositional damage.

8. Blade

Context information: BREA '17, CRB, Op. 35, Zn. 7, Sq. J, LCB 9442

Length: 53.6 mm, 18.5 mm, 7.1 mm

Description: A whole chert blade. The blade is made from medium to fine-grained greenish-gray and brownish banded chert. It appears to have had some post-depositional surface modification, possibly some burning or black oxidation. It is most likely Northern Chert-Bearing Zone (NCBZ) chert. There is no cortex on the artifact. The platform is flat and measures 11.7 mm wide and 2.4 mm thick. In medial cross-section that blade has both a triangular and trapezoidal shape alternating along its length. The artifact was produced using hard-hammer percussion based on the pronounced bulb of percussion and visible éraillure scar. It has not been retouched. The distal end possesses a feather termination. Iceland (1997: 125, Fig. 3.10) provides examples of blades from Op. 4046 (south), Zone D at Colha. No use-related wear was observed on the artifact due to surface damage resulting from burning.

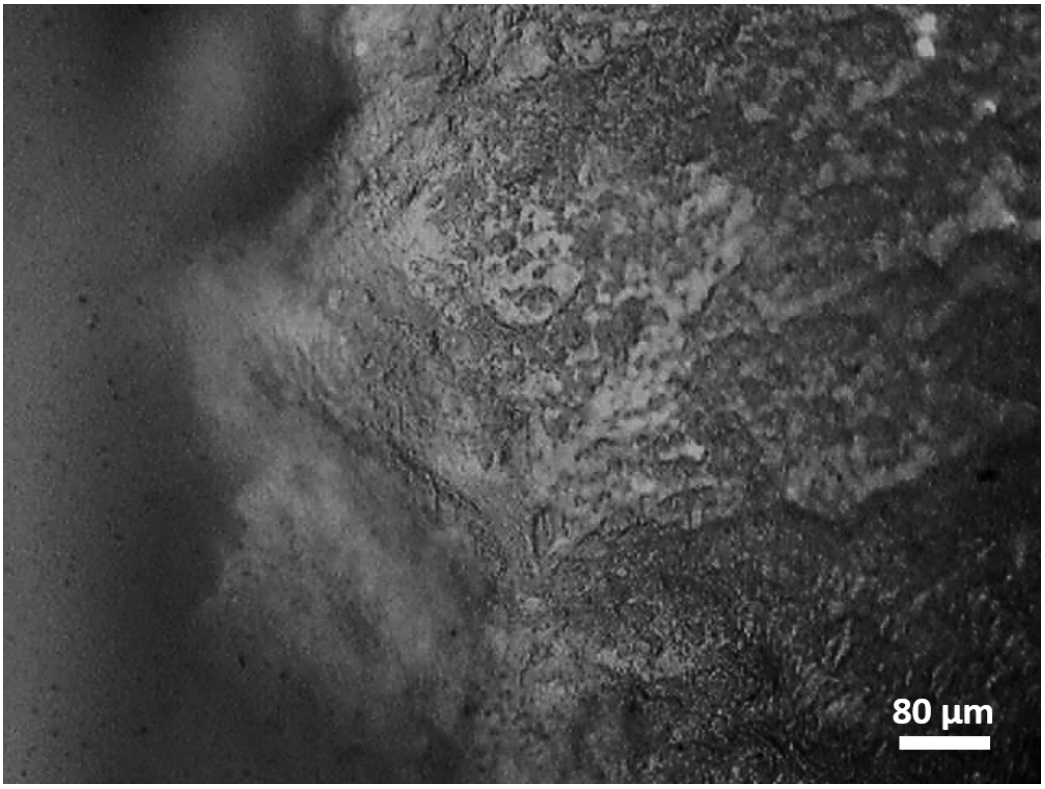
9. Retouched macroblade/uniface

Context description: BREA '17, CRB, Op. 35, Zn. 8, Sq. E, LCB 9458

Length: 86.2 mm, Width: 39.5 mm, Thickness: 15.6 mm

Description: The distal fragment of a retouched chert macroblade or uniface. The artifact is black in color, with some glossy surfaces on higher microtopography. The color is likely the product of some oxidation process (see above). However, banding can be observed under the black surface

and the chert is fine-grained. A small portion of the surface remains a brownish color. These details suggest the artifact was made from Northern Belize Chert-Bearing Zone (NBCZ) chert. A patch of white porous cortex occurs of the dorsal surface near the distal end of the fragment. The unifacial retouch occurs on both lateral margins and around the distal end on the artifact. The macroblade was produced using hard-hammer percussion, as was the unifacial retouch. The edge angle at the distal end/bit is roughly 40 degrees. In lateral profile, the shape of the bit is relatively flat, rather than upturned (see Gibson 1991: 232-233, Table 3; Iceland 1997: Appendix B). It is possible this is the distal end of a "constricted adze/uniface"; however, the narrowing near the proximal end is not present and the proximal end with the striking platform itself has broken off, as indicated by the snap fracture. Overall, this tool is shorter and narrower than most other reported "constricted adzes/unifaces". It is worth noting that there is a wide range in variation of artifacts that have been called "constricted adzes/unifaces", with some showing minimal to no constriction at all (e.g., Gibson 1991: 234, Table 5; Iceland 1997: 126-128, Figs. 3.11-3.13, 224-226, Figs. 4.6-4.8, Appendix B; Rosenswig 2015: 140, Fig. 5; Lohse 2010: 328, Fig. 7; Lohse et al. 2006: 220, Fig. 7; Stemp and Awe 2013: 22, Fig. 2). This macroblade is also similar to a "trimmed" macroblade from Sand Hill, Belize (Iceland 1997: 180, Fig. 4.1). Using the Unitron MS-2BD microscope, use-wear that was observed on the artifact at 40x and 200x magnification is consistent with wood contact and a transverse motion. The removal of relatively deep microflakes with some step and hinge terminations (observable near the left side of the photomicrograph below) suggests the transverse motion likely includes impact (more likely adzing than planing or scraping). Some portions of the surface at the very edge of the distal end also possess wear consistent with soil contact within the wood polish zones (slightly rougher, more matte, and some criss-crossing striations within and along the microflake scar margins). There is a slight rounding and thin polish bevel along the used distal edge. The black patina seemed to reduce the brightness of the polish.



10. Large biface

Context information: BREA ’17, CRB, Op. 35, Zn. 8, Sq. E, LCB 9458

Length: 60.5 mm, Width: 49.3mm, Thickness: 22.7 mm

Description: The proximal fragment of a chert biface. The biface fragment is both burnt and heavily patinated (white patina). The burning is demonstrated by the red coloration and glossy appearance in non-patinated areas of the chert. The chert appears to be quite fine-grained, but its type/source cannot be determined for certain. There is no cortex on the artifact. The biface was produced using a ‘softer’ hammerstone, possibly a limestone hammer. In medial cross-section the artifact is slightly asymmetrically biconvex. The distal end break is a snap fracture. A finished bifacial celt is reported from Op. 4046 (south), Zone B-C transition at Colha, Belize (Iceland 1997: 132, Fig. 3.17d, 2005: 21, Fig. 2.4). The burning and white patina complicated use-wear analysis. No reliable use-related wear was observed.

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Chapter 17

Future Directions for BREA

Eleanor Harrison-Buck

The 2016-2017 field seasons yielded tremendously productive results, as these chapters attest. By the end of the 2017 season, the BREA project had identified over 2000 mounds representing nearly 100 different sites in the middle and lower Belize River Watershed, which had never been mapped before (**Figures 1.1** and **1.2** [Harrison-Buck 2011, 2013, 2015a, 2015b]). Beginning in 2016, we began to turn our attention more fully to the lower half of the Belize River Watershed where we find several large tracts of perennial wetlands (Harrison-Buck 2014, Harrison-Buck, Murata, et al. 2016). The sites in this area, such as Jabonche and Chulub, are surrounded by marginal land inadequate for farming. For this reason, I have argued that these Maya settlements relied more heavily on the wetlands for agriculture, building ditched and drained fields (visible in satellite imagery), while also relying on these biologically-rich environments for hunting and aquaculture (Harrison-Buck 2014). Our survey and reconnaissance in this part of the BREA study area has revealed a range of occupation, including a dense Maya occupation dating to the Late-to-Terminal Classic transition (ca. AD 700-900), as well as a strong British colonial occupation with evidence of potential "slave camps" that were occupied by Kriol—enslaved African people originally brought to the former British colony for logging in the eighteenth century.

In future field seasons, we will continue to build on our prior research, carrying out further survey, mapping, and excavation of select sites in the BREA study and continue to have our base in the village of Crooked Tree. This chapter outlines our future program of research that has two separate but complementary components aimed at documenting these different aspects of settlement history that are found in the BREA study area: 1) the ancient Maya occupation, and 2) the more recent colonial history. The former builds on our prior research, combining ancient Maya settlement and paleoecological studies and will inform the doctoral dissertation of Ms. Lori Phillips, a BREA staff member and current graduate student who joins the project from Washington State University in Pullman. The latter component of the project—the colonial history—will examine the British colonial period, specifically focusing on the Kriol occupation in this area, documenting their "deep history" through oral histories, historic archives, and archaeological research. This interdisciplinary research will be conjoined with local public outreach and education that will result in the development of a permanent public museum in the village of Crooked Tree, Belize with an opening planned for summer 2018. This research and public engagement is supported by a Public Engagement Fellowship I was awarded from the Whiting Foundation.

Future Research Objectives

Below I discuss these two primary components of the BREA project individually. Although treated separately below, these two components of the project are not mutually exclusive, but are complementary in that they both will be considered in the content development of the museum and both will overlap in the course of our fieldwork during future field seasons. For instance, we find that in most cases due to the limited high ground, both pre-Hispanic and colonial occupation overlap and we often find evidence of both during the course of our survey, reconnaissance, mapping, and excavation, even when fieldwork is targeted with specific research goals in mind. Therefore, in many cases data on both Maya and colonial archaeology will be collected simultaneously. Examined together, the results of our work will provide a fuller understanding of the rich heritage and "deep history" of this long-occupied part of Belize.

Future Research on Ancient Maya Occupation

This first component of the BREA project builds on our prior research, aimed at further documenting the ancient Maya settlement distribution and the use of wetlands through time, particularly during periods of long-term drought. We aim to address how drought impacted settlement and wetland use, if at all, during the Late-to-Terminal Classic transition (ca. AD 700-900). Combining settlement and paleoecological studies, this component of the project is guided by the following three research objectives:

1) to expand our understanding of the history and aerial extent of wetland use and surrounding Maya settlement in the eastern Belize Watershed;

2) to test for evidence of climate change, specifically examining changes in faunal remains from a series of targeted excavations of trash deposits (middens); and

These two primary research objectives will build on the previous investigations we have carried out elsewhere in the BREA study area, such as Jabonche and Chulub (Harrison-Buck 2015; see also this volume). Paleoenvironmental studies of perennial wetlands have demonstrated that these are ideal environments for revealing evidence of drought through marked changes in faunal species and provide a context in which to review the paleoecological record in direct association with the cultural contexts (Emery and Thorton 2012, 2013; for other examples see Beach et al. 2009; Dunning et al. 2012). As part of our proposed future research, we plan to further test for additional midden deposits at Ek'Tok north of Chau Hiix and other sites located adjacent to the wetlands to amass a large enough assemblage of swamp-fidelic fauna to compare Late and Terminal Classic contexts (**Figure 17.1**). Our aim with this research–which forms the basis of Lori Phillips' dissertation—is to test a hypothesis proposed by Emery and Thorton (2012, 2013) that suggests aquatic taxa from small water bodies, like perennial wetlands, diminish in the Terminal Classic period at most sites when compared to the Late Classic period and can serve as a local index of drought directly associated with cultural contexts.

Emery and Thorton (2012, 2013) relied on Neotropical animal ecology researchers to determine habitat preferences for the range of taxa identified in the zooarchaeological collections. In the summer of 2014, we conducted a similar study of the microenvironments and range of habitats found in and around the BREA wetlands. Specimens of mollusks, fish and other water-dependent taxa were collected from around the Western Lagoon Wetlands and a study of their local habitat preferences was carried out (Van Dam et al. 2015). As part of our proposed future research, our zooarchaeologist, PhD student Lori Phillips, will rely on this habitat study and comparative reference collection to classify all faunal remains recovered in wetland and settlement excavations by species and habitat preference.

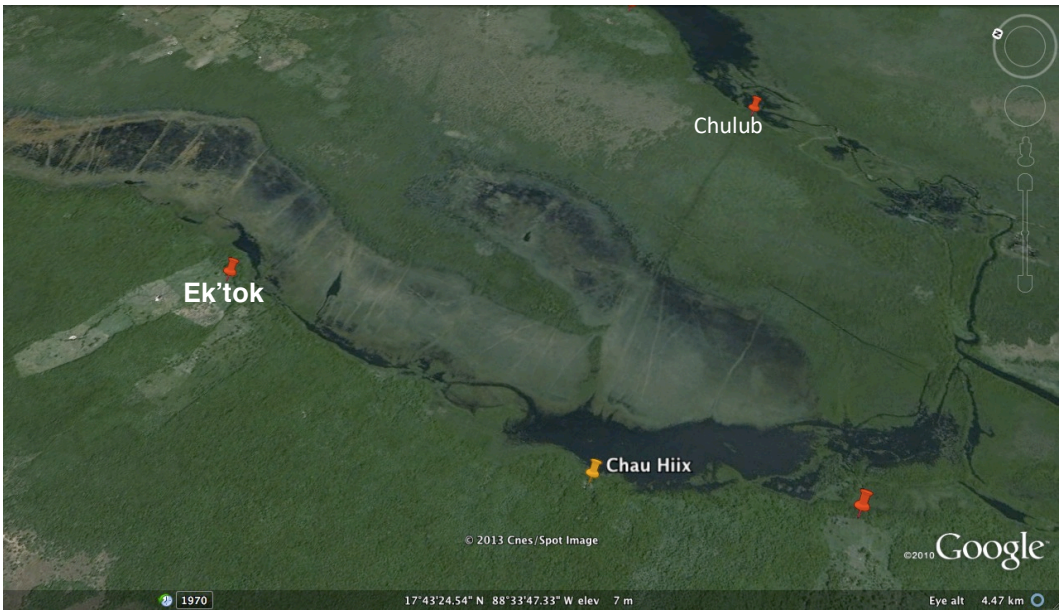

Figure 17.1 Satellite image showing linear channels and wells in Western Lagoon Wetlands.

To better understand the aerial extent of wetland use and associated settlement (Objective #1), BREA has devoted the last several years to surveying the eastern half of the Belize River Watershed. Although higher ground with arable land is not as abundant as it is in the uplands, our survey has revealed that settlement in the lower Belize Watershed is densely packed with large numbers of mounds in the relatively small pockets of higher ground that exist (see **Figure 17.2**). Over 1000 mounds were identified at roughly 25 sites in the lower half of the Watershed. By contrast, the same number of mounds comprises around 60 sites that we have identified thus far in the middle reaches of the BREA study area.

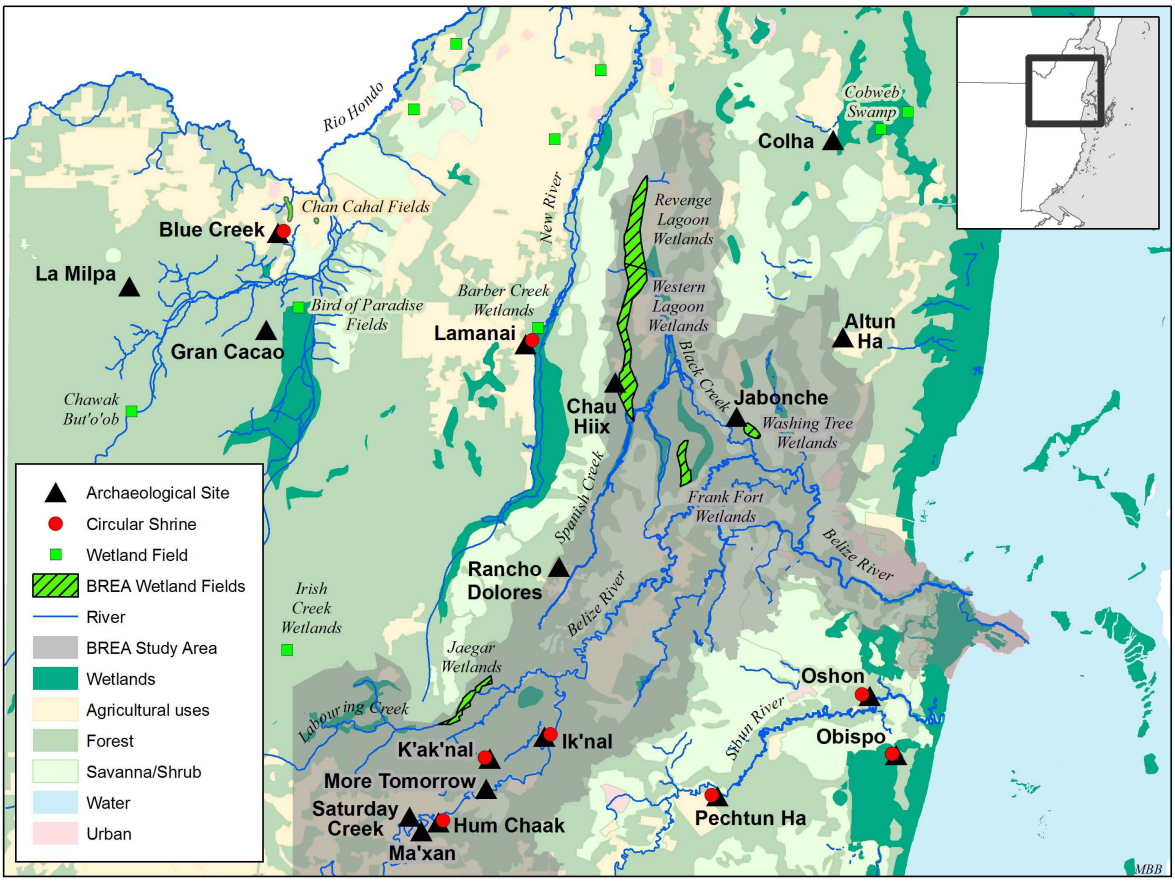

Figure 17.1. Map of BREA study area showing locations of wetland fields (drafted by M. Brouwer Burg).

Future Research on the British Colonial Period and the History of Kriol Occupation

Ancient Maya settlement in the vicinity of Crooked Tree has been the focus of archaeological research over the years (Andres 2009; Andres and Pyburn 2004; Harrison-Buck 2015, Harrison-Buck, Brouwer Burg et al. 2016; Pyburn 2003). Relatively little investigation of colonial sites has been conducted in this area. Our future research will expand on the colonial period investigations that BREA began in the middle reaches of the valley, beginning in 2011, and has continued over the years (Harrison-Buck, Murata, and Kaeding 2012; Harrison-Buck, Craig, and Murata 2017). Our future investigations aim to cross-examine oral histories alongside archival and archaeological evidence in an effort to reconstruct the colonial history and settlement in this area. For instance, we know that Crooked Tree was one of the earliest Kriol villages in Belize and was initially established during the British colonial period as a logging camp that housed enslaved Africans. Yet, none of the historic sites in and around Crooked Tree have been investigated or documented archaeologically. Based on the preliminary evidence, the area is not only rich in ancient Maya history, but also has a wealth of information concerning

early Kriol history and will shed light on Belize's colonial past, which we aim to investigate through archaeological survey and the aid of archival research and interviews with local informants in future field seasons.

Kriol ethnicity is defined as descendants of Europeans and enslaved African people who were originally brought to Belize, a former British colony, during the eighteenth century for the logwood and mahogany industries. As one of the oldest Kriol villages, members of the Crooked Tree community serve as stewards of a valuable repository of colonial archaeology and also hold a wealth of local knowledge in the form of oral histories. In partnership with the local Kriol communities, my future objectives for this research component are three-fold:

1) Conduct additional oral history interviews, archival research, and archaeological investigations to further document the history of the Kriol culture in the context of British colonial period archaeology.
2) Overhaul a building the village council has donated to become a permanent museum in Crooked Tree and design and implement a permanent exhibition that will feature the rich local history of Belize, including both Kriol and Maya culture.
3) Work with local teachers to produce educational materials that correspond to exhibit displays, specifically geared for local school-age children, with the aim of integrating the museum into the national curriculum.

During our future field seasons, we plan to conduct oral history interviews, archival research, and historical archaeological investigations (Objective #1) that will inform the content of a permanent public history museum. To support this project, the Crooked Tree Village Council has agreed to make an in-kind contribution, donating a primary existing structure in the center of Crooked Tree village that will be re-modeled to house the museum facility (Objective #2). This cement structure (the village's old Community Center) is of sound construction and measures roughly 30' x 60' in dimension, which will nicely house a modest-sized exhibition. The building will need to be remodeled to include a small addition to accommodate an office, museum store and storage space. The building will require interior and exterior finishing, such as re-painting, installation of secure windows and doors, as well as plumbing and electrical work. Other interior construction will be necessary based on the exhibition design and layout, including fabrication of dividing walls, display cases, and other specialty mounts for the exhibits. The plans are to remodel the building in the spring of 2018 with a tentative opening date scheduled for summer 2018.

The displays for the museum will be designed around an overall learning goal for visitors: to engage with the deep history of eastern Belize Watershed and discover the diverse cultures and heritage practices that occurred here from ancient to colonial times. Both Maya and Kriol customs will be vividly displayed in the museum building. A range of colonial and ancient artifacts (including some replicas that can be handled) will be on display with interpretive labels explaining where the objects originally came from and how they were used in the past. Tracing

this history provides greater appreciation for the importance and preservation of the archaeological past, often found right in one's very own "backyard" in Belize.

The museum displays will be developed alongside an educational curriculum (Objective #3), centered around activity-based learning. Activities will rely on the exhibit displays and involve both tangible and ponderable activities, ranging from a visitor's personal observations of artifact collections to content gleaned from interpretive labels. The idea is to maximize interactive engagement, making students partners in the learning process. An educational component with a hands-on experience has been shown to be an effective means of promoting active learning, stewardship, and heritage preservation. We aim to develop with the teachers of Crooked Tree an educational program for the museum that can be fully integrated with the museum collections and displays. Visitors will learn not only about the ancient Maya civilization, but also about the lived experience of their Kriol ancestors who imprinted particularly powerful memories on adults who now have the opportunity to share them with a younger generation.

Concluding Thoughts

Crooked Tree is not only the oldest Kriol community in Belize, it is also home to one of the largest ancient Maya sites in the BREA study area—Chau Hiix. The deep history of Crooked Tree makes it an ideal location for a permanent cultural museum celebrating the rich heritage of this area. The museum will be designed with, by, and for the local community. In this way, the research design for this component of the BREA project exemplifies a publicly engaged, collaborative project whereby community members serve as both informants and active participants in the collection, recording, and presentation of the local history. The museum exhibits will likely be of interest to tourists, but will be primarily geared for Belizeans, namely school-age children. Collaborating with teachers, our aim is to develop an educational component along side the displays that can be integrated into the national social studies curriculum. In this way, the museum and its curriculum will have broad impact beyond Crooked Tree, with student groups regularly visiting the museum from across the country.

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