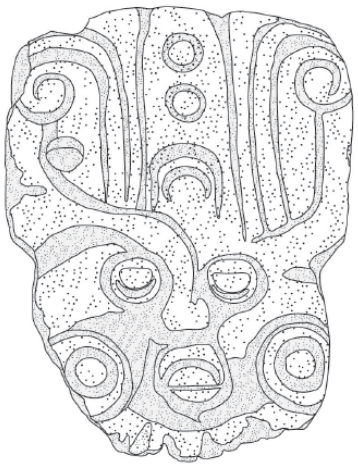
Investigations of the Belize River East Archaeology Project:
A Report of the 2023 Field Seasons



Marieka Brouwer Burg and Eleanor Harrison-Buck, Editors

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Preface and Acknowledgements

Marieka Brouwer Burg and Eleanor Harrison-Buck

With its inaugural season in 2011, the Belize River East Archaeology (BREA) project initiated its thirteenth year of archaeological research in the middle and lower reaches of the Belize River Watershed in 2023. Our work continues to uncover evidence for a long period—upwards of 8000 years—of near continuous occupation in this region. With a surface area of nearly 2000 km^2, the BREA project has documented abundant data to confirm that people occupied this watershed from perhaps as long ago as the Paleoindian period (earlier than 8000 BCE) up through the Archaic, Maya, Contact, Colonial, Historic, and present times. In the last handful of years, our attentions have focused on the hydrologically dynamic and biodiverse area around Crooked Tree Wildlife Sanctuary, a location with plentiful resources, access to the ocean and uplands, as well as a rich social web. Contrary to the former notion that the lower Belize Watershed constituted a cultural "no-man's land", we have documented innumerable examples of human occupation that indicate this area has been neither unknown nor uninhabited to surrounding populations.

This report details research carried out by the BREA team over the course of two 2023 seasons conducted in January and May-July. Thankfully, the restrictions of COVID-19 had largely been lifted at this juncture and fieldwork resumed more-or-less as usual. We continued to make our home base at Tillett's Village Lodge on Crooked Tree Island, with our investigations radiating outward from that loci.

We were joined by a crack team, to which we owe our deep gratitude! Jack Biggs, Amy Hair, Adam Kaeding, Samantha Krause, Hollie Lincoln, Satoru Murata, Astrid Runggaldier, Katie Shelhamer, Marie White, and Mark Willis were pivotal in keeping research afloat. We welcomed three student staff members in January 2023: Cormac Day, Fiona Haverland, and Kyle Nord and were excited to have James Stemp join us in Summer 2023 to analyze Archaic period lithics. This incredibly competent team brought a number of skills from paleoenvironmental reconstructions and coring, to survey and mapping, to remote sensing, excavation, and laboratory analysis. We are indebted to these staff members as well for helping to train our January 2023 field school students.

This field school—*ANTH 674 Archaeological Survey and Mapping*—was offered through the University of New Hampshire and trained 10 students. These students hailed from three universities: seven from the University of New Hampshire (Laura Allen, Daniel Bartus, Kathryn Concannon, Erin Fox, Chase Johnson, Gabrielle Petersen, and Shane Roosa), two from the University of Vermont (Grey Rinaldi and Caroline Hess), and one from New York University (Quinn Butler). These students were trained in field survey and mapping using a total data station, as well as tape and compass methods. Additionally, they received basic training in using ESRI ArcGIS software to generate a map of the site they surveyed. We are indebted to

Kaeding and Murata for leading this field program. We also thank Fiona Haverland and Tate Norwood for helping to digitize field maps and forms.

None of the field or laboratory research would have been possible without the incredible support of the many Belizeans involved directly or indirectly with this project. Helping in the field, we thank Cardinal Baptist, Rubin Crawford, Alrid Flowers, Melvin Quilter, Jeremiah Potts, Roy Smith, Bruce Tillett, Kenroy Wade, and Emmanuel Williams. In the lab, Ms. Icilme Crawford and Ms. Philipa Banner helped wash and process artifacts. Mr. Michael Saguro aka Flowers granted us permission to excavate at Xtabentun and regaled us with many fascinating stories about growing up in that area. Mr. Godfrey and Mrs. Dorothy Smith accommodated our requests to *again* dig up their front garden (i.e., Najil Iik). We can say with confidence that Mrs. Dorothy's hot sauce is one of the best in Belize and Mr. Godfrey's Keitt mangos are incomparable! We again thank Mr. Marv Tillett for his excellent chauffeuring. And to our mechanic, Mr. Kareem Swasey, for saving us on the side of the highway on more than one occasion.

Brouwer Burg wishes to extend additional thanks to the many landowners who permitted her to inspect and, in some cases, conduct shovel test pits on their property. These hospitable folks include the late Mr. Eddie Jex (may he rest in peace), Mr. Eustace Dawson, Mr. Wayne Wade, Mr. Uriah Rhaburn, Mr. Leroy Jex, Mr. Louis Cadle, Mr. Charlie Wade, Mrs. Marlene Menzies, and Mrs. Pandora and Mr. Gillie Canton. We also thank Mr. Luke Crawford for lending us his boat and motor to visit Revenge Lagoon. Furthermore, Mr. Walter Tillett acted as tour guide and took us to the northern tip of Crooked Tree Island on one occasion.

Tillett's Village Lodge has become our home-away-from home and there are many people to thank for making that possible. From the bottom of our hearts, with thank Ms. Judy Tillett, for cooking up a storm and washing all of our terribly dirty clothes. To Mr. Water Tillett, we thank for seeing to everyday maintenance, helping facilitate pick-up basketball games, and for being generally available seven days a week. We are indebted to Ms. Delia Tillett for her flexibility in working with our unusual schedules and seeing to our many strange accommodation requests. And a general thank you to the rest of the Tillett clan for always providing us a warm welcome.

We also extend our gratitude to all those at Birds Eye View Lodge, including but not limited to Ms. Verna Samuels, Mr. Denvour Gillett, Mr. Lenny Gillett, Ms. Kim Samuels, Ms. Lenicia Gillett, and Ms. Lorena Martinez. Thank you for taking care of our additional family when they visit us in the field! Looking forward to weekend visits to the pool often keep us going.

Many other people in Crooked Tree and Biscayne Village are to be thanked for their hospitality. This includes Crooked Tree Village Chairman George Tillett and Biscayne Village Chairman Mr. Adolphus.

BREA research has been made possible by the generous support from the Alphawood Foundation and from the National Science Foundation. We also thank our universities and academic departments for supporting us in running the archaeological program, most especially

our administrative coordinators: at UNH, Anne Torres and at UVM, Trevor Link. We again thank Dr. Meghan Howey at UNH for use of her Top Con total station and to Dr. John Crock at UVM for the loan of the EOS Arrow GPS receiver.

We thank our families for bearing with us – including the youngest members of the team, Eliza Buck, Natalie Buck, and Viggo Brouwer Burg. We also thank former field school student Ms. Miranda Miller for returning to Belize not to excavate, but to provide all important childcare. Not least, we thank our partners—David Buck and Jonathan Burg—for juggling home life while we "galivant" around Belize.

Our permit to conduct archaeological research was granted by the Belize Institute of Archaeology, as part of the National Institute for Culture and History, and we thank all those who make those enterprises run smoothly. In particular, our thanks go out to Dr. Melissa Badillo, Mr. Josue Ramos, Mrs. Joyce Tun, Mr. Paul Smith, and Ms. Rumari Ku.

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Chapter 1

Introduction to the BREA 2023 Season: Investigations in the Lower Reaches of the Belize River Watershed

Marieka Brouwer Burg and Eleanor Harrison-Buck

Much of low-lying coastal Belize has been continuously inhabited by human groups since the Archaic period onward, a chronology extending back in time more than 8000 years ago. Since 2015, the Belize River East Archaeology (BREA) project has been investigating the deep history of human-landscape interaction in the lower reaches of the Belize River Watershed, specifically in the area of Crooked Tree Wildlife Sanctuary (CTWS; Brouwer Burg and Harrison-Buck eds. 2023; Harrison-Buck 2015a, 2018, 2020; Harrison-Buck et al. 2016, 2017, 2018, 2019, 2020a, 2020b; Harrison-Buck and Brouwer Burg eds. 2022; **Figure 1.1**). Archaeological traces of Archaic up through ancient Maya, contact, and colonial period settlements have been found throughout the study area. The unique hydrology of the area has provided both opportunities and limitations—as a rich source of food and non-food resources, as a mode of transportation and information exchange, and likely as an important anchoring feature in the social and spiritual lives of the people living within the region (see **Krause, Brouwer Burg, and White, Chapter 3**). As such, one of the BREA project's main lines of investigation has been to examine past human-landscape interactions in this alternating wet/dry, low-lying area of the Belizean coastal plain. And a critical component of our research has involved engaging the local communities of Crooked Tree and Biscayne in discussions about land use, subsistence, and sustainability, facilitated in part through outreach initiatives co-organized in part with the Crooked Tree Museum and Cultural Heritage Center (see Harrison-Buck and Clarke-Vivier 2020; Harrison-Buck et al. 2020).

The BREA project carried out two field programs in 2023: one in January and one in May-July. In January 2023, we had 10 field school students (7 from UNH, 2 from the University of Vermont, and 1 from New York University) join us through the University of New Hampshire (UNH) sponsored "Archaeological Survey and Mapping" course led by Dr. Eleanor Harrison-Buck, director of the BREA project. Drs. Adam Kaeding and Satoru Murata led the survey and mapping component of this course, which focused on mapping the previously undocumented site Xtabentun, located along Mile 23 on the Philip Goldson Highway (see **Kaeding, Murata, and Willis, Chapter 4**). Dr. Harrison-Buck and Hollie Lincoln (MA, Louisiana State University) led field excavations at Xtabentun (see **Lincoln and Harrison-Buck, Chapter 6** and **Harrison-Buck and Lincoln, Chapter 7**). Katie Shelhamer (BA, UNH) led excavations at Waxak Nicte' (**Shelhamer and Harrison-Buck, Chapter 8**). Co-director Dr. Marieka Brouwer Burg conducted Archaic reconnaissance, survey, and some limited test excavations around Crooked

Tree Island (**Brouwer Burg et al., Chapter 2**), at Xtabentun (**Brouwer Burg, Haverland, and Krause, Chapter 9**), and at some raised fields outside of Chau Hiix (**Brouwer Burg and Krause, Chapter 10**). Dr. Samantha Krause and graduate student Marie White (both of Texas State University) joined Brouwer Burg to continue investigations of the paleolandscape and environment through geological coring (**Krause, Brouwer Burg, and White, Chapter 3**). In addition to senior staff, the field work was supported by efforts from BREA student staff: Fiona Haverland (UVM), Cormac Day (UNH), and Kyle Nord (UNH).

During the May-July 2023 season, the BREA team focused on a number of research initiatives. From May 22-June 4, Brouwer Burg and Krause led a small team including graduate student Marie White in field work focused on expanding our understandings of the paleogeography and paleoclimate of the CTWS. We borrowed a vibracore coring device from Dr. Timothy Beach (University of Texas at Austin), which had been housed over Covid at the Maya Research Project (MRP) camp in Blue Creek. The results of this geomorphological work are discussed in **Krause, Brouwer Burg, and White, Chapter 3.** In June, Dr. Eleanor Harrison-Buck and bioarchaeologist Jack Biggs (MA, MSU) completed excavations at the site of Najil Iik (see **Biggs, Harrison-Buck, and Lamb, Chapter 5**). Laboratory staff Amy Hair (MA, Louisiana State University) joined us for this period, and was overseen by Brouwer Burg.

From mid-June through the end of July, the BREA team refocused efforts on laboratory analysis, which took place in our field laboratory on Crooked Tree Island. Staff members included Harrison-Buck, Brouwer Burg, Runggaldier, and Biggs. Osteological analysis was completed for the human remains from Waxak Nicte' and Najil Iik (**Biggs and Bower, Chapter 11**). In addition, Dr. W. James Stemp of Keene State College completed his analysis of the Archaic assemblage (see **Stemp, Chapter 12**).

The current report details the reconnaissance, survey, mapping, and excavation work that was carried out during these two field seasons (**Figure 1.2**). Additionally, we include analytical chapters written by three field school students that attended our Summer 2022 field school. Their chapters consider a distinctive ceramic vessel, freshwater and marine shell artifacts, and settlement pattern analysis (see **Miller, Harrison-Buck, and Murata, Chapter 13; Hanson and Phillips, Chapter 14;** and **Haverland and Brouwer Burg, Chapter 15**).

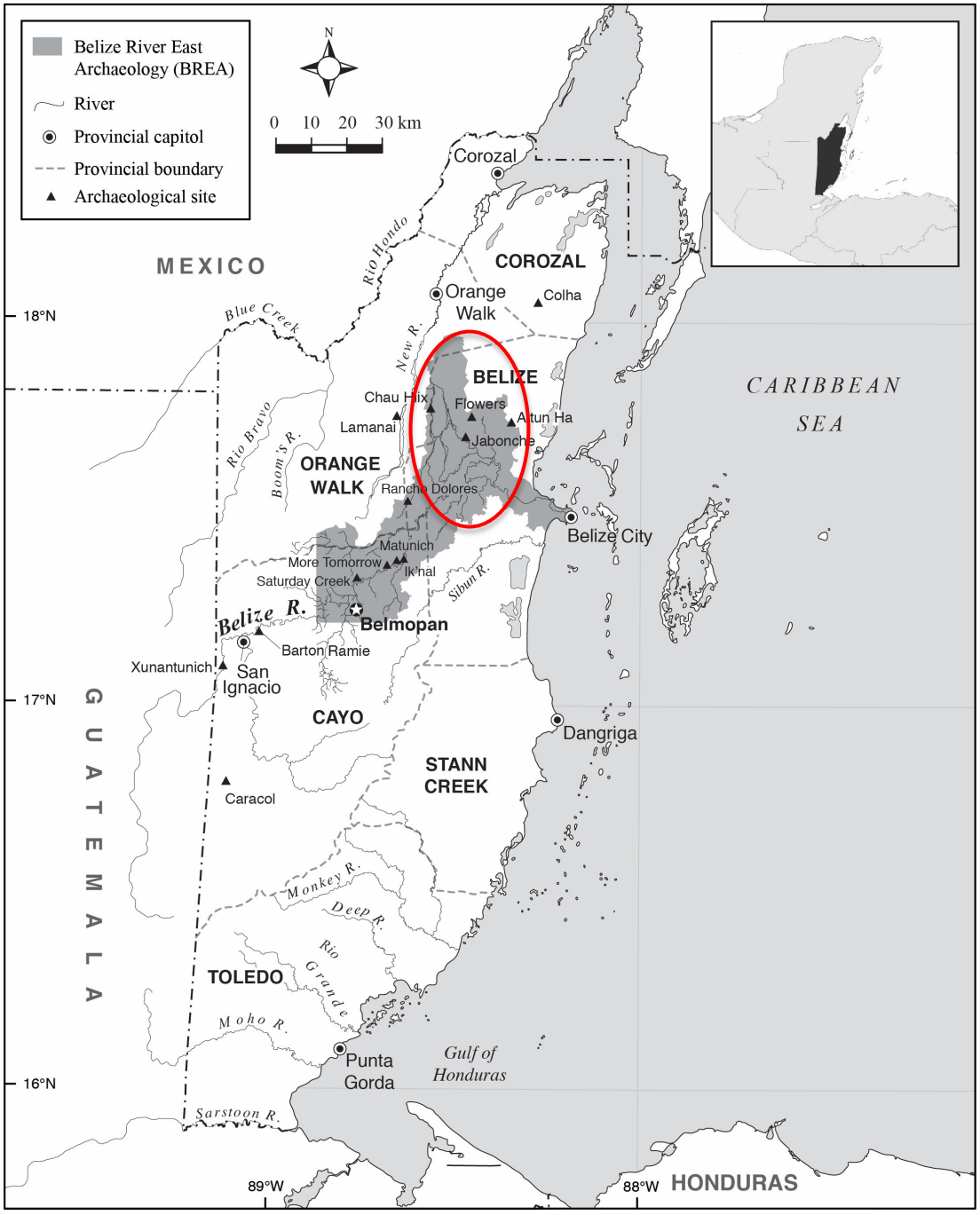

Figure 1.1 Map of Belize showing BREA study area. Lower reaches outlined in red (map by M. Brouwer Burg).

Background to the Research

The mid-to-lower reaches of the Belize River have long been the locus of human activity (**Figure 1.2**), from the Preceramic to the present day, ca. 8000 BC-AD 1950 (Brouwer Burg et al. 2014, 2015, 2016; Harrison-Buck, editor 2011, 2013, 2015a, 2015b, 2018, 2020; Harrison-Buck and Brouwer Burg, editors 2022; Harrison-Buck et al. 2012, 2013, 2015, 2016, 2017, 2018, 2019, 2020; Runggaldier et al. 2013). Since 2015, the BREA project has focused efforts on understanding human-landscape dynamics in the lower Belize Watershed, most recently focusing on the area in and around Crooked Tree Island. While the soils in this area are generally acidic and sandy—largely unsuitable for agriculture—there is high ecosystem diversity, including wide swaths of lowland broadleaf moist and moist scrub forest, mangrove/littoral forest, savanna, shrubland, and wetlands (Meerman and Sabido 2001; Meerman and Clabaugh 2017; see Brouwer Burg and Harrison-Buck 2022:Figures 1.2 and 1.3). However, there are a few key areas of highly arable land, such as along the western margin of Western Lagoon, where "black soils" have been used by local populations and the ancient Maya for farming (Pyburn 2003; Harrison-Buck, ed. 2020). The presence of a large-scale fish trapping facility continues to be investigated by the BREA team, indicating that aquaculture was an important subsistence activity in the area (Harrison-Buck 2020; Harrison-Buck et al. 2024; Krause, Beach, and Luzzadder-Beach 2020).

In terms of other available resources, the area is in proximity to the Northern Belize Chert Bearing Zone (NBCZ), a rich deposit of chert that was widely used in prehistory for the production of a range of different tools and weapons (e.g., Cackler et al. 1999; Hester and Shafer 1984; Shafer and Hester 1983; Stemp and Graham 2006). Additionally, logwood—a rot-resistant hard wood—is widely available in the area; apart from putting Crooked Tree Village on the map as a logwood camp in the late 1700s, logwood was undoubtedly used by the ancient Maya and their precursors for a variety of uses, including tool armatures and structural supports (see Stemp and Harrison-Buck 2019). We continued in this season to investigate how Archaic and ancient Maya groups utilized different ecosystems through widespread reconnaissance and survey (see **Brouwer Burg et al., Chapter 2**).

Environmental data from the wetlands is beginning to show how the landscape evolved over time, with the lagoonal systems evolving from year-round lakes to seasonal wetlands sometime in the Late Archaic period (c. 2000 BCE; see **Krause, Brouwer Burg, and White, Chapter 3;** Harrison-Buck and Brouwer Burg 2023; Harrison-Buck et al. 2024). We are also coming to understand the hydrology of the region as well as the additional post-depositional forces at play (see **Haverland and Brouwer Burg, Chapter 15**).

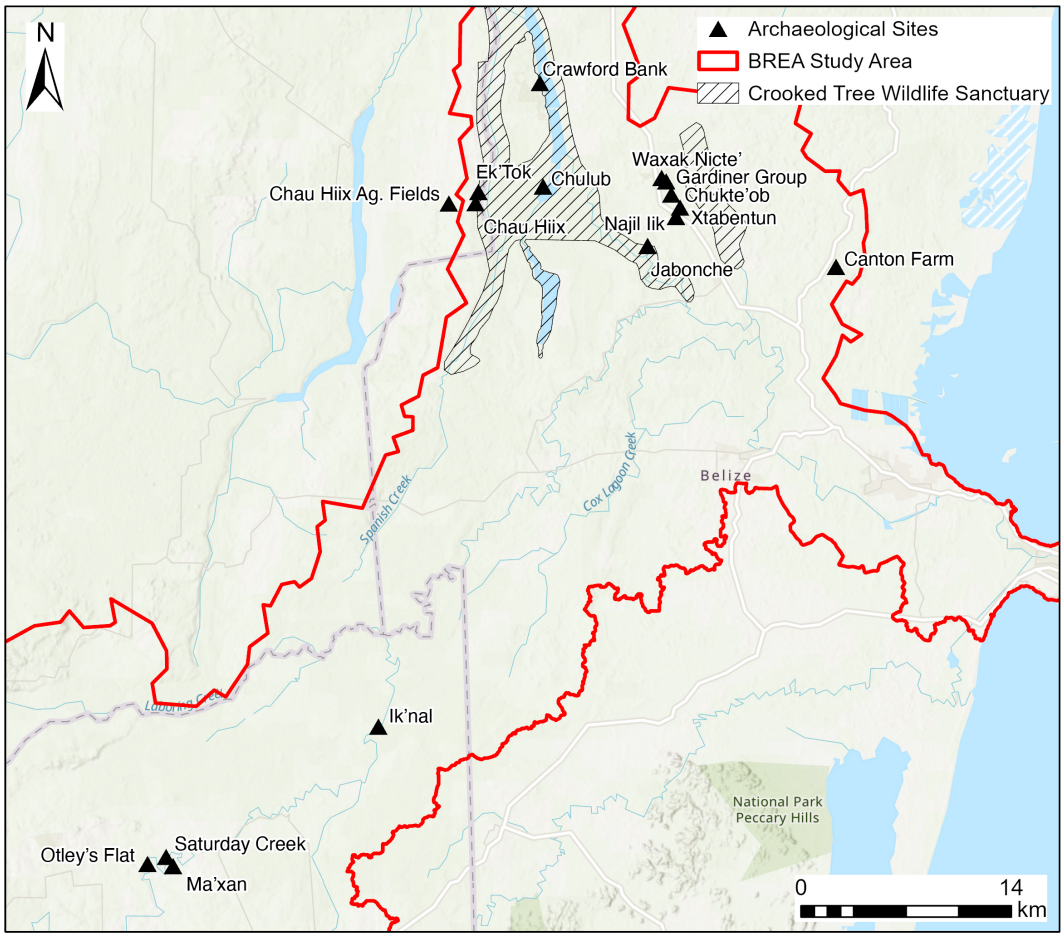

Figure 1.2 Areas and sites investigated by the BREA team during the 2022 field seasons or mentioned in this report (map by M. Brouwer Burg).

Since 2015, the BREA survey team has identified sprawling Maya settlement on both the western and eastern sides of the Northern Highway, in the vicinity of Biscayne village and Washing Tree (**Figure 1.2 and 1.3**). The densest concentrations of settlement exist around two minor ceremonial centers—Waxak Nicte' in Biscayne and Jabonche in Washing Tree (Buck et al. 2022; Murata and Robinson 2015; Murata et al. 2018 and 2022; Norris et al. 2015). During January 2020, parts of the Waxak Nicte' site (including the Reyes, Wade, and Gardner Groups, all east of the northern highway) were surveyed and mapped with a Total Station (Buck et al. 2022; Murata et al. 2022). Two excavations were carried out in the Ceiba Plaza (Plaza A) by Shelhamer, Craig, and Harrison-Buck (2022) and Lamb (2022). In January 2023, we continued excavations at the Gardiner Group of Waxak Nicte' in order to gain insight into the chronology and use of this remote area of the site (see **Shelhamer and Harrison-Buck, Chapter 8**).

The other area targeted in 2023 was Xtabentun, a site on a tract of land approximately 2 km south/southeast of Waxak Nicte' also located in the modern-day village of Biscayne near the junction with the Washing Tree Road. Several mound groups forming parts of Xtabentun were first identified during a reconnaissance in the 2020 field season (Buck et al. 2022). Located on

the property of Mr. Mike Saguro (aka Flowers), this sprawling complex of large structures was formerly referred to as Saguro 1 site, and also included the nearby Walton Glen Harris site, both named for the two adjacent property owners in this area (see Buck, Murata, and Robinson 2022:Figure 3.1). The site was subsequently given the name Xtabentun during the 2022 field season. At this time, survey of the area using LiDAR-equipped drones was performed by Willis and Murata (2023:Figure 2.11), which offered us a better sense of the aerial extent of this sizeable secondary center. It was determined that the site of Najil Iik located approximately 0.75 km south-southwest of the Xtabentun site center, was likely an associated rural hamlet, artificially bisected from the rest of the site by the Northern Highway (see **Figure 1.3**).

One of the reasons we have continued to focus our investigations around the area of Biscayne village is for the purpose of archaeological salvage. A good deal of the ancient Maya settlement associated with both Waxak Nicte' and Xtabentun are in close proximity to the Northern Highway and have been damaged over the years by modern development. Most of the destruction has been due to the construction of the highway in the 1970s, with most of the largest structures in these site centers quarried for road fill. In the case of the Flower's Group—the main ceremonial center at Waxak Nicte'—all of the pyramidal architecture appears to be gutted by quarrying activity, in addition to several gaping looter's pits (Buck et al. 2022:39-40). Likewise, the largest structures in the Southern Group at Xtabentun, including the main temple and much of what appears to have been a ballcourt in the civic-ceremonial center (see **Figure 4.4**), were leveled as a result of quarrying for road fill when the Northern Highway was constructed in the 1970s. Fortunately, other parts of Xtabentun, like the Northern Group, have not undergone any modern mechanized clearing with bulldozers and there is only minimal evidence of looter's pits. Likewise, the Gardiner Group at Waxak Nicte' is relatively unscathed. However, the reality is that all of the settlement in this area is vulnerable to further destruction on account of the ongoing modern development of village land.

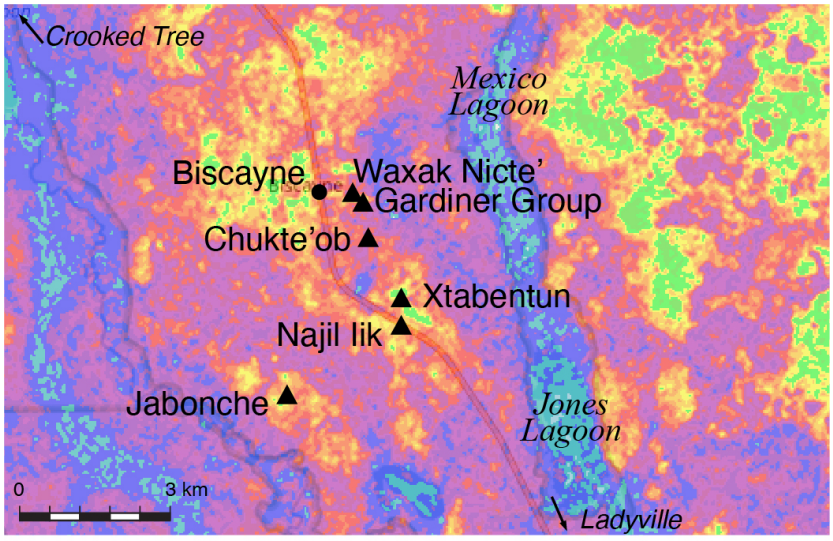

Figure 1.3 Map of the Biscayne Area, showing high ground in green and low ground in light blue (base map from www.floodmap.net).

The 2023 investigations that are described further below expand on the prior reconnaissance, survey, mapping, and excavation work that has been carried out in previous field seasons by the BREA project.

2023 Field Work

This report is divided into three main sections detailing the fieldwork conducted during the January 2023 and May–July 2023 field 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 at sites in the lower Belize River Watershed. Chapters in "Section III" detail a number of the analytical studies our team has carried out in the past year. Below, we provide an overview of each of these sections and the chapter contributions included therein.

Section I: Survey, Mapping, and Reconnaissance

Reconnaissance and Survey of Archaic Sites

Reconnaissance and survey work conducted during the January 2023 field season was geared toward identifying further Archaic settlement in the study area. We shovel tested in three main areas: 1) in and around Crooked Tree Island, including the community's hinterland farming tracts in the area known as Blackburn; 2) at two sites in the village of Biscayne, where additional research was being carried out on the ancient Maya sites of Waxak Nicte' and Xtabentun; and 3) along a stretch of the old Northern Highway near the village of Boston (see **Brouwer Burg et al., Chapter 2**). To inform our decisions about where to survey, we sought to test in microenvironments that are not yet well represented in our database (i.e., savanna, wetland shoreline, and mangrove swamp).

Mapping

Intensive archaeological mapping of the site of Xtabentun was carried out during the January 2023 field season, as part of the UNH-sponsored Archaeological Survey and Mapping field school (see **Kaeding, Murata, and Willis, Chapter 4**). The site was found to have a possible E-Group complex, pyramid, and ballcourt (albeit partially destroyed; see **Brouwer Burg, Haverland, and Krause, Chapter 9**) that formed the Southern Group. Kaeding et al. (this volume) identified at least one intersite sacbe connecting the southern part of the site to the Northern Group, which comprised an elite residential or administrative group centered around a

central plaza. Given the size of Xtabentun, we believe this site was another in a string of medium-sized Late Classic plaza groups in the area that run roughly N-S along the western edge of Mexico-Jones Lagoonal system; these sites include the Flowers group and the Reyes group of Waxak Nicte', as well as the smaller household settlement of the Hugh Tillett group, the Hines group, and Najil Iik (see Buck, Murata, and Robinson 2022:Figure 3.1). As these sites lie parallel to the Philip Goldson Highway, many of the associated structures have been partly or fully destroyed on account of the highway construction and later development and building projects.

Geoarchaeological Survey

To continue our work in reconstructing the unique hydrology and geomorphology of the Crooked Tree Wildlife Sanctuary (CTWS) and the surrounding environs, we conducted a coring campaign in various locations of interest, including along the shorelines of Crooked Tree Lagoon and Western Lagoon. We also tested out our coring equipment in the New River Pine Savanna and in a couple of prairie pothole-like water bodies along the Old Northern Highway (see **Krause, Brouwer Burg, and White, Chapter 3**). The sediment samples collected during this work have been exported to the research laboratory of Dr. Timothy Beach (University of Texas at Austin), where Dr. Samantha Krause has been analyzing them and preparing them for shipment to additional specialist laboratories.

Section II: Site Investigations

Test excavations were carried out at four main site locations during the 2023 field seasons, including: 1) Xtabentun, 2) Waxak Nicte', 3) Najil Iik, and 4) along the agricultural margins of ancient settlement at Chau Hiix. The findings from these excavations are presented in the chapters in this report and are summarized below.

Xtabentun

Two initial test excavations (Operations 65 and 67) were opened at Xtabentun during January 2023, in conjunction with the archaeological mapping and LiDAR undertaken by **Kaeding, Murata, and Willis, Chapter 4**. The landowner Mr. Mike Saguro (aka Flowers) has lived in the area since the 1960s and recounted that some of the Xtabentun structures were bulldozed in the 1970s for road construction materials. BREA excavations were located in the Northern Group, the elite/administrative center of the site, with the goal of understanding the chronology, construction, and use of these buildings individually and in relation to one another. Operation 65 was located along the center line of Structure 1 (a long rectangular building running E-W; see **Lincoln and Harrison-Buck, Chapter 6**). Operation 67 was located

perpendicular to the center line of Structure 2, in the northwest corner of the plaza on the southern (plaza-facing) side of the building (see **Harrison-Buck and Lincoln, Chapter 7**). As can be seen in **Figure 4.1**, Structure 2 lies west and slightly north of Structure 1. Two additional test excavations were carried out at Xtabentun by Brouwer Burg, with the intent of testing whether earlier Archaic occupation could be identifying beneath the ancient Maya structures. To this end, Operation 68 and 69 were carried out: Operation 68 focused on punching down beneath the foundation of the partially destroyed ballcourt structures while Operation 69 cut into an already low point of the site, possibly a drainage ditch (see **Brouwer Burg, Krause, and Haverland, Chapter 9**).

Waxak Nicte'

Operation 66 was opened at Waxak Nicte', a site the BREA team had previously investigated in 2020 (see Shelhamer et al. 2020:74-82; Lamb 2020:83-95). This season, we targeted an area (Plaza C) on the land of Charlie Wade that was not previously excavated by the team. This plaza, also known as the Gardner Plaza, is unique in its location apart from the main plaza of the site and its overall layout (see **Shelhamer and Harrison-Buck, Chapter 8**). After having mapped this part of the site in 2020, the BREA team returned to get a handle on the chronology and significance of the plaza, which has also been subject to some recent disturbance.

Najil Iik

Excavations at Najil Iik (Operation 55) were begun in January 2022 by Drs. Eleanor Harrison-Buck and Céline Lamb. Today located just off the Philip Goldson highway, this site, as noted above, was likely an extension of Xtabentun in ancient times. Initially, the BREA team laid out this operation as an L-shaped unit consisting of six 2-x-2 m squares extending from the base of Structure 1 (on its west side) to its summit. Squares A-D comprised 2-x-8 m (east-west) and Squares E and F were to the south of squares A and B, respectively. During Summer 2022 and Summer 2023, the unit was expanded with two more 2-x-2 m squares added to the north (Sq. G and H) and two 1-x-2 m extensions added to the east (Sq. I) and south (Sq. J) to capture the full extent to two complex burial deposits (see **Biggs, Harrison-Buck, and Lamb, Chapter 5**). A number of intrusive deposits containing multiple human interments were encountered, making this one of most complicated difficult excavations the BREA team has undertaken to date.

Chau Hiix Margins

The last area investigated via test excavation was a depressed, wet area about 2 km west of the Chau Hiix site core (see **Brouwer Burg and Krause, Chapter 10**). K. Anne Pyburn and team extensively mapped the area of Chau Hiix in the 1990s and 2000s (e.g., Pyburn 2003), but

to our knowledge, they focused primarily on Western Lagoon in their surveys of agriculturally productive wetlands. Recently, using Google Earth Pro, we identified the honeycomb pattern characteristic of ditched and drained wetland fields in this seasonally inundated depression and Operations 70 and 71 were initiated in order to ground truth this imagery.

Section III: Analytical Investigation

We held a month-long laboratory season in June-July 2023 during which time various artifact categories were further investigated beyond basic processing. Dr. W. James Stemp spent 10 days analyzing our assemblage of Archaic stone tools and debitage (**Stemp, Chapter 12**). He was able to show continuity between Late Archaic and early Formative tool types, in the form of macroblades and constricted adzes. He also identified one possible fragment of a Paleoindian fluted point that, critically, extends backward in time the occupation of the CTWS to at least 8000+ BCE. His work also underscores the need for further research on the Archaic technochronology, for which we still need to build a more robust dataset with corresponding radiocarbon dates if we are to better understand its nuances.

As part of our Summer 2022 archaeological field school, students carried out small-scale analytical projects on various artifact types. These chapters are included here as they are based directly on data collected by the BREA team and provide deeper insight into our assemblages. Miranda Miller reconstructed a Teotihuacan-style vessel from the site of Chukte'ob and made inferences about what the presence of this enigmatic vessel means (**Miller, Harrison-Buck, and Murata, Chapter 13**). Abby Hanson looked at a sample of the marine and freshwater shell artifacts that have been recovered by the project, calculating the MNI from various sites and comparing the degree of workmanship visible on the shell. With the help of BREA faunal specialist Lori Phillips, Hansen highlighted patterns in the data and made some inferences about the uses of these shell for food and other purposes (**Hanson and Phillips, Chapter 14**). Fiona Haverland used ArcGIS to investigate geospatial relationships between Archaic occupations (**Haverland and Brouwer Burg, Chapter 16**). They also conducted a least cost path analysis to investigate the possible routes by which chert was brought to Crooked Tree Island.

Conclusions

This report provides detailed information about the three main types of field work—mapping, excavation, and analytical investigations—conducted by the BREA team during the January and May-July field seasons of 2023. As an interdisciplinary team, we have many different specialists who also contribute to the findings reported herein. During 2023, we were joined by our LiDAR drone specialist Mr. Mark Willis, geoarchaeology specialist, Dr. Samantha Krause, and lithic analyst, Dr. W. James Stemp. The expertise that these contributors offer, in

addition to the wide range of research foci brought to the research by our talented BREA team members, provides the project with a rich, multiproxy set of data. With this growing body of information, we are continuing to add nuance and detail to our understandings of how humans interacted with their landscape in this area over an ~8000-year period.

Studying the deep history of the Crooked Tree Wildlife Sanctuary and its neighboring environs has been an important focus for the BREA team in recent years and, as this report shows, the 2023 seasons contributed a great deal of new data. In the final chapter of this report, we discuss both near and long-term research plans of the BREA project.

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Chapter 2

Reconnaissance of Archaic Occupations in and Around Crooked Tree Island

Marieka Brouwer Burg, Samantha Krause, Fiona Haverland, and Eleanor Harrison-Buck

Introduction

To continue investigation of Archaic occupations in and around the Crooked Tree area, the Northern Belize Archaic Adaptive Strategies (NBAAS) sub-project carried out a number of reconnaissance missions and shovel test surveys. In January 2023, we focused our efforts along the Old Northern Highway, further exploring the vicinity of Sand Hill Quarry, where the Belize Archaic Archaeological Reconnaissance (BAAR) Project and Colha Archaic Project (CAP) found traces of Archaic occupation in the 1980s. We also targeted a few sites along the Northern Highway, where the BREA project was conducting research on ancient Maya sites, as well as locations around Crooked Tree Island (**Figure 2.1**). The goal of this research was to continue investigation into the different kinds of adaptive strategies Archaic groups used in varying landscapes and ecosystems.

Objectives

1. Continue investigation of areas of high archaeological potential;
2. Identify locations where Archaic occupation may have occurred;
3. Isolate stratified deposits for future testing;
4. Recover diagnostic lithic artifacts.

Description of the Research and Methods Used

We followed the same procedure outlined in Brouwer Burg et al. (2023), involving information gathering from local informants, geospatial predictive modeling, pedestrian survey, and shovel test survey. The areas focused on during the January and Summer 2023 seasons are highlighted in **Figure 2.1**. As in previous field seasons, we used a posthole digger for STPs (see Kaeding 2022:100), spaced systematically in 5-, 10-, or 15-meter intervals. All material was screened with a ¼-inch mesh screen. STPs were dug until sterile sediment was encountered or a bedrock/C horizon sediment (in this area, marl and marly limestone is the basal geologic material). Most STPs ranged in depths from 20-100 cm.

There were three prime areas targeted in this research:

A. Crooked Tree Island proper as well as part of "Blackburn" – the area of farmland and savanna used by residents of Crooked Tree village for planting crops and cattle pasture.
B. A segment of land on the eastern side of the Northern Highway where other BREA research was being carried out on ancient Maya settlements.
C. A stretch of the Old Northern Highway where previous work had identified Archaic occupations.

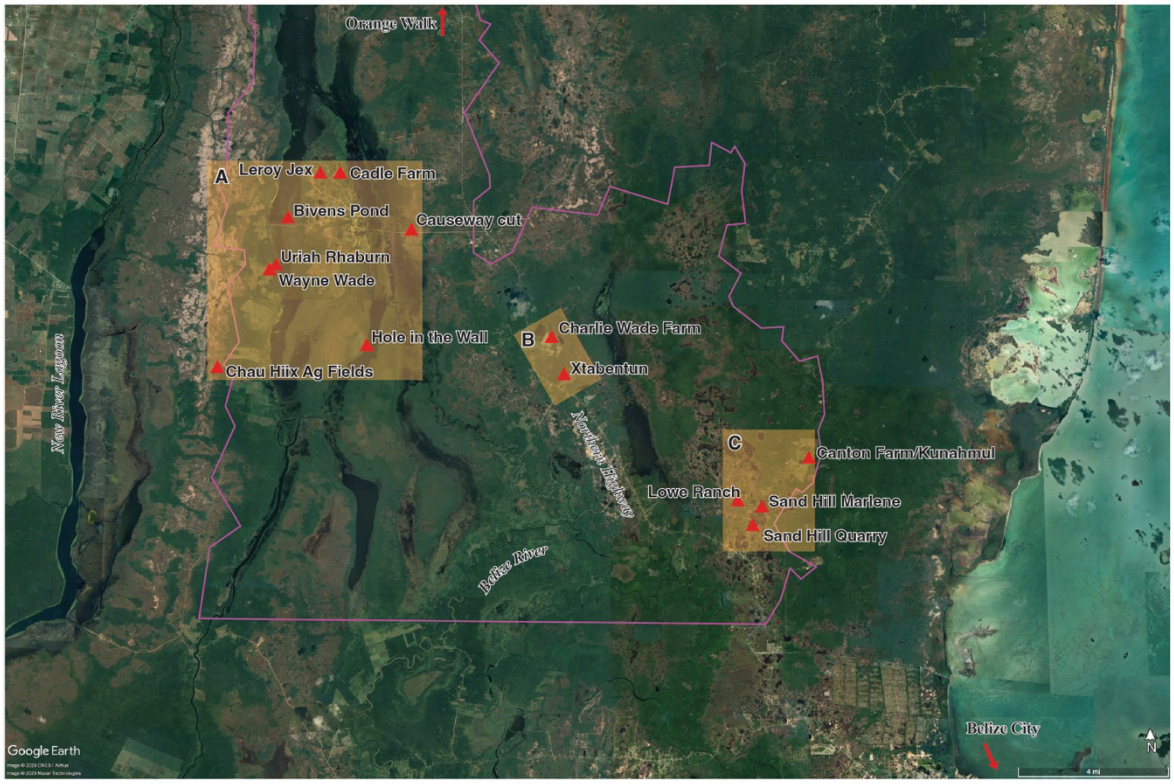

Figure 2.1 Overview of the NBAAS target area for 2023. Pink = NBAAS study area. Orange = areas of targeted Investigation. Red triangles denote Areas of interest described here (map by M. Brouwer Burg).

Results

Area A: Crooked Tree and Blackburn

The island of Crooked Tree is underlain by Pleistocene sediments and is comprised mainly of nutrient poor, sandy soils. For this reason, locals do not plant crops here apart from small gardens, preferring the darker, richer soils of Blackburn for cultivation of maize, cane,

coconut, and silvaculture. Throughout most of this area, the most agriculturally productive use of land is cattle ranching. On the island itself, cashew fruit and seed harvesting is the most lucrative form of commercial food production, although the cashew tree is not native to the area and was introduced some 300 years ago during the Colonial period.

However, the area around Crooked Tree Island—known and protected as the Crooked Tree Wildlife Sanctuary—is a rich repository of lagoonal inland wetlands, where a host of diverse floral and faunal species flourish. Both the ancient Maya and their ancestors took advantage of these resources, as evidenced by previous excavations at Chau Hiix (carried out by Dr. Anne Pyburn and colleagues in the 1990s and 2000s; see e.g., Pyburn 2003), Ek'Tok (see Harrison-Buck 2020:83-95; Craig and Shelhamer 2020:96-104; and Rybka 2020:105-111), Chulub (Flanagan 2018:132-155; Harrison-Buck 2018b:156-172; Shelhamer and Craig 2018:173-190), and Crawford Bank (Harrison-Buck et al. 2018:194-207; Brouwer Burg 2022:49-73; Brouwer Burg 2023:114-147). Furthermore, we have identified a number of wetland features crosscutting Western Lagoon that date to the Late Archaic and Early-Middle Formative periods, indicating that the wetlands themselves were exploited for fish, aquaculture, and other resources (see Krause et al. 2020:116-127).

To continue investigating this area for traces of pre-Maya, Archaic occupation, we targeted a few keys areas of Crooked Tree Island and its environs. In some instances, STP survey was carried out in conjunction with geoarchaeological coring (see **Krause, Brouwer Burg, and White, Chapter 3**). This was the case for the Hole in the Wall STP series (051) and Bivens Pond series (052).

Hole in the Wall

Also known as the ancient Maya site of Chulub, "Hole in the Wall" is an area located on the far southeastern side of Crooked Tree Island and was investigated by the BREA team in 2016 and 2017. The team established that Chulub was a small satellite occupation of Chau Hiix, and probably coeval with that site during at least the Terminal Classic (Flanagan 2018:154). It is located on slightly elevated terrain, although locals have observed the entire site becoming inundated during the wettest seasons. In a previous report, Harrison-Buck noted that the presence of small wetland features scattered between Maya mounds indicates that the site "may be predominantly a production locale, perhaps related to fisheries or some other form of aquaculture" (Harrison-Buck 2018a:7).

The toponym Hole in the Wall is used by local fishers to describe the lagoonside of the area directly to the east of Chulub. To this day, people still congregate in the area to fish and the remains of modern fishing camps are scattered throughout the shoreline. The area is dynamic hydrologically: here, Spanish Creek flows into Crooked Tree Lagoon, and not far to the northeast, Black Creek channels water to the Belize River during the dry season (although Black Creek often reverses flow during the wet season). To better understand the hydrology of this dynamic portion of Crooked Tree Lagoon, we collected geoarchaeological cores from a few

locations along the shoreline (see **Krause, Brouwer Burg, and White, Chapter 3**). Additionally, as we had recovered some lithic debitage and a constricted adze in January 2022 in this location (approximately 700 m north of the core location), we carried out a STP series (051) perpendicular to the shoreline to get a sense of artifact distribution (**Table 2.1; Figure 2.2**). Five STPs were laid out in 5-m intervals. STPs 1-4 were in the logwood trees and STP 5 was located on the open shoreline. Only STP 5 yielded positive artifact evidence, from the top 10 cm, indicating that these are not deep deposits of artifacts and mostly, the lithics have been deposited through wave action.

Table 2.1 Results of STP series 051 at Hole in the Wall.

STP #	Positive or negative	Ending elevation (cm BGS)	Stopping point of STP
1	Negative	56	0-2 cm O horizon of dense root mat; transitions to A horizon of vertic dark gray (10YR3/1) clay with organics, fine roots and few larger (>1 cm) river pebbles; at 24cm, transition to C of homogenous powdery marl with few quartz sand grains, carbonate (CaCO3) masses 50% of matrix
2	Negative	63	Same as STP 1, beginning at 32 cm, C horizon lightens with depth, gypsum increases with depth; color between 2.5Y4/2 (dark grayish brown) and 2.5Y6/6 (olive yellow)
3	Negative	58	Same as STP 1, much gypsum and Sulphur at bottom of column; transition to C horizon begins at 39 cm
4	Negative	48	Same as STP 3 but A horizon is sandier and transition to C horizon begins at 34 cm
5	Positive	45	Same as STP 3 and 4 but no O horizon, and C horizon marl is eroding – gypsum matrix with redox features, pebbles (1-2 cm) rounded by bioturbation of roots. 1 pc of chert debitage (~5 cm), artifacts visible on surface, including a large microblade tool (~15 cm long).



Figure 2.2 Location of STP Series 051 at Hole in the Wall (map by M. Brouwer Burg).

Bivens Pond

Bivens Pond represents the only location on the northern side of the western causeway where we have attempted to core. Unfortunately, the access road to this spot was sufficiently wet, such that we could only drive a short distance off the causeway. Nevertheless, we attempted a core here, the results of which are described in **Krause, Brouwer Burg, and White, Chapter 3**. Much of the area is seasonally wet and the predominant flora were round reeds locally called "pop grass," and logwood along the shoreline. We laid out a short transect leading due west from the slightly elevated rise of the island into the lagoon (**Figure 2.2**). STPs were dug at 10-meter intervals. No artifacts were recovered (**Table 2.2**).

Table 2.2 Results of STP Series 052 at Bivens Pond.

STP #	Positive or negative	Ending elevation (cm BGS)	Stopping point of STP
1	Negative	67	0-3 cm O horizon of dense root mat; A^1 horizon from 3-20 cm of dark, sandy clay with many roots; A^2 horizon from 20-50 cm that is lighter in color with more mottles; C horizon begins at 50 cm and comprises a gray sandy clay with carbonate masses, gypsum, iron redox features that increase with depth (40% matrix)
2	Negative	49	Same as STP 1, transition to C horizon at 45 cm
3	Negative	40	Same as STP 1, contact with C horizon at bottom of column
4	Negative	49	Same as STP 1, C encountered at 39 cm
5	Negative	47	Same as STP 1, C horizon at 40 cm
6	Negative	55	Same as STP 1, C horizon at 43 cm



Figure 2.3 Location of STP Series 052 at Bivens Pond (map by M. Brouwer Burg).

Causeway Roadcut

After a season of driving past this thick, 2+ m thick road cut, which serves as a drainage canal along the northern edge of the causeway, we stopped to investigate the cut's stratigraphy (described in **Krause, Brouwer Burg, and White, Chapter 3**). We also conducted a brief STP survey near the cut—in palmetto/sawgrass gilgai depression—to gain insight into the uniformity of these layers across this part of the Crooked Tree lagoonal area (**Table 2.3**; **Figure 2.4**). Three STPs were dug and revealed that the upper sand layer is not nearly as thick as it is in the road cut, suggesting that where we tested is one of the thicker areas of the dune, or that some of the sand was piled up during excavation. While a piece of ground stone (perhaps a metate fragment) was found in the wall of the road cut, no other artifacts were encountered and the three STPs were all negative.

Table 2.3 Results of STP Series 054 at Causeway Roadcut.

STP #	Positive or negative	Ending elevation (cm BGS)	Stopping point of STP
1	Negative	43	0-2 cm O horizon of roots; 2-25 cm A horizon of pure clay with sand (less than 5% of matrix); 25-40 cm C horizon strongly vertic clay, mottled light gray with orange redox features
2	Negative	40	Same as STP 1 in pine savanna
3	Negative	40	Same as STP 1 in pin savanna



Figure 2.4 Location of STP Series 054 at the Causeway Roadcut (map by M. Brouwer Burg).

Cadle Farm and Leroy Jex

Having thoroughly investigated the surface and shallow subsurface along much of the eastern shoreline of Crooked Tree Island (see Brouwer Burg et al. 2023), we also felt that we should shovel test a transect E-W across the island, perpendicular to the shorelines. The northern portion of the island was selected for this transect as it is easier to access than the southern portion and is also narrower in width. To that end, we began a linear series of shovel tests beginning at the water's edge at Cadle Bank, extending across Cadle Farm (STP series 045) and Leroy Jex's land (STP series 044) westward toward Western Lagoon.

A total of 73 STPs were carried out across Cadle Farm (**Table 2.4; Figure 2.5**). Most of the STPs were located at 10-m intervals, except for a cluster of positive STPs that were encountered near a small, sandy rise roughly 50 m from the shoreline. Here, the STPs were located at 5-m intervals, to detect artifact density (see right inset of Figure 2.5). This transect was highly instructive and revealed that this upland area of Crooked Tree Island consists of an undulating sand dune underlain by vertic, seasonally wet/dry sandy clay. No marl was reached in these STPs, indicating that the sand dune is thicker here, whereas along the shoreline, the underlying clay/marl is typically encountered within ~50 cm.

Table 2.4 Results of STP Series 045 at Cadle Farm.

STP #	Positive or negative	Ending elevation (cm BGS)	Stopping point of STP
1	Negative	70	Tan/grey sand (2.5YR6/2), water table 60 cm
2	Negative	74	Same as STP 1, water table 66 cm
3	Negative	76	Bottom sand slightly browner
4	Negative	80	Clay (10YR5/8) at 76 cm with orange (redox) flecks (2.5Y 6/1), sand above is 10YR3/3
5	Positive	70	1 pc chert debitage, clay at 62 cm with red ferrous flecks (2.5YR4/8) and pebble inclusions
6	Positive	70	1 pc chert debitage (~5 cm), from 30-40 cm), clay at 62 cm
7	Positive	73	1 large pc chert debitage, clay at 63 cm
8	Positive	71	1 pc pottery? Or friable concretion found ~30 cm., 1 pc microdebitage, clay at 62 cm dark in color with orange flecks
9	Negative	70	Clay at 62 cm, water table at 70 cm
10	Positive	68	1 pc chert debitage, clay at bottom with red flecks
11	Positive	65	1 pc chert debitage (~5 cm), clay at 62 cm
12	Negative	65	Clay at 56 cm
13	Negative	71	Dark clay (10YR3/2) at 60 cm
14	Positive	64	1 pc chert debitage (~10 cm), clay at 53 cm
15	Negative	69	Clay at 60 cm
16	Negative	60	Clay at 55 cm
17	Negative	66	Medium brown clay at 20 cm to bottom (pushed up from lower area?)
18	Positive	68	Chipped tool at 50 cm, dark to light sand grades to clay at 60 cm
19	Negative	61	Clay at 50 cm
20	Negative	62	Clay at 56 cm
21	Negative	64	Clay at 59 cm
22	Negative	55	Clay at 40 cm
23	Negative	75	Clay with red flecks at 55 cm, water table 66 cm
24	Negative	70	No clay, only sand grading from dark to light, water table at 60 cm
25	Negative	72	Same as STP 24
26	Negative	64	Same as STP 24, water table at 43 cm
27	Negative	65	Same as STP 24, water table at 23 cm
28	Negative	54	Same as STP 24, water table at 31 cm
29	Negative	64	Same as STP 24, water table at 36 cm
30	Negative	79	Same as STP 24, water table at 60 cm
31	Negative	81	Same as STP 24, water table at 74 cm

32	Negative	72	Same as STP 24, water table at 64 cm
33	Negative	74	Same as STP 24, water table at 66 cm
34	Negative	72	*In trees*, dark sand grades to lighter sand at 32 cm, water table 44 cm
35	Negative	70	Same as STP 24, water table at 38 cm
36	Negative	44	Same as STP 24, water table at 15 cm
37	Negative	60	Same as STP 24, water table at 46 cm
38	Negative	62	Same as STP 24, water table at 42 cm
39	Negative	58	Same as STP 24, water table at 40 cm
40	Negative	58	Same as STP 24, water table at 49 cm
41	Negative	58	Same as STP 24, water table at 58 cm
42	Positive	64	1 pc chert debitage (~10 cm), same as STP 24, water table at 50 cm
43	Negative	62	Same as STP 24, water table at 42 cm
44	Negative	69	Medium brown (10YR3/4) sand grades into lighter tan sand toward bottom, no clay, water table at 46 cm
45	Negative	69	Medium brown sand to bottom with higher clay content, water table at 48 cm
46	Negative	73	Brown sand not as dark here (out in cleared area), much charcoal flecking, water table at 43 cm
47	Negative	66	Same as STP 44, water table at 43 cm
48	Negative	68	Same as STP 44, water table at 46 cm
49	Negative	63	Medium brown lens (5 cm thick) clearly sandwiched between tan/grey sand and light brown sand at 28-33 cm
50	Negative	85	0-20 cm is humic A horizon with lots of charcoal inclusions, grades into lighter tan sand, water table at 69 cm
51	Negative	73	Same as STP 50, but medium brown sandy clay with concretions at 26 cm, sharp transition to tan/yellow
52	Negative	83	0-14 cm dark humic sand, 14-38 cm medium brown sand, 38-80 cm light grey sand (5Y7/2), 80-83 cm brown sand (10YR5/8), water table at 80 cm
53	Negative	82	Transition to light gray sand at 44 cm, water table at 80 cm
54	Negative	98	Transition to light gray sand at 67 cm, water table at 87 cm, orange mottling in lowest layer
55	Negative	92	Same as STP 54, water table at 77cm
56	Positive	88	1 pc chert debitage, same as STP 54, water table at 72 cm
57	Negative	101	Same as STP 54, water table at 98 cm
58	Negative	92	Same as STP 54, water table at 78 cm
59	Negative	106	Same as STP 54, water table at 98 cm
60	Negative	95	Same as STP 54 but strong orange mottling 15 cm from bottom of unit, water table at 90 cm

61	Negative	103	Same as STP 52 but basal sand with orange mottling and sandier clay
62	Negative	107	Same as STP 61, water table at bottom
63	Negative	100	Same as STP 61, mottles turning into iron concretions and consolidated sand at bottom of column, water table at bottom
64	Negative	90	Medium brown (10YR4/2) sandy clay descends directly into orange/brownish yellow sand (10YR6/6) that becomes lighter with depth. Reddish concretions at bottom of brownish yellow sand, water table at bottom
65	Negative	82	Same as STP 61, water table at 77 cm
66	Negative	74	Same as STP 64, but less brownish yellow sand, water table at 69 cm
67	Negative	94	Humic layer thicker here (in woods – pine/oak broken ridge within savanna), 26-77 cm light tan sand with less mottling and almost no orange, water table at 77 cm
68	Negative	79	Still in woods, orangey/brown layer stronger, water table at 65 cm
69	Negative	76	Still in woods but in depression where water runs off during wet season; A horizon very shallow
70	Negative	78	Much sandier than STP 69, but probably because near to an access road, water table at 68 cm
71	Negative	91	Same as STP 64, water table at bottom
72	Negative	85	Similar to STP 71, few little pebble inclusions, water table at 73 cm
73	Negative	76	0-2 cm O horizon, 2-13 cm humic A horizon, 13-30 cm light tan/gray sand, 30-70 cm medium brown sand, 70-76 cm gray clay with heavy orange mottling, water table seeping in at bottom

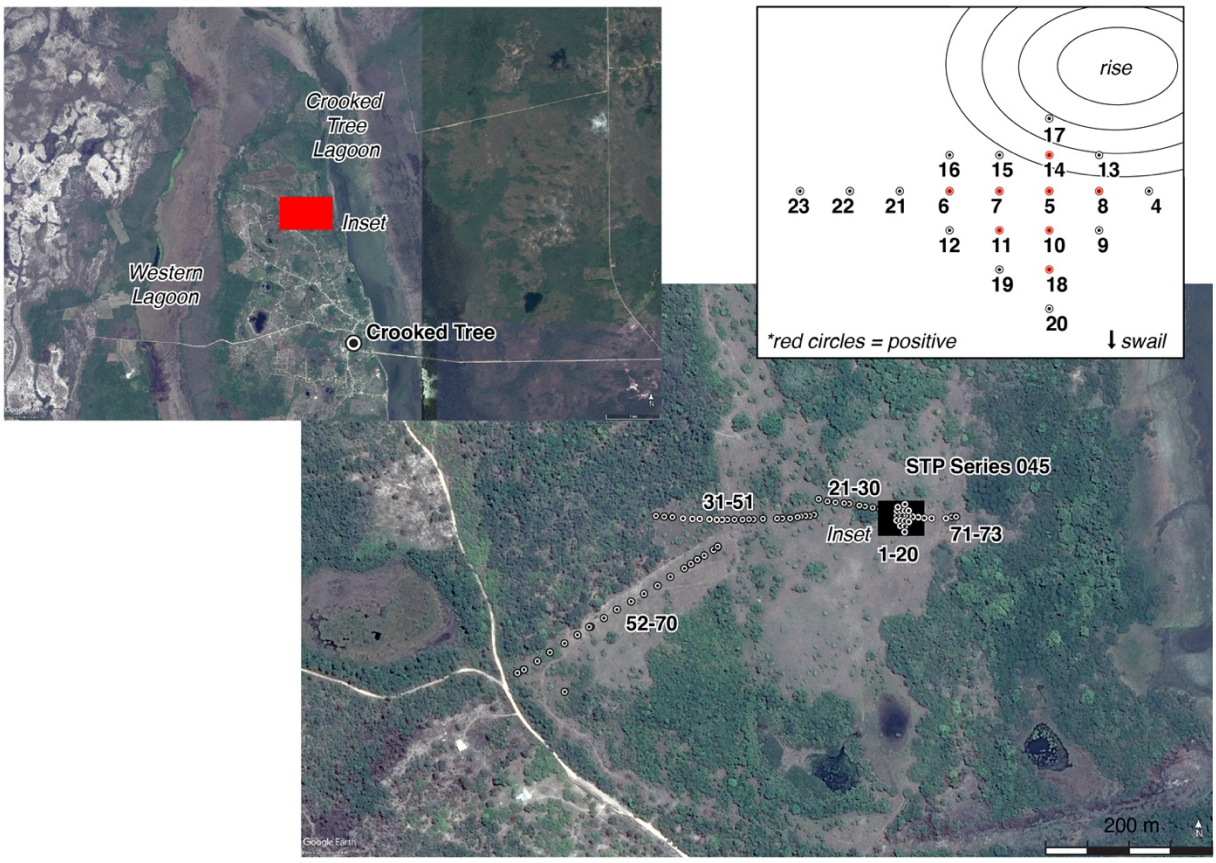

Figure 2.5 Location of STP Series 045 at Cadle Farm (map by M. Brouwer Burg).

Also worth noting was the concentration of chert debitage (some as large as 10 cm) encountered between STPs 5-18, which lie SW of a small rise in the landscape. This concentration may be indicative of an ancient occupation, or could be a product of recent disturbance, as some tree removal and surficial grading was reported by the landowner, Louis Cadle. Further test excavations in this area are planned for future research.

STPs were continued on the land of Leroy Jex (**Figure 2.6**). STP series 044 consisted of 42 STPs located at 10 m intervals (**Table 2.5**), all of which were negative. While we laid out an additional 11 STPs (43-53), we were not able to dig them due to the very wet conditions in that area. Relatedly, we were also not able to connect STP series 045 and 044 because of four ponds (some natural, others man-made) that lie between the two transects. Further, at the time of investigation, we were not able to dig further west than STP 39 due to inundated land. We did, however, walk as far west as possible to establish points on where the edge of the logwood began.

Regardless of these restrictions, STP series 044 revealed a picture consistent with what was found in STP series 045: dark grey sand (colored by seeping organic material) grades into lighter tan and then whitish sand, representative of a large, probably Pliocene-aged sand dune. This dune is anchored on top of a clay body, which caps the underlying limestone bedrock. The

clay is formed as the limestone bedrock erodes with water seepage and seasonal wet-dry events, plus the infiltration of organic elements through bioturbation.

Table 2.5 Results of STP Series 044 at Leroy Jex's land.

STP #	Positive or negative	Ending elevation (cm BGS)	Soil profile and stopping point of STP
1	Negative	99.5	0-2 cm O horizon; 2-16 cm A horizon of dark gray sand (GLEY1 2.5/N), pure white silica inclusions; 16-28 cm is B horizon yellowish-brown (10YR5/8) sand that descends into light brown (10YR4/3); 28-99.5 cm grey (10YR7/1) sand descends into lighter grey sand with flecks of charcoal
2	Negative	93	Same as STP 1
3	Negative	92	Same as STP 1
4	Negative	86	Same as STP 1
5	Negative	105	Same as STP 1
6	Negative	105	Same as STP 1, clay mottled with white and orange flecks encountered at bottom
7	Negative	88	Same as STP 1, no clay
8	Negative	97	Same as STP 1, no clay
9	Negative	90	Same as STP 1, no clay
10	Negative	98	Same as STP 1, no clay, water beginning to seep in at bottom
11	Negative	84	Same as STP 1 but sediment slightly darker, probably because a low area and water table pooling.
12	Negative	72	Same as STP 11, orange redox features present, water table at 43 cm
13	Negative	67	Same as STP 11, water table at 42 cm
14	Negative	63	Same as STP 11, water table at 47 cm
15	Negative	69	Same as STP 11, water table at 10 cm, very wet depression
16	Negative	64	Same as STP 11, water table at 48 cm
17	Negative	78	Same as STP 11, water table at 66 cm, coming out of depression
18	Negative	79	Same as STP 1, water table at 70 cm
19	Negative	86	Same as STP 1, water table at 81 cm
20	Negative	88	Same as STP 1, water table at bottom
21	Negative	92	Same as STP 1, water table at bottom
22	Negative	97	Same as STP 1, water table at 97 cm
23	Negative	97	Same as STP 1, water table at 92 cm
24	Negative	94	Same as STP 1, water table at 94 cm
25	Negative	98	Same as STP 1, water table at bottom

26	Negative	100	Same as STP 1, water table at bottom
27	Negative	99	Same as STP 1, water table at bottom
28	Negative	100	Same as STP 1, water table at bottom
29	Negative	91	Same as STP 1, water table at bottom
30	Negative	92	Same as STP 1, water table at bottom
31	Negative	92	Same as STP 1, no water table encountered
32	Negative	93	Same as STP 1, water table at bottom
33	Negative	97	Same as STP 1, water table at bottom
34	Negative	97	Same as STP 1, water table at bottom
35	Negative	77	Same as STP 1, water table at 70 cm
36	Negative	70	A horizon now dark brown, organic sand that transitions into tan sand and ends in whitish sand (silica rich), water table 58 cm
37	Negative	60	Same as STP 36, water table at 35 cm
38	Negative	60	Same as STP 36, water table at 32 cm
39	Negative	59	Same as STP 36, water table at 30 cm, topography getting lower toward Western Lagoon
40	Negative	76	Same as STP 1
41	Negative	69	Same as STP 1, water table at 62 cm
42	Negative	60	Same as STP 1, water table at 60 cm



Figure 2.6 Location of STP Series 044 on Leroy Jex's land (points to the far west indicate the edge of the logwood; map by M. Brouwer Burg).

Chau Hiix Agricultural Fields

Prior to completing test excavations at the Chau Hiix Agricultural Fields, we conducted a STP series (053) of 31 STPs. The results of this work are report in **Brouwer Burg and Krause, Chapter 10** (**Figure 11.2, Table 11.2**).

Wayne Wade and Uriah Rhaburn Farms

Similar to the E-W transect carried out across Crooked Tree Island with STP series 044 and 045, we conducted a similar E-W transect in the Ridge area, across the land of Mr. Wayne Wade. STP series 050 consisted of 27 STPs located at 10-m intervals (**Table 2.6; Figure 2.7**). The whole area is known for its sticky black, humic soil, which was once cohune ridge (lowland broadleaf moist forest) and is more arable than the sandy soils of Crooked Tree Island. This entire ridge area sandwiched between Western Lagoon and the pine savanna to the west has revealed traces of ancient Maya settlement, including mounds and other structures and abundant

artifacts. A few mounds exist on Mr. Wayne's property while, in the next plot north, many mounds with artifacts strewn on the surface are visible on the land of Mr. Uriah Rhaburn. Artifacts included ceramic sherds, fragments of ground stone, as well as chalcedony debitage and tools. Chalcedony is a form of chert that is coarse-grained and fibrous in texture. There are some outcrops of the lower quality tool stone in the area to the north and south.

The first STP was located in an area that is typically submerged by Western Lagoon in the wet season. STPs 1-14 were located in 10-m intervals; from 15 onward, the STPs were spaced in 20-m intervals. The overall picture indicates that the humic loamy clay extends to between 53-70 cm throughout the STPs, with an undulating clay marl underlying this rich arable layer. This is a notably different profile than seen in Crooked Tree, where the soils are predominantly sandy clays. Comparing the results of STP series 044, 045, and 050, it seems clear that Crooked Tree Island is an anchored sand dune and Blackburn ridge is an area of deep lacustrine-deposited loamy clays that were overlain upon an earlier sand dune (New River Pine Savanna), perhaps in the Pleistocene (see **Figure 2.8**).

Table 2.6 Results of STP Series 050 at Wayne Wade's farm.

STP #	Positive or negative	Ending elevation (cm BGS)	Soil profile and stopping point of STP
1	Negative	67	0-20 cm dark brown (10YR2/1) humic, loamy clay A horizon; 20-46 cm A horizon descends into lighter clay (10YR5/2) with some orange mottling (wet/dry conditions); 46-67 cm light clay (2.5Y5/1); water table just beginning to seep in at bottom
2	Negative	79	Same as STP 1, loamy clay dark brown (10YR3/1), water table at bottom of column
3	Positive	68	Same as STP 1, dark loamy clay thicker here (extends to 58 cm), no water table encountered. Artifact is a chalcedony core fragment
4	Negative	73	Same as STP 3 with thicker loamy clay to 70 cm, no water table
5	Negative	56	Same as STP 3
6	Positive	70	Same as STP 3, a few very eroded sherds found but not kept
7	Negative	46	STP into an ancient Maya mound. STP reveals a clayey marl from 8-42 cm, two lens' (10-20 cm and 30-36 cm) lighter in color and perhaps represent plaster floors; darker loamy clay (10YR3/1) from 36-46 cm
8	Negative	63.5	Off mound, STP similar to STP 4
9	Positive	62	0-15 cm dark brown, humic loamy clay; 15-41 cm descends into very dark grey clay (2.5Y3/1); 41-62cm

			transition to gray clay (10YR6/1); one small pc ceramic (non-diagnostic)
10	Negative	62	Same as STP 9 but no gray clay encountered at bottom
11	Positive	57	Same as STP 10 – dark, homogenous clay throughout. Artifact is a piece of chalcedony (natural?) spall
12	Negative	69	Same as STP 11
13	Positive	53	Same as STP 11. Artifacts are 2 pcs of chalcedony debitage/natural spall
14	Positive	64	Same as STP 11 – dark homogenous clay but lighter marly clay encountered at 62 cm. Artifact is small pc of ceramic (flanged)
15	Positive	52	Same as STP 14, one small pc ceramic (non-diagnostic)
16	--	--	Skipped because of large Ceba tree
17	Negative	65	Same as STP 14 but lighter clay/marl at bottom of column (7.5Y4/1)
18	Negative	62	Same as STP 11, no water table
19	Positive	74	Same as STP 14 with marl at bottom. One pc chalcedony debitage
20	Positive	60	Same as STP 14. One tiny sherd found at interface of dark clay and marl (~46cm), also one chunk of chalcedony (natural?)
21	Negative	64	Same as STP 14, marl encountered at 20 cm (10Y5/1)
22	Positive	50	Same as STP 14, chalcedony cobbles at 41 cm. One pc chalcedony debitage/spall
23	Negative	55	Same as STP 14, pebble layer from 20-30 cm
24	Positive	60	Same as STP 14, pebble layer 10-20 cm, one piece chalcedony debitage/spall
25	Positive	52	Same as STP 14, marl encountered at 37 cm, one piece chalcedony debitage/spall
26	Positive	75	Same as STP 14, powdery marl at 60 cm, water table at 72 cm. 2 pc's chalcedony debitage
27	Negative	53	Same as STP 14, gray marl gets lighter with depth starting at 46 cm. Both layers have chalcedony pebbles and cobbles at greater percentages

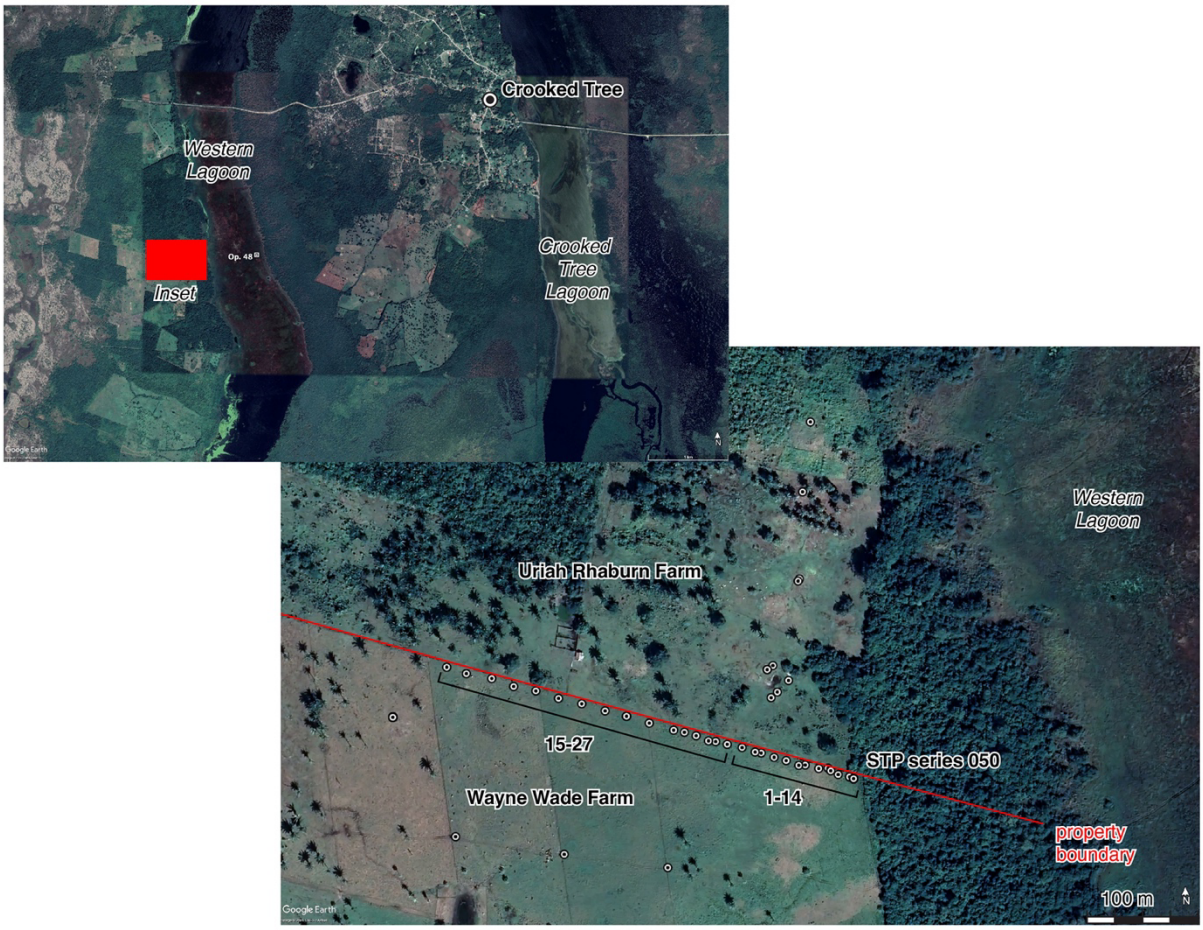

Figure 2.7 Location of STP Series 050 at Wayne Wade's farm (map by M. Brouwer Burg).

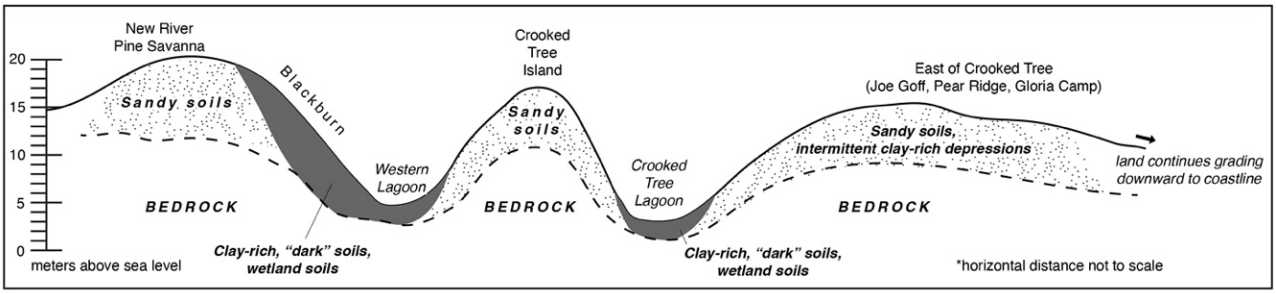

Figure 2.8 Schematic representation (catena) of New River Pine Ridge, Blackburn Ridge, Crooked Tree Island, and Western and Crooked Tree Lagoons (image by M. Brouwer Burg).

Tillett's Village Lodge

As Tillett's Village Lodge is location on one of the higher areas of Crooked Tree Island, we took one day to carry out a short STP survey (041) on the grounds of the Lodge and our field

camp. Further, some residents of Crooked Tree have reported finding complete macroblades and Lowe Points when digging for wells or during public works projects. We felt taking a day to explore our own backyard was in order.

The STPs were spaced at 10 m intervals. Only depth and presence/absence of artifacts was recorded as we were cognizant that much of the subsurface had been disturbed in the past 30 years with the construction of the Lodge buildings (**Table 2.7; Figure 2.9**). The general soil description is as follows: 0-20 cm is a dark, sandy A horizon (10YR2/2, 10YR3/2), which descends into a weakly developed, possible B horizon (10YR4/4, and 10YR4/6) with white silica sand inclusions. At the bottom of the profiles (~50 cm), as orange/tan basal sand (10YR7/3) was encountered, which likely represents the anchored sand dune that constitutes the bulk of Crooked Tree Island.

Table 2.7 Results of STP Series 041 at Tillett's Village Lodge.

STP #	Positive or negative	Ending elevation (cm BGS)	Description of artifacts if present
1	Negative	62.5	
2	Positive	98	Chert debitage
3	Negative	41	
4	Positive	50.5	Metal nails
5	Positive	65	Chert debitage
6	Negative	72	
7	Positive	34	Glass shards and metal nails
8	Positive	59.5	Ceramic tile fragment, historic pottery
9	Negative	64	
10	Negative	51	
11	Negative	52.5	
12	Positive	63	Glass shard

While the finds from the STP series were not particularly noteworthy, we do underscore that chert debitage is found in the subsurface as noise, even though chert is non-native to the island. This is interesting because it underscores how far chert microdebitage can travel by natural processes such as water, wind, animals, and humans.



Figure 2.9 Location of STP Series 041 at Tillett's Village Lodge. Red dots are positive STPs (map by M. Brouwer Burg).

Area B: Charlie Wade Farm and Xtabentun

The STP surveys conducted in this area centered around two sites that were undergoing concurrent excavation: Waxak Nicte' (see **Shelhamer and Harrison-Buck, Chapter 8**) and Xtabentun (see **Lincoln and Harrison-Buck, Chapter 6** and **Harrison-Buck and Lincoln, Chapter 7**). The work was intended to provide possible insight into additional time periods of occupation of the area. Namely, we were looking for traces of Archaic-looking tools that might lie below or proximate to ancient Maya occupations.

Charlie Wade Farm

The BREA team conducted test excavations on the land of Charlie Wade over multiple seasons and refer to the ancient Maya settlement as Waxak Nicte' (see Shelhamer et al. 2022: 74-82; Lamb 2020:83-95; and **Shelhamer and Harrison-Buck, Chapter 8**). During January 2023, the BREA project uncovered a patinated macroblade fragment interred with human remains at Waxak Nicte'. The patina development on the macroblade looked distinctly like the whitish

patina often encountered on older Archaic tools. Paired with the form of the blade and its association with a human burial indicated it may have been a curated or heirloom artifact, perhaps originally produced in the late Archaic. To determine if any additional Archaic trace could be found in the subsurface, we conducted a limited STP survey (046; **Table 2.8**; **Figure 2.10**) linking the slightly elevated area near Waxak Nicte' eastward toward the mangrove swamp.

The STPs were located at 10 m intervals apart and were dug until the posthole digger could no longer easily penetrated the subsurface, which was mostly when the subsurface was too rocky or marly. As can be seen in the elevation schematic in **Figure 2.10**, the transect runs roughly downhill toward the mangrove depression. Interestingly, of the 11 positive STPs, the western-most STPs (2, 4, 6, 7, 11, 12, and 17) contained only pottery, while the eastern-most STPs (STPs 18, 19, 23, 24) contained chert lithics and some pottery. This may only be a coincidence, but we wonder to what degree it might reflect actual land-use tendencies in the past.

In addition to STPs 1-26, we dug two STPs (27 and 28) in what appeared to be a quarry or borrow pit. These STPs descended directly into what appeared to be limestone bedrock. In the vicinity of these two STPs were a number of artifacts visible on the surface, including ceramic sherds, and some chert lithics with white patination.

Table 2.8 Results of STP Series 046 at Charlie Wade's farm.

STP #	Positive or negative	Ending elevation (cm BGS)	Soil profile and stopping point of STP
1	Negative	67	0-5 cm dark humic layer; 5-20 cm rocky soil; 20-45 cm very dark grayish brown (2.5Y3.2) silty clay; 45-67 cm silty clay grades into sticky clay with orange flecks mottled (2.5Y4/1 and 2.5Y6/4)
2	Positive	39	Too rocky to go deeper; 1 pc pottery < 1cm
3	Negative	20	Same as STP 2
4	Positive	34	Rocky layer at 30cm, otherwise same as STP 1; 1 small pc pottery
5	Negative	18	Rocky layer at 10cm, otherwise same as STP 1
6	Positive	85	0-40cm humic layer; 40-85cm clay with crumbly mottled marl, no rocks, 2.5Y7/1 light grayish brown and 2.5Y6/6 olive yellow; 1 small pc pottery
7	Positive	44	0-40 cm dark gray humic layer (10YR2/1) grades into dark grayish brown clay; at 40 cm some limestone cobbles in 2.5Y5/4 light olive brown clay; 3 small pcs pottery
8	Negative	98	0-50cm very dark gray humic; 50-98cm light olive brown, mottled clay (2.5Y7/1, 2.5Y6/6)
9	Negative	74	May be in a bulldozer cut; dark gray humic grades to light, compact marl at 20cm
10	Negative	35	Same as STP 9, 20-35cm is progressively denser marl (limestone bedrock?)

11	Positive	76	dark gray humic grades into loose brown (10YR5/3), silty marly clay at 58cm, flecks of limestone; 15 small pcs of pottery
12	Positive	41	Same as STP 10, into marl at 33cm, 6 small pcs pottery
13	Negative	80	Similar to STP 7; light olive brown clay at 60cm
14	Negative	45	Similar to STP 6; dark humic A into crumbly marl at 30 cm
15	Negative	31	Similar to STP 10; descends into marl at beginning at 21 cm
16	Negative	47	Similar to STP 7; light olive brown clay with some limestone chunks
17	Positive	49	Similar to STP 16 but more limestone chunks and crumbly marl encountered at 28 cm; 2 pcs pottery
18	Positive	66	Similar to STP 17, into crumbly marl at 49 cm; one small chert flake found at interface; also 2 small pcs pottery
19	Positive	88	Similar to STP 13; light olive brown clay at 60 cm (5Y6/2 light olive grey and 2.5Y6/6 olive yellow); one pc patinated chert core fragment
20	Negative	69	Dark humic A descends into gray clay at 50 cm (5Y6/2)
21	Negative	45	Similar to STP 20; grey transitions into lighter yellow from 34-45 cm, sticky clay with some marl
22	Negative	73	Similar as STP 21 but lots of charcoal at 60 cm and burned limestone
23	Positive	64	Like STPs 21 and 22 but marly clay at bottom of column and much grayer, almost a greenish gley (GLEY6/10Y); one pc patinated, tertiary chert flake, from top of marly clay
24	Positive	61	Similar to STP 20; one sm chert flake and 2 pc pottery
25	Negative	68	Grey (5Y4/1) clay at 20 cm, water table at 62cm
26	Negative	48	0-20 cm very rooty, wet, organic humic layer; 20-44 cm very wet grey clay with minimal sand; water table at 44 cm
27	Negative	34	This STP was carried out inside a quarry pit to gain visibility into the deeper subsurface; 0-34 cm consisted of 2.5Y8/2 marl with 2.5Y8/6 mottles. Seems to penetrate directly into bedrock outcrop
28	Negative	30	This STP was outside of the quarry pit; 0-10 cm thin layer of humic topsoil, descends into marl

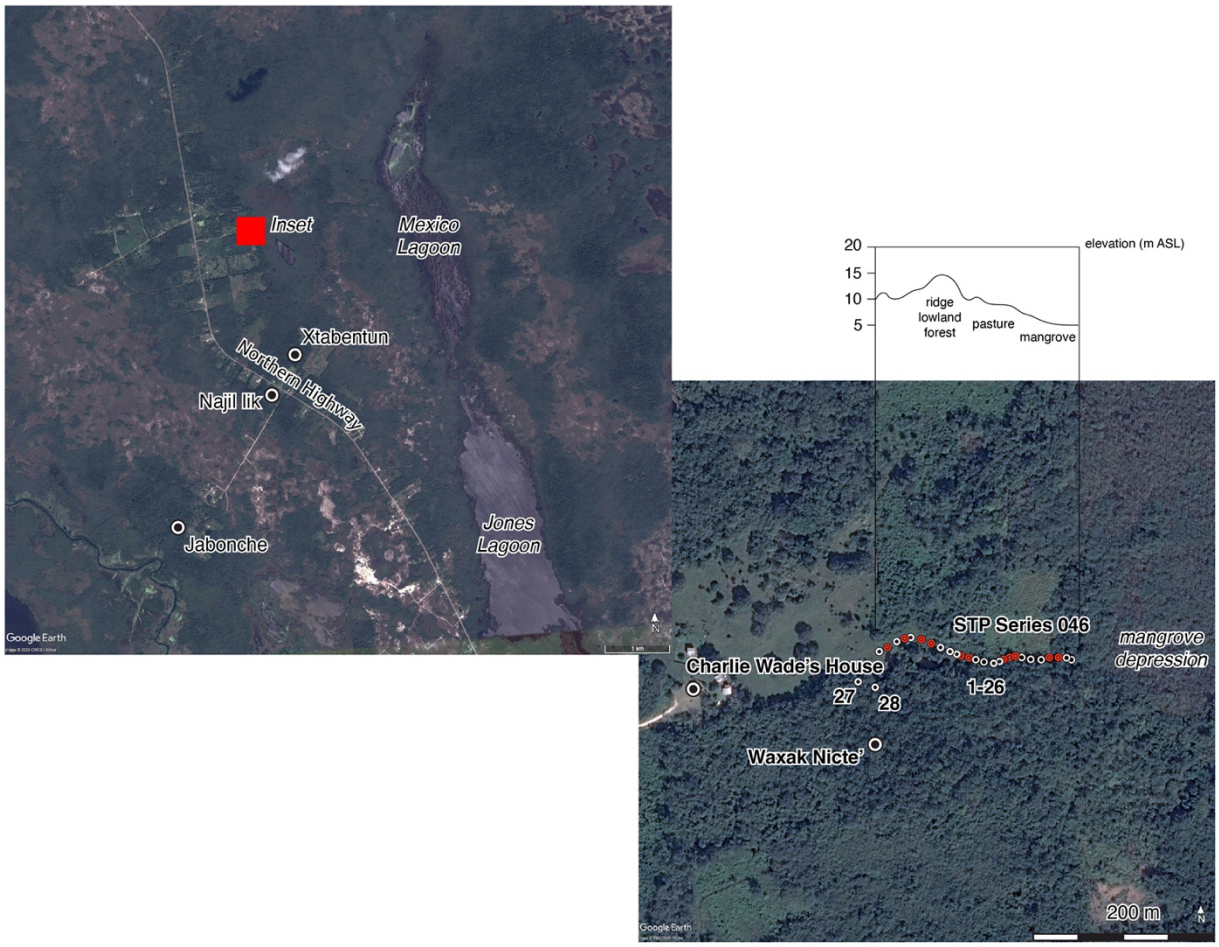

Figure 2.10 Location of STP Series 046 at Charlie Wade's farm. Red dots are positive STPs (map by M. Brouwer Burg).

Xtabentun

In preparation for some exploratory test excavations carried out at the ancient Maya site of Xtabentun, we conducted a short STP survey (047) around the outskirts of what appeared to be the eastern range structure of an E-Group structure. The findings of this STP survey are detailed in **Brouwer Burg, Haverland, and Krause, Chapter 9**.

Area C: Boston-Sand Hill Corridor

This area comprises a section of the Old Northern Highway stretching from the junction with the New Northern Highway at Sand Hill and stretching NE toward the village of Boston (**Figure 2.1**). The area around Sand Hill Quarry—incorporating Lowe Ranch, the site for which the Lowe Point was named—is known for its Late Archaic occupations since the early 1980s, when Richard S. MacNeish and colleagues carried out field investigations there, and subsequently proposed a technochronological sequence for the sub-period (see MacNeish 1981,

1982; MacNeish and Nelken-Terner 1983; MacNeish, Wilkerson, and Nelken-Terner 1980). While we had visited both of these noteworthy sites to assess their current preservation status and look at subsurface sediments in 2022 (see Brouwer Burg et al. 2023), we returned to expand STP surveys at Sand Hill Marlene and Canton Farm in January 2023.

Sand Hill Marlene

Located just about 700-900 m NE of Sand Hill Quarry, we found a surface scatter of patinaed lithics in a bulldozer scar, on the edge of the property of Ms. Marlene Menzies (**Figure 2.11**). Ms. Menzies gave us permission to conduct a small shovel test survey on her land (STP series 042). We initially placed two parallel lines of STPs (1-12), and then placed eight more around the bulldozer push to see how deeply the lithics were buried. The STPs were located at 5 m intervals.

All the STPs were fairly shallow; we halted digging in STPs 1-12 when the lighter sand at the bottom of the column became too dense to dig through with the posthole digger. We suspected that we were digging into a highly compact portion of an ancient sand dune that regularly undergoes low energy flooding, which seems to increase the hardness of the sand layer we encountered. Furthermore, since there was abundant chert debitage on the surface, this STP survey was also geared to understand just how deeply the chert was buried. And, as can be seen in **Table 2.9**, the chert occurred mostly in the top 30 cm of the profile.

For STPs 13-20, the STPs were halted when chert cobbles were encountered and could not be penetrated. Much more chert was present in these columns and indicates that a chert vein occurred here within that which was once limestone bedrock but has since eroded away to be replaced by a highly compressed aeolian sand dune. What is most important to underscore is the sheer number of chert debitage recovered from this small area, reiterating what MacNeish and colleagues suggested in the 1980s, namely that the Sand Hill area is rich in chert and that both the ancient Maya and their predecessors appear to have taken advantage of this abundant resource for tool production.

Table 2.9 Results of STP Series 042 at Sand Hill Marlene.

STP #	Positive or negative	Ending elevation (cm BGS)	Soil profile and stopping point of STP
1	Positive	41.5	0-16 cm dark humic sand, some roots; 16-41.5 cm light silicate sand; 5 pcs chert debitage (4 cm in length)
2	Positive	24	Dark to light sand transition at 12 cm; 10 pcs chert debitage (less than 9 cm in length)
3	Positive	28.5	Dark to light sand transition at 9 cm; 1 pc chert debitage (4 cm in length)
4	Positive	27.5	Dark to light sand transition at 10 cm; 20 pc chert debitage (2-11 cm in length)

5	Positive	40.5	Dark to light sand transition at 14 cm, water table encountered at bottom; 10 pc chert debitage (5 cm in length)
6	Positive	28.5	Dark to light sand transition at 9.5 cm; large chert cobbles encountered at bottom of unit; 5 pcs chert debitage (2-7 cm in length)
7	Positive	12	Dark to light sand transition at 11 cm; 3 pc chert debitage (8 cm in length)
8	Positive	9	No light sand encountered; 2 pcs chert debitage (7.5 cm in length)
9	Positive	11	Dark to light sand transition at 11 cm; 6 pcs chert debitage including a blade core (21.5 cm in length)
10	Positive	28	0-19 cm dark humic sand; 19-28 cm light silica sand; 3 pcs chert debitage, ~5 cm in length
11	Positive	15	Dark humic sand to 15 cm; 4 pcs chert debitage, ~5 cm in length
12	Positive	23	0-20 cm dark humic sand; 20-23 cm light silicate sand; 15 pcs chert debitage (2-14.5 cm in length)
13	Positive	20	0-20 cm light tan sandy loam, chocked full of chert (cultural?); ended at 20 cm because chert cobbles
14	Positive	30	Same as STP 13; at 20 cm, sand becomes lighter in color with bigger flakes and blades; ended because of chert cobbles
15	Positive	60	Same as STP 13; from 40-60 cm, almost entirely rock with little sand, few apparent artifacts (other than microdebitage which could be natural); 60 cm reveals gray clay with redox mottling, flecks of limestone, and chert
16	Positive	20	Same as STP 13, sandy loam bottoms out on chert cobbles
17	Positive	20	Same as STP 16
18	Positive	60	Same as STP 13; much chert debitage recovered throughout but uncertain how much is cultural
19	Positive	70	Same as STP 13; much chert debitage (?) recovered especially from 0-40 cm; 40-60 cm chert lighter; 60-70 cm few chert flakes
20	Positive	40	Same as STP 19



Figure 2.11 Top left: location of STP Series 043 at Canton Farm; Bottom left: location of STP Series 042 at Sand Hill Marlene; Right: overview of STP Series in the vicinity of Sand Hill (map by M. Brouwer Burg).

Canton Farm

Canton Farm is a plant nursery owned and operated by Gillie and Pandora Canton. The BREA team conducted survey here in the past (see Norris et al. 2015: 62-63). Over 385 mounds were identified using GPS mounted atop an all-terrain vehicle (ATV). While most of the large structures were looted and bulldozed in the recent past, around the time of the construction of the Old Northern Highway, many smaller structures and features still exist. The landowner and his cousin Matt have both reported to us at some point that the pond on the property is lined with limestone blocks, which is not something commonly seen among ancient Maya water features, although various examples of clay lined features do exist (see Lucero 2023:5; Scarborough et al. 2012:12409). To test whether the pond was indeed lined—suggesting it was fully anthropomorphic or modified—we attempted to core along the edge and in the middle. As described in **Krause, Brouwer Burg, and White, Chapter 3**, we were not able to collect a viable core sample with the piston corer as the clays were too dense to push through.

We also conducted a STP survey along the eastern side of the pond, near where Matt Canton had suggested four ancient Maya drainage culverts lie (**Table 2.10; Figure 2.10**).

Table 2.10 Results of STP Series 043 at Canton Farm.

STP #	Positive or negative	Ending elevation (cm BGS)	Soil profile and stopping point of STP
1	Positive	26.5	10YR2/3 pure clay with limestone fragments and prolific shell and ceramic inclusions; worms throughout; potentially a vertisol; about 25 pcs chert debitage (1-11 cm), 25 pcs pottery (1-4.5 cm)
2	Positive	68	Same as STP 1 but becoming lighter with depth, more chunks of limestone, verging on a gley at the bottom; 8 pcs chert debitage (1-6.5 cm), 4 pcs pottery (1 cm)
3	Positive	6	Limestone rock (construction?); 3 pcs chert debitage (1-5 cm)
4	Positive	43	Same as STP 2; 28 pcs chert debitage (1-7 cm), 6 pcs pottery (1-3 cm)
5	Positive	36.5	Same as STP 2; 4 pcs bone (turtle carapace?), 7 pcs pottery (1-4 cm), 43 pcs chert debitage (1-7 cm)
6	Positive	32	Same as STP 2; 12 pcs chert debitage (1-4 cm), 1 pc pottery (2 cm)
7	Positive	33.5	Same as STP 2; 12 pcs chert debitage (1-9 cm), 1 pc pottery (3 cm)
8	Positive	40	0-20 cm 10YR2/3 clay; 20-40 cm gray-tan clay with charcoal flecks, limestone, and ceramics throughout (ancient Maya occupation level?); 16 pcs chert debitage (1-3 cm), 3 pcs pottery (1-4 cm)
9	Positive	32	Same as STP 2; 14 pcs chert debitage (1-5 cm), 3 pcs pottery
10	Negative	18	Homogenous black vertic clay throughout, roots at bottom
11	Positive	33	Same as STP 10; 15 pcs chert debitage, 3 pcs pottery
12	Positive	22	Same as STP 10; 7 pcs chert debitage
13	Positive	38	Same as STP 8; 4 pcs chert debitage, 5 pcs pottery
14	Positive	30	Same as STP 2; 2 pcs chert debitage, 3 pcs pottery
15	Positive	22	Same as STP 2 but no limestone, pure clay throughout; 3 pcs chert debitage
16	Negative	19	Same as STP 2
17	Negative	14.5	Same as STP 1; roots and rocks at bottom of profile
18	Positive	20	Same as STP 17; 8 pcs chert debitage

STP series 043 revealed that the area to the east of the pond is characterized by heavy clay deposits sitting atop what is likely natural limestone bedrock. Likely, this vertic clay is the product to seasonal expansion of Canton Pond. We did not find traces of any subsurface modifications indicative of ancient Maya drainage culverts. Most of the STPs contained artifacts

which highlights the long period of occupation of the area, which lies within the Northern Belize Chert Bearing Zone, even though there is no natural outcrop of chert on the property, at least according to the landowners.

Interpretations and Conclusions

The NBAAS field investigations carried out in January and Summer 2023 added substantial information to our ongoing analyses. Not only did we continue to STP in diverse microenvironments, adding mangrove and littoral forests, but we also had the opportunity to test for Archaic deposits underneath ancient Maya occupations. As with past seasons, definitive Archaic occupations were elusive. The locations with the greatest potential were probably Cadle Farm, Sand Hill Marlene, and Wayne Wade's farm in Blackburn. Cadle Farm revealed an area with a concentration of what might be Archaic stone tools, on a raised former shoreline of the dune that constitutes the island. Future research is planned to further test in this area. The former (Sand Hill Marlene) revealed a rich assemblage of lithic debitage consisting of primary production chert macroblades. While these tool preforms were also fashioned in the Maya period, they were widely used in the Archaic so understanding the distinguishing characteristics between macroblades from these periods is of great importance. Gathering a wide assemblage will be critical for lithic analyses. Similarly, understanding the relationship between similar tool types over time, such as constricted adzes and tranchet bit adzes, is also an important goal for lithic analysis. Last, while the STP series conducted at Wayne Wade's farm did not yield secure evidence of Archaic occupation, we believe that some of the linear channels cutting across Western Lagoon may date to this cultural period, and so in future work, we plan to continue surveying for traces of Archaic occupation along this shoreline.

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Chapter 3

Reconstructing Wetlands in Northern Coastal Belize: Results from the January and May 2023 Seasons

Samantha Krause, Marieka Brouwer Burg, and Marie White

Introduction

The geology and geomorphological history of coastal Belize provides the foundation upon which past societies made decisions about their landscape, settlement patterns, and resource use. By surveying the soils and geomorphology of the BREA study area, we can better understand and reconstruct both natural and human-influenced landscapes. There are still too few research efforts dedicated specifically to understanding the fluvial and alluvial processes that control landscape characteristics of the region, and therefore a comprehensive survey effort is necessary to understand how the landscape has changed over the Quaternary. This chapter provides a background of the geology and geomorphology of northern coastal Belize, and then details the geomorphic survey efforts conducted in both the January and May 2023 seasons, conducted through both wetland coring and sediment description of exposed sequences along roadcuts.

The geomorphological and geoarchaeological team consisted of Samantha Krause, Marieka Brouwer Burg, Marie White, Fiona Haverland, as well as local researchers Rubin Crawford, Cardinal Baptist, Bruce Tillett, Melvin Quilter, and Alfred Vasques. During the January and May field seasons, we conducted a total of ~4 weeks of pedestrian survey, as well as wetland coring via a modified piston corer and a WINK vibracore. When possible, we also studied and sampled roadcuts with exposed sediments.

Environmental Framework and Background

The coastal plain of Belize is a low-lying but complex system formed by deltaic progradation throughout the Cenozoic Era, from 66 million years ago until the present. This region's elevation ranges from sea level to only 10-20 meters above sea level (masl), and consists of many microenvironments of alluvial dune deposits, lagoons and tidal systems. The geological framework in this region is predominantly Eocene, Miocene, and Pliocene limestone and dolomitic limestone (Perry et al. 2009; Beach et al., 2009). These formations are overlain by discontinuous Holocene coastal sediments, both from carbonate and silicate sources (High 1975). The chert bearing zone is roughly aligned with the Middle Eocene Doubloon Bank formation (King et al., 2004). Within the greater Chert-Bearing Zone, pockets of chert bearing soils and

larger chert nodules have been located through coastal lagoon systems and in the surrounding pine ridge savanna (Cackler et al. 1999). The modern climate of coastal Belize is seasonally wet/dry, and the primary Köppen-Geiger climate type is tropical monsoon (Am) and is controlled by the seasonal placement of the Intertropical Convergence Zone (ITCZ), the easterly trade winds, subtropical low/high pressure dynamics, and extratropical cyclone events (Gamble and Curtis 2008). Precipitation is higher in the southern portions and higher elevations of Belize, receiving up to 3000 mm/yr, while the northern coastal regions within our study area receive 1800-2000 mm/yr.

The Belize River watershed is the major catchment within our study area, and the main stem of the river carries a high siliceous sediment load from the Maya Mountains (Ferro et al. 1999) and is hydrologically connected to many creeks and complex wetlands including swamp forests, herbaceous marshes, and open water areas. The most expansive of these is in the Crooked Tree Wildlife Sanctuary (CTWS), a Ramsar Wetland of International Importance (Pinelo 2000), one of the only two Ramsar wetlands in the country of Belize. This 167 km^2 wetland complex is connected to the Belize River via two streams, Black Creek and Spanish Creek, and is made up of the Northern (Crooked Tree) Lagoon, and Western, Southern and Mexico Lagoons. CTWS is bounded to the west by slightly elevated ridges comprised of anchored Pliocene quartz sand dunes and Quaternary alluvium, underlined by limestone bedrock. These ridges support a pine-palmetto savanna with a seasonal fire regime. As the wet season progresses, both Black Creek and Spanish Creek drainages, the former reversing course due to flooding from the Belize River, push water into the wetland-lagoons and in-fill the Crooked Tree and Western Lagoons (Pyburn 2003). Slight changes in elevation across the coastal plain result in different ecosystems across microenvironments. The major ecoregion groupings consist of inundated wetlands (marsh and hardwood swamp), fire affected savannas, and mixed low broadleaf tropical forest. The lowest waterlogged wetland areas support several types of swampy forest, which include freshwater, and mangroves dominated ecosystems with some hardwoods. Herbaceous marshes are dominated by sawgrass, rushes. and cattails. Low savannas are poorly understood and under threat of development across Belize, despite their generally infertile soils (Goodwin et al., 2013; Donoghue et al 2019). Savannas typically support pine, palmetto, pimento, and some oak, with short grasses making up the understory. These develop on top the coarse-textured alluvial sand deposits from the Maya Mountains. Slightly higher calcareous outcrops support broadleaf low tropical forest (Goodwin et al., 2013). Mixed broadleaf low tropical forest can consist of palm, tropical hardwoods, and many species of epiphytes. Soils in this mixed broadleaf area are generally more hummocky, with higher organic matter.

Our previous soil research in the region focused on pedestrian survey and soil test pit (STP) excavations across transects in the following locations: 1. Joe Goff and New River Pine Savanna (two typical low savanna areas with some pockets of low tropical forest), 2. Revenge (mixed sawgrass marsh and hardwood swamp), and 3. Cadle Bank, Crawford Bank, and Birds Eye View, which were conducted on or near the shorelines of the western and eastern Crooked

Tree Lagoon (mixed hardwood swamp with slightly elevated dunes above the shorelines; see Brouwer Burg et al. 2023). This survey provides us with baseline soil structural and morphological characteristics in an expanded locale within the BREA study area, and these continued and expanded efforts provide additional understanding of the soils, sediments, and geomorphological characteristics across the region.

Objectives

The objectives for the geomorphological team during the January and May 2023 field seasons consisted of the following:

1. Expand understandings of the soil geomorphology of the study area, especially focused on how soils relate to the various microenvironments in the landscape.
2. Collect deeply buried sediments from seasonal and perennial wetlands within the study area, which will enhance our understanding of past climate regimes through the use of multiproxy study.
3. Connect deeply buried sediment deposits with pre-Maya time periods, as well as later cultural shifts and transitions.

Description of the Research and Methods Used

Lake and wetland sediment deposits are important archives of both natural and anthropogenic environmental changes. Such sediment archives can provide continuous or semi-continuous records of climate and environmental change over timescales of thousands of years. To collect such sediment records from wetlands and lagoons, we used two primary pieces of equipment: a modified piston corer (**Figure 3.1**) and a WINK vibracore (**Figure 3.2**). The modified piston corer is a more mobile device and was primarily used in areas that were difficult to access. The WINK vibracore, due to its weight and complex setup, was used in areas that were accessible by field truck.

The modified piston corer was designed by Dr. Jason Curtis at the Land Use Environmental Change Institute, University of Florida (**Figure 3.1**). The design of the modified piston corer is based on the original design detailed in Livingstone (1955), and the benefit of using this system is that it is lightweight and transportable across rugged terrain. In addition, it can be transported easily onto a boat for open-water coring efforts. Before beginning a sampling drive, the piston and attached cable is brought to the lower end of the sampling tube. The sampling tube is then lowered to the surface of the lagoon/wetland bottom so that the side of the tube with the piston is flush with the sediment surface. Then the tube is pushed down around the piston by pushing on the extension rod, usually at least 2-3 team members are needed to push the rod. As it goes down the tube fills with lagoon sediment; the piston prevents compression of the

sample during the drive. In addition, the piston prevents the sample from falling out while the sampler is being lifted up after a successful collection. After the tube is pushed down as far as possible, the entire device is hoisted back up, and the tube is removed, capped, labeled with identifying information and directional arrows, and replaced by an empty collection tube. The operation is then repeated until the team can longer successfully collect material, or until basal material is reached. The methodology for the modified piston corer is the same when conducting sampling on open bodies of water, and in addition, the team tied two small boats together (usually a canoe and a small aluminum fishing boat) and drove the core down between the two boats for stability and maximum drive power.

The WINK vibracore is a heavier, less mobile system that works best on unconsolidated, heterogeneous sediments and soils (**Figure 3.2, 3.3**). The WINK system is powered by a 6.5 hp Honda engine. It generates 7,000–12,000 acoustic vibrations per minute, and these vibrations are transferred to the drill head and core tube via a drill string (Scotto 2017). This action allows the mechanism to drive into semi-saturated wetland sediments via vibration, rather than percussion or rotation. This keeps the sediment layers from being accidentally churned, heavily compressed, or disturbed. When coring, additional tubes can be added to the top of the device between drives. When extruding the entire sample, a winch is used to facilitate easy removal from the ground surface. One drawback for this system is that without a sophisticated coring platform or heavy-duty boat (such as a large pontoon boat with a moon pool), it is impossible to use the system on open water.

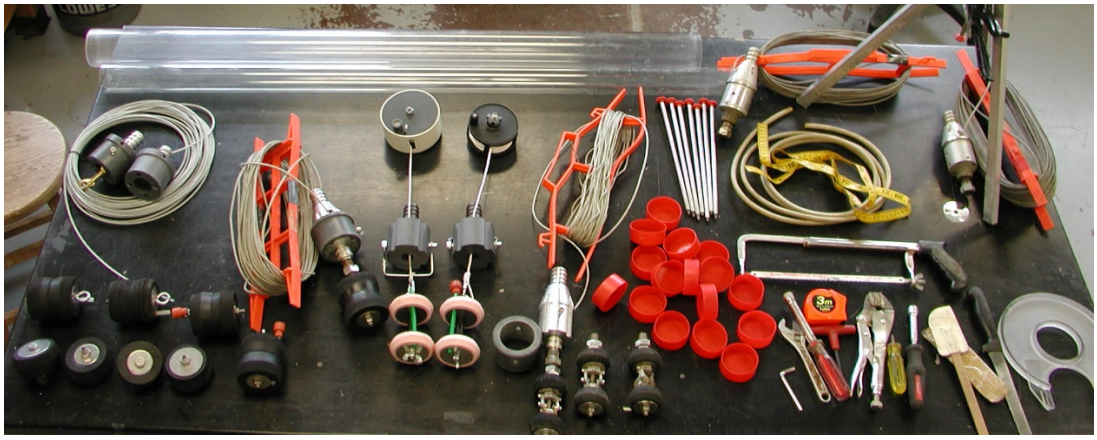


Figure 3.1 Components of a modified piston corer (photo courtesy of J. Curtis).



Figure 3.2 Components of a WINK vibracore (photo courtesy of R. Dyck).



Figure 3.3 Example of WINK Vibracore coring procedure (photo by S. Krause).

Over the course of the two field seasons in 2023, the geomorphology team collected ~5 cores using the modified piston corer, and ~10 cores using the vibracore (**Figure 3.3**). All core samples were extruded in the laboratory facilities at BREA in Crooked Tree. Subsamples were collected from the cores using a clean knife or trowel, transferred into plastic bags, and exported

to the laboratory facilities at the University of Texas at Austin for further multiproxy analysis. **Figure 3.4** indicates core and sediment sample collection loci.

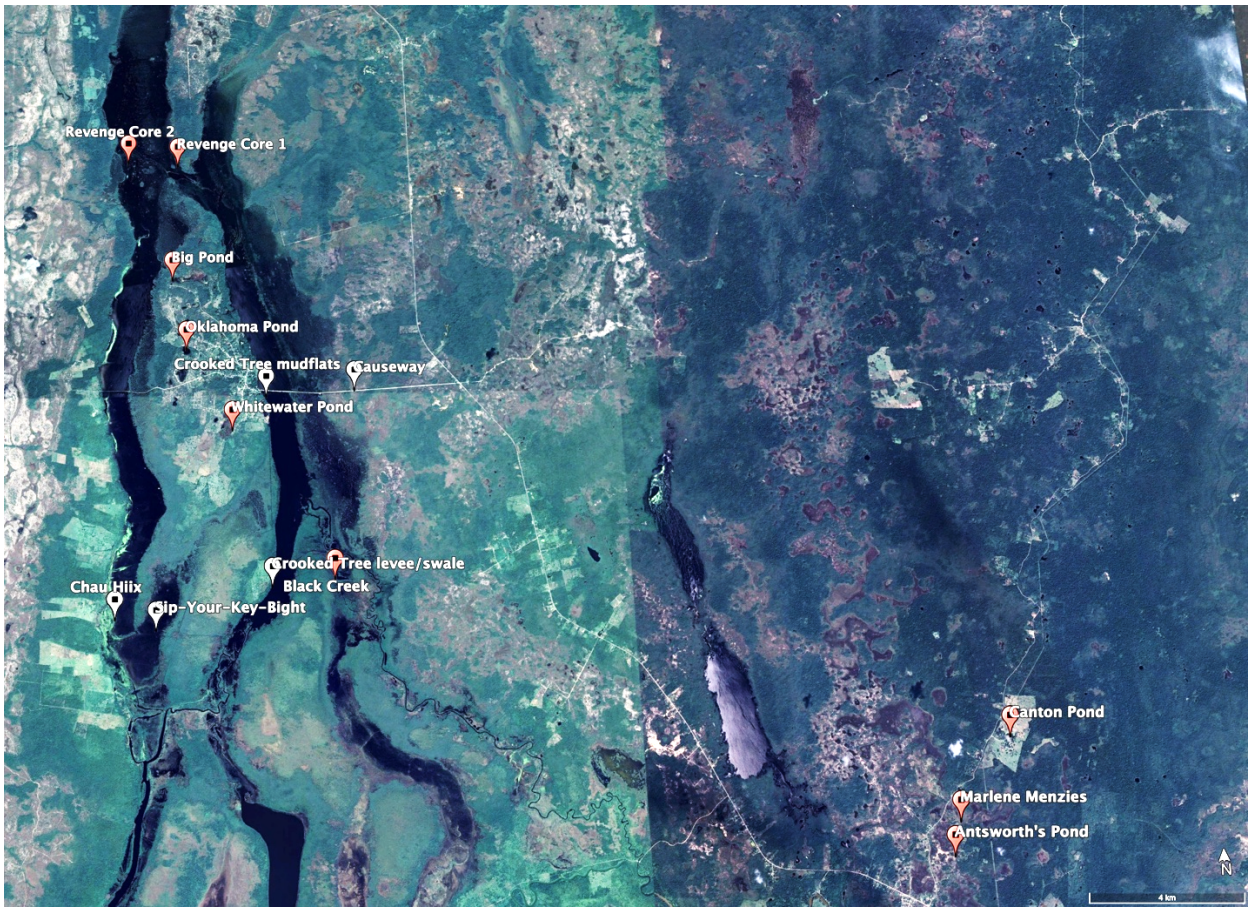


Figure 3.4 Coring locations depicted in red and sediment collection locations in white. Satellite imagery courtesy of Google Earth.

Ongoing Results from Coring Efforts

Sediment Description from Crooked Tree Island (January 2023)

Our team focused efforts around Crooked Tree Island during the January 2023 season. We studied the following locations: Oklahoma Pond, Whitewater Pond, and Big Pond. Each of these features are shallow depressions around the village and are located on various resident's properties. Each property owner granted permission before we cored these features. All descriptions of the sediments are described in descending order from the ground surface (0 centimeters below surface, cm BGS) to the bottom of the core.

Oklahoma pond is located on Crooked Tree Island (UTM 335731.97 m E, 1967283.85 m N Zone 16Q) just north of the Crooked Tree racetrack (**Figure 3.5**). We have observed this

water feature in past seasons, and have noticed that the water level does fluctuate dramatically between the wet and dry seasons, suggesting that the depression is rainfed rather than groundwater fed. The vegetation around this area has been cleared and is mostly used as a horse pasture currently. We selected a coring location along the shoreline of the pond in a depth of 5-10 cm of water. The core sample reached a depth of 86 cm before hitting basal clay. The sediment description was as follows: from 0-2 cm BGS the material was primarily an organic cap of mud/sand with many extremely fine roots. From 2-14 cm BGS, the sediment slowly transitioned into pure white fine quartz sand. From 14-64 cm, the sand became increasingly tan in color, with some white and/or transparent very rounded quartz fragments >2 mm in size. In this layer, we noted that there was no charcoal, nor any roots or organic material. Around 64 cm, the sand became extremely saturated. After this depth, there was a sharp transition to a sticky clay-sand with abundant redoximorphic mottles that were gray, white, and tan in color. We did not note any organics in this layer. With depth, the redoximorphic orange and tan mottles increased and became even more abundant with depth, however the corer would not go beyond 85-86 cm BGS, either due to the compaction of basal clay, or proximity to degrading bedrock material. We collected bulk samples every 10 cm for further laboratory analysis.



Figure 3.5 Left: Oklahoma Pond; Right: Sediment sequence (photos by S. Krause)

Whitewater Pond is located south and slightly east of Oklahoma pond (UTM 336910 m E 1964995 m N Zone 16Q; **Figure 3.6**). Whitewater pond is another small depression feature. Vegetation around the feature is mostly sedge, and local informants suggested that it generally remains wet throughout the year, possibly due to interaction with the water table. We selected two areas on the shoreline for sampling with the vibracore, in just a few cm of standing water.

Two cores were extruded ~5 meters apart. Both cores had almost identical stratigraphy. The top 5 cm of each core was a mucky organic rich sand with many roots, which slowly transitioned to a gray/tan sand with fewer roots and organics. From 20-41 cm the stratigraphy transitioned to a hard pack sandy clay with many dark and tan mottles. In this layer, the mottles do not seem to increase with depth, and the grain size is relatively homogenous. By 40 cm, each core sequence transitioned into basal clay, which the vibracore could again not penetrate. The clay was very mottled with abundant redoximorphic features, including a few small Mn streaks, stains, and nodules, which is indicative of a stable sequence that frequently undergoes seasonal wetting and drying. We selected 4 bulk samples from core 2 at Whitewater Pond for subsequent laboratory analysis.



Figure 3.6 Left: Whitewater Pond; Right: Sediment sequence (photos by S. Krause).

Big Pond is located in the northern portion of Crooked Tree Island (UTM 335398.17 m E 1969256.43 m N Zone 16Q). Big Pond's vegetation is again comprised of sedge marshland with a hard-pack sand bottom. Throughout the area, there are pockets of palmetto stands, as well as some taller grasses and sedges. The WINK vibracore was unable to penetrate deeply enough into the substrate to collect any representative samples, but we observed that the strata were similar to Oklahoma Pond, with 5cm of mucky organic rich sand with many roots, which transitions into hard packed sand, and then basal clay. The road to Big Pond was somewhat washed out during the 2023 field season so our team was able to opportunistically take note of the depth of sand layers on the island itself.

Sediment Description from Testing in Western and Crooked Tree Lagoons (January 2023)

Revenge is a sedge and sawgrass dominated, slow flowing series of perennial and seasonally inundated marshes and wetlands at the far northern end of Crooked Tree Island (**Figure 3.7**). There are some areas of logwood and scrubland within this area, making the landscape a patchwork mosaic of microenvironments. There is a hydrological chokepoint in this area that connects the Western and Crooked Tree lagoons together. There are some larger, perennial ponds in this area, one of the largest is called "Alligator Pond". In Revenge, there is an old travelling point called Hen and Chicken. We obtained core samples (Revenge Cores, RC1 and RC2) from the inundated area that connects Crooked Tree and Western Lagoon after renting a motorized boat to access hard-to-reach areas on the landscape.

The first of the two cores (RC1, UTM 335622E, 1972495N Zone 16Q) has a root mat that extends from the top of the sequence to 3 cm in depth. Below this, from 3-8 cm, the material is comprised of a dense histic peat. From 8-13 cm, there is a distinct transition to a tan sand with some clay matrix material. From 13-17 cm, we noted a zone of heavily oxidized material, that could have been an inclusion. Below this, from 17-49 cm, there was a tan calcareous clay with some silica sand trapped within the matrix. Within this zone, there were a few thin roots, lightly mottled with orange redox features, distinct lack of shells throughout the rest of the sequence. At 49 cm, we obtained organic material lodged in center of sample, which could provide a C14 date. We were unable to core below 49 cm, likely because we hit some sort of basal clay material that prevented us from going deeper.

The second core (RC2, UTM 334254E 1972684N Zone 16Q) only drove to a depth of 35 cm. This core likely represents a seasonally wet/dry environment, rather than a perennially wet stream, as its sediment description is quite different from RC1. From the top of the sequence to about 10 cm, we observed dense root matter and hard packed organic material. After that, the entire sample consisted of dark vertic clay. There were no shells visible through the entire length of the sequence, and there was some ferrous redox staining. We did not collect any sediment from this sequence for additional sampling.

Our next objective was to move south to the Black Creek area in Crooked Tree Lagoon, where we tested three locations but only obtained one core sample. Black Creek is a slow flowing drainage that feeds into the Belize river. It is a typical meandering stream channel with many oxbows. There are likely many complex slackwater deposits in many of these small lagoons and seasonally inundated points along the river. The single core was obtained in one such slackwater area (UTM 339504E 1960841N Zone 16Q). The sediment description for the Black Creek core was as follows: From the top of the sequence to 5 cm, we observed a black peaty clay with many roots and no obvious shells or inclusions, or riparian material (coarse sand, pebbles, cobbles) From 5-10 cm the material transitions to a slightly lighter clay, but composition remains the same. Again, there were no redoximorphic features or shells noted, but there were many fine roots. From 10-20 cm, the sediment continued as a pure gray clay that began to lighten with depth. Some redoximorphic features (mostly orange streaking) began to appear with depth as well, and we noted some organic rich inclusions as well. Below this, from 20-38 cm,

the dense clay continued but there appeared to be sandy coarse matrix materials that were likely composed of calcite or gypsum. We also collected one possible C14 sample: burnt material at 29-30 cm. Below this, from 38-44 cm we described continued dense clay with many mottles, light gray to white material and larger calcite crystals appearing in the matrix. We were unable to drive past 44 cm due to the dense clay, but we do not believe that we reached any bedrock material here.



Figure 3.7 Left: Revenge Lagoon; Right: Revenge Sediment sequence (photos by S. Krause).

Sediment Samples from Boston (January 2023)

We extended our research efforts to the area around Boston, located southeast of Crooked Tree Island. Before any coring was conducted, all local landowners gave consent for us to conduct research on waterbodies on their properties.

The geography around Boston is comprised mostly of two different microenvironments of higher/dryer sandy zones dominated by low tropical forest or grassy savanna, and lower/wetter depressions in which organic rich histosols develop. This surface topography is likely driven by differential weathering on the karst bedrock, as well as from feedbacks among vegetation production, respiration, and hydrologic conditions.

We began our efforts at "Antsworth's Pond" (UTM 355116E 1952740N Zone 16Q), which was a sedge depression wetland with pockets of low scrub brush (**Figure 3.8**). Our survey efforts suggest that the sedge depression is mostly fed by small creeks that drained in a southern direction, and interaction with the groundwater table. We observed a human-constructed depression on this particular property, which was also full of groundwater seepage, and the local landowner described that the basal materials that he dug through consisted of chert cobbles and

clay. Our coring efforts at Antsworth's Pond revealed the following stratigraphy: 0-37 cm was a completely homogenous black clay with just a few faint redox mottles of tan/orange (less than 1% of core), many large roots and one small limestone inclusion was noted (less than 1 mm, very decomposed). Within this top horizon, there were no shells, and no distinct sediment changes. Below this, the vibracore could not penetrate the chert-rich material, which could represent basal clay prolific with nodules. This sediment layer could be synonymous with a region that some archaeologists in the past have labeled as "chert bearing soils" (Hester and Shafer 1984). We tested additional portions of depression wetland on another property (owned by Ms. Marlene Menzies) in Boston, which had an identical sediment sequence (UTM 355362 m E 1953592 m N Zone 16Q).



Figure 3.8 Left: Antsworth's Pond 1; Right: Sediment sequence (photos by S. Krause).

We also cored Canton Pond, which is located on Canton Farm (owned by Gillie and Pandora Canton) near Boston (UTM 356883.70 m E 1955629.46 m N Zone 16Q; **Figure 3.9**). Canton Pond, unlike Antsworth's Pond, is a true karstic depression lake, rather than a seasonal "pothole" wetland. There is a Maya archaeological site, named Ku Nah Mul, on the margin of the lake. The landowners at Canton Pond hypothesize that the lake reaches a depth of 30 feet. The soils around Canton Pond have vertic characteristics, and large chert nodules were visible at the surface. Since we decided to core within the open water, we switched to the modified piston corer and recovered 2 core samples. Canton Pond Core (CPC) 1 was taken in waist deep water near the shoreline. We then boated out to a portion of the pond that we could easily core from to obtain another sample. CPC 2 was taken in about 1-1.2 meters of water from canoe. CPC 1 was the shorter of the two cores and was obtained closest to shore, so it was discarded after photos/stratigraphic analysis. With this sample, we only reached a depth of 32 cm. The top 5 cm of material was a seasonally wet/dry tan soil, and the rest of the core was similar stratigraphically to CPC 2.

CPC 2 consisted of the following stratigraphic units: From 0-3 cm, the sediment was a tan silt/clay with prolific roots and no noticeable shell material. From 3-8 cm, the sediment gradually lightens with depth to a lighter tan color, where shell materials begin to accumulate. From 8-28 cm, the sediment was a tan/white marl material, with some gravel and sand fragments. The marly clay quickly dries to a fine powder and is comprised almost completely of $CaCO_3$, but more testing in the laboratory will confirm the geochemical makeup of the material. We were unable to core past ~30 cm, due to the hardpack nature of the material.



Figure 3.9 Left: Canton Pond; Right: Core 2 Sediment sequence (photos by S. Krause).

Sediment description from Crooked Tree Lagoon: levee and swale (May 2023)

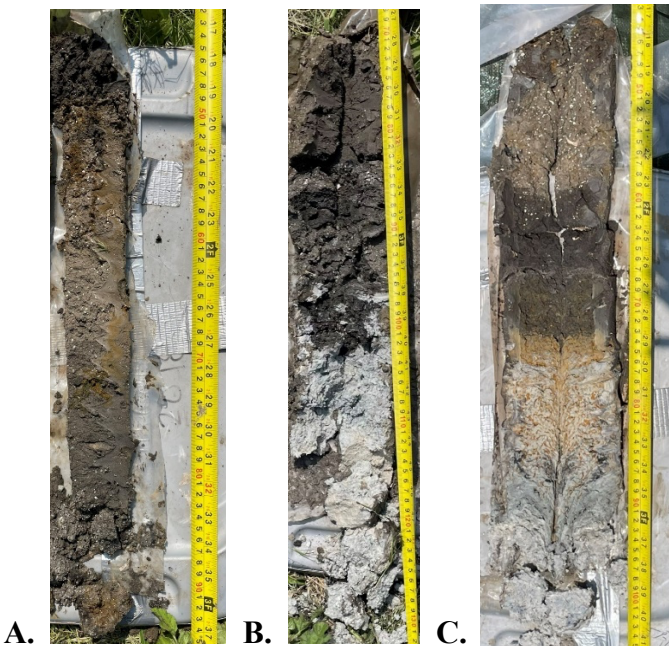
In May 2023, we continued our coring efforts, focused mainly on using the vibracore. We began the season's efforts targeting locations that were usually inundated in the wet season, and drain during the spring, becoming accessible by the early summer. We began these efforts by targeting the western shoreline of Crooked Tree lagoon, prioritizing the areas south of the modern causeway and north of the Maya site of Chulub. We conducted a paired vibracore test sequence on a slight natural levee along the shoreline and within a slight swale (**Figures 3.10 and 3.11**).



Figure 3.10 Coring at Crooked Tree levee (photo by S. Krause).

In the levee sequence, the top 50 cm were mostly comprised of dense brown vertic clay with few roots (approximate UTM 337829 E 1960737 N Zone 16Q; **Figure 3.11**). From 50-73 cm, the sediment transitions to a clay rich, lighter tan layer, with prolific small shells and some redoximorphic features. From 73-83 cm, the sediment was slightly darker, and although small shells were still present, they were less frequent than previous horizons. Below this, there was a distinct shell rich layer from 84-90 cm. This layer was so dense in shells, that it held quite a bit of water, and caused the entire zone to be crumbly in appearance. Below this, the dark organic material continued until 100 cm. At this depth, there was a sharp transition to a white clay with distinct slickensides, that quickly descends into a sascab/clay mix at 110 cm, with larger gypsum crystals.

In the swale sequence, the top 46 cm were mostly comprised of dense brown vertic clay with few roots (**Figure 3.11**). From 48 to 59 cm, there was a slightly more tan layer, with prolific shells, (both large apple snail fragments as well as smaller gastropods). This layer had slight redoximorphic iron staining. Below this, from 60 to 67 cm, there was a sharp transition to a distinct dark organic horizon with a noticeable lack of slickenside features. This layer was separated from the slightly lighter layer below it (from 68 to 73cm) by a very thin (less than 1 cm thick around 68cm) gray clay band, which could represent some sort of unconformity or event (potentially a drying event). Below 73 cm, the sediment quickly transitions to a bright orange clay until 76 cm, where the orange matrix quickly becomes a light gray/orange mottled pure clay. This zone transitions to a blue/gray pure clay at ~87 cm, and there is some evidence of compaction and mixing in the core, due to vertical dark clay streaking around this zone. From 92-105 cm, which is the base of the core, the clay gradually lightens until it becomes powdery and light, akin to a sascab basal horizon.



Figre 3.11 A-B: Upper and lower core sediment sequences from the Crooked Tree Lagoon levee; C: Sediment sequence from the Crooked Tree Lagoon swale (photos by S. Krause).

In addition, we collected a vibracore sequence from the mudflats along the western side of the Crooked Tree Lagoon, just south of the modern causeway (approximate UTM 337852 E 1965858 N Zone 16Q; **Figure 3.12**). The vegetation in this area is dominated by sedges and small scrub plants. Our rational is that this area represents a backwater, in which fine sediment will accumulate during much of the year. We collected a vibracore sequence that spanned aboiut 102 cm. From 0-24 cm, we recoreded the same vertic black clay that was found in other parts of the lagoon. Below this, from 25-32 cm the strata became much more redoximorphic in nature, with clear evidence of wetting and drying, as well as abundant shells. From 32-37 cm, the orange mottling dissappeared, and we recorded a light gray clay (glay) with the same abundance of shell fragments as above. There was a sharp transition at 37 cm to a black clay devoid of shells and some slickensides, which continued until about 53 cm. From 53-85 cm, the clay began to lighten and become more tan with depth, displaying less slickensides, very few shells (less than 1% of the matrix), and some quartz sand fragments. Below this, from 86-102 cm, there was a sharp transition to very dense, blue/gray reduced clay with some calcite and gypsum precipitating. We posit that there is likely basal sascab not far from this depth of 102 cm, as the vibracore could not penetrate further into the sedimenet.



Figure 3.12 Left: Crooked Tree mudflats; Right: Sediment sequence (photos by S. Krause).

Sediment description from Western Lagoon: Chau Hiix and Sip Your Key Bight (May 2023)

We continued our coring efforts in the Western Lagoon during the May 2023 season (**Figure 3.13**). Our goal was to continue to constrain our understanding of the lagoon sediments and deposition in the area. We tested two locations on the eastern side of the Western Lagoon south of the causeway, and another location on the eastern side of the lagoon north of the causeway, to corroborate our findings from the 2019 season. We did not collect the sediment sequences in these locations for subsequent testing.

We collected our longest core of the season just south and east of the Maya site of Chau Hiix, on the western shoreline of Western Lagoon (approximate UTM 333650 E 1960142.78 N Zone 16Q). This core corroborates our findings from OP 47 in the 2019 season and provides a deeper sampling of the system as a whole, as we posit that we reached basal material close to bedrock at the base of the sequence.

The sediment description for the Chau Hiix vibracore is as follows: From 0-5 cm there was an organic rich root mat/O horizon. From 5-25 cm, we describe an organic rich, black clay with some orange and tan streaks and mottles (redoximorphic features), pedogenic carbonate threads, and increasing shells. From 25-96 cm the redoximorphic features disappear, but the clay matrix is relatively homogenous with some shell, as well as increasing slickensides and a consistent black color, although beginning around 88 cm, the clay slowly transitions to a black organic clay that is consistent with a buried soil. At 96-103 cm there is a sharp transition to a pure preserved histic peat. At 104 cm there is another abrupt transition to a tan/gray silt with

many shells. By 110 cm, this tan silt (which we posit is a lacustrine marl) has transitioned to a lighter tan with small bands (1-2 cm thick) of darker gray material. From 150-200 cm this banded marl becomes even more finely laminated, with some larger apple snail inclusions and flecks of charcoal. At 200 cm, there is a transition back to a non-banded silty marl. From 213-223 cm, the sequence descends into a blue reduced hard packed basal clay with sascab fragments at the very bottom, indicating close proximity to bedrock. The Chau Hiix core represents the most complete sequence we have collected thus far in the Western Lagoon, and the excellent preservation will provide an important regional environmental record for the region.

We then moved westward into the backwater zone of the Western Lagoon, which is a smaller connected depression area on the southeastern side of the system. This portion of the lagoon is locally known as Sip Your Key Bight (SYKB) and contains several small perennial ponds that persist through the dry season and likely have some form of anthropogenic component associated with their formation (approximate UTM 334731 E 1959789 N Zone 16Q). We cored two ponds in SYKB and described/sampled one of these for further analysis and radiocarbon dating.

The sediment sequence at the SYKB ponds is as follows: from 0-17 cm, the sediment consisted of a black clay A horizon with many roots, a vertic structure, and few shells. At 18 cm below surface, there is an abrupt transition to a tan calcium carbonate-rich material with abundant small shells as well as apple snail shell fragments. There is a slight orange hue due to slight redoximorphic features in this section of the sequence. The transition to the next horizon within the core is slightly mixed due to the compression and shaking of the vibracore, but generally begins at 40 cm with a sharp transition to a black pure clay with high organic materials. This horizon appears to be a decomposed (likely sapric) peat with no shell material. There is an interruption in this sapric organic material from about 46-48 cm, where a thin band of light material appears in the core. This could either represent a time in which the pond had dried, or perhaps a burned/ash layer, or some sort of anthropogenic disturbance. From 48-53 cm, the sapric organic clay continues. From 54-to 110 cm (the bottom of the core) there is a distinct change to a potential C horizon, as the clay abruptly switches to a light in color gleyed clay with no shells, and abundant redoximorphic features between 54-74 cm. After 74 cm, the redoximorphic orange staining decreases, and the sequence descends into a blue reduced hard packed basal clay with sascab fragments at the very bottom, indicating close proximity to bedrock.

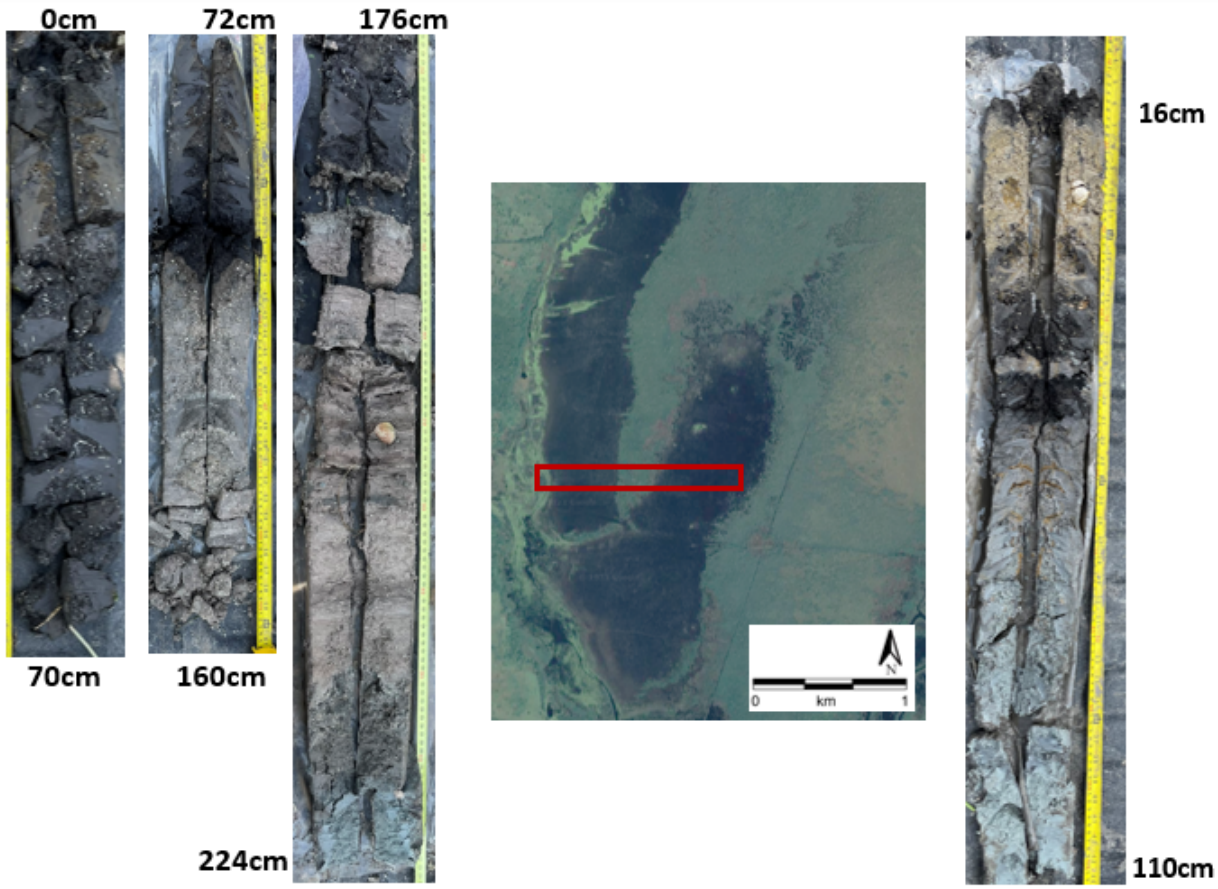


Figure 3.13 Left: Sediment sequence from Chau Hiix; Right: Sediment sequence from Sip-Your-Key-Bight (photos by S. Krause).

Sediment Description from the Crooked Tree Causeway

During the May 2023 season, we also opportunistically described and collected sediments from exposed sequences within the study area (**Figure 3.14**). Along the Crooked Tree Causeway that connects to the Northern Highway, we located a sediment sequence that was exposed from recent mechanized trenching/canal digging (approximate UTM 340240 E 1965887 N Zone 16Q). The vegetation in this area mostly consists of a mixture of logwood scrub, pine-scrub oak and palmetto with a dense understory of grasses. The sediment profile consisted of the following horizons and pedogenic processes: from the surface to about 10 cm, we describe a quartz sand organic O horizon, with a few fine roots and larger pebbles. From 10 cm to about ~30-50 cm (depending on the area, as this zone undulates dramatically), we describe a homogenous, tan medium grained sand comprised of rounded quartz. We describe this zone as an aeolian (wind-blown) but currently anchored dune horizon. Below this, starting around 45 cm to 50 cm is a darker and more fine-grained sandy horizon. The dark color is the result of charcoal and organic matter accumulating in this area after leaching down from above. From 50-75 cm we describe a bright white "E" horizon. Percolating rainwater removes clay and organic matter from the soil

surface downward into lower layers of the soil profile, and the depletion of these materials from the surface or near the soil surface results in the formation of an E horizon. The development of an E horizon is often typical in areas with high rainfall and sandy parent material, though the presence of this horizon does suggest that pedogenesis has been occurring for some time in this location. From about 76-90 cm we tentatively characterize the sediment as being a B horizon, as it is much more clay rich than above, though sand is still present. From ~100 cm to the base of the exposed sequence (which we dug into slightly to a depth of 250 cm), we describe a C horizon with abundant redoximorphic features (streaks, concentrations, nodules) that increase in size and complexity with depth. When we exposed more of the sequence at the bottom, the clay was a light blue (reduced) color, but quickly bleached in the sun as it dried.



Figure 3.14 Exposed sediment profile along the Crooked Tree causeway (photo by S. Krause).

We hypothesize that this entire sequence represents a plinthic soil, which—as the name suggests—contains a significant amount of plinthite. Plinthite is an iron-rich, humus-poor mixture of clay with quartz and other highly weathered minerals (which be posit comprises the B and C horizons of the sequence). It is found across much of the global tropics, but especially in

places like the Amazon. It commonly occurs as reddish redox concentrations in a layer that has a polygonal, platy, or blocky structure. Plinthite hardens (usually irreversibly) upon exposure to repeated wetting and drying. We note that this sediment sequence has hardened dramatically after it was originally exposed. Additional research will need to be conducted to better understand the age of this soil, as well as the formation of the sandy anchored dunes that overlay the sequence.

Interpretations and Conclusions

The geography and geomorphology of coastal tropical zones is complex, perhaps even more complex than was originally recognized. This opportunity to comprehensive survey the geomorphology of coastal Belize within the BREA study area has provided our team with new information on how these environments change based on hydrology, soils, vegetation, and elevation. The data that will be acquired from these excavations will highlight the unique geologic and hydrological context of the Crooked Tree Lagoon and surrounding area and can provide insight into the natural environment upon which the Maya and their Archaic predecessors used, maintained, and modified. This coring and intensive soil/sediment survey supplements our broader work on local human-landscape interactions within the project area and enhances the team's ongoing archaeological efforts. We are currently conducting laboratory analyses on the sediments collected from each of these areas that we studied in the 2023 January and May seasons, including paleoecology and geochemical analysis.

Intensive geochemical analysis of the soils within these agricultural systems is critical to the continued understanding of ancient human interaction with these areas as a source of goods, materials, and arable land. The geochemical analysis of soils near and on archaeological sites has recently yielded a variety of results for geoarchaeologists (Cook et al. 2006; Beach et al., 2015). The objectives laboratory work during the 2024-2025 calendar year will be to carry out a suite of soil tests includes but is not limited to: pollen and phytolith analysis (Jones 1994), and carbon isotopic analysis to understand vegetation communities and agricultural patterns (Beach et al. 2015) geochemical analysis to understand enrichment/depletion patters of phosphorus and other key elements as an indicator of past human activity, (Hutson et al. 2009, Cook et al. 2006), particle size analysis and percentage of organic matter to elucidate sediment origin and geomorphic processes, (Dean 1974), and micro and macro charcoal analysis to understand fire regime and possible drought patterns (Anderson and Wahl 2016), the results of which will be published in subsequent reports and peer-reviewed journal articles.

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Chapter 4

Mapping of the Site of Xtabentun, Biscayne

Adam Kaeding, Satoru Murata, and Mark D. Willis

Introduction

During the January 2023 field season, the site of Xtabentun—previously identified by BREA reconnaissance team members (Buck, Murata, and Robinson 2022)—was revisited as a candidate for further investigation including detailed mapping and excavation. During the initial visit in January 2022, a drone flight was flown and a portion of the site was mapped with LiDAR (Willis and Murata 2023). At that time, what is now Structure 10 was visible in a recently cleared field. However, in the year since that first visit and our return in January 2023, the field had been ignored and the vegetation allowed to regrow. The name given to the site by the BREA project reflects the dominant vegetation reclaiming Structure 10: morning glory vines and flowers, or "Xtabentun" in Yucatec Maya. This chapter presents the objectives, methods, and results of the mapping efforts at Xtabentun, along with some interpretations of our results and on-site observations.

Objectives

The mapping program at Xtabentun was designed to expand our understanding of the site's architectural signature, and to provide the proper site-level context for the excavation units presented in Chapters 6, 7, and 9 of this volume. Thus, the objectives were to:

1. Train students on archaeological survey and mapping by
2. Compile a complete topographic map of the site
3. Generate a Mahlerized version of the map to provide context for the operations carried out.

Description of Research Methods

Xtabentun was mapped using the standard BREA approach. A primary control point (station 1, or STN 1) was established by driving a length of rebar to a secure depth on top of a prominent structure with the longest visible line of site and recording its location with a Trimble GeoXH receiver to submeter accuracy. In this case this was Structure 10, the long linear range structure described above that gave the site its name. Because most of this structure had been

cleared in the previous year and because pastures dominate the viewshed to the south and east, this location allowed for a long (255 m) initial control shot to a backsight point also recorded to submeter accuracy with the Trimble receiver to establish the site map's orientation. From this initial station, oriented to the furthest-possible distant backsight and corrected according to standard BREA methodology, we shot a line of five additional control points heading northwest to the northernmost structure in what is understood to be the primary plaza (Structure 1). From the station on top of Structure 1 (STN 6), we established a loop of four control points shot in a clockwise circle enclosing the northern plaza. Once the initial control loop was completed, the minimal error accumulated throughout the process was mathematically distributed among all (n=10) control points and coordinates of each control point were updated accordingly.

As the mapping within the primary control loop was nearing completion, an additional loop of five control points was established to the southeast of the northern plaza in order to capture several smaller structures identified in that direction. Meanwhile, another series of five control points was extended from the initial loop, extending the coverage south to include an area east of the prominent Structure 10. This additional line was intended to capture land modification in the southern portion of the site, an area that had clearly featured monumental architecture at some point in antiquity but has since been subjected to extensive disturbance.

All areas within and surrounding the control loops and extensions were thoroughly mapped following the standard BREA sequence. BREA workers from Crooked Tree and Biscayne cleared all low vegetation to ensure a high degree of visibility. BREA team members and students visually assessed the entire site multiple times employing pace and compass to identify and approximately measure the dimensions, relationships, and orientations of all structures, features, and other site characteristics. All observations were recorded with sketch maps and narratives in field notebooks. These walkovers and sketch maps provided basic guidance for precise detailed mapping employing a Nikon NPL-352 and Topcon GTS total stations. Point coverage across the site was comprehensive though judgmental – distributed in tighter intervals in sloped areas or areas with identifiable architectural elements, and wider intervals in areas observed to be relatively flat and uniform. **Figure 4.1** shows the resulting topographic map next to the LiDAR overview of Xtabentun produced by Willis and Murata (2023).

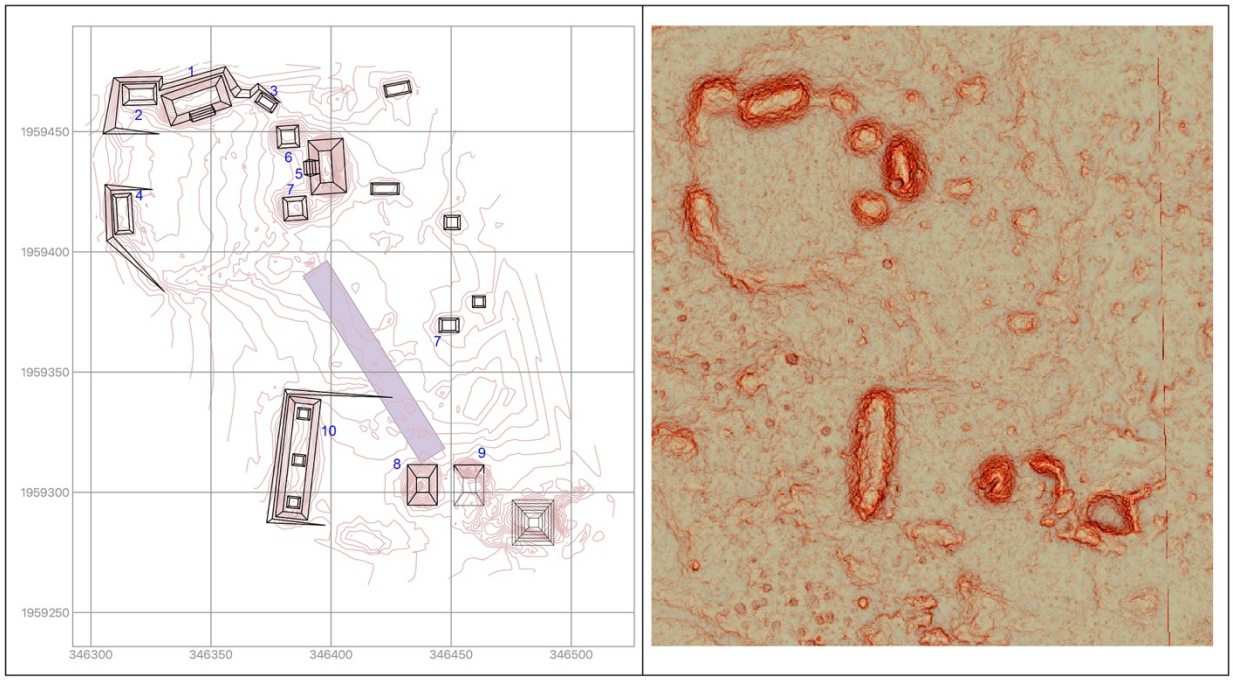

Figure 4.1 Xtabentun site overview. Left: topographic map; Right: LiDAR imagery.

Results

The controlled mapping of Xtabentun yielded a detailed, accurate, and precise representation of site topography, as depicted in **Figure 4.1** above. As usual in this heavily forested environment, this exercise yielded insights into the nature of the site that were not apparent on the surface. The topographic mapping was informed by and refined the data collected by an earlier drone-mounted LiDAR survey (Willis and Murata 2023), also shown in **Figure 4.1**.

As currently understood, the site of Xtabentun is separated into a Northern and a Southern Group, with additional structures identified and mapped to the east of the Northern Group (referred to here as the Eastern Extension). The largest and most prominent structure on the site is Structure 10, the long range structure representing the western side of the Southern Group. However, at the time of mapping, the Northern Group was clearly the largest, best preserved, and most complex.

Northern Group

The central area of the Northern Group (**Figure 4.2**) appears to be surrounded by a combination of large structures and low platforms on all sides except part of the southern end and a distinct opening on the west side. This creates something of a sunken-plaza effect, though

it seems that the elevation outside the plaza is either effectively the same or possibly lower than the inside.

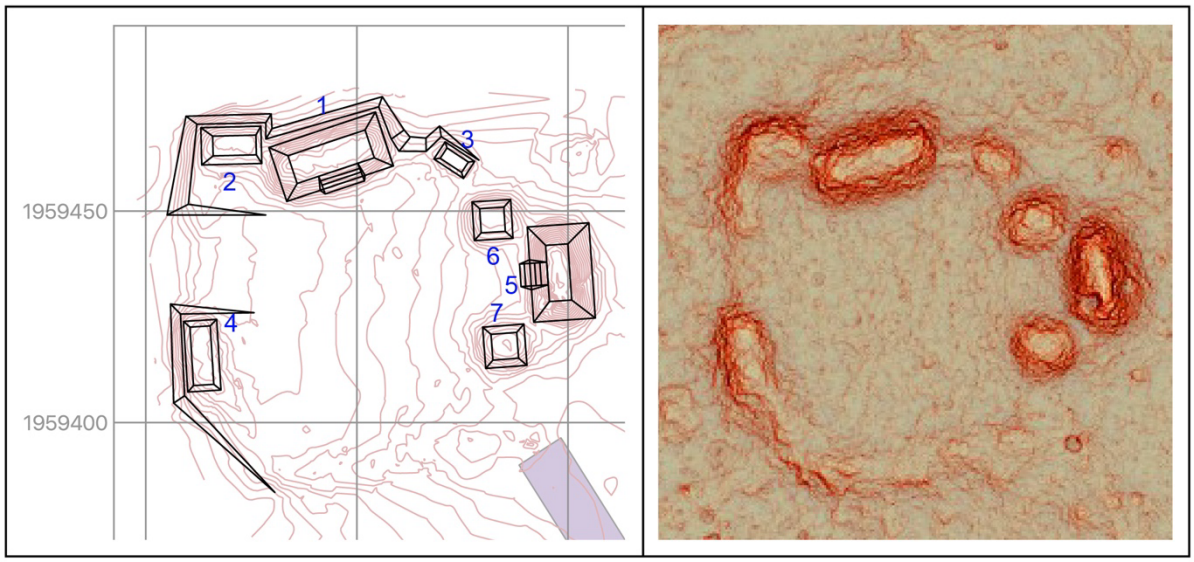

Figure 4.2 Mahlerized topographic map of the Northern Group.

The largest structure of the Northern Group is Structure 1, a high, flat-topped structure measuring approximately 35-x-21 m and standing 2.5 m high. Interestingly, Structure 1 is oriented at approximately 340 degrees, which is unique within the structures of Xtabentun and is discussed in more detail below (see also **Lincoln and Harrison-Buck, Chapter 6**). Directly west (disregarding differential orientation) of Structure 1 is a smaller distinct structure (Structure 2) which establishes the northwest corner of the Northern Group. Structure 2 is approximately 12-x-8 m and 1.25 m high, and appears to be oriented as much as 4 degrees west of north (but see **Harrison-Buck and Lincoln, Chapter 7**). This structure seems to sit on a platform that extends and connects to Structure 1 to the east leaving a space between them that may have created a functional passageway. Given its current manifestation, it is most likely that the presumed 'walking surface' of this passageway would have been on a platform rather than level to the surface of the plaza. However, there is a chance that this reflects collapse from the structures on either side rather than intentional construction. The east side of Structure 1 is characterized by an even stepper descent, though again this does not reach plaza level. Instead, extending 6 m east from roughly the center, at the bottom of Structure 1, is a narrow platform approximately 3 m wide and ~50 cm higher than plaza level. This narrow platform continues east to a small but distinct structure (Structure 3), which measures approximately 10-x-7 m and reaches 75 cm above plaza level. At approximately 38 degrees, Structure 3 (like Structure 1) seems to be uniquely oriented among Xtabentun buildings. Structure 3 represents the northeast corner of the Northern Group, though it is somewhat obscured by the eastern complex (discussed below).

As mentioned above, Structure 2 sits on a raised platform (see **Harrison-Buck and Lincoln, Chapter 7** for further discussion) and this platform turns a distinct corner extending not

only west from Structure 1, but also south from Structure 2 a distance of approximately 13 m before dropping down to plaza level rather abruptly. Continuing south from the edge of this platform extension there is a gap in the architectural features that otherwise enclose most of the plaza. This gap likely represents a ramp or stairway that allowed access into the Northern Group on the west side of the plaza. This opening covers a span of approximately 15 m before reaching the northern end of the next structure, Structure 4. Structure 4 is approximately 23-x-11 m, and 1 m higher than plaza elevation. There may be a small central staircase extending toward the middle of the plaza from Structure 4. Surface preservation was not sufficient to confirm the existence of this staircase, and so this interpretation is based more on the characteristics of collapse in this specific location. Similarly unconfirmed, there may be a relatively large and flat stone located just east of and aligned with the possible Structure 4 staircase. The southern edge of Structure 4 does not descend to the plaza surface. Instead, raised architecture continues in this direction, extending the architectural enclosure of the central plaza around its southwest corner. This corner is less clear than other sides of the Northern Group, presumably due to some combination of its construction and preservation. As a result, though there is architecture here, individual structures are not particularly distinguishable.

Similar to the feature connecting Structure 1 and 3 along the north edge of the Northern Plaza, a small, narrow walkway or platform seems to extend south of Structure 3, connecting to what is interpreted as the rear of one of the three structures constituting the Eastern Complex. This area features the tallest of the Northern Group structures in a triadic arrangement extending eastward ~30m from the Northern Group plaza surface. The central, largest structure of the triadic group is Structure 5. It is set the farthest east of all structures in the Northern Group, measuring 25-x-18 m, and rising 4.25 m above plaza level. Incidentally, Structure 5 is really the only extensively looted structure in the Northern Group, with two massive pits nearly bisecting its southern end. Structure 5 faces west, meaning that the triadic group is completed by two symmetrical flanking structures positioned equidistantly west of Structure 5, with one structure positioned off of the north side (Structure 6; the rear of which is connected to Structure 3 by the low narrow platform/walkway mentioned above) and one structure positioned to the south (Structure 7). Structure 6 measures 12-x-14 m and stands 1.5 m above plaza level. It's counterpart to the south appears to have been constructed as an exact twin, also measuring 12-x-14 m with an elevation of 1.5 m above plaza level. Considering the variability of taphonomic impacts in the years since site abandonment, this level of symmetry now strongly suggests that these were identical structures when constructed.

Structure 5 not only represents the central, focal point of the eastern complex triadic group, it also appears to establish a significant central axis and orientation for the Northern Group overall. The discussion above regarding the western side of the plaza describes a gap between the platform under Structure 2 and the north side of Structure 4; conspicuous as one of only a few areas where the plaza is not otherwise enclosed. This gap is exactly east of and approximately the same length (N-S) of Structure 5. Though no other direct evidence was recovered to confirm as much, the interpretation of these two features and their relationship

would be that the western gap represents a specific point of entry meant to align with Structure 5 to the east. The imagined effect of accessing the area through this entrance would be one of stepping up into the plaza, flanked on either side by guiding architecture (a lower platform to the entrant's left, Structure 4 to the right, either of which potentially hosted perishable superstructures or other architectural elaborations), opening up a view in which Structure 5 reaches upward, directly ahead, exactly centered, and accentuated by its flanking structures (6 and 7).

As noted above, Structure 7 is the southern flanking building of the triadic group. It is also roughly parallel to the northern edge of the smaller Structure 4 on the western side of the main plaza. Also similar to the western side of the plaza, the architecture becomes less clear as it continues toward—and interfaces with—the Northern Group's southern edge. While it proved challenging to identify distinct structures on the southwest corner of the site, the minimal variability in elevation along that edge was undeniable evidence of some level of modification and construction. This is far less obvious on the eastern side of the southern plaza edge, so much so that this portion of the plaza may, in fact, lack any additional architecture and may represent the only other portion (along with the western entrance across from Structure 5) that is not enclosed.

Eastern Extension

The area east of, south of, and behind Structure 5 is low, flat, and features several low topographical prominences (**Figure 4.3**). Upon inspection, these are clearly architectural manifestations, but they lack any particularly well-defined characteristics, dimensions, pattern of distribution, or obvious function. Presumably these represent low house mounds or platforms for other designated activities or uses. They are low enough that, at a scale relative to the primary structures of the Northern Group, they are essentially indistinguishable from natural rises on the landscape, especially when reviewing the LiDAR data (right image in **Figure 4.3**). However, when mapped with the full suite of BREA methods, they appear distinct.

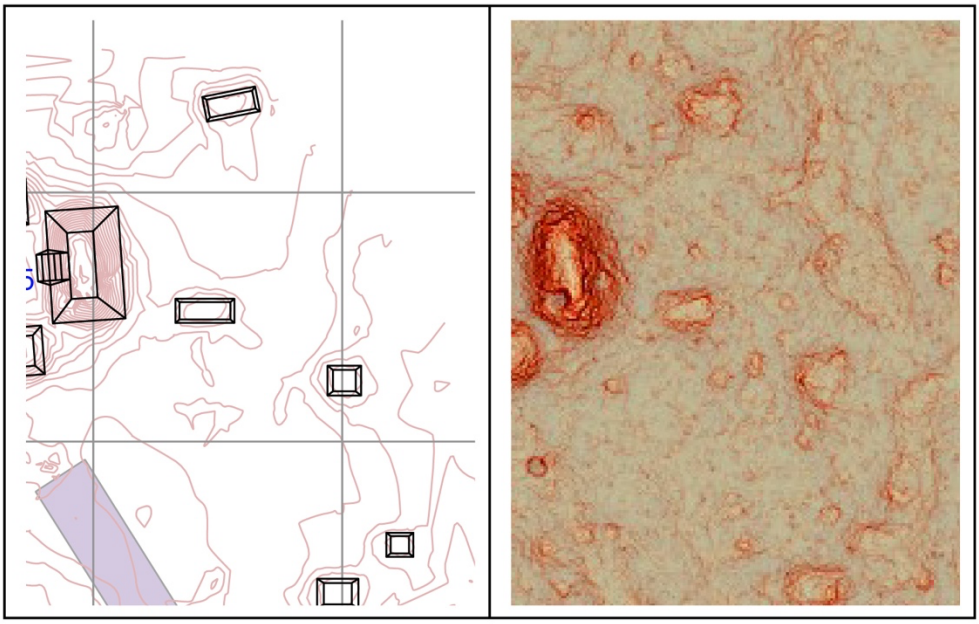

Figure 4.3 Mahlerized topographic map of the eastern extension.

BREA mapping efforts identified and mapped six of these low structures in the Eastern Extension. No additional small mounds were identified with exploratory clearing and reconnaissance further to the east, but it is certainly possible that more exist. Review of LiDAR data further to the east and north do reveal what appears to be another cluster of substantial structures, so it may be the case that this apparently un-patterned distribution of small platform mounds like those recorded as the Eastern Extension characterize the space in between, though again, neither LiDAR data nor on-the-ground reconnaissance has confirmed as much.

Southern Group

The Northern and Southern Groups appear to be connected by a low sacbe (**Figure 4.4**). This sacbe extends from the southeast corner of presumably the rear side of Structure 7 (the southernmost of the flanking structures constituting the Eastern triadic group) and continues straight at an orientation of approximately 330 degrees. This feature can be identified in LiDAR data and on the ground but is not prominent in the data collected via total station mapping. In all cases, the sacbe is only obvious in relatively small segments. It seems most likely that this is a matter of preservation, but it is also possible that the sacbe was never a contiguous connection between the two groups. No additional evidence has yet been identified to suggest that there are additional sacbe alignments within or extending out beyond the site boundaries.

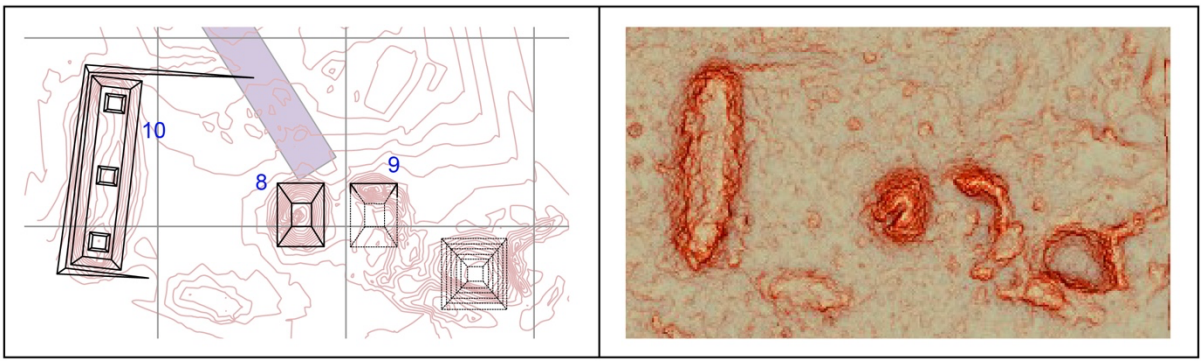

Figure 4.4 Mahlerized topographic map of the Southern Group.

As mentioned above the sacbe extends roughly southeast from the southwest corner of Structure 7. The sacbe terminus on this northern end is relatively clear. Its southern terminus was never confidently identified, potentially due to natural preservation conditions, environmental conditions at the time of survey, or the extensive disturbance and destruction that characterizes the Southern Group generally. However, if the known and identified trajectory of the sacbe were followed out as if it were uninterrupted, it would either interface with the northern end of Structure 8, or more likely may terminate directly between Structure 8 and Structure 9. Structure 8, in its current manifestation, is 20-x-17 m and raises 3 m above the surrounding surface level. It is arguably the most pyramidal of the structures at the entire site. All other Xtabentun structures—including those that are higher than they are long—are characterized by level surfaces at the top, sufficient to conceivably host superstructures. Structure 8, conversely, rises to nearly a point. It should be noted again, and will continue to be repeated through this section, that this could reflect its current state more than its initial construction. The Southern Group has been disturbed to a point of devastation. As a result, any interpretation of the remaining archaeological signature in this area is almost purely speculative. Aside from this elevated state of disturbance in the Southern Group generally, Structure 8 also features a pronounced, straight trench cutting halfway into the building. This seems to be an extensive and aggressive looters trench, though again, all interpretation in this portion of the site is speculative.

Directly east of Structure 8, indications suggest that there was a matching, parallel structure separated by a distance of only about 5 m. The evidence on the ground leads to the interpretation that these may have been parallel structures. This is based purely on the general topographic footprint as visible from LiDAR and total station data, compared against subjective field observations distinguishing obviously displaced building materials from those that seemed somewhat intact. The vast majority of the construction material from which the building itself would have been comprised is gone. To the best understanding of BREA team members, this portion of Xtabentun suffered the same fate as many sites along this corridor: complete annihilation during road construction. Based on conversations with staff from the Institute of Archaeology and local residents it is clear that monumental Maya sites in this area were

identified as easily accessible sources of building material during construction of the Philip Goldson Highway (Northern Highway) in the late 1960's and 1970's.

One result of this recent developmental history with the highway construction is that this stretch of the BREA archaeological study area is pock-marked with craters where monumental architecture once stood. And those craters are not randomly distributed—they almost certainly reflect the distribution of the highest volume of building material available at the time of construction. In other words, the impact to archaeological sites seems likely to be the devastation of the largest, tallest, or otherwise most substantial pyramidal structures in the region, along this linear corridor of the Northern Highway. Structure 9 at Xtabentun seems to have been large and accessible enough to qualify as a quarrying candidate for road fill material and, so, has been effectively destroyed. For Structure 9, all that remains are what would have been the northern and eastern sides of the original building, with loose, disarticulated piles of stones spilling out to the south and west. Disregarding the obviously disarticulated stones and instead trusting the possibly intact northeast corner, this structure would have had dimension of 11-x-9 m, though the length is particularly speculative given the state of preservation (unfortunately, any exact height is unknowable but local informants recall them being sizeable structures). With these extrapolated potential dimensions, and the extrapolated distance between this structure and Structure 8 to the west, the hypothetical arrangement here may have looked quite a bit like a ballcourt prior to its destruction (see **Brouwer Burg, Haverland, and Krause Chapter, 9** for further discussion).

To the east of this theoretical ballcourt, at a distance of 30 m, is a massive pit. This pit measures an average of roughly 23 m in diameter and reaches a depth of 2 m from the current surface. There is a line of limestone rubble on the eastern edge of this pit that seems to manifest as an intentional nearly 90-degree corner. This may represent a remnant of intact architecture, but it may just as reasonably be interpreted as a product of site demolition. What does seem clear based on the BREA team theory of site development here is that this pit reflects a location where there was likely to have been a particularly substantial monumental structure at the time of highway construction. So again, though this theory based on negative evidence cannot be proven, the idea is that this crater represents a monumental, possibly pyramidal (based on the dimensions of the pit) structure.

Arguably the most prominent building at the site of Xtabentun is Structure 10 – the long linear, range structure that we encountered swathed in morning glories in January 2023. Structure 10 is also the most prominent of the Southern Group, in that group's current manifestation. It is 59-x-20 m and stands 2.5 m tall. It is oriented 7 degrees along its central axis. At 52 m west of Structure 8, Structure 10 almost seems to represent its own distinct site component; however, since it also establishes the western side of the Southern Group, it is included for the purposes of this chapter. The low, vine vegetation covering this structure almost completely obscured any surface visibility. So, though this structure was clearly large, high, long, and straight, no additional characteristics were initially observable. After vegetation clearance and detailed total station mapping, however, three significant characteristics of

Structure 10 were revealed: a) it was built as a straight, uniform structure (no corners, angles, or other embellishments were visible in plan view); b) it would likely have featured a tall, well-faced exterior at least on its western wall (**Figure 4.5**); and c) there were three minor architectural platforms across the otherwise flat top of the structure—one in the center and two equidistant to the north and south from the central prominence.

These three characteristics provide robust confirmation of the theory that this structure represented the eastern component of an E-Group architectural arrangement. The missing element was the necessary western structure or "viewing platform" that would have signified the reference point from which to track astronomical progression against the backdrop of Structure 10. The environmental setting extending west from Structure 10 at the time of mapping was particularly challenging—low, secondary scrub and undergrowth, both visually and physically impenetrable. Nevertheless, BREA team members calculated the location where the western reference point should be located and navigated to that location with GPS guidance. A rise, seemingly architectural, was identified in that exact location. Unfortunately, because of the environmental conditions noted above, any interpretation of the manifestations in this area comes with low confidence. However, the most recent LiDAR imagery reinforces the preliminary ground survey, capturing what appears to be a small platform due west of Structure 10, which may in fact be the western "viewing platform" for the E-Group (**Figure 4.6**). Additional clearing and ground-truthing of this area is necessary to confirm the presence of this structure and its association with Structure 10.



Figure 4.5 Intact wall segment on west side of Structure 10.

Throughout the last decade of BREA site mapping, it has been assumed that the large site centers documented via the traditional walkover survey, sketch mapping, GPS, and total station mapping were representing only the nuclei of a considerably larger architectural footprint primarily made up of smaller structures. The BREA team still understands this to be largely true of this region, but the addition of LiDAR mapping to our suite of data collection methods has provided further insight. In the case of Xtabentun, for example, LiDAR data suggest that in fact there is not a great deal of additional architecture radiating out from this central location. The small topographic prominences that may represent activity-area platforms and house mounds certainly exist, but in low density and apparently without much pattern or planning. There are a number of factors that may influence this settlement distribution, but key among them seems to be the historical and current distribution of wetlands.

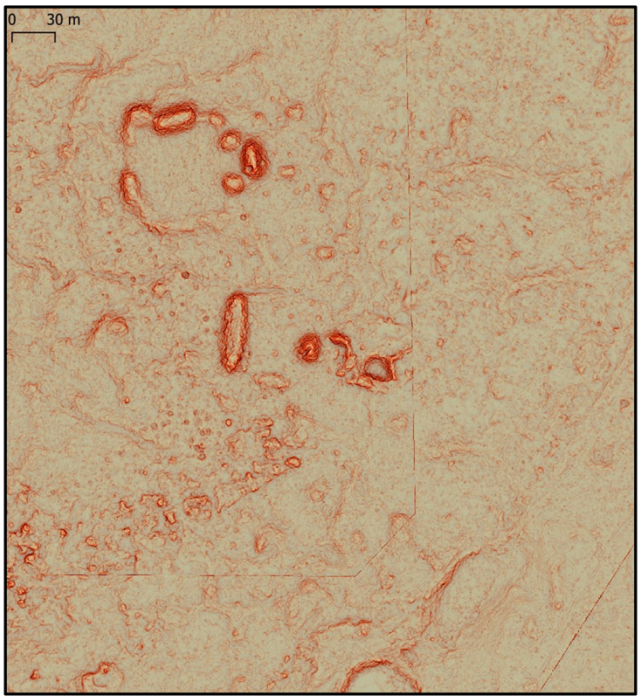

Figure 4.6 Wider view of Xtabentun and surrounding area LiDAR.

Interpretations and Conclusions

The conclusion of these mapping efforts, stated most simply, is that Xtabentun represents a substantial and intriguing site. Though it is not particularly expansive, there are many elements of this site that warrant further discussion and potentially further research. This section of this chapter will highlight a few of those key elements.

One of the interesting characteristics of the site is the different orientations among some of its main features. While there may be slight but significant offsets throughout different

portions of the site, it is most notable with Structure 1, the main structure of the northern side of the Northern Group. Structure 1 is at least 18 degrees off from even the immediately surrounding and attached architecture. The orientation of the Southern Group seems internally consistent but slightly off from the overall orientation in the Northern Group and from Structure 1. These different orientations may represent different periods of construction and elaboration. Further excavation will be necessary to understand the different orientations found throughout the site.

Throughout the description of the Northern Group above are many references to small platforms, walkways, and/or other architectural features, lending to the enclosed feel of the plaza. Even after extensive and intensive mapping of these features, their function remains somewhat unclear. It would be interesting to further investigate the nature, use, and chronology of these smaller platforms.

There is a relatively low-lying area north of the Southern Group and south of the Eastern Extension which presumably holds water on at least a seasonal basis. Other features in and around the Southern Group seem to be designed to direct water to this wetland area. Specifically, there are modifications leading from Structure 10 east toward this low, potential seasonal wetland. It is unclear whether this is coincidental or represents a water management infrastructure that may be more widespread, though not yet understood elsewhere within the site. Finally, as discussed above, the Southern Group at Xtabentun has been nearly razed by modern quarrying. It is impossible to know exactly what the archaeological and architectural signatures were here prior to that destruction. However, based on the interpretation of the building scars left behind from that demolition, it seems that the Southern Group would have featured a massive E-Group, a tall pyramid, a ballcourt, and a possible water management system. This complex was then connected by sacbe to a semi-enclosed monumental plaza (the Northern Group). Again, it is impossible to know with certainty, but these characteristics would signify a substantial monumental center here at Xtabentun, which adds complexity to the understanding of site distribution throughout the BREA survey area.

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Chapter 5

Excavations of Structure 1 at the Rural Mound Group Site of Najil Iik (Operation 55)

Jack A. Biggs, Eleanor Harrison-Buck, and Céline Lamb

Introduction

Excavations at the site of Najil Iik ("House of the chili peppers" in Yucatec Mayan, also referenced as the Godfrey Smith Site) commenced during BREA's January 2022 season, led by Céline Lamb. Excavations continued during the Summer 2022 and Summer 2023 seasons, led by Jack A. Biggs and Eleanor Harrison-Buck. The site was mapped during the Summer 2022 season by Satoru Murata and field school students Cormac Day and Abby Hanson (Murata et al. 2023). The site is located roughly 0.75 km south of Xtabentun, a recently documented ceremonial center with the remains of large monumental architecture, including a probable E-Group complex (see **Brouwer Burg and Harrison-Buck, Chapter 1:Figure 1.2**; Buck et al. 2022; **Kaeding, Murata, and Willis, Chapter 4**).

Najil Iik is a rural mound group site that was likely bisected by the construction of the Philip Goldson Highway. The site is comprised of four structures: Structure 1 is the largest and southernmost mound at the site and was the focus of the excavations (**Figure 5.1**). Despite the site's small size and rural locale, a possible monument or stela fragment was identified during mapping and located on the northern side of Structure 4, the northwestern structure at Najil Iik (Murata et al. 2023). In addition, prior to excavation, the land owner Mr. Godfrey Smith showed us two large eccentrics lying on the surface along the western edge of Structure 1. These eccentrics, now on display in the Crooked Tree Museum, were one of the reasons that BREA initially decided to investigate the structure. Our excavations of Structure 1 have revealed numerous burials and elite ceremonial objects, including another chert eccentric, a drilled jade cylinder bead, and several hematite mirror tesserae with slate backing fragments—all of which demonstrate the ritual significance of this seemingly small rural site.

Objectives of the Operation 55 Excavations

The primary objectives of the three field seasons conducted at Structure 1 were to:

1. Understand the structure's function (ritual, residential, administrative, etc.);
2. Obtain ceramic and/or carbon samples from each construction phase of the structure to reconstruct the building's use-life;

3. Explore the burial patterns and life histories of the individuals interred within the structure;
4. Collect artifacts (including those associated with special deposits) to understand the relationship of the site to larger nearby centers (Xtabentun 0.75 km to the northeast, Waxak Nicte' less than 3 km to the north, and Jabonche a little over 3 km to the southwest).

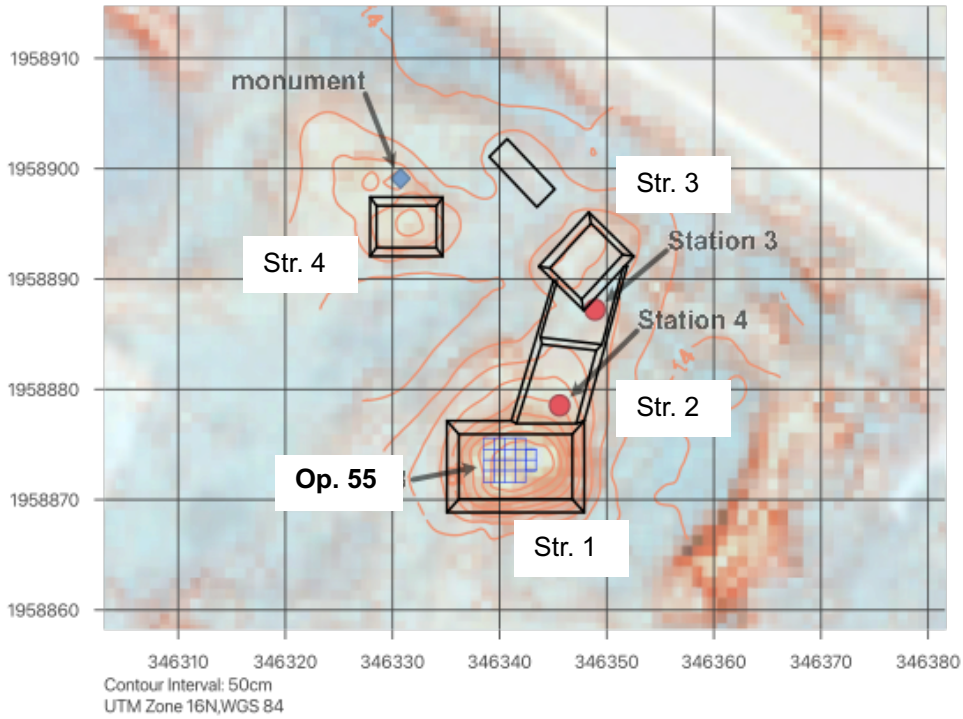


Figure 5.1 Mahlerized overview map of Najil Iik structures and total data stations (*after* Murata et al. 2023:Figure 5.2).

Description of the Research and Methods Used

The excavation unit at Najil Iik (Operation 55) was cardinally oriented on Structure 1 and measured 9-x-5 m (E-W and N-S). The excavation included Squares A-J which encompassed the northern and western edges of the superstructure, possibly some of the southern edge of the superstructure, and the western terraces leading down to the plaza floor (**Figure 5.2**). Squares A-H are 2-x-2 m squares; Squares I and J are 1-x-2 m squares that were added in order to capture contexts that extended beyond the existing squares.

Although ceramic analysis is still ongoing, preliminary results indicate that the latest occupation of the site was during the Postclassic, with earlier occupations extending back into the Terminal Classic. It is possible that the site was occupied earlier than the Terminal Classic

since excavations of Structure 1 were not deep and at least three floors were identified due to burial cuts, but were not excavated.

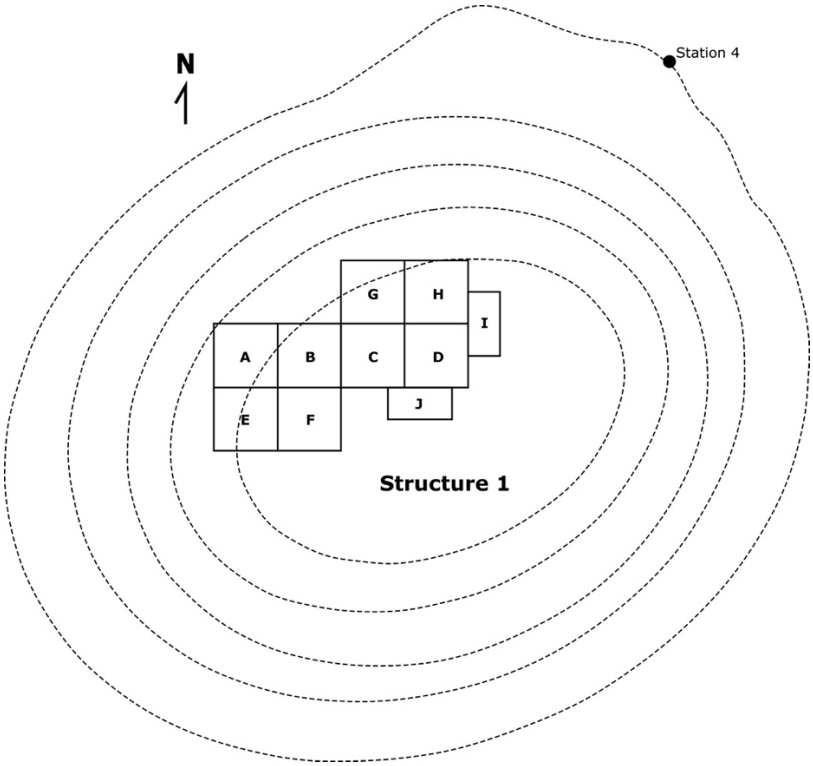


Figure 5.2 Location of Operation 55 excavation units (image by M. Brouwer Burg).

During excavations, a surprising number of interred individuals were identified (n = 8 for relatively undisturbed, *in situ* individuals), in addition to a few pits that likely held buried individuals but were highly disturbed by later activity, most likely from treefalls. As surprising as the number of interred individuals was, the vast array of burial treatments seen within the structure was most notable; this included primary and secondary burials, extended and flexed individuals, supine and prone positions, ages ranging from infants to at least middle adults, one individual (an infant) buried in a bowl, many individuals buried with no associated goods, and one individual buried with many elite and ceremonial items. The osteological analysis of these individuals is discussed in a separate chapter (see **Biggs and Bower, Chapter 11**). Here, we describe all the zones and various construction phases defined in our excavations of Operation 55 and the different contexts of the burials found in Structure 1.

The upper zones and surfaces of Structure 1 revealed numerous intrusive pits, some natural and some cultural. Unfortunately, this made it quite difficult to determine if certain zones, floors, underlying fills, etc. were the same context between squares or across the structure. As a result, many of these were precautionarily split into multiple zones during excavation and then recombined during analysis, once it was determined that they were the same context. Thus,

one floor surface or construction fill layer may be made up of multiple zones that did not fully connect to each other across the excavation squares.

Excavation Methods

All vertical measurements throughout the excavations were taken from five temporary datum points (Datums A, B, C, D, and E). Due to the overall height of the mound, and excavations spanning three separate field seasons, it became necessary to use multiple datums to ensure vertical control. Datums A, B, and C were used during the January 2022 season, Datum D was used in the Summer 2022 season, and Datum E was used in the Summer 2023 season. For excavation, 5-gallon buckets were used to remove all materials from the units. Zones were separated arbitrarily (10 or 20 cm depths) or when a texture and/or color change was evident in the matrix. Most of the dirt was screened using ¼-inch mesh screen, with the exception of backdirt that was removed and not screened at the beginning of the Summer 2022 and 2023 seasons. Picks and shovels were used to remove overburden, especially the large amount of backdirt that was placed back into the excavation at the end of each season. Trowels were used to define *in situ* artifacts and intact architecture and small wooden tools were used to define and excavate around *in situ* human remains within the burials. The subsequent sections detail the findings of our excavations, broken down by zone, our smallest unit of excavation. The following sections are divided by the phases of architecture encountered in Structure 1, such that the latest phase is discussed first (Phase 1) and the earliest detected phase is discussed last (Phase 4). **Table 5.1** is included here to help the reader interpret the different construction phases, deposits, and zones described below.

Phase 1 – Final Occupation

Zone 1 Humic Layer (Topzone)

Zone 1 (depicted in red in **Figure 5.3;** see also **Figure 5.4**) was the humic layer overlying all squares (A-J) on Structure 1 (henceforth Str. 1). It consisted of loose to semi-loose soil made up of silty loam with black coloration (10YR2/1). Inclusions included grass, roots, cohune palms, and rocks ranging in size from pebble to fist-sized. The artifacts ranged in density from light to medium; those recovered included chipped tools, debitage, obsidian, ceramic rims and sherds, and faunal bone.

Table 5.1 Overview of the construction phases, deposits, and zones of Operation 55.

Architectural Phase	Description	Associated Zones
Phase 1 (latest)	Superstructure 1 Floor Surface	2, 18, 32, 49
	Superstructure 1 Ballast/Construction Fill	19, 43, 44, 53
	Intrusive Pit (Tree Disturbance?) into Zn. 2 (Sq. B)	3
	Possible Burial Pit into Zn. 2 (Sq. F)	10
	Possible Burial Pit into Zn. 2 (Sq. C)	5, 23
	Intrusive Pit (Tree Disturbance?) into Zn. 18 (Sq. C &D)	21 (disturbed Bu.2A)
	Intrusive Pit Tree Disturbance? ('Zone 33 Pit') into Zn. 32	28, 33, 37, 39
	Intrusive Pit (Tree Disturbance?) into Zn. 32	42
	Intrusive Pit Tree Disturbance? ('Zone 34 Pit') into Zn. 32	34, 40, 55
	Intrusive Pit (Tree Disturbance?) into Zn. 49 (Sq. J)	47
	Intrusive Pit (Tree Disturbance?) into Zn. 49 (Sq. J)	48
	Redeposited Burial 4 and Kik style vessel fragments	52
	Intrusive Pit (Tree Disturbance?) into Zn. 49 (Sq. J)	76
	Basal Floor Surface (Sq. A)	17
	Construction Fill under Basal Floor Surface (Sq. A)	20
	Terrace #1	7, 8, 9, 15
	Terrace #2	Exposed but not excavated
Phase 2	Terrace #3	24, 26, 30
	Superstructure 2 Surface	22, 29, 56, 69
	Superstructure 2 Retaining Wall	25
	Superstructure 2 Construction Fill	27, 35, 59, 71
	Intrusive Pit (Tree Disturbance?) into Zn. 29/56 (Sq. D)	45
	Intrusive Pit (Tree Disturbance?) into Zn. 29/56 (Sq. D)	46
	Intrusive Pit (Tree Disturbance?) into Zn. 27 (Sq. H) under Bu.1C	66
	Intrusive Pit (Tree Disturbance?) into Zn. 69 (Sq. J)	68
	Burial 1A	54, 58
	Burial 1B	62
	Burial 1C	(2-mixed), 57, 63
	Burial 1D	64
	Burial 2A	31, 38, 41, 60
	Burial 2B	67, 70, 74, 77
	Burial 3	61
	Burial 4 and Kik style vessel fragment	51
	Partial Burial Deposit (Sq. J)	75
Phase 3	Superstructure 3 Surface	50
	Superstructure 3 Construction Fill	36
	Possible Burial (NW corner of Sq. C)	36
Phase 4 (earliest)	Superstructure 4 Surface	73

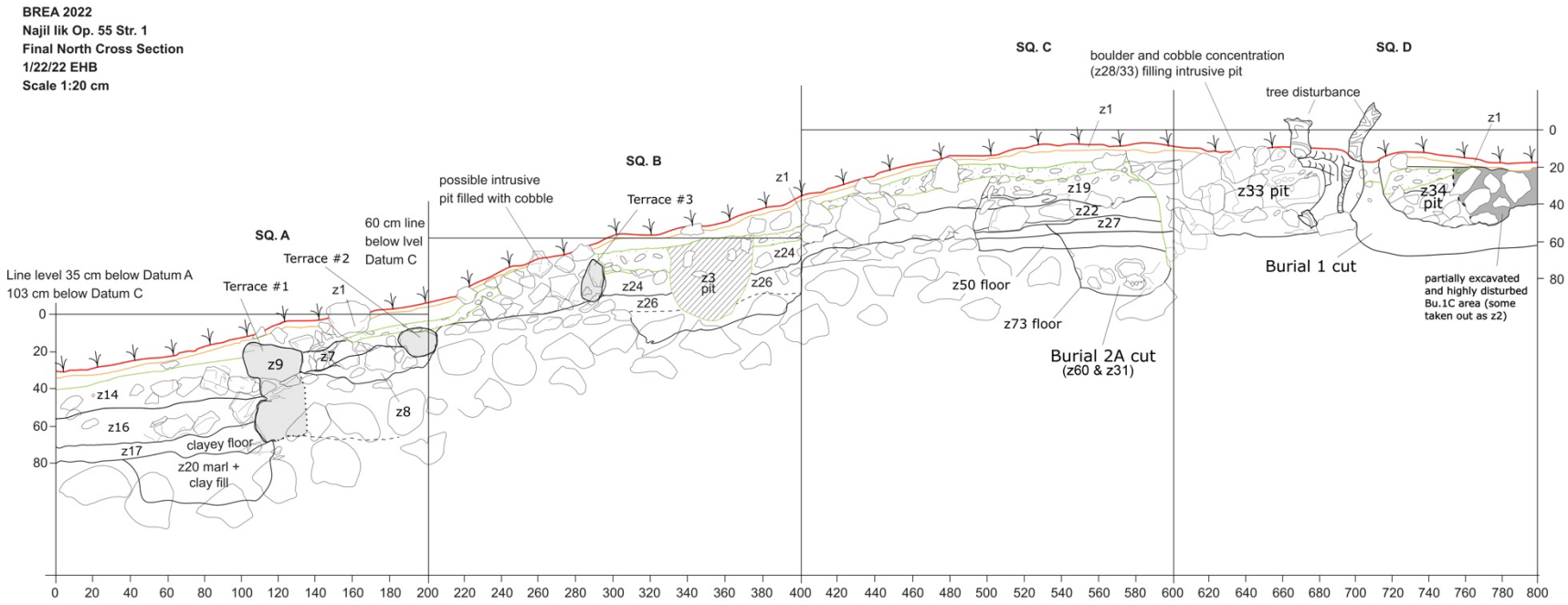


Figure 5.3 North profile of Squares A, B, C, and D (drawing by E. Harrison-Buck; digitized by M. Brouwer Burg and J. A. Biggs).

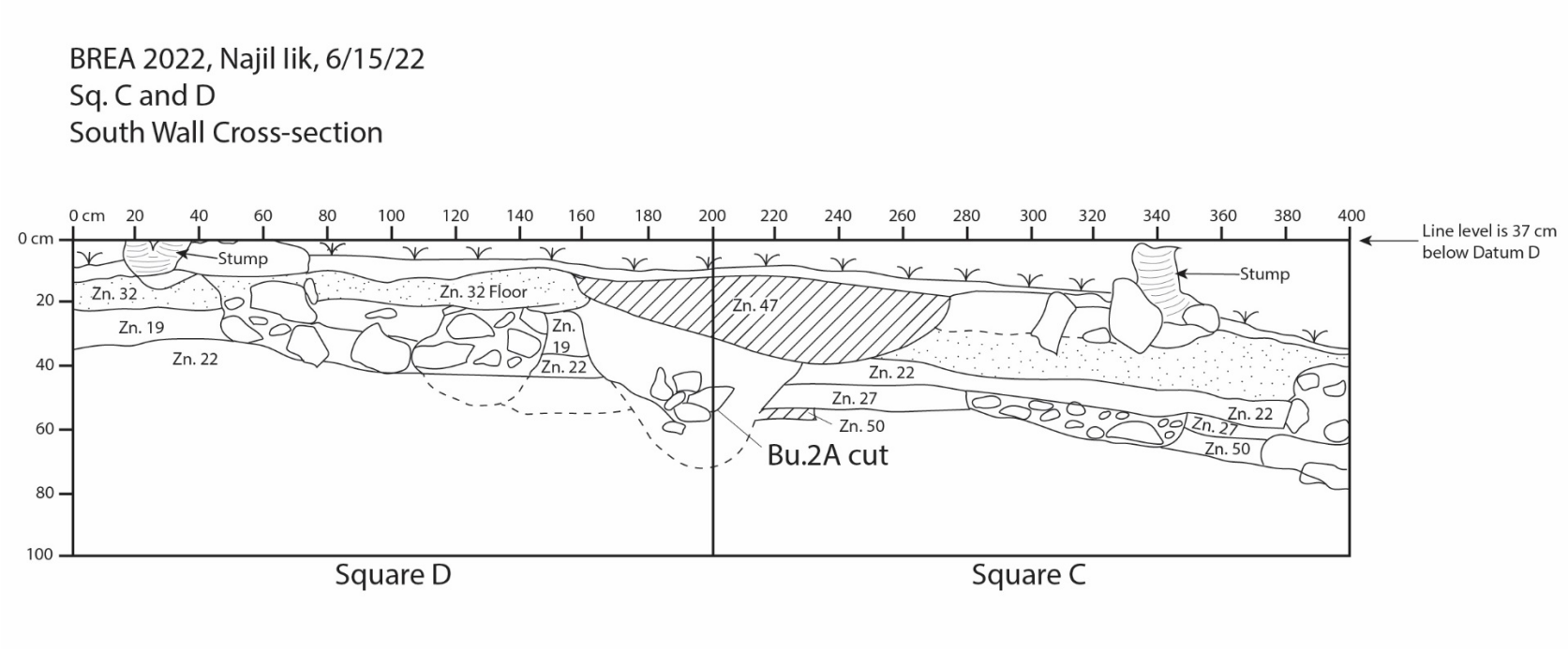


Figure 5.4 South profile of Squares D and C (drawn by E. Harrison-Buck; digitized by M. Brouwer Burg and F. Haverland).

Zone 2 Latest Plaza Floor and Basal Platform Construction

Zone 2 (depicted in orange in **Figure 5.3**) was a mix of collapse and the latest floor of Terraces 1, 2, and 3 in Squares A, B, E, and F. The Zone 2 designations for Squares C and D were later determined to be a mixing of contexts of collapse and the last occupation surface in the latest superstructure (Superstructure 1) and were thus combined with Zone 32 in Squares G, H, I, and J (discussed separately). Additionally, the heavy mixing of contexts was further complicated in Square D due to several large intrusive pits (Zones 33 and 34) along the northern edge of the square and to some rather quick, spirited, and deep excavation carried out in the northeast corner of Square D by one of the workmen, which uncovered skeletal human remains (demarcated in top image in **Figure 5.3**). Fortunately, these remains were reconstituted with their original burial context when it was later determined they belonged to a partially disturbed burial (Burial 1C) further exposed in Squares H and I, which will be discussed later.

Zone 2 in Square A consisted of silty loam (humus) with small white flecks (likely plaster). The soil in the western half of Square A was more compact than in the eastern half. A line of stones running N-S in approximately the center of the square were noted. Soil in the eastern half of the square (demarcated by the line of stones) was looser than in the western half of the square. This line of stones was determined to be the lowest terrace (Terrace #1) on Str. 1. Zone 2 ended in the eastern half of Square A when it was level with the tops of the Terrace #1 stones. In the western half, Zone 2 ended when the soil was level with the bottom of the Terrace #1 stones, thus fully exposing Terrace #1. The artifact concentration in Zone 2, Square A was medium and included chipped tools (including a bifacial medial fragment), lithic debitage, obsidian, and pottery sherds and rims.

Zone 2 in Square B consisted of silty loam with a very dark grayish brown organic soil (10YR3/2). The artifact density in Square B was heavier than in Square A and included chipped tools, obsidian, and ceramic rims and sherds. Like in Square A, Zone 2 in Square B contained a row/line or large stones running N-S, dividing Square B into eastern and western halves.

Zone 2 in Square E is equivalent to Zone 2 in Square A, existing on and below the Terrace #1 wall. Trees present in the NE corner, center (along the terrace wall), and directly south of Square E along the terrace wall likely contributed to the slumping and collapsing stones in the southern portion of Zone 1 in Square E. Zone 2 in Square E was a silty loam with very dark grayish brown (10YR3/2) organic soil and had a mix of small and large cobbles and one boulder, likely part of the Terrace #1 wall. The artifact density was light and included chipped tools, debitage, and ceramic rims and body sherds.

Zone 2 in Square F had a silty loam matrix with very dark grayish brown (10YR3/2) organic soil with cobble and boulder inclusions. As with Zone 2 in other squares, it represents the collapse debris overlaying Str. 1 and the terrace walls. The artifact density was medium and contained faunal bone (with some possible human remains – lab analyses are still ongoing), debitage, a possible chipped tool, ceramic rims and body sherds, as well as two Belize Molded-carved sherds (**Figure 5.5**). This ceramic style is mostly associated with the Terminal Classic

(800–950 CE), suggesting that the collapse debris and perhaps terminal use associated with the latest terraces occurred during the Terminal Classic period (see e.g., Harrison-Buck and Pugh 2020; Helmke and Reents-Budet 2008; LeMoine et al. 2022).



Figure 5.5 Belize Molded Carved sherds found in Zone 2 Square F (photo by C. Lamb).

Zone 9 Terrace #1 Retaining Wall

Zone 9 consisted of the lowest terrace (Terrace #1) retaining wall and was only present in Squares A and E (**Figure 5.6**). This zone was only represented by the limestone blocks used for the wall and does not include the terrace construction fill behind the retaining stones which were given their own zone designations (7 and 8, discussed below).

Zone 9 in Square A consisted of two standing courses of cut (possibly) silicified limestone blocks. The northern portion of Square A contained three nicely preserved facing stones that were aligned with the likely cornerstone located north of the excavations. Using these three terrace wall stones and the "cornerstone", it was determined that the terrace wall (and thus presumably the entire structure) runs 4 degrees east of north. This orientation was later confirmed by the presence of three cut stones representing the remnants of a wall of the superstructure in Square H and the orientation of the individuals in Burial #1 (Bu.1), discussed in greater detail below. However, the same orientation of Bu.1 as the stones in Terrace #1 indicated that this lowest terrace wall (or basal platform) may have been part of the earliest construction phase with the orientation of the building remaining the same throughout its occupational history. In the southern half of Square A, two likely cut stones sat lower than those in the northern half, with only one course of the wall preserved.

Zone 9 in Square E was a continuation of the Terrace #1 wall seen in Square A. However, the terrace wall stones in Square E were not as well preserved as they were in Square A. While there were likely two courses of stone for the wall in Square E, only the uppermost course was defined.

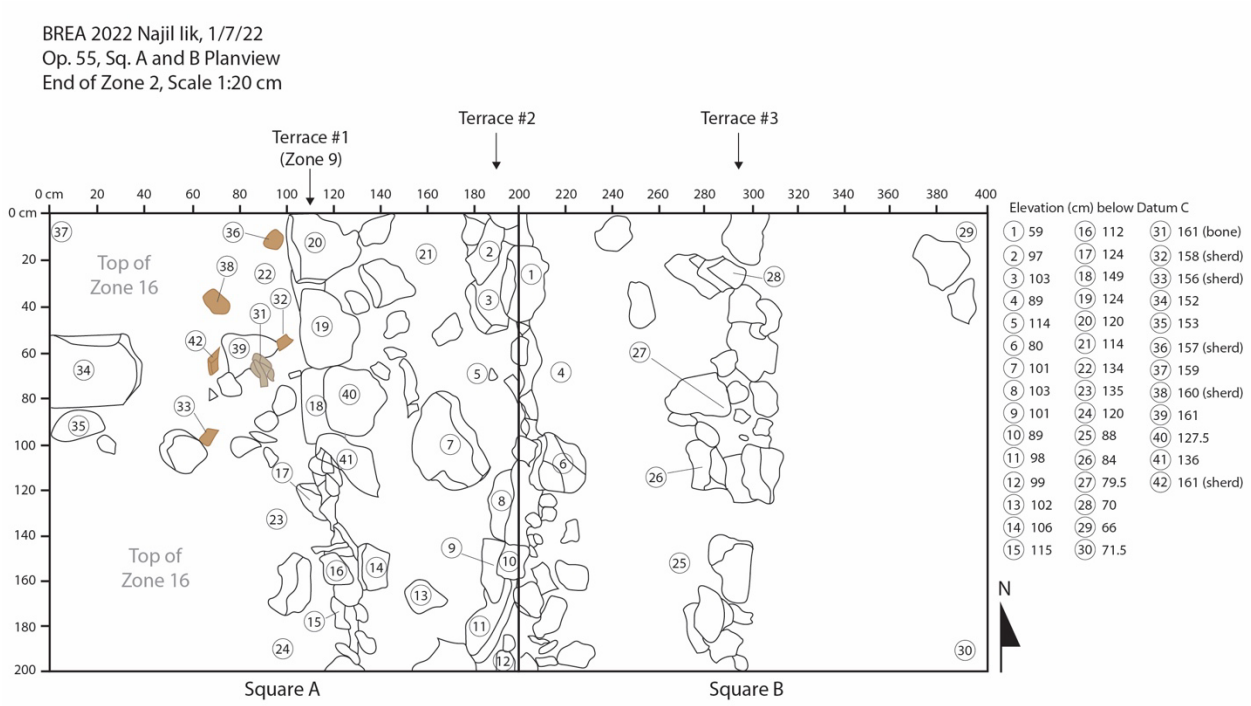


Figure 5.6 Planview of Squares A and B (drawn by E. Harrison-Buck; digitized by F. Haverland).

Zones 14 and 16 Collapse Debris of Terrace #1 (Square A)

Zones 14 and 16 were only within Square A, located just west of (in front of) the Terrace #1 retaining stones (Zone 9) and were likely the collapse debris associated with this terrace (**Figure 5.3**).

Zone 14 underlies Zone 2 and is the collapse debris located in Square A just in the area in front of (west of) the Terrace #1 (Zone 9) retaining wall stones. The soil in Zone 14 was 10YR4/2 and contained an inconsistent mix of large and small cobbles sloping off to the west of the Zone 9 retaining wall. This same matrix likely continued into Square E as only the northern half of Zone 14 in Square A was excavated. Zone 14 was arbitrarily ended upon reaching the second course of the retaining wall for vertical control. Artifact density was medium in Zone 14 and included lithic debitage, obsidian, ceramic rims and body sherds, and human remains.

Zone 16 was also located in Square A and is a continuation of the collapse debris west of the Terrace #1 retaining wall. The Zone 16 collapse is directly under Zone 14 and consisted of a

grayish brown (10YR5/2) semi-compact silty clay loam with some very dark grayish brown (10YR3/2) mottling. It was characterized by an inconsistent mix of small and large cobbles, although larger stones and small boulders (compared to Zone 14) were found closer (more easterly) to the Zone 9 retaining wall, possibly representing terminal collapse from the wall. Artifacts were more numerous and larger in size in Zone 16 compared to Zone 14, presumably from having eroded off the Terrace #1 wall earlier than the heavier collapsed material. Artifacts in Zone 16 included lithic debitage, faunal bone, marine shell, freshwater/snail shell, and ceramic rims and body sherds. Zone 16 was ended when the matrix became noticeably more compact, and the artifact assemblage changed, indicative of a living surface (Zone 17).

Zone 17 Living Surface (Square A)

Zone 17 was in Square A only, located directly below Zone 16, and was the living surface associated with the Terrace #1 retaining wall (**Figure 5.3 and 5.7**). Although no plaster floor surface was identified, there were a number of indicators that this compact earthen matrix was a living surface; this included a lack of larger inclusions (compared to Zone 16), the presence of sherds lying flat at the interface of Zone 16 and Zone 17, a much more level and compact matrix, and a high concentration of white flecks (likely remnant plaster) within the soil. Zone 17 was a compact silty clay (10YR4/3) and presumably extends north, south, and west. Sascab material (mostly found in the north and west part of Zone 17) likely represented construction fill, rather than floor surface. This mixing of sascab and the matrix at the southern end of Zone 17 resulted in a slightly lighter grayish brown color (10YR5/2) in the southern profile. A heavy concentration of artifacts was discovered in Zone 17 and included faunal bone, charcoal fragments, lithic debitage, marine shell, mother of pearl, obsidian, and ceramic rims and body sherds.

Zone 20 Construction Fill (Square A)

Zone 20 was located in Square A only and was the underlying construction fill for the Zone 17 living surface (**Figure 5.3**). This zone was a grayish brown (10YR5/2) made of very compact silty clay with white speckling and very few inclusions, mostly gravel (1-2 cm in diameter) and small amounts of cobbles. Zone 20 was above sascab/limestone boulders that had a depression within them, indicating that the Zone 20 matrix could have been used to fill in and level out this area before constructing the floor surface (Zone 17). Artifacts in Zone 20 were both sparce and poorly preserved, fragmenting upon extraction in the field. These artifacts included a large charcoal fragment, lithic debitage, freshwater/snail shell, marine shell, and ceramic rims and sherds.



Figure 5.7 Northern portion of Square A showing the bottom of Zone 17 (foreground), the Terrace #1 retaining stones (Zone 9; middleground), and Terrace #2 (background [photo by C. Lamb]).

Zone 7 Terrace #1 Construction Fill (Squares A & E)

Zone 7 was encountered in Squares A and E and represents the Terrace #1 construction fill that Zone 9 retains. Zone 7 in Square A was taken out as two separate 'sub-squares', a northern and a southern section with each measuring about 0.5 m E-W by 1 m N-S. While the construction fill matrix was expected to be lighter in color, the soil was surprisingly dark (10YR3/2) and consisted of silty loam in the southern sub-square. In the northern sub-square,

the soil was lighter in color (10YR6/2) with a small portion being much darker (10YR3/1), which was interpreted as the remains of likely tree disturbance. This darker soil in the northern sub-square gave way to the same lighter terrace fill material seen elsewhere around the level of the bottom of the first course of Terrace #1, reaffirming likely tree disturbance.

During excavation of Zone 7, another line of stones behind (east of) the original Terrace #1 wall (Zone 9) was encountered that was also slightly lower in elevation. This separate line of stones ran roughly N-S and was given its own zone designation (Zone 8) as a precaution with the possibility it represented an earlier construction phase, such that Zone 9 Terrace #1 was an addition or expansion of this earlier phase. However, this thought was mostly reversed and it was concluded that the Zone 8 stones and matrix were likely a mix of construction fill and rubble core that had been disturbed by trees, similar to Zone 7. This is further evidenced by the darker/organic soil found in Zone 7. Thus, Zones 7 and 8 should be thought of as the same context. However, Zone 8's matrix and findings will be discussed below. Artifacts for Zone 7 in Square A were very few in number.

Zone 7 in Square E was taken out in one unit, rather than subdivided into Zones 7 and 8 like in Square A. Measuring about 1-x-1 m in the northeastern corner of Square E, the Zone 7 matrix seems to mirror Zone 7/8 in Square A, with the exception that it was more mottled due to root and tree disturbance. Like in Square A, there were very few artifacts in Zone 7 of Square E.

Zone 8 Terrace #1 Construction Fill (Square A)

Zone 8 in Square A, as stated above, was separated from Zone 7 due to the presence of a line of stones possibly representing an earlier terrace retaining wall. However, it is most likely that Zone 8 was a mix of construction fill and collapse, the same as Zone 7. The matrix of Zone 8 was a loose silt (10YR6/2) with white speckles and cobble inclusions ranging from 5-15 cm in diameter. However, the southeast corner of Zone 8 in Square A was a much lighter silty marl (2.5YR7/2). Like Zone 7, Zone 8 was sparse in artifacts, but included lithic debitage, marine shell fragments, ceramic rims and sherds, as well as a charcoal fragment.

Zone 15 Terrace #1 Possible Construction Fill (Square E)

Zone 15 was a line of stones running roughly E-W in the southeast corner of Square E. It was excavated to test the possibility that there was a wing coming off Terrace #2 as an addition. Excavation of these stones did not reveal an actual wall running E-W and was likely construction fill for Terrace #1 or collapse from Terrace #2, as it is located south of Zone 7 in Square E. Thus, the possibility of a terrace wing was discarded.

The soil matrix for Zone 15 was dark (10YR3/2) and contained few artifacts including ceramic sherds, faunal bone, and human remains (two teeth).

Terrace #2 (final phase)

Terrace #2 was the second terrace going up Str. 1 (see **Figures 5.3 and 5.6)**. The latest phase of this terrace was poorly preserved but ran roughly N-S like Terrace #1, and was located at the interface of Squares A and B, straddling the line between them.

This terrace was defined after taking out the Zone 2 collapse debris (described previously) but was not excavated into. Thus, no zone designations were made for Terrace #2 apart from its description when it was defined at the bottom of the Zone 2 collapse debris.

Terrace #3 (final phase)

Terrace #3 was likely the uppermost terrace before the superstructure on Str. 1 (see **Figure 5.3 and 5.6**). Like the two lower terraces, Terrace #3 ran roughly N-S and is seen in Squares B and F with the eastern portion possibly extending into Square C. This latest phase of Terrace #3 was not as well-preserved in Squares B and F as Terraces #1 and #2 in Squares A and E.

Zone 2 Terrace #3 Collapse Debris

As with Terraces #1 and #2, Zone 2 in Square B represented collapse debris associated with the terminal occupation of Str. 1. The soil consisted of a very dark grayish brown (10YR3/2) silty loam with both small and large cobble and boulder inclusions. Artifacts from Zone 2, Square B included those from across the entire square, not just within the confines of Terrace #3. Artifact density was heavy in Zone 2 and included chipped tool fragments, obsidian, and ceramic rims and sherds. Zone 2 was ended when an intrusive pit was found in the SE corner of the square (Zone 3, discussed below), and when the matrix throughout the rest of the square changed and likely represented an earlier construction phase (Zone 24, discussed below).

Zone 2 in Square F was similar to that in Square B. As discussed above, Zone 2 in Square F had a very dark grayish brown (10YR3/2) silty loam matrix with cobble and boulder inclusions. The artifact density was not as heavy compared to that in Square B, but included faunal bones, human remains, chipped tool fragments, lithic debitage, ceramic rims and sherds, and the previously mentioned Belize Molded-Carved sherd (**Figure 5.5**).

Zone 3 Intrusive Pit

Zone 3 was an intrusive pit within the SE corner of Square B (**Figure 5.3 and 5.8**). It was originally excavated as Zone 2 but was later separated due to the discovery of a concentration of cobbles. However, these cobbles ended up creating an amorphous boundary, suggesting that this pit was natural and not cultural, possibly the result of a cohune palm. The artifact density for this pit (measuring roughly 70-x-70 cm) was heavy, and contained faunal

bone, chipped tools (bifaces) and ceramic rims and sherds. The matrix of Zone 3 mirrored that of the above Zone 2 with a very dark grayish brown (10YR3/2) silty loam.

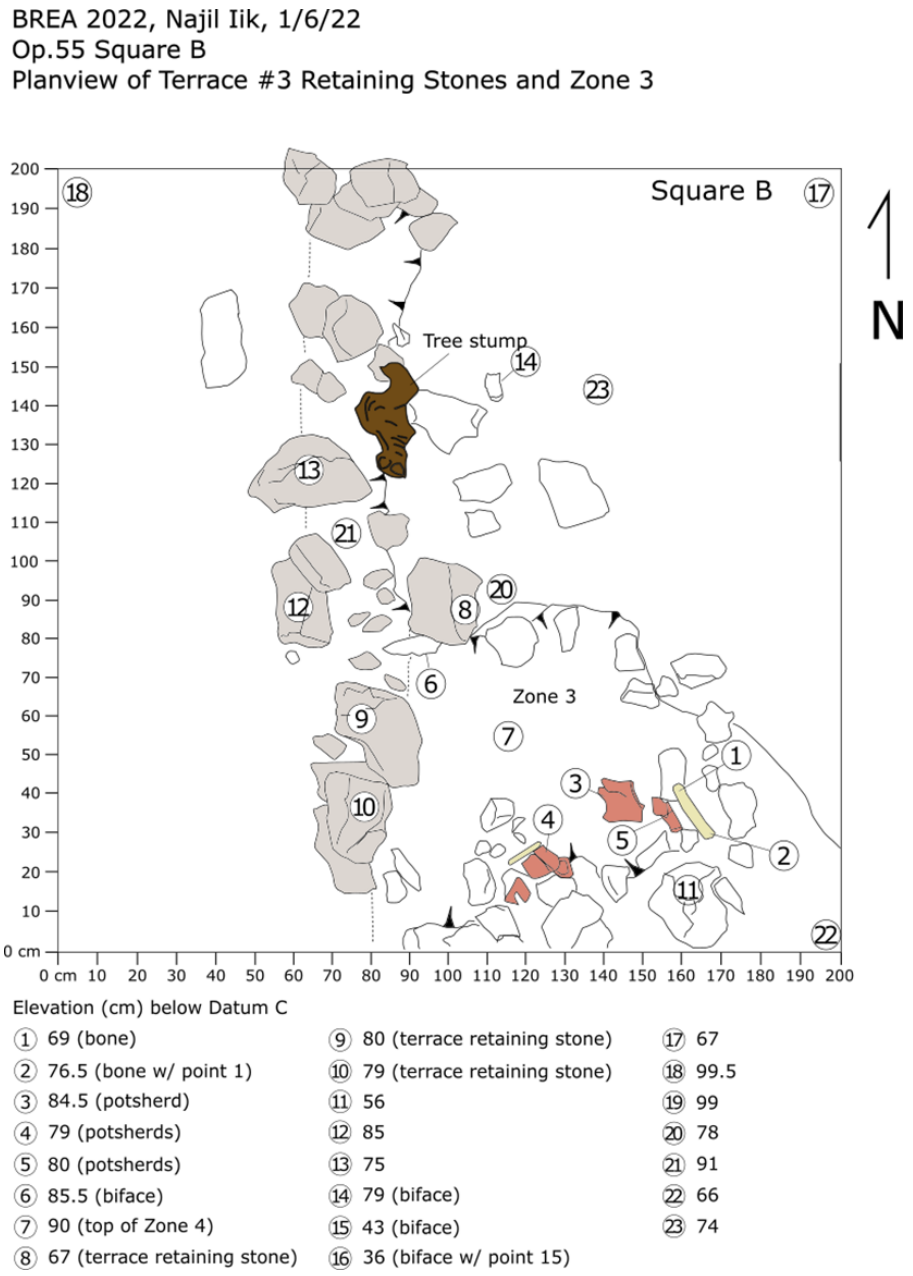


Figure 5.8 Planview of Square B showing Terrace #3 (shaded gray stones) and the Zone 3 Pit (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zone 4

Zone 4 was originally defined as a lighter gray matrix seen in both Squares A and D. However, these zones were changed upon excavation such that Zone 4 in Square A was dug as

Zones 7 and 8, and in Square D, Zone 4 was dug as Zone 18. Therefore, Zone 4 is actually an undesignated zone and has no associated bags of artifacts.

Zone 10 Intrusive Pit, Possible Burial Pit (Square F)

Zone 10 was a pit located in the eastern-central area of Square F, just east of the Terrace #3 wall stones, measuring roughly 60 cm (N-S) x 80 cm (E-W) and was possibly a disturbed burial pit (**Figure 5.9**). This zone was separated from the surrounding matrices due to a somewhat circular area delineated by stones. Within this possible burial pit, the matrix was relatively devoid of inclusions compared to the matrix surrounding it, a pattern seen within the known burial deposits elsewhere on Str. 1. Although these other known burial matrices on the mound contain lighter-colored soil, the matrix within the Zone 10 pit was a very dark grayish brown (10YR3/2) comprised of silty loam. If this truly was a burial pit, its disturbed nature and close proximity to the topsoil can explain this surprisingly dark matrix. The artifact density within this pit was heavy for its small size and included human remains (including teeth), faunal bone, obsidian, lithic debitage, and two large potsherds. Both adult and juvenile human remains were found within the Zone 10 pit. This, coupled with the overall sparse amount of remains recovered and the small size of the pit, suggests this may have been a secondary burial deposit where only a few bones from multiple individuals were interred, rather than containing the remains of two primary burials that were disturbed.

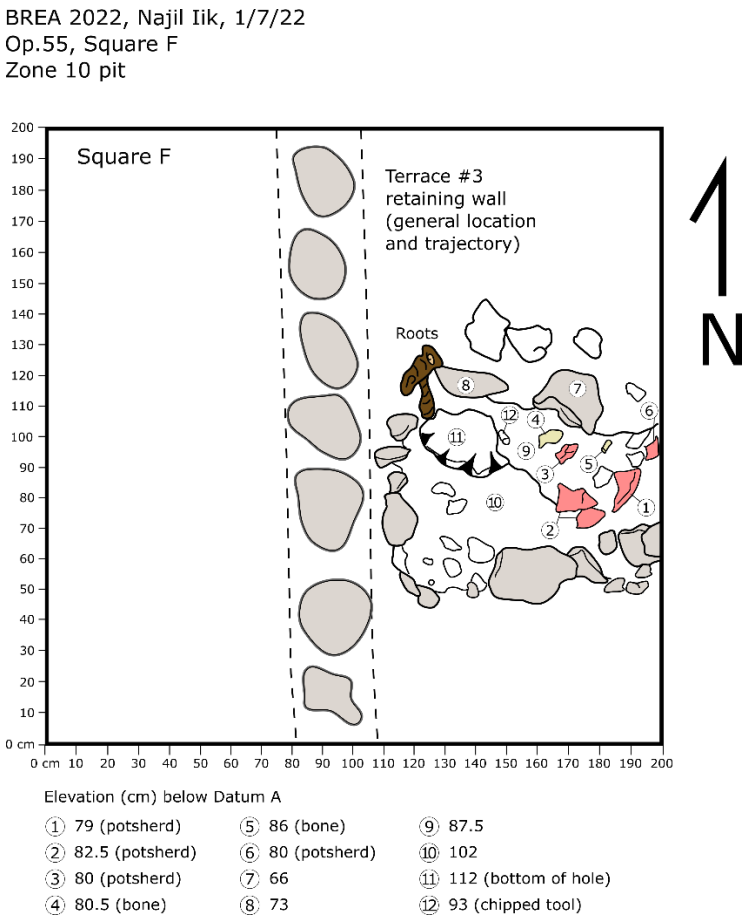


Figure 5.9 Planview of Square F showing the Zone 10 pit in relation to Terrace #3 (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zone 11 Collapse Debris (Square F)

Zone 11 was an area in the northeast corner of Square F that was most likely collapse debris associated with the terminal occupation. Although Zone 11 contained stones that were not as delineated as Zone 10 just to the south, this was given its own designation mostly due to the presence of human remains. It is possible that the high degree of disturbance on this mound shifted around the skeletal remains from other contexts, meaning that Zone 11 could be included with Zone 2. The skeletal remains found within Zone 11 are not enough to constitute an actual burial but could possibly have been a small secondary deposit consisting of a few teeth and cranial fragments. Given the paucity of human remains, though, it is more likely that this zone represents collapse debris.

The soil was a semi-loose silty loam with a very dark grayish brown color (10YR3/2), similar to that seen in Zone 2. This is likely due to its close proximity to the topsoil and root disturbance, with inclusions of mostly fist-sized cobbles. Artifacts in Zone 11 included faunal bone, human remains, lithic debitage, obsidian, and potsherds.

Zones 12 and 13 Collapse Debris (Square F)

Zones 12 and 13 were located within the western half of Square F and were west of Zones 10 and 11. These zones were originally arbitrarily separated due to the presence of human remains within the matrix. However, there was nothing that indicated these were truly separate contexts from Zones 11 and 2. Apart from the presence of human remains, there were no soil changes compared to Zone 2. Therefore, Zones 12 and 13 were collapsed back into Zone 2 for Square F.

Superstructure 1 (latest phase appears to retain the rough footprint of earlier superstructure)

Superstructure 1 was thought to be the latest occupation phase for Str. 1 at Najil Iik. Excavations on/within the superstructure contained Squares, C, D, G, H, I, and J (**Figures 5.10 and 5.11**). Square G appeared to contain the northwest corner of the Superstructure 1 with Square H exhibiting the north face/front of the building. The architecture for Superstructure 1 was very poorly preserved, with only a few stones representing very small portions of walls. It is likely that the footing walls were only one course thick with most of them being stripped off the mound at some point. However, the orientation of the few remaining wall stones seems to be in line with the orientation of 4 degrees east of north seen with the likely northwestern cornerstone and the alignment for Terrace #1 (as previously discussed). Lastly, Superstructure 1 had numerous intrusive pits that made deciphering the exact delineations of the structure and living surfaces across the superstructure difficult to connect and interpret.

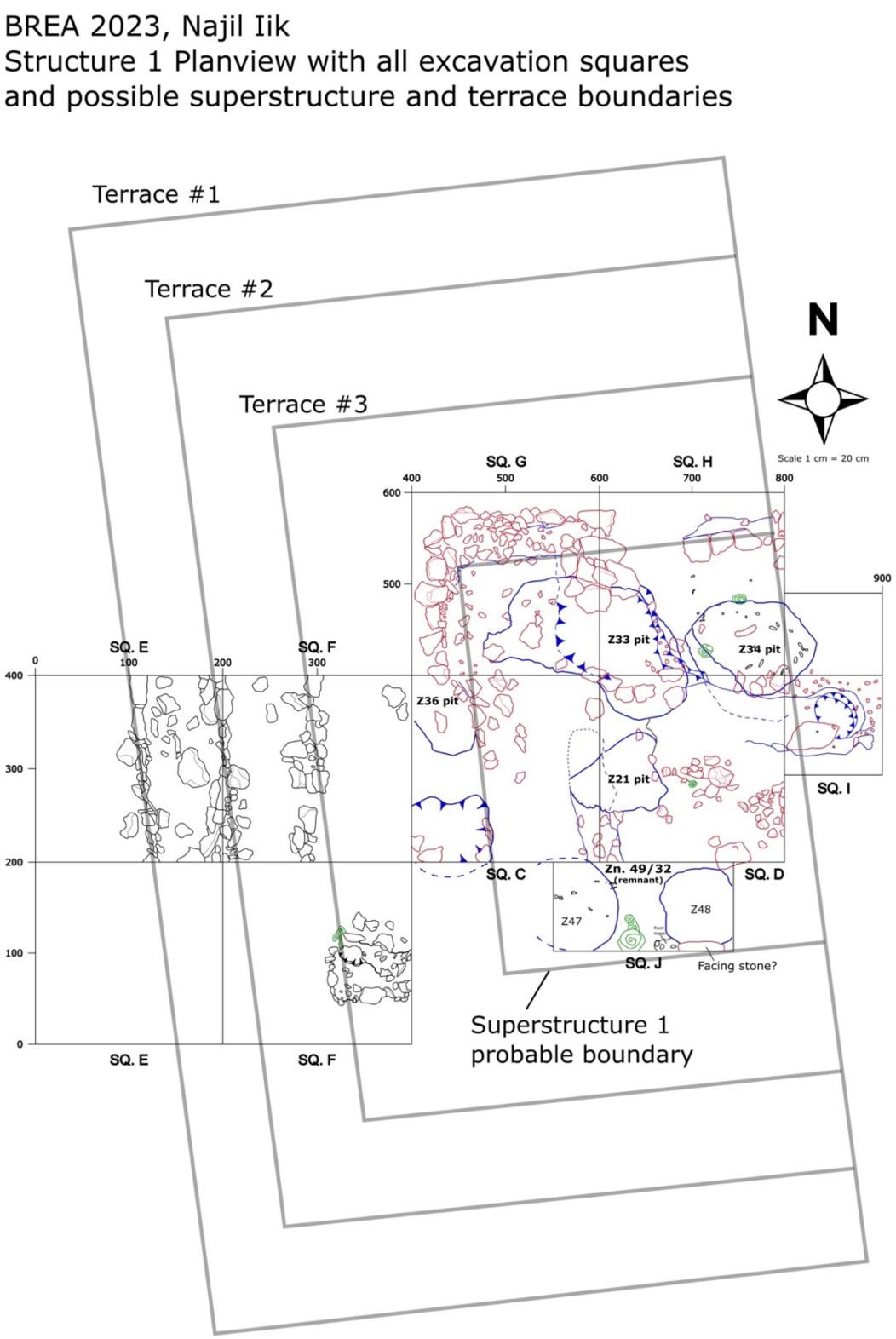


Figure 5.10 Planview of all excavation squares on Str. 1 with the probable locations and boundaries of Superstructure 1 and its three terraces (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

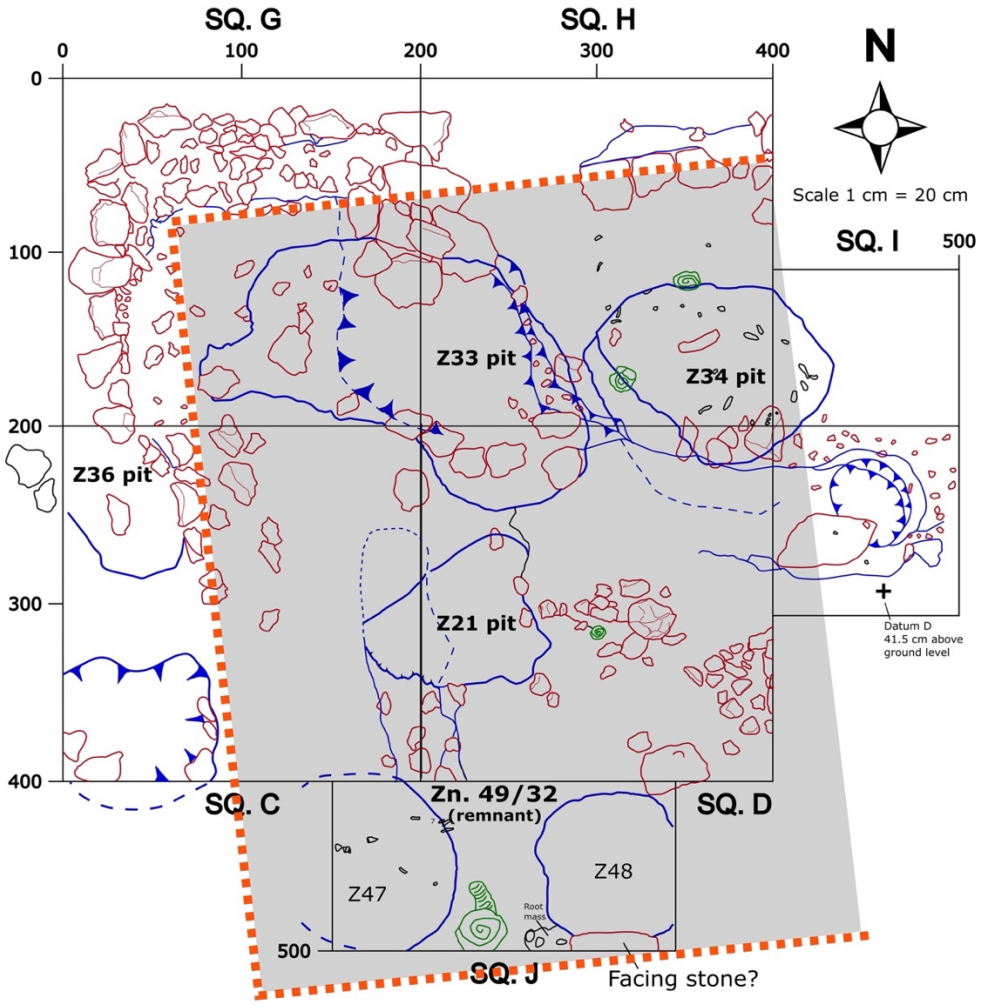


Figure 5.11 Planview of Proposed Boundary for Superstructure 1. Entirety of the Superstructure was not Encompassed Within the Excavation Squares (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zone 6 Ceramic Concentration (Square D)

Zone 6 was a concentration of artifacts within the center and southwest corner of Square D. This concentration underlayed Zone 2 and overlayed Zone 18 on the superstructure. The matrix of Zone 6 was the same as Zone 2 elsewhere: loose silty loam with a very dark grayish brown 10YR3/2 color. As of this writing, it is not entirely known if this is a special deposit or the result of a termination activity for the structure. However, it contrasts in artifact density found elsewhere at this level on the superstructure. Most of the artifacts within this dense

deposit are ceramic rims and body sherds, some of which possibly belong to the same vessel(s) (analysis still in progress). Lithic debitage and chipped tool fragments were also recovered from this zone, though not with the same frequency as with the ceramic artifacts.

Zone 2/18/32/49 Collapse and Terminal Living Surface (Squares C, D, G, H, I, J)

Zone 2

Zone 2 was originally interpreted purely as collapse during the January 2022 excavations. While drawing the north wall cross section of Squares A–D (**Figure 5.3 and 5.12**), it was discovered that there existed a lens of dark soil with white flecks in what was originally deemed as Zone 2 in Squares C and D within the superstructure. It was then decided that this dark lens with white flecks (likely remnant plaster) was the terminal living surface for Superstructure 1. During the Summer 2022 excavations, this was taken into account and Zone 2 was given the designation of Zone 32 for Squares G, H, I, and J. Thus Zone 2 in Squares C and D (January 2022) represent a slightly combined collapse and terminal living surface. Additionally, Zone 18 (assigned in January 2022) was identified as the potential terminal living surface in Square D and has thus been placed within this section. Zone 2 in Squares G, H, I, and J (Summer 2022) represents this separated collapse with Zone 32 in those squares representing the living surface. The separation (and accidental combination for Squares C and D) of these two zones arguably represents the final phase of occupation for the site, despite being a few discrete lenses existing within profoundly deflated strata.

Zone 2 in Square C was a very dark grayish brown (10YR3/1) silty loam. This context had a medium artifact density that included a complete large biface, lithic debitage, human remains, obsidian, ceramic rims and body sherds, and a possibly worked chunk of pumice.

Zone 2 in Square D surrounded and was below the Zone 6 ceramic concentration discussed above. The matrix was a dark grayish brown (10YR3/2) silty loam with chert cobble inclusions. While ceramic artifacts were still found in this zone, they were not found with the same frequency or density as in Zone 6. Other artifacts found in Zone 2 included a small concentration of faunal bone in the northeast corner of the square, as well as lithic debitage, and a human tooth found during screening. A concentration of mostly hand and wrist bones was also found in the northeast corner of Square D when one excavator dug too enthusiastically, resulting in the partial removal of what would eventually be designated as Burial 1C (this specific area in the northeast corner of Zone 2 in Square D became known as “Rubin’s Corner”). This individual was part of a multiple interment that was discovered during the Summer 2022 season and removed during the Summer 2023 season (note that this multiple burial is not associated with the final phase of occupation on Str. 1, but an earlier phase, discussed later in greater detail). These human remains were separated out from the Zone 2 artifacts and were eventually reassociated with the rest of the Bu.1C individual remains in the field lab. This individual, and the rest of the individuals within this multiple burial, will be discussed in greater detail in a later section.

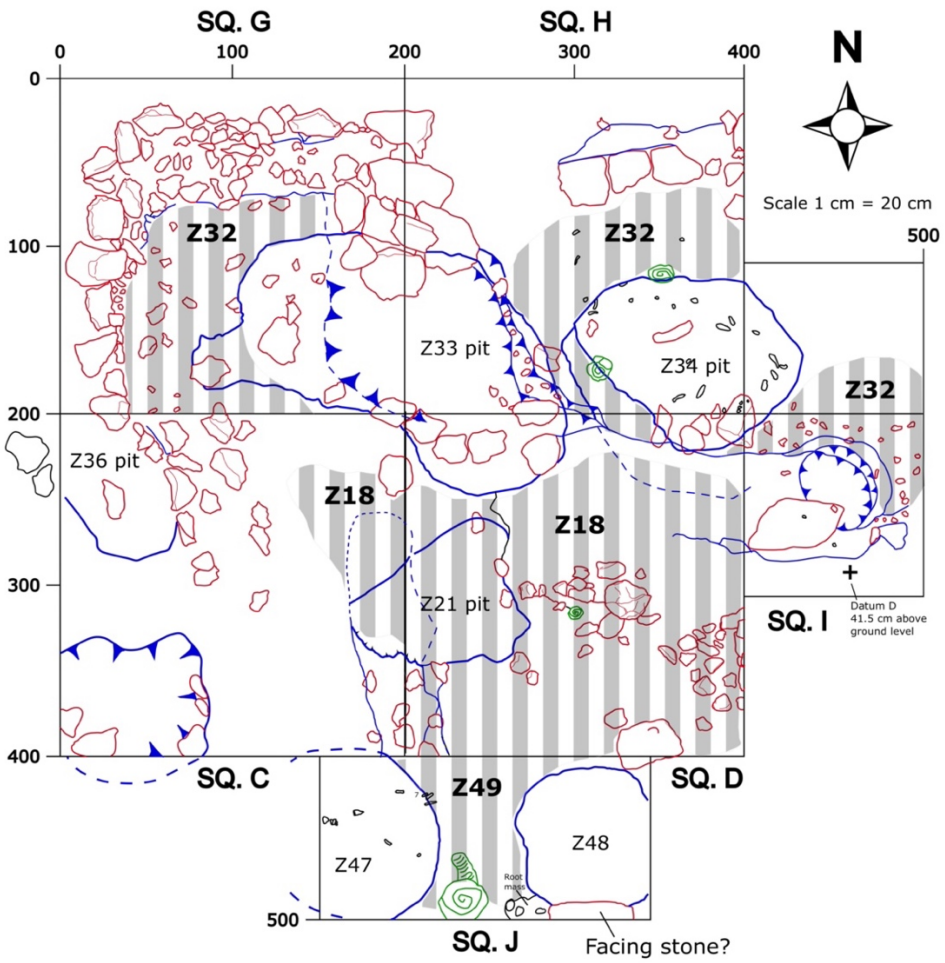


Figure 5.12 Planview of superstructure 1 showing the general locations of the identified terminal living surface (Zones 2/18/32/49) throughout the different excavation squares (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zone 2 in Square G was a semi-compact loamy silt with a dark grayish brown (10YR3/2) matrix with cobble inclusions. The artifact density was medium and contained lithic debitage and ceramic rims and sherds. This zone was ended when the matrix of compact and dark soil with white flecks (likely plaster) was discovered and given its own zone designation (Zone 32), and due to the discovery of a clearly delineated area of cobbles in the eastern and southern areas of Square D that extended east into Square H.

Zone 2 in Square H mirrored that in Square G with a semi-compact loamy silt with a very dark grayish brown (10YR3/2) matrix with cobble inclusions. Artifacts were of a similar medium density as well, containing lithic debitage, chipped tool fragments, and ceramic rims and sherds.

Zone 2 in Square I was a much smaller area, given that Square I originally started as a 1-x-1 m square expansion off of Square H that was later expanded into a 1-x-2 m square. Much of the northern portion of Square I was left untouched after removing the Zone 1 topsoil as (likely) architectural stones were exposed naturally before excavation in the square began. Zone 2 in Square I was a semi-compact silty loam with a very dark brown (10YR2/2) matrix with cobble inclusions. The artifact density was very light and only contained ceramic rims and sherds.

Zone 2 in Square J was barely discernible and appeared to be around only 1 cm thick before becoming the Zone 32 white speckled terminal living surface. For much of this smaller square (1-x-2 m), the matrix changed immediately from Zone 1 topsoil to Zone 32. Despite this, the known Zone 2 matrix of Square J was a semi-compact silty loam and was very dark brown (10YR2/2). Very few artifacts were found within this highly deflated stratum and consisted only of potsherds.

Zone 18

Zone 18 lay within Squares C and D only and likely represented the poorly preserved terminal floor surface within those squares (**Figure 5.12**). It directly underlaid Zone 2 in Squares C and D. The majority of Zone 18 was located in Square D while only the easternmost portion of Square C retained any of the Zone 18 floor, equivalent to the Zone 2/32 floor seen elsewhere.

Zone 18 in Square C was a very small portion, existing only in the east part of the square and included possible terminal debris (in the form of cobbles).

Zone 18 in Square D was more substantive and consisted of a silty marl. A large amount of faunal bone came from this zone, along with sherds lying flat, presumably on the terminal surface. The Zone 6 ceramic concentration was located right above (on top) of the Zone 18 surface in Square D, indicating that this may have been an intentional deposit/termination event on the latest floor surface as the structure was being abandoned.

Zone 32

Zone 32 underlied a very thin Zone 2 layer within Squares G, H, and I (**Figure 5.12**). While still a very dark grayish brown color, it contained white flecks, likely remnant plaster of the terminal living surface, and was more compact than the Zone 2 matrix found elsewhere on Str. 1.

Zone 32 in Square G did not cover the entire square as the western edge, northwestern corner, and northern edge all had lines of large rocks and boulders which were interpreted as the entire northwestern corner of Superstructure 1. Zone 32 was absent in the southeastern corner of Square G, perhaps obliterated by a large amorphous intrusive pit that extended into Squares D and H. This intrusive pit was initially identified in Square D as Zone 28 and was given further arbitrary zone designations during its full excavation in the Summer 2022 season (starting with Zone 33; for more deatil, see below). The Zone 32 matrix in Square G was a semi-compact, very

dark grayish brown (10YR3/2) loamy silt with white (plaster) flecks and pebble inclusions throughout. Zone 32 in Square G was only delineated and remained unexcavated.

Zone 32 in Square H was similar to that in Square G in that it did not cover the entire square. The northern edge of Square H had the continuation of stones seen in Square G that are the northern boundary of Superstructure 1. The northeast corner of Superstructure 1 is not captured within Square H and likely lies east of the square. The aforementioned intrusive pit in the southeast corner of Square G (Zone 33) continued into the southwest corner of Square H. Just east of this intrusive pit is another amorphous intrusive pit (designated Zone 34 and discussed later), located within the southeast corner of Square H. Zone 32 is thus bounded to the north by the Superstructure 1 northern wall and to the south by these two intrusive pits. The matrix in Zone 32 Square H is a compact very dark grayish brown (10YR3/2) loamy silt with white (plaster) flecks and pebble and fist-sized inclusions. The artifact density was medium and included lithic debitage, chipped tool fragments, human remains, and ceramic rims and sherds.

Zone 32 in Square I was much smaller than in Squares G and H, partially due to its smaller square size (1-x-2 m for Square I compared to 2-x-2 m for Squares G and H), but also due to the presence of the southeastern intrusive pit in Square H. This pit (referenced as the Zone 34 pit) extended southeast from Square H, so Square I was opened in order to capture this entire pit. Since this pit intruded into Zone 32, there was very little surviving Zone 32 within Square I. The matrix in Zone 32, Square I was similar to that in other squares with a very dark grayish brown (10YR3/2) loamy silt that was compact. Few artifacts were found within this zone/square and included ceramic sherds and lithic debitage.

Zone 49

Zone 49 in Square J was the equivalent of Zone 32 in Squares G, H, and I (**Figure 5.12**). This was given its own zone number out of precaution due to its location on the mound. Square J is the southernmost square on the superstructure as it was originally opened in order to capture the southern extent of a known burial pit that straddled the Square C and D border. Since Squares C and D were opened during the January 2022 excavations, no Zone 32 floor surface was detected and was initially taken out as Zone 2 (as previously mentioned). Thus, there was no Zone 32 floor surface seen in Squares G, H, and I that definitively/contiguously linked it with what was seen in Square J. However, the same matrix in Square J and its similar elevations compared to Zone 32 in the other squares indicated that Zone 49 was in fact the same floor surface as Zone 32. The Zone 49 matrix in Square J was the same semi-compact loamy silt with white speckles, was a very dark grayish brown (10YR3/2) and had pebble and cobble inclusions throughout. Artifact density within Zone 49 was very light and only exhibited lithic debitage and ceramic rims and sherds. This zone did not extend throughout the entire square. Two pits were found to be intruding into this floor surface: Zone 48 pit to the east and a Zone 47 pit to the west (both discussed below). A tree stump also protruded at the southern central boundary of Square J, disturbing some of the remaining living surface. Lastly, a large stone block was found in the

southeastern corner of Square J that likely extends farther south out of the square which then slopes sharply downward. This block appears to be cut and in line with the orientation of the superstructure, suggesting that it is part of its southern boundary.

Zones 19/43/44/53 Construction Fill Beneath Terminal Living Surface

Zones 19, 43, 44, and 53 were most likely the construction fill for the latest living surface within Str. 1 (Zones 2, 18, 32, and 49, as previously discussed; **Figure 5.13**). While it is possible that this lens could have been its own floor surface, rather than construction fill for a surface, it was determined that the most likely and logical scenario is that these zones are construction fill, as no true plaster floor was identified at the beginnings/tops of the zones. Zone 19 was only in Square C, Zone 43 was only in Square I, Zone 44 was identified in Squares G and H, and Zone 53 was in Squares D and H.

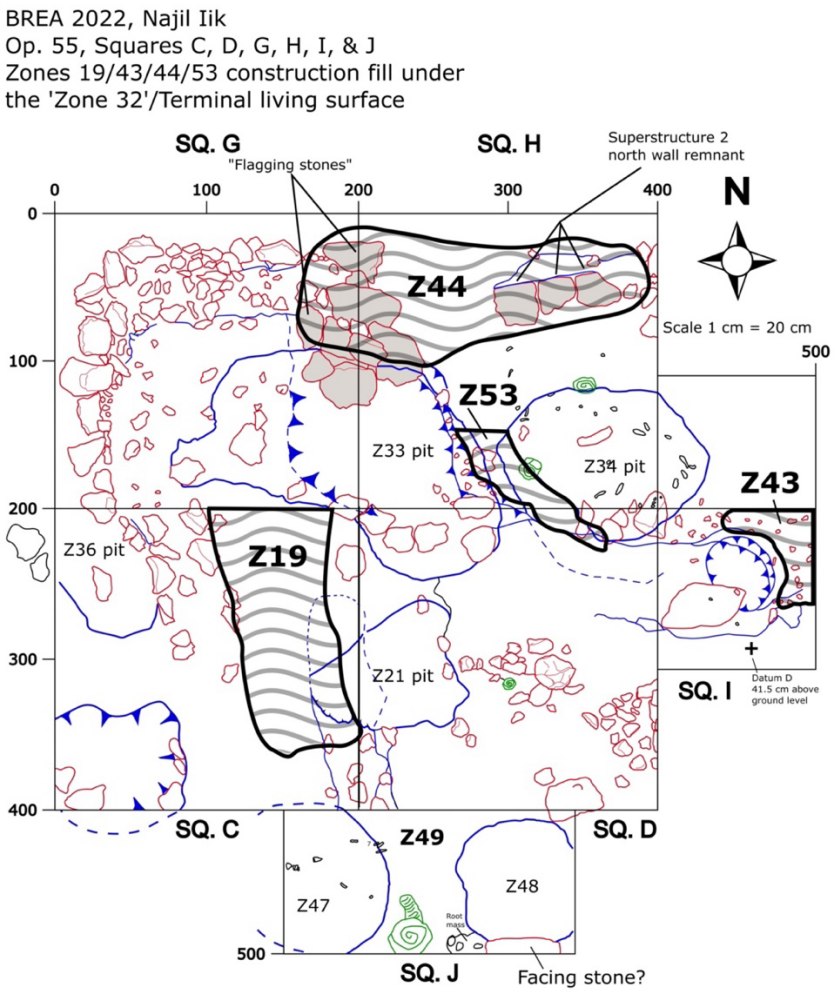


Figure 5.13 Planview of Squares C, D, G, H, I, and J showing the construction fill zones associated with the terminal living surface referred to as the 'Zone 32 Floor' (drawn by E. Harrison-Buck and J.A. Biggs; digitized by J. A. Biggs).

Zone 19

Zone 19 in Square C was mostly located in the eastern portion of the square and was a relatively linear area running slightly west of N-S (**Figure 5.13**). It is thought to be the construction fill for the overlying terminal floor surface due to the presence of large cobbles and a high density of limestone pebbles and sascab. However, these pebbles and sascab did not extend all the way to the southern edge of Square C, due to the presence of a pit (Zone 5, discussed below). The matrix of Zone 19 was a semi-loose 10YR6/3 silty loam. This zone was ended due to the discovery of a purer sascab matrix that extended N-S in the eastern portion of Square C; this new zone (Zone 22) turned out to be a plaster floor and will be discussed later in this chapter.

Zone 43

Zone 43 in Square I was a very small portion within the square that was under the Zone 32 final phase floor, occurring only in the eastern side of the square that defined a likely treefall pit. Overall, the matrix resembled that of Zone 19 seen in Square C and was very light in artifacts. While disconnected from the rest of Zone 19 construction, it became clear that this was a small and far separated portion of that same fill.

Zone 44

Zone 44 in Square G was a little darker in color (10YR3/2) than in Zone 19 in Square C, but the elevations corresponded with one another and the matrix had similar inclusions as Zone 19, namely cobble stones and smaller pebbles in between, suggesting this was construction fill. This zone in Square G was mostly just in the northeastern portion of the square, and helped uncover and define large "flagging stones" (see **Figure 5.13**) that laid in both Squares G and H. It is possible that these stones were part of a threshold or outset stair, although the stones lay directly under this construction fill layer. The southernmost of these stones was originally thought to be a capping stone for a possible burial in a pit. However, this turned out not to be the case.

Zone 44 in Square H was a continuation of the same matrix seen in Square G. This zone was taken out to the northwest, north, and northeast of the "Zone 34 Pit" in Square H. It was directly under the Zone 32 floor surface mentioned previously and helped define three cut stones towards the northern portion of the structure. These three stones (visible in **Figure 5.13**) were the last and only known in situ stones of the northern wall of the superstructure. The Zone 32 floor did not extend over these stones, suggesting that they were in place during the final phase of Str. 1. All of the other footing/wall stones appear to have been removed (likely in antiquity).

Zone 53

Zone 53 was the same construction fill matrix seen in the previous zones, but was originally unexcavated due to its position within Squares H and D. It became known as "The Peninsula" due to its odd shape that existed between the "Zone 33 Pit" and "Zone 34 Pit" (see **Figure 5.13**). Once these two pits were removed, they left a long and arcing arm of soil that was mostly within Square H and a very small portion that existed in Square D.

Zone 53 in Square D only existed in the northern portion, right up against the Square H boundary. It was a semi-compact matrix made up of silty clay with pebbles and cobbles throughout and had a grayish brown color (10YR5/2). The artifact density was light, consisting only of pottery sherds, likely due to its small size within Square D.

Zone 53 in Square H was more substantial than in Square D, with the bulk of "The Peninsula" (or arm) of soil existing between two large intrusive pits in Square H. The matrix in Zone 53 of Square H mirrored that of Square D with a semi-compact silty clay with pebbles and cobbles. The color was also the same as in Square D (10YR5/2). Despite a bigger area of this zone existing within Square H, only a few artifacts were recovered, including some pottery sherds and lithic debitage.

Zone 5 and 23 Possibly Disturbed Burial Pit (Square C)

Zones 5 and 23 were part of a possible burial in the latest phase of the superstructure that was then disturbed by trees sometime after their interment (**Figure 5.14**). About 15 cm deep, Zone 5 was initially identified as an area of tree disturbance in the southern portion of Square C. Zone 23 was an area within the confines of Zone 5 and possibly represented the original location of a burial, despite the tree disturbance.

Zone 5

Zone 5 in Square C was an area of dark (10YR3/2) semi-loose silty loam with limestone cobbles and small boulder inclusions. These inclusions were greater in number along the western portion of the zone, possibly part of the terminal Superstructure 1 retaining wall.

Zone 23

Zone 23 in Square C was an area of dark brown (10YR3/2) silty loam within Zone 5, based on the presence of a cluster of teeth and poorly preserved cranial fragments (**Figure 5.14**). While some of the limestone cobble and boulder inclusions could have been part of the terminal Superstructure 1 retaining wall, others located above and within the pit fill could have originally been capping stones for the burial, only to be disturbed by trees over time. Initial osteological

analyses of the human skeletal material from Zones 5 and 23 indicate that at least one juvenile individual was interred in this location.

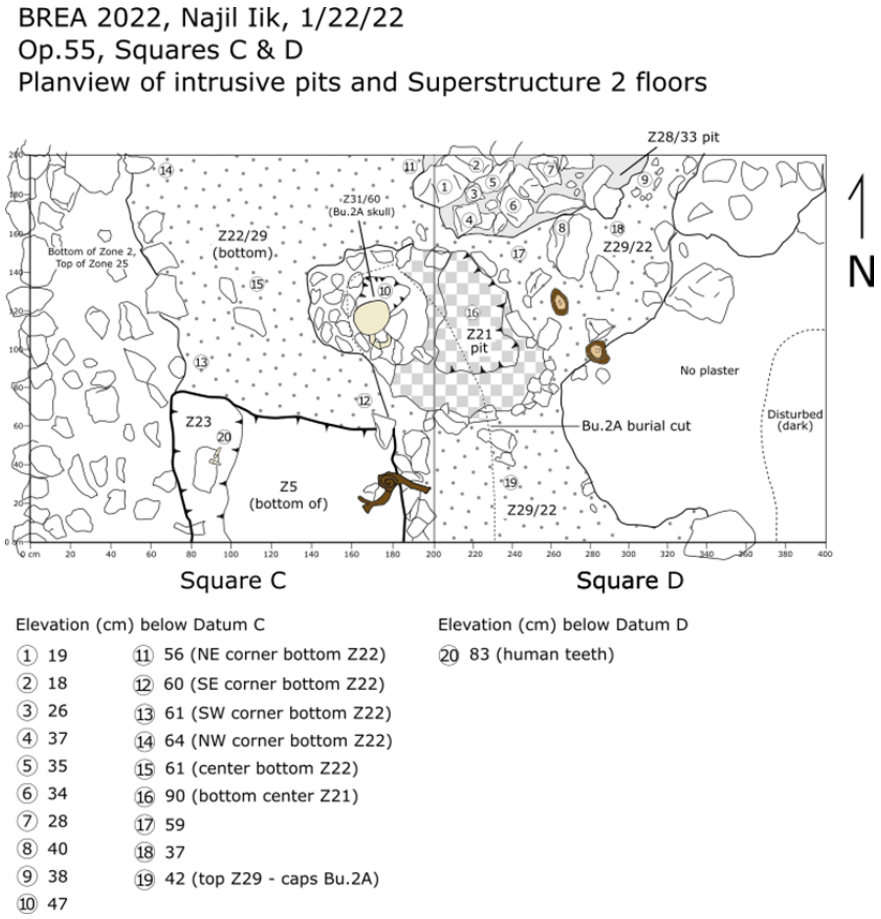


Figure 5.14 Planview of Squares C and D showing the Superstructure 2 Floor (Zones 22/29) and several intrusive pits associated with the latest superstructure that disturbed this earlier context, including Zones 28/33 Pit and the Zone 21 Pit, which disturbed the upper torso of Burial 2A (Zones 31/60). Also shown is the bottom of Zones 5/23, a pit associated with the latest superstructure representing a possible burial deposit (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zones 28/33/37/39 Intrusive Pit (Squares D, G, and H)

These zones were ultimately deemed part of a large tree disturbance that cut intruding into the first two phases of the superstructure. This large amorphous pit spread across the northwestern corner of Square D, the southeastern corner of Square G, and the southwestern corner of Square H **(Figure 5.15**). This pit was originally found in Square D during the January 2022 season and was one of the reasons for opening Squares G and H in the Summer 2022 season. The pit was easily discernible from the surrounding matrix due to a concentration of cobbles and boulders. However, the overall paucity of artifacts and human remains suggest it

was likely a natural pit from tree and root activity. Zone 28 represents the portion of the pit excavated only in Square D. Zones 33, 37, and 39 were within Squares G and H and were arbitrary zone designations for vertical and horizontal control.

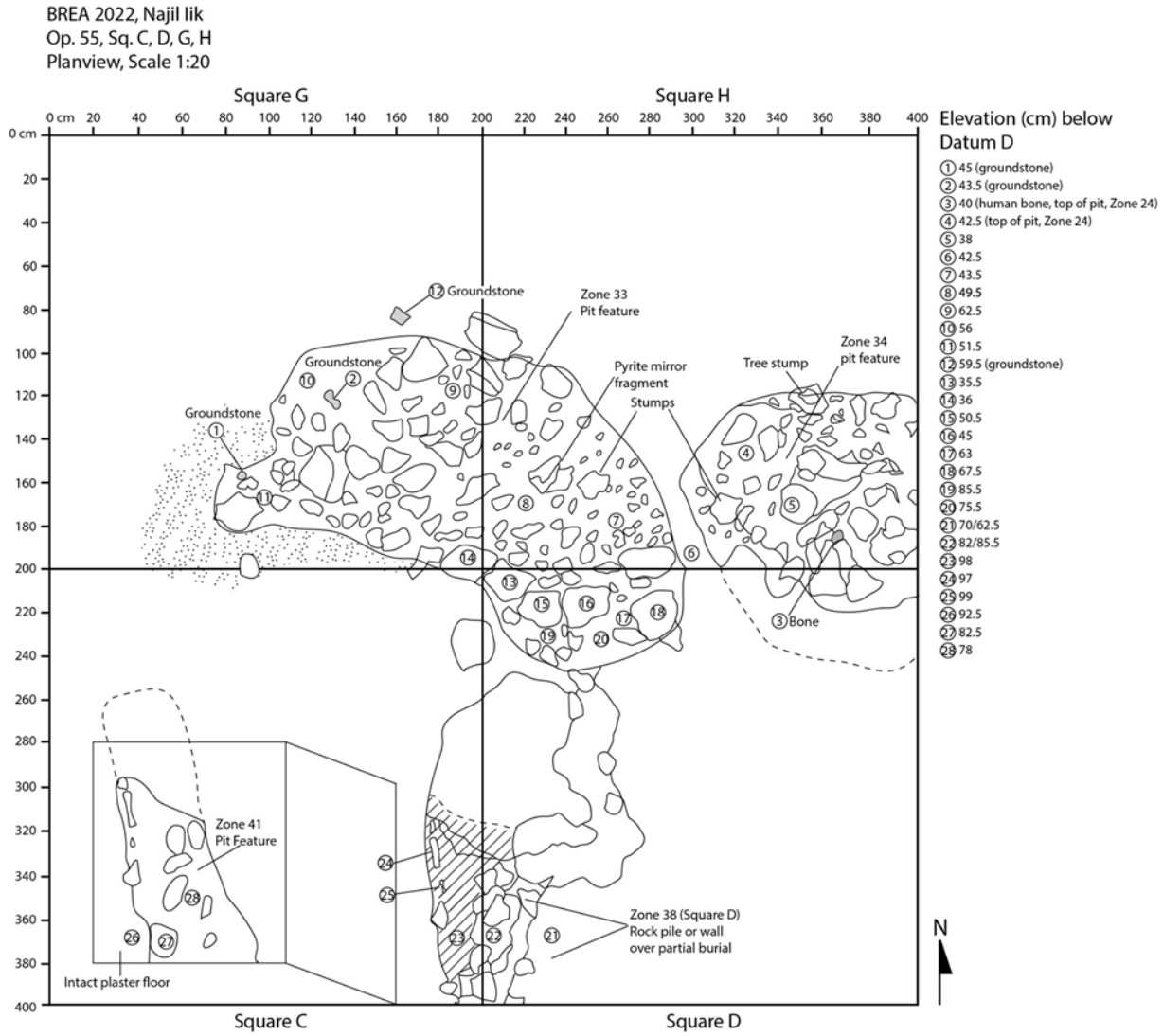


Figure 5.15 Planview of Squares C, D, G, and H showing the 'Zone 33 Pit Feature' (left) and the 'Zone 34 Pit Feature' (right) (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zone 28

Zone 28 in Square D was the southern extent of the large amorphous pit (Zones 28/33/37/39). It abutted the Zone 21 pit which lay southwest. The pit was filled with irregularly shaped (possibly cut) limestone rocks and boulders, measuring 12-30 cm in diameter with inclusions of smaller (6-10 cm) cobbles. This matrix was a very dark grayish brown (10YR3/2) silty loam. Very few artifacts were found within Zone 28 and included chipped tool fragments and potsherds.

Zone 33

The Zone 33 pit in Square G was delineated from the surrounding matrix that it intruded into (Zone 32) by its stark concentration of cobbles (**Figure 5.16**). Below the initial "cap" of cobbles, there were very few cobble or larger rocks, but contained pebbles throughout. The matrix was relatively compact and was a very dark grayish brown (10YR3/2) clayey silt. There were very few artifacts in Zone 33 but the zone included lithic debitage and ceramic rims and sherds.

Zone 33 in Square H contains the same matrix seen in Square G. An initial layer of cobbles gave way to a more pebbly and compact matrix of very dark grayish brown (10YR3/2) clayey silt. However, Zone 33 in Square H contained more cobbles within the matrix than in Square G. A light artifact density was represented by lithic debitage and ceramic rims and sherds.

For vertical control, Zone 33 was ended arbitararily in Squares G and H after about 20 cm and changed over to Zone 37 and then after another 20 cm changed to Zone 39. However, these zones all the same large pit feature, which once complete was deemed a natural tree disturbance. For the sake of simplicity, it is referred to below as the "Zone 33 Pit."



Figure 5.16 Zone 33 pit feature (looking south) defined by a concentration of cobbles in Squares G (right) and H (left) (photo by J. A. Biggs).

Zone 37

Zone 37 in Square G was a continuation of pit fill directly underneath Zone 33. The matrix is similar to Zone 33, slightly darker with a high density of cobble inclusions that distinguished it from the surrounding packed clay floor surface (Zone 32).

Zone 37 in Square H was a continuation of the Zone 33 pit fill seen in Square D. Its matrix is virtually identical to Zone 33 above and to the Zone 33/37 matrix in Square D with the exception that there were fewer small sized cobbles. Artifacts were light within this zone. However, two hematite mirror tesserae were found within this zone and were likely from the Burial 1A individual where other mirror-related artifacts were found (see further below). Since it is thought that this pit is natural (i.e., tree disturbance), it should not be surprising that there was vertical movement of artifacts from below deposits/burials. Additionally, a few human remain fragments were discovered in this zone, also possibly associated with one of the individuals in the Burial #1 multiple interment.

Zone 39

Zone 39 represents the third and final arbitrary zone of the "Zone 33 Pit" within Squares G and H. In Square G, Zone 39 continued with the same matrix as seen in the above two zones (33 and 37). The artifact density was light and included lithic debitage, ceramic sherds, and a few human remain fragments. Additionally, a large flagstone was exposed in the northern extent of the pit in this zone (seen in **Figure 5.17**). Originally thought to have been a potential capstone placed atop the head of an individual in a possible burial pit, the flagstone was drawn and removed, revealing a dense, light gray matrix which represents the fill associated with the superstructure of Structure 1. This matrix was then uncovered throughout the rest of the pit/zone in Square G and was determined to be the bottom of the pit and indicated that this pit was the result of tree activity and not a burial interment. Additionally, this large "capping stone" was in line with the other large 'flagging stones' to the north (see **Figure 5.13**).

Zone 39 in Square H yielded the same matrix as in Square D, Zones 33 and 37. It was ended when the same compact light gray clay was discovered in Square G.



Figure 5.17 The 'Zone 33 Pit' mid-excavation. Note one of several flagstones that appears to be part of the superstructure just above the North arrow (photo by J. A. Biggs).

Zone 42 Intrusive Pit Feature (Square D)

This zone was a mostly circular, though somewhat amorphous pit feature located just south of the large 'Zone 33 Pit', in the northwest corner of Square D (**Figure 5.18**). This pit was discovered when an excavator went too far down into this area and discovered the outline of the previously unknown pit. This pit was essentially within and possibly part of the southernmost extent of the 'Zone 33 Pit'. However, it had definite boundaries and was a relatively deep pit (~32 cm) and contained little other than ceramic rim sherds and cobbles (measuring ~10-20cm) at the bottom. Its size resembles a large posthole, but it is unknown if this pit is cultural or natural given the paucity of artifacts found within it.

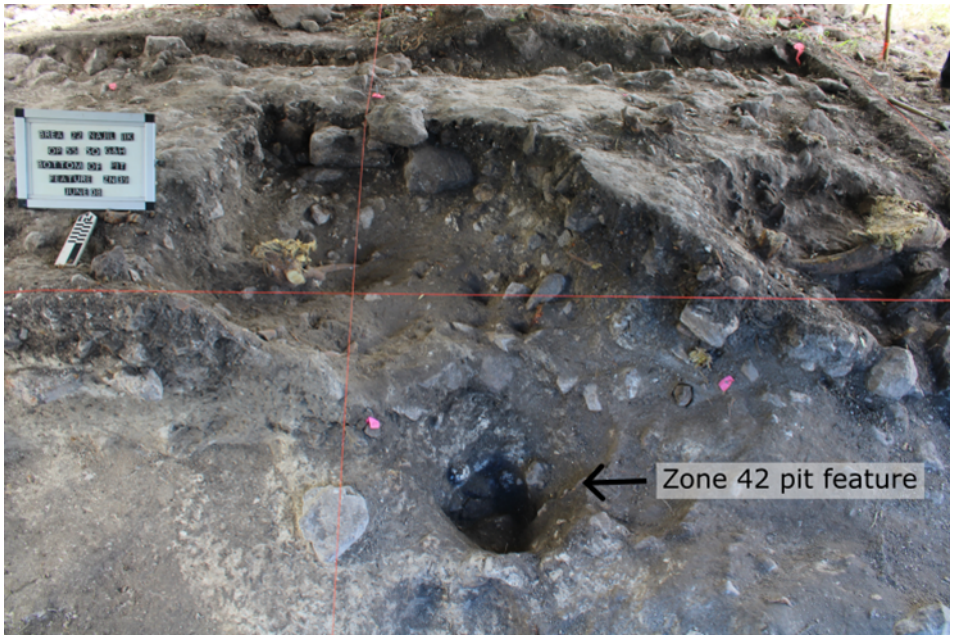


Figure 5.18 End of Zone 39 (within the Zone 33 Pit Feature) and Zone 42 Pit Feature to the south (photo by J. A. Biggs).

Zones 34/40/55 Intrusive Pit (Squares D, H, and I)

Like the "Zone 33 Pit", the Zone 34 pit was arbitrarily broken into additional zones for horizontal and vertical control, but all represent a single feature that is likely natural tree disturbance. Originally, the "Zone 34 Pit" was thought to have been partially within the northern portion of Square D (already excavated as part of Zone 2 in the January 2022 season) and within the southeast corner of Square H (**Figure 5.15 and 5.19**). Further excavation/delineation of this pit showed that it extended farther east than Squares D and H, thus Square I was opened up in order to fully encapsulate the "Zone 34 Pit."



Figure 5.19 Top of the 'Zone 34 Pit' in the southeast corner of Square H characterized by the outlined concentration of cobbles (photo by J. A. Biggs).

Zone 34

Zone 34 in Square H was similar to the "Zone 33 Pit" seen to the west. It was a clearly visible area of cobbles surrounded to the north and west by the Zone 32 floor. This uppermost layer of the pit was a dark (10YR3/2) color, clayey silty in texture, and contained inclusions of fist-sized cobbles. Artifact density was light and included ceramic sherds and lithic debitage. It was arbitrarily ended after about 10 cm throughout, after which a new zone was assigned (Zone 40).

Zone 34 in Square I was similar to that in Square H. However, many of the cobbles that demarcated the pit were visible in the surface, meaning that no true Zone 1 or 2 were covering the uppermost levels of the pit fill. Apart from this, the matrix and artifact density was like that of Zone 34 in Square H.

Zone 40

Zone 40 in Square H was the continuation of the "Zone 34 Pit" and had the same soil color (10YR3/2) and texture (clayey silt) as in Zone 34. The artifact density in Zone 40 was similarly light compared to Zone 34 in Square H. This zone was ended with the appearance of the same compact, light gray clayey matrix in the west, and with a drastic change in soil texture and color. The soil became much lighter in color and was much finer with fewer inclusions. This new zone was given the designation of Zone 54 and was originally thought to be a cache but was later determined to be a multi-person interment (Burials 1A-1D; see discussion below).

Zone 40 in Square I was also similar in soil color and texture to that of Zone 34. However, this zone had fewer cobbles within the matrix than in Square H and was ended at a higher elevation than in Square H (by ~8 cm) due to the appearance of the light gray clay layer. As this clay layer was defined, it became clear that there was likely a tree in Square I at some point in the past that disturbed the area and created a depression that was similar in appearance to a pit.

Zone 55

Zone 55 was a small area on the east side of the "Zone 34 Pit" that was discovered while defining the Burial 1 multi-interment cut. The matrix here does not resemble the much finer and lighter soil within Burial 1 but is similar in color and texture to Zone 40 (and 34). This zone was separated out as a precaution and should be thought of as a missed remnant of Zone 40 in Square H. Overall the artifact density was light and mostly consisted of body sherds.

Zone 21 Intrusive Pit (Squares C & D)

Zone 21 was an intrusive pit that spanned the northeast portion of Square C and the northwest portion of Square D and underlay Zones 18 and 19 (**Figure 5.12**). Irregularly cut limestone boulders (20-40 cm in size) were located on the north side of the pit. The matrix was a dark 10YR3/2 and very soft near the top of the pit, but gradually changed to a 10YR4/2 semi loose clay loam that became siltier towards the bottom. While lithic debitage, animal bone, and human bone were found within the pit fill, the overall paucity of artifacts suggested that the Zone 21 pit was not cultural, but the result of a tree.

Additionally, the pit appears to have disturbed the torso of a buried individual (Burial #2A, Zone 60, Squares C, D, and J), separating the skull (Zone 31, Square C) from the rest of the body (**Figure 5.26**). This was initially interpreted as an isolated skull deposit (Zone 31) at the end of the January 2022 season. Skeletal elements found within the Zone 21 pit fill were able to be reassociated with both the Zone 31 skull and postcranial bones from the disturbed Burial #2A, discovered during the Summer 2022 season. Thus, the likeliest scenario is that Burial #2A was once a primary burial that was then disturbed by a tree, displacing remains from the torso and

separating the skull from the rest of the body, giving the appearance of an isolated skull pit. Zones 31 and 60, associated with Burial #2A, are discussed below.

Zone 47 Intrusive Pit and Possible Disturbed Secondary Burial/Deposit (Square J)

Zone 47 was an intrusive pit in the western half of Square J. The pit was not fully encapsulated by the square, with the western and southern portions extending beyond the Square J boundaries (**Figures 5.4 and 5.20**). This pit had a very dark grayish brown color (10YR3/2) with a loose clayish silty texture. This pit appeared to have cut into the terminal/latest living surface in Str. 1 (Zone 32 in most squares but Zone 49 in Square J, described above) as evidenced by a 50 cm strip of Zone 49 running N-S down the middle of Square J with another pit (Zone 48, discussed below) on the eastern side of Square J. The Zone 47 pit initially was thought to be too wide to be cultural, measuring around 1 m in diameter and was around 30 cm at its deepest point, suggesting it may be the result of tree activity. Additionally, the paucity of artifacts (which included human skeletal remains, pottery sherds, and a chipped tool) indicates a natural pit rather than an intentional deposit.

However, it is possible that a secondary burial may have been located here at one time based on the presence of adult human remains. Though not very numerous, remains of adult long bones, teeth, and cranial fragments suggest that a secondary burial with a few elements may have been in/near this location at one time, but was then disturbed by tree activity. This theory is also supported by the discovery of a broken vessel and associated infant skeletal remains (Zone 51) that were clearly disturbed by humans and moved (a nearby deposit designated as Zone 52).

Thus, the scenario could have been that there was an underlying burial/deposit (Zone 51 – associated with an earlier phase of the structure) that was then disturbed during the digging and placement of a secondary burial (and possibly perishable items that did not preserve) that included adult skeletal remains. At a later point in time, after the site was abandoned, a tree disturbed the overlying Zone 32/49 floor and the possible secondary burial or cache, creating the large Zone 47 pit that was seen during excavations. The actual series of events may never be fully known, but this explanation can explain some of what was discovered during excavations.

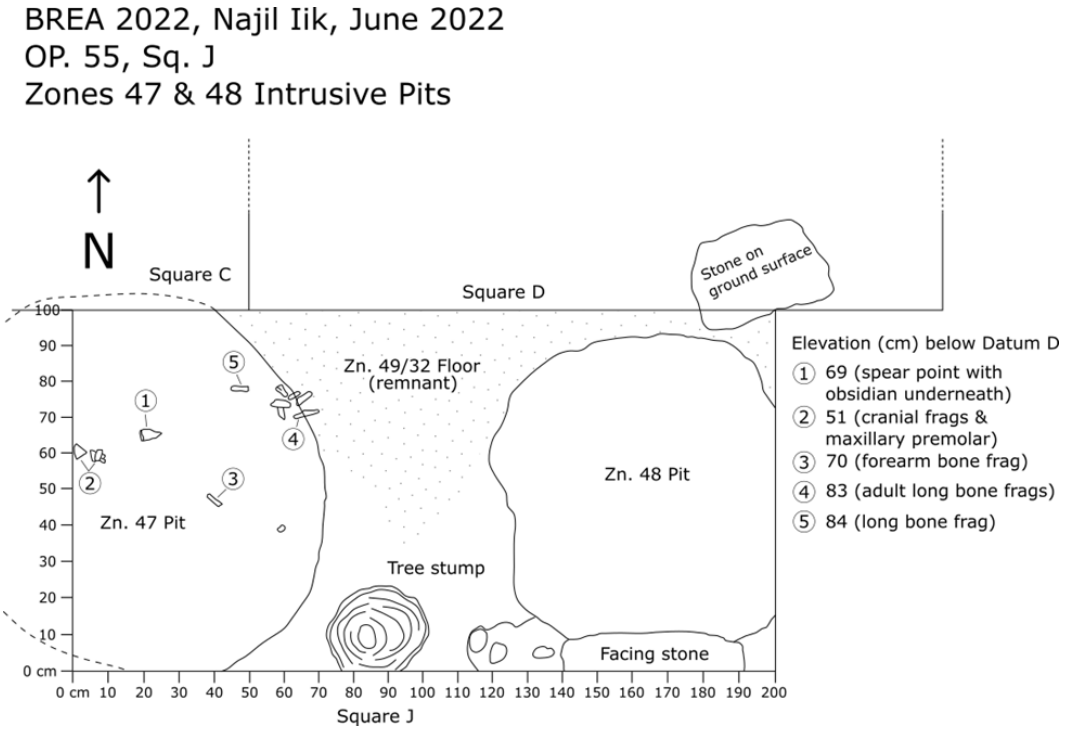


Figure 5.20 Planview of Zones 47 and 48 in Square J (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zone 48 Intrusive Pit (Square J)

Zone 48 was a pit of near equal size in Square J as the Zone 47 pit, and was located on the eastern half of Square J. Similarly to the Zone 47 pit, the Zone 48 pit cut into the latest floor surface (Zone 32/49) and was not fully captured by Square J, extending east outside the square boundary (**Figure 5.20).** However, the northern, western, and southern edges were captured within the Square. The southern edge of this pit was bounded by a long cut stone (approx. 50 cm in length) that ran along the southern edge of Square J and extended south beyond the square. This stone possibly demarcates the southern edge/wall of the superstructure, as there is a steep drop on the southern side of the mound not far from this stone.

This pit also intrudes slightly into a lower zone, Zone 52. This Zone 52 deposit is closely associated with Zone 51 and will be discussed together below. The Zone 48 pit did not disturb the underlying Zone 52 deposit as with the Zone 47 pit and the underlying Zone 52. The matrix is a loose and very dark grayish brown (10YR3/2) with a clayish silty texture. Not as many artifacts in Zone 48 were recovered as in Zone 47 (which was still sparce) and included pottery sherds and lithic debitage. The overall size (approximately 90-95 cm diameter), shape, and shallow depth (about 30 cm) of the pit suggests this was a natural/tree pit, similar to the Zone 47 pit (without the possible secondary burial before intruding into the Zones 51/52 deposits).

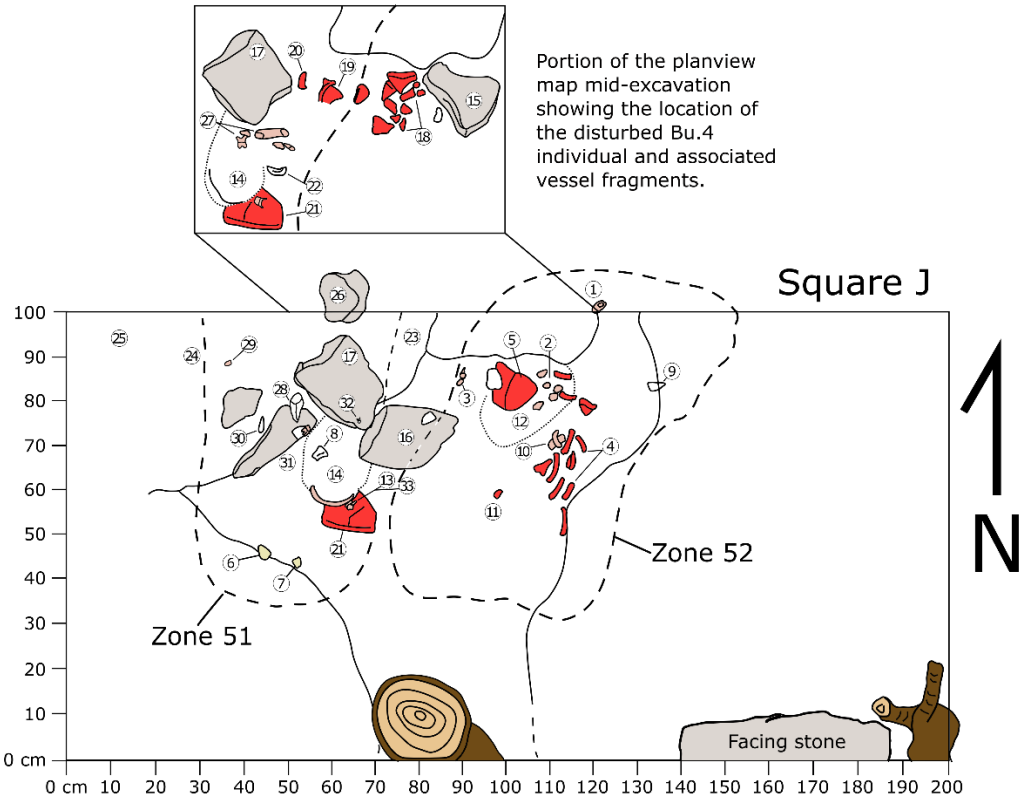
Zone 65 Mixed Context Between Zone 47 Intrusive Pit and Zone 51 Infant Burial (Burial #4) (Square J)

Zone 65 is a very small zone on the western edge of Square J that was designated late in the Summer 2023 season. This zone is a mix of the Zone 47 pit matrix and the underlying Zone 51 (infant burial – Bu.4) matrix. There is no true boundary of this zone, but it had a semi-compact silty clay texture with a grayish brown (10YR5/2) color, which represents a mixing of the darker Zone 47 soil and the lighter Zone 51 soil. The artifact density was light and included pottery sherds and human skeletal remains from both an adult and from an infant. This is not surprising as the boundary between Zones 47 and 51 were not clear as this zone demonstrates.

Zone 51 and 52 Disturbed Infant Burial and Redistributed Items (Square J)

Zones 51 and 52 occupy a confusing place within the history of this structure. These two zones were distinguished by a change in soil color and texture below the Zone 47 and 48 intrusive pits. They represent both an earlier infant burial (Bu.4) and later activity that disturbed the burial. As will be discussed in greater detail below, the Bu.4 infant burial was part of a complex interment episode and is associated with Phase 2 of the structure and with an adult burial (Bu.2A). However, sometime during the occupation of the structure after Phase 2, this infant burial space was perhaps accidentally disturbed during a later deposition event. Upon breaking into and through the infant remains and their associated vessel, it appears that a second pit was dug just west of the original location. A few infant bone fragments and most of the vessel sherds were collected from the original area (Zone 51 to the west) and redeposited in the newly dug pit (Zone 52 to the east). Additionally, some of the vessel sherds were not haphazardly mixed in with the Zone 52 matrix, but were intentionally stacked vertically with the rims facing up (**Figures 5.21, 5.22, and 5.23**). This suggests that care and respect were given when redepositing these sherds.

BREA 2022, Najil Iik
Op. 55, Square J
Bu.4 (Zone 51) & Redistributed Bu. 4 remains
and Kik style vessel fragments (Zone 52)
Scale 1:10



Elevation (cm) below Datum D

① 68 (infant petrous portion)	⑫ 67 (cranial cluster)	㉓ 76
② 59.5 (infant cranial frags.)	⑬ 75 (tooth)	㉔ 77
③ 60 (deciduous tooth & frags.)	⑭ 73 (cranial cluster)	㉕ 67
④ 56 (upright sherds)	⑮ 64.5	㉖ 69.5
⑤ 59 ("overturned" body sherds)	⑯ 66	㉗ 73 (misc. infant bones and tooth)
⑥ 74 (longbone frag.)	⑰ 63	㉘ 76 (worked chert)
⑦ 74.5 (misc. bone frag)	⑱ 66 (basal sherd cluster)	㉙ 73.5 (tooth bud)
⑧ 64 (chipped tool frag.)	⑲ 68 (basal sherd)	㉚ 72 (adult long bone frag)
⑨ 62	⑳ 75 (sherd)	㉛ 73.5 (adult tooth and maxillary frag.)
⑩ 66 (infant long bone)	㉑ 78 (large sherd - in situ)	㉜ 86 (deciduous tooth under rock)
⑪ 57 (long bone frag)	㉒ 72.5 (shell frag)	㉝ 83 (tooth under the 13 tooth)

Figure 5.21 Planview of Zones 51 and 52 in Square J (drawn by E. Harrison-Buck; digitized by J. A. Biggs).



Figure 5.22 Zone 52 outlined in Square J. Note the upright rimsherds stacked in the middle of the pit (photo by J. A. Biggs).



Figure 5.23 Oblique view, looking east, of the upright sherds in Zone 52, Square J (photo by J. A. Biggs).

Zone 76 Intrusive Pit (Square J)

This zone is likely a tree pit located within the southwestern corner of Square J (**Figures 5.24 and 5.32**). Due to the complex nature of this particular area of Square J, the Zone 76 pit was not identified until later in the Summer 2023 season. Although it is deep and punched through the Phase 2 floor and construction fill in Square J (Zones 69 and 71, respectively), it occurred after the Phase 2/Superstructure 2 was present. It was designated due to the presence of large irregularly shaped stone (up to 30 cm) that formed about ¼ of a circle/arc that went into both the southern and western walls of Square J. The matrix in the pit was a semi-compact dark grayish brown (10YR4/2) sandy loam. Due to the darkness of the soil and the small amount of artifacts—a few pottery sherds—it was determined that this was not a cultural pit, but the result of tree activity. The large stones continued throughout the extent of the pit, which also separated the small amount of Zone 69 and 71 floor and floor fill, respectively, along the southern edge of Square J from the Zone 74 and 75 possible earlier secondary burial pits/deposits (discussed later). Since this pit bisected these two areas, it is likely that it may have contributed to the slightly darker soil of Zone 74 and also disturbing any number of the floors or burials in this area. This zone was ended when a lighter matrix was encountered, although still darker than the matrices seen in the nearby burials.

Phase 2 – Superstructure 2 and Associated Deposits from Penultimate Phase of Str. 1

Superstructure 2 is the designation given to the peniultimate (second to latest) exposed phase of Str. 1. The focus of the excavations shifted mostly to within the superstructure for the remainder of the seasons. Thus, the majority of the zone designations described below are within the superstructure. Additionally, there is (unsurprisingly) better preservation of floor surfaces and associated deposits within Superstructure 2 and the earlier phases. Though this should not suggest that there were no intrusive pits nor mixed contexts within the earlier phases of construction as this is very much not the case.

Zone 22/29/56/69 Phase 2/Superstructure 2 Floor (Squares C, D, J); Zone 25 Wall Retaining Zone 22 Fill (Square C)

The penultimate floor surface of the superstructure was originally identified in Square C as a poorly preserved plaster floor. This is referred to as Superstructure 2. As a precaution, a similar matrix in Square D (that was not connected to that in Square C) was identified and designated as Zone 29; though this was later determined to be the same surface based on elevations. Both of these zones (22/29) were assigned during the January 2022 season. After removing backfill, it was not quite certain if a portion of this earlier identified floor surface was

the same that was identified in the southern half of Square D during the Summer 2022 season and thus, this same surface was given a new number (Zone 56). As above, it was later confirmed that this was indeed all the same floor that was identified the previous season. Lastly, Zone 69 was assigned in the Summer 2023 in Square J and was found to be the equivalent of the Zone 22 surface seen in the southern wall of Square C into Square J. Thus, Zones 22, 29, 56, and 69 should all be thought of as the same floor surface that was separated between squares as a result of time (between seasons), poor preservation, and stratigraphic breaks due to multiple intrusive pits. Collectively, this floor surface has mostly been referred to as the 'Zone 22 Floor' and generally referred to in this way here or as Superstructure 2 Floor. Lastly, a poorly preserved retaining wall (Zone 25) identified within Square C appeared to retain the Superstructure 2 Floor and will be discussed in this section as well (see **Figure 5.14**).

Zone 22

As mentioned above, Zone 22 was the penultimate floor surface of Superstructure 2 identified within Square C. This zone was below Zone 19 (the construction fill for the latest living surface in the superstructure) located and only preserved in the northeastern and southeastern portions of the square and represented by plaster and sascab. Towards the top of the zone, the matrix consisted of patches of light gray silt (10YR7/2) with white flecks and very light mottling of dark brown (likely leeching from zones above). This mottling was only seen in the upper centimeters of the zone, after which the matrix was a consistent 2.5YR7/2 silt with gravel and a few cobbles. Unsurprisingly, very few artifacts came from this zone as it was the plaster floor surface, but contained a few animal bone fragments, lithic debitage, and pottery sherds. Lastly, and as discussed previously, the Zone 21 intrusive pit cut into and through the Zone 22 floor on the eastern edge of Square C.

Zone 25

Zone 25 was only in Square C and consisted of a N-S line of roughly hewn cobbles (~10-15 cm long) around the same elevation as the Zone 22 floor. This line of stones was found in the western portion of Square C, with the Zone 22 floor found only east of this. Therefore, it is likely that the Zone 25 stones retained the Zone 22 floor, but it is not certain if this was an interior wall or an early exterior wall. The latter is unlikely given the size of the stones, but the architecture on the structure has been seen to be both minimalist and ephemeral in some areas. The matrix was a very loose silt (2.5YR7/2) although the southern portion was slightly darker (10YR5/3), likely due to both the Zone 5 pit (which was above this area) and tree disturbance as evidenced by large roots directly south of the square.

Zone 29

Zone 29 was in Square D and was the remnant portion of the "Zone 22 Floor" identified in Square C that was under Zone 18 (the latest living surface construction fill). It was located south and east of the Zone 21 intrusive pit that also affected Square C. The zone also extended slightly to the north where some boulders were visible which were part of Zone 28 (a portion of the "Zone 33 Pit" discussed earlier). Along the southern edge of Square D, near the border with Square C, a compact cluster of cobbles were revealed while excavating Zone 29. These stones ran roughly N-S, similar to those in Zone 25, and were originally thought to be another interior wall. However, subsequent excavations revealed that these were capping stones overlying Burial #2 (Zone 38). No true, flat living surface for this zone was identified; rather, the zone was comprised of uneven and undulating white powdery plaster/sascab. Zone 29 was only partially excavated in its southern portion, where inclusions consisted of cobbles. The matrix in this zone was a slightly darker color than that seen in Zone 22 in Square C, and was a pale brown silt (10YR6/3). However, elevations of Zones 22 and 29 indicated they were part of the same surface.

Zone 56

Zone 56 was located on the southern and southeastern portions of Square D. It was determined in the Summer of 2022 that this was likely the same Zone 29 (and also Zone 22) floor identified during the January 2022 season, but was separated out as a precaution. This was a small zone that was excavated in order to reveal stratigraphy against the boundary between Squares D and J (directly south). Some of this zone was also taken down in the eastern part of the square, where a posthole was discovered, about 20 cm in diameter, and represented a footprint of the perishable structure on Superstructure 2. Additionally, a cluster of cobbles against the southern half of the east edge of Square D was identified and was thought to be a potential pit. This was designated Zone 46, as it was discovered during a clean scrape of the unit before actual excavation of Zone 56 began, and is discussed below. The matrix was a grayish brown (10YR5/2) silt with cobbles throughout. The artifact density was light and included pottery sherds and human remains.

Zone 69

Zone 69 was identified within Square J only and represented the continuation of the Zone 22 floor in Square C (**Figure 5.24, 5.32;** see also **Figures 5.34 and 5.36**). It existed only within the northwestern corner and along the southern edge of Square J on the west side. This is likely due to the many intrusive pits within Square J, but also the presence of three interments (Burials 2A, 2B, and 4) that are mostly within the western half of the square. The matrix was a semi-loose clayish silt and a brown color (10YR5/3). While this is darker than the much lighter color seen in Square C, this area was affected by trees and the overlying Zone 47 pit which was very dark in color. We also determined that this was the same surface as Zone 22 since it was directly

and physically connected, i.e., the Zone 22 stratum seen along the south wall of Square C was followed and continued south along the western wall of Square J, but was given the designation Zone 69. Only a few pottery sherds were found in this zone.

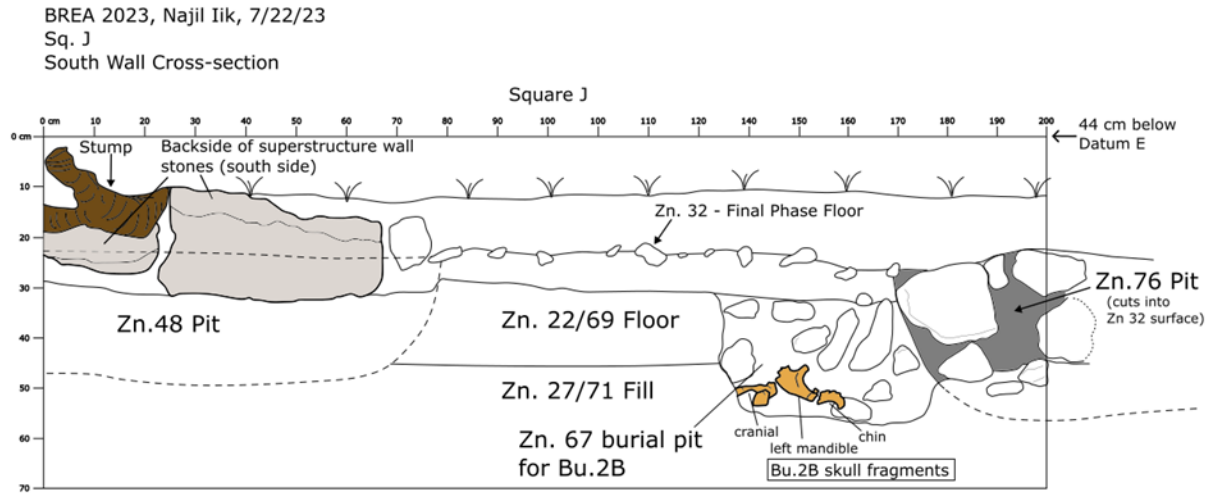


Figure 5.24 Profile of the South Wall of Square J (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Zones 27/59/71 Construction fill for Phase 2/Superstructure 2 Floor (Squares C, D, and J)

Zones 27, 35, 59, and 71 represent the construction fill for the "Zone 22 Floor". Zone 27 was located just under Zone 22 in Square C, Zone 59 was just under Zone 56 (and technically this was Zone 29) in Square D, and Zone 71 was just under the Zone 69 floor surface in Square J. Like with the "Zone 22 Floor", the "Zone 27 Construction Fill" was not present throughout all of the squares due to the many pits and burial features. These zones overlaid the "Zone 50 Floor", which is described below as part of Phase 3 of the superstructure.

Zone 27

Zone 27 was found only within Square C and represented the first identified construction fill layer for the "Zone 22 Floor" (**Figure 5.25**). It was excavated out in a small 1-x-1 m 'punch down' in the northeast corner of Square C. This location was chosen because of the intact floor surface (Zone 22) and because it was at the approximate summit and central axis of the mound, meaning that a special deposit could be located within or under the construction fill that was placed during the construction of Superstructure 2. The Zone 27 matrix consisted of a very loose and fine pinkish white (2.5YR8/2) silt with sascab chunks and a very small amount of cobble inclusions. Excavations stopped on average at 8 cm in depth when a cut (originally thought to be

the Zone 21 cut/pit, but was actually an associated cut labeled Zone 31) was encountered. Only one artifact, a single rimsherd, was found within Zone 27.

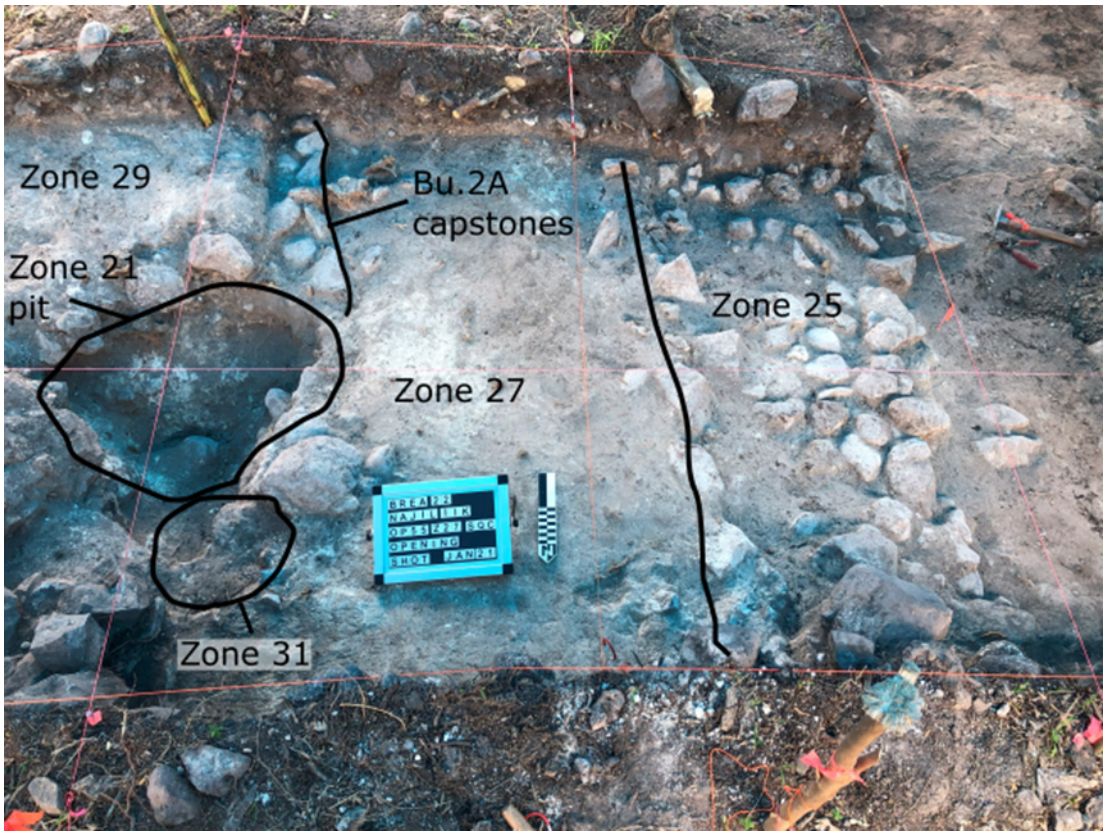


Figure 5.25 Top of Zone 27 construction fill in Square C. Note Zone 25 to the right, demarcated by the N-S line of stones (photo by J. A. Biggs).

Zone 59

Zone 59 was encountered in Square D only and was located directly under the Zone 56 (22) floor surface. Only the southern half of Square D was excavated in order to understand the next floor in the sequence. During excavation of this zone, an infant burial was located in the southeastern portion of the square. Given the designation Bu.3 (Zone 61), this infant burial was squarely within the Zone 59 (27) construction fill (**Figure 5.26**). This burial will be discussed in greater detail below. The matrix of Zone 59 was a very pale brown (10YR7/3) silty clay marl. Artifacts were light in density and included only pottery sherds and human remains (the Bu.3 infant). This zone was not fully excavated due to the presence of the infant burial and the need to shift focus to other areas of the superstructure.

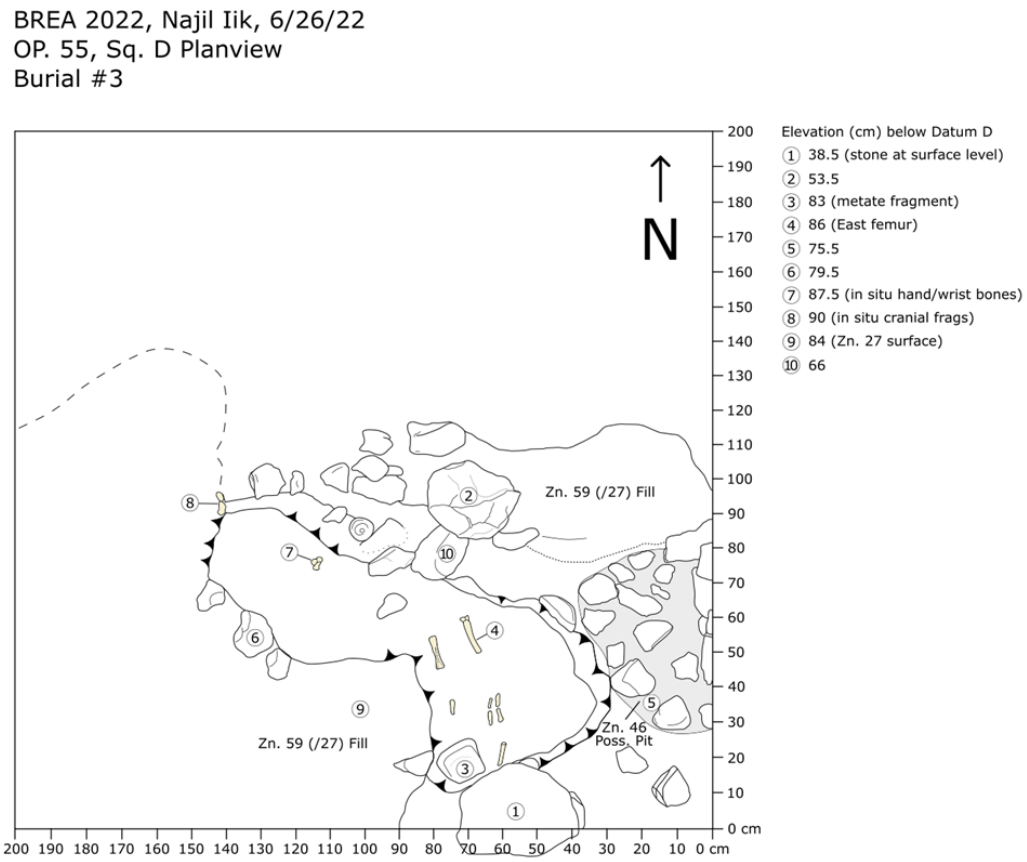


Figure 5.26 Planview of the Bu.3 infant within the Zone 59 construction fill in Square D (drawn and digitized by J. A. Biggs).

Zone 71

Zone 71 was the Zone 27 equivalent in Square J (**Figure 5.24 and 5.33**). It is the construction fill associated with the superstructure floor (Zone 69/22) of Phase 2. The fill layer lay directly under the Zone 69 Floor and both occupied a very small area in Sq. J in the northwestern corner and the southern edge of the square, bisected by the Bu.2 cut. The matrix of zone 71 was a pale brown (10YR6/3) fine silty marl with small inclusions of limestone and sascab.

Deposits and Burials Associated with Phase 2/Superstructure 2

Zone 45 Likely Pit Feature (Square D)

Zone 45 was a possible pit feature along the southern half and border of Square D. It was within the Zone 56 (Zone 22 equivalent) floor layer. It was a possible pit demarcated by cobbles. However, the cobbles extended south into Square J into unexcavated territory. This zone remained fully unexcavated throughout all seasons as this level was not reached in Square J by

the end of the Summer 2023 excavations. The matrix in this zone was a semi-compact grayish brown (10YR5/2) clayish silt.

Zone 46 Likely Pit Feature (Square D)

Zone 46 was a likely portion of a pit in the southeast corner of Square D, but just along the eastern edge. It was discovered while doing a clean scrape of the then still unexcavated Zone 29/56 ("Zone 22 Floor") for a photo. The likely pit was characterized by a much darker soil than the surrounding matrix and a clear level of cobbles in a half circle shape, with the rest of the pit presumably extending east into unexcavated territory (**Figure 5.26**). As a result, this pit was defined but left unexcavated. The cobbles clearly place it in association with the the "Zone 22 Floor" although it is uncertain if this pit is cultural or natural. The matrix was a semi-compact dark grayish brown (10YR4/2) clayish silt.

Zones 51 and 52 Disturbed Infant Burial (Bu.4) (Square J)

As discussed above, Zones 51 and 52 were likely two pit and/or burial cut features that were identified within Square J that likely extended somewhat into Square C (**Figure 5.21**). While Zone 52 contained both human remains and potsherds associated with the Bu.4 infant, only Zone 51 will really be discussed here. This is due to the hypothesis that Zone 52 represents a disturbance later in time than the actual interment of the Bu.4 individual, of which only a few cranial fragments and one large potsherd were found in their likely original position at the bottom of Zone 51, within the Phase 2 occupation floor and fill (Zones 22/69 and 27/71, respectively) of the superstructure. Additionally, vessel sherds from the later Zone 52 pit refit with the in situ sherds at the bottom of Zone 51, confirming this was a disturbed earlier burial context. The vessel was reconstructed (**Figures 5.27**); it resembles Kik Group ceramics, placing the vessel and likely the burial within the Terminal Classic Period (Harrison-Buck 2024).

Based on these findings and the complex stratigraphy in this square, we believe the likeliest sequence of events for Bu.4 are as follows. The infant in Bu.4 was buried within the "Zone 22 Floor" living surface in Superstructure 2 at the location of Zone 51. Burial #4 was interred above the feet of an adult individual (Bu.2A) and then the infant was interred in association with the Bu.2A individual, but below the top of the Zone 22/69 floor. At some point after the interment of Bu.4, and once enough time had passed that the presence and/or location of Bu.4 (and Bu.2A) was forgotten, the area was unintentionally disturbed while digging a pit for a new deposit. Once the vessel and infant bones of Bu.4 were found, a second pit (Zone 52) was created to inter the broken bones and vessel fragments; some of the potsherds were placed vertically with their rims facing up and were then covered over. It is not entirely known if the pit that disturbed the infant (the upper portion of Zone 52 that was higher in elevation than the Zone 22/69 floor) was ever finished or if anything was eventually deposited at that time due to the

multiple pits in this area that intruded on one another (Zones 47, 75, and 76, all within the western half of Square J).



Figure 5.27 The reconstructed miniature Bu.4 vessel in the Kik Style of the Terminal Classic. Note the faintly preserved pseudo glyph designs around the outside rim of the vessel (photo by J. A. Biggs).

Zones 21/31/38/41/60/67/70/74/77 Burials 2A and 2B and Associated Burial Construction (Squares C, D, J)

The context that encompasses Zones 21, 31, 38, 41, 60, 67, 70, and 77 is part of a complicated burial that contained at least two individuals. Whether or not these individuals were interred at the same time is not certain. Although Zone 21 was discussed earlier, it is relevant here as it disturbed the individual designated as Bu.2A. Zone 21 was located in Squares C and D, Zone 31 was only within Square C, Zones 38 and 41 were both only in Square D, Zone 60 was in Squares C, D, and J, and lastly, Zones 67, 70, 74, and 77 were only within Square J. **Figure 5.28** depicts the burial cuts.

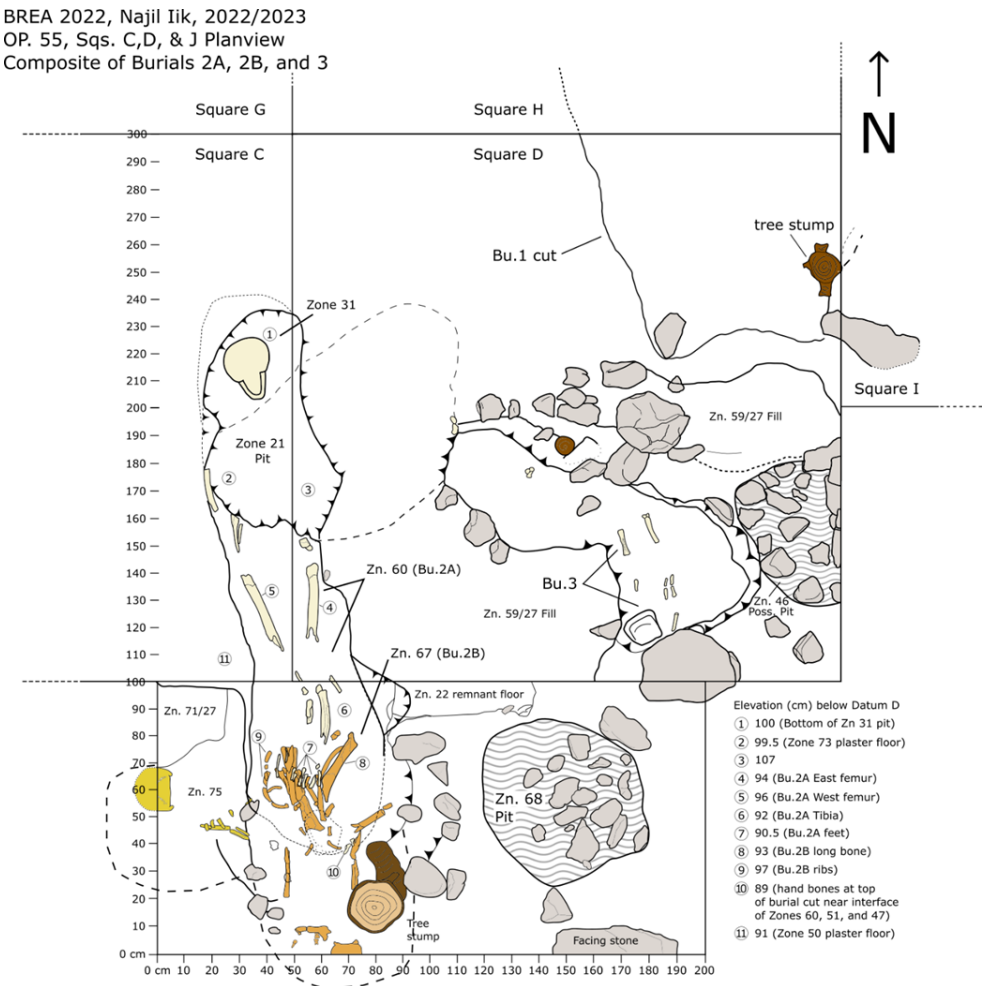


Figure 5.28 Planview of Bu.2A, 2B, and the surrounding contexts within Phase 2/Superstructure 2 construction sequence (drawn and digitized by J. A. Biggs).

Zone 21

Zone 21, located in Squares C and D, was associated with the final phase of construction but is discussed here because as a likely tree pit has heavily disturbed the Bu.2A individual. Most of the torso and upper portion of the hips were either displaced or crushed by the tree activity. This left the skull and just a few cervical vertebral fragments isolated within the Bu.2A cut, such that it appeared to be an isolated skull deposit. The separate skull deposit was discovered on the last day of excavation during the January 2022 season and designated as Zone 31. The fill of this "pit" was a very loose and fine silt with a light gray (10YR7/2) color. No artifacts were found within the boundaries of the Zone 31 pit.

Zone 38

Zone 38 was a mound of cobbles that was exposed primarily along the western edge of Square D, intruding slightly into Square C. It was all removed as part of Square D for ease; **Figure 5.29**). This zone was comprised of cobbles that were slightly larger than fist sized and a matrix that was a very pale brown (10YR7/3) silty clay marl. Originally thought to be a possible footing or interior wall, it was determined that these were the capping/fill stones placed over Bu.2A. To obtain a clean cross section of the area, the zone was arbitrarily extended 50 cm east and 80 cm north.



Figure 5.29 Zone 38 cobble fill/capping stones for Bu.2A in Squares C (left) and D (right) with the outline/cut of Bu.2A (red arrows) and the Zone 21 intrusive pit (blue arrows). Note the exposed humerus fragment in Square C near the boundary with the Zone 21 pit. Square J (bottom of photo) has yet to be excavated (Photo by J. A. Biggs).

Zone 41

Zone 41 was located just below Zone 38 along the south wall of Square D. This zone was dug in order to define the burial pit in the southern half of the square. The matrix was a light gray (10YR7/2) silty clay with cobble inclusions. The artifact density was very light and included only potsherds. This zone was ended when it reached the level of a humerus fragment in Square C, now known to belong to the Bu.2A individual, that was uncovered during a

rainstorm. Excavating down to the level of this humerus also revealed the Bu.2A burial cut seen in Square D which had already been defined in Square C (see **Figure 5.28**).

Zone 77

Zone 77 was likely the southeastern extension of the Burial 2 cut that is characterized by a line of stones running roughly N-S in Square J. These stones are similar to those found during the January and Summer 2022 seasons that were the capping stones that lined the burial space. This zone was separated out as a precaution, but should be interpreted as part of the overall Burial 2 cut, roughly equivalent to Zones 38 and 41. Zones 69/71 were above with Zone 60 (Bu.2A) and 67 (Bu.2B) below. The matrix was a semi-loose pale brown (10YR6/3) fine sandy silt. Very few artifacts came from this small zone, namely just human skeletal fragments.

Zone 60

Zone 60 was the main burial zone for Bu.2A, an adult individual whose primary interment was disturbed by the Zone 21 intrusive pit which destroyed and displaced much of the torso and separated the skull from the lower half of the body (**Figure 5.14, 5.28,** and **5.30**). As mentioned above, a rainstorm initially revealed an in situ right humerus fragment and washed away much of the overlying matrix that were partial remnants of Zones 22 and 27. The little remaining soil in Square C was removed as Zone 27, but did not contain any artifacts.

Zone 60 in Square C captured most of the upper half of the burial cut (except for the Zone 21 intrusive pit). The matrix within Zone 60 of Square C was a loose pale brown (10YR6/3) loamy silt with few inclusions. The elevation of Zone 60 in Square A lines up with that of the Zone 31 skull pit. Moreover, lab analysis of the human remains in the Zone 21 pit reconnect with both the Zone 31 skull and contain the "missing" torso elements that belonged to the Bu.2A individual, thus confirming that the Zone 31 skull definitively belongs to the disturbed Bu.2A individual to the south. Zone 60 in Square C only contained the right humerus fragment and the upper right leg of Bu.2A.

Zone 60 in Square D is a much smaller area and only contains the eastern edge of the Bu.2A burial cut. It had the same matrix color and texture as that in Square C and contained some small pelvic fragments and the upper left leg of Bu.2A.

Zone 60 in Square J is a bit more complicated than it was in Squares C and D. It was located below Zone 51 and the lowest portion of the Zone 47 pit. This is likely due to the presence of capping stones originally identified in Square C and those that were disturbed in Square J by the Zone 47 pit. While the actual burial cut itself was easy to define, its association with the surrounding matrices is much less clear. However, it had the same loose pale brown (10YR6/3) loamy silt seen in Squares C and D. Zone 60 in Square C contained the majority of the in situ bones associated with Bu.2A, namely some of the upper legs, the lower legs, and feet. Based on those bones present, it is clear that Bu.2A was laid extended and supine, likely hands to

the sides, with their head slightly west of north, in line with the orientation of the superstructure. This zone in Square J is complicated by the presence of a long bone from a leg (identification still pending) located just east of the lower legs and feet of Bu.2A. This other lower leg bone clearly does not belong to the Bu.2A individual as they had no missing leg bones. This isolated bone (which was subsequently discovered to not be as isolated as originally thought) was given the designation of Bu.2B. As this burial was defined at the end of the Summer 2022 field season, it was covered up until the Summer 2023 season when the full burial (Bu.2A and 2B) could be lifted.

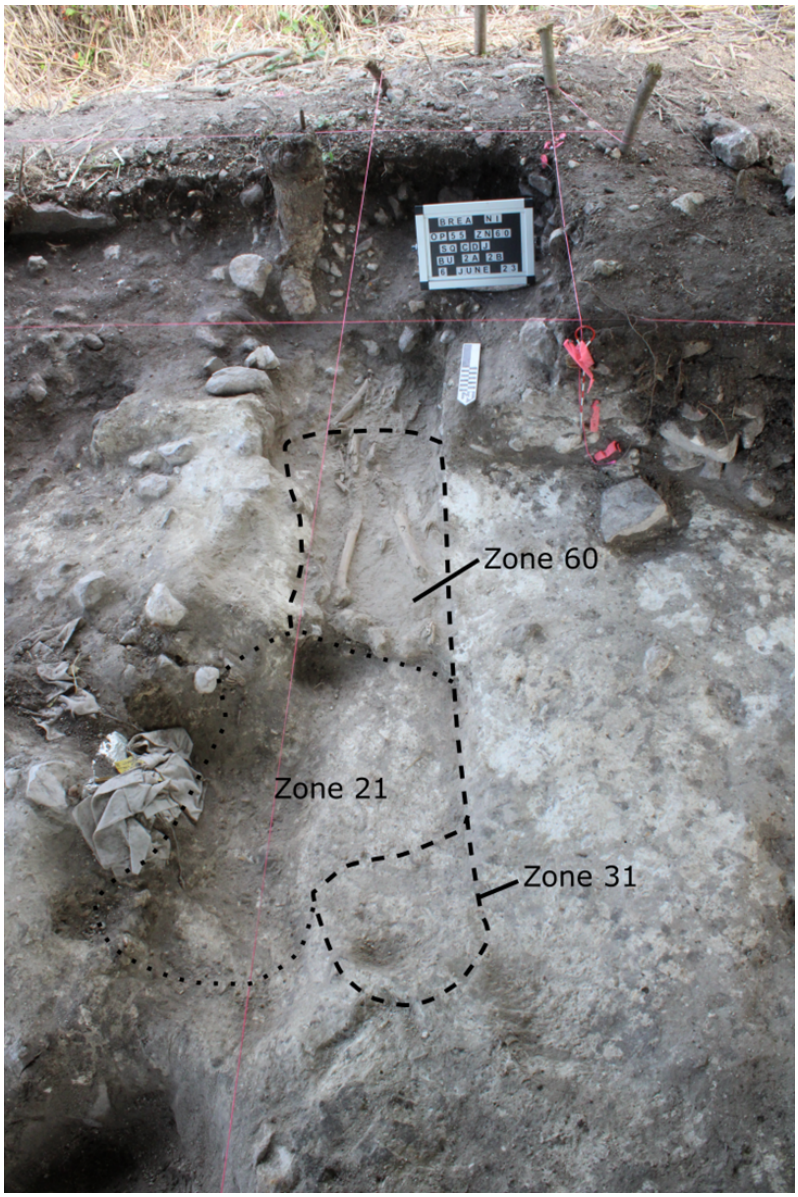


Figure 5.30 Photo showing Bu.2A (Zone 60) mid-excavation with the long bones of Bu.2B exposed just south of the legs and feet of Bu.2A (photo by J. A. Biggs).

Upon its eventual excavation and removal, Bu.2A was clearly interred in a space that cut through multiple phases of Str. 1. These individuals were likely interred during the construction of Superstructure 2 such that those who were digging the burial in the present Zone 27 construction fill intruded into Zone 50 (an earlier phase plaster floor below Zone 27) and into Zone 73 (earliest identified floor surface in the superstructure) before capping Bu.2A with stones and covering it up with the "Zone 22 Floor".

Zone 70

Zone 70 represents mixed contexts and washout from rain. This zone lies within the southern portion in the western half of Square J and over the Bu.2B individual (Zone 67). It is south and southeast of the Zone 69 (floor) and 71 (floor fill) lenses (equivalent to the "Zone 22 Floor" and "Zone 27 Construction Fill" in Square C, respectively). This zone was taken out to further define the Bu.2 cut which extended farther south than anticipated. It was a surprisingly dark color compared to the surrounding matrices (10YR4/3, brown) and had a semi-compact clayey-silt texture, which suggests mixed contexts due to the numerous pits in Square J and the nearby tree growing out of the square's southern edge. Very few artifacts came from this zone, only pottery sherds and human skeletal remains.

Zone 74

Zone 74 was also only encountered within Square J and was underneath the Zone 70 matrix, but above Zone 67—Bu.2B (**Figures 5.31 and 5.34**). This zone was defined based on its lighter soil than the above Zone 70 matrix. Zone 74 was a semi-compact pale brown (10YR6/3) sandy-clay-silt that contained a human tooth, forearm bone fragments, and three rib fragments, all from the southwest corner of the zone and square. Based on their depth, and with the darker soils of Zone 70 right above them, it is possible this also represents mixing of zones due to pit digging and tree disturbance. Another possibility is that this is yet another remnant of an intrusive pit or secondary burial/bone deposit that has been cleaned out and covered up by surrounding matrices and floors, as it was under the Zone 71 construction fill. Unfortunately, the truncated nature of this area within Square J (about 50-x-50 cm) is incredibly complex with numerous soil changes, tree disturbances, and isolated human remains.

Zone 67

Zone 67 is the zone associated with the individual designated as Bu.2B (**Figures 5.31–5.36**). This zone was assigned during the Summer 2023 excavations once it became clear that the isolated leg bone next to (and at the same elevation as) the legs and feet of Bu.2A likely belonged to a separate individual just under Bu.2A in Square J. As such, Zone 67 lies only within Square J and is the burial cut, associated matrix, and human remains associated with

Bu.2B. Zone 67 was designated once the legs and feet of Bu.2A (Zone 60) were removed and a possible capping stone for the lower burial and some long bones were uncovered (see **Figures 5.31 and 5.32**). This capping stone, the surrounding matrix, and the matrix to the south all the way to the southern wall of Square J were in Zone 74 (which was slightly darker in color than the Zone 67 matrix). Zone 67 was a semi-compact very pale brown (10YR7/3) clayish silt.



Figure 5.31 Square J, Bu.2B shown partially covered by remnant capping/fill stones with an underlying bone bundle (photo by J. A. Biggs).

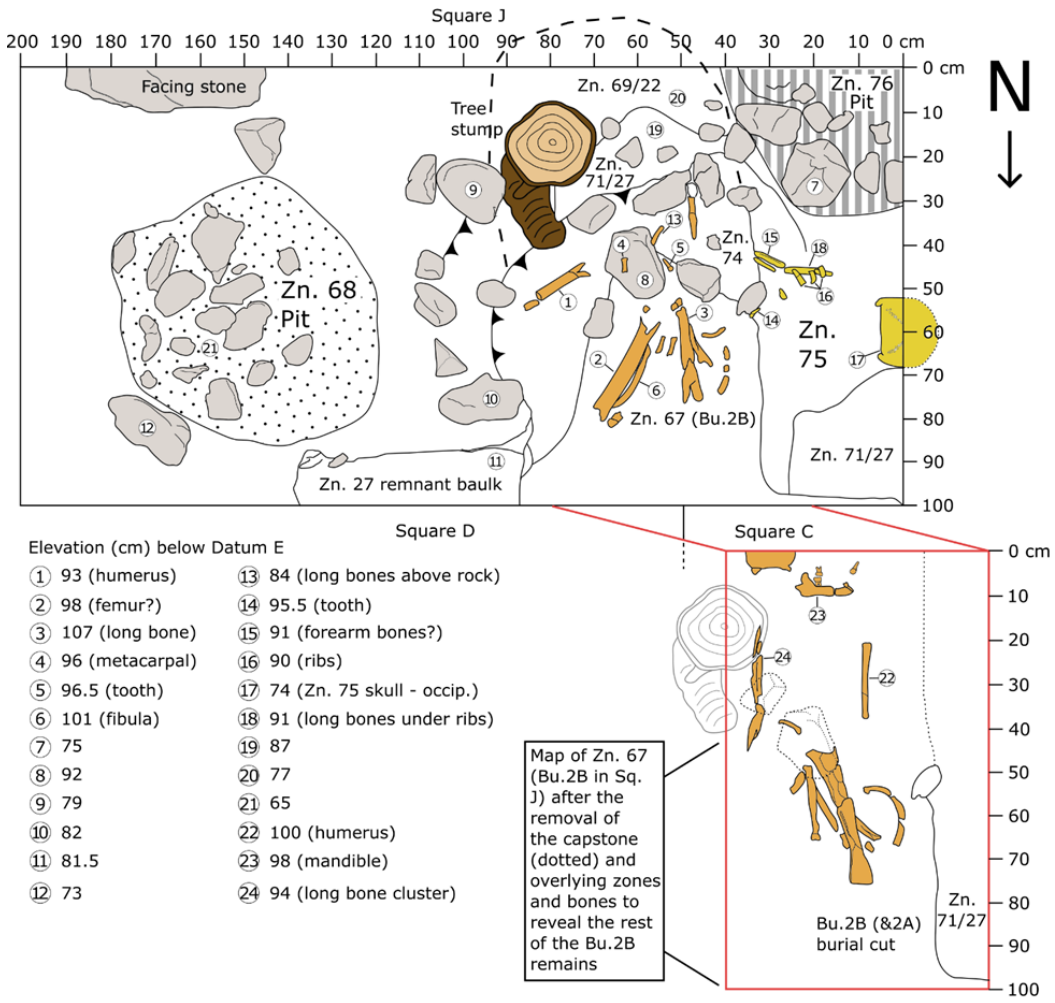


Figure 5.32 Planview of Square J showing Bu.2B and the surrounding zones (drawn and digitized by J. A. Biggs).

This zone was located under the Bu.2A Zone 60 matrix in the northern half of Square J, and Zone 70 and 74 in the southern portion. It was also bounded to the east by a line of stones, yet these were at a higher elevation than the Zone 67 matrix so their association is not well understood. Zone 67 extended all the way to the southern edge of Square J, and unfortunately extended southward into unexcavated territory. Within Zone 67 was a possible capping stone overlaying a bundle of long bones. Once this capping stone was removed, it became clear from the paucity of bones, and their positions within the burial, that Bu.2B was a secondary burial. Most of the bones are missing; those that are present were placed in a "semi-anatomical" position, meaning that some bones were placed in the general area of where they would be if it were a primary burial, but not in the exact position. This made the overall burial very truncated. Unlike Bu.2A, Bu.2B's head was slightly east of south. The cranium and mandible were

seemingly in the correct position (difficult to determine due to the head extending south into the wall of Square J). Only a few rib fragments and one or two very small vertebral fragments were found where the thorax should have been. A humerus was found in the general vicinity of where one would be expected, but other arm and leg bones were bundled together and placed where the pelvic bones should have been. This bone bundle was what the capping stone was partially covering.

Interestingly, there seems to have been no break in the burial cuts between Bu.2A and the slightly lower Bu.2B. However, it is likely that these individuals were not interred in the same event. This was most evident by the presence of the isolated leg bone at the same elevation of the legs and feet of Bu.2A. It is therefore plausible that Bu.2B was interred first as a secondary burial with at least one capping stone. Sometime later, Bu.2A was interred and partially disturbed Bu.2B. Since the feet of Bu.2A only covered the northernmost portions of Bu.2B, it is conceivable that once the Bu.2A burial cut was dug, they encountered some of the secondary Bu.2B burial, displaced one of the leg bones (and possibly some other capping stones) of Bu.2B during the burial event of Bu.2A, and then covered them both up. The near perfect alignment of the Bu.2A and Bu.2B burial cuts could be the result of social memory, such that the location of Bu.2B was known when the Bu.2A burial cut was made, and they were intentionally placed there. Future DNA analyses of these remains could reveal whether any relationship existed between these individuals.

The Bu.4 infant is another interesting piece of this complicated puzzle. As noted before, the high degree of disturbance in the area prevented the elucidation of a clear association of Bu.4 and Bu.2. As per Harrison-Buck's preliminary ceramic analysis (pers. comm.), the Bu.4 infant designated Zone 51 was interred with, in, or covered by a Terminal Classic Kik Group-styled miniature bowl, which was broken by later cultural activity and in the final phase of construction were redeposited in a separate area (Zone 52) to the east (**Figure 5.33**). The Bu.4 infant may have originally been interred over the feet of Bu.2A and over top of a previously used burial space for Bu.2B (see **Figure 5.33** for a breakdown of the proposed burial sequence). In previous BREA excavations, a similar burial pattern was found where a Terminal Classic adult individual was interred with three infants at the site of Chikin Chi'Ha in the middle Belize Valley (see Craig et al. 2016).

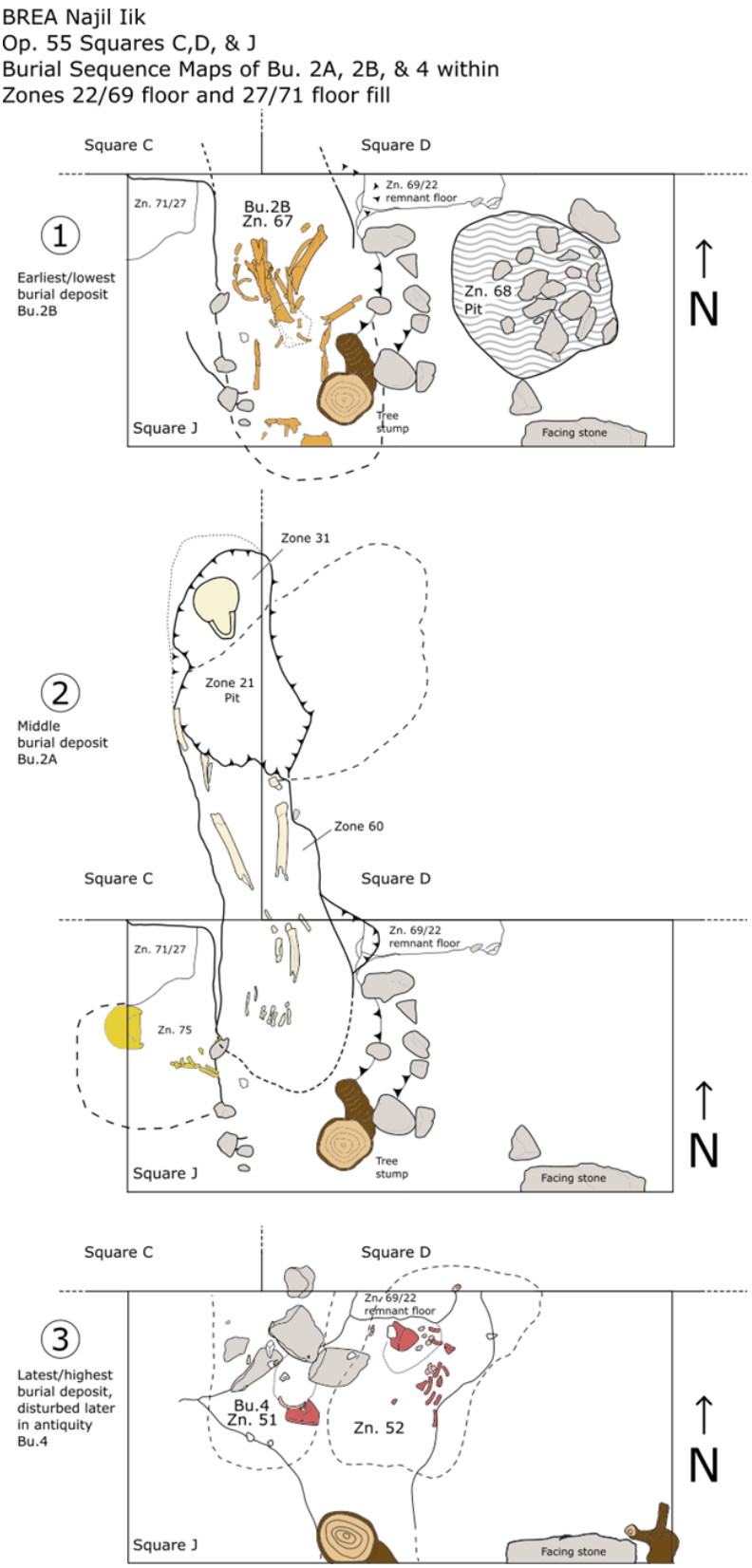


Figure 5.33 Burial sequence for Burials #2A, 2B, and 4 in Squares C, D, and J (drawn by E. Harrison-Buck and J.A. Biggs; digitized by J. A. Biggs).

Zone 68 Possible Intrusive Pit (Square J)

Zone 68 was a circular pit feature that was in the eastern half of Square J (see **Figure 5.28**). It was under the Zone 52 pit feature associated with Bu.4. The entire pit feature is evidenced by numerous fist-sized cobbles (and some smaller) that form a circular shape fully within the confines of Square J. It was a compact very dark grayish brown (10YR3/2) clayish silt. Due to the other complex issues encountered within the western half of Square J, this pit feature was not excavated.

Zone 75 Possible Intrusive Pit or Burial Cut (Square J)

Zone 75 was a small and complicated zone only near the western edge of Square J. The matrix of Zone 75 was a semi-loose brown (10YR5/3) fine sandy silt. Much of this zone remained unexcavated as it continued west into unexcavated territory outside of Square J. It was bounded on the east by the Bu.2 burial cuts, to the south and southeast by Zone 74, to the southwest by an intrusive pit (Zone 76), and to the northwest by the Zone 71/27 construction fill. Thus, it can best be described as a small area of soil that runs south from the northern edge of the square and then expands west into the western wall of Square J (see **Figures 5.32-34 and 5.36**). Additionally, this zone was discovered after the Zone 69 floor ("Zone 22 Floor") was removed and while Zone 71 was being taken down, suggesting it may be a pit that was deposited during the construction of Zone 71 and was capped by the Zone 69/22 floor. Once a clean scrape of the walls was collected (Zone 72), part of the base of a cranium was found within this zone. It was likely an isolated cranium that was face-down, with only the mastoid processes, some of the basicranium, and some of the inferior occipital squama visible.

It is possible that this zone represents a disturbed burial cut, partially based on the presence of the disturbed human remains, but also the similar soil colors and textures seen throughout the other burials within Str.1. The clean scrape also indicated that the uppermost portion of Zone 75 was disturbed by the Zone 47 pit (as was the Zone 69/22 floor) discussed above. This zone was bounded to the east by the Burial 2 cuts and extends to the west outside of Sq. J. Unfortunately, not much of the overall Zone 75 burial deposit was uncovered and left mostly unexcavated due to time constraints. Despite the highly disturbed nature of the zone given the numerous intrusive pits surrounding it, its presence bolsters the notion that this particular area of the superstructure (at least by Phase 2) was an important space to inter individuals.

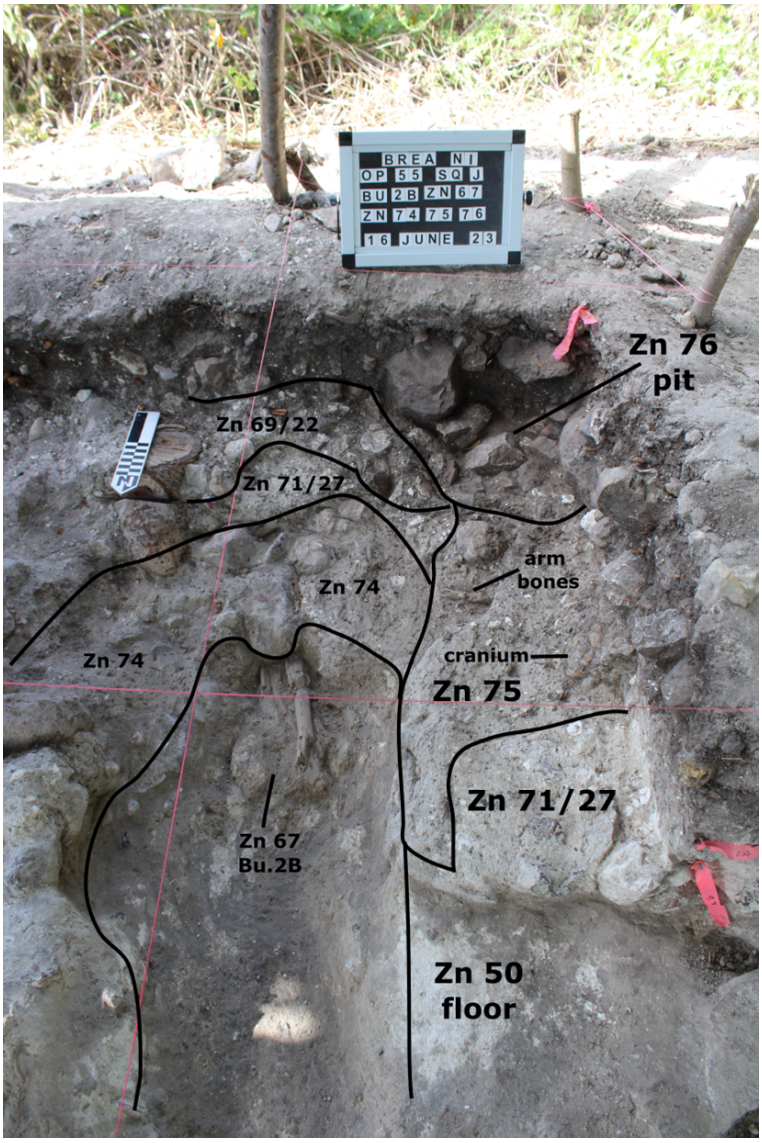


Figure 5.34 Background: Square J; foreground: parts of Squares C and D showing the locations of the zones surrounding the Bu.2A and Bu.2B cuts (photo by J. A. Biggs).

Zone 72 Mixed Context from Wall Scrapings (Square J)

This zone comprised a large wall scraping along the western wall of Square J. It was necessary because the western wall of the square was steeply angled. The scraping was taken from the ground surface down to the poorly preserved Zone 69 surface ("Zone 22 Floor"). Overall, this was a small, very mixed zone. No Munsell color was taken as this was a mixing of multiple strata. Only a few artifacts were recovered, including pottery sherds and human skeletal remain fragments.

Zone 61 Burial #3 (Square D)

Zone 61 was an infant burial that was uncovered when excavating Zone 59 (the equivalent of the Zone 27 construction fill for the Zone 22 floor) in Square D. It was located in the southeast corner of the square. Due to time constraints, this burial was not fully excavated, but left in situ for future excavation. Only long bones of the arms and legs were defined, no other skeletal elements were visible. The bones were in an extended position, but it is unknown whether the individual was laid prone or supine. It is also possible that due to the total lack of other bones present, even the cranium, these bones are part of a secondary burial. In this case, the bones may be flipped, out of place, or on the wrong side of the body, making it impossible to determine whether they were laid prone or supine. Interestingly, a groundstone fragment (likely a metate) was found around the location of where the skull should have been (see **Figure 5.26**). The matrix around the burial was a loose brown (10YR5/3) loamy silt, similar to that seen throughout the rest of Zone 59, but a little darker. Since Bu.3/Zone 61 remained unexcavated, no artifacts were collected; the human skeletal remains and groundstone tool were simply noted.

The presence of the possible metate fragment near the area of the head may be ritually significant, as infants and young children among the ancient Maya were thought of as maize dough that was in the process of being formed, reaching full Maya personhood in their mid-late teens. It is also interesting that this was potentially a secondary burial of an infant in near anatomical position (missing bones notwithstanding). Infants were not commonly afforded this level of care in secondary burials, which typically involve isolated elements, skulls, or bundles.

Lastly, there was no evidence of a defined burial cut associated with Bu.4. The most likely scenario is that this individual was interred during the construction of Superstructure 2 within the Zone 59 fill and was capped by the Phase 2 "Zone 22 floor."

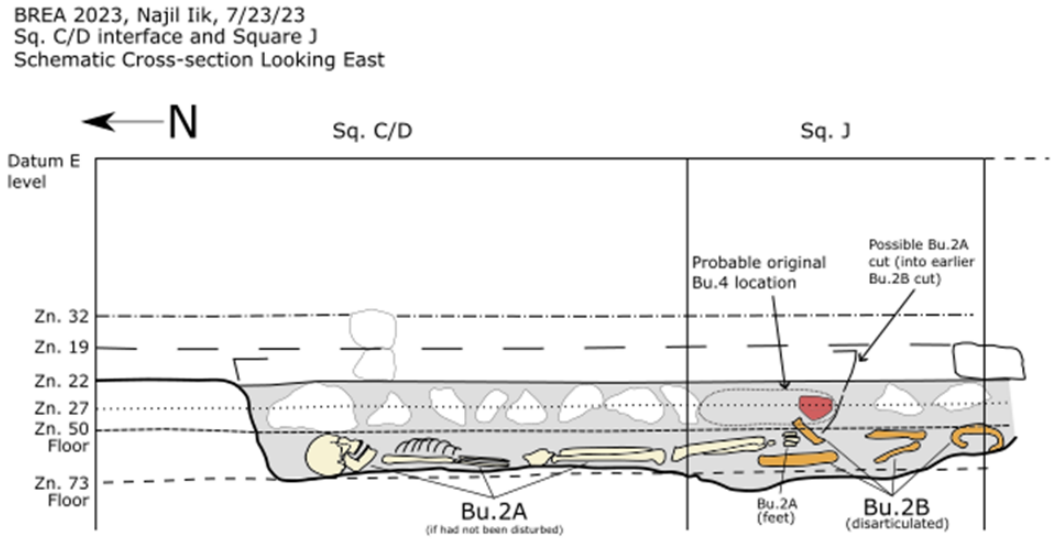


Figure 5.35 Schematic cross-section of the Squares C/D interface and Square J, looking east, depicting the floor/fill layers and their relation to Burials #2A, 2B, and 4 (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

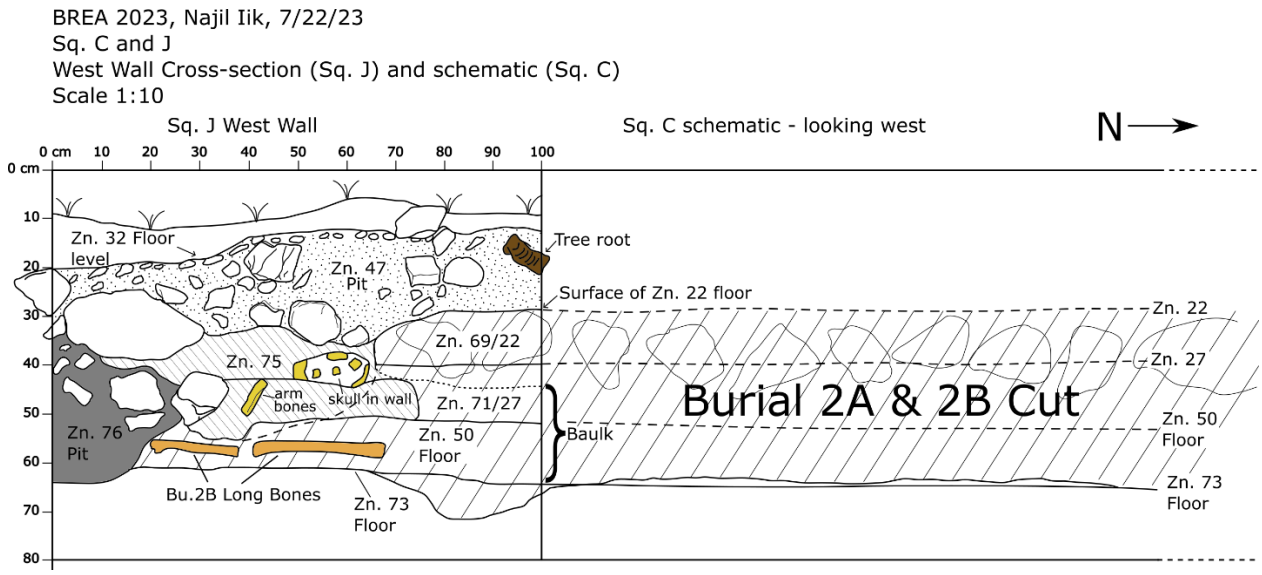


Figure 5.36 Square J west wall cross-section and schematic (Square C), looking west, depicting the complex nature of the burials and pits inside Superstructure 2 (drawn by E. Harrison-Buck; digitized by J. A. Biggs).

Burial 1 – Multi-Person Interment

Burial 1 is a complex multi-person interment that spans multiple excavation squares and numerous zones. The pit was initially identified underneath Zone 40 in Square H, the lowest zone associated with the "Zone 34 Pit". While originally thought to be a four-person burial, osteological analyses of the remains suggest the presence of three primary individuals and one human bone deposit/cache that does not represent a fourth individual. As this discovery was not made until after excavation, four burial designations were given: Burial 1A, 1B, 1C, and 1D (**Figure 5.37**). Though not technically a burial, the bone deposit was labeled as Bu.1D in the field and has retained this designation for ease. Each burial will be discussed separately below with its associated zones, which include the following: Zones 54 and 58 Burial 1A (Squares D, H); Zone 62 Bu.1B (Square H); Zone 57 and 63 Bu.1C (Squares D, H, and I); and Zone 64 Bu.1D (Square D)

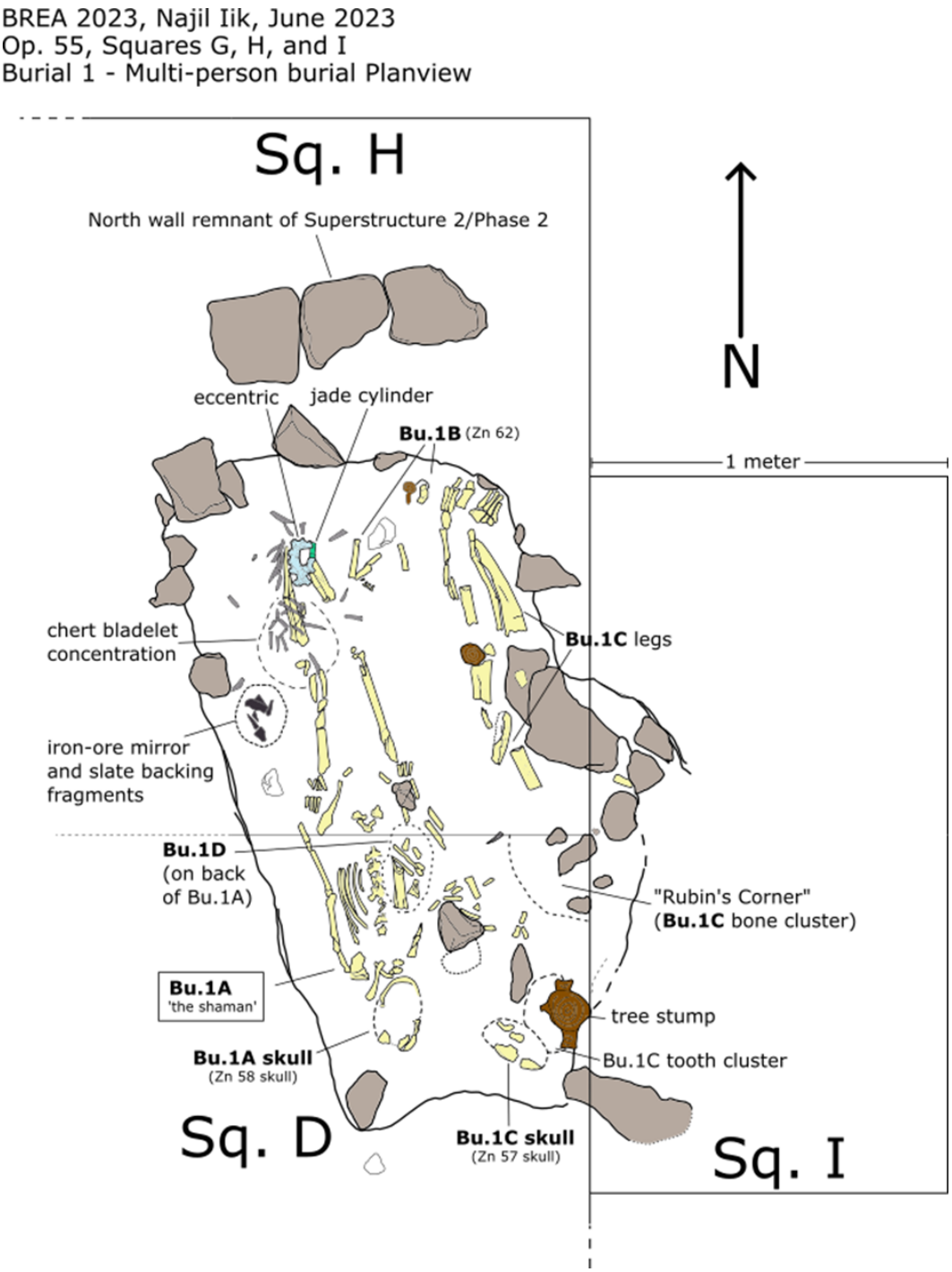


Figure 5.37 Planview of the Burial 1 multi-person interment in Squares D, H, and I within the Superstructure 2/Phase 2 floor/fill (drawn by E. Harrison-Buck and J. A. Biggs; digitized by J. A. Biggs).

Zones 54 and 58 Burial 1A (Squares D, H)

Zone 58

Before the entire skeleton of Bu.1A was revealed, two poorly preserved skulls were found in Square D and part of Square I. These were originally given their own zone designations: Zones 57 and 58. Zone 58 was uncovered before the rest of the Bu.1A individual. The matrix for Zone 58 (a loose and brown [10YR5/3] silt was the same matrix as that of Zone 54 in Square H, also a loose and brown (10YR5/3) loamy silt. It was then suggested that this Zone 58 skull belonged to the leg bones in Zone 54 (no other bones were uncovered at that time). As excavation continued, more bones were uncovered, undoubtedly linking the Zone 58 skull to the rest of the Zone 54 remains. Thus, Zone 58 should be thought of as the same context as in Zone 54.

Zone 54

Zone 54 was first identified in Square H beneath Zones 40 and 53 (intrusive pit and mixed context matrix) based on the presence of many chert bladelets, a very loose silty loam texture, a lighter color (10YR5/3), and very few initial inclusions other than a few fist-sized cobbles. This led to Zone 54 to be initially interpreted as a cache or special deposit. These soil characteristics persisted throughout the entire multi-person burial space for Zones 54 in Squares D and H, Zone 57 and 58 in Square D, Zone 62 in Square H, Zone 63 in Square D, H, and I, and Zone 64 in Square D.

Once the initial "cache" was outlined (Zone 54, Square H), further excavation revealed a fire-treated chert eccentric lying on top of a broken jade cylinder with drilled holes on one end. Both were placed on human long bones, now known to be the lower legs of Bu.1A (**Figure 5.38**). The presence of these long bones required us to expand the original boundary of the then termed "Zone 54 Cache", eventually revealing the entire skeleton of Bu.1A.

Zone 54 in Square D was the same matrix described above in Zone 58. Additionally, Zone 54 in Square D contained most of the upper body of Bu.1A, from the lower lumbar vertebrae up to the head; however, the hands were within Square H. Surprisingly, no ceramic vessels were found within Zone 54 of Square H, nor any within the entire Burial 1 space.

Zone 54 in Square H was the same matrix as seen in Zone 54 and 58 in Square D. The lower body, from the hips down to the lower legs were within Square H, including the hands. Interestingly, no foot bones were found for Bu.1A. While this might be a preservation issue, it is interesting since many of the burial goods for Bu.1A were located at or around where the feet would have been. These include the aforementioned fire-treated eccentric and drilled jade cylinder, 80+ chert bladelets scattered around the lower leg/foot area, a few ceramic rim sherds found near the right hip, and a mosaic hematite mirror piece with slate mirror backing fragments and possible ceramic backing that was very poorly preserved and very thin, also near the right hip. A peccary tusk and a drilled shell bead were also found within the Bu.1A matrix of Square H, but were found in the screen so their exact location within the burial is unknown. Once the

entire skeleton was uncovered, it became clear that the Bu.1A individual was buried extended and prone with their head slightly east of south, in line with the orientation of the superstructure.



Figure 5.38 Close-up of the chert eccentric and jade cylinder underneath (red arrow), surrounded by chert bladelets. A small portion of the lower leg bones of Bu.1A can be seen under the eccentric/beside the jade cylinder (photo by J. A. Biggs).

On the left side of the back of Bu.1A, a small cluster of bones was found and originally given the designation of Bu.1D, working under the assumption that this was a small infant bundle burial. This is no longer the case and will be discussed below.

One fragment of the slate mirror backing had a drilled hole, indicating that it could have been worn by this individual. Measurement of one substantial slate fragment showed it was part of a beveled and circular mirror ~10 cm in diameter. These mirror fragments suggest that this individual could have been a shaman or diviner in life. Out of all the identified burials at Najil Iik, the Bu.1A individual is the only one to have been buried with any grave goods, except for the Bu.4 infant who was buried in/with a whole vessel.

The chert eccentric was found lying on top of the distal portion of the lower leg bones. It is similar to one found within a cache (A-5/2) in Structure A-5 at Altun Ha which is described as

crescentic in form with a handle (Pendergast 1979; **Figure 5.39A and 5.39B**). The most noticeable difference between the two is the "handle" of the eccentric described by Pendergast (1979) while the eccentric from Najil Iik has a "fish-tail" form at its base. The upper/top portion of the eccentric is also different in that the one from Najil Iik does not have an "overhang" that is present on the one from Altun Ha.

The A-5/2 cache at Altun Ha only contained chert, but its depth (24 cm below the ground surface and within collapse debris/matrix) suggests it was deposited sometime after Str. A-5 had ceased being used, along with much of the site core (Pendergast 1979). Although no vessels were found associated with Bu.1A (or any burial at Najil Iik), preliminary ceramic analysis of the Bu.1A matrix also suggests a later date, during the Terminal Classic (Eleanor Harrison-Buck, personal communication). Najil Iik and Altun Ha are geographically close, separated by only 12.25 km. Thus, it is possible that the community living at Najil Iik was connected in some way to Altun Ha. This similar eccentric may represent a shared connection or influence from those living at Altun Ha, even after much of the site core was abandoned.

The eccentric from Najil Iik was likely fire-treated or intentionally burned sometime before it was deposited with the Bu.1A individual. The off-white color seen on both sides of the eccentric, with some areas not as affected, could be the result of contact with fire. This hypothesis is further supported by numerous chert bladelets found within the burial that also had this fire-treated appearance.

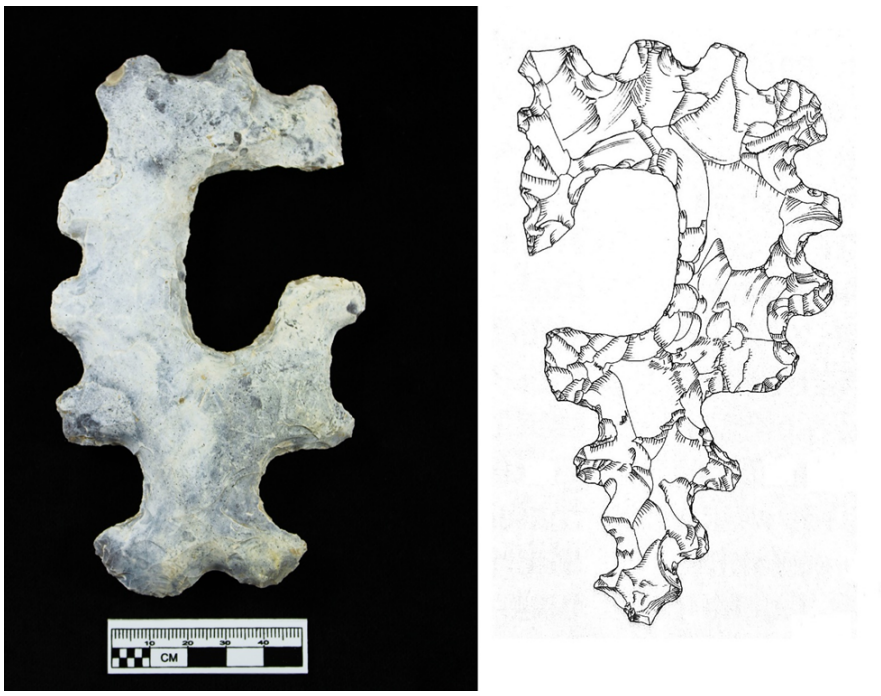


Figure 5.39 Left: The eccentric found over the lower legs of Bu.1A at Najil Iik (photo by Jack A. Biggs); Right: Chert eeccentric from Cache A-5/2 from Altun Ha (after Pendergast 1979:Figure 68-j).

Over 80 chert bladelets were recovered while excavating Bu.1A (**Figure 5.40**) and were clustered around the feet and lower legs. Complete bladelets measured up to 6 cm in length and about 1-1.5 cm in width at the base. Fragments of these bladelets were found throughout the Bu.1A matrix as well, mostly around the lower legs. As mentioned above, many of these bladelets were also possibly fire-treated, likely in the same ceremony as the chert eccentric.



Figure 5.40. Sample of the chert bladelets found around the lower legs of Bu.1A (photo by J. A. Biggs).

Directly underneath the chert eccentric was a broken jade cylinder with two drilled holes (**Figure 5.38**). While two pieces of the jade refit, it is clear that much, if not more than half of the original jade piece was missing and not seen during excavation (see **Figure 5.41)**. The jade piece widens towards the broken end. One drill hole is located on the end of the cylinder while the other is located on the side of the cylinder, just below the rim. This hole connects to the one on the end, meaning this jade is not a true bead but a jade cylinder. If this same hole pattern was repeated on the missing end, it is likely this jade cylinder could have been hung horizontally, suspended from each end by the connecting holes. While we cannot know the original finished form, or how it was meant to be displayed, it could have been hung as a type of pectoral (see **Figure 5.42**).



Figure 5.41 Jade cylinder fragment found under the chert eccentric on the lower leg bones of Bu.1A (photos by J. A. Biggs).

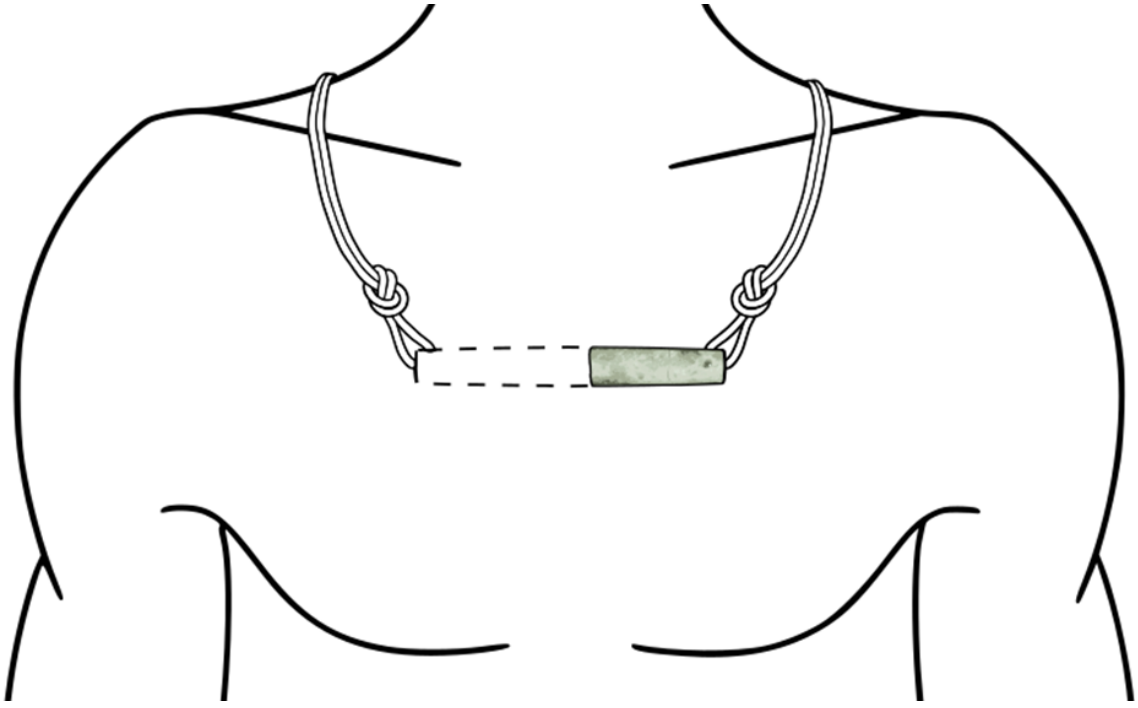


Figure 5.42 Possible configuration of jade cylinder "pectoral." Scaling and estimations based on average shoulder-to-shoulder breadth of 40 cm. Total length of the jade cylinder is speculative (drawn by J. A. Biggs).

Likely much larger before it was broken, this jade cylinder fragment is similar to examples seen on polychrome vessels depicting elite, rulers, or gods. Vessel K631 (**Figure 5.43**) from Justin Kerr's Maya Vase Database depicts a palace scene with a cacao tree and 5 or 6 figures around it. The seated figure to the left of the cacao tree is the god K'awiil. Around his neck is a pectoral with a similar horizontal bar. While the one depicted on the vessel is more ornate, other examples of horizontal bars/pectorals have been identified (e.g., K6341, K7062, K1728; see **Figure 5.44**). On vessel K631, K'awiil and the other seated individual are not wearing cloth around their waists, but mirrors. Mirrors have often been interpreted as tools for divination and scrying for the elite, royals, and priests, acting as portals or communication devices between the diviner and the "Otherworld" (see e.g., Healy and Blainey 2011; Ménager et al. 2024). On the same vessels mentioned above, all individuals depicted as wearing a horizontal pectoral/necklace are also interacting with mirrors in some way.

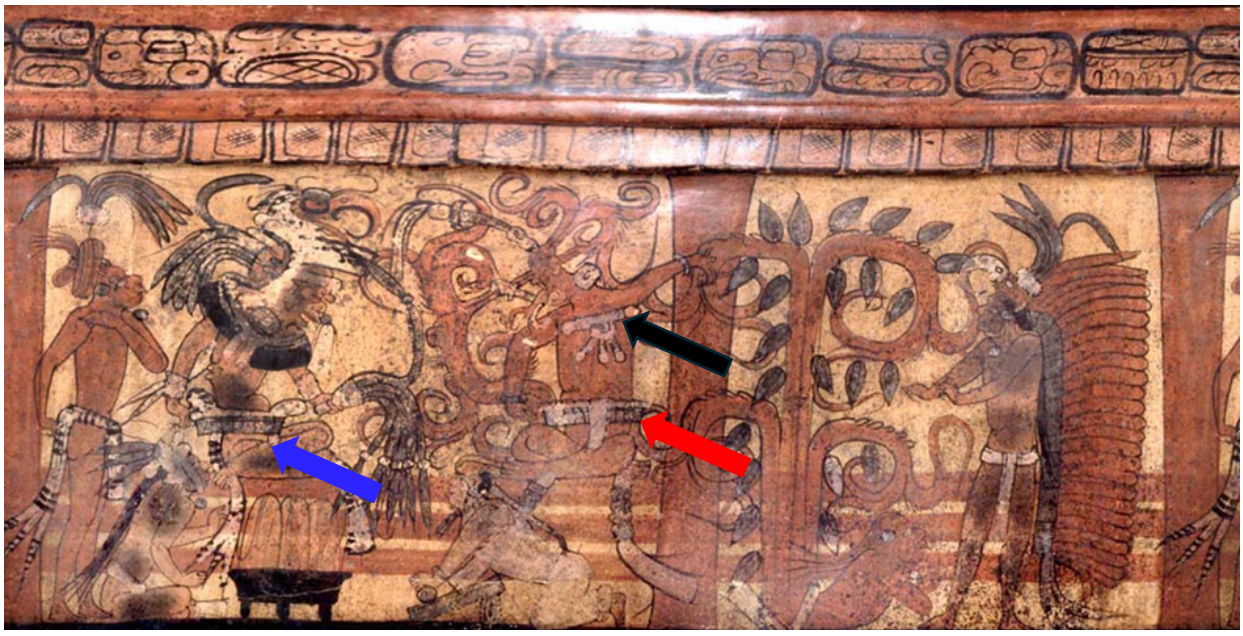


Figure 5.43 Vessel K631 rollout of a palace scene. Horizontal pectoral (black arrow) and mirror (red arrow) worn by K'awiil. Mirror also worn around waist of left seated figure (blue arrow). Image courtesy of the Kerr Maya Vase Database.



Figure 5.44 Vessel K1728 rollout depicting a seated figure (center) wearing a possible jade cylindrical pectoral. Underneath the seated figure on the right is a mirror. Image courtesy of the Kerr Maya Vase Database.

Possibly the most surprising finds associated with Bu.1A were fragments of a mirror (**Figure 5.45**). One piece of a mosaic hematite mirror and over 50% of its slate backing were found just west of Bu.1A, near the right knee. While only one piece of the actual mirror surface (the hematite mosaic piece) was found, it is likely that most of, if not the entire mirror, was buried with the individual. Two other hematite mirror tesserae were found within the overlying tree pit fill, highlighting the degree of disturbance throughout much of the site. The mirror fragments appeared to have been the only artifacts associated with the Bu.1A individual that were disturbed by tree and root activity.

While mirrors could have been used or displayed as status symbols, it is more likely they were employed as powerful objects for scrying that could help the diviner communicate with the "Otherworld" (Healy and Blainey 2011). Their combination of dark materials emanating light creates a mysterious dichotomy. Thus, those who used these specialized items were not just politically powerful, but likely occupied a spiritually significant position as the negotiator between the realms. Combined with their other grave goods, it is clear that the Bu.1A individual held some kind of importance in life and was afforded an elaborate and distinct burial upon their death.



Figure 5.45 Slate mirror backing and iron ore tesserae found in association with Bu.1A (photo by J. A. Biggs).

Zone 62 Burial 1B (Square H)

Zone 62

Burial 1B was a small juvenile located at the north end of the Burial 1 cut. The burial was identified when more individuals were discovered to the east of Bu.1A. The matrix within Zone 62 of Bu.1B was the same as that within Bu.1A. This individual was located near and between the feet of Bu.1A and 1C. The Bu.1B individual was likely flexed, on their right side with their head to the northeast; tree activity to the west of the poorly preserved cranium likely disturbed the burial. Only a few cranial fragments, a few teeth, crumbled leg bones, and possible metacarpals were recovered. No other skeletal elements were preserved.

Zones 2/57/63 Bu.1C (Squares D, H, I)

Zone 2

During the January 2022 season, one excavator dug too enthusiastically within Zone 2 in the northeast corner of Square D where a cluster of human bones were discovered. This area was then colloquially called “Rubin’s Corner”. Luckily, these human bones were separated out in the field and then reassociated with the rest of Bu.1C in the lab after the individual was fully excavated during the Summer 2023 season. The bones found within Rubin’s Corner mostly

represent bones of the hand and wrist, indicating that these were likely some of the few parts of the individual that were not disturbed by later intrusive pits.

Zone 57

As with Zone 58 and 54 for Bu.1A, Zone 58 was an isolated cranium in Square D with a cluster of teeth that extended across Squares D and I. Based on the presence of other remains in Squares D and H, the Zone 58 cranium was determined to belong to the Bu.1C individual (see **Figure 5.37**). Unfortunately, a tree stump located between Squares D and I likely disturbed this area such that a cluster of teeth that were in both squares were separated from the rest of the cranium. However, this scenario was informative as it suggested that the teeth (and likely the maxillae and mandible) were located just east of the rest of the cranium. This meant that the Bu.1C individual was buried in extended position with their head just east of south, like Bu.1A. Additionally, the teeth were rather large, matching the overall size and robusticity of the Bu.1C individual, further suggesting that this tooth cluster belonged to the Bu.1C individual.

Zone 63

Zone 63 represents the majority of the area and remains associated with Bu.1C. Unfortunately, there was far more tree disturbance in the area of Bu.1C in Squares D and H than with Bu.1A. Multiple tree roots were actively growing where Bu.1C was interred at the time of excavation. Compound tree disturbance in the past obliterated any primary context for the bones, apart from the lower legs in the northern section of the burial cut in Square H. Most other fragments were found scattered and fragmented within the burial matrix. Some of the femora were either in situ or in the general location of a femur in a burial. However, the bones of the lower legs and feet were still in situ and retained their original position with good preservation. These few bones confirmed that Bu.1C was likely laid extended and supine, unlike Bu.1A. It was also clear, even while the bones were still in the ground, that the Bu.1C individual was tall and robust, and suffered from a chronic and systemic, pathological condition that affected many of their bones. This will be discussed further in **Biggs and Bower Chapter 10**. The matrix of Zone 63 in Squares D and H matched Zone 54 in Bu.1A. No goods were found in direct association with Bu.1C.

Zone 64 Bu.1D (Square D)

Burial 1D was assigned to Zone 64 as the last individual within this multi-person burial. Bu.1D was located directly on the back (left ribs) of Bu.1A (**Figure 5.37**). It was originally thought to be the bundle burial of an infant, given the overall size of the visible bones and the physical area. Upon further inspection, a juvenile—not infant—tibia was found. Closer inspection revealed that infant, juvenile, and adult long bone fragments were all present in

Bu.1D. Therefore, Bu.1D was classified as a human bone cache/deposit associated with the Bu.1A individual. The matrix for Zone 64 was slightly lighter in color than the burial matrix of Bu.1A, consisting of a loose pale brown (10YR6/3) loamy silt.

Overall, this burial represented a complex set of events for multiple people, all of whom were treated differently in death. Because of the large intrusive pits located above (the "Zone 33 Pit" and "Zone 34 Pit"), it was difficult initially to understand where this burial fit into the construction sequences. However, the interment was likely associated with the Phase 2/Superstructure 2.

The Bu.1A individual is particularly interesting due to their unique burial position at the site and the accompanying goods they were buried with. These items, compared to the dearth of items associated with the individuals in any of the other graves, suggest that this was an important person during their lifetime. The presence of mirror tesserae and slate backing fragments highlight that this individual was likely a shaman or diviner during life, and likely used the mirror for scrying, conjuring, or communicating with the Otherworld. Mirrors (and fragments) have mostly been found in elite/royal or priest burials, as well as in caches, at large urban centers. The presence of an individual buried with a complete and full mosaic mirror (that was then disturbed by trees, roots, and pits) in such a rural location suggests that people who lived far from the large cities (like Altun Ha) were still culturally and cosmologically connected.

Zone 66 Possible Pit Feature (Square H)

An ovular area of stones and cobbles was identified after excavating all of the Bu.1 individuals and matrices. This oval feature measured roughly 50-x-60 cm and had a brown (10YR5/3) clayey-silt matrix. It was likely a natural pit created by tree disturbance, as evidenced by the stump growing through the middle of the feature. This was also one of the trees that probably disturbed the Bu.1C individual. The pit was documented but left unexcavated.

Zone 24 Phase 2 Floor of Terrace #3 (Squares B, F)

Zone 24 was located in the eastern half of Square B, underlying Zone 2. It consisted of a transition between Zone 2 and intact construction fill consisting of many cobbles and a lighter gray (10YR6/2) silty-clay loam. Thus, it might be a mix of the Superstructure 2 architecture that was built up in the final phase (Superstructure 1). The artifact density was medium, including faunal bone fragments, lithic debitage, pottery sherds, and human bone (plus 17 teeth).

Zone 24 in Square F was similar in texture and color as that in Zone 24. It lay on and behind Terrace #3 (Zone 9) and was also poorly preserved.

Zone 26 Terrace Construction Fill (Square B)

Zone 26 was only within the eastern half of Square B. It is the construction fill underlying the Zone 24 terrace, behind the third and poorly preserved terrace (#3). Terrace #3 sits atop Zone 26, suggesting that Terrace #3 was built after Zone 26. It is also possible that Zone 26 was constructed in order to level out the area so that Terrace #3 could be constructed. The matrix of Zone 26 was light brownish gray (10YR6/2) sandy silt with tiny white flecks. The artifact density was medium with lithic debitage, a chipped tool, pottery sherds, and an unidentified artifact made of stone with two perforations.

Zone 30 Core Fill of Str. 1 Under Terrace 3 (Square B)

Zone 30 was core fill underlying the Zone 24 terrace construction fill. It was taken out in a 1-x-1 m square in the northeast corner of Square B. The matrix consisted of a loose, light brownish gray (10YR6/2) silt and soft limestone boulders. This zone was only excavated ~10-15 cm.

Phase 3 of Str. 1 - Superstructure 3

Zone 50 Plaster Floor (Squares C, J)

Zone 50 was a plaster floor only visible in Squares C and J. It was exposed by the burial cut for Bu.2A in Square C and found within the burial cuts for both Bu.2A and 2B within Square J (**Figures 5.34, 5.36, and 5.37).** A well-preserved plaster chunk along the south wall of Square C (approximately 25-x-25 cm) represented the only untouched portion of Z50 that was not part of the actual burial cuts, located just west of Bu.2A in Square C along the southern edge. The rest was disturbed in antiquity or accidentally tamped down during excavations. The interment event for Bu.2A and 2B involved cutting into the Zone 50 floor, thus postdated that floor. This zone lies beneath the Zone 27 construction fill originally identified in Square C and remains unexcavated.

Zone 35 Possible Construction Fill for Zone 50 Plaster Floor (Square C)

Zone 35 was likely construction fill under the Zone 50 floor in Square C. It appeared that some of the Zone 50 floor was not well preserved on the northern edge of Square C and was only discernable in the wall. In order to investigate the construction sequence, a 1-x-2 m area was delineated running east-west along the northern half of Square C. This zone was not fully excavated due to the discovery of a possible burial pit feature in the NW corner of Square C within the Zone 35 matrix (given designation of Zone 36). Time constraints and the inability to excavate down most of Square G to this level prevented us from excavating the rest of this zone and the pit. The matrix for this zone was a brown (10YR5/3) silty clay with white specks.

Zone 36 Likely Burial Feature (Square C)

Zone 36 was a probable burial feature in the northwest corner of Square C. It was found while excavating Zone 35 as the 1-x-2 m area along the northern half of the square. It became discernible when a semi-compact, slightly darker (light brownish gray, 10YR6/2) silty clay was found in conjunction with a cluster of stones (ranging in size from 5-20 cm). As the rocks were being defined, a few bone fragments (some possibly vertebral) began appearing within the pit boundary. Since this pit likely extended to the north into unexcavated territory within Square G, this zone, and the surrounding Zone 35, were abandoned and left unexcavated. Additionally, the numerous other pits and burials prevented any further investigation into this area. No artifacts were found during the short excavation of Zone 36.

Phase 4 of Str. 1 - Superstructure 4

Zone 73 Plaster Floor (Square C)

Zone 73 was a plaster floor that was identified while excavating Bu.2A and 2B (**Figure 5.36**). It lies under the Zone 50 floor and was also dug into during the interment event(s) of Bu. 2A (and possibly 2B). Like with Zone 50, only a small portion of the floor was uncovered within Square C along the western edge of the Bu.2A burial cut, and was not further excavated. It was comprised of a very compact and smooth white plaster, and represented the earliest floor surface yet identified within the superstructure of Str. 1 at Najil Iik.

Interpretations and Conclusions

Str. 1 at Najil Iik clearly had a long history and use-life. At least four phases of construction were discovered during excavation; there is a strong possibility that earlier phases still lie beneath, given the generally shallow nature of the excavations described above. Ceramic analysis is forthcoming and will aid in our understanding of the purpose of this structure and its chronology. Excavations at Najil Iik revealed a surprising number of buried individuals interred on the apex of Str. 1 in Phase 2 of the superstructure. The presence of a possible monument to the north on Str. 4 at Najil Iik, combined with Str. 1's prominence as the tallest structure in this relatively small, rural mound group, suggests the site functioned as an important ceremonial space for the local community. Its north-facing orientation towards Xtabentun and proximate location (.75 km away) suggests this plaza group was likely associated with this center, perhaps serving in some supporting ritual and/or administrative capacity.

Importantly, the grave goods found associated with Burial 1 point to an important religious specialist (Bu.1A) within a larger multi-person burial event. The stark contrast of Bu.1A's burial position and associated grave goods including an eccentric and mirror suggest this

was an important person who likely lived in this rural locale and served as a shaman or diviner who may have acted as an integral link between the physical world and the supernatural realm comprising the spirits and deceased ancestors.

The excavations at Najil Iik highlight the importance of investigating rural areas in the Maya area, rather than focusing exclusively on larger urban centers. While informative, preferencing the cities to the exclusion of the hinterlands means that a large portion of the ancient Maya population and culture is unintentionally silenced. The discoveries at Najil Iik show that rural communities also engaged in civic-ceremonial activities and rituals that had similar contours to those seen at major urban centers.

Ongoing ceramic analysis will help solidify the construction sequences revealed during excavation. Further osteological analyses, including geochemical and aDNA studies, would allow those interred at the site to be fully understood in their temporal and cultural contexts.

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Chapter 6

Excavation of Structure 1 at Xtabentun (Operation 65)

Hollie Lincoln and Eleanor Harrison-Buck

Introduction

The site of Xtabentun is a Maya center that was initially identified in a BREA reconnaissance mission in January 2020 (see Buck et al. 2022:Figure 3.1). In January 2022, the area was surveyed and mapped using LiDAR-equipped drones (Willis and Murata 2023:Figure 2.11) and a more comprehensive topographic and mahlerized map was created by the BREA survey team during January 2023 (see **Kaeding, Murata, and Willis Chapter 4**). The site center of Xtabentun was the focus of several test excavations during the January 2023 field season, including Operation 65 presented herein (see also **Harrison-Buck and Lincoln, Chapter 7**; **Brouwer Burg, Haverland, and Krause, Chapter 9**).

Excavations at Operation (Op.) 65 is a cardinally oriented excavation unit measuring 2 m E-W by 4 m N-S. The unit was positioned on the center line of Structure 1. This is the largest structure of the Northern Group, which likely served as the main elite residential plaza at Xtabentun. Kaeding and Murata (**Chapter 4**) provide an in-depth description of this high, flat-topped structure, which measures approximately 35-x-21 m and stands 2.5 m high. Notably, Structure 1 is oriented at approximately 340 degrees (**Figure 6.1**).

The 2-x-4 m excavation unit of Op. 65 was divided into two 2-x-2 m squares (A and B). The position of each square was recorded using a Total Station (see **Kaeding, Murata, and Willis, Chapter 4**). Squares A and B were positioned toward the base of the building on its central axis. This layout aimed to expose the building's orientation in its latest phase of architecture, along with a portion of the associated exterior plaza floor (**Figures 6.1 and 6.2**). However, since the structure itself is oriented at 340 degrees, the excavation unit was not parallel with the orientation of the exposed architecture (see **Figures 6.2**).

Upon exposure of an intact plaza floor, a 1-x-1 m unit was positioned inside of Square A using a Total Station (**Figure 6.2**). The goal of this unit was to identify any earlier phases of construction beneath the plaza floor and to obtain additional artifacts for dating.



Figure 6.1 Structure 1 prior to excavation, facing northwest (photo by H. Lincoln).

Objectives

There were three primary objectives of this operation;

1. Expose the exterior of Structure 1 and a possible central staircase;
2. Define the presence of any special deposits on the centerline and collect diagnostic artifacts to determine when the structure was built and occupied;
3. Investigate the presence of any earlier architecture in an effort to understand the different phases of construction and the history of occupation.

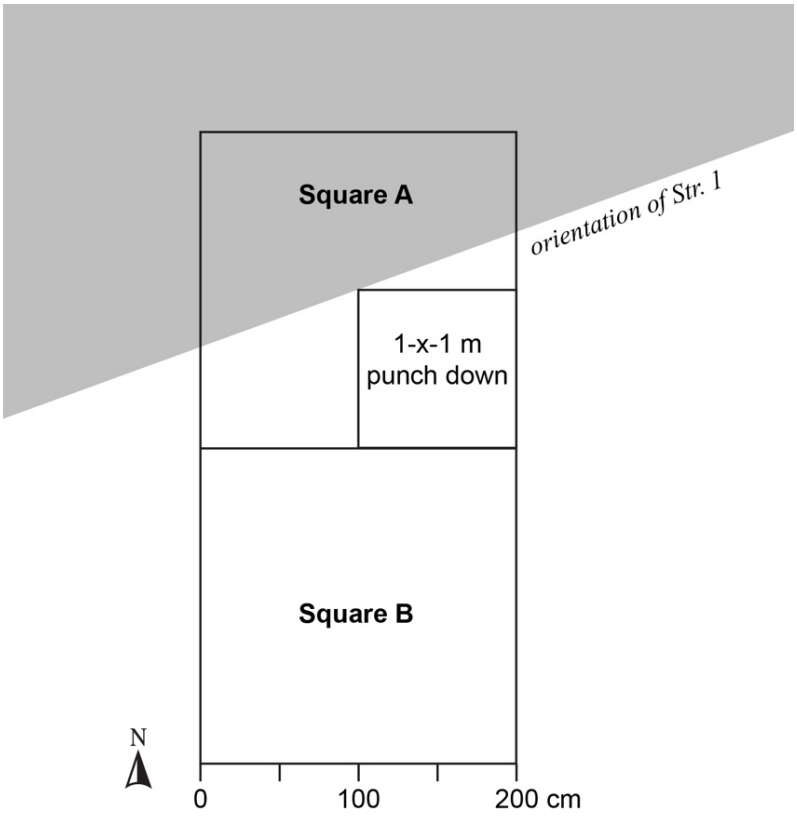

Figure 6.2 Schematic representation of Operation 65 layout, indicating orientation of Str. 1 (Image by M. Brouwer Burg).

Excavation Methods

One temporary datum (Datum 1) positioned east of Op. 65 was used to collect all vertical measurements throughout the excavation and was logged with the Total Station. One profile map was hand drawn consisting of the eastern wall of Square A and B. Another profile map of the north wall of Square A shows the remaining final phase exterior of Structure 1 (Str. 1). A plan view map of Squares A and B was also hand drawn. Picks and shovels were used for removal of overburden and trowels were used to define architecture and in situ artifacts. All dirt was screened through ¼-inch mesh screens. Plastic buckets measuring 5 g in volume were used to transport all soil and rock from the excavation to the screening stations. Zones, the smallest unit of excavation, were separated when color, texture, composition, or a combination of factors changed.

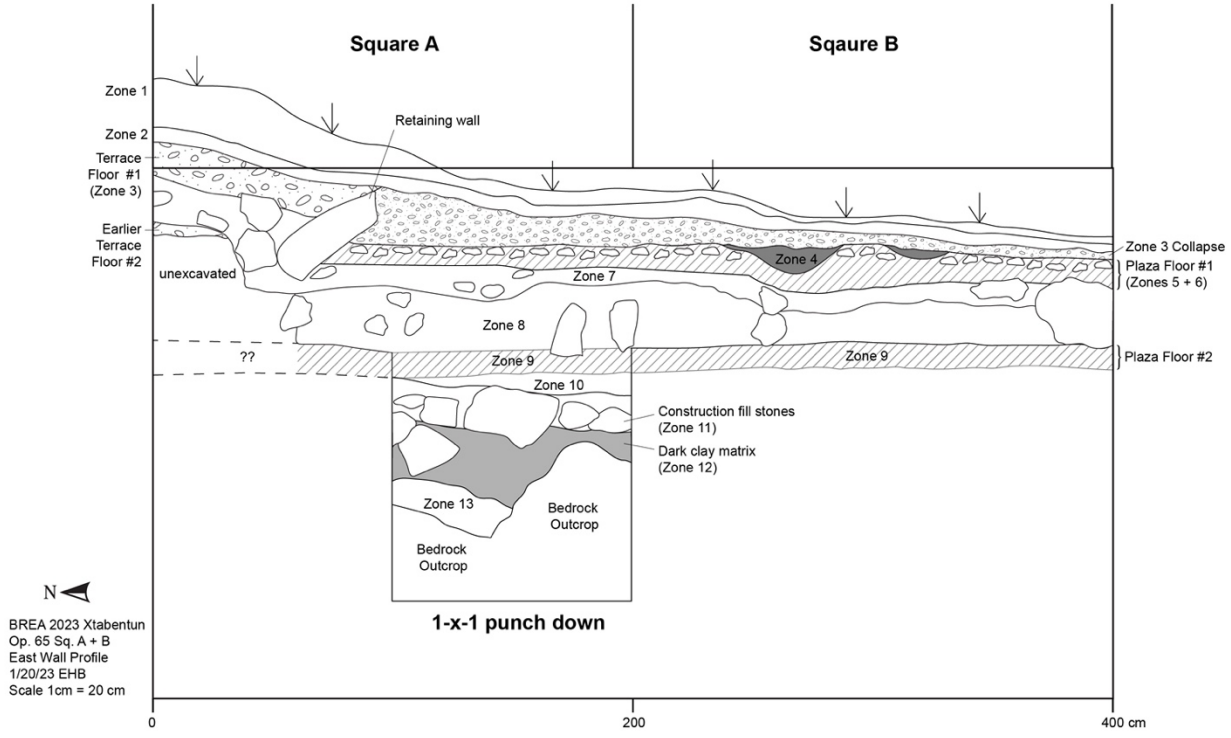

Figure 6.3 East wall profile of Op. 65 (drawing by E. Harrison-Buck, digitized by M. Brouwer Burg).

Excavation of Squares A and B in Operation 65

Zone 1 Humic Layer (Topzone)

Zone 1 across Squares A and B is composed of semi-compact, dark brown, organic rich soil. This silty-loam layer contained a large number of rootlets, some large roots, leaves, and limestone pebbles (**Figure 6.1**).

Removal of Zone 1 exposed several limestone cobbles in the northern half and western edge of Square B. The top of a large cut stone at the northern edge of Square A and a large collapsed stone on the southwest edge of Square A next to Square B also became visible upon removal of this zone.

Zone 2 Collapse Debris

Zone 2, across Squares A and B, continued to be rich in organic material, including an abundance of roots and charcoal. Fragments of limestone from pebble to cobble size were also present. During the removal of Zone 2 across Squares A and B, it became evident that fragments

of limestone plaster were present just below. Efforts were made to leave about 2 cm of matrix on top of whatever remained of the plaster floor so that fragile floor and any in situ artifacts sitting on top of it could be left intact and removed separately.

Two large, faced stones were exposed running across the center of Square A. Removal of this zone in Square A also exposed more of the massive, linear, cut stone at the north edge of Square A, extending outside of the western wall and the large stone protruding from the western wall of Square A. This series of cut facing stones slump forward and retain a poorly preserved upper terrace (Terrace #1).

Zone 3 Collapse and Remnant Plaster Floor, and Construction Fill of Upper Terrace #1

Zone 3 was defined in the notes as the remains of a limestone plaster floor, defined in the cross-section as Terrace Floor #1 (**Figure 6.3**). This surface is retained by the series of linear cut stones associated with Str. 1 that were exposed in the northern end of Square A (**Figure 6.4**). In defining the Zone 3 surface, attempts were made to expose any in situ artifacts that were remaining on top of this floor feature. Zone 3 defined to the south of these cut stones appears to be collapse debris that was removed as part of Zone 3 (see **Figure 6.3**). Due to the highly fragmented and undulating nature of this limestone plaster floor, it was difficult to follow across the excavation, indicating heavy bioturbation forces, and resulting in mixed contexts with Zone 2. The material that sloped off the structure into Square B—and removed as "Zone 3 collapse"—is therefore a mix of contexts, including intact terrace construction material, some spill out from the upper terrace, and collapse debris that is a continuation of Zone 2. The matrix of Zone 3 includes plaster fragments mixed with silty, semi-compact soil, limestone pebbles and cobbles, and a significant number of roots.

Zone 4 Possible Pit Feature (Tree)

During excavation of Zone 3 in Square B, a circular area appearing darker in color and lacking any visible limestone cobbles indicated a possible pit feature in the southeastern quadrant (**Figure 6.3**). This pit feature measured roughly 15 cm in depth and was excavated separately as a precautionary measure but likely represents tree disturbance given the nature of the shallow pit and the absence of an associated floor surface.

During excavation of this zone, a well-preserved fragment of limestone plaster floor was found at a lower depth (~15-20 cm). This pit feature intruded into a relatively intact plaster floor (Zone 5) that was in much better condition than any of the fragments previously encountered. Zone 4 was terminated when there was no indication that its matrix or contents were unique from the surrounding soil. It appears this dark feature is likely a natural formation representing the former location of a tree.

Zone 5 Plaster Floor (Plaza Floor #1)

Zone 5 is the remains of an intact plaster floor that appears to represent the latest plaza surface, referred to in the cross-section as Plaza Floor #1 (**Figure 6.3**). The floor was first identified at the bottom of Zone 4 and further exposed in Squares A and B with the removal of the Zone 3 collapse debris defined south of the large facing stone. The line of facing stones and Terrace #1 appear to be associated with the surface of Plaza Floor #1, all of which demarcate the final phase of Str. 1.

The matrix within Zone 5 continued to be semi-compact but increased in silt content. There continued to be a large number of roots and limestone cobbles present. Zone 5 was removed from Square B first and then was removed from the southern half of Square A, up to the two cut facing stones that sit on the surface of Zone 5. The facing stones were exposed during the removal of Zones 2 and 3 from Square A (**Figure 6.4**).



Figure 6.4 Line of cut facing stones retaining upper Terrace #1 on south side of Str. 1, which is associated with Plaza Floor #1 (Zone 5). Earlier Plaza Floor #2 (Zone 9) visible in the foreground runs underneath (photo by H. Lincoln).

Zone 6 Construction Ballast for Plaza Floor #1

Zone 6 underlies Zone 5 and serves as the ballast construction fill for Plaza Floor #1. The matrix composition of Zone 6 across Squares A and B is similar to Zone 5. These two zones were originally separated based on the incorrect assumption that Zone 6 represented another

plaster floor extending across the squares at the same elevation as the large fragment of plaster found in Zone 4.

Zone 6 matrix was semi-compact and silty, mixed with pebble to cobble size limestone and chert.

Zone 7 Construction Ballast/Fill

Zone 7 marks an increase in density and size of limestone cobbles mixed within very silty, loose soil. Zone 7 was similar to Zone 6 in matrix composition across Squares A and B and is interpreted as a fill layer associated with the construction of Plaza Floor #1.

Zone 8 Core Construction Fill

Zone 8 lies directly underneath Zone 7 and is composed of a compact layer of large, dense, irregular shaped limestone construction fill, which is associated with the construction of Plaza Floor #1 (**Figure 6.3**). Matrix surrounding these larger stones was loose, silty loam. Initial removal of this core fill required the prying force of a large pickaxe, as the large stones seemed to have been carefully placed in a way that locked them together.

Upon removal of the large stones and sediment in Square B, a well-preserved limestone plaster floor was exposed (Zone 9). All of Zone 8 was removed from Square B, then progressed to the north, into Square A. This zone was completely devoid of artifacts.

Earlier Terrace #2

Initially, Zone 5, Zone 6, Zone 7, and Zone 8 were removed entirely from Square B and up to the series of cut, faced stones that comprise the upper Terrace #1 in Square A. Once it was determined that the earlier, well-preserved plaster floor (Zone 9) continued beneath the unexcavated portion of Square A, the cut stones and fill of Terrace #1 (Zone 3) were removed along with the associated core fill (Zones 7 and 8) beneath/behind them (**Figure 6.5**).

As these excavations in Square A progressed down to the Zone 9 plaster floor shown in **Figures 6.4 and 6.5**, along the north edge of Square A an earlier Terrace #2 was exposed. Excavations revealed a poorly preserved, very soft, plaster-covered limestone sloped wall that appears to be directly associated with the earlier Zone 9 Plaza Floor #2 (**Figure 6.3**). Capping the top of this terrace feature, a flat plaster floor surface remains. The flat, plaster surface is most visible in the northeast corner of the unit (see **Figure 6.3 and 6.5**). Due to the poor condition of this feature, it was difficult to define (**Figure 6.6**).



Figure 6.5 Top of Plaza Floor #2 (Zone 9) exposed in Square A of Op. 65. The remnant earlier Terrace #2 of Structure 1 is also visible in the north end of Square A. Red arrow indicates where plaza floor #2 likely continues under Zone 8 (photo by H. Lincoln).



Figure 6.6 View of earlier Terrace #2 of Structure 1. Blue arrow indicates earlier terrace floor #2 which was underlain by fill and below that, the Zone 9 Plaza Floor #2 (red arrow, pointing north; photo by H. Lincoln).

Zone 9 Plaster Floor (Plaza Floor #2)

Zone 9 is a well-preserved earlier plaster floor, designated Plaza Floor #2 (**Figure 6.3**). A 1-x-1 m unit was placed entirely in Square A using a Total Station to excavate a small area of the Zone 9 floor (**Figure 6.5**). The south wall of this unit was placed directly on the line where Square A and Square B met and 30 cm west of the east edge of Square A to avoid two large stones protruding from the eastern wall of the unit. Zones 9–13 are all located within this 1-x-1 m square "punch down" in Square A.

Zone 9 represents the original limestone plaster floor of the plaza and runs underneath Terrace #1, the latest phase of Str. 1, and appears to be associated with Terrace #2 (see **Figure 6.3**). It is possible, however, that Plaza Floor #2 predates Terrace #2, which was not excavated during the January 2023 season.

Zone 10 Construction Fill

Zone 10 is directly beneath Zone 9 and is the construction fill associated with this well-preserved plaster floor exposed in the 1-x-1 m area of Square A. Zone 9 is composed of semi-compact silty clay with roots, limestone pebbles, limestone and chert cobbles just below the plaster floor. A single pottery sherd was found in this zone. Some yellow inclusions, likely from decomposed limestone were also visible in this zone.

Zone 11 Construction Fill

Chert and limestone cobbles increase in size throughout Zone 11, which is a continuation of the Zone 10 construction fill associated with Plaza Floor #2. In between the stones within this zone was very compact silty clay with some small roots (**Figure 6.7**).

Zone 12 Construction Fill

A drastic change in sediment and sediment color occurs at Zone 12. This very compact, very dark brown clay layer contained abundant charcoal and gravel. It is possible that this Zone was burnt. Small pottery sherds were also found within this Zone.

Zone 13 Construction Fill or Bedrock

Zone 13 is composed of multi-colored, highly compact clay with limestone and gravel inclusions surrounding massive irregular shaped stones (**Figure 6.8**). Due to the size of the unit and the size of the stones, it was impossible to remove any of the stones and therefore the unit had to be terminated. While the size of the 1-x-1 m unit was restrictive, it is also possible that

the large stones encountered at the bottom of this excavation may be bedrock. A small carbon sample was collected from this zone.



Figure 6.7 Large limestone and chert cobble fill at bottom of Zone 10/top of Zone 11 in Square A (photo by H. Lincoln).



Figure 6.8 Bottom of 1-x-1 m excavation unit in Square A (photo by H. Lincoln).

Interpretations and Conclusions

Excavation of Operation 65 succeeded in revealing the construction sequence of Str. 1 as well as its articulation with the plaza. Starting with the initial construction phase, it appears as though the limestone boulders found at the bottom of the 1-x-1 m punch down in Zone 13—surrounded by clay and gravel—could represent either the underlying bedrock of the area, or rock that was brought in as core fill to level the site prior to the construction of the initial plaza surface. No artifacts were recovered in this zone other than a piece of charcoal. Zones 10, 11, and 12 were additional fill layers that also appear to be part of the leveling phase and seem to constitute the original basal surface upon which the entire Northern Group was built (**Figure 6.3**). Zone 9 represents the initial plaza floor, characterized by thick plaster that may run underneath Str. 1 and predate the building. Either way, the plaza floor appears to be associated with Terrace #2, an earlier terrace/step construction found in the northern portion of Square A, which was bounded by a poorly preserved cut stone retaining wall.

This wall and fill of Terrace #2 were covered by Terrace #1 (Zone 3), a later terrace/step construction. The facing stones of Terrace #1 sit directly on a later plaster floor, referred to as Plaza Floor #1 (Zone 5). Zones 6, 7, and 8 are construction fill layers associated with Plaza Floor #1, which cover the earlier Zone 9 plaza floor. While Zone 8 is comparatively thicker and comprised of large limestone construction fill, Zones 6 and 7 are thinner layers of ballast with progressively finer sediments, suggestive of subfloors. This floor overlies the later plaza floor, suggesting that this phase of building expansion may have been the last large-scale change to the architecture in this area.

Overall, the stratigraphy seems to indicate that Str. 1 was built sometime during or right after the initial preparation of the first plaza floor, and that this structure was refurbished and/or expanded at least once, as indicated by the presence of two discrete terrace constructions associated with Str. 1. While detailed investigation of the artifacts recovered from Op. 65 is ongoing, preliminary analysis of diagnostic ceramics sherds suggest that Str. 1 was last occupied during the Postclassic. Radiocarbon analysis will help illuminate the earlier phases of use and construction of this structure and site.

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Chapter 7

Excavations of a Midden on Structure 2 at Xtabentun (Operation 67)

Eleanor Harrison-Buck and Hollie Lincoln

Introduction

During the January 2023 field season, Operation (Op. 67) exposed a portion of the front-facing (southern) side of Structure 2 in the so-called Northern Group at Xtabentun (see **Kaeding, Murata, and Willis, Chapter 4**). Excavations revealed a fairly well-preserved low platform wall with a one-course high step running along the front of the platform. **Kaeding, Murata, and Willis, Chapter 4** provide a more in-depth description of Structure 2. It is situated west of Structure 1, the largest platform in the Northern Group, and is significantly smaller, measuring approximately 12-x-8 m and 1.25 m high. Prior to excavations, a line of stones was visible on the surface that appeared to run in a straight line, oriented at 350 degrees. This line of stone suggested the building, like Structure 1, was not perfectly cardinal. Operation 67, a 6 m (east-west) x 2 m (north-south) unit was laid out at an orientation of 350 degrees in an effort to parallel this existing line of stone (**Figure 7.1**).

The mahlerized map based on a topographic survey that **Kaeding, Murata, and Willis, Chapter 4** subsequently produced of Xtabentun using a Total Station does not suggest the orientation of Structure 2 is as much as 10 degrees west of north, but closer to 1 to 4 degrees (see **Figure 7.2**). Excavations revealed that while the upper line of stone visible on the surface appears to be 350 degrees, the lower step may be oriented closer to cardinal, although it is less conclusive because of some dislodged stones (**Figure 7.3**). It is possible that the lower step is at a different angle from the upper platform and functioned as a low basal platform that was originally built to connect to Structure 1 to the east, which is oriented 340 degrees (see **Lincoln and Harrison-Buck, Chapter 6**). **Kaeding, Murata, and Willis, Chapter 4** note the existence of a raised area that likely served as a basal platform that elevated the area around Structure 2 above the surrounding plaza, which may have been connected to Structure 1 to the east and allowed a space between the two structures to function as a passageway.

Structure 2 marks the northwest corner of the Northern Group, which likely served as the main elite residential compound at Xtabentun. Often, midden deposits are found swept into the corner of residential plazas and are associated with ancillary structures that functioned as kitchen facilities attached to larger elite residential compounds (LeCount 2010). This possibility was one of the main reasons we decided to test this area of the plaza, in addition to the presence of well-preserved architecture visible on the ground surface.



Figure 7.1 Opening shot of Operation 67 on Structure 2 at Xtabentun (photo by E. Harrison-Buck).

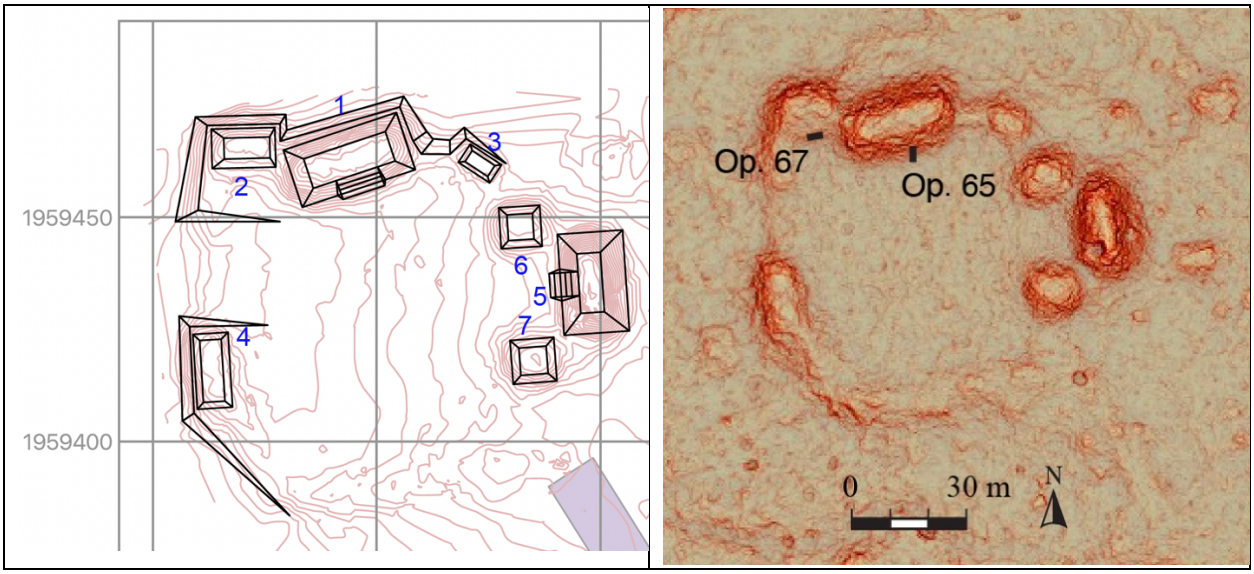


Figure 7.2 Xtabentun Northern Group. Left: mahlerized map showing Structure 2 (*after* Kaeding, Murata, and Willis, Chapter 4:Figure 4.1). Right: LiDAR map showing locations of Operations 65 and 67 (map by M. Willis).



Figure 7.3 Operation 67 showing final phase of Str. 2 and Floor #1 (photo by H. Lincoln).

Objectives

There were three primary objectives of this operation:

1. Test for the presence of midden deposits in the northeast corner of the plaza;
2. Expose the exterior of Structure 2 and confirm its orientation and potential association with Structure 1;
3. Investigate the presence of any earlier phases of construction to understand the different phases of construction and the history of occupation in the Northern Group.

Description of the Research and Methods Used

Op. 67, a 6-x-2 m unit, was subdivided into three squares (A-C), measuring 2-x-2 m each, although only Squares B and C were excavated. All vertical measurements were taken from Datum 1, located on a nearby tree at 42.5 cm above ground surface. 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. Picks and shovels were used to remove the overburden and trowels were used to define architecture and in situ artifacts. Below we review the details of this excavation by zone, our smallest unit of excavation.

Excavations of Squares B and C in Operation 67

Zone 1 - Topzone

Zone 1 was a roughly 10-20 cm thick, dark humic layer that extended across the entire operation and was excavated in Squares B and C. It consisted of a semi-loose, root-filled matrix. A light density of limestone and chert pebbles were encountered in this matrix toward the bottom of the zone, although patches of more compact clay were also noted toward the bottom. At the base of this zone, another row of stones was partially exposed and appear to be a step running along the southern side of Str. 2. Most of the ceramics appear to be Early Postclassic in this zone. A concentration of artifacts was found in the front of the lower step in the NE corner of Square B, including a very large rim sherd that may be an Early Postclassic Rio Juan unslipped jar. In addition to ceramics, some chert debitage was also encountered. Overall, only a light density of artifacts was recovered in Square C.

Zone 2 - Collapse/Midden

This zone appears to represent the uppermost portion of the collapse debris of the building, although the matrix was mostly comprised of dark silty-clay, organic material. The top of the step running roughly E-W was further exposed at the base of the zone and extended across all squares. Zone 2 was slightly grayer in color. A medium density of artifacts was recovered in Square B (~50), including animal bone, chipped tools and debitage, freshwater shell, obsidian, and ceramics. In Square B, excavation focused south of the lower (second) step but halted when a much lighter, clayey matrix with marl and small limestone inclusions was encountered, along with some larger collapsed building stones. Farther to the south in Square C, Zone 2 appeared as a mix of mostly building collapse and the top portion of a dense midden deposit heaped onto the southern side of the structure. Zone 2 was quite a bit deeper in Square C than in Square B perhaps due to the midden heap. Here, roughly 20-30 cm of collapse mixed with some of the midden was removed from this square whereas only about 10 cm of collapse was removed as Zone 2 in Square B. Artifacts recovered from the collapse and midden were numerous and included animal bone, debitage, freshwater shell, and ceramics.

Zone 3 - Collapse/Midden

Zone 3 was excavated in Squares B and C. In Square B, Zone 3 consisted of a thick deposit of collapse debris mixed with a dense midden deposit whereas in Sq. C the matrix of Zone 3 consisted mostly of midden debris. The matrix was dark in color (10YR3/2) and comprised a semi-compact silty-clay. It was a dense deposit taken down roughly 18 cm before the zone was arbitrarily changed (some areas of Zone 3 were thicker and some thinner across the unit). The artifacts recovered were numerous and included animal bone, chipped tools and debitage, ground stone, freshwater and marine shell and one possible piece of coral, human bone, obsidian, ceramics, and plaster fragments.

Zone 4 - Midden

This 12 cm thick zone consisted of the rest of the midden deposit excavated in Square C only, extending from the bottom of Zone 3 down to the level of a poorly preserved plaster floor surface. The midden heap was thickest in Square C and encompassed most of Zones 3 and 4 while in Square B it was thinner and was mostly removed as Zone 3. The bottom elevations of Zone 3 in Square B were roughly the same as the bottom elevations of Zone 4 in Square C, together exposing what appears to be roughly the level of Floor #1 (Zone 5) across the whole unit (see **Figure 7.3**). The matrix in Zone 4 in Square C were similar to Zone 3 and continued to be a dark grayish brown (10YR4/2), semi-compact silty clay. Many artifacts were recovered from this lower part of the midden, including animal bone, chipped tools and debitage, freshwater and marine shell, obsidian, ceramics, and plaster fragments. The midden deposit directly overlay the Zone 5 floor which was poorly preserved, consisting of only small plaster fragments near the wall stones. After exposing the level of Floor #1, excavations penetrated below the floor, but exclusively in Square C to the east.

Zone 5 – Floor #1/Fill

Zone 5 was only removed in Square C and represented the latest (terminal) floor surface associated with the one course high step running along the south side of Str 2. This poorly preserved plaster floor (designated Floor #1) and some of the fill below this surface to the south of the one course high step were removed as Zone 5. This ~16 cm thick fill layer was comprised of loose cobbles/pebbles mixed with soil (loose, silty, dark grayish brown 10YR4/2) and ended on top of a deeper surface (designated Floor #2). The one course high step did not continue below Floor #1. Many pieces of debitage and tool fragments were found in this zone, along with animal bone, ground stone, and pottery sherds.

Zone 6 – Floor #2/Fill

Zone 6 (**Figure 7.4**) was only removed in Square C and represented Floor #2, a plaster surface located directly below Zone 5 (Floor #1) and directly above Zone 7 (Floor Surface #3).

Floor #2 is a compact plaster surface that runs underneath the one course high step and appears to be associated with an earlier phase of interior construction that was not exposed in January 2023. Zone 6 was taken down ~10 cm to another well-preserved floor surface (#3). The matrix of Zone 6 was a loose and silty, grayish brown sediment (10YR5/2). No artifacts appear to have been recovered from the Zone 6 floor and associated fill.

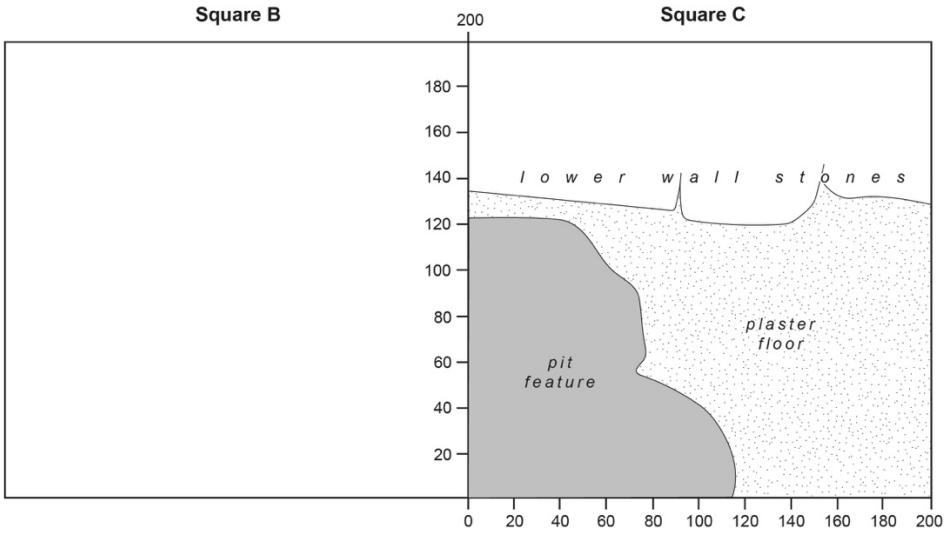


Figure 7.4 Foreground of Operation 67 showing top of Floor #2 (Zone 6) in Square C found directly beneath Floor #1 (Zone 5). Note Floor #2 runs underneath the east-west step (photo by H. Lincoln).

Zone 7 – Floor #3/Fill

Zone 7 was a nicely preserved plaster floor defined at the base of Zone 6. The Zone 7 floor surface extended across Square C but was interrupted by a cut in the western side of the square. The cut of the pit in Floor #3 was defined but not excavated in January 2023. The edge of the cut was visible at the interface of Squares B and C (see **Figure 7.5**). Floor #3 designated Zone 7 consisted of a semi-compact silty loam, grayish brown in color (10YR5/2). Only a small portion of the Zone 7 plaster floor within Square C was removed in an area measuring roughly

1m (east-west) x 1.2 m (north-south) just to the south of the wall stones of the lower step (**Figure 7.6**). Pottery fragments were found lying on Floor Surface #3, some of which were removed as part of Zone 6. Additionally, chipped tools and debitage and marine shell were recovered on and in the fill of Floor #3. Artifacts included animal bone, chipped tools and debitage, freshwater shell, obsidian, and pottery sherds.



BREA 2023 XT
Op67 Str. 2 Pit Feature
Scale 1 cm = 20 cm



Figure 7.5 Planview showing extent of pit feature exposed in Square C of Operation 67 (above) with a field photo that shows the western edge of the cut right at the interface with Square B (drawn by H. Lincoln; digitized by M. Brouwer Burg; photo by H. Lincoln).



Figure 7.6 Closing shot of Operation 67 showing in Square C (middle) the top of Zone 7, Floor Surface #3 (photo by H. Lincoln).

Interpretations and Conclusions

Operation 67 succeeded in finding a dense midden deposit in the northeast corner of the plaza. A preliminary analysis of the discarded objects in the midden from Zones 3 and 4 alone suggest numerous cooking and serving vessels, at least 5 ground stone fragments, over 75 broken chipped tools, and roughly 260 animal bones (including fish and small and large mammals). The midden heap lay directly over Floor #1, the latest floor surface that appears to be directly associated with the one-course high step running along the southern edge of Structure 2.

What still needs further clarification is the exact orientation of Structure 2. While the upper line of stones aligns with the orientation of the unit at 350 degrees, the lower step is less clear due to several dislodged stones (see **Figures 7.3-7.5**). The lower step does appear to widen as it moves east and may have a slightly different orientation than the upper line of stones. It is possible this basal step/platform was added at a slightly different angle (closer to cardinal) to connect Structure 2 with what was likely the main elite residence at Xtabentun (Structure 1) to the east. While further excavation is necessary to fully understand the relationship between these two structures, the dense midden deposit containing numerous household goods may indicate that Structure 2 served as an attached kitchen. The suite of household items found in the

associated midden deposit suggest food preparation and cooking occurred in this vicinity at least during the final phase of occupation.

While terminal debris associated with the building suggest a Terminal Classic to Early Postclassic final occupation, excavations in Operation 67 suggest an earlier date of occupation for the Northern Group. A total of three floors (Floors #1-3) were exposed in Square C of Operation 67 (**Figure 7.7**). Notably, both Floor #2 (Zone 6) and Floor #3 (Zone 7) run underneath the one course high step and suggest that Structure 2 has at least one (if not two) earlier phases of construction. Further excavation is necessary to fully understand the history of occupation in the Northern Group, but the identification of a possible E-Group to the south of the Northern Group (Str. 10, see **Kaeding, Murata, and Willis, Chapter 4**) suggests at least parts of the site were established as early as the Preclassic. While the ceramics in the midden suggest that the Northern Group may have been occupied as late as the Terminal Classic-Early Postclassic, it would not be surprising if future investigations find an earlier vibrant Classic period occupation beneath this latest phase.

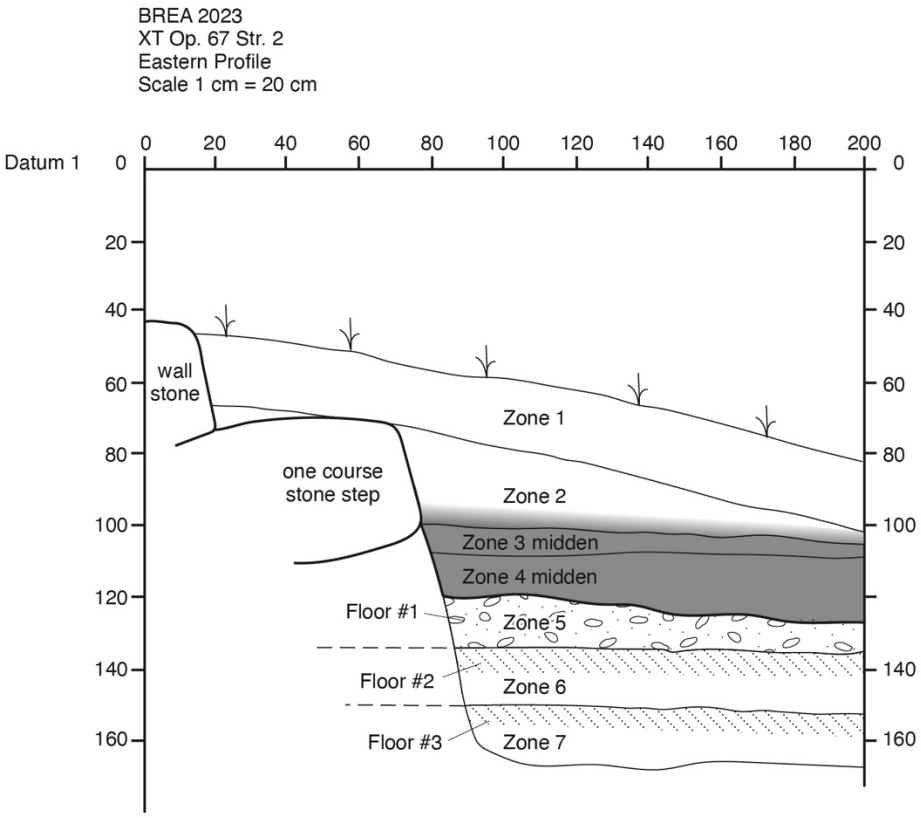


Figure 7.7 East wall profile of unit (drawn by H. Lincoln; digitized by M. Brouwer Burg).

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Chapter 8

Further Excavations at Waxak Nicte' (Operation 66)

Katherine Shelhamer and Eleanor Harrison-Buck

Introduction

Waxak Nicte' was initially discovered by the BREA team in 2016 as part of an effort to identify Maya sites located close to the Northern Highway (Murata et al. 2022). Ongoing reconnaissance and mapping have shown it to be a sprawling site, consisting of several discrete plaza groups (A-C; Buck et al. 2020). In January 2020, excavations were carried out at Plaza A in the site center. At the time, access to the southeastern portion of the site was limited due to landowner permission, which prevented any excavations from occurring in that area. During the January 2023 field season, landowner Mr. Charlie Wade granted us access to Waxak Nicte' and conduct Operation 66 at Plaza C.

Also referred to as Gardner Plaza, Plaza C is noticeably separated from the site center and most other substantial structures (**Figure 8.1**). Additionally, it has an unusual layout with six non-cardinal structures almost completely enclosing the plaza. Although this area had not previously been excavated, it was thoroughly cleared and mapped by students during the January 2020 season (Murata et al. 2022). At that time there was already evidence of looting on several of the mounds, including the structure where Op. 66 was conducted. The intention of this operation was to better understand this isolated plaza group and how it relates to the larger site.

Objectives

1. To expose a portion of the final phase of architecture and any earlier phases of occupation.
2. To collect ceramic and/or carbon samples from each phase of construction for use in chronological analysis of the structure's development.
3. To find and define the plaza floor and its' orientation to the structure.

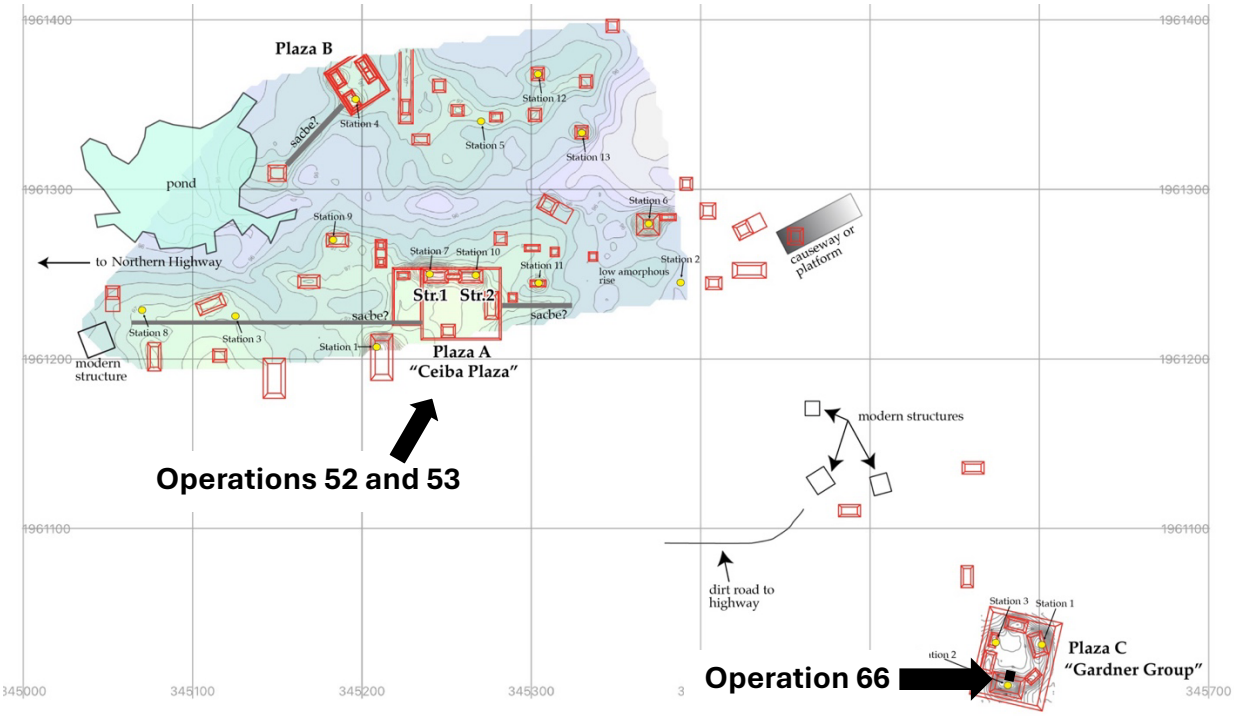

Figure 8.1 Topographic and architectural map of the Waxak Nicte' site, with the Wade Group (Plaza C/Gardner Plaza) shown in the southeast corner (*after* Murata et al. 2022:Figure 4.2).

Operation 66 at Waxak Nicte'

Operation 66 at Waxak Nicte' was a 2-x-5 m excavation unit, oriented cardinally with the length of the unit running N-S. The unit was originally 2-x-4 m, sub-divided into two squares (A and B) measuring 2-x-2 m each. Later, the unit was extended 1 m to the north via Square C (**Figure 8.2**). All squares were excavated during the January 2023 field season.

Within Plaza C, Operation 66 was located on the southern-most structure (**Figure 8.1**). The unit was placed in the center of the north side of the structure. Preliminary investigation of the mound led us to believe there may be a central staircase stepping down into the plaza, so the unit was laid out with the objective of exposing this potential feature.

Excavation was carried out using trowels, small to large pickaxes, and five-gallon buckets. Most soil was then put through ¼-inch mesh screens, although some especially dense clay had to be hand screened. A singular datum to the east of the unit (Datum A) was used for all vertical measurements during excavation.

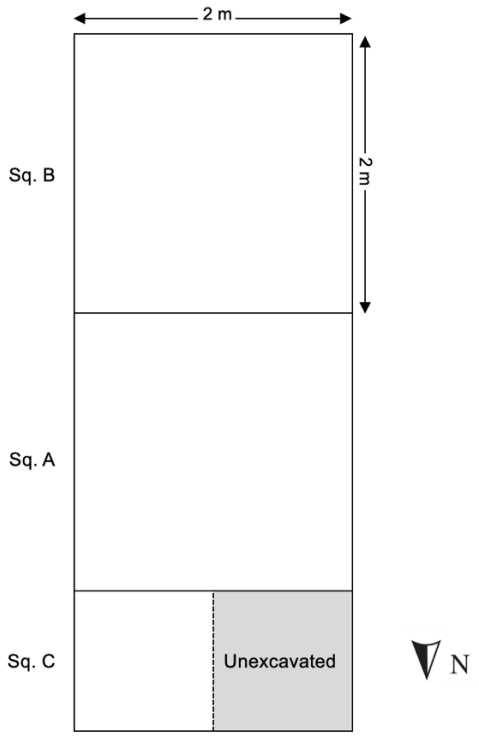

Figure 8.2 Overview of Op. 66 showing layout of all squares (image by K. Shelhamer).

Zone 1 – Topzone

Zone 1 across all squares is composed of dark (10YR2/2), loose, loamy soil with little archaeological material. This zone had thin, densely packed roots throughout which had to be peeled back using hand picks. There were also what appeared to be the remnants of modern tree burn in the northwest corner of Square A. Because there was collapse material so close to the surface this zone was closed once the dense root layer was removed and was therefore very shallow.

Zone 2 – Collapse

Zone 2 is a layer containing collapse debris located directly below Zone 1 in all squares. Compared to Zone 1, the soil was still dark (10YR2/1) and loamy but also contained small to medium limestone collapse ranging from 10–20 cm in diameter. Notably, a jade fragment was collected from Square B in this zone. The portion of Square B in which this and numerous artifacts were found was disturbed by a small tree, so it is possible they were pushed up from an earlier context. The same evidence of tree burn seen in Zone 1 in Square A was still visible in Zone 2. There were also small chunks of plaster speckled throughout the zone in Square A, over the plaza area.

Zone 2 was closed as soon as we came down on top of the large facing stones that would later be labeled as Zone 9. This was done so we could collect artifacts that were "on structure" and "off structure" separately as we continued to define the architecture.

Zone 3 – Collapse

Zone 3 represents the "off structure" collapse debris located beneath Zone 2 (**Figure 8.3**). This zone is only present in Squares A and C, north of Zone 9. The soil matrix was dark (10YR2/1) but becoming slightly more compact and characterized by an increased presence of plaster and limestone speckle throughout. Smaller limestone collapse ranging 10–20 cm in diameter was still present in this zone along with one large stone that we believed may be sitting on a potential surface. Artifact density was light (mostly ceramic) and preservation was incredibly poor. The zone was ended when we came down on a more concentrated layer of horizontal plaster chunks sitting at the base of the Zone 9 facing stones.

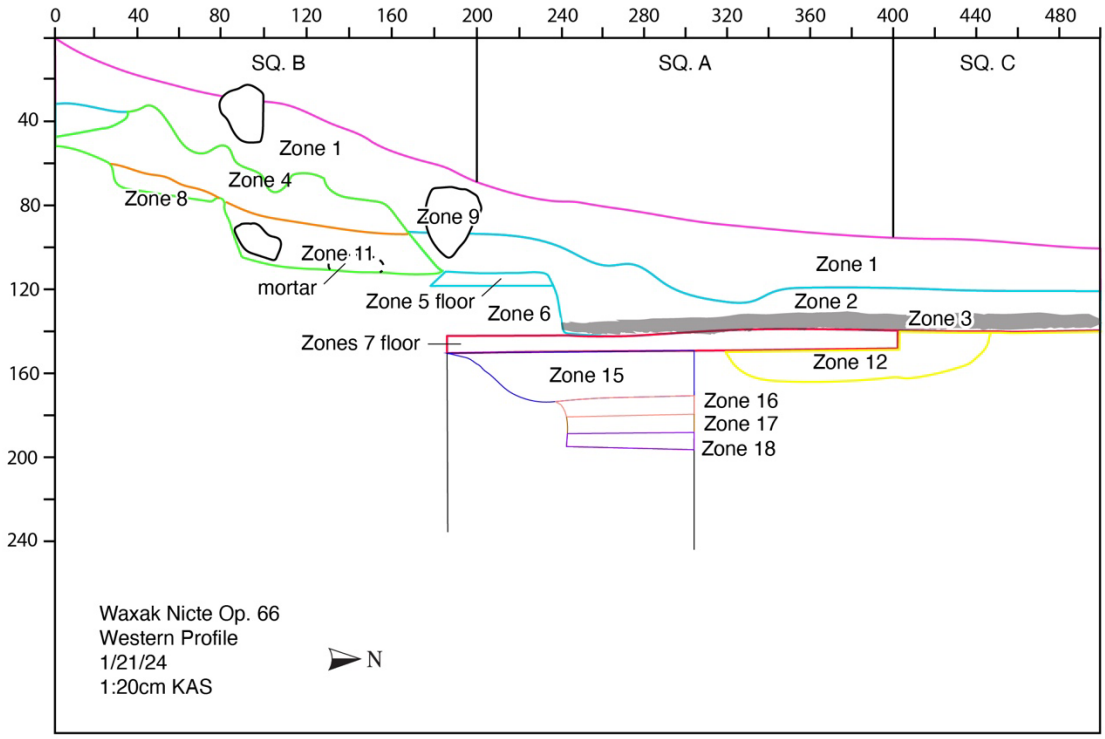

Figure 8.3 Western profile of Operation 66 indicating zones (image by K. Shelhamer).

Zone 4 – Collapse

Zone 4 represents the "on structure" collapse debris located beneath Zone 2. This zone is only present in Square B, south of Zone 9. The soil matrix was dark (10YR2/1), with a semi-compact but crumbly texture. There was also highly eroded limestone speckled throughout.

Artifact density was light. The zone ended when all collapse stones were removed, using the top of the Zone 9 wall stones as a guide.

Zone 5 – Floor

Zone 5 is what remains of the latest plaster floor in Squares A and C. This surface corresponds with the Zone 9 wall and appears to slightly lip up on the front of the facing stones before sloping away toward the north (**Figure 8.4**). The plaster was highly fragmented and poorly preserved, seemingly due to both elemental erosion and fallen collapse. The thin plaster layer and the ballast beneath were both excavated as Zone 5. The construction ballast was characterized by a slightly grey soil (10YR3/1) mixed with small 3–5 cm diameter stones and gravel-like limestone chunks. Artifacts recovered from this zone were mostly eroded ceramics.



Figure 8.4 Top of Zone 5 surface in Square A (photo by K. Shelhamer).

Zone 6 – Floor/Step

Zone 6 is an intact earlier plaster floor directly below Zone 5. This floor was distinct with a much lighter color (10YR7/2), smooth texture, and solid composition. There was a noticeably higher concentration of lithics and less ceramics in this zone. The lithics being collected were higher in quality than what we had seen thus far in the excavation, with more chipped tools and nicer chert. Zone 6 was exposed in Square C, but was only excavated in Square A.

Unfortunately, we used a pickaxe to excavate this zone and, in the process, failed to notice that we went through what was likely a low-lying step without switching zones. This step,

as we refer to it, can clearly be seen in the southern profile of Square A (**Figure 8.5**), but when we tried to follow it east or west in the profile it fades out. Because this was something we caught in the sidewall after the fact, that means any artifacts collected as part of Zone 6 could be from either the step or the floor beneath it. Both the step and floor were constructed with a layer of 10–15 cm diameter stones directly underneath the plaster.



Figure 8.5 Zone 6 partially excavated on the eastern half of Square A (photo by K. Shelhamer).

Zone 7 – Floor

Zone 7 is the label given to the earliest plaster floor, located below Zone 6. We did not end up excavating anything as Zone 7, but it was exposed in the eastern half (1-x-2 m) of Square A. Part of Zone 7 was excavated as the Zone 15 punch down. This was kept separate so we could later excavate the rest of the zone normally, but there was not enough time in the season.

Zone 8 – Construction Fill

Zone 8 is a potential later course of construction located in the southern half of Square B (**Figure 8.6**). It is comprised of loosely packed 3–5 cm diameter stones mixed with dark loamy soil that is steeply mounded in a way that suggests it has slumped down from its original position. This appears to be construction fill sitting on top of the lower terrace, but we did not find any retaining wall after completely leveling it.



Figure 8.6 Zone 8 unexcavated in Square B and Zone 9 wall (photo by K. Shelhamer).

Zone 9 – Wall

Zone 9 is architectural in nature, consisting solely of the large facing stones that make up the latest phase of construction. This wall was the most clearly defined piece of architecture we had and served as an anchor for the excavation, even though it only contained two stones. The stones in question were quite large, with the bigger of the two measuring about 90 cm wide x 40 cm tall. The wall runs slightly off-cardinal E-W, almost directly on the line between Squares A and B (**Figure 8.6**). In order to proceed with the excavation, we had to remove the smaller stone on the western side of Square B.

Zone 10 – Cleanup

Zone 10 was used to clean up dark, silty soil (10YR2/1) that was left behind after the western Zone 9 wall stone was removed. This appeared to be soil that filtered into the cracks around the architecture and therefore was not the same as the rest of the construction fill. This was an incredibly shallow, transient zone just around the edges of where the wall stone once was in Square B.

Zone 11 – Construction Fill

Zone 11 is the later phase of construction fill retained by Zone 9. This zone was only excavated on the western half of Square B (1-x-2 m) where we were able to remove one of the lower terrace wall stones. This zone was characterized by a semi-compact dark grey soil and

light artifact density with 10–15 cm diameter limestone inclusions throughout. Our goal was to continue to remove this fill until we fully uncovered the earlier phase of construction that corresponds with Zone 6.

Zone 12 – Pit Feature (Burial)

The outline of an intrusive pit was identified at the bottom of Zone 7 in the eastern half of Square A (**Figure 8.7**). In this pit, the remains of what is likely an adolescent male, buried in extended position, were recovered (Biggs, pers. comm.). The individual was oriented N-S and was, in general, poorly preserved. The burial pit was partially lined with rocks. A macroblade fragment was found in association with this individual and we speculate that it may have been an heirloom (see **Figure 8.10**). All bones associated with this individual were collected and are undergoing bioarchaeological analysis (see **Biggs and Bower, Chapter 11**).

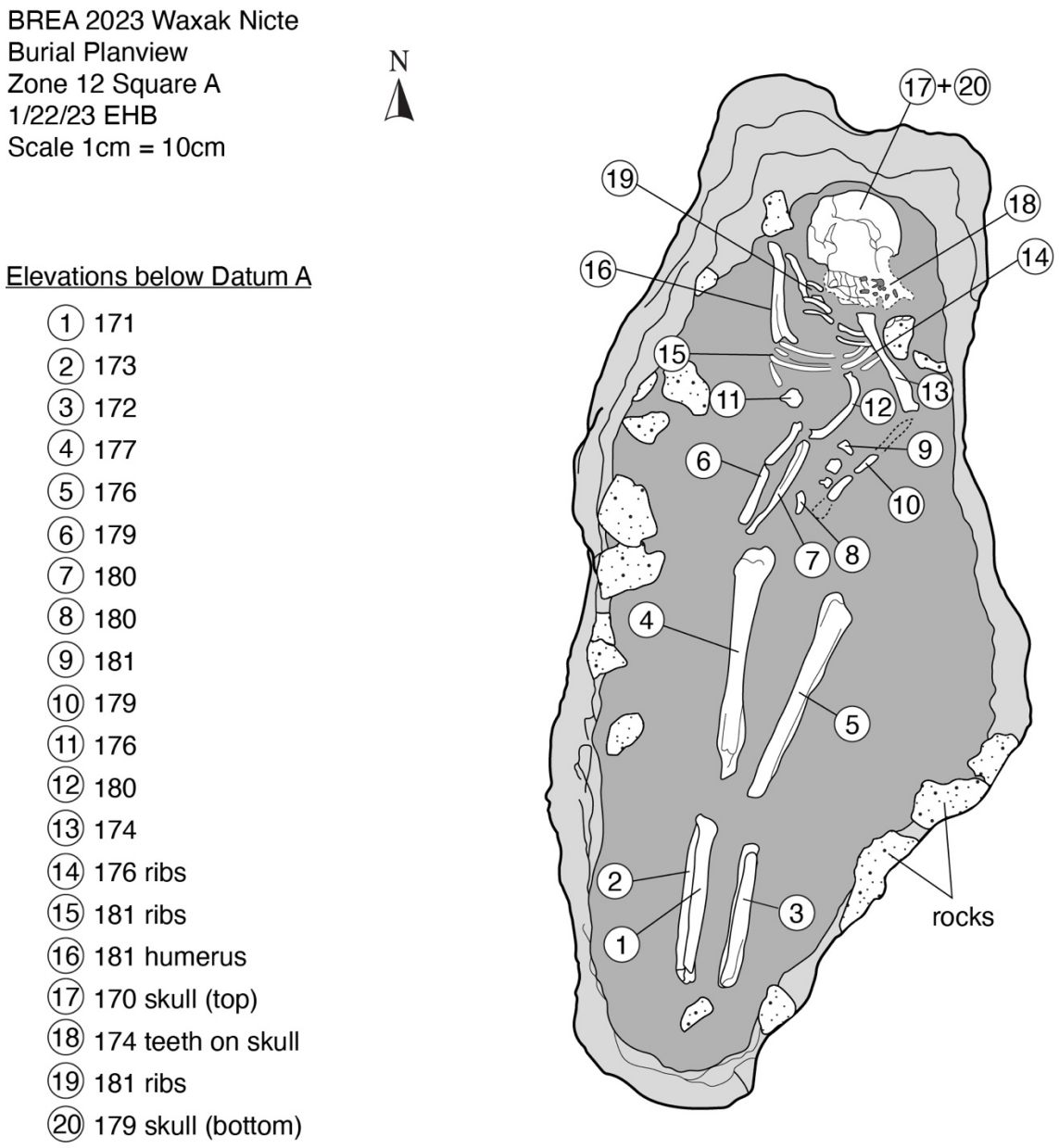

Figure 8.7 Zone 12 interment (image by E. Harrison-Buck, digitized by M. Brouwer Burg).

Zone 13 – Posthole

Zone 13 is one of two postholes that cut into Zone 7 in the southeastern corner of Square A (**Figure 8.8**). Zone 13 is the posthole located further to the north. It is 15 cm in diameter and 18 cm deep. This feature was capped with a stone and no artifacts were returned.

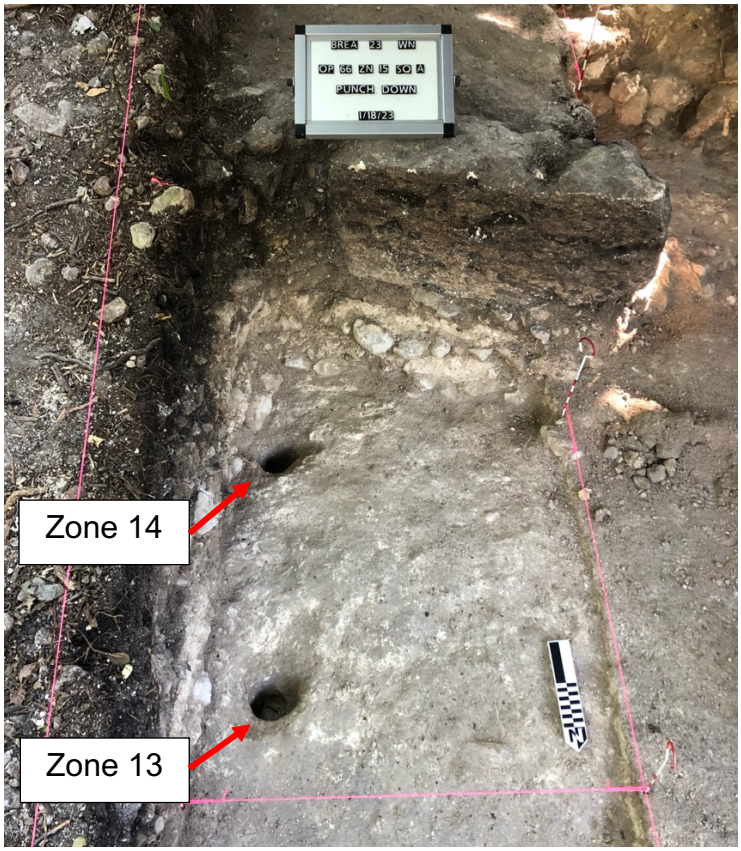

Figure 8.8 Top of Zone 15 with Zones 13 and 14 already excavated (photo by K. Shelhamer).

Zone 14 – Posthole

Zone 14 is the second posthole that cut into Zone 7 in the southeastern corner of Square A. Zone 14 is the posthole located further to the south (**Figure 8.8**). It is 18 cm in diameter and 38 cm deep. Daub and charcoal fragments were collected from this zone, about 10 cm from the bottom.

Zone 15 – Floor

Zone 15 is the start of a 1-x-1 m punch down in the southeast corner of Square A (**Figure 8.9**). It contains the only excavated portion of Zone 7 and the construction fill beneath it (see Zone 7 description). This zone is about 20 cm deep and comprised of plaster floor over top of a light (10YR6/3) sandy layer. Few, if any, ceramics were collected and the lithics we found were highly patinated. The Zone 14 posthole also cuts into this zone.



Figure 8.9 Punch-down in Square A at the top of Zone 18 (photo by K. Shelhamer).

Zone 16 – Earthen Layer

Zone 16 is a continuation of the 1-x-1 m punch down beneath Zone 15. It is characterized by a sudden transition to grey clay (10YR5/2) with minimal artifacts and highly friable burned ceramics. This zone is not uniform in depth because the grey clay goes around some type of amorphous ledge on the southern side of the punch down (**Figure 8.3**). The Zone 14 posthole also cuts into this zone.

Zone 17 – Earthen Layer

Zone 17 is a continuation of the 1-x-1 m punch down beneath Zone 16. It is characterized by a sudden transition to extremely dark clay (10YR2/1) with small bits of charcoal speckled throughout. The ceramics in this zone were still burnt, but better preserved and several diagnostic sherds were collected. Some daub was also present in this zone.

Zone 18 – Earthen Layer

Zone 18 is a continuation of the 1-x-1 m punch down beneath Zone 17. It is characterized by a sudden transition to slightly lighter (10YR5/4), more yellow marled clay. The

clay in this zone was extremely compact, to the point that it was difficult to excavate at all. The only visible presence of cultural material in this zone was intermittent ceramic smear that could not be collected. The zone was ended after only a couple centimeters due to the end of the season.

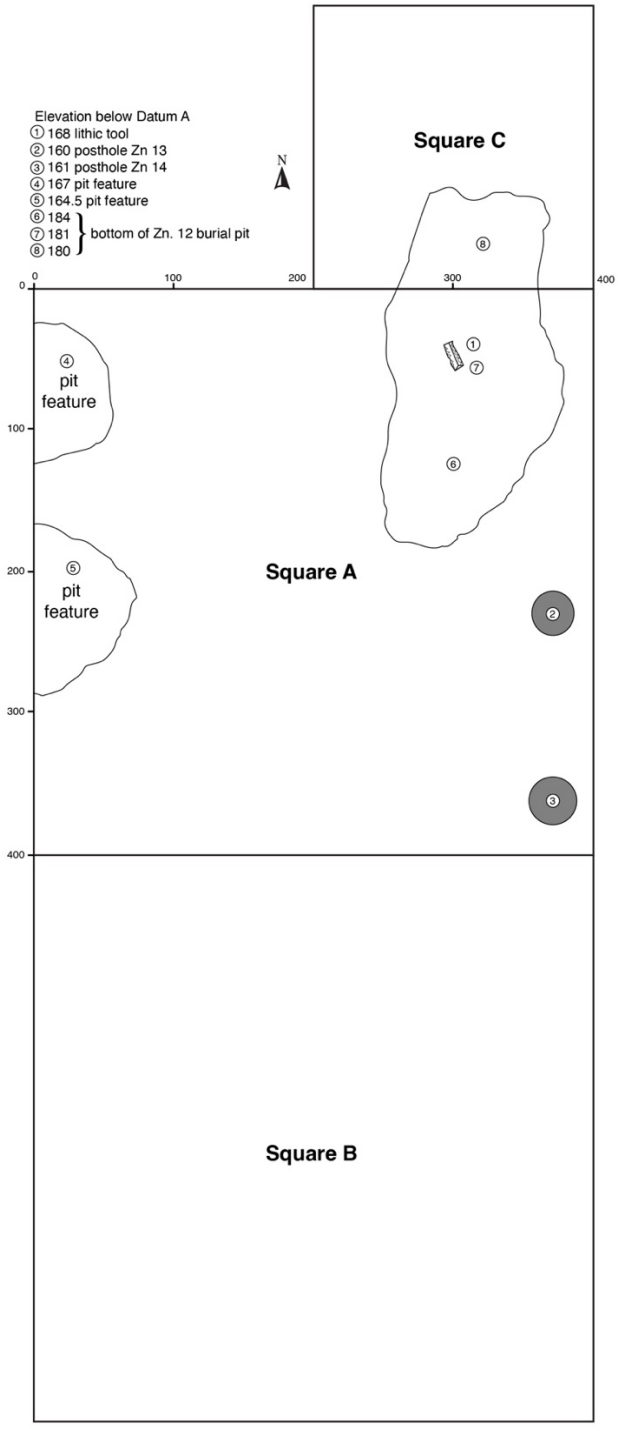

Figure 8.10 Closing plan view of Operation 66 (image by E. Harrison-Buck, digitized by M. Brouwer Burg).

Interpretations and Conclusions

Op. 66 was a confusing but productive excavation. Unfortunately, we failed to articulate the central staircase we originally speculated could be present on this structure. We were still able to succeed in our objectives by identifying distinct construction phases, finding the plaza floor, and gaining a better understanding of Gardner Plaza's relation to the rest of the site. For example, the type of low-lying monolithic facing stones present at Op. 66 appear similar to what was previously found on Structure 2 at Op. 53 (see Lamb 2020).

We did have some difficulty finding and defining the boundaries of the architectural phases. This was largely due to the fact that there were almost no facing stones and most of the construction fill was slumped and amorphous in nature. This is reminiscent of Op. 52, which was previously conducted at Waxak Nicte' (Shelhamer et al. 2022). Zone 8 at Op. 66 is very similar to Zone 10 at Op. 52 in the way it completely lacks any retaining stones. The earlier phase of construction we uncovered beneath Zone 11 at Op. 66 also appears to be lacking facing stones. Just like we surmised at Plaza A, this suggests some type of dismantling or robbing of larger architectural stones occurred at Plaza C.

It's clear that we passed through several chronological periods with this excavation, but further laboratory analysis of diagnostic artifacts will help us better understand exactly what time periods are represented. Our initial thoughts on the highly patinated chipped tools from Zone 15 suggest possible re-use of archaic tools. This is something that could also benefit from further analysis.

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Chapter 9

Searching for Traces of Archaic Occupation Beneath a Maya Urban Core at Xtabentun (Operations 68 and 69)

Marieka Brouwer Burg, Fiona Haverland, and Samantha Krause

Introduction

One of the primary goals of the Northern Belize Archaic Adaptation Strategies (NBAAS) project is to identify stratified Archaic occupations. Various strategies have been employed to this end, including intensive surface survey and shovel test pitting. However, even at sites where diagnostic Archaic tools have been found, such as Crawford Bank, intact deposits have yet to be fully confirmed (see Harrison Buck et al. 2018; Stemp and Harrison-Buck 2019; Brouwer Burg 2022; Brouwer Burg and Harrison Buck 2023 eds.). Thus, one of the aims of the January 2023 NBAAS field season was to target known ancient Maya sites in order to punch down below Maya occupation to determine if Archaic deposits exist beneath. The reoccupation of Archaic Maya occupations by Preclassic and Classic Maya populations is a pattern that has been identified at some select sites, such as Xunantunich, Pulltrouser Swamp, Wits Cah' Akal, and Callar Creek Quarry (Brown et al. 2011; Horowitz 2017; Murata 2011; Pohl et al. 1996).

The site of Xtabentun is located at mile 26 on the Philip Goldson Highway. It was originally identified during reconnaissance of Najil Iik by David Buck and others (Buck et al. 2022; Murata et al. 2023). As can be seen in **Kaeding, Murata, and Willis, Chapter 4:Figure 4.1**, a ballcourt lies at the southern end of the site core (comprised of structures 8 and 9) but had been partially bulldozed in recent times. Mr. Mike Sagura (aka Flowers)—the landowner—could recall that this had been done perhaps ~30 years ago as part of the limestone mining required for the construction of the Philip Goldson Highway. As a large chunk of the ballcourt had been cut away, almost down to its base, we felt this could be a good location to punch into older stratigraphy.

Objectives

1. To test the lower foundational layers, and perhaps site preparation techniques, of a Classic Maya ballcourt in Op. 68
2. To expose stratigraphy dating to before the construction of the ballcourt in Op. 68
3. To explore the construction sequence of a ditch feature in Op. 69.
4. To investigate the stratigraphy below the ditch feature in Op. 69.
5. To collect C-14 samples and associated artifacts.

In both Operation 68 and 69, trowels and small to large pickaxes were used to remove the dense clay and sascab (naturally occurring, eroding limestone). We screened between 50-100% of the excavated soil with a ¼-inch screen. Below, we describe each of the zones from each operation. We discuss them in context because they were carried out by the same team, in the same time span, with the shared goal of punching below Maya construction to identify possible traces of Preceramic occupation.

Operation 68 at Xtabentun

Operation 68 was oriented cardinally, at the base of what was originally thought to be a pyramidal structure (**Figure 9.1**). However, after further clearing of overgrowth, it was determined that the operation was at the base of the easternmost structure of a ballcourt. The operation began as a 1-x-1 m unit (Square A) but was expanded to the west with Square B (1-x-1m), which facilitated access into the unit. The landowner told us that the original structure used to stretch "up to the top of the trees" when he was a child. However, the building was gutted for building material in the 1970s with the construction of the new northern highway.

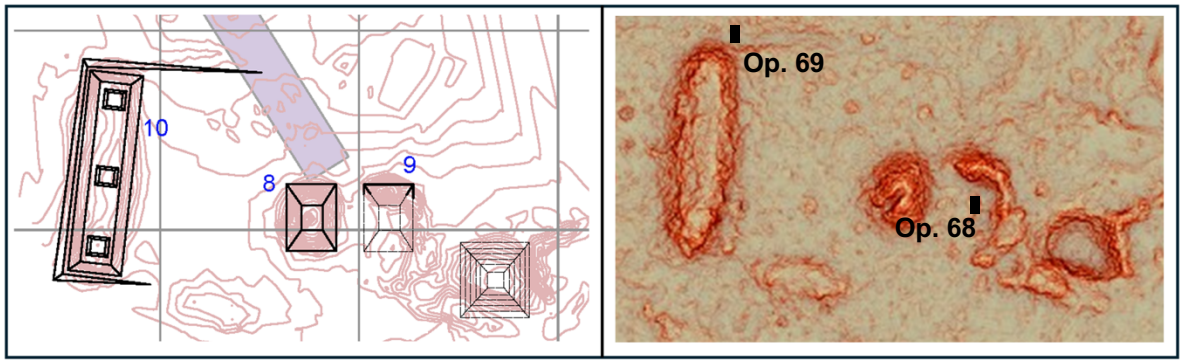

Figure 9.1 Location of Operations 68 and 69 in the Southern Group at Xtabentun (*after* Kaeding, Murata, and Willis, Chapter 4:Figure 4.1).

Zone 1

This zone comprised a lowland jungle topsoil (10YR2/1, black) replete with roots, leaves, and cahune nut shells. Many limestone cobbles (10-20 cm in diameter) were recovered, likely strewn about by the bulldozer. It was assumed that this zone represents bulldozer disturbance that broke up the construction blocks and ballast at the bottom of the ballcourt building. In the last ~40 years, a 5 cm thick topsoil (O horizon) formed on top of this disturbance layer. In total the layer is about 10 cm thick. The sediment matrix itself was a compact clayey limestone with a sticky and wet texture.

This zone contained a low number of artifacts (~20), most of which were fragmented, including a chipped tool fragment and debitage. Limestone pebbles and cobbles between 0.5-20 cm were found throughout and are thought to be eroding limestone plaster construction fill that has been additionally broken up by the bulldozer.

Zone 2

This zone is a slightly lighter clayey sediment (10YR4/1, dark gray) that continues to be full of limestone chunks and pebbles. We interpreted this layer as construction fill that had been disturbed by bulldozing and likely also some slump after the bulldozing event. This sediment was a sticky clay with limestone chunks throughout. The zone was roughly 15 cm thick and consisted of a dense clay. Very few artifacts were recovered from this layer (~3), including a highly eroded body sherd and two pieces of debitage.

Zone 3

The third zone was a brown clay (7.5YR3/2, very dark brown) underlying the lighter sediment of Zone 2. At this point, we began to screen at 50% due to the many fewer artifacts found in the previous zone. This brown clay still contained limestone flecks that were smaller than the above-lying zones, and bits of shell, degraded pottery, chert debitage (1-10 cm in diameter), and charcoal were observed. The average thickness of this layer was ~12 cm. Very few artifacts were collected (~2). At the bottom of this zone, we began to expose a white, marly surface that may have been a prepared plaster surface. This layer was encountered around 70 cm BD.

Zone 4

The last zone was excavated down 15 cm into what appeared to be either a prepared plaza floor and subfloor ballast or sascab. This silty clay sediment was dry, crumbly, and sometimes powdery (**Figure 9.2**). The sediment was colored 2.5Y9/1 (white), with some mottles light gray 2.5Y8.5/1. Small, soft chunks (1-15cm) of limestone were present at about 40%. Screening was carried out at 50%. A few darker lenses, full of burned material, were encountered between 80-100 cm. A charcoal sample was taken for C14 dating in the sediment at 99 cm. Additionally, a small piece of a possible charred corn kernel was collected as an archaeobotanical sample. Between 100-135 cm, a few small, brown clay pockets were exposed but were very ephemeral and difficult to distinguish as separate zones (**Figure 9.3**).

To determine the depth of this zone, we punched down another 80 cm in the eastern half of Square A (in a 1-x-0.5m rectangle) to a depth of ~170 cm BD. The sediment remained consistently powdery, and we did not observe chunkier or harder limestone cobbles, as would be expected if we were digging into natural limestone bedrock. Instead, we continued to observe

ephemeral layers of medium brown clay within the material, which could be interpreted as traces of basket load fill.



Figure 9.2 Bottom of Zone 4 in Square A (looking south; photo by M. Brouwer Burg).

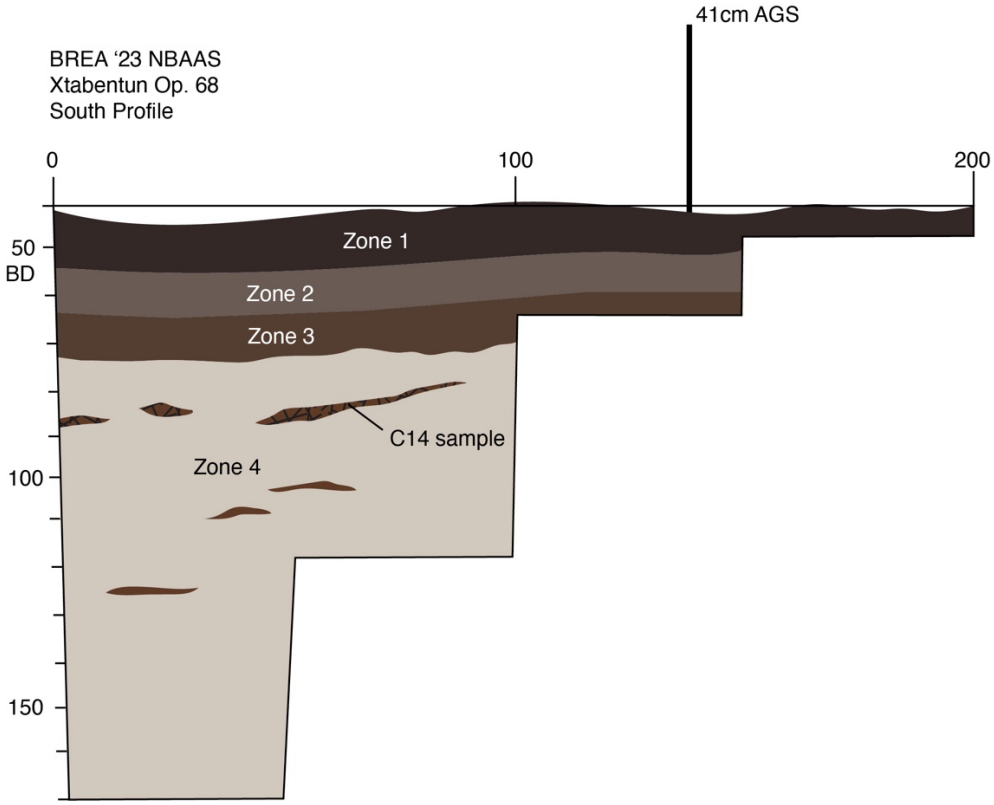

Figure 9.3 South profile of Operation 68 (drawing by M. Brouwer Burg).

We collected four soil samples from this operation for future analysis (**Table 9.1**).

Table 9.1 Soil samples from Operation 68 at Xtabentun.

Sample No.	Depth Below Datum (cm)
1	90
2	40
3	20
4	10

Interpretations

In summary, while we failed to find diagnostic materials from the Preceramic in this operation, we were successful in obtaining a better understanding of the construction sequence of the basal layers of the easternmost ballcourt building. Based on the data recovered, it appears that the uneven ground surface around the Xtabentun site core was filled in with sascab ballast, probably during the Preclassic period, in preparation for further construction. This foundational material may have been mined and brought to the site, as evidenced by the deep profile of Operation 68. It is also possible that the ancient Maya scraped down to limestone bedrock and then elevated the foundation of the site with additional sascab. They likely used basket-load construction, of which we see ephemeral traces in Zone 4. The charcoal-rich lenses seen in Zone 4 may represent a specific period of construction during which plaster was being produced by burning limestone and mixing it with water. At the top of Zone 4, we saw a few faint traces of a prepared limestone surface, which was likely disturbed by recent bulldozing.

It appears that Zones 1-3 at Operation 68 were the result of mixing via post-depositional processes, evidenced by the presence of many chunked-up limestone cobbles, pebbles, and artifacts. We assume that originally, Zones 2 and 3 were likely part of the construction fill of the ballcourt building.

STP Series 047

Before opening another unit, we wanted to get a sense of the depth of the purported sascab brought in to level off the site. Thus, we conducted a very brief STP survey (047) with the intent of identifying another location close to bedrock for test excavation. The first STP was located just west and along the center line of the eastern range structure, thought to be part of an E-Group structure at the site. The second STP was located about 20 m due west, in what we assumed would be the E-Group plaza. The third STP was located 3 m west of a low rectangular structure that was part of a large administrative or residential group on the north side of the site.

Table 9.2 Results of STP Series 047 at Xtabentun.

STP #	Positive or negative	Ending elevation (cm BGS)	Soil profile and stopping point of STP
1	Positive	58	0-10 cm dark humic layer; 10-34 cm medium brown clay that gets lighter with depth; 34-58 cm sticky marl that becomes powdery marl (sascab); one small sherd
2	Positive	46	0-27cm dark brown humic layer; 27-46 cm powdery marl with some limestone cobbles (sascab); one chert flake
3	Positive	60	0-50 cm dark brown humic layer; 40-50 cm pale brown horizon of clay; 50-60 cm clay descends into powdery marl; four small and eroded sherds all from humic layer

What became apparent through this STP survey was that the sascab base of Xtabentun was apparently deep and widespread. Not only did we encounter it in the blown-out ball court building investigated in Op. 68, but we also found it west of the E-Group range structure, and to the north along the edge of the administrative/residential component. This suggests that much effort was directed at the raising and leveling of the site area prior to building, which likely took place in the Late Formative period. The same powdery marl/sascab was found at the bottom of text excavations in Op. 65 (see **Lincoln and Harrison-Buck, Chapter 6**). With this knowledge, we decided to focus our remaining efforts at Xtabentun on a low ditch-like area, where we hoped to get one last insightful view into the preparatory work involved in the construction of the site.

Operation 69 at Xtabentun

With the closing of Operation 68 and conclusion of STP series 047, we refocused our energies along a low-lying, ditch-like feature running roughly 280 degrees (or 10 degrees north of west) at the site (**Figure 9.1**). This ditch began near the N-S sacbe and continued to the west, at least as far as we could see with the naked eye. Further LiDAR analysis will help to clarify this impression.

We located Operation 69 just to the north of the site's eastern range structure, which is part of an E-Group configuration. In placing the unit here, we hoped to not only capture some of the construction sequence of the range structure, but also—given the already low-lying nature of the ditch—we hoped to be able to easily punch down to any potentially earlier occupations. The unit, 1-x-2 m in dimension, was oriented with the long side pointing north. We screened 50% of sediment due to the difficulty of screening the dense clay fill.

Zone 1

This zone represents a black (10YR2/1), humic topsoil (~10 cm in thickness), dense with roots and cahune nut shells, and another ~15 cm of dense, sticky, silty gray clay (GLEY1 2.5N). This gray clay became concentrated in the northern half of the unit with depth. This zone became somewhat lighter (10YR4/1, dark gray) in coloration in the southern half of the unit with depth, due to an increase in small limestone inclusions. Some of these limestone chunks appear to have been broken up in antiquity, while others were broken by us as we excavated with the pickaxe (necessary in the clayey soil). A few larger limestone cobbles (>30 cm) were exposed in situ and may have been part of a retaining wall, although they were not faced and thus could also have been part of rubble/cobble building fill. In the southwest corner, many small to medium cobbles were found with crumbly limestone, which we thought could possibly be the result of building tumble. A medium number of artifacts were recovered, including chipped tools, debitage, a possible ground stone tool, and pottery sherds.

As we progressed lower in Zone 1, it became apparent that we probably had two separate zones – one defining building collapse and the other representing the ditch feature. However, as this was observed in hindsight, we could not go back and separate Zone 1 into separate entities.

Zone 2

This zone consisted of a ~10 cm thick, dense, sticky clay (10YR4/1, dark gray; **Figure 9.4**). A few more large rocks were found in the northern portion of the unit, suggesting another retaining wall. Few artifacts were recovered in Zone 2, including a stem biface fragment, debitage, and pottery sherds.



Figure 9.4 Opening shot of Zone 2 (photo by of M. Brouwer Burg).

Zone 3

This ~10 cm thick zone lay in the northern ¼ of the unit (**Figure 9.5**), north of what we began to refer to as the ditch wall. The zone consisted of darker, homogenous clay (2.5Y4/2, dark grayish brown) with some darker mottling (2.5Y4/1, dark gray). A few pieces of chert were recovered.

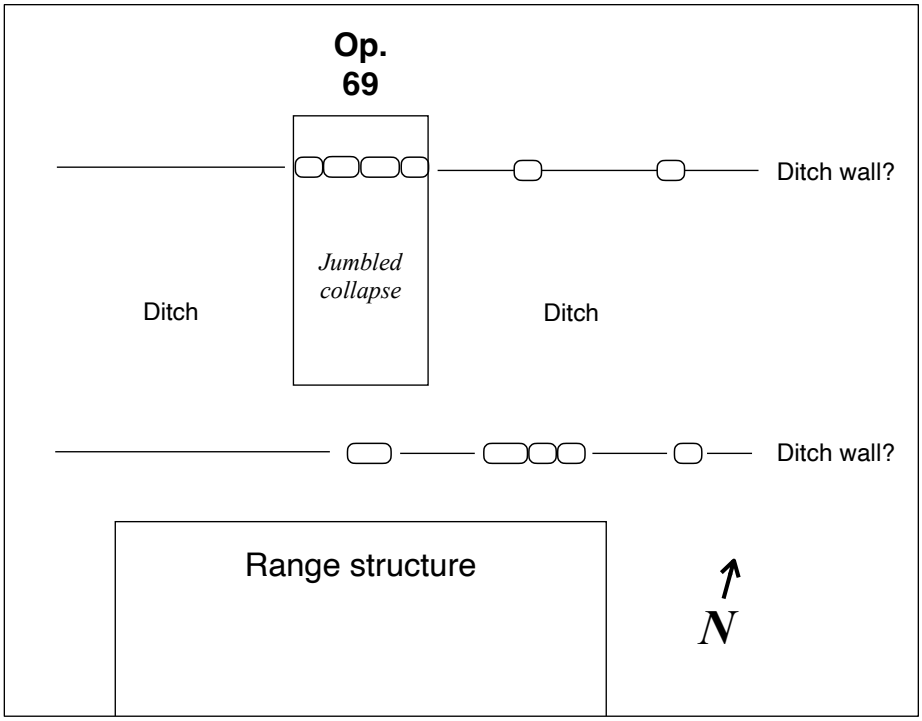

Figure 9.5 Schematic plan view of Operation 69 (drawing by M. Brouwer Burg).

Zone 4

Zone 4 lay south of the ditch wall and included many big rocks interspersed with cobbles and limestone chunks (**Figure 9.6**). We removed some of the bigger boulders that were not faced and seemed to be the result of building collapse. The surrounding matrix was a homogenous, brown/gray clay (2.5Y5/1, gray). A few artifacts were found in this ~15 cm thick layer, including chert debitage and pottery sherds. A posthole was dug into the center of Zone 4 to a depth of 163 cm, revealing powdery marl/sascab, reminiscent of Zone 4 in Op. 68, at a depth of 160 cm. This marl was mottled in coloration, from 10YR 8/2 (very pale brown) to 10YR6/1 (gray). Very few artifacts were recovered from this zone although natural limestone pebbles-cobbles were frequent.

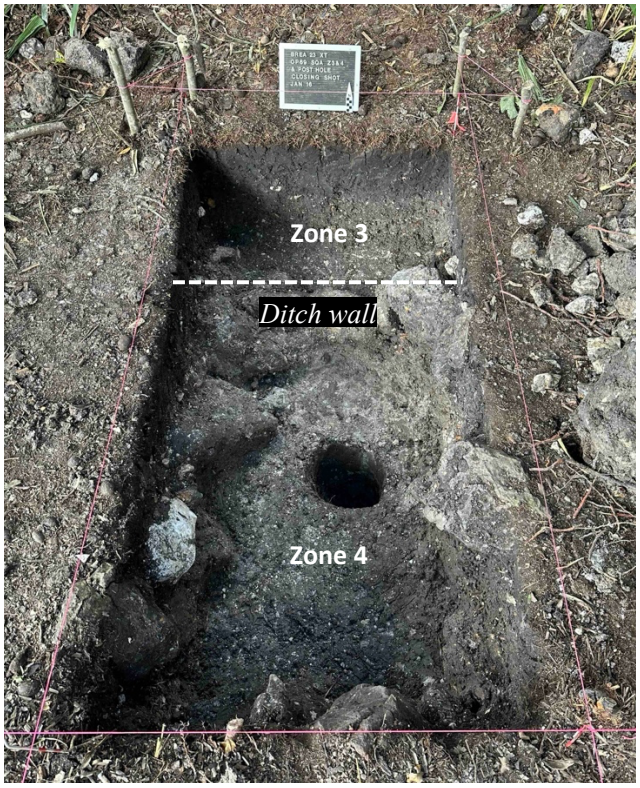

Figure 9.6 Closing shot of Op. 69 (photo by M. Brouwer Burg).

Interpretation and Conclusions

While speculative, we believe that the structural remains found in Operation 69 represent part of a ditch wall that lined the northern edge of the ditch (see **Figure 9.5**), which was then covered by collapsed construction debris from the range structure. Unfortunately, we were not successful in punching below what appeared to be ancient Maya construction, although we were able to confirm the continuation of the built-up platform of sascab that was found in operation 68. It is interesting to observe that this platform would even have underlain a low-lying ditch feature, suggesting that the ditch might have been constructed after the original preparation of the site core's deep limestone foundation. Alternatively, if the sascab represents the underlying bedrock of the area, the ancient Maya may have taken advantage of an already low-lying channel for the ditch. Regardless of construction sequence, the ditch appears to have been lined with rock in Maya times, probably to stabilize and reinforce the margins.

In summary, we were ultimately unsuccessful in finding conclusive evidence of Preceramic occupation beneath ancient Maya structural features at Xtabentun. However, our investigations yielded insights indicating that the entire site core may have undergone extensive preparation work involving the quarrying of limestone and raising of the natural ground level. Similar kinds of site preparation have been documented during the Preclassic in the Maya World; for example, at the site of Cival, Estrada-Belli (2013) and colleagues found that many meters of

sascab were brought in to build up the foundation of the plaza. It appears that a similar kind of Preclassic plaza preparation occurred at Xtabentun, likely requiring much labor and many resources. The ditch feature is also intriguing. While most of the published literature on ancient Maya ditches refers to either wetland modifications for agricultural purposes (e.g., Beach et al. 2009; Guderjan and Krause 2011; Matheny 1976; Wyatt 2014) or defensive ditches (Matheny 1976), there are a few studies that have considered the hydrological role of ditches within urban cores (Puleston and Callendar 1967; Webster et al. 2007). For example, at Tikal, Silverstein et al. (2009) suggest that ditch-and-earthwork features may have been important for the collection and filtration of surface water. We wonder if perhaps the ditch feature at Xtabentun may have been built for a similar purpose. Further testing will be required to affirm this supposition.

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Chapter 10

Investigating a Possible Agricultural Field Complex West of Chau Hiix (Operations 70 and 71)

Marieka Brouwer Burg and Samantha Krause

Introduction

The ancient Maya relied upon large-scale, wetland agricultural practices to feed their communities and support the development of complex, sedentary society. A common practice among the Maya was to ditch and drain wetlands to convert them into nutrient-dense fields for planting a variety of crops, including maize, cotton, cacao, chilis, manioc, squash, beans, etc. The ditches or canals adjacent to the fields were also home to various aquatic species. Much research has been devoted to understanding how these fields were constructed and their role within the local hydrology and economy (key Beach citations/Krause, etc.). Pyburn (2003:126) speculated that raised fields were created on the margins of Western Lagoon and on the broad tops of dams, but she did not consider whether wet depressions in the pine ridge ecosystem just west of Chau Hiix may also have been utilized for agricultural pursuits.

Chronologically, it is assumed that raised field agriculture was a development of the Preclassic Maya. However, there is evidence to suggest that people were living in and modifying wetlands during the Preceramic period too. For example, in their excavations at Pulltrouser Swamp, Pohl et al. (1996: Figure 3) uncovered an "Archaic Settlement" at the juncture of basal clay, peat, and organic soils. The chronological designation of this "Archaic Settlement" was based ostensibly on their recovery of a Lowe point (dated to 2210 BCE, although Lowe Points have since then been dated to the Early Archaic, c. 8000 BCE); maize, squash, and bottle gourd dated to 1520 BCE, and a uniface dated to 1275 BCE. We note that these researchers found similarly early dates at Douglas and Cob Swamps, including a "log pile" dated to 3370 BCE and charred maize dated to 3360 BCE. Additionally, we have found in our own excavations in Western Lagoon that large-scale wetland features—perhaps fish weirs or canals—were initiated during the Late Archaic (c. 4000 BCE; Krause et al. 2019). Thus, a main goal for investigating this wetland was to determine if we could recover C14 samples or artifacts diagnostic to the Preceramic in this wetland feature.

Traces of ditched and drained fields have long been detectable by remote survey (see e.g., Siemens and Puleston 1972); people sometimes refer to them as having a honeycomb-like pattern. However, these features must be ground truthed to establish their veracity. To that end, the other primary goal of this operation was to ground truth an area to the west of Chau Hiix where we had identified a honeycomb pattern in a low-lying, wet depression (**Figure 10.1**).

Objectives

1. Test whether the features on the Google Earth imagery are, in fact, ditched fields.
2. Explore the stratigraphy and possible construction sequence of the ditched fields.
3. Obtain artifacts and C14 samples to shed light on the chronology of the1996 field use.

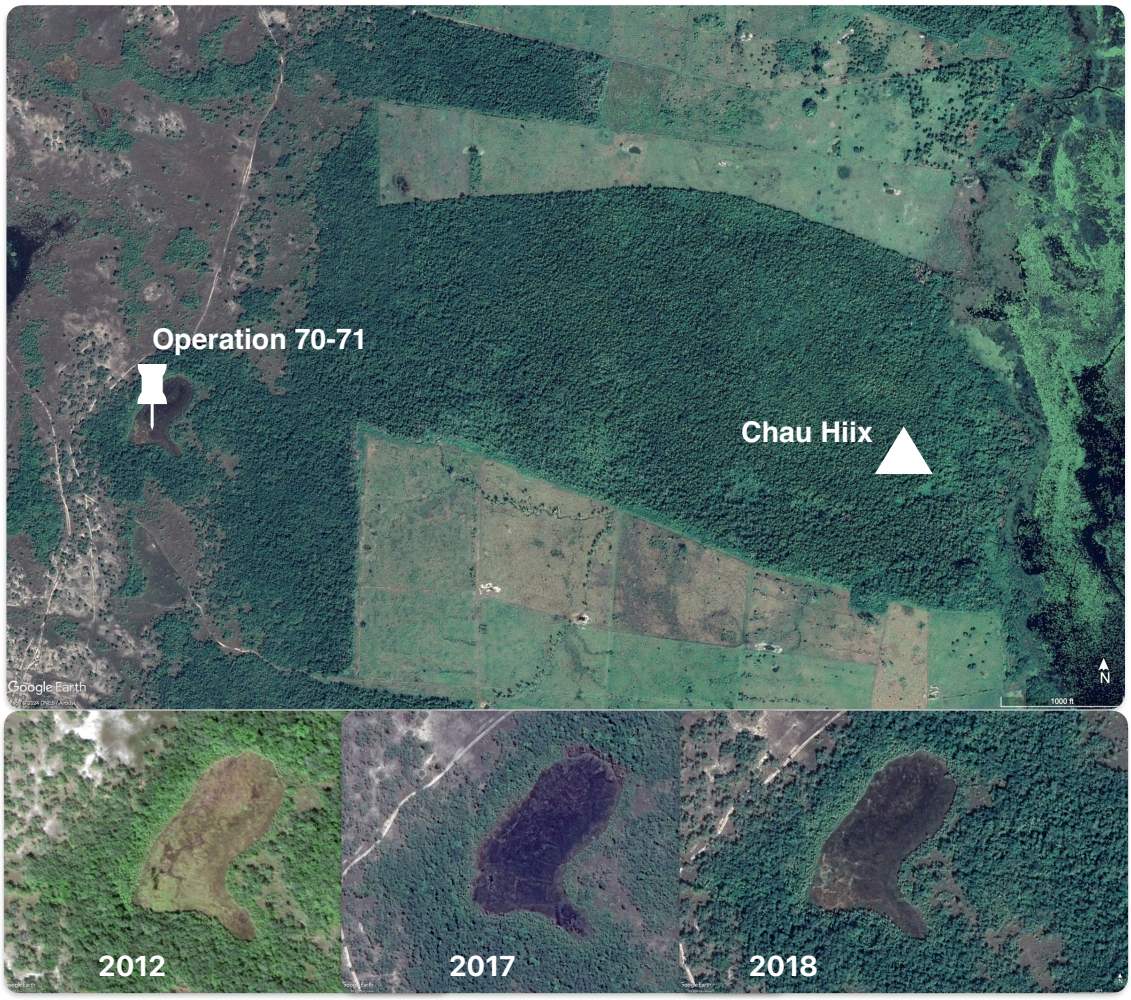

Figure 10.1 Top: Overview of Chau Hiix and agricultural fields. Bottom: Satellite imagery of wetland features from 2012-2018 (image by M. Brouwer Burg).

Description of the Research and Methods Used

We followed the standard BREA strategy for shovel test pit (STP) campaigns, which is outlined in Brouwer Burg (et al. 2023). Accordingly, we used a posthole digger for these surveys (Kaeding 2022:100). Individual STP units were located at 10 m intervals. All material was screened through a ¼-in mesh. We recorded field notes on an STP form developed by Adam

Kaeding for the 106 Group, modified to suit the needs of the NBAAS project (see Brouwer Burg et al. 2023: Figure 3.5).

For excavation, we followed the standard procedure for geoarchaeological trenching, outlined by Krause et al. (2020:118) and we refer the reader to that source for further detail.

Shovel Test Series 053

Prior to placing a unit in this wetland, we conducted shovel test series 053 that cut perpendicularly across the feature and ran parallel along the margins for ~50 m (**Figure 10.2**; **Table 10.1**). As can be seen in Table 11.1, none of the 31 STPs returned positive artifact results, although we were able to gain a better understanding of the subsurface and soil pedogenesis. On the pine-oak savanna ecosystem, white quartz sand was encountered at the bottom of the STPs, indicating that these savannas lie atop anchored sand dunes, likely Pliocene in age. The subsoil becomes progressively clayier across the low scrub forest growing on the margins of the wetland feature and into the feature, where sandy clay dominates. In a few select STPs, peaty clay was found, suggesting a water-logged, organic-rich environment at some point in the past. The presence of peat would also help us place the Op. 71 excavation unit.

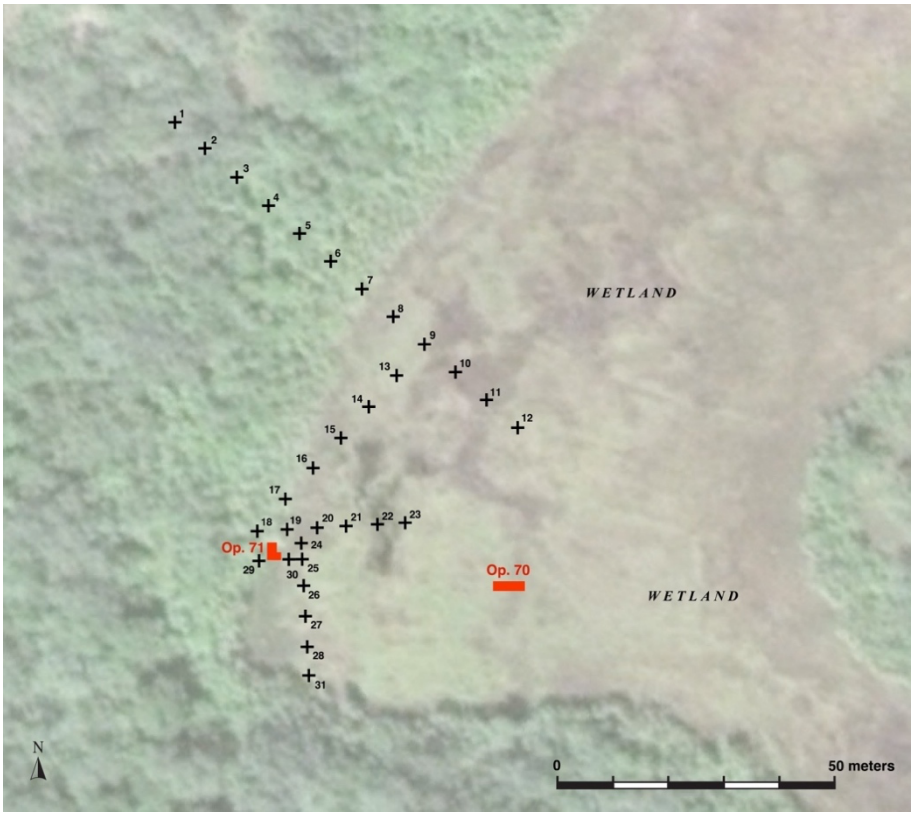

Figure 10.2 STP Series 053. Operations 70 and 71 noted (image by M. Brouwer Burg).

Table 10.1 Results of STP Series 053 at Chau Hiix agricultural fields.

STP #	Positive or negative	Ending elevation	Stopping point of STP
1	Negative	69	White quartz sand
2	Negative	80	Tan sand
3	Negative	70	White-tan sand with some small sandy concretions
4	Negative	70	Tan sand
5	Negative	70	Tan sand
6	Negative	70	Tan sand
7	Negative	63	Tan sand
8	Negative	84	Gray and mottled clay with redoximorphic features
9	Negative	80	White sandy clay with iron staining
10	Negative	89	Sandy clay
11	Negative	75	Sandy clay
12	Negative	69	Sandy clay
13	Negative	90	Gray clay
14	Negative	78	Sandy clay with round/subrounded pebbles
15	Negative	80	Clayey sand, no redox. features, no pebbles
16	Negative	80	Sandy clay with round pebbles fining upwards
17	Negative	63	Sandy clay
18	Negative	54	White sand
19	Negative	63	Sandy clay
20	Negative	74	Peaty clay, some small pebbles, water table at bottom
21	Negative	71	Peaty clay, water table at bottom
22	Negative	72	Clay with sand, sandier with depth
23	Negative	60	Sandy clay, water table at 50 cm
24	Negative	58	Peaty clay
25	Negative	84	Sandy clay
26	Negative	72	Black, vertic clay with some pebbles and slickensides
27	Negative	70	Sandy clay
28	Negative	79	Sandy clay
29	Negative	46	Vertic clay (with slickensides)
30	Negative	52	Vertic, organic clay (with slickensides)
31	Negative	77	Sandy clay

[1] Redoximorphic features are caused by the depletion or concentration of certain minerals in soils, such as iron (red staining) or manganese (black staining), usually from periodic wetting/drying in this part of the world.

Operation 70

To place this unit, we identified the location of what we thought was the clearest canal visible in the satellite imagery (see **Figure 10.2**). We placed the 1-x-3 m unit perpendicular to the canal with the intention of starting in the canal and working up onto the purported field.

Zone 1

This zone consisted of thick root matting characteristic of an O horizon. The zone was 12 cm thick. No artifacts were found.

Zone 2

Zone 2 was roughly 30 cm thick and consisted of dense, sticky black peat. No artifacts were recovered. The water table was encountered around 50 cm, so constant bailing was required.

Zone 3

At about 56 cm below ground surface, we noted a transition to sandy clay (10YR4/1, dark gray). Some small, (sub)rounded river pebbles (2% or matrix) were present in the sandy clay, and the sand element was characterized as quartz sand. The sandy clay got sandier and coarser with depth. No artifacts were recovered. We collected some of the organic sediment at the peat/sandy clay transition, at roughly 56 cm and 65 cm below ground surface. At about 70 cm, some redoximorphic feature appeared. A posthole digger was used to punch down further before closing the unit, to a depth of 133 cm below ground surface, and revealed that the sandy clay continued (**Figure 10.3**).

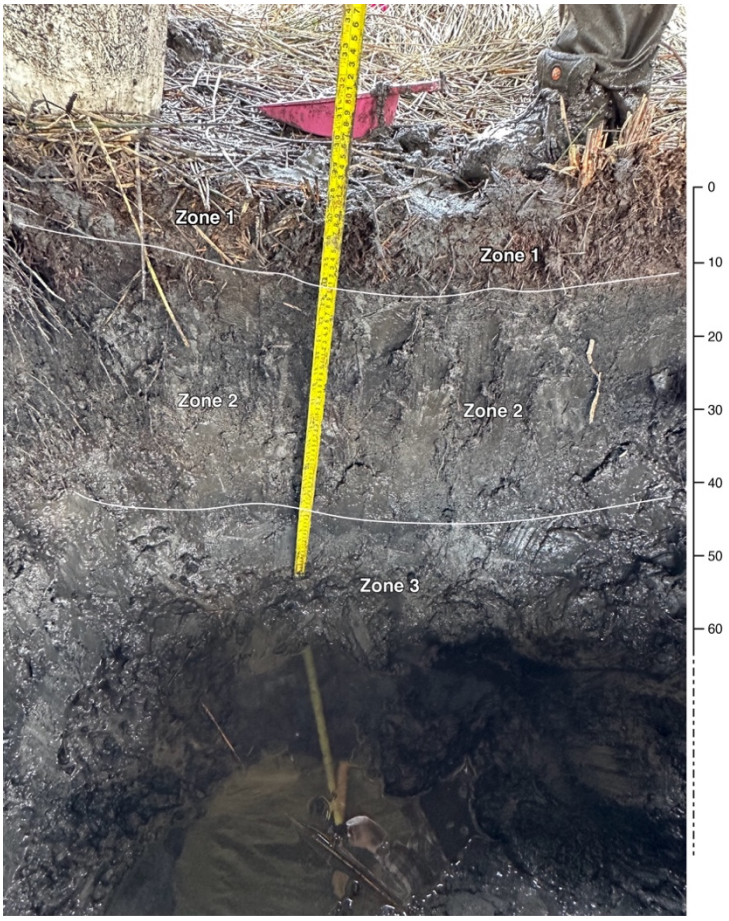

Figure 10.3 West profile of Operation 70 (photo by M. Brouwer Burg).

Operation 71

With the closing of Operation 70, we wanted to find an area that looked more like a planting surface. Referencing the STP campaign and the satellite imagery, we decided to place an additional unit (Operation 71) in a higher and dryer location where the water table would be deeper and the peat layers thicker. We selected an area closer to the margins of the wetland where we could see a narrower canal-like feature and set out a 1-x-1 m unit. Later, we expanded the unit 50 cm to the east to construct steps to facilitate access. Finally, we expanded the unit 70 cm to the north to try and catch the canal (**Figure 10.2**). We screened 50% of sediment on account of the very sticky and wet material.

Zone 1

This 7 cm thick zone was an organic O Horizon full of decomposing peat, roots, and minerals. It was black in color (10YR2/1). No artifacts were recovered.

Zone 2

This zone was 13 cm thick and consisted of a dense, black, vertic clay. We interpreted it as an A1 horizon with slickensides, columnar structure, a few sandy pockets, and many fine roots. No artifacts were recovered.

Zone 3

Similar to Zone 2, Zone 3 also displayed a columnar clay structure but contained fewer organics. Very pale brown (10YR7/3) pockets of sand persisted along with some roots. For these reasons, we interpreted the zone as an A2 horizon. It was roughly 20 cm thick and contained one eroded sherd, found at 29 cm below surface. A C14 sample was collected at 40 cm below ground surface.

Zone 4

Zone 4 was markedly different from the zones lying above it. It consisted of three separate layers that appear, in aggregate, to represent an Anthrosol. The uppermost sublayer was a dark, compact, clayey sediment with few roots or sand pockets (11 cm in thickness). The middle sublayer was a 2 cm thick, soft, undulating very pale brown (10YR7/3) clay band. This band did not contain ash but may have been an ancient activity surface. It was found to dip downward on the north side of the unit (possibly into the canal). The lower sublayer was a very thin (0.5-1 cm thick) organic layer that quickly descended into krotovinas and roots in the profile. One lithic flake was found at 53 cm below ground surface, in the very pale brown clay band. C14 samples were collected at 55-56 cm below ground surface.

Zone 5

The final zone excavated at Operation 71 consisted of a coarse gray sandy clay layer (5Y6/1, 5Y5/1) with little clay. After 3 cm, the zone descended into finer sand and more clay. (Sub)rounded river pebbles were present throughout, as were iron streaks along root paths (2.5Y5/6). This zone was taken down 74 cm to 130 cm below ground surface. At this point, we dug a posthole down to 175 cm below ground surface to find the water table (at 175 cm). In the posthole, the sediment remained consistent. A C14 sample was collected at 66 cm below ground surface (**Figures 10.4 and 10.5**).



Figure 10.4 Closing photo of Operation 71 (photo by M. Brouwer Burg).

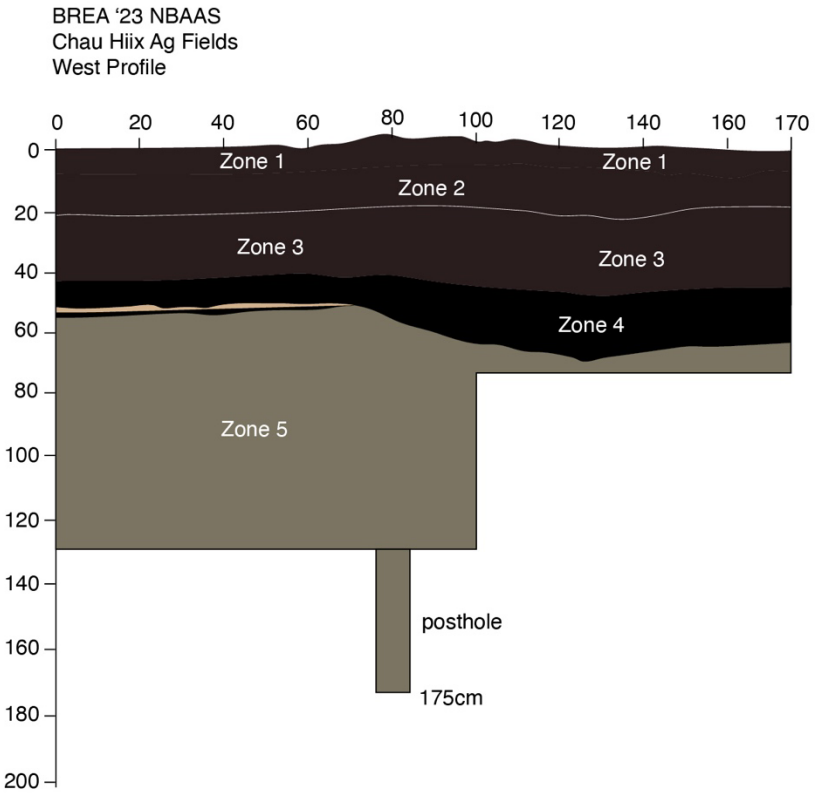

Figure 10.5 West profile of Operation 71 (drawing by M. Brouwer Burg).

Interpretations and Conclusions

In short, it appears that this area was perennially wet in the Pleistocene, when thick clay layers were deposited. In the mid-late Holocene (late Archaic to Formative cultural periods), the wetland became seasonal, leading to the formation of vertic clays. We presume that the ancient Maya channelized the wetland during this time to make use of the rich soils. In the recent past, likely during particularly wet climate oscillations, some of the cracks between vertic peds became infilled with histosols (wetland soils).

While excavation of Operations 70 and 71 did not yield definitive evidence of canals and planting surfaces—at least not in comparison to similar features excavated to the north (e.g., the Chan Cahal or Birds of Paradise wetlands; [Beach et al. 2015; 2019; Krause et al. 2019])—we did uncover ephemeral traces of possible activity surfaces, accompanied by very few artifacts. This evidence suggests that if this area does indeed represent an ancient field system, it was short-lived, perhaps used for 15-30 years before being abandoned. Future research that examines the characteristics of nearby agricultural fields is needed, such that we can evaluate whether the expressions described here are unique or part of a broader trend.

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Chapter 11

Osteological Analyses of the Human Skeletal Remains from the BREA 2022-2023 Field Seasons

Jack A. Biggs and Allison Bower

Introduction

Excavations conducted by BREA during the 2022 and 2023 field seasons revealed multiple human burials. Due to the number of primary and secondary interments, a separate chapter dedicated to the osteological analyses of these human remains is presented here. Remains from excavations at two sites, Najil Iik (Op. 55) and Waxak Nicte' (Op. 66) were analyzed during the Summer 2023 and 2024 seasons. The archaeological investigations are reported elsewhere (see **Biggs, Harrison-Buck, and Lamb, Chapter 5** for Najil Iik and **Shelhamer and Harrison-Buck, Chapter 8** for Waxak Nicte').

Description of Research and Methods Used

Both *in situ* and field lab analyses were completed on the skeletal remains so that as much data could be gathered as possible. After excavation, the bones were cleaned using water and fine-bristled toothbrushes to remove all soil while preserving the features of the bones. The specimens were then placed on drying racks with ¼ in screen—and even finer window screen depending on the size of the bone fragments—and allowed to fully air dry before being analyzed in the lab.

Analyses were completed in accordance with the *Standards for Collection of Data from Human Skeletal Remains* (Buikstra and Ubelaker 1994), combined with the open-source Transition Analysis 3 (TA3) software. Human bone identification drew upon multiple reference books present at the BREA field lab (including White et al. 2011; Schaefer et al. 2009) and in the field (White and Folkens 2005). Dental development was scored using the *London Atlas of Human Tooth Development and Eruption* (AlQahtani et al. 2010). We collected as much data per individual as possible using these sources; for each specimen, we attempted to reconstruct a full osteological inventory, estimations of age at death and biological sex, and the presence and interpretations of pathological conditions, cultural modifications, and taphonomy. Skeletal inventory and analysis forms were created for the BREA project to accommodate the cultural- and region-specific circumstances in which human remains have been found. These forms are a combination of skeletal forms from other institutions and projects (such as Arizona State Museum Osteology Recording Packet from the University of Arizona and the Anthropology

Recording Form for Individual Adult Skeletons from the International Forensic Centre of Excellence and the California State University, Chico).

The observations and interpretations of the human skeletal remains are presented below for each site and burial deposit. The burials from Najil Iik will be reported first, followed by the single individual excavated from Waxak Nicte'. **Table 11.1** shows a summary of the osteological data reported in this chapter.

Table 11.1 Osteological summary of individuals analyzed (Bu = burial; Mod. = modification; Ind. = indeterminate).

Site	Bu. designation	Age	Sex	Pathologies	Trauma	Cranial Mod.	Dental Mod.
Najil Iik	Bu.1A	Older adult	Male?	Present	Present?	Unknown	No
Najil Iik	Bu.1B	Older child	Ind.	Absent	Absent	Unknown	No
Najil Iik	Bu.1C	Adult	Male	Present	Present	Unknown	No
Najil Iik	Bu.1D	Multiple	N/a	N/a	N/a	N/a	N/a
Najil Iik	Bu.2A	Adult	Ind.	Present (dental abscess)	Absent	Present	Present
Najil Iik	Bu.2B	Young adult?	Ind.	Present	Absent	Unknown	Absent
Najil Iik	Bu.3	Infant	Ind.	Absent	Absent	Unknown	Absent
Najil Iik	Bu.4	Infant	Ind.	Absent	Absent	Unknown	Absent
Waxak Nicte'	WN_burial	Adolescent	Ind.	Absent	Absent	Unknown	Absent

Najil Iik

The burials from Najil Iik (Op. 55) discussed here were all found within the superstructure of Structure 1 at the site within Squares C, D, H, I, and J (see **Biggs, Harrison-Buck, and Lamb, Chapter 5:Figure 5.10**). A total of eight individuals will be discussed below. These individuals were interred in both single and multi-person interment episodes. These include Bu. 1A, 1B, 1C, 1D, 2A, 2B, 3, and 4.

Burial 1

Burial 1 was a multi-person interment that had three primary burials (Bu.1A-1C) and a human bone cache (originally thought to be a secondary burial and labeled Bu.1D; **Figure 11.1**). As discussed in Chapter 6, this volume, Burial 1 is associated with the penultimate phase of occupation in Str. 1. The burial space was first revealed when a soft, silty, and tan matrix was

encountered in the southeast quadrant of Square H. This matrix was followed out and a chert eccentric, jade cylinder, and numerous chert bladelets were discovered, leading to its initial designation as a special deposit. However, fragments of long bones were seen underneath the eccentric and jade cylinder. These were further defined and followed out, exposing the skeletal remains of Bu.1A. These were connected to what was then thought to be one of two isolated skulls in Square D (Zone 57 and 58 skulls). Thus, it was determined there was likely at least one more individual based on the presence of the second skull. More exposure of the area revealed the presence of three primary burials and one human bone deposit. The osteological analyses of these will each be discussed separately.

Burial 1A – Zones 54 and 58, Squares D and H

Burial 1A (Bu.1A) was the first individual revealed within the larger Burial 1 space. This was originally thought to be a special deposit/cache base within Square H (see **Biggs, Harrison-Buck, and Lamb, Chapter 5:Figure 5.38**). Numerous chert bladelets, a fire-treated chert eccentric, and a jade cylinder with two drill holes were found within a silty and tan matrix. While defining the eccentric and jade cylinder, human long bones were seen underneath. These were followed out and revealed the lower legs of Bu.1A.

Osteological Assessment of the Bu.1A Individual

The skeletal elements of the Bu.1A individual were analyzed in two phases. First was an in-field assessment and the second was a field lab analysis after the bones were cleaned. Unfortunately, before the lab analyses could be conducted, some of the elements were compromised when a gust of wind blew over two drying screens, mixing up bone fragments from different anatomical regions of Bu.1A, skeletal elements from the Bu.1C individual, as well as human skeletal remains that were not associated with any burial (i.e. loose and isolated bone fragments within the general matrices of the superstructure). Thus, many remains lost their provenience. Only those that could be reassociated with the correct individual were analyzed.

Skeletal Preservation and Completeness

The skeletal remains of the individual in Bu.1A were preserved moderately well, with about 75% of the skeleton available to be analyzed. More elements would have been available if it had not been for the tipped drying screen and subsequent context mixing. **Table 11.2** shows an inventory of the skeletal remains that were available for analysis after some of the commingled elements were reassociated with the rest of the Bu.1A individual.

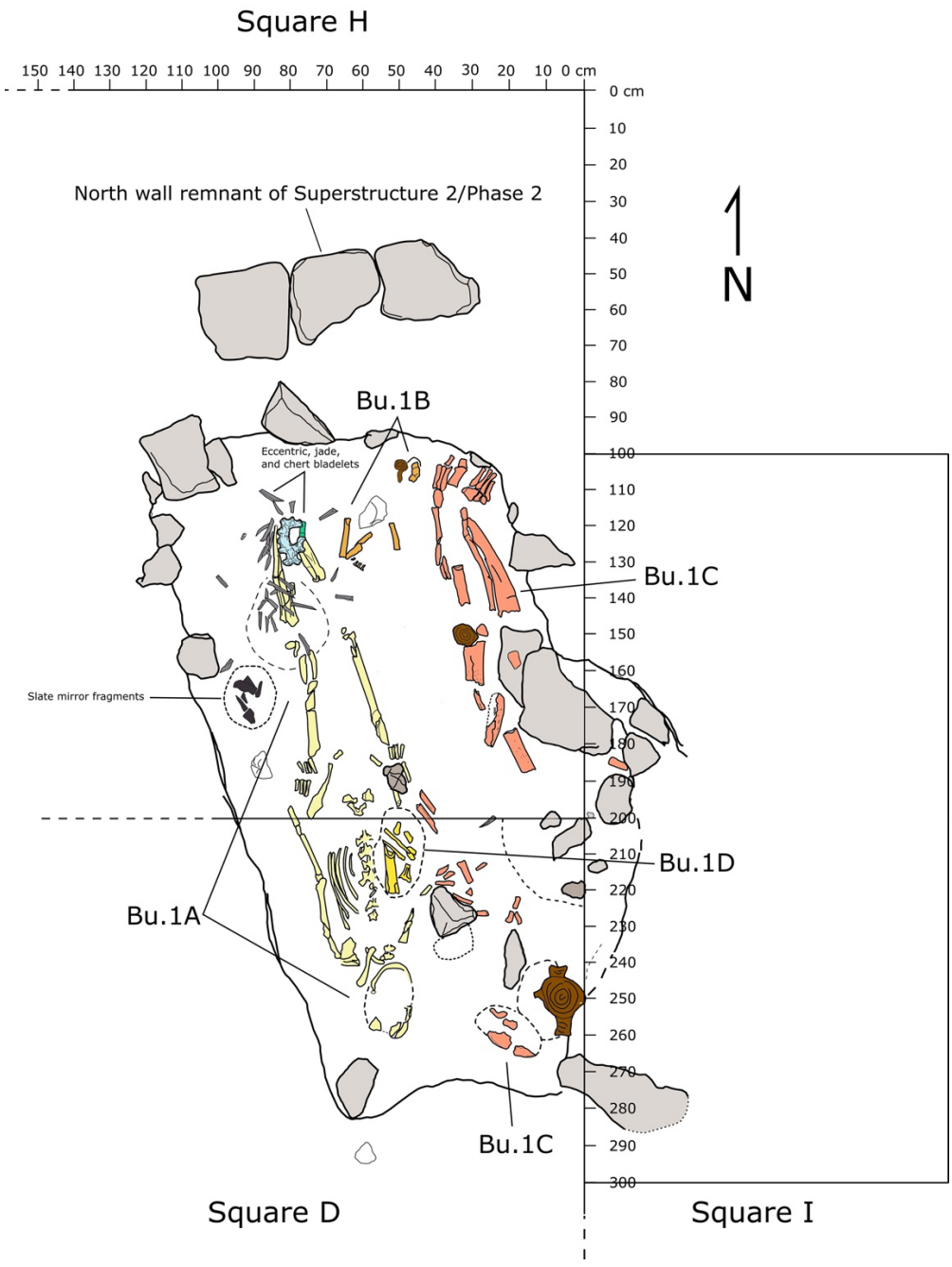

Figure 11.1 Plan view of multi-person Bu.1 (drawing by E. Harrison-Buck; digitized by J. A. Biggs).

Age and Sex Estimation

Landmarks typically used in age estimation were not well observed enough to be used. However, all epiphyses were fused, as well as a fully erupted left third mandibular molar, indicating the individual was an adult at the time of their death. All teeth recovered had at least moderate wear/attrition observed with some exhibiting extensive/severe wear, suggesting the individual was likely not a young adult.

Despite the presence of portions of the pelvis and ribs *in situ*, they were not well preserved enough to be used for age estimation. Looking at present and observable skeletal elements, we used the TA3 software to generate an age estimation. The TA3 markers available for macroscopic observation for the Bu.1A individual include fusion of the spheno-occipital synchondrosis, C1 lipping, C1 eburnation, L1 superior epiphyseal ring fusion, L1 superior surface morphology, cervical vertebral lipping, and thoracic vertebral lipping. Based on the observation of these markers, TA3 generated an estimation of 52.9 years at the age of death with a standard error of 13.3. If this age estimation holds, this places Bu.1A around the transition from middle to older adult.

Sex was estimated using only cranial traits, as those traits in the pelvis did not preserve. The glabella, mental eminence, both supra orbital margins, and the right mastoid process were observed, with each landmark receiving a score of 4. More masculine traits were present in the skull; however, the overall size, morphology, and robusticity of the postcranial remains suggest a more gracile individual. Therefore, we attributed a biological sex estimation of ambiguous to possible male for the Bu.1A individual.

Dentition

The majority of teeth from Bu.1A were recovered (**Table 11.3**), with most still in occlusion within the skull (**Figure 11.2**). Almost all teeth were present for observation. Antemortem loss evidenced by full alveolar bone resorption was seen for RM^3, LM^1, LM^2, LM^3, and RM_3. It is also likely that antemortem loss is responsible for RM^1 and RM^2, due to the moderate to severe amounts of calculus on the occlusal surface of the right mandibular molars, i.e., no maxillary molars were ground against them when chewing, allowing plaque to buildup on the occlusal surfaces of these mandibular teeth (**Figure 11.3**).

A pathological bony reaction observed on the right maxilla near the area of the first and second molars could have contributed to their premature loss (discussed below). There is no evidence of filing or inlays on any of the anterior teeth. As mentioned previously, attrition on the teeth range from moderate to severe with the left mandibular molars and the left maxillary premolars showing the most amount of wear.

Table 11.2: Skeletal Inventory for Bu.1A Individual. Presence Reported as Percent Complete; Blank = Absent/Not Observed.

Element	Left	M/?	Right
Frontal	50%		50%
Parietal	25%		25%
Occipital		25%	
Temporal	25%		100%
Maxilla	>75%		>75%
Zygomatic	>75%		>75%
Sphenoid		50%	<50%
Nasal	100%		100%
Ossicles (#)			
Mandible	100%		100%
Hyoid			
C1/Atlas		100%	
C2/Axis		50%	
C3-C6		50%	
C7		25%	
T1-T9		25%	
T10		50%	
T11		>75%	
T12		25%	
L1-L4		25%	
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1	25%		
Rib 2			
Rib 3-10	25%		25%
Rib 11			
Rib 12	25%		
Clavicle	100%		100%
Scapula	25%		25%
Humerus			25%
Radius	25%		25%
Ulna	50%		50%
Ilium	<25%		<25%
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur	<75%		<75%
Tibia	<75%		<75%
Fibula	25%		50%
Patella	<50%		
HANDS			
Carpals	<25%		
Metacarpals	<75%		<75%
Manual Phalanges	<50%		<50%
FEET			
Tarsals			
Talus			
Calcaneus			
Metatarsals			
Pedal Phalanges			

Table 11.3 Dental Inventory for Bu.1A Individual.

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
			X	X	X	X	X	X	X	X	X	X			
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

A pathological bony reaction observed on the right maxilla near the area of the first and second molars could have contributed to their premature loss (discussed below). There is no evidence of filing or inlays on any of the anterior teeth. As mentioned previously, attrition on the teeth range from moderate to severe with the left mandibular molars and the left maxillary premolars showing the most amount of wear.

Pathologies on the dentition included calculus, caries, linear enamel hypoplasias (LEH), and abscesses on the alveolar bone. Calculus was observed on every tooth recovered, ranging from small to large amounts that protruded from the tooth. Dental calculus extending past the CEJ and onto the root in some instances suggests this individual was suffering from gingivitis or receding gumlines (Hillson 2023).

Linear enamel hypoplasias (LEH) were also seen on some of the teeth in the form of horizontal grooves and linear pitting. Horizontal line LEHs were observed on LC^1, LI^2, LI^1, RI^1, RI^1, LP_1, and RP_2. A possible area of horizontal pit LEHs was seen on LC_1 but was obscured by calculus buildup around the area. Most of these LEHs are along the same level across the anterior teeth, suggesting that some major illness or stress event was endured by the Bu.1A individual during their childhood.

A total of eight caries were observed on the teeth. Three of these caries were on the same tooth (LM_1). Five of these caries occurred on the interproximal surfaces of the teeth, one on the occlusal surface of LM_2, and two at the cemento-enamel junction (CEJ), both on the same tooth (LM_1).

Two—and possibly up to four—abscesses were seen within the dentition. The first was identified on the mandible at the location of RP_1 and had an occlusal surface drainage channel with flaring and porous alveolar bone around the tooth. The second was located on the right maxilla near the root apex of RI^1. Only part of the margin of this abscess can be seen as some of the bone that once covered RI^1 did not preserve. This abscess may also connect to a pocket/space near the root apex of RI^2 and also to a possible abscess at the root apex of RC^1. Due to preservation, it is unknown whether this space near RI^2 represents another abscess, but there is more space than the actual root tip takes up, suggesting an infection here as well. The same scenario also exists with RC^1, yet the space for the root tip might connect to an active infection on the nasal floor on the right maxilla (described below).

Lastly, LP_1 exhibited a small bulbous growth on the distal root apex, suggesting a case of hypercementosis. This condition is characterized by a large buildup of cementum around the root. Despite its appearance, hypercementosis is typically an asymptomatic occurrence, but has been associated with excessive wear, Paget's disease, and other bony changes involving the maxilla and mandible (Hillson 2023).

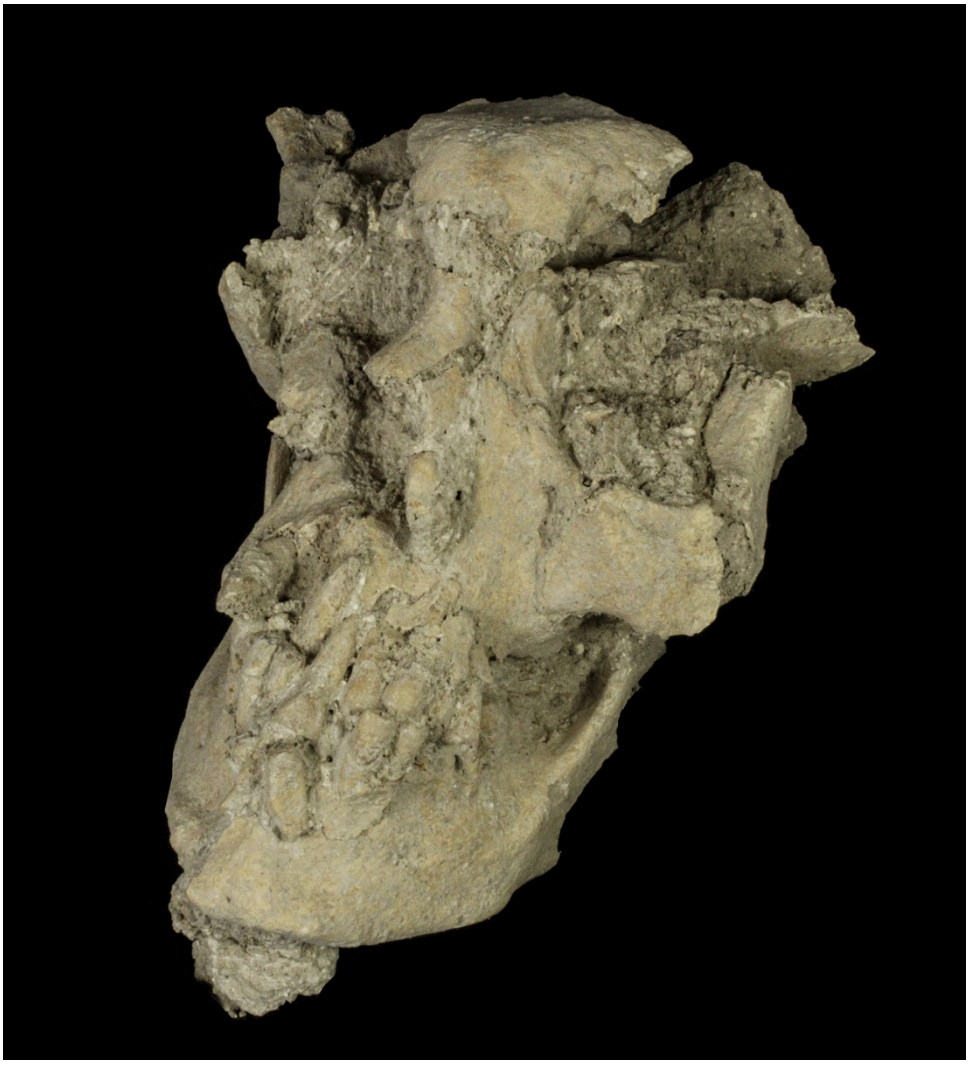

Figure 11.2 Oblique view of the excavated Bu.1A skull showing dentition still in occlusion (skull later excavated in lab; photo by J. A. Biggs).

Pathology and Trauma

Pathologies were observed in three locations on Bu.1A's skeleton, apart from those in the dentition. The first is a complex set of bony reactions within and around the right maxillary sinus. Porosity was observed on the interior surface of the right maxillary sinus, accompanied by thickened walls (**Figure 11.4**). There is also a likely cloaca that drained the infected sinus located on the anterior aspect of the maxilla. Unfortunately, the maxilla is fragmented, preventing full reconstruction. Yet the lateral margin of the cloaca is present and clearly exhibits a margin that is not from postmortem damage. The bony reactions within the sinus and on the margins of the likely cloaca do not appear to have been active at the time of Bu.1A's death, indicating that this was an old infection that was healed or mostly healed when the individual died.



Figure 11.3 Superior view of right mandible fragment from Bu.1A showing RP_2, RM_1, and RM_2 exhibiting thick calculus on the occlusal surfaces (photo by J. A. Biggs).



Figure 11.4 Inferior view of a Bu.1A right maxilla fragment exhibiting thickened and porous walls and an irregular internal surface of the maxillary sinus (photo by J. A. Biggs).

There is, however, an active infection seen via porosity and bone destruction on the nasal floor of the right maxilla (**Figure 11.5**). The most posterior margin of the right nasal floor that

was recovered also suggests that some of the missing portions of bone were not due to poor preservation, but to bone destruction as there is no postmortem damage seen.

Overall, these infections could have been connected to the abscesses seen in the dentition. Possibly RI^1, RI^2, and RC^1 all had an abscess, or one abscess that connected all the root tips and then possibly invaded other areas of the maxilla. If this infection was severe enough, it could explain the possible large cloaca seen on the anterior portion of the maxilla as well as the porosity of the nasal floor and possible subsequent bone destruction (likely a portion of the right palatine). While the infection within the sinus was healed or healing as evidenced by the sclerosis of bone, the infection and porosity of the nasal floor and possible maxillary abscesses were active at the time of death. It is not known if this was a causal factor in the Bu.1A individual's death, but a severe infection in this area of the body, close to the blood-brain barrier, could easily have been fatal. It may be tempting to assign a cause of death resulting from these complex infections, mostly due to their location, but the aim of these analyses is to understand the life of the individual, rather than trying to piece together the circumstances leading to their death.

The second pathology observed could only be categorized as a periosteal reaction on the distal aspect of the left ulna. A small patch of woven bone was observed, but poor preservation of the ulnar ends prevented further interpretation. Based on its location in just one area of the bone, it is likely from a non-specific localized infection.

There is one possible example of trauma, seen on the distal diaphysis of the right fibula. The area is characterized by an irregular and slightly undulating surface that could be the result of a bone callus from a fracture. Based on the level of healing it is likely the fracture occurred years before death. It is also an interesting location for a fracture as the fibula is surrounded and encased in muscle compared to the tibia, making it a more difficult bone to break in isolation. However, the tibia showed no evidence of healed trauma.

Interpretations and Conclusions of Bu.1A

The osteological analyses of the individual designated as Bu.1A revealed that they were possibly male and in their 50's when they died. They were laid extended and prone with their head to the south within a three-person burial. Their dentition revealed a moderate to severe amount of wear, supporting the age estimation generated from TA3 as an 'older adult'. The presence of calculus on every tooth recovered indicates that their diet was high in starchy foods (and/or an overall lesser amount of foods high in fiber) which could have contributed to the presence of caries.



Figure 11.5 Posterior view of Bu.1A maxillae showing porosity and possible destruction on nasal floor of the right maxilla (photo by J. A. Biggs).

Dental abscesses were possibly related to (or perhaps even the cause of) a bony reaction on the right maxilla. Porosity and thickened walls within the maxillary sinus with a likely cloaca perforating the anterior portion of the maxilla suggests a severe infection. Porosity of an active infection on the nasal floor that possibly destroyed some of the palatine bone is also likely associated with the overall infections seen throughout the rest of the right maxilla. Thus, it is possible that a dental abscess formed, traveled between some of the anterior teeth, and eventually invaded the maxillary sinus and nasal floor.

The presence of LEHs on some of the anterior teeth indicate that the individual endured a stress event or illness during infancy. There were no other markers of generalized stress or illness seen in the bones, such as porotic hyperostosis or cribra orbitalia, although poor preservation of the orbits and parts of the cranium prevented full analysis.

Taken together, these contextualize the life experiences and quality of life for this individual. This is especially true for the dental and cranial pathologies that likely lowered the comfort level and quality of life for the Bu.1A individual towards the end of their life. Multiple dental abscesses that may have spread and caused infections in the right maxilla and nasal areas would have been an uncomfortable, if not miserable, set of maladies to endure.

Burial 1B – Zone 62, Square H

The individual identified as Bu.1B was a likely flexed individual that was heavily disturbed by tree and root activity. They were found at the northern end of the Burial 1 space between the lower legs and feet of Bu.1A and 1C (**Figure 11.1**). Less than 25% of the individual was recovered. The preservation of the remains was poor, characterized by a highly fragmented and friable bone quality.

Skeletal Preservation and Inventory

Very few remains from the Bu.1B individual were identified during excavation. Less than 25% of the individual was recovered and mostly consisted of a few poorly preserved long bones, two metacarpal fragments, four manual proximal phalanges, cranial fragments, and some teeth (**Table 11.4**). The disturbed nature of the individual, likely by trees and roots, and overall very poor preservation prevented an accurate interpretation of the burial position. However, one flexed joint, likely a knee, was uncovered, suggesting the Bu.1B individual was probably interred in a flexed position (**Figure 11.6**). The bone quality was equally poor with a friable texture.

Dentition

While very few teeth were recovered from the Bu.1B matrix, analyses of the dentition show a confusing and commingled scenario. No teeth were found fully *in situ*, although five teeth were discovered near the cranial fragments. An additional three teeth were found unassociated and loose within the Bu.1B matrix. All teeth were inventoried and scored for developmental stage and pathologies. **Table 11.5** shows all the teeth recovered from the Bu.1B matrix.

None of the recovered teeth showed signs of cultural modification. Additionally, no teeth were fully developed, confirming that the Bu.1B individual was a juvenile at the time of their death. Due to the young age of the individual, attrition was non-existent to only very small wear facets. Likewise, very little calculus was observed. One occlusal caries was seen on the right first mandibular molar of Bu.1B. Lastly, LEHs were observed on only two teeth. One was a horizontal groove on the left maxillary second premolar. The other instance was on the left maxillary canine where two horizontal LEHs demarcated an area with extensive horizontal pitting.

Table 11.4 Skeletal inventory for Bu.1B. Presence reported as percent complete; blank = absent/not observed.

Element	Left	M/?	Right
Frontal			
Parietal		<25%	
Occipital		<25%	
Temporal			
Maxilla			
Zygomatic			
Sphenoid			
Nasal			
Ossicles (#)			
Mandible			
Hyoid			
C1/Atlas			
C2/Axis			
C3-C6			
C7			
T1-T9			
T10			
T11			
T12			
L1-L4			
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1			
Rib 2			
Rib 3-10			
Rib 11			
Rib 12			
Clavicle			
Scapula			
Humerus	<25%		50%
Radius			
Ulna			
Ilium			
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur		50%	
Tibia		50%	
Fibula			
Patella			
HANDS			
Carpals			
Metacarpals		<25%	
Manual Phalanges		<50%	
FEET			
Tarsals			
Talus			
Calcaneus			
Metatarsals			
Pedal Phalanges			



Figure 11.6 Bu.1B between feet/lower legs of Bu.1A (left) and Bu.1C (right). Black arrow depicts knee joint; red arrow indicates cranial fragments (photo by J. A. Biggs).

Table 11.5 Dental inventory of Bu.1B and surrounding matrix. X = teeth likely belonging to Bu.1B; * = commingled teeth found within Bu.1B matrix.

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
									X, *	X		X			
		X,*, *										X			
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

Age and Sex

Age was estimated using the recovered dentition. Few ends of bones were recovered that would have aided in an age estimation using epiphyseal fusion. The only ones recovered were the bases of some manual phalanges. The bases of these were unfused, indicating that the Bu.1B individual was less than 14 or 15 years of age (Schaefer et al. 2009). However, this information was not particularly helpful as the overall size of the bones clearly suggests an age younger than 14 years.

The most informative elements were the teeth recovered during excavation. Five of the eight total teeth were found in close proximity to each other and also near the very fragmented cranial remains. These five teeth (LP^2, LC', LI^2, LP_2, and RM_1) generated an estimated age of 9.5-11.5 years at the time of death. The other three remaining teeth (RM_1, RM_1, and LI^2) each gave a different age estimation from each other and from the teeth believed to have belonged to the Bu.1B individual. As can be seen from this inventory, a total of three right mandibular first molars were found, indicating that at least three individuals are represented within the Bu.1B matrix. One RM_1 generated an estimated age of around 3.5 years, another RM_1 suggested an age of about 7.5 years, and the third RM1 was from the set of teeth thought to belong to the Bu.1B individual with an estimated age of 9.5 years. The third unassociated tooth was a left maxillary second incisor, a repeat from the actual Bu.1B teeth. This unassociated LI^2 was fully developed but with very little attrition, suggesting an age of over 11.5 years.

Taken together, the MNI for this small area of the overall Bu.1 burial space is four. Despite the number of individuals represented here (even though three of them are only represented by a single tooth), none were adults at the time of their death. It is not known if the presence of the three teeth not associated with the Bu.1B individual represent earlier interments that were disturbed by the Bu.1 burial event, or if these teeth were included as a type of offering or good during the deposition of the Bu.1B individual. The disturbed nature of the entire area precludes a definitive answer, but the inclusion of juvenile remains in primary burial spaces is a pattern that can be seen elsewhere on the same structure at Najil Iik (Bu.1D with Bu.1A and Bu.4 with Bu.2A).

Pathologies and Trauma

Apart from the few mild dental pathologies described above, no other pathologies or trauma were observed on the Bu.1B remains. The overall poor preservation and bone quality of the remains prevents a more in-depth analysis.

Interpretations and Conclusions of Bu.1B

Unfortunately, the highly fragmented and poorly preserved condition of the few recovered remains of the Bu.1B individual prevents a more detailed understanding of this individual compared to the others within the Bu.1 burial space. What was recovered paints a complex picture involving remains of at least four juveniles of different ages. **Figures 11.1 and 11.6** show that the flexed position of Bu.1B differs from any other burial recovered at Najil Iik. Additionally, if the cranial fragments and five associated teeth were in a moderately undisturbed original position, then the head of Bu.1B was placed facing north while Bu.1A and Bu.1C were interred with their heads facing south. Furthermore, the relationship of the Bu.1B individual to the others within the larger Burial 1 space is not known. Future analyses, possibly through use of aDNA, may help determine if kin-based ties link these individuals.

Burial 1C – Zones 57 and 63, Squares D and H

The individual designated as Bu.1C was the third individual identified while determining the boundaries of the Burial 1 pit. Unfortunately, this individual was highly disturbed by tree and root activity, as well as some "enthusiastic digging" by an excavator in Square D during the January 2022 season, before it was established that this was a multi-person burial (**Figure 11.1**). While the majority of the skeletal elements for Bu.1C were part of Zone 63, the likely *in situ* but poorly preserved cranium was discovered before the rest of the burial and was given the designation of Zone 57. Once this cranium was connected with the rest of the bones associated with Bu.1C, Zone 57 was collapsed into Zone 63.

As previously mentioned, artifact drying screens that held skeletal elements from Bu.1A, Bu.1C, and other non-primary burial human bones were commingled by a gust of wind. While many of the bone fragments could not be reassociated with their original contexts, most of those from Bu.1C could be reassociated. This was due to a systemic pathological condition that the Bu.1C individual was experiencing at the time of their death. This pathology left a noticeable appearance that differentiated the Bu.1C remains from others (see below).

Skeletal Preservation and Inventory

While only about 25-50% of the Bu.1C individual was recovered, the bone quality of the elements collected were good. Likely tree and root activity affected the overall preservation of what was recoverable for this individual. As seen in **Figure 11.7**, only the skull and the lower

legs are likely *in situ*; all other elements were likely disturbed and displaced post-interment. An inventory of the Bu.1C remains is presented below in **Table 11.6**.

Table 11.6 Skeletal inventory for Bu.1C. Presence reported as percent complete; blank = absent/not observed.

Element	Left	M/?	Right
Frontal			<50%
Parietal			<50%
Occipital		50%	
Temporal	25%		50%
Maxilla			
Zygomatic			50%
Sphenoid			
Nasal			
Ossicles (#)			
Mandible	100%		100%
Hyoid		50%	
C1/Atlas			
C2/Axis			
C3-C6			
C7			
T1-T9			
T10			
T11			
T12			
L1-L4			
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1			
Rib 2			
Rib 3-10		50%	
Rib 11			
Rib 12			
Clavicle	<75%		
Scapula			
Humerus	50%		50%
Radius	<50%		<50%
Ulna	<50%		<50%
Ilium	<25%		<25%
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur	75%		<75%
Tibia	<100%		50%
Fibula	75%		25%
Patella			<100%
HANDS			
Carpals	75%		<50%
Metacarpals	<25%		75%
Manual Phalanges		<50%	
FEET			
Tarsals	<100%		75%
Talus	50%		50%
Calcaneus	50%		
Metatarsals	100%		100%
Pedal Phalanges			<50%

Dentition

Most of the teeth recovered from Bu.1C were not recovered adjacent to the skull, near the trunk of a tree within the burial pit. The similar morphology between the teeth, their location next to the skull, the fact that some of the teeth fit into the alveolar sockets in the fragmented

skull bones, as well as the lack of any other bones within the immediate area confirm that the teeth recovered at the base of the small tree belonged to the Bu.1C individual (see **Table 11.7** for an inventory of the dentition recovered during excavation).



Figure 11.7 Screenshot of Burial 1 from 3D photogrammetry model showing Bu.1C skull (red arrow) and lower legs (black arrow; photo by J. A. Biggs).

Table 11.7 Dental inventory for Bu.1C.

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
					X	X	X	X	X	X					
		X	X			X	X		X	X			X	X	X
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

Moderate wear was seen on all teeth. There were no indications of dental filing or inlays present despite the dental wear observations. Calculus was present on all teeth, but only in small to moderate amounts, unlike that seen on the teeth from Bu.1A which had large amounts of calculus. Most of the calculus present on Bu.1C was located near the gumline on the labial/buccal or lingual aspects.

Caries were present and mostly located on the posterior teeth. The few seen on the anterior teeth were isolated cervical caries on RC^1, RI^1, and LI^2. All molars recovered had at

least two caries present, most located on the occlusal surfaces. However, LM_1 had a very large caries that resulted in the destruction of half the tooth, with only the distal half preserved. A drainage canal was seen within the LM_1 alveolar bone that likely connected to an abscess located on the anterior surface of the mandible below the location of LP_2 (which was not recovered).

Horizontal LEHs were observed on four anterior teeth: LI^2, RI^2, RC^1, and LC^1. All four teeth had three horizontal LEHs, yet one LEH could not be measured on LC_1 due to the presence of dental calculus. The measurements/locations of the LEHs on each tooth was similar to those of its antimere, such that the three LEHs on LI^2 were possibly the same three stress events or prolonged illnesses that caused the three LEHs on RI^2. Based on these comparisons, it is clear that the Bu.1C individual endured at least three separate stress events during childhood that were severe enough to leave macroscopically observable traces on their dentition.

Age and Sex

The age-at-death and sex estimations for Bu.1C were conducted almost solely on overall size and robusticity due to the poor preservation of skeletal elements that would be the most useful for these analyses (namely the pelvis and the skull). While parts of the calvarium are present, the skull features used in sex estimation were not recovered or observable due to pathologies.

While pathologies also afflicted most of the bones recovered, including severely affected bones of the leg, the foot and hand bones remained mostly unaffected. The large size of the tarsal, metatarsal, carpal, and metacarpal bones suggests that the individual was a male.

No open epiphyses were observed on the skeletal elements. This coupled with the presence of a fully erupted third molar (LM_3) and moderate wear on the teeth indicate the Bu.1C individual was an adult, possibly a middle adult or older (35+ years). The only other indicators were on the right patella in the form of marginal osteophytes and pitting and sclerosis on the articular surface, suggesting osteoarthritis (OA; discussed below). OA mostly occurs in middle-to-older adults and those who do repeated actions with a joint over many years (Waldron 2021). Thus, it is possible that the Bu.1C individual was in their 40s or older at the time of their death. Unfortunately, more accurate age and sex estimations are not possible at this time.

Pathologies and Trauma

While few separate pathologies were observed on the Bu.1C individual, a likely chronic and systemic condition was seen on almost every element observed. This presented as an active porosity on the bones in every region of the body apart from the hands or feet. Additionally, porosity is not relegated to one specific area on each bone but appears to inundate almost all aspects apart from articular surfaces. An added complexity to the active porosity is multiple areas where long-healed pathologies are evident. These are mostly seen on the long bones of the leg and on the cranial vault. It is unclear at this time if these healed lesions were from a separate

illness that the Bu.1C individual endured and healed from earlier in their life, or if this was part of a larger and more chronic condition where both active and healed lesions are seen on the same bone as the result of a prolonged illness.

Active porosity was observed on the cranium (right orbital margin and right zygomatic/maxilla), the superior and inferior surfaces of the right clavicle (left not recovered), the anterior and posterior surfaces of the ribs, the anterior and posterior surfaces of the vertebral neural arches, and the diaphyses of the left humerus (right not recovered), the right radius (left not recovered), the femora, the tibiae, and the fibulae. **Figures 11.8** shows many of these elements with active porosity. Due to the systemic nature of the active porosity, it is likely that the cause was neither congenital nor neoplastic, but possibly the result of a metabolic or hematopoietic disorder.



Figure 11.8 Bu.1C bone fragments exhibiting porosity and active bony reactions. A: Right supraorbital ridge; B: Right zygomatic/maxilla; C: Posterior surface of thoracic vertebra; D: Right superior clavicle (photos by J. A. Biggs).

These two disease categories are considered here due to the mostly system- or body-wide involvement of diseases within them. Metabolic bone disorders are those which inhibit the processes involved in bone remodeling and prevents the body from properly extracting nutrients from food (Ortner 2003; Brickley et al. 2020). Meanwhile, hematopoietic (or blood) disorders are those that affect or are carried by the blood, many involving the marrow spaces within bones

and affecting the vasculature. Pathological conditions from other disease categories might mimic some of the skeletal manifestations seen on Bu.1C's bones, yet most of these do not affect almost all bones or even regions of the body. Metabolic and hematopoietic disorders are a more plausible explanation for what the Bu.1C individual endured at the time of their death.

As mentioned above, one factor that compounds the complexities of active pathology within bones at the time of death is the presence of earlier and mostly healed pathologies seen on the legs and cranium of Bu.1C. While there is no extensive thickening of the cranial vault, the undulating appearance of the outer table of the parietal bones indicates that there was likely a period of lytic activity where the bone was actively destroyed followed by a latent stage where the bone healed itself (see **Figure 11.9**). Based on the smooth appearance of these lesions, it is clear they healed long before the appearance of the active porous areas. Interestingly, no active lesions or areas of porosity were observed on the parietals or the posterior portion of the frontal bone, yet there was clearly active porosity observed on a fragment of the supraorbital margin and ridge near the supraorbital foramen.



Figure 11.9 A: Superior view of Bu.1C right parietal with irregular morphology near bregma suggesting a healed lesion (black arrows; anterior is up); B: Oblique view of Bu.1C right parietal showing healed lesion (photos by J. A. Biggs).

Evidence of earlier pathologies is most clearly seen on the legs, where both healed and active lesions were observed. The femora, tibiae, and fibulae showed overall abnormal surface morphology while the femora and tibiae exhibited extensive thickening and widening, particularly with the cortical bone. The left tibia (the best preserved and most intact of the long bones) could have sustained a fracture earlier in Bu.1C's life based on the presence of slight lateral bowing just distal of the midshaft (**Figure 11.10**). It is possible that if this fracture was severe enough, it could have introduced some kind of pathology that resulted in the older/healed skeletal manifestations seen in the legs and possibly the skull. Given the compounding factors of

a possible fracture and at least two instances of bone-affecting illness, it is not possible to accurately determine if this scenario occurred.



Figure 11.10 Right tibia of Bul.1C. A: Anterior view; B: Lateral view. Note irregular morphology, porous cortical texture, and possible healed fracture (arrows) on distal half (photos by J. A. Biggs).

The right tibia was in poorer condition than the left but exhibited a greater degree of widening of the cortical bone such that the anterior crest was not discernible, unlike on the left tibia (**Figure 11.11**). Moreover, the surface of the right tibia was more irregular than the left and may even have a possible cloaca. Unfortunately, this cannot be seen on the external surface of the bone due to poor preservation, yet the interior aspect of the right tibia shows the start of a channel that could be a cloaca within the medullary cavity.



Figure 11.11 Fragment of left tibia of Bu.1C with extensive cortical involvement from an active pathology. Proximal is up (photo by J. A. Biggs).

Both femora also show widening and thickening of the cortical bone, however this thickening is not uniform in nature (**Figure 11.12**). A right femoral fragment in cross-section shows that solid cortical bone was not produced throughout. Going from internal to external, a dense and thick layer of bone was observed deep, adjacent to the medullary cavity, then a thick but vascular layer of bone, followed lastly by another thick and dense layer of cortical bone which can be seen on the outer surface (**Figure 11.13**). These layers could represent the stages of the earlier pathology such that once the femur was affected, a thick layer of vascular bone was laid down during an active stage, followed by the thick outer layer of cortical bone during the healing stage (or possibly as a result of the pathology affecting the individual). Whatever the case, it is clear that a complex suite of events affected the normal bone functions of remodeling at least twice during Bu.1C's lifetime.



Figure 11.12 Fragmented femora of Bu.1C. A: Posterior aspect of left femur; B: Posterior aspect of right femur (photos by J. A. Biggs).



Figure 11.13 Cross-section of femoral fragment from Bu.1C showing inner thickened layer, a thick vascular layer, and another thickened cortical layer (all indicated by arrows; photo by J. A. Biggs).

Osteophyte formation was observed on the medial margin of the articular surface of the right patella. Additionally, porosity/pitting and some sclerosis on the articular surface were noted (**Figure 11.14**). Together, these data suggest that osteoarthritis (OA) could have affected the knee(s) of the Bu.1C individual. Eburnation, which is pathognomonic to OA, was not observed on the patella (Ortner 2003; Waldron 2021). Despite this, OA is still the mostly likely pathology. The left patella did not preserve and therefore bilaterality could not be confirmed. Moreover, the lack of preservation of almost all proximal and distal ends of bones prevented further assessment of the widespread nature of OA throughout the body.



Figure 11.14 Posterior view of right patella of Bu.1C showing pitting and sclerosis on articular surface and osteophytic lipping along margins (photo by J. A. Biggs).

Trauma

Antemortem trauma was observed in two locations on Bu.1C's skeletal remains. The first has already been mentioned and discussed: the possible left tibial fracture that is obscured by at least two bone-affecting illnesses. The second are two healed rib fractures (**Figure 11.15**). Poor preservation makes it impossible to know which two ribs the fractures occurred on, but the morphology of the two rib fragments suggests the trauma occurred on two of ribs 3-10. One of the rib fragments exhibiting a healed fracture is possibly from the right side of the ribcage, yet the other fragment is too small to determine the side. The healed fracture on the larger rib fragment shows that the overall curvature of the rib was changed once the rib healed, suggesting

that it healed improperly at the incorrect angle. Whether this is the case with the other healed rib fracture is unknown due to preservation. The degree of healing for each rib fracture indicates that these traumas occurred possibly years before the second illness that was active at the time of death. This assessment is based on the presence of the active porosity/periosteal reaction on and around the healed trauma locations, the remnant bone callus. The degree of healing might also suggest that both rib fractures occurred during the same traumatic event, yet this cannot be confirmed. Rib fractures are also types of trauma that are the result of interpersonal violence (Redfern and Roberts 2019). It is possible that some time before death, the Bu.1C individual was the victim of or engaged in some type of violent act, resulting in at least two rib fractures that healed over time.



Figure 11.15 Inferior view of a rib fragment showing healed fracture (arrow; photo by J. A. Biggs).

Interpretations and Conclusions of Bu.1C

Compared to the other individuals within Burial 1, or throughout the rest of the analyzed burial population from Str. 1 at Najil Iik, the Bu.1C individual presents a more difficult challenge. This is due to the poor preservation of the remains (mostly from tree and/or root activity) combined with the suite of pathologies and trauma observed on the skeleton, obscuring landmarks and markers that would otherwise be used in age and sex estimations. Nonetheless, it is clear from the overall size and robusticity of the remains that this individual was likely a

biological male. Moderate dental wear and the presence of OA on their right patella suggests an adult, possibly in their 40s or older at the time of their death.

The systemic pathologies seen throughout their skeletal remains implies that this individual endured at least two bone-affecting illnesses. While it is not possible at this time to determine the exact type(s) of illnesses they experienced, the occurrence of these pathologies throughout most of the bones in the body indicates that one of them might have been a metabolic condition.

The large amount of osteological involvement for the pathology no doubt would have decreased the quality of life for the individual. This may have been especially true towards the end of life since the pathology was actively affecting Bu.1C's body at the time of their death and likely causing them some physical suffering.

Burial 1D – Zone 64, Square H

Burial 1D was originally thought to be a secondary burial of an infant deposited directly onto the mid back of the Bu.1A individual (**Figures 11.1 and 11.16**). Before removal, this cluster of bones was given the designation of Bu.1D. It became clear upon further excavation of the area on and around the bone cluster that not only were most of the skeletal elements missing, but also that there were long bone fragments that belonged to at least three individuals. Thus, Bu.1D should not truly be thought of as a separate secondary burial, but a human bone cache deposited on the back of Bu.1A.

Skeletal Inventory and Preservation

Only long bone fragments were found within the deposit known as Bu.1D. Of those, few could be positively identified as belonging to a certain bone class. Most of what was recovered was too fragmented or eroded to give a designation beyond 'long bone fragment'.

Dentition

No dentition was found within the Bu.1D matrix.

Age and Sex

Given the fragmentary nature of the bones within Bu.1D, age estimations are very broad and based on the macroscopic appearance of the bones, including the overall size of the bone and the texture and appearance of the cortical surface. Only two bone fragments could be positively identified, a right tibial diaphysis fragment and an un-sided fibular diaphysis fragment. The size and appearance of these two bones indicate that they did not come from an adult individual. Without more of the bone preserved, the age-at-death estimation for these bones can only be

categorized as juvenile, possibly between the ages of five and 10. It is possible that these tibia and fibula fragments came from the same individual based on similar appearance, preservation, and comparative size, but this cannot be confirmed. However, these two fragments were the best preserved and the only truly identifiable fragments associated with Bu.1D.

At least 35 other miscellaneous long bone fragments were found within the Bu.1D designated area. As previously mentioned, none are more identifiable than being a long bone fragment, but the morphology of some of these fragments broadens the number of individuals represented within the cache. Some small and porous long bone fragments clearly indicate that they belonged to an infant while the thicker cortical bone and more mature morphology of others suggest they came from at least one adult. Thus, Bu.1D is not a single secondary burial, but a bone cache represented by three broad age cohorts: infant, juvenile, and adult,

Sex could not be estimated for any of the remains found within Bu.1D based on the fragmentary nature of the bones and the lack of any identifiable markers.



Figure 11.16 Bu.1D cache (dashed) placed on back of prone Bu.1A individual (photo by J. A. Biggs).

Pathology and Trauma

No pathologies or trauma were identified on any of the bones within the Bu.1D bone cache. Slight porosity was observed on the right tibia fragment, yet there was no reactive bone formation seen. It is likely that this porosity is due to growth and development as this tibia belonged to a juvenile at the time of their death.

Interpretations and Conclusions of Bu.1D

As previously mentioned, Bu.1D is not a true primary or secondary burial, but a bone deposit or cache. Given the many other goods deposited with Bu.1A, and the likelihood that they were a shaman/priest during their lifetime (see **Biggs, Harrison-Buck, and Lamb, Chapter 5**), it is likely that the Bu.1D bone cache was actually a spiritually powerful burial good interred *for* the Bu.1A individual, rather than being a discrete deposit *near* Bu.1A.

Burial 2

Similar to Burial 1, Burial 2 represents an interment space with more than one individual, labeled Bu.2A and Bu.2B (**Figure 11.17**). While it is likely that the individuals within Burial 1 were deposited at the same time or in the same event, it is not known whether this was the case with Burials 2A and 2B. Moreover, there is a third individual, Bu.4, that is possibly associated with the Burial 2 individuals but was given its own burial designation at a later date. The relationship between these three individuals is still not completely known, yet possible scenarios for their deposition within the construction layers of the Structure 1 superstructure have been discussed previously in this volume (see **Biggs, Harrison-Buck, and Lamb, Chapter 5**).

Burial 2A – Zones 21, 31, and 60, Squares C, D, and J

Burial 2A (Bu.2A) is split between three zones (21, 31, and 60) as a result of a large intrusive pit (Zone 21) that made the skull appear as if it was an isolated skull deposit (originally designated as Zone 31). The skull and surrounding matrix were removed *en masse* during the January 2022 season and excavated in the lab during the Summer 2022 season. Lab analyses during the Summer 2022 field season confirmed that human remains found within the Zone 21 intrusive pit articulated with the skull in the Zone 31 pit. This indicates that the Zone 31 pit was not an isolated skull deposit, but part of a larger, disturbed primary burial. Square J was opened in order to uncover the rest of the remains of this individual and was designated Zone 60. Due to the complex nature of the interment, joint analyses were conducted by Jack A. Biggs and Allison Bower.

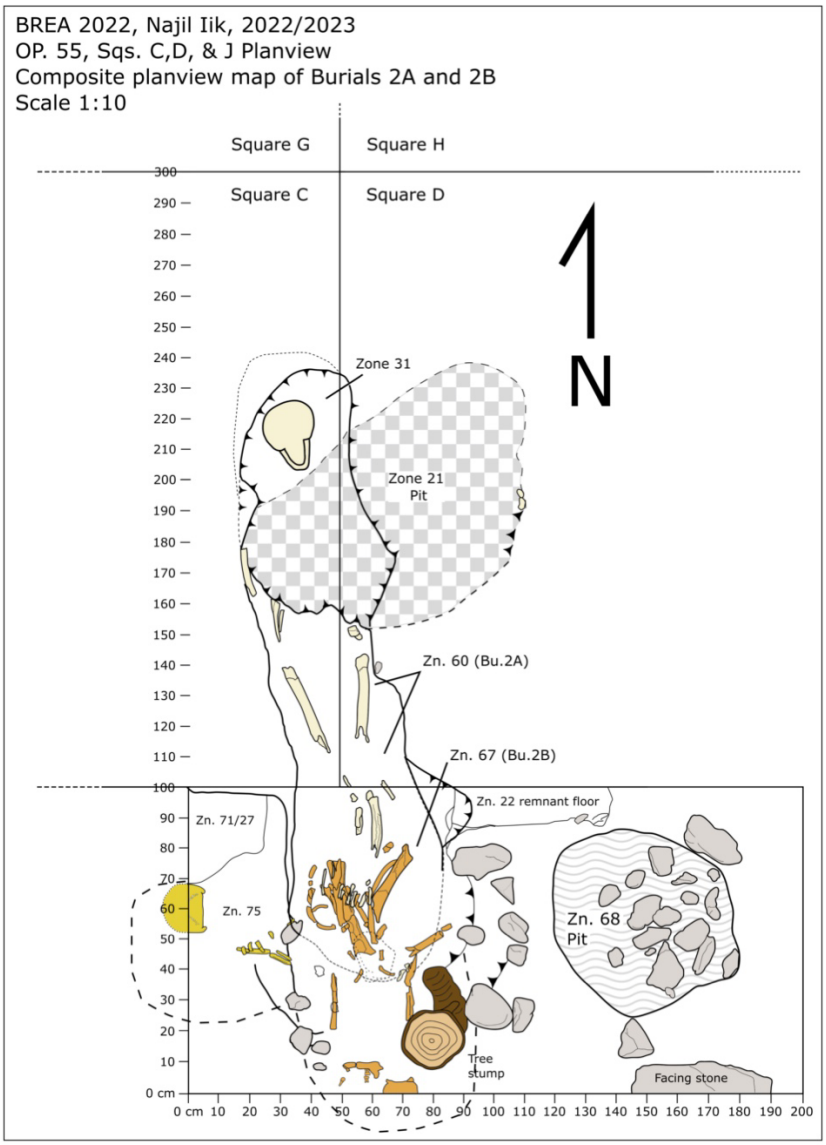

Figure 11.17 Plan view of Bu.2A and Bu.2B (image by J. A. Biggs).

Skeletal Preservation and Inventory

The overall preservation of the Bu.2A remains was fair to poor and exhibited a friable texture. Only about 25-50% of the skeleton was recovered; much of the individual's remains were highly disturbed by the Zone 21 intrusive pit. **Table 11.8** shows the recovered remains that were analyzed.

Table 11.8 Skeletal inventory for Bu.2A. Presence reported as percent complete; blank = absent/not observed.

Element	Left	M/?	Right
Frontal			
Parietal	25%		25%
Occipital		50%	
Temporal	75%		50%
Maxilla			
Zygomatic			
Sphenoid	25%		
Nasal			
Ossicles (#)			
Mandible	100%		<50%
Hyoid			
C1/Atlas		<25%	
C2/Axis		<25%	
C3-C6			
C7			
T1-T9			
T10			
T11			
T12			
L1-L4			
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1			
Rib 2			
Rib 3-10		<25%	
Rib 11			
Rib 12			
Clavicle			
Scapula			
Humerus			
Radius			
Ulna			
Ilium			
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur	75%		75%
Tibia	<50%		<50%
Fibula	25%		25%
Patella			
HANDS			
Carpals			
Metacarpals			50%
Manual Phalanges			25%
FEET			
Tarsals			<25%
Talus			
Calcaneus			
Metatarsals		25%	
Pedal Phalanges			

Dentition

A total of 16 teeth were found within the burial contexts of Bu.2A (**Table 11.9**). Since the skull was separated from the rest of the body by the Zone 21 intrusive pit, not all teeth were found in articulation with or in close proximity to the skull. One maxillary tooth and 11 mandibular teeth were found within the skull block that was excavated out in the field lab. Four additional maxillary teeth were identified within the Zone 21 intrusive pit matrix. When both contexts were combined, no tooth repeats were found. Furthermore, due to Bu.2A's extended

and supine burial position and the disturbed and missing facial bones, the displacement of some of the teeth into the Zone 21 intrusive pit supports the contention that these teeth belonged to the Bu.2A individual. Attrition scores between most of the teeth were fairly consistent, apart from one tooth (LI^2) from the Zone 21 pit (see below).

Table 11.9 Dental inventory for Bu.2A. * = dentition found within Zone 21 intrusive pit.

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
		X*				X*		X	X*				X*		
			X	X		X	X	X	X	X	X	X	X	X	
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

Caries were observed on three teeth found in direct association with the skull. Interproximal caries were found on LI_1 and LI_2 while a carious lesion was found on the lingual surface of RP_1. Teeth found in the Zone 21 intrusive pit matrix also exhibited caries. LM^1 had both occlusal and interproximal caries, LI^2 had one cervical caries, RI^2 had both interproximal and cervical caries, and RM^1 had two interproximal caries. None of the caries observed on the dentition were large or destroyed enamel to a major degree.

A moderate to severe amount of attrition was seen on the teeth. Dental filing on the maxillary left central incisor and all four mandibular incisors prevented accurate attrition scores for these teeth. However, the margins of the dental filing and the overall blunted nature of the surfaces still indicated marked wear after the filing event (discussed below). Teeth found in direct association with the skull exhibited moderate to high attrition. The two maxillary first molars found within the Zone 21 intrusive pit matrix had severe attrition, in which the entire enamel crown had been worn away, while LI^2 had a similar and moderate attrition score to those found with the rest of the skull.

The attrition rates observed throughout the dentition are slightly elevated on the left side compared to the right, suggesting that the Bu.2A individual used or favored the left side of their mouth for chewing.

Calculus was observed on all teeth except for RM^1 and was present in small amounts except for RP_1 which had a large amount of calculus.

Sex and Age

Unfortunately, no pelvic features preserved (the most accurate for estimating sex). Of the features of the skull, only the nuchal crest, mastoid processes, and mental eminence were scorable. The nuchal crest and mastoid processes were scored as ambiguous. The mental eminence was more pronounced, suggesting an estimation of male. However, the femora were not very rugose with a linea aspera that was not well pronounced. Taken together, no accurate sex estimation can be made at this time.

Age estimation of the Bu.2A individual is mostly based on dental attrition, discussed above. Due to the moderate to severe wear facets seen on the teeth, it is likely this individual was a middle to older adult at the time of their death (at least 35 years old). Unfortunately, the lack of remains and the poor preservation of those present prevented a more precise estimation.

Pathologies and Trauma

The only pathologies observed on the remains were dental: an abscess on the lingual aspect of the mandible was seen near the root tip of LP_2. This was evidenced by the presence of porous bone and a drainage channel on the lingual aspect of the mandible. This abscess was active at the time of death, though it is not known if it had any role in the cause of death. The extreme tooth wear seen on LP_2 could have resulted in the pulp chamber of the tooth becoming exposed sometime prior to death. This in turn could have led to the introduction of bacteria into the tooth and surrounding bone, resulting in an infection and dental abscess.

The only other pathology seen on the individual is based on the location of the dental calculus on the two central mandibular incisors. Calculus is present below the CEJ, about halfway down the root, suggesting a very low gumline as the result of gingivitis.

No trauma was observed on the remains of the Bu.2A individual.

Cultural Modifications

Cranial shaping and dental filing were observed on the remains during lab analyses. Despite the fragmented nature and missing anterior portion of the cranium, planes of compression were evident on the posterior and possibly superior aspects. The posterior compression was asymmetric on the right side of the cranium, resulting in a slightly lateral expansion on the left side near the temporal area. The presence of some slight flattening on the superior surface, combined with the posterior (though asymmetric) compression, suggests a cranial modification designation of Superior Flattening within the Tabular oblique group, based on modification styles outlined by Tiesler (2014).

Dental modification via filing was observed on LI^1, LI_2, LI_1, RI_1, and RI_2. Surprisingly, multiple filing styles were observed between the teeth (**Figure 11.18**). Styles for the teeth were assigned according to those by Williams and White (2006) and reported in **Table 11.10**.

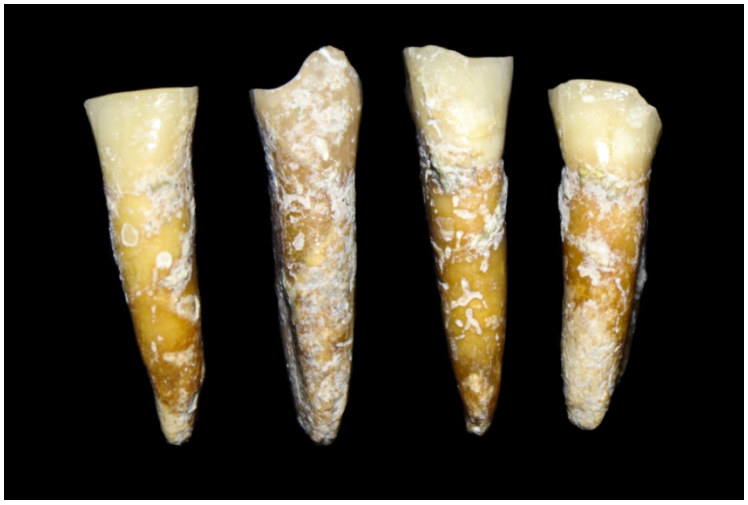

Figure 11.18 Mandibular incisors for Bu.2A (left to right: RI_2, RI_1, LI_1, LI_2) exhibiting different dental filing styles (photo by J. A. Biggs).

Table 11.10 Dental filing styles assigned to Bu.2A dentition based on Williams and White (2006).

Tooth	LI^1	RI_2	RI_1	LI_1	LI_2
Filing Style	C1 or C6	A4 (variant?)	F4	B6 (or F4?)	F4

The multiple filing styles seen in Bu.2A's teeth could be attributed to the extensive wear observed on their occlusal surfaces. If the individual was a middle to older adult as estimated, then their teeth would have been filed when they were an adolescent (Scherer 2018). As dental filings are not usually re-touched once the initial filing is complete, the original style could wear away over time or have a different appearance decades later. This could also be compounded by Bu.2A's favoring the left side for chewing. Taken together, it is possible that the styles the teeth were assigned during lab analyses may not have been the original styles that were filed during Bu.2A's youth. This should not suggest that dental filing styles commonly shift as an individual ages, but that wear, diet, and time obscure original dental filing styles or make them resemble others.

Interpretations and Conclusions of Bu.2A

Despite the poorly preserved and disturbed nature of Bu.2A's remains, much can be interpreted from the mortuary and osteological data. While more definitive estimations of age and sex were not possible, it is clear that the Bu.2A individual was an adult of at least 35 years of age, and likely older. The expressions of cultural modifications via cranial shaping and dental filing are the only examples seen among the known and excavated burials at the site. This places them in a unique position as these types of modifications are possibly related to group identity (Tiesler 2012). Since both cranial shaping and dental filing are performed on the individual during the early life course (acting as stages towards Maya personhood; Tiesler [2013]; Scherer

[2018]), the Bu.2A individual may have been born and spent the earlier stages of their life in a separate region where those modifications were more common and acted as part of the group's social identity. Sometime after these modification events, the Bu.2A individual may have migrated to the Xtabentun/Najil Iik region where such modifications were not important regional cultural practices, thus making them unique within the known burial assemblage. Their inclusion and interment within the superstructure, possibly buried alongside/with Bu.2B and the Bu.4 infant deposited above their feet (see **Biggs, Harrison-Buck, and Lamb, Chapter 5**), means that they were fully integrated into the community at their time of death. Moreover, they could have attained an elevated position within the community to warrant such a complex mortuary treatment upon their death. Future research on this individual could include stable isotope analyses to determine if they were born and raised in a different region or aDNA analysis to examine whether they were genetically related to anyone else in the burial population.

Burial 2B – Zones 67, Square J

Bu.2B was a secondary burial that was either interred with, or disturbed by, Bu.2A (see **Biggs, Harrison-Buck, and Lamb, Chapter 5** for a detailed discussion of these burial events). Many of the observations for Bu.2B were made in the field as the entirety of Bu.2B was not excavated. The cranium extended into the southern wall of Square J into unexcavated territory (**Figures 11.17 and 11.19**). Thus, many cranial observations could not be made as it was not removed from the site.

Skeletal Preservation and Inventory

Less than 25% of the skeleton belonging to the Bu.2B individual was available for analysis (**Table 11.11**). This is not due to preservation issues or the result of tree disturbance, but mostly because of the secondary nature of the burial. Only some of the skeletal elements were recovered from the primary interment and these partial elements were subsequently reburied in their secondary location, resulting in a partial secondary burial. The bones that were recovered by the BREA team were in poor condition.

As previously stated, some of the skull was exposed in the field but part extended south into the wall of the square. Some teeth were found still in occlusion within the mandible near the cranium. However, other loose teeth found within the Bu.2B matrix prevented a positive association with Bu.2B, suggesting that teeth from another individual might have been mixed with or disturbed by the Bu.2B secondary interment episode.

Multiple unidentifiable bone fragments were recovered, along with a femur, tibia, ulna, humerus, talus, two metacarpals, three fragmented ribs, and two pedal sesamoid bones.



Figure 11.19 Some *in situ r*emains of Bu.2B in Square J. (Photo by J. A. Biggs).

Dentition

The teeth found within the Bu.2B space present a complex and commingled picture. A total of 14 teeth were found, yet only two are positively associated with the Bu.2B individual as they were in occlusion within the mandible and maxillary bone fragments near the rest of the cranium. Twelve other teeth were found within the matrix near the skull of Bu.2B, yet the repetition of a specific tooth (RI^1) indicates the presence of at least two individuals within the burial space. This prevented the positive association of any other teeth with the Bu.2B individual. Thus, the two sets of teeth will be discussed separately (**Tables 11.12 and 11.13**). Future lab analyses may allow more teeth to be positively reassociated with the Bu.2B individual.

Table 11.11 Skeletal inventory for Bu.2B. Presence reported as percent complete; blank = absent/not observed.

Element	Left	M/?	Right
Frontal			
Parietal			
Occipital		<25%	
Temporal			
Maxilla			
Zygomatic			
Sphenoid			
Nasal			
Ossicles (#)			
Mandible	75%		?
Hyoid			
C1/Atlas			
C2/Axis			
C3-C6			
C7			
T1-T9			
T10			
T11			
T12			
L1-L4			
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1			
Rib 2			
Rib 3-10			
Rib 11			
Rib 12			
Clavicle			
Scapula			
Humerus	50%		
Radius			
Ulna		50%	
Ilium			
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur		75%	
Tibia			
Fibula			
Patella			
HANDS			
Carpals			
Metacarpals		<25%	
Manual Phalanges			
FEET			
Tarsals			
Talus		25%	
Calcaneus			
Metatarsals			
Pedal Phalanges			

Multiple caries were found on both teeth positively associated with the Bu.2B individual. One proximal and one cervical caries were found on RI^1 while two occlusal caries and a cervical caries were found on RM_3.

Only small amounts of calculus were observed on both teeth. RI^1 exhibited a thin layer of calculus on the lingual smooth surface and the lingual aspect of the CEJ. Calculus was only seen on the distal aspect of the RM_3 dentine below the enamel crown.

Table 11.12: Dental inventory of teeth positively associated with Bu.2B.

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
							X								
X															
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

No linear enamel hypoplasias were observed on either tooth.

Lastly, wear was minimal to moderate, with only small amounts of dentine exposed suggesting that the Bu.2B individual was not a middle or older adult at the time of their death.

Table 11.13: Dental inventory of teeth found within the burial matrix of Bu.2B (no positive associations made).

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
		X	X	X	X	X	X			X					
			X	X	X	X				X					
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

Comparatively more teeth (n = 12) were found within the Bu.2B matrix than could not be positively associated with the individual. Caries were observed on RC^1, RP^1, RP^2, RM^1, and LP_1 (**Table 11.14**).

Table 11.14 Caries type/location by tooth for Bu.2B.

Tooth	Occlusal Caries	Interproximal Caries	Cervical Caries
RC^1			X
RP^1	X	X, X	
RP^2		X, X	
RM^1		X	
LP_1		X	

Small to large amounts of calculus were observed on these teeth. Only the RP_2 did not show any calculus buildup. The most severe examples of calculus were seen on some of the anterior teeth including RI^1 (a moderate amount) and both right lateral incisors (large amounts). The calculus buildup on the lateral incisors covered most of their labial surfaces, portions of their lingual surfaces, and extended down past the CEJ in a thick layer.

Attrition scores for these teeth were similar to those seen in the positively associated teeth described above. Where scoring was possible, slight to moderate dentine patches and enamel

blunting were observed. Two teeth (RI^1 and RI^2) were scored for attrition but have dental filing (although RI^2 may have a distinct wear pattern), thus potentially skewing the attrition scores.

Linear enamel hypoplasias were observed on seven teeth: RI^1, RC^1, LC^1, RC_1, RP_1, RP_2, and LC_1. The LEHs were mostly in the form of linear horizontal grooves. Two teeth, RC^1 and RC_1, had two linear horizontal grooves while the rest of the teeth had only one, except for LC^1. This tooth had a linear horizontal groove accompanied by an area with pitting and slight vertical lines and only occurred on the distal half of the labial aspect. The cause of this surprising enamel hypoplasia is unknown.

Lastly, LP_2 has an expansion of the dentine at the root tip, extending distally. This small nodule is indicative of hypercementosis.

Sex and Age

No skeletal remains or landmarks with strong correlations to sex estimation were recovered or preserved sufficiently. No pelvic bones were found, and the cranial bones could not be removed as they extended beyond the excavation square boundary. The fragmentary nature of the recovered remains also prevented an accurate assessment of sex. Thus, the estimated sex of the Bu.2B individual is unknown.

Similar to sex estimation, age for Bu.2B could not be accurately assessed. No pelvic, vertebral, or rib end fragments were recovered upon which age estimations are typically reliant. Most articular facets that could be indicative of systemic degenerative changes did not preserve. The most informative measure for age was the attrition rates. The two teeth positively associated with the Bu.2B individual had slight-to-moderate wear. The presence of RM^3 still within the mandible indicates an age of at least 18. Yet the heavy wear on the mesial aspect and slight wear on the distal suggests that this third molar was disproportionately used on the mesial side, especially after the antemortem loss and total alveolar bone resorption of RM^1 and RM^2. This observation, combined with the small amounts of dentine seen on RI^1, suggests that Bu.2B was not a young adult but rather middle aged (at least 35 years at time of death).

Pathologies and Trauma

Two instances of periostitis were seen on the remains of Bu.2B. The first was noticed on a femur fragment, but the side and location of the pathology is unknown due to the fragmentary nature of the bone. This patch of periostitis appears to have been in the process of healing when the individual died. It was not fully healed, but also not active.

The second occurrence of periostitis was observed on an unidentified long bone fragment. The thinner nature of the cortical bone likely excludes the femur. The curvature of the bone suggests it may be from the proximal portion of the humerus or tibia. The reaction seen on this fragment was active at the time of death due to the presence of very porous woven bone on the fragment.

Without more of the skeleton to analyze, the causes of these periosteal reactions remain unknown.

Cultural Modifications

One RI^1 tooth that was not positively associated with the Bu.2B individual, but found within the Bu.2B matrix, displayed dental filing. This tooth exhibited the B4 or B5 style as outlined in Williams and White (2006). Another tooth found within the Bu.2A matrix (RI^2) is possibly filed and has a similar appearance to the B1 style (Williams and White 2006). However, as there is no antimere for this tooth, it is uncertain if this shape is due to intentional filing or concentrated wear on a singular area of the tooth as the result of repeated use or activity. Since the RI^1 tooth positively associated with Bu.2B is not filed, and no other teeth from this individual show signs of dental modification, it is probable that the former teeth were mixed in with the burial matrix during the secondary deposition of the Bu.2B individual.

As most of the cranium was outside of our excavation boundaries, it is unknown if there is any evidence of intentional cranial shaping.

Interpretations and Conclusions of Bu.2B

The secondary nature of Bu.2B's interment resulted in very few remains that could be analyzed. Similar to Bu.2A, the bone quality was poor and fragmentary. Thus, accurate sex and age estimations could not be made. It is also unclear if all the remains found within the Bu.2B space actually belonged to a single or multiple individuals. The dentition suggests at least 2 individuals, but small elements such as teeth are commonly found throughout other burial matrices at the site, as well as in non-mortuary contexts. However, it is clear that the remains present within the Bu.2B space belonged to an (or multiple) adult of unknown sex. Their proximity to Bu.2A undoubtedly indicates that these two individuals were intentionally interred within the same space. Whether these burial episodes were conducted minutes or years apart is unknown.

Burial 3 – Zone 61, Square D

The individual given the designation of Bu.3 was an infant buried within the Zone 56 construction fill in Square D (the Zone 27 equivalent in Square C). This burial was found while leveling out the zone and is noteworthy in that no pit outlines were noticeable within the matrix. This suggests that Bu.3 was not a later interment that was placed by cutting into the Zone 56 construction fill but may have been placed there while the fill layer was being laid (**Figure 11.20**).

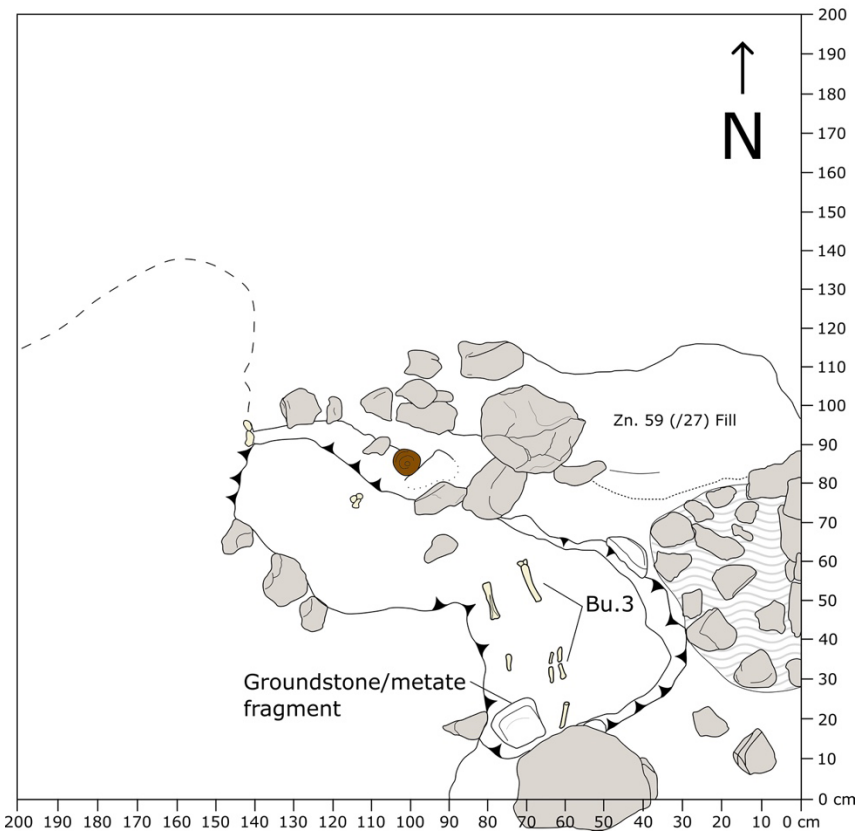

Figure 11.20 Bu.3 in Square D (image by J. A. Biggs).

Another interesting aspect of this interment is that it appears to be a secondary burial. The only bones that were uncovered were long bones of the arms and legs (femora only). No cranial, axial, manual, or pedal bones were seen. Additionally, a ground stone piece (likely a metate fragment) was found near where the head would have been (**Figure 11.21**). Unlike most of the other individuals discovered at Najil Iik, Bu.3 was not fully excavated and removed. It was only defined, documented, and then reburied. While it is possible that other remains of Bu.3 were not uncovered, the overall lack of bones or fragments suggests that few, if any, other remains were interred during this event.

Skeletal Preservation and Inventory

Very few bones were available for analysis due to the possible secondary nature of the interment and the fact that the skeleton was analyzed *in situ* and then reburied. The quality of the bone was fair to good but was fragile due to the individual being an infant at the time of death. **Table 11.15** shows the remains identified for the Bu.3 individual.



Figure 11.21 Bu.3 infant burial still i*n situ* with a metate fragment where head would be (photo by J. A. Biggs).

Dentition

No dentition was found associated with the Bu.3 individual.

Sex and Age

No sex estimation was conducted on the Bu.3 individual as they were an infant at the time of their death.

Likewise, a more precise estimation of age could not be made due to the still *in situ* remains, of which there are none that allowed for an accurate assessment. Developmental stages of the tooth buds are usually the most accurate method for age estimation in juveniles, however no teeth were discovered around the head area nor in the surrounding matrix. Based on the general size of the remains, it is clear that this individual was an infant when they died. An 'infant' is described in osteology as being between birth and about three years old. The size of the long bones indicates that this individual was on the lower end of this spectrum, likely dying sometime during the first year of life.

Pathologies and Trauma

No pathologies or trauma were seen on the few remains for *in situ* analysis.

Table 11.15 Skeletal inventory of Bu.3. Presence reported as percent complete; blank = absent/not observed.

Element	Left	M/?	Right
Frontal			
Parietal			
Occipital			
Temporal			
Maxilla			
Zygomatic			
Sphenoid			
Nasal			
Ossicles (#)			
Mandible			
Hyoid			
C1/Atlas			
C2/Axis			
C3-C6			
C7			
T1-T9			
T10			
T11			
T12			
L1-L4			
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1			
Rib 2			
Rib 3-10			
Rib 11			
Rib 12			
Clavicle			
Scapula			
Humerus	100%		
Radius	75%		50%
Ulna	75%		
Ilium			
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur	100%		75%
Tibia			
Fibula			
Patella			
HANDS			
Carpals			
Metacarpals			
Manual Phalanges			
FEET			
Tarsals			
Talus			
Calcaneus			
Metatarsals			
Pedal Phalanges			

Interpretations and Conclusions of Bu.3

Overall, very little is known about the Bu.3 individual. Their secondary burial, general lack of remains, the placement of the long bones in an anatomical and extended position, and the placement of a likely metate fragment where the head would have been, are interesting and have been discussed elsewhere in this volume (**Biggs, Harrison-Buck, and Lamb, Chapter 5**). However, the paucity of remains available for in-field analysis, coupled with the burial

remaining *in situ* within the Zone 56 construction fill, prevents much from being known about the short life of the Bu.3 individual.

Burial 4 – Zones 51 and 52, Square J

The individual designated as Bu.4 at Najil Iik was an infant that was found disturbed and split between two pit features (Zones 51 and 52 in Square J; **Figure 11.22**). As discussed elsewhere (e.g., **Biggs, Harrison-Buck, and Lamb, Chapter 5**), the Bu.4 individual was possibly interred with and above the feet and lower legs of Bu.2A. At some point later in time, this space was disturbed by an intentional/cultural pit that broke the vessel associated with Bu.4 and disturbed many of the remains. Most of the vessel sherds and some of the bones were then deposited in another pit just beside the original location of Bu.4.

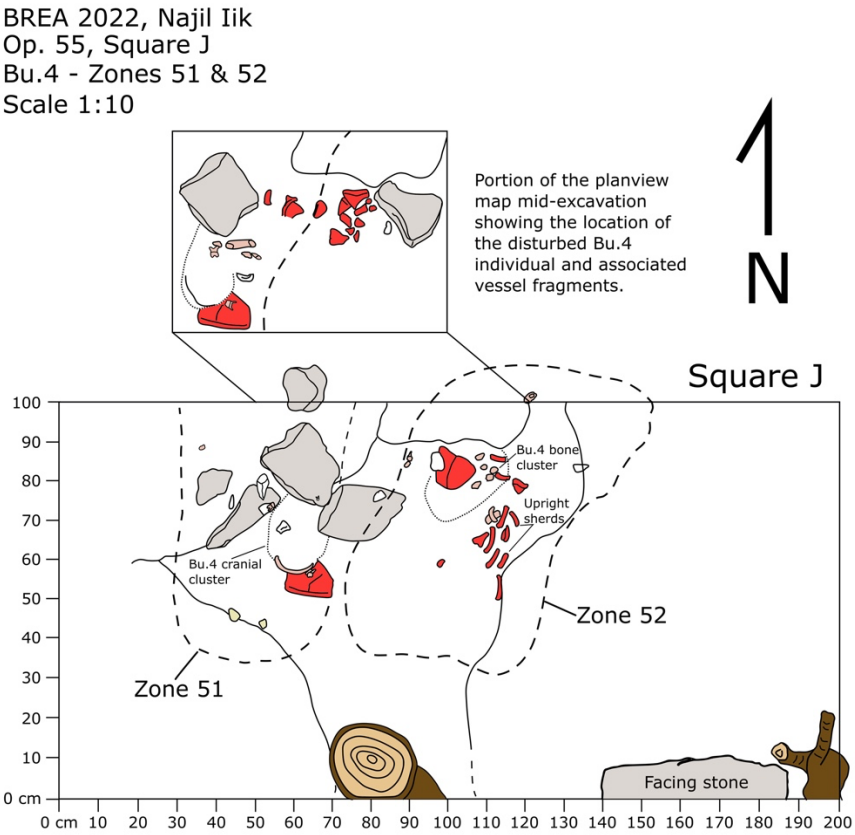

Figure 11.22 Bu.4 and the associated Zone 51 and 52 pit features (image by J. A. Biggs).

Skeletal Preservation and Inventory

Overall skeletal preservation for Bu.4 is fair to poor. Less than 25% of the skeleton was observable and was highly fragmented. This is due to both the fragile nature of infant remains and the highly disturbed nature of the burial spread across two pits. Most of the cranial

fragments were unidentifiable due to their small and friable condition (**Figure 11.23**). The two temporal petrous portions were recovered and were the only truly identifiable cranial elements. Some of the mandible was preserved and aided in generating an age estimation. Very few postcranial bones could be identified apart from being assigned to a general bone class or region. The remains that could be identified are presented in **Table 11.16**.



Figure 11.23 View of fragmented and disturbed Bu.4 'cranial cluster', referenced in figure 11.22. Note large vessel sherd on which cluster sits. North is left (photo by J. A. Biggs).

Table 11.16 Skeletal inventory of Bu.4. Presence reported as percent complete; blank = absent/not observed.

Element	Left	M/?	Right
Frontal		<25%	
Parietal		<25%	
Occipital			
Temporal	25%		25%
Maxilla			
Zygomatic			
Sphenoid			
Nasal			
Ossicles (#)			
Mandible		75%	
Hyoid			
C1/Atlas			
C2/Axis			
C3-C6			
C7			
T1-T9		<25%	
T10			
T11			
T12			
L1-L4			
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1			
Rib 2			
Rib 3-10			
Rib 11			
Rib 12			
Clavicle			
Scapula			
Humerus			
Radius			
Ulna		25%	
Ilium			
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur			75%
Tibia			
Fibula			
Patella			
HANDS			
Carpals			
Metacarpals			
Manual Phalanges			
FEET			
Tarsals			
Talus			
Calcaneus			
Metatarsals			
Pedal Phalanges			

Dentition

Similar to other contexts at Najil Iik, the teeth from the Bu.4 matrix appear to derive from more than one individual. A dental inventory for those found in the Bu.4 matrix is provided in **Table 11.17** and **Table 11.18** as this individual had mixed dentition.

Table 11.17 Permanent dental inventory for Bu.4.

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
		X											X		
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

Table 11.18 Deciduous dental inventory for Bu.4. Note presence of two left mandibular first molars found within the burial matrix.

rm^2	rm^1	rc^1	ri^2	ri^1	li^1	li^2	c^1	lm^1	lm^2
			X						
X					X		X	X,X	
rm_2	rm_1	rc_1	ri_2	ri_1	li_1	li_2	c_1	lm_1	lm_2

Mixed dentition was found within the Bu.4 matrix with two permanent teeth and six deciduous teeth. It should be noted that the developmental stages of the permanent teeth suggest they belong to the Bu.4 infant and did not come from an adult. In addition to the other deciduous teeth, two deciduous left mandibular first molars were also found, indicating two individuals were present and thus highlighting the disturbed nature of the burial space. The developmental stages of these teeth and their association with the actual Bu.4 individual will be discussed in the next section.

Caries were noted on both the permanent and deciduous teeth. Four caries were observed on LM^1 with two on the occlusal surface, one on the lingual surface, and one on the buccal surface. None were seen on the other permanent tooth (RM^1). Large caries (i.e., much larger than pinprick sized) were seen on the lingual and labial surfaces of ri^2. A total of seven occlusal caries were observed on one of the lm_1 teeth and one occlusal caries found on the other/repeat lm_1 tooth. Based on the comparison of the developmental stages for each of these molars, it is likely that the tooth with the seven occlusal caries is associated with the Bu.4 individual while the other lm_1 belongs to a separate individual. No other caries on the teeth were observed.

Neither calculus, nor any LEHs, were seen on any of the teeth recovered.

Sex and Age

Sex cannot be accurately estimated on juvenile remains with the few elements that were discovered as part of Bu.4. An estimation of the Bu.4 individual's age was based on two factors: 1) union of primary ossification centers and 2) developmental stages of the recovered teeth. The only element that was available for age estimation based on fusion of primary ossification centers was the mandibular symphysis. This symphysis was closed for the Bu.4 individual, meaning that the right and left halves of the mandible fused into one bone. This occurs during the latter half of the first year of life, typically around 7-9 months. The fused mandibular

symphysis of Bu.4's mandible indicates they died sometime around or after the first year of life, but possibly as early as 7 months after birth.

Two lm_1s were found, indicating the presence of at least two juveniles within this burial space. Thus, a difference in the developmental stages of these teeth, and therefore different ages at the time of death, aided in the association of one lm_1 being most likely associated with the Bu.4 individual and the other lm_1 being mixed into the matrix at some point in time.

Developmental stages of the two permanent teeth (RM^1 and LM^1) suggest an age around 3.5-4.5 years at the time of death. The developmental stages of the observable deciduous teeth indicate an age range of around 1.5-2.5 years, including one of the two left mandibular first molars. The other left mandibular deciduous first molar was in an earlier stage of development and generated an age estimation of less than a year at the time of death, possibly around 6-8 months after birth. Taken together, the developmental stages of these teeth indicate that at least three individuals are represented within the Bu.4 matrix. One individual appears to have been around 3-4 years at the time of their death based on the permanent molars, one around 1.5-2.5 years (this is most likely the Bu.4 individual), and one less than a year old based on the singular lm_1. While teasing these individuals apart is difficult, it reinforces the notion that this area was disturbed multiple times in antiquity.

While we cannot definitively establish which set of teeth belonged to the Bu.4 individual, those that generated an estimation of 1.5-2.5 years of age are the most likely as this is most consistent with the fused state of the mandibular symphysis.

Pathologies and Trauma

Apart from the dental pathologies (caries) described above, no other pathologies or trauma were observed on this set of remains.

Interpretations and Conclusions of Bu.4

The overall paucity of remains found within the Bu.4 matrix (and intrusive pits that disturbed the original interment), the poor preservation and fragmented state of bones that were available for analysis, and the multiple individuals represented within the burial space via the dentition, preclude us from making many definitive statements about this individual. What is known is that the Bu.4 individual was very young at the time of their death, probably within the first two years of life. The two permanent molar tooth buds generated an age too old to be included and are likely from another individual.

The lm_1 that gave an estimated age of less than a year (around 7.5 months) is a confounding factor. This developmental stage falls within the window of when the mandibular symphysis could have been fused for Bu.4, meaning that all other deciduous teeth belong to a different individual and not Bu.4. However, the consistency of the developmental stages of the five other deciduous teeth suggest they belong to the same individual. Their estimated age still

falls within the 'infant' age category, which the recovered skeletal remains clearly demonstrate. Thus, the most likely scenario is that the deciduous teeth with an estimated age of 1.5-2.5 years are those associated with the Bu.4 infant while the other teeth were mixed in with the rest of the burial matrix.

Waxak Nicte' Juvenile Burial – Op.66, Zone 12, Squares A and C

During the January 2023 season, the burial of an individual was discovered while excavating at the site of Waxak Nicte' (see **Shelhamer and Harrison-Buck, Chapter 8**). The outline of the burial pit was seen within Square A and extended north into unexcavated territory. Square C was then opened immediately north of Square A, in order to capture the rest of the burial cut (**Figure 11.24**). The skeletal remains from the burial were taken out in multiple blocks and then fully excavated, washed, and analyzed in the field lab during the summer of 2023.

Skeletal Preservation and Inventory

The overall preservation of the Waxak Nicte' (WN) burial was poor. While most portions of the long bones were recovered, the cranium was very friable and fragmented. Additionally, most of the bones of the thorax (the vertebrae and ribs) did not preserve well with only a few elements available for analysis. Approximately 50% of the skeleton was preserved. **Table 11.19** presents the identified remains for the WN burial.

Dentition

Analyses of the dentition were hampered by the poor preservation of the teeth, as many of the roots were broken. As this individual was clearly a juvenile, the missing roots/root tips prevented an accurate assessment and subsequent age estimation. However, most analyses involving the enamel were conducted. The inventory for the WN burial is presented in **Table 11.20**.

Caries were observed on 12 of the 25 teeth. Of these 12 affected teeth, seven had more than once caries, with RP^2 and RM^1 both having four caries and RM_1 exhibiting six caries. **Table 11.21** presents the caries type by tooth due to the large number of caries seen on these teeth.

Calculus was seen on most of the teeth and was slight in its expression. Only RI^2 and LM^3 did not have any calculus buildup. All other teeth had small amounts of calculus except for RI_2, which was the only affected tooth to have a moderate degree of calculus. Despite the overall small calculus buildup on the teeth, much of labial and lingual surface areas of the anterior teeth were affected. This can most accurately be described as a very thin sheet or sheath of calculus covering much of the tooth.

Attrition scores were relatively low for all teeth. Most teeth had little to no dentine patches showing and very few wear facets. The posterior teeth, namely the molars, were those that exhibited the most attrition, but this was seen only in pinprick-size dentine patches and the blunting of cusps. This level of wear is not surprising given the young age of the individual.

Linear enamel hypoplasias (LEHs) were observed on 12 of the 29 teeth. The LEHs were only seen on the incisors, canines, and premolars. Of the observed LEHs (n = 18), 14 (77.8%) were linear horizontal grooves, three (16.7%) were linear horizontal pits, and one possible case (5.6%) of linear vertical grooves occurring on the distal half of LP_2.

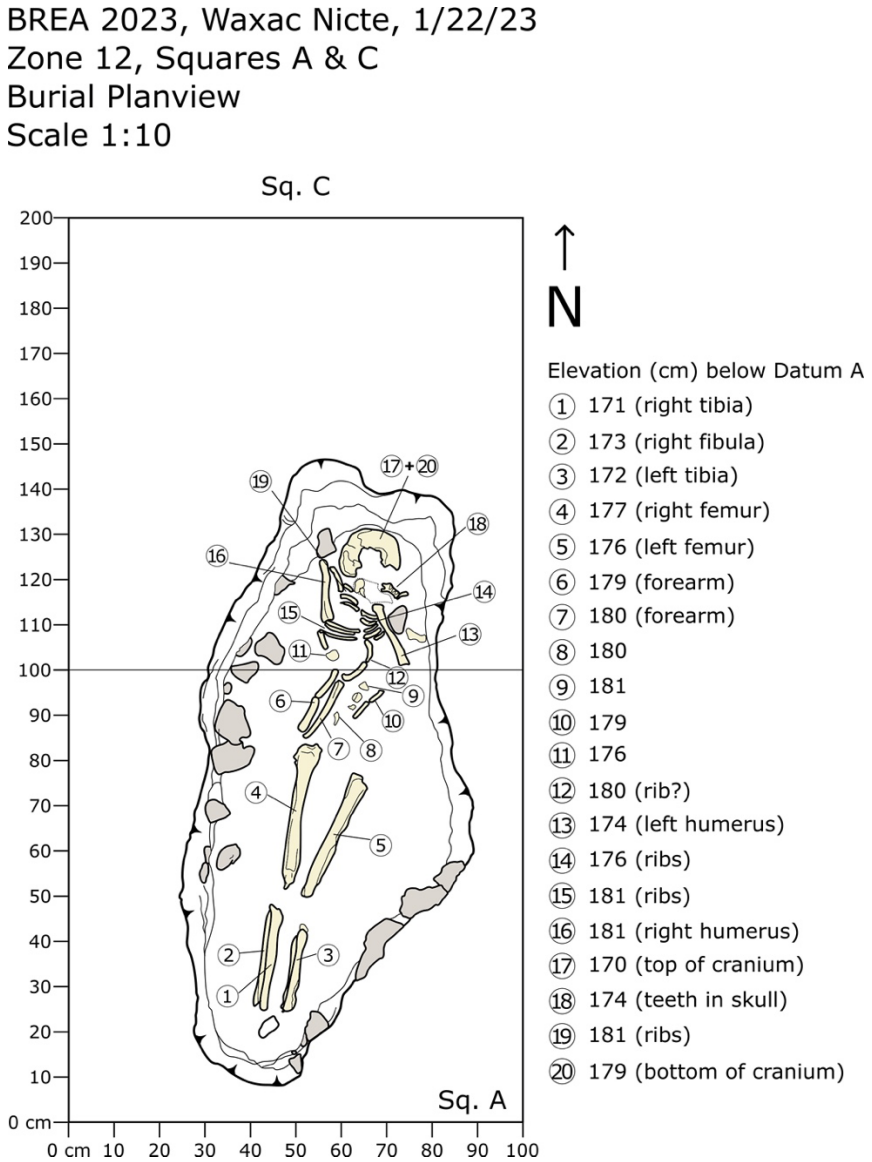

Figure 11.24 Waxak Nicte' juvenile burial (drawing by E. Harrison-Buck, digitized by M. Brouwer Burg, modified by J. A. Biggs).

Table 11.19 Skeletal inventory of the WN burial. Presence reported as percent complete; blank = absent/not observed.

Element	Left	M/?	Right
Frontal	25%		25%
Parietal	25%		25%
Occipital		50%	
Temporal	50%		25%
Maxilla	<25%		<25%
Zygomatic			
Sphenoid			
Nasal			
Ossicles (#)			
Mandible	25%		25%
Hyoid			
C1/Atlas			
C2/Axis			
C3-C6			
C7			
T1-T9			
T10			
T11			
T12			
L1-L4			
L5			
Sacrum			
Coccyx			
Manubrium			
Sternal body			
Xyphoid			

Element	Left	?	Right
Rib 1			
Rib 2			
Rib 3-10	25%		25%
Rib 11			
Rib 12			
Clavicle			
Scapula			
Humerus	25%		25%
Radius			50%
Ulna			50%
Ilium			
Ischium			
Pubis			
Acetabulum			
Auricular			
Femur	>75%		
Tibia	<50%		<50%
Fibula			<75%
Patella			
HANDS			
Carpals			
Metacarpals		<25%	
Manual Phalanges		50%	
FEET			
Tarsals			
Talus			
Calcaneus			
Metatarsals			
Pedal Phalanges			

Table 11.20 dental inventory for WN.

RM^3	RM^2	RM^1	RP^2	RP^1	RC^1	RI^2	RI^1	LI^1	LI^2	C^1	LP^1	LP^2	LM^1	LM^2	LM^3
X		X	X		X	X	X	X	X			X	X		X
X		X	X	X	X	X	X	X	X	X	X	X	X		X
RM_3	RM_2	RM_1	RP_2	RP_1	RC_1	RI_2	RI_1	LI_1	LI_2	C_1	LP_1	LP_2	LM_1	LM_2	LM_3

Table 11.21 Type and count of caries per affected tooth for WN.

Affected Tooth	# of Occlusal	# of Interproximal	# of Smooth Surface	# of Cervical	Total caries
RM^3	1			2	3
RM^1	1	1	1	1	4
RP^2			4		4
RC^1		1			1
LI^2	1				1
LM^1	2				2
LM^3				1	1
RM_3	2		1		3
RM_1	3		1	2	6
RC_1				1	1
LP_1		1			1
LM_3	2				2

Sex and Age

Sex for this individual could not be estimated. The overall preservation of the remains was too poor for any useable landmarks that would aid in sex estimation. Additionally, the individual's age as a juvenile at death prevents an accurate assessment, as the characteristics used in sex estimation typically do not manifest until the end of adolescence or beginning of skeletal adulthood.

The estimated age for this individual is likely around 14-16. This is mostly based on LM^3 where only one of the three root tips was undamaged and showed that the roots were not fully developed. Unfortunately, this was the only third molar where the root tips were not broken. No mandibular teeth had any root tips preserved while a few maxillary teeth did.

This age estimation is surprising given the overall diminutive and gracile nature of the remains which suggested a younger age at death. Fortunately, some of the proximal ends of the recovered intermediate manual phalanges were observable for their stages of union. The bases of these phalanges, which typically fuse to the rest of the bone by age 13, were open. This would

then suggest that the individual died before the age of 13, thus differing from the age estimation generated by the dentition.

The different age estimations (dental vs. skeletal) ultimately present more information about the individual and their life history than introducing conflicting data. The teeth typically remain resilient against extrinsic and intrinsic factors (such as infectious diseases, malnutrition, genetic conditions, parasites, generalized stress, etc.) that would slow their development during the early life course (Hillson 2023). In comparison, the skeleton is more plastic and affected by these events (referred to as stunting). Thus, the older dental age (14-16) and younger skeletal age (<13) suggests that this individual was likely 14-16 years old at the time of their death, but sustained periods of stress throughout their life that resulted in delayed skeletal development.

Pathologies and Trauma

No pathologies nor trauma were observed on any of the remains available for analysis.

Interpretations and Conclusions of the WN Burial

Despite the poor preservation of the remains from the WN burial, the short life history of this individual can be reconstructed to a decent degree based on the osteological observations. While much information about juveniles can be garnered from their skeletons in the archaeological record, it must be remembered that they are individuals who "failed to thrive", meaning that they do not represent a typical or 'successful' childhood (Wood et al. 1992). Thus, it should not be surprising when juvenile skeletons exhibit evidence of health events and a discrepancy between their skeletal and dental ages. Such is the case with the WN juvenile burial.

The dental age places this individual within the adolescent age category, yet their skeletal age suggests they were much younger when they died, around or before 13 years of age. This suggests that the WN individual endured potentially severe enough chronic health events that they were skeletally stunted by potentially three years. This would account for the older appearing dentition with a younger and more petite skeleton. Supporting this observation is the presence of at least 18 LEHs which also form during periods of stress or ill-health. Moreover, six of the 12 teeth with LEHs exhibited two discreet LEHs on the same tooth. This means that two separate and severe stress events, separated by months or possibly a year or more, were recorded on the same tooth.

The combined LEH data, generally small size of the remains, and discrepancy between the dental and skeletal age indicates that this individual unfortunately led a short life characterized by chronically poor health and/or numerous stress events early on. Interestingly, the vertebrae of an animal, possibly a snake, were found within the burial matrix. Many of these faunal bones were found within the excavation blocks containing the cranium and those of the upper body, possibly suggesting that a snake was intentionally interred with the WN individual

near the head. Faunal analyses have yet to be conducted to confirm the taxa, yet it is an interesting find within this adolescent burial.

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Chapter 12

Lithic Analysis of Chipped Stone Artifacts from the 2020 Belize River East Archaeology (BREA) Project Excavations at Crawford Bank, Crooked Tree, Belize: 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, K, L, M, and O from Operation 51 at Crawford Bank, Crooked Tree, Belize, by the Belize River East Archaeology (BREA) Project in 2020 (see Brouwer Burg 2022 for full report). A total of 1083 stone artifacts were analyzed in terms of raw material, metrics, technology, and use-wear. The lithic artifacts were recovered from largely aceramic contexts. A total of 5 body sherds were recovered from this operation, all from the within the top 20-30 cm (see Brouwer Burg 2022:Table 5.1). Unfortunately, the charcoal samples collected from this operation were compromised during the field work hiatus imposed by the COVID-19 pandemic. To this end, Brouwer Burg and team returned to Crawford Bank in January 2022 to conduct a 1-x-1 m test unit with the goal of obtaining dateable materials nearby (Operation 57; see Brouwer Burg 2023:124-130). A purported hearth pit was found ~60-70 cm below surface and charcoal was collected from this feature. In association were only stone tools made of chert and chalcedony, so Brouwer Burg anticipated a preceramic date (Brouwer Burg pers. comm.). However, the dates returned were effectively modern in age (i.e., 200 +/- 30 BP or 1720-1780 CE). Much evidence of burning was found during the Op. 51 excavation and it appears that the hearth-not in Op. 57 was also the result of recent burning. In fact, this accords with accounts from locals that detail a large burning event of the Paradise Lodge in the 1990s (Brouwer Burg pers. comm.). Given what we now know about the extreme modification of the shoreline that occurs every few years (Brouwer Burg 2023:Figure 6.1), it seems likely that most of the artifacts found in these operations have been mixed by lagoonal action. Irregardless, the artifacts described below are still considered to be preceramic based on the notable lack of pottery in the units from which they were recovered and the presence of some tool types similar to those recovered from other preceramic contexts in Belize (see below).

Raw Materials

The lithic assemblage from the 2020 BREA excavations at Crawford Bank consists of 1071 (98.9%) cryptocrystalline silicates (chert or chalcedony) and 12 (1.1%) limestone artifacts (**Figure 12.1**). Additionally, one burnt gray glass fragment and one green bottle glass fragment were included with the lithics. Of the cryptocrystalline silicate chipped stone artifacts, 285 (26.6%) were identified as chert from the Northern Belize Chert-bearing Zone (NBCZ) based on their 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) that contains 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; Stemp and Harrison-Buck 2019; Stemp and Rosenswig 2022).

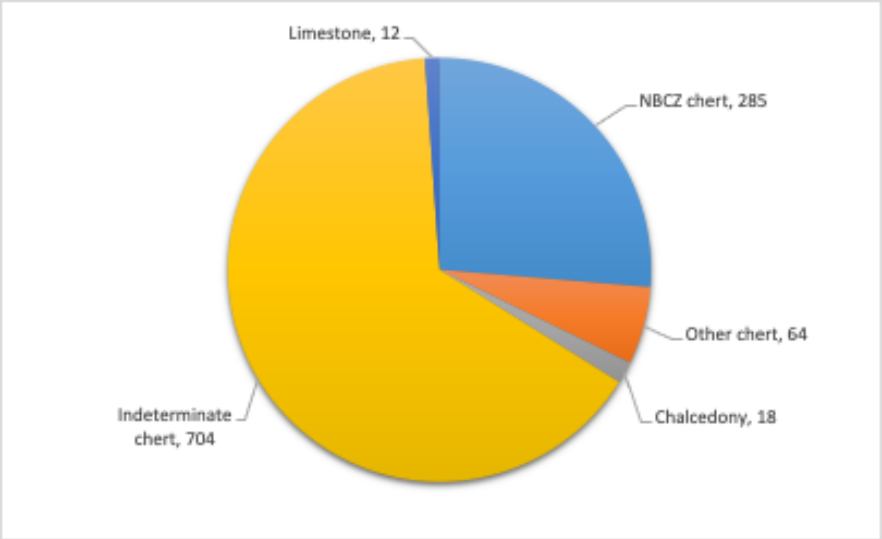

Figure 12.1 Number of lithic artifacts by raw material type from Operation 51, Crawford Bank, Crooked Tree, Belize.

In addition to NBCZ chert, 64 (6.0%) chipped stone artifacts were made from medium- fine- to coarse-grained cherts that were primarily brown and gray in color, some of which were semi-translucent. A few have banding. 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, but 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; see Paris 2012: 114-115, Fig. 1 for the "Cryptocrystalline Pebble Zone";)

There were 18 (1.7%) chalcedony artifacts recovered. The chalcedony artifacts possessed a whitish-gray, porous cortex; the stone itself had a fibrous texture and was variably translucent brown/honey and yellow 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 12.1**; see Paris 2012: 114-115, Fig. 1 for the "Cryptocrystalline Pebble Zone";)

Table 12.1 Formal tools by raw material types from Operation 51, Crawford Bank, Crooked Tree, Belize.

Tool type	NBCZ chert	Other chert/limestone	Chalcedony	Indeterminate chert
Bifaces	-	1[a]	-	1[b]
Biface edges	2	-	-	4
Retouched macroblades (unifacial)	1	-	-	-
Pointed unifaces (macroblades?)	2	-	-	-
Blades	2	-	-	-
Total	**7**	**1**	**0**	**5**

[a] Serrated thin biface; partial beveling from pressure flaking/retouch.

[b] Thin biface; medial edge fragment (badly burnt).

Most of the chipped chert or chalcedony artifacts (704 or 65.7%) were classified as "indeterminate" in terms of chert/chalcedony type due to the significant burning 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 environments 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. 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 12 limestone artifacts were dolomitic and likely came from areas in or around Crawford Bank. In some cases, the limestone was very similar to coarse-grained chert. Like the cherts, the limestone tended to be badly burnt.

Tool Types and Production Technology

Of the 1083 chipped artifacts excavated from Crawford Bank in 2020, 13 (1.2%) were classified as 'formal' tools (**Table 12.1**). The 'formal' tools consist of 2 thin biface fragments (**Figure 12.2**), 6 edge fragments from small bifaces/celts (**Figure 12.3**), 1 unifacially retouched medial macroblade fragment (**Figure 12.4**), 2 pointed unifaces (likely the distal ends of retouched macroblades) (**Figure 12.4**), 1 whole blade (**Figure 12.5**), and 1 blade fragment. Most of these tools (7 or 53.8%) were made from NBCZ chert, 1 (7.8%) was made from other chert and the rest (5 or 38.5%) were indeterminate chert (some of which are also likely NBCZ chert) or chalcedony. Many of the tool types in this report are similar to those described for the Archaic period in Belize (Lohse et al. 2006: 222 Fig. 8; Stemp et al. 2021) and are similar to some of those recovered from excavations at Crawford Bank in 2017 (Stemp and Harrison-Buck 2019). Based on the debitage recovered and the lack of biface preforms and macroflake or macroblade cores, it seems unlikely that most 'formal' tools were produced at Crawford Bank (see below). At least some blades may have been locally produced given the recovery of a blade core with multiple unidirectional blade scars originating from the same striking platform (see below).

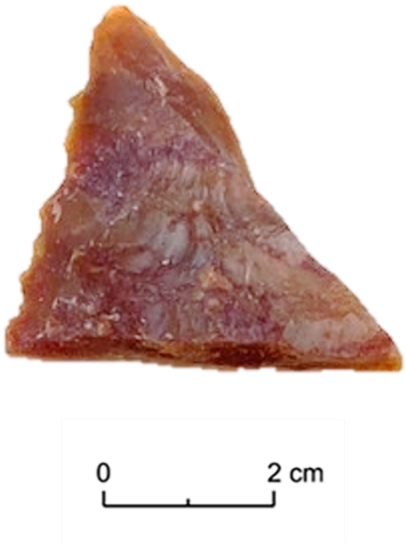

Figure 12.2 Serrated thin biface fragment from Operation 51, Crawford Bank, Crooked Tree, Belize.



Figure 12.3 Two biface edge flakes from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: the biface edge flake on the right is burnt.



Figure 12.4 A distal retouched macroblade fragment (left) and a medial retouched macroblade fragment (right) from from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: the medial macroblade fragment is burnt.



Figure 12.5 A whole blade with a hinge termination from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: the blade has some 'black' patination [manganese oxidation].

Of particular note is the medial thin biface fragment recovered in Square M, Zone 20 (LCB 11085-7) (**Figure 12.2**). The biface fragment is made from medium/fine-grained brown, semi-translucent chert. The chert has a 'fibrous' texture reminiscent of chalcedony. Red portions of what appear to be slightly coarser material are the product of texture and color changes due to exposure to fire, although this is not thought to be deliberate heat-treatment of the raw material. The raw material most likely comes from Northern Belize; however, it is not the typical fine-grained variety from the NBCZ proper. Technologically, the biface demonstrates flake scarring consistent with bifacial flaking using a 'softer'-hammer and the edge is partially serrated using pressure-flaking. This edge retouch is unifacial on the dorsal surface of the tool and creates a bevel on a portion (about half) of the biface's edge. Given the general size and

production technology of this medial fragment, it is possible that it was part of a preceramic stemmed biface, such as a Lowe point. However, without additional diagnostic features, such as the Lowe point's wide stem with basal thinning, corner-notching, or a large barb, it is difficult to say for certain (Kelly 1993; Lohse et al. 2006; Stemp and Awe 2013; Stemp et al. 2016).

The rest of the assemblage excavated in Operation 51 at Crawford Bank in 2020 consists of different types of debitage (1070 or 98.8%) (**Table 12.2**). The majority of the 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, there were 4 unifacially retouched non-cortical flakes (**Figure 12.6**) and 4 unifacially retouched blocky fragments recovered from Operation 51. These artifacts were all retouched on the dorsal surface using hard-hammer percussion. The edge angles of all four of the retouched flakes are generally acute (<45°); whereas 2 of the retouched blocky fragments' edges were acute (<45°) and 2 were about 50-55°. In addition to the retouched flakes, there were 654 (61.1% of all debitage) hard-hammer flakes, including flake-blades (**Figure 12.7**). The hard-hammer retouched flakes and non-retouched flakes were mostly made from 'indeterminate' chert (387 or 58.8%). There were also 210 (31.9%) NBCZ chert flakes, 46 (7.0%) other chert flakes, 9 (1.4%) chalcedony flakes, and 6 (0.9%) limestone flakes. The numbers of cortical and non-cortical flakes varied by raw material type, but there is a full range of reduction debitage for the cherts and chalcedonies (**Figure 12.8**). Based on the percentages for NBCZ and 'indeterminate' cherts, there are no statistically significant differences in the numbers of cortical versus non-cortical flakes ($x^2 = 0.825589$, $p > 0.05$) suggesting that similar reduction processes are represented. The data tend to support the belief that a majority of the 'indeterminate' chert was, in fact, originally NBCZ material before patination and/or burning. The percentages of cortical-to-non-cortical flakes, as well as the presence of cores, core fragments, and blocky fragments (some cortical) indicate that *ad hoc*/expedient flake production occurred at Crawford Bank and is the main form of reduction. The cores and/or cores fragments of NBCZ chert, other chert, and chalcedony provide evidence for local reduction of these three types of raw material at the site (**Figure 12.9**). The sizes of the flakes (**Table 12.3**) indicate a fairly wide range, but at least some cores were quite large. With the exception of some biface repair (see below), almost all of the reduction was the result of hard-hammer percussion. This is supported by the few thinning flakes, the flat and cortical platforms observed on the whole flakes and proximal flake fragments (**Table 12.4**) and the high percentages of hinge terminations on the whole flakes and distal flake fragments (**Table 12.5**).

Table 12.2 Informal tools/debitage by raw material types from Operation 51, Crawford Bank, Crooked Tree, Belize.

Tool type	NBCZ chert	Other chert/limestone	Chalcedony	Indeterminate chert
Flakes – 100% cortex	2	3	0	19
Flakes – >50% cortex	11	1	3	20
Flakes – <50% cortex	40	10[b]	2	53[e]
Flakes – 0% cortex	147[a]	36[c]	3	291[f]
Flake-blades – >50% cortex	1	-	-	-
Flake-blades – <50% cortex	3	1	-	-
Flake-blades – 0% cortex	3	1	1	3
Bifacial thinning flakes – >50% cortex	-	-	1	1
Bifacial thinning flakes – <50% cortex	-	-	-	2
Bifacial thinning flakes – 0% cortex	15	-	-	11
Bifacial thinning pressure flakes – 0% cortex	-	-	-	1
Biface edge retouch/repair flakes – 0% cortex	1	-	-	11
Uniface edge retouch/repair flakes – 0% cortex	-	-	-	4
Retouched flakes (unifacial) – 0% cortex	3	-	-	1
Simple flake cores	14	2	1	11
Bifacial/discoidal flake cores	1	1	-	-
Blade cores	1	-	-	-
Simple flake cores/hammerstones	-	1	-	-
Blocky fragments	33	17[d]	7	200
Retouched blocky fragments (unifacial)	2	1	-	1
Potlids and burnt fragments	1	1	-	70
Total	**278**	**75**	**18**	**699**

[a] Two flakes are from bifaces/celts, but they are not bifacial thinning flakes.
[b] Two flakes are hard limestone.
[c] Four flakes are hard limestone.
[d] Six blocky fragments are hard limestone.
[e] Two flakes could be refit.
[f] Two flakes are from bifaces/celts, but they are not bifacial thinning flakes.

Table 12.3 Metrics (mm) for whole flakes from Operation 51, Crawford Bank, Crooked Tree, Belize.

Max. length	Min. length	Mean length	Max. width	Min. width	Mean width	Max. thickness	Min. thickness	Mean thickness
66.2	9.0	36.7	60.4	14.4	43.3	29.3	3.2	12.3

Table 12.4 Platforms for whole flakes and proximal flake fragments from Operation 51, Crawford Bank, Crooked Tree, Belize.

	Cortical	Cortical/flat	Flat	Flat/lipped	Dihedral	Facetted	Facetted/lipped	Linear	Punctiform	Crushed
NBCZ chert	7 (4.8%)	13 (8.9%)	99 (67.8%)	7 (4.8%)	6 (4.1%)	1 (0.7%)	2 (1.4%)	6 (4.1%)	1 (0.7%)	4 (2.7%)
Other chert/limestone	4 (12.9%)	3 (9.8%)	22 (71%)	0	0	1 (3.2%)	0	0	0	1 (3.2%)
Chalcedony	0	1 (25%)	2 (50%)	0	0	0	0	0	0	1 (25%)
Indeterminate chert	11 (5.9%)	10 (5.3%)	124 (66%)	12 (6.4%)	6 (3.2%)	2 (1.1%)	1 (0.5%)	10 (5.3%)	4 (2.1%)	8 (4.3%)

Table 12.5 Flake termination types on whole flakes and distal flake fragments from Operation 51, Crawford Bank, Crooked Tree, Belize.

	Feather	Hinge	Step
NBCZ chert	47 (43.9%)	60 (56.1%)	0
Other chert/limestone	11 (61.1%)	7 (38.9%)	
Chalcedony	4 (80%)	1 (20%)	
Indeterminate chert	108 (55.7%%)	85 (43.8%)	1 (0.5%)



Figure 12.6 A distal retouched flake fragment from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: the white patina on the flake fragment.



Figure 12.7 Debitage from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: 'black' patination, white patination, and burning on some artifacts.

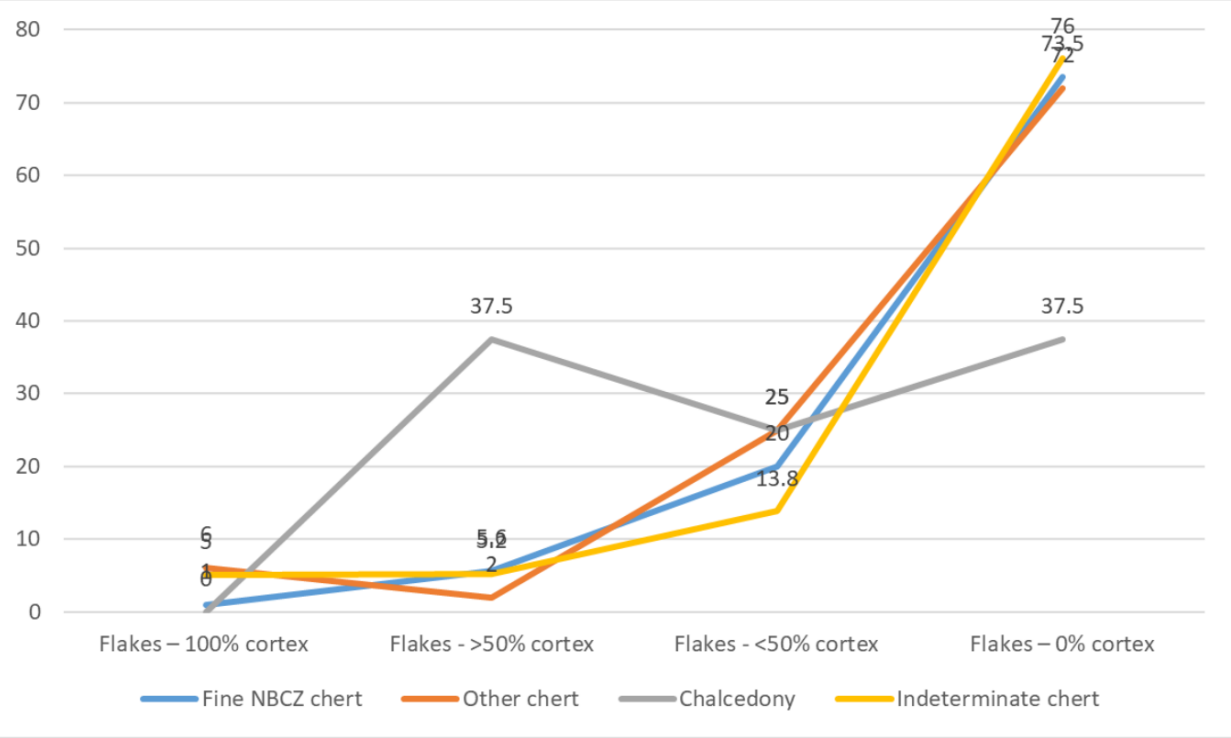

Figure 12.8 Percentages of cortical and non-cortical flakes by raw material type from Operation 51, Crawford Bank, Crooked Tree, Belize.



Figure 12.9 Three chert flake cores from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: one core (left) is burnt and two cores (middle, right) have 'black' patination.

The 42 bifacial thinning flakes and biface edge repair flakes from Operation 51 at Crawford Bank constitute 3.9% of the debitage and are mostly non-cortical (38 or 90.5%), representing end stage flaking and biface repair (**Figure 12.10**). The few bifacial thinning flakes suggest that biface production was not occurring on-site (**Figure 12.11**). The majority of these flakes (41 or 97.6%) are NBCZ chert and 'indeterminate' chert [of which most is suspected to be

NBCZ chert]. This is consistent with the assumption that the biface technology at Crawford Bank was primarily associated with NBCZ chert. Some of the bifacial thinning flakes are quite large (**Table 12.6**). Notably, no bifaces of NBCZ chert were recovered in the 2020 BREA excavations. Two different types of bifacial thinning flakes were identified at Crawford Bank in 2020 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 initiations 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 faceted to variable degrees (31 or 77.5%), and most are lipped (92.5 or 77.5%) (**Table 12.7**). In all, 22 (55%) of the flakes are consistent with 'harder'-hammer percussion, while 6 (15%) are the result of 'soft'-hammer percussion. For the remaining bifacial thinning flake fragments (12 or 30%), there is not enough production evidence to distinguish hammer type or there are combinations of traits from both hammer reduction types. Most whole bifacial thinning flakes and distal bifacial thinning flake fragments end in feather terminations (**Table 12.8**). It was noted that a few of the bifacial thinning flakes were quite large.

Table 12.6 Metrics (mm) for whole bifacial thinning flakes from Operation 51, Crawford Bank, Crooked Tree, Belize.

Max. length	Min. length	Mean length	Max. width	Min. width	Mean width	Max. thickness	Min. thickness	Mean thickness
79.2	20.7	30.6	67.8	21.0	28.5	5.0	2.8	4.2

Table 12.7 Platforms for whole bifacial thinning flakes and proximal bifacial thinning flake fragments from Operation 51, Crawford Bank, Crooked Tree, Belize.[a]

	Cortical	Cortical/flat	Flat	Flat/lipped	Dihedral	Facetted	Facetted/lipped	Linear/lipped	Crushed
NBCZ chert	0	0	0	2 (12.5%)	0	2 (12.5%)	12 (75%)	0	0
Other chert/limestone	0	0	0	0	0	0	0	0	0
Chalcedony	0	0	0	0	0	0	0	0	0
Indeterminate chert	0	0	0	5 (20.8%)	0	0	17 (70.8%)	1 (4.2%)	1 (4.2%)

[a] Includes biface edge retouch/repair flakes.

Table 12.8 Flake termination types on whole bifacial thinning flakes and distal bifacial thinning flake fragments from Operation 51, Crawford Bank, Crooked Tree, Belize.[a]

	Feather	Hinge	Step
NBCZ chert	9 (100%)	0	0
Other chert/limestone	0	0	0
Chalcedony	0	0	0
Indeterminate chert	17 (94.4%)	1 (5.6%)	0

[a] Includes biface edge retouch/repair flakes.



Figure 12.10 Bifacial thinning flakes from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: All the flakes are burnt.

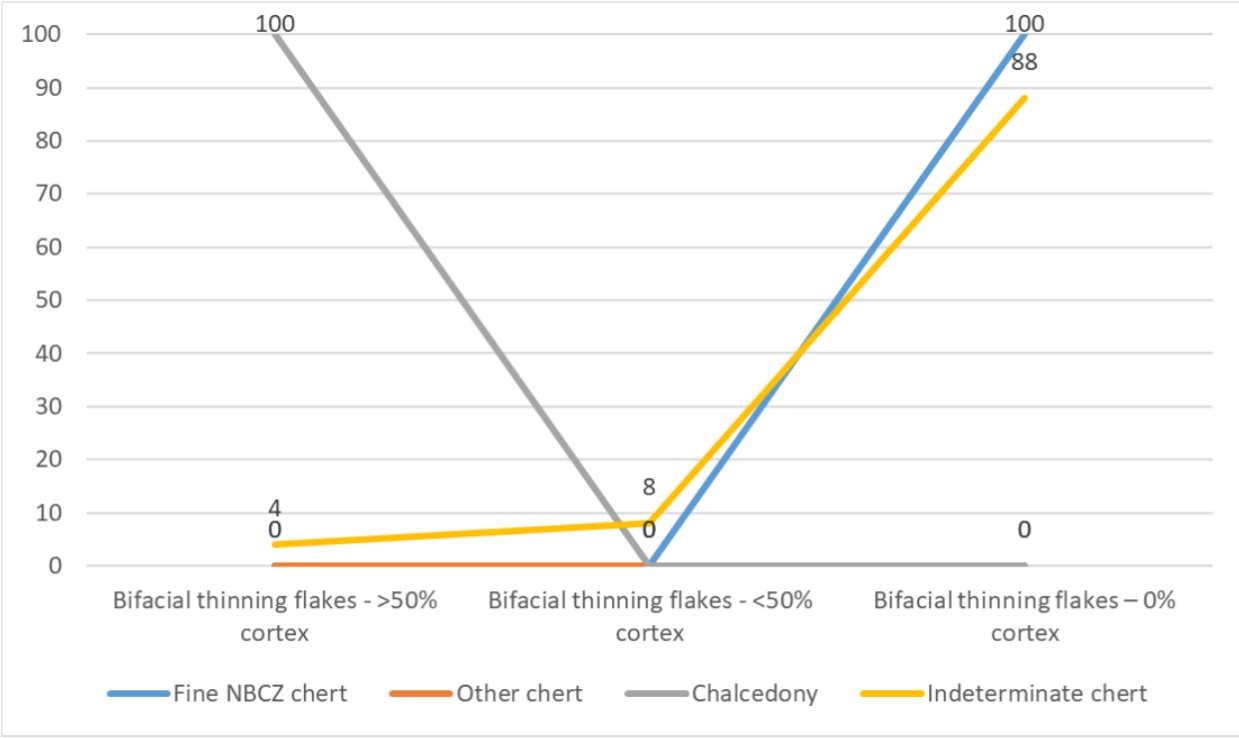

Figure 12.11 Percentages of cortical and non-cortical bifacial thinning flakes by raw material from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: there are no 'other' chert bifacial thinning flakes.

The simple flake cores and core fragments (28) are mostly NBCZ and 'indeterminate' cherts (25 or 89.3%), although there were two core fragments of other chert and one of chalcedony. All show multiple striking platforms and somewhat random flake scar patterns. The bifacial or discoidal flake core fragments are made from NBCZ and other chert (**Figure 12.12**). Of most interest is the NBCZ chert blade core fragment. It appears to be somewhat *ad hoc* in that it lacks a prepared striking platform (the platform is partially cortical). There are four unidirectional blade removal scars that all originate from the proximal (platform) end. One blade scar demonstrates a deep hinge termination. It appears the core fragment itself was struck from a larger core based on the ventral surface of the fragment. All the flaking associated with the blade core is hard-hammer.



Figure 12.12 Large bifacial/discoidal chert flake core from Operation 51, Crawford Bank, Crooked Tree, Belize. Note: slight burning on the core.

The lithic raw material and technology data demonstrate a heavy reliance on NBCZ chert debitage as tools. The debitage was used without further modification with a few exceptions. Although some biface fragments, biface flakes, and some macroblade fragments were recovered at the site, these tool types do not appear to have been made at Crawford Bank. More likely, they were acquired as finished tools. With the exception of the thin biface fragment from Zone 20 and a few bifacial thinning flakes, all of the reduction is hard-hammer. With the exception of the edge resharpening of the thin biface fragment, retouch on the rest of the artifacts was accomplished using hard-hammer percussion. Overall, the assemblage points to people who primarily relied on chert debitage, usually unretouched, for most of their stone tool needs. This appears to be typical of the preceramic period in northern Belize (Stemp and Harrison-Buck 2019; Stemp and Rosenswig 2022).

Use-wear Analysis

Method and Equipment

The protocol for 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; Stemp and Harrison-Buck 2019; Stemp and Rosenswig 2022) for chipped chert and chalcedony tools. However, the cleaning procedure was changed. Rather than using solutions of 15% hydrochloric acid (HCl) and 20% sodium hydroxide (NaOH) as done previously, the artifacts were first rinsed in cold water and laid out to air dry. The main reason for this cleaning

procedure was to potentially preserve some residues on the stone tool surfaces (see Stemp and Rosenswig 2022: Online Supplement 1). During the use-wear analysis, some unidentified residues were noted on the artifacts. Whether they are simply sand/soil still adhering to the surfaces or contain some plant or animal materials remains to be seen.

A metallurgical microscope [Unitron MS-2BD] was used to locate and identify use-wear features at both low- (40×) and high-power (100×, 200×, 400×) magnification under angled and incident light. Photomicrographs of the tools' worn surfaces were taken using a Moticam X3 (4.0 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, and 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 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 2020 BREA excavations at Crawford Bank was only possible for a proportion of the entire assemblage because the damage to the tools due to post-depositional forces was quite severe. A total of 299 (27.6%) of the 1083 chipped chert, chalcedony, and limestone artifacts were in good enough condition for use-related wear analysis.

There are many problems associated with post-depositional alteration of stone tool surfaces at Operation 51 at Crawford Bank. The most significant post-depositional changes to the lithic artifacts from the site was burning. Burnt cryptocrystalline silicates demonstrate changes, sometimes extreme, that include the following: color changes (from pinks, to reds, grays, blacks, and whites), potlid fractures and heat crazing, increased susceptibility to edge microflaking, increased surface smoothing or 'gloss', some edge rounding, and the possible addition of non-use-related residues. The alterations usually damaged tool surfaces to variable degrees and frequently made observation of use-wear on stone tools very difficult, if not impossible (see Luedtke 1992; Olausson 1983; Sievert 1992). In general, mildly to severely burnt artifacts were evenly distributed throughout the sub-assemblages in the excavation units of Operation 51 (**Table 12.9**).

Table 12.9 Number of burnt lithic artifacts by Square from Operation 51, Crawford Bank, Crooked Tree, Belize.

	Square A	Square J	Square K	Square L	Square M	Square O
Burnt	78/129 (60.5%)	83/108 (75.9%)	229/298 (76.8%)	95/167 (56.9%)	185/242 (76.4%)	109/139 (78.4%)

Patination of different types also affected the conditions of the lithic artifacts. Although there were not many artifacts that developed a heavy white or yellowish-white patina, some did. Well-developed white patination creates a porous microsurface that destroys surface polishes and striations, which greatly hinders microscopic use-wear analysis (see Anderson-Gerfaud 1981; Glauberman and Thorson 2012; Keeley 1980; Luedtke 1992; Rottländer 1975). 'Black' patination/manganese oxidation not only changes the color of the stone tool surface but seems to reduce 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 microscopically under high magnification (>100×). Overall, the percentage of tools with significantly developed black patinas was low in Operation 51; however, it was proportionately higher in Squares L, M, and O (**Table 12.10**). The likely reason for the low percentage of 'black' patinated lithics recovered during the 2020 excavations is that the artifacts were not subjected to an alternating sequence of submersion in salty or brackish water and exposure to the air. It has been argued that the pattern of repeated exposure to air and water results in the development of a 'black' patina. Glossy patinas produce shiny or lustrous surfaces 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); however, 'glossy' stone tools surfaces (not associated with burning) were rare in the Operation 51 lithic assemblage.

Table 12.10 Number of 'black' patinated lithic artifacts by Square from Operation 51, Crawford Bank, Crooked Tree, Belize.

	Square A	Square J	Square K	Square L	Square M	Square O
'Black' patination	0/129 (0%)	0/108 (0%)	7/298 (2.3%)	7/167 (4.2%)	12/242 (5%)	11/139 (7.9%)

There were series of physical/mechanical forces that also altered the edges and surfaces of the chert and chalcedony artifacts form Operation 51 at Crawford Bank. 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, 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.

Microchipping along a tool edge could also be identified as the result of post-deposition 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 lithic artifacts in the ground could also cause contact friction with stones or other chert artifacts creating 'bright spots' on some of the chipped stone tools from the Crawford Bank excavations. The bright spots are usually localized or spatially clustered and consist of a very reflective flat polish (see Lévi-Sala 1986: 231).

It should also be noted that many lithic artifacts were scratched by the aluminum 'context' tags that were included in the bags containing the stone tools. 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). These linear traces are quite bright and distinctive; however, they can cover or alter possible use-related wear. Aluminum tags should 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 very few use-wear studies of chipped stone artifacts. 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). Two other studies have primarily focused on debitage (Stemp and Harrison-Buck 2019; Stemp and Rosenswig 2022). 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 this analysis, 9 'formal' tools, and 290 pieces of debitage were examined for microscopic traces of use.

In total, 95 of the 299 (31.8%) chipped chert and chalcedony artifacts possessed some use-related wear. The use-wear analysis was not performed on a true random sample. As such, it is possible that the percentage of used artifacts in the total assemblage excavated from Crawford Bank in 2020 is lower. The artifacts with use-related wear were identified as NCBZ

(41 or 43.2%) chert, other chert (8 or 8.4%), chalcedony (3 or 3.2%), and 'indeterminate' chert/chalcedony (43 or 45.3%) based on raw material type. None of the limestone artifacts had evidence of use. However, if the numbers of artifacts with use-wear are considered in terms of all the chipped stone tools excavated in 2020, then the total percentage of used tools would only be 8.8%. By raw material type, 41 of the 285 (14.4%) NBCZ chert artifacts, 8 of the 64 (12.5%) other chert artifacts, 3 of the 18 (16.7%) chalcedony, and 43 of the 704 (6.1%) 'indeterminate' chert artifacts were used. Most of the used 'indeterminate' chert artifacts had some mild white patination and were either not burnt or minimally heat-modified. It is also possible that a fairly high/significant amount of very small 'indeterminate' debitage is contributing to its lower percentage of used tools.

There were a total of 105 IUZs on the 95 stone tools with use-wear traces (**Table 12.11**). Most of the used stone tools only possessed one IUZ (89 or 93.7%); however, there were three (3.2%) that had two IUZs, and two (2.1%) that had three IUZs, and one (1.1%) that had possibly four IUZs. Only one of the tools with two IUZs was a bifacial thinning flake that had use-wear on its dorsal surface and/or near its proximal end/striking platform that was the product of use while it was still attached to a biface and use-wear that was associated with its use as an *ad hoc*/expedient tool after having been detached from the biface (see below). The other two tools with two IUZS were flakes. One of the tools with three IUZs was a flake and the other was a blocky fragment. The single tool with possibly four IUZs was a large flake.

Table 12.11 Number of IUZs on chipped stone tools from Operation 51, Crawford Bank, Crooked Tree, Belize.

IUZs	Thin bifaces	Retouched macroblades	Pointed unifaces (macroblades?)	Blades	Flakes[c]	Bifacial thinning flakes[e]	Blocky fragments
Bone/antler							
cut/slice	-	-	-		1 (1.0%)	-	-
saw	-	-	-		4 (3.8%)	-	-
Meat/skin/fresh hide							
cut/slice	-	-	-		5 (4.8%%)	-	-
Meat/skin/fresh hide and bone							
cut/slice	1[a] (1.0%)	-	-		2[d] (1.9%)	-	-
Plant							
cut/slice	-	-	-	1 (1.0%)	6 (5.7%)	-	-
Soil							
dig/hoe	-	-	-		1 (1.0%)	1 (1.0%)	-
Wood							
adze/chop	-	-	-		-	5[f] (4.8%)	-
cut/slice	-	-	-	1 (1.0%)	9 (8.6%)	-	-
saw	-	-			14 (13.3%)	-	1 (1.0%)
scrape/plane	-	-	-		5 (4.8%)	-	-
whittle	-	-	-		10 (9.5%)	-	-
Soft							
cut/slice	-	-	-		4 (3.8%)	-	-
Hard							
adze/chop	-	-	-		-	1 (1.0%)	-
cut/slice	-	-	-		3 (2.9%)	-	-
saw	-	-	-		11 (10.5%)	-	2 (1.9%)
scrape/plane	-	-	-		2 (1.9%)	-	-
whittle	-	-	-		3 (2.9%)	-	-
Indeterminate							
saw	-	-	-		3 (2.9%)	1 (1.0%)	1 (1.0%)

indeterminate	-	-	1[b] (1.0%)		3 (2.9%)		3 (2.9%)
Total	1	0	1	2	86	8	7

[a] May include other contact materials as well; burning of the tool renders identifying other contact materials difficult.

[b] Complex polish mostly restricted to the tool's edges; sometimes it looks like bone or wood, but it seems like there is a soft contact material involved as well.

[c] Includes retouched flakes.

[d] Traces of wood polish noted (bright, domed polish).

[e] Also includes biface edges.

[f] Two bifacial thinning flakes also have wear consistent with soil.

The use-wear on the chipped chert and chalcedony artifacts from the 20202 BREA excavations at Crawford Bank is mostly consistent with working wood (45 IUZs or 42.9%) (**Figures 14.13, 14.18, 14.19**). Other tools were used on bone or antler (5 IUZs or 4.8%) (**Figure 12.14**), meat/skin/fresh hide (5 IUZs or 4.8%), meat/skin/fresh hide and bone (3 IUZ or 2.9%) (**Figures 14.15** and **14.16**); plants (7 IUZ or 6.7%) (**Figure 12.17**), unidentified soft materials (4 IUZs or 3.8%), unidentified hard materials (22 IUZs or 21.0%), and indeterminate materials (12 IUZs or 11.4%). Some artifacts were used to dig in soil (2 IUZ or 1.9%; plus use-wear traces on one bifacial thinning flake used to adze/chop wood) (**Figure 12.18**).

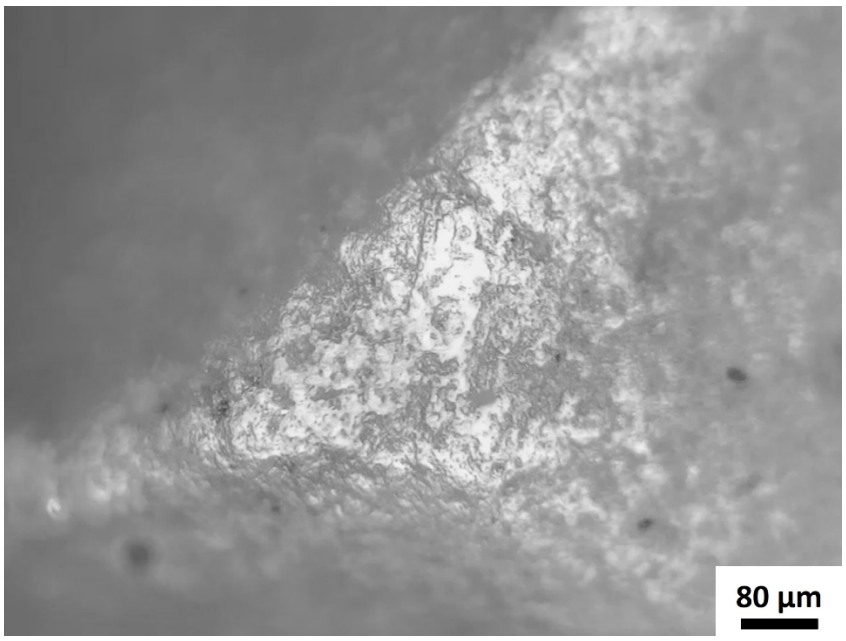

Figure 12.13 Photomicrograph of a bifacial thinning flake [dorsal surface] used to adze/chop wood (200×). Polish is bright and reticular in distribution. It is domed on the lower microtopography, but better developed and 'flatter' at the apex of the surface. A couple of striations through the polish zone are the product of soil contact. The flake is mildly patinated.

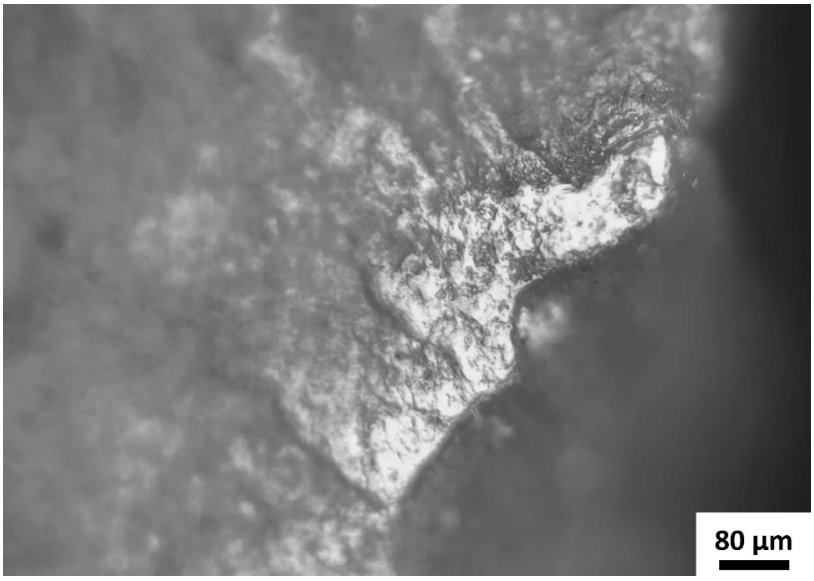

Figure 12.14 Photomicrograph of an unretouched chert flake used to saw antler/bone (200×). The region of well-developed polish is bright and 'liquid'-looking on the higher microtopography, and partially reticular. The polish is limited in distribution to the very edge of the flake.

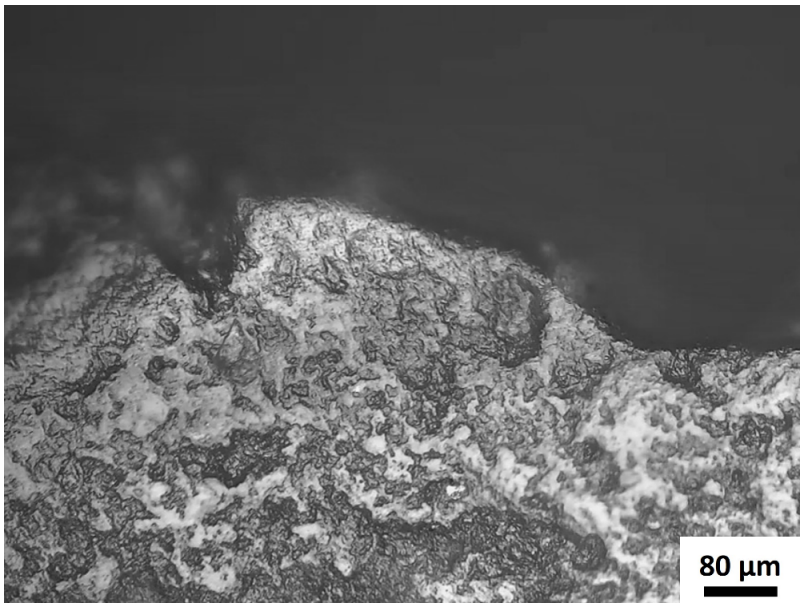

Figure 12.15 Photomicrograph of an unretouched chert flake used to cut meat/skin/fresh hide and bone and wood (200×). The polish is complex: some is dullish, 'greasy'-looking, and covers both the high and low microtopography. Areas of higher microtopography have a slightly domed, reticular, 'liquid'-looking, bright polish. Some of the domed polish also resembles wood polish, so the tool may have also been used to cut wood. Based on the minimal bifacial edge microchipping, consisting of primarily round, feather-terminated flake scars, with only one to to row of flake scars, this was a cutting or slicing, rather than sawing, motion. The flake is burnt.

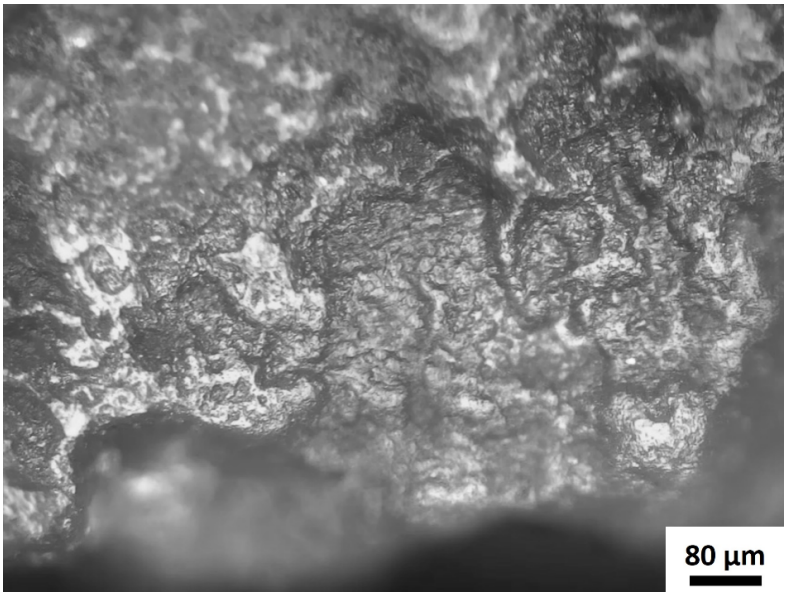

Figure 12.16 Photomicrograph of a thin chert biface used to cut/slice meat/skin/fresh hide and bone (200×). The polish is both dullish and 'greasy'-looking on the mid-level and low microtopography, and contains brighter, reticular, 'liquid'-looking patches on the higher microtopography. The thin biface is burnt.

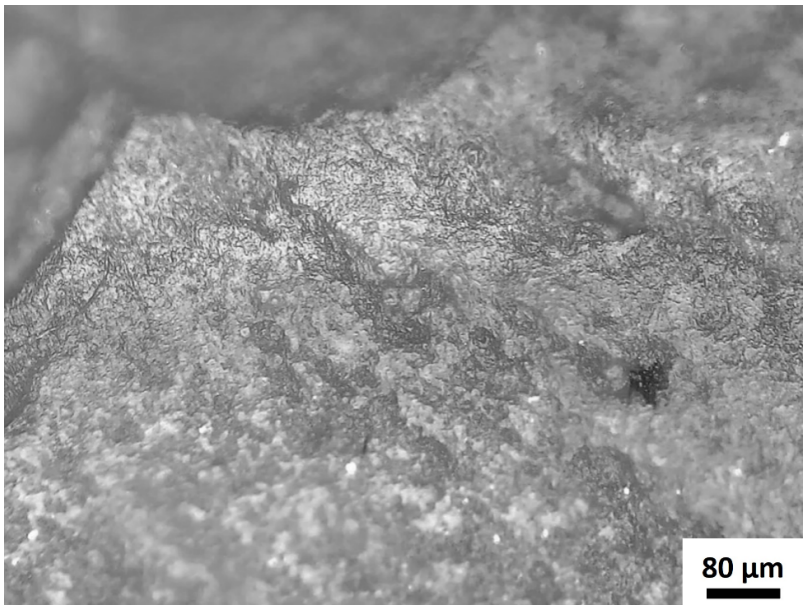

Figure 12.17 Photomicrograph of an unretouched chert flake used to cut/slice non-woody plant (200×). The polish is well-distributed away from the edge, but tends to be less well-developed in the lowest regions of microtopography. The polish is generally dull with infrequent brighter patches on the higher microtopography. Bifacial microflaking exists in one to two rows of minimally overlapping flake scars.

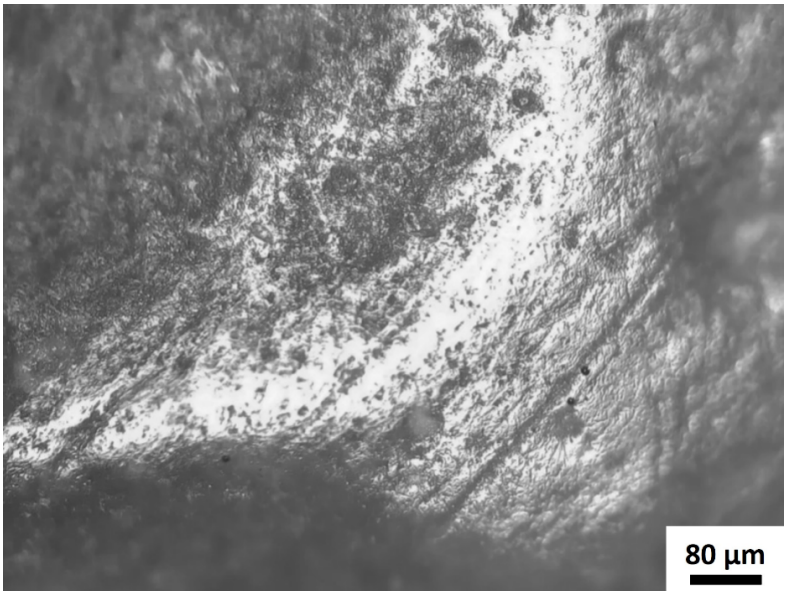

Figure 12.18 Photomicrograph of a chert bifacial thinning flake [dorsal surface] used to dig/hoe in soil and adze/chop wood (200×). The polish is 'dry'-looking and ranges from dull to generally bright, with numerous wide and narrow striations in the direction of use. In locations where the polish is 'duller', there are considerably more striations across the surface. The polish on the higher region of microtopography is rounded at the front [bottom of photomicrograph] and less so near the back. Part of the 'brighter' polish zone [top and left side] is likely also due to contact with wood with an adzing/chopping motion.

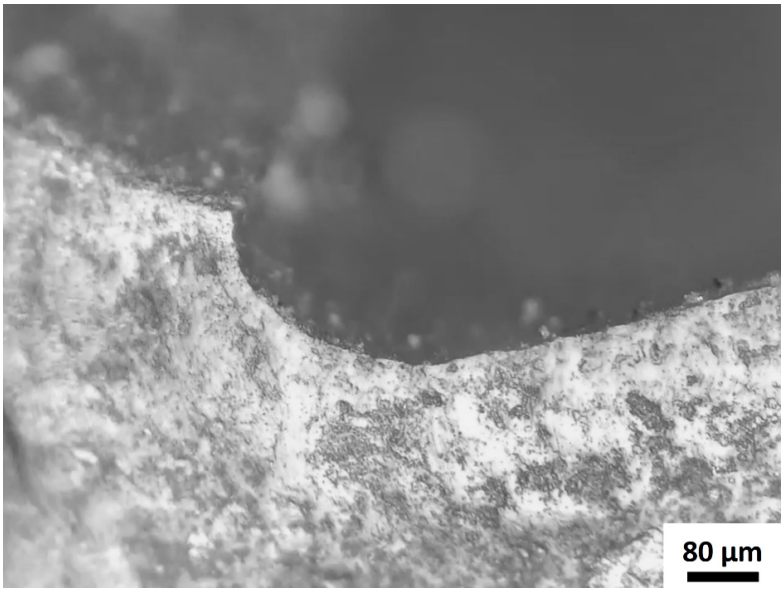

Figure 12.19 Photomicrograph of an unretouched chert flake used to saw wood (200×). The polish is generally bright and mildly domed [likely due to the fine grain size and flatter microtopography of the chert]. The polish is well-developed and is beginning to link up beyond the reticular stage of development. Some faint, diagonal, fine striations can be seen

in the polish zones. The large, deep, bifacial microflake scars with feather, step-, and hinge-terminations support a sawing motion. The flake is partially patinated.

Based on the results of the use-wear analysis, the people at Crawford Bank clearly relied on wood as an important resource and worked it in a number of different ways. Cutting and sawing were the main motions associated with wood-working (21.9%), but scraping, planing, and whittling of wood was also quite common (14.3%). These motions likely represent tasks such as making handles for hafted tools and weapons, supports for perishable structures, making containers, forest clearance, or firewood. Because wooden artifacts were not found at Crawford Bank, the use-wear on the stone tools serves as important secondary evidence for a reliance on wood. There is good use-wear evidence for subsistence activities in terms animal hunting and butchery (12.4%) and plant cutting/slicing (6.7%). Other items used for non-dietary purposes may have been produced using animal or plant parts as well. Some of the unidentified soft and hard materials used by the Crawford Bank inhabitants were likely animal or plant parts of some kind.

Most of the motions on the tools recovered from the 2020 excavations at Crawford Bank were cutting, slicing, or sawing (71 IUZs or 67.6%). Far fewer tools were used with a scraping, planing, or whittling motion (20 IUZs or 19.0%), for adzing or chopping (6 IUZs or 5.7%) or digging in soil (2 IUZs or 1.9%). The fact that most of the flakes had fairly acute edge angles assists in understanding why evidence indicating longitudinal motions was most commonly found on the tools' surfaces. Few flakes had edge angles that exceeded ~ 45-50°, which are typically associated with scraping, planning, or whittling activities.

The use-wear data also demonstrate that *ad hoc*/expedient flake technology was an important source of tools for the people of Crawford Bank, as noted in other debitage studies from preceramic sites in Belize (Stemp and Harrison-Buck 2019; Stemp and Rosenswig 2022). Although lithic debitage has been recovered at other preceramic sites in Belize, it has not undergone a detailed use-wear analysis (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).

Interpretations and Conclusions

Based on the analysis of lithic raw material types for the artifacts recovered at Crawford Bank by BREA in 2020, the inhabitants relied on sources of chert and chalcedony from Northern Belize with most identifiable stone coming from the NBCZ and smaller amounts originating from locations in the 'Pebble Zone', within which Crawford Bank is located. The results of the lithic analysis from the excavations undertaken in 2017 at Crawford Bank (Operation 35) by BREA can be compared to those from 2020 (Operation 51). Although significant proportions of the chert artifacts were classified as 'indeterminate' in terms of raw material type in both

Operations 35 and 51 and there are generally similar high percentages of burnt chert and chalcedony at both locations, far fewer lithic artifacts from Operation 51 developed a 'black' patina when compared to those from Operation 35 (Stemp and Harrison-Buck 2019). It is suspected that the locations of the excavation units for both Operations relative to the shoreline and fluctuating lagoon water levels over time are associated with this difference. Aside from the 'black' chert, the pattern of raw material procurement at Operation 51 is similar to that of Operation 35 at the site (Stemp and Harrison-Buck 2019).

The 13 'formal' stone tools from the 2020 excavations at Crawford Bank are similar to those reported from other preceramic sites in 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). These tools are also similar to some from the Operation 35 excavations, although stemmed bifaces, oval bifaces, and trimmed macroblades/constricted unifaces were not found in Operation 51. It is possible that the medial thin biface fragment with a serrated edge and partial beveling was originally part of a preceramic stemmed biface, but this is difficult to know for certain. Most of the 'formal' tools with a recognizable raw material were made from NBCZ chert.

Based on the types and quantities of debitage at the site and the absence of biface preforms, macroflake and macroblade cores, the 'formal' tools were most likely not made at Crawford Bank. Some of the bifacial thinning flakes have use-wear on their dorsal surfaces, which suggests biface repair/refurbishing rather than biface production. Aside from a few unifacially retouched flakes and blocky fragments, there were no other 'intentional' flake tools (e.g., burins, denticulates, etc.) in the assemblage. The people who made the Operation 51 artifacts 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 and >50% cortex), and the striking platforms that are cortical or partially cortical. At least some cores appear to have been partially decorticated and reduced before arriving at the site based on the ratios of flakes to cores and core fragments and the high percentages of non-cortical flakes (see Tomka 1989: 138, **Table 12.1**). 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 fewer non-cortical versus cortical flakes.

The use-wear clearly indicates a reliance on expedient technology to complete tasks (also see Stemp and Harrison-Buck 2019; Stemp and Rosenswig 2022). Many tasks involve wood (see Acosta Ochoa 2010: 2; Pérez 2009; Stemp and Harrison-Buck 2019; Stemp and Rosenswig 2022), but tools were also used to a fairly high degree on animals (bone, meat/skin/fresh hide), and plants as well. There is little evidence for contact with soil, which seems to argue for minimal horticultural activity that may have involved stone tools at Operation 51. For the most part, the use-wear seems consistent with activities undertaken by hunter-gatherers. The residues on some tools, such as the serrated thin biface fragment, could be analyzed to get a better understanding of particular plants or animals exploited by the inhabitants of Crawford Bank.

Overall, the results of the lithic analysis at Operation 51 are very similar to those from Operation 35 (Stemp and Harrison-Buck 2019). The lithic artifacts from both sites were mostly made using hard-hammer percussion of chert and chalcedony from Northern Belize, specifically the NBCZ. There were few formal tools recovered in either operation. Cores and core fragments of NBCZ chert, other chert, and chalcedony and flake ratios in both Operations demonstrate a pattern of acquiring nodules that were partially decorticated and reduced before reaching Crawford Bank. Macroblade and macroflake cores are absent in both assemblages. Tool use-wear patterns are similar, with wood being the most common contact material and most tools being used for longitudinal motions. Proportionately, more tools were used on bone or antler, meat/skin/fresh hide, and plants at Operation 51; however, there is no evidence for contact with dry hide and fewer stone tools contacted soil than at Operation 35.

As at Operation 35 (Stemp and Harrison-Buck 2019), it is believed that some activities performed using stone tools are underrepresented by the use-wear evidence. At Operation 51, the use-wear overwhelmingly consists of contact with hard materials (wood, bone/antler, unidentified hard). Use-wear consistent with meat/skin/fresh hide, non-woody plants, and other 'soft' materials is much less frequent. As with Operation 35, there are two hypotheses for the use-wear pattern distribution observed at Operation 51. 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 much of the assemblage was burnt, it is noteworthy that some researchers (Clemente-Conte 1997: 533; Rutkoski et al. 2020) observed that burning affects use-wear polishes differently. For example, bone and wood polishes seem to survive exposure to burning better than polishes associated with soft contact materials, such as meat, fat, and sinew. As well, Plisson and Mauger (1988) noted that use-related polishes resulting from contact with animal tissues (i.e., meat, hide) are less resistant to chemical alteration associated with white patination than polish produced by contact with harder materials, specifically wood. Given full consideration of the use-wear patterns and the significant post-depositional damage to the artifacts, the second hypothesis is believed to be more likely correct.

Post-depositional evidence, specifically edge microchipping, surface abrasion, and burning on the Operation 51 lithics, 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. This has also been suggested for the stone tools from Operation 35 (Stemp and Harrison-Buck 2019).

More excavation in and around Crawford Bank will undoubtedly clarify the nature of stone tool production and use by preceramic people in this part of Northern Belize.

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Chapter 13

Implications of an Early Classic Teotihuacan-Style Tripod Vessel Found at Chukte'ob

Miranda Miller, Eleanor Harrison-Buck, and Satoru Murata

Introduction

It is well known that the Maya had some degree of contact with the city of Teotihuacan in Central Mexico during the Early Classic period (ca. AD 150-600). In addition to the characteristic *talud-tablero* architecture, one the greatest indicators of Teotihuacan influence in the Maya area is the slab-footed tripod vessel. In previous research, scholars debated the nature of Teotihuacan-Maya interaction and whether such material signatures signaled a physical incursion, such as mercantile and diplomatic contacts, or was merely local elite emulation of a "foreign" style (Braswell 2003; Carrasco et al. 2000; Carrasco and Engelhardt 2019; Miller 1983; Sanders and Price 1968:168-169). David Stuart (2000) has convincingly argued that the Maya epigraphic evidence, namely the reference to the "arrival of strangers" in the glyphic record at Tikal and elsewhere, points to a physical presence of Teotihuacanos in the Maya area, specifically at the end of the fourth century AD.

In addition to Maya monuments, iconography on certain slab-footed tripod vessels from Tikal and elsewhere also reference the "arrival," depicting Teotihucano warriors who according to the glyphs ventured to large Maya centers as distant as Copán in Honduras and Kaminaljuyu in highland Guatemala (Schaeffer 2019:164-165, Figure 5.12). Scholars have long interpreted this as evidence of Teotihucano dominance over a passive Maya culture. In spite of Teotihuacan's great military power, some argue that their interactions with the Maya were mutually beneficial (Coe and Houston 2015). For instance, recent studies by D. Bryan Schaeffer (2019) argue that the Early Classic Teotihuacan-style slab-footed tripod vessel was not a product of Teotihuacan dominance, but rather a Maya appropriation that was adapted over time to "fit" a local form and function. In this chapter, we examine a Teotihuacan-style slab-footed tripod vessel found at Chukte'ob, an inland Maya salt-making site located in northern Belize near the modern-day village of Biscayne. The vessel displays the body form, button-appliques, and three slab feet—all characteristic of Teotihuacan tripod vessels but contains a fluted surface treatment and red slip that is distinctly Maya, suggesting a "hybridized" production, which may lend support to Schaeffer's (2019) argument.

Background

Scholars identify Teotihuacan contact in part through the presence of *talud-tablero* architecture on temples, the presence of artifacts in burials and caches such as Pachuca obsidian, and Teotihuacan style ceramics like slab-footed tripod vessels. Most evidence of this cultural contact with the Early Classic Maya comes from major cities, including Kaminaljuyu, Tikal, Copán, Lamanai, Barton Ramie, Rio Azul, Uaxactun, and Altun Ha (Braswell 2003; Carrasco et al. 2000; Carrasco and Engelhardt 2019; Coe and Houston 2015; McKillop 2004; Santley 2004). The latter site of Altun Ha is just 12 km to the east of Chukte'ob. While some sites, like Tikal and Kaminaljuyu, have substantial evidence of trade and direct contact with Teotihuacan, the evidence for such interaction at Altun Ha is relatively minor by comparison (Pendergast 2003). The primary evidence of Teotihuacan contact at Altun Ha was found in a singular "post-interment offering" of obsidian artifacts found overlying Tomb F-8/1 on the summit of a 17 m high pyramid in the southernmost part of the site center (Pendergast 1971:455). The offering consisted of 23 non-local jars, bowls, and dishes that are of a style that suggests a Teotihuacan-related source (Pendergast 2003:238). In addition, among the large group of artifacts were 245 small obsidian "eccentrics" comprising humanoid forms and a range of other shapes along with 13 large bifacially-chipped stemmed obsidian points, all produced in the Teotihuacan style and made from Pachuca green obsidian, a central Mexican source (Pendergast 1971:Figure 3; Pendergast 2003:Figures 9.1 and 9.2).

Scholars have long argued that the Pachuca obsidian source was likely controlled by Teotihuacan and when found elsewhere suggests long-distance trade or direct contact with this center. According to Pendergast (2003:238), the assemblage closely parallels the full suite of obsidian objects found in caches at Teotihuacan that date to the Miccaotli or Early Tlamimilolpa–phase (ca. A.D. 150-250). The dates for this assemblage are more than a century or two earlier than most of the Teotihuacan influence found throughout the Maya area. For instance, the most detailed epigraphic references to the "arrival of strangers" at Tikal date to AD 378. It is during this Early Classic time period (ca. A.D. 250-600) when the *talud-tablero* architecture and slab-footed vessels also make their appearance in many parts of the Maya Lowlands, including the Chukte'ob deposit discussed below.

Save for a few key examples, the majority of Teotihuacan-style slab-footed tripod vessels have been found in elite contexts, specifically burials (Braswell 2003; McKillop 2004; Schaeffer 2019). This has led some scholars to conclude that the Early Classic Teotihuacan style was associated with elite power, citing the large centers that incorporated this "foreign" style into their lexicon as supporting evidence. However, the finds of a Teotihuacan-style slab-footed tripod vessel in a salt production site in northern Belize brings this assumption into question. Salt production has been extensively documented in southern Belize where evidence suggests the Maya were producing salt primarily by boiling down brine water (McKillop 2005, 2019). Here, the earliest evidence of salt production has been dated to the Early Classic period (McKillop and Sills 2024). By this time, there is also evidence of brine boiling near the coast of central Belize

at the site Wits Cah Ak'al where both salt and pottery production workshops have been found (Murata 2011).

Below we describe the excavation of the mound excavated at Chukte'ob, an Early Classic (AD 250-600) context which shows similar evidence for both salt and ceramic production, including pottery sherds that may be from salt-boiling pots and baked clay material (BCM) from pottery production. Chukte'ob requires further excavation and analysis of the artifacts, soils, and charcoal samples, but little to no evidence of habitation was found, such as ground stone or lithics. The Early Classic slab-footed tripod vessel and pottery sherds were left on a packed earthen surface within what appears to be a nonresidential production-oriented mound—a highly unusual archaeological context—and suggests the Teotihuacan-style vessel functioned as a dedicatory cache (Murata 2023).



Figure 13.*1*1 Views of the slab-footed vessel from Chukte'ob (photos by M. Miller).

Excavation and Analysis of the Slab-Footed Vessel

The slab-footed vessel (**Figure 13.1**) was found during the summer 2022 field season in a 2-x-2 m unit, which was excavated in one of several mounds at Chukte'ob. The site of Chukte'ob was first identified during survey as one of several salt production sites just west of Mexico and Jones Lagoons (Buck, Murata, and Robinson 2022; Norris et al. 2015; Murata, Kaeding and Buck 2023). As described by Murata (2023), the mound at Chukte'ob did not yield evidence of domestic activities indicative of a residence and displayed the "fluffy orange soils" characteristic of salt production, likely produced through soil leaching rather than brine boiling (for further discussion of this technique see Williams 2021). The broken but whole tripod vessel was uncovered in the southwest corner of the unit, 77 cm below datum, tipped on its side. The vessel was found slightly NW of a larger "heap" of sherds; its elevation correlated to the bottom

of the sherd heap (see Murata 2023:Figure 9.5). Many of the sherds from the heap appeared similar in surface treatment and temper to those from the whole vessel, and some had details such as medial flanges indicating likely Early Classic dates (Harrison-Buck, pers. comm. June 2022). Both the tipped vessel and the sherd heap appear to have been placed atop a packed earthen surface or floor. Additionally, a lump of what appeared to be unbaked white clay also lay atop this surface, within the sherd heap. Upon further inspection, project geomorphologist Dr. Samantha Krause found that this was not pure clay but rather a lump of light tan silty-clay (Krause pers. comm. June 2022).

The complete vessel was collected with the surrounding soil matrix in the field and was excavated completely in the BREA field laboratory. No significant difference could be distinguished between the external and internal sediment found within of the vessel; screening the sediment revealed no other artifacts or datable samples. Once the sherds were lightly washed, the vessel was reconstructed by the senior author. Save for a few 1–2 cm^2 pieces missing from the body, the vessel was intact. One of the slab feet had also sustained some breakage and apparent erosion (see **Figure 13.1**). The vessel measures 15.7 cm tall x 14.5 cm wide, and weighs 574.3 g. Given the lack of erosion on the breakage surfaces of the sherds, it is clear that this vessel was likely intact when it was originally deposited on the packed earthen surface.

The body of the vessel could easily pass for a locally produced Early Classic Maya pot in a Teotihuacan style, rather than direct imports like the finds from Altun Ha. The red slip on both the interior and exterior of the vessel, along with the even fluting on the exterior and the smooth rim, reflect attributes found in traditional Maya pottery styles from the Early Classic time period (see for example Gifford's [1976] Hermitage Complex). The smoothness of the slip, precision of shape, and overall uniformity of the vessel's physical attributes are all strong indicators that the pot was made by a very skilled ceramicist. What makes this vessel unique are the distinctive feet—particularly, how they differ in style and skill from the body of the vessel. The style of the three slab feet along with the button or "bead" applique decoration are traits linked with Teotihuacan and are found on other local and imported examples from the Maya area during the Early Classic time period.

A close inspection of the three slab feet show that two of them are relatively uniform, both measuring 4.7 cm wide, but the third one is 5.4 cm wide and appears to be less finely made than the other two. A portion of one of the feet has deteriorated somewhat, but it is still evident that all three were gouged and inscribed with the same design that was created during the clay's leather-hard stage of drying (**Figure 13.2**). The pattern—three cut-out triangles, outlined by shallowly etched straight lines—is crude and lacks the measured uniformity of the upper half of the vessel. It is worth noting that this three-triangle pattern recurs on the feet of Maya Teotihuacan-style tripod vessels, including an example from Becan, which was also found in a non-burial context (Ball 1974, 1983, Schaeffer 2019:Figure 5.10).



Figure 13.2 Close-up of foot design.

The differences between the body and base of the Chukte'ob vessel are significant. The interior and upper exterior of the body is slipped, but the feet and exterior bottom of the vessel were left unslipped. It is noteworthy that the upper body of the vessel is smooth and finely made in contrast with the feet and base, which display the same repeated triangle design, but which lack uniformity. In addition to being 0.7 cm wider, one of the slab feet has two of the decorative lines smudged by what may be a fingerprint on the top right edge. The crudeness of the lines suggests the slab feet were cut out and incised freehand, with no template used for the lines. The question remains: why would this Maya potter make the top portion of a vessel so professionally, but finish it with a rustic, less skilled base and feet? The opposing degrees of finesse present on the body versus the base and feet of this vessel could be indicative of two different artisans or perhaps this was a teaching pot produced by an apprentice who was learning to shape and inscribe these "foreign" style slab feet, perhaps trying to mimic an imported version of a Teotihuacan vessel.

Discussion

The vessel itself, as the inspiration for this research, and its archaeological context both have many unusual qualities. It is rare to find a whole vessel like this outside of a sealed context, such as a burial or cache deposit. This style vessel is usually found in these contexts and associated with the elite. These Teotihuacan-style ceramics are thought to have functioned as serving vessels. Some of these pots are decorated with the glyph for cacao and associated chemical signatures of cacao have been found inside the vessels, signifying their function as fancy containers for a frothy chocolate drink used throughout Mesoamerica in ritual ceremonies (Hall et al. 1990; see also McNeil 2005). This virtually intact example from Chukte'ob appeared to be sitting on an exterior packed earthen floor of a production-oriented space far from an elite ceremonial space. As noted above, the area where the pot was found was likely an Early Classic salt and ceramic production site, based on comparisons with findings from Wits Cah Ak'al, a

nearby non-residential site with strong evidence for both salt and pottery production (Murata 2011).

If the mound at Chukte'ob was a production site like Wits Cah Ak'al, the tripod vessel may have been serving one of two functions. The first is that given the evidence of pottery production and the nature of the vessel itself, the site may have been used to train amateur potters in ceramic production. The second theory, not mutually exclusive from the first, is that the vessel and accompanying sherds are part of either a dedicatory or closing cache ceremony for the production site. If this mound is indeed a multi-crafting production site, we know from other such workshops that salt production has specific seasons that are ideal for extraction; therefore, it is conceivable that the Maya performed opening and closing ceremonies to honor the beginning and ending of a season (McKillop 2004; Murata 2011; Wilk and Ashmore 1988). If this was the case, we would expect to find other mounds containing similar evidence of ritual deposits. These very preliminary hypotheses require further testing of the mounds from Chukte'ob and elsewhere.

In terms of how this vessel fits into the greater web of Teotihuacan-style tripod vessels, it is in the minority in terms of a production-based context. The vessel at Chukte'ob is almost certainly not part of an elite burial, and the site itself is not part of a major Maya city or trading port, where most Teotihuacan-style tripod vessels have been found. Such vessels are frequently found in Maya caches, but again, normally in elite contexts. For instance, a more elaborately decorated Teotihuacan-style vessel with similar button or "bead" appliques and triangle cut-outs on the slab feet was found in a dedicatory cache deposit at Becan in Campeche, Mexico that dates between AD 450 and 550 (Ball 1974, 1983, Schaeffer 2019: Figure 5.10). This evidence may provide an analogous example to the Chukte'ob vessel supporting the idea that it acted as part of an offering that ritually opened or closed the space seasonally. Further horizontal exposure is necessary to better understand the unusual context of the vessel from Chukte'ob. Additional ceramic analyses, such as compositional and chemical studies of the vessel could tell us if it was imported or locally produced and what method of production may have been used for the vessel. If the body were created in a mold, for example, this would indicate that at least that portion was standardized (Pool and Bey 2007).

What we can say more confidently is that the physical presence of Teotihuacan in this area of northern Belize in places like Altun Ha dates as early as AD 250 and appears to be found in ritual contexts that are strictly associated with elite members of society. By the end of the fourth century, there appears to be more widespread interaction between Teotihuacan and the Maya at which time we see the earliest evidence of tripod vessels in this region (Ball 1983; McKillop 2004; Schaeffer 2019). From the fourth through the sixth century, Schaeffer (2019:151) notes that tripod vessels were being locally produced and adapted to what he describes as a "Teotihuacan-Maya hybrid aesthetic." The hybrid blending of local and foreign attributes is found on the Becan example, described above. Another example from Oxkintok in northwestern Yucatan has fluting on the body, similar to the Chukte'ob vessel, but instead of Teotihuacan-style slab feet it includes stylized bat-effigy supports that Schaeffer (2019:Figure

5.11) attributes to a Maya aesthetic. With this mixing of attributes, the tripod vessel became more localized in slip, style, and function, as it became appropriated into Maya use as a hybridized material form.

Interpretations and Conclusions

Early researchers studying the relationship between the Maya and Teotihuacan cited most of their findings as indication of Teotihuacan's military prowess and the Maya as passively receiving their influence. More recently, new discoveries and interpretations are challenging that traditional belief and some now are considering the relationship between the Maya and Teotihuacan as a two-way exchange. The findings reported herein contribute to this revised interpretation, lending support to the notion of a hybrid sharing of ideas in the blending of both Maya and Teotihuacan stylistic attributes. The context of this find also broadens interpretive perspectives, opening up new contexts in which to review this evolving interaction between Teotihuacan and the Maya during the fourth through six centuries AD. In addition to militarism, typically Teotihuacan influence has been interpreted as an elite preoccupation associated strictly with ritual behavior. The archaeological context of the slab-footed vessel from Chukte'ob demonstrates Maya ritual and production, with the use of such vessels as offerings but in a context related to salt and ceramic production some distance from any civic-ceremonial center. Further excavations at Chukte'ob and other Early Classic production sites in the Maya area may reveal more concrete insights into the nature and evolution of Teotihuacan-Maya interaction studies going forward.

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Chapter 14

An Analysis of Marine and Freshwater Shell Across BREA Sites

Abby Hanson and Lori Phillips

Introduction

Shells played a vital role in ancient Maya subsistence, ceremony, and trade (Coe and Houston 2015; McKillop 2004). While freshwater snails were often exploited as a dietary supplement, marine shells were used for consumption, adornment, and rituals. They were also a valuable exchange item, as they had to be brought from the coast to inland areas, like those in the Belize River watershed. This made marine shell a status symbol for the elite (McKillop 2004:263). While marine shells were often "worked" or cut and smoothed to produce a crafted item, freshwater shells were sometimes modified in the process of preparation or cooking. Freshwater shells were also sometimes deposited in cache or burial contexts (Halperin et. al 2003:207). Not only did these organisms prove useful for the ancient Maya, but they also continue to reflect the ecology and environments of the Belize River Watershed and continue to be used—albeit sporadically—by living populations in the area.

For the purpose of this report, shell found at Belize River East (BREA) sites were sorted into several categories by family, genus, species, or type. These include:

Pomacea: A genus of freshwater "apple snails" that typically prefer standing or slow-moving water, like that of the Western Lagoon Wetlands. Shells are often circular or oval-shaped, with a proportionally short spire and proportionally large body whorl (Leal 2002b).

Unionidae: Bivalve shells, commonly referred to as "pearly mussels." Found all over the world, they can exist in a broad range of freshwater environments (Leal 2002a).

Pachychilus: This genus of freshwater gastropods is typically found in shallow, swift-moving water. Two species are found at BREA sites: *Pachychilus glaphyrus*, which is "sculpted" with textural grooves on the exterior of the shell, and *Pachychilus indiorum*, which is "unsculpted" and has a smooth exterior. The ancient Maya consumed both species and would prepare them for cooking by either puncturing the body of the shell or removing the apex ("spire-lopping"). The common name is jute snails. Research suggests Pachychilus shells may have had a ritual as well as dietary purpose, as they have been found in ceremonial contexts in caves in the southern Maya lowlands (Halperin et. al 2003:208; Leal 2002b).

Euglandina: A genus of non-native "land snails." Because they were introduced in the modern era, they have no archaeological relevance but are still part of the present environment (Leal 2002b).

Strombidae: This genus of marine, "Conch" shells are referred to in this report as *Strombidae*, but may also refer to similar shells in the families *Melongenidae*, *Fasciolariidae*, and *Turbinellidae*. When complete, they are large with a proportionally short spire and are typically found bleached white in color. The Maya consumed *Strombidae* meat, worked the shells into pendants, trumpets, and other items, and traded them inland from the coast as a high-status commodity (Leal 2002b).

Unidentified marine shell: This category is reserved for fragments that, while determined to be marine, remain unidentified as to genus.

Description of the Research and Methods Used

To gain broad insight into shell occurrence and exploitation at BREA sites, specimens were examined from four archaeological sites across the study area. Two of these sites—Ik'nal and Saturday Creek—are located in the middle Belize River Watershed, and two others—Chulub and Ek'Tok—are in the lower Watershed, in a protected area known as the Crooked Tree Wildlife Sanctuary (CTWS).

Information was collected on shell metrics, such as weight and maximum length, as well as the completeness of specimens. Special note was made of any human alterations, for example, some marine shell specimens were "worked," displaying signs of cutting or smoothing. Moreover, many shells of the freshwater jute snail showed signs of human activity in punctures on the body of the shell, or removal of the apex ("spire-lopping"). Both these alterations indicate the preparation of snails for cooking and consumption by the Maya (Healy et. al 1990:171).

To inventory the number of shells and fragments present, the Minimum Number of Individuals (MNI) was recorded by counting the number of apertures (shell openings) in gastropod shells and hinges in bivalve shells. Number of Individual Specimens (NISP) was calculated by tallying the number of collected fragments overall (**Table 14.1**). Identifications of species, genus, or family were made via the FAO Species Identification Guide (Leal 2002:25-147). Additional notes were collected on specimen condition and provenience.

Collectively, this data presents a partial picture of the presence and relevance of marine and freshwater shell in the Belize River Watershed. By noting where shells are found, which species are present, and how human activity has altered collected specimens, a host of environmental and cultural information may be gleaned.

Analysis of Shell Data from BREA Sites

All Featured Sites

Of the 208 individual shells found at the BREA sites of Ik'nal, Saturday Creek, Chulub, and Ek'tok, 50.5% of the sample consisted of the genus *Pomacea* (n = 105 individuals). This was followed by 25.5% (n = 53) *Pachychilus*, of which 16.3% (n = 34) were *Pachychilus indiorum,* 5.8% (n = 12) were *Pachychilus glaphyrus*, and 3.4% (n = 7) were too calcified to determine exact species. The rest of the sample consisted of 9.6% (n = 20) *Euglandina*, 8.7% (n = 18) *Strombidae*, 4.3% (n= 9) *Unionidae*, and 1.4% (n = 3) undetermined marine shells (**Figure 14.1; Table 14.1**).

Overall, 89.9% of shells recovered were from freshwater or terrestrial organisms. *Pomacea* was most common at the lower Watershed sites of Chulub and Ek'tok (**Figure 14.1; Table 14.1**). At the middle Watershed sites of Ik'nal and Saturday Creek, the most common shell was the *Pachychilus* genus or jute snails. By comparison, no *Pachychilus* shells were recovered at Chulub, and only one was found at Ek'tok. Only 10.1% of the sample was from marine shell. Saturday Creek had the largest sample of marine shell, followed by Ek'tok, Ik'nal, and last, Chulub; however, when we consider the overall ratio of marine-to-freshwater shell, Ek'tok is slightly higher than Saturday Creek.

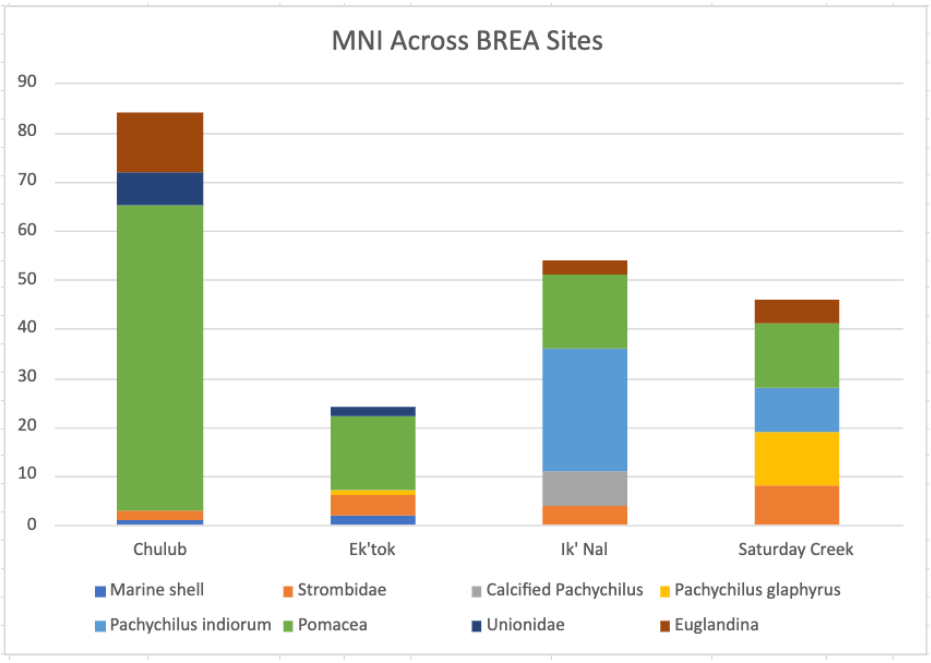

Figure 14.1 Minimum Number of Individuals (MNI) of different shells at recovered at featured BREA sites.

In terms of completeness, 45.7% of specimens were more than half present. This varied greatly by site, with a higher proportion of "complete" shells found in the middle Belize River Watershed sites of Ik'nal and Saturday Creek. Freshwater shells were more likely to be more than half complete than marine shells, perhaps on account of marine shells being used for crafting activities. There was an interesting discrepancy between species of *Pachychilus*—91.2% of *P. glaphyrus* had either body punctures or a missing apex, and only 43.8% of *P. indiorum* showed such changes. Of the human modifications, apex removal proved to be most popular: 30.4% (n = 14) were missing part of the spire, 6.5% (n = 3) had punctures on the body, and 15.2% (n = 7) had both alterations.

Some of the specimens from Ik'nal possessed a thick, dusty, yellow layer of calcification on the exterior of the shell, making species identification impossible (**Figure 14.2**). Of the 46 uncalcified jute shells collected at these sites, 24 showed signs of human alteration (52.2%).



Figure 14.2 Left: *Pachychilus glaphyrus* ("sculpted jute") specimen from Saturday Creek (LCB 6286). Right: *Pachychilus indoirum* shell found at Ik'nal (LCB 3268) with calcified spire (photos by A. Hanson).

Table 14.1 Select shell data from featured BREA sites.

Site Name	NISP	MNI	% MNI of Total	Total Weight	% of MNI over Half Complete	% of Jute Shell with Alterations	% Fresh-water	% Marine
Chulub	226	84	40.4%	188.6	23.8%	–	96.4%	3.6%
Ek'tok	97	24	11.5%	200.2	20.8%	100%	75.0%	25.0%
Ik'nal	114	54	26.0%	593.4	74.1%	24%	92.6%	7.4%
Saturday Creek	92	46	22.1%	1083.4	65.2%	85%	82.6%	17.4%
All Sites	529	208	100.0%	2065.6	45.7%	52.20%	89.9%	10.1%

Although overall shell size was not analyzed in this report—the low sample sizes at some sites could skew the results—trends in maximum length and width may elucidate the health and presence of snail populations in specific areas (see **Tables 14.2 and 14.3**).

Table 14.2 Average maximum length by shell species.

Shell Type	Chulub	Ek'tok	Ik'nal	Saturday Creek	Total Average
Marine shell	–	25.6	–	–	25.6
Calcified *Pachychilus*	–	–	31.2	–	31.2
Pachychilus glaphyrus	–	41.2	–	39.8	39.9
Pachychilus indiorum	–	–	26.9	24.5	26.2
Pomacea	34.2	29.1	40.8	18.8	31.7
Strombidae	–	–	146.3	137.5	139.2
Tree snail	32.8	–	41.2	40.8	38.0
Unionidae	15.1	16.8	–	–	15.7

Table 14.3 Average maximum width by shell species.

Shell Type	Chulub	Ek'tok	Ik' Nal	Saturday Creek	Total Average
Marine shell	–	22.8	–	–	22.8
Calcified *Pachychilus*	–	–	16.0	–	16.0
Pachychilus glaphyrus	–	18.3	–	16.2	16.4
Pachychilus indiorum	–	–	11.7	11.0	11.5
Pomacea	25.2	24.2	32.2	17.7	25.4
Strombidae	–	–	62.3	73.0	70.9
Tree snail	15.0	–	18.4	19.0	17.1
Unionidae	27.2	28.8	–	–	27.7

Ik’nal

The site of Ik’nal lies along the western side of the Belize River, about 25-50 m north of the river channel. The area is considered part of the middle Belize River Watershed. During the 2012 field season, a circular shrine was excavated within Ik’nal’s single plaza group and main elite residential structure (Harrison-Buck 2013). A mix of Terminal and Postclassic artifacts were found, suggesting multiple phases of construction. Within this excavation—Operation 13—at least 54 individual shells were recovered, including 50 freshwater and four marine.

Notable zones were largely concentrated in Squares R and S, which covered the southern interior of the stone structure. In Zones 8 and 9, seven specimens of *Pachychilus* were found fully calcified, making the species indeterminable. However, all other jute shells recovered at Ik’nal were *Pachychilus indiorum*, many displaying partial calcification on the exterior, so this identification is more likely.

Also found in Zone 8, which consisted of construction fill from the structure’s final building phase, was a cache of *Pomacea* along the western edge of Square S (Harrison-Buck 2013:113). Zone 8 also exhibited the most *Pachychilus indiorum* specimen, yielding 68% (n = 17) of the individuals found at Ik’nal; however, only two of these shells showed signs of human alteration—with apices removed. Other artifacts found in Zone 8 included turtle carapace, ceramic sherds, and several pieces of unidentified bone.

Between Zones 6 and 7—also part of the construction fill—a high density of artifacts was found, including Terminal Classic and Postclassic ceramics and a fragment of a conch shell (Harrison-Buck 2013:111-113). Other *Strombidae* shells were found in Zone 2 (collapse debris), and Zone 4 (exterior collapse debris). None of the conch shell specimens found at Ik'nal showed noticeable signs of having been worked.

Although Ik'nal contains the most *Pachychilus* shell out of the four sites investigated here, only 24% of specimens show signs of human alteration. Also, the condition of most of the shell recovered is unusually good: 40 out of 54 specimens (74%) were found at least half-complete, the highest proportion of any featured site. It is worth noting that, despite the high volumes of "unsculpted" *Pachychilus indiorum* shells, no specimens of "sculpted" *Pachychilus glaphyrus* were collected. In this way, Ik'nal differs from Saturday Creek, another middle watershed ceremonial site.

Saturday Creek

Saturday Creek is a large, ceremonial center surrounded by a sprawling community, located along the middle stretches of the Belize River. The site core contains several well-defined plaza groups and is surrounded by hinterlands with hundreds of mounds, many of which are classified under different BREA site names. During excavations in 2014, operations in the north plaza group (Operations 17-19) all showed signs of Classic Period occupation and a small amount of Terminal Classic debris (Flanagan and Harrison-Buck 2015; Runggaldier, Harrison-Buck, and Isa 2015). These operations together yielded only 30.4% (n = 14) of the total freshwater/marine shell assemblage from Saturday Creek. In contrast, Operation 23—located in the southwest plaza group—yielded 69.6% (n = 32 or the total 46) specimen of the assemblage (Harrison-Buck and Flanagan 2015).

Operation 23 targeted a square-shaped Postclassic shrine (Structure 11), similar in nature to the circular structure at Ik'nal (Harrison-Buck and Flanagan 2015). Square C, which was located off-mound in the plaza and Square D, which exposed the western radial staircase and portion of the surrounding plaza area, contained the highest density of shells. In Zone 1, a conch shell was collected from the surface of Square I (**Figure 14.3**). Within Zone 3, a pit containing a conch shell, ceramic sherds, and 38% (n = 5, out of 13) of the recovered *Pomacea* shells was defined in Square C as Zone 7. Another area yielding marine shell fragments was Zone 17 in Square F, an early floor surface composed of dense pebbles. Zone 4, a combination of tumble and looter's back dirt, contained 35% (n = 7, out of 20) of recovered *Pachychilus* shells, mostly from Square D.



Figure 14.3 Conch shell from Saturday Creek (LCB 6353).

The preservation condition of shells at Saturday Creek is second only to Ik'nal, with 65.2% of shell specimen being more than half intact. Of the 46 specimen, 17.4% of the individual shells at Saturday Creek are marine, making it second-highest proportionally of the featured sites after Ek'Tok. All are *Strombidae*, and some fragments appear to be smoothed, or "worked."

Saturday Creek is also the only site considered here to contain both *Pachychilus indiorum* and *Pachychilus glaphyrus* shells (**Figure 14.4**). Overall, 85% of the jute snail shells at Saturday Creek had evidence of human alteration: 9 were missing the apex, 3 had punctures—commonly on the first spire—and 5 more had modifications. The rate of human alteration was higher in *P. glaphyrus* shells (90.1%) than in *P. indiorum* (77.8%). The most common modification in *P. glaphyrus* shells was apex removal, which was seen in 8 out of 11 specimens. Just one *P. indiorum* specimen showed evidence of just apex removal. The Maya consumed both *P. glaphyrus* and *P. indiorum* (Healy et. al 1990:171), so the difference in rate and type of modification is interesting but could be skewed by a small sample size.

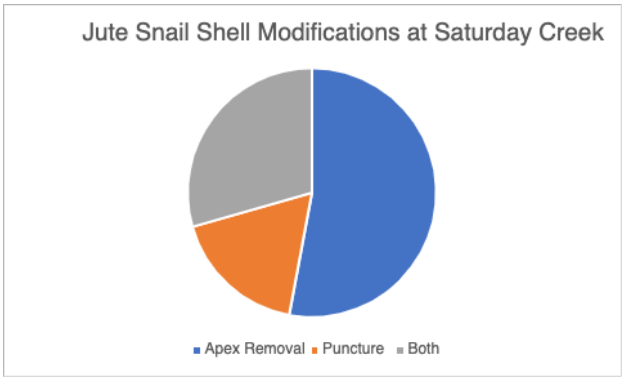

Figure 14.4 Human alterations of *Pachychilus* shells found at Saturday Creek.

Ek'Tok

Ek'Tok, located in the wetlands of the lower Belize River Watershed, consists of two pyramidal structures in the main plaza and a series of discrete residential plaza units arranged on platforms (Harrison-Buck 2020; Harrison-Buck and Shelhamer 2020; Rybka 2020). Ceramics found across the site date to the Early Classic, Terminal Classic, and Contact periods.

Of the 24 shells recovered from Ek'Tok, 14 were from Operation 43 (58.3%). The objective of this operation was to explore phases of construction and a midden deposit on the corner of Plaza C, one of the largest residential plaza groups. Ceramics found in Plaza C suggest a Terminal Classic construction and Postclassic occupation.

One-fourth of all shells recovered from Ek'Tok were marine, including two unidentified shells. This high proportion is similar to that of Saturday Creek and may be related to the fact that both sites are ceremonial centers where high-status exchange items like marine played an important role. Half of the *Strombidae* specimen from Ek'Tok showed clear signs of having been "worked." Marine shell was found in Zones 2, 3, and 5, alongside burned turtle carapace, fish bones, pottery, charcoal, and lithic material.

Only one jute snail shell (*Pachychilus glaphyrus)* was found at Ek'Tok. It was recovered from Zone 4 of Operation 42, on the floor of a structure in Plaza E (Harrison-Buck 2020). The apex had been removed, and punctures on the body whorl and first spire whorl indicate human alteration for consumption. Nearby artifacts included animal bone, debitage, and Terminal Classic potsherds. Surprisingly, no *Euglandina* specimen were collected from Ek'Tok, unlike the other sites described here, which is notable given the prevalence of this non-native shell in recent times.

Ek'Tok shells were the most fragmented or incomplete of the sites studied here—only 20.8% of individual specimens were at least half complete. The presence of *Unionidae* shells draws a parallel between Ek'Tok and Chulub, the other lower watershed site (**Figure 14.5**).

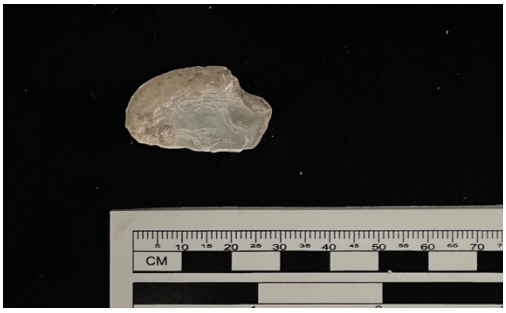

Figure 14.5 Half of *Unionidae* shell found at Ek'Tok (LCB 10631).

Chulub

The ancient Maya site of Chulub was excavated in 2018-2019. Located in the lower Belize River Watershed, it consists of one formal plaza and several mounds surrounded by water features, primarily depressions in the ground called pocket *bajos* (Runggaldier, Harrison-Buck, and Krause 2020). The presence of these features—as well as Chulub's place near the Crooked Tree and Western Lagoon Wetlands—makes it a possible locale for aquaculture.

Ceramics and faunal remains suggest that Chulub's structures date to the Terminal Classic and Early Postclassic (ca. AD 830-1200) periods (Flanagan 2018; Harrison-Buck 2018; Runggaldier, Harrison-Buck, and Krause 2020; Shelhamer and Craig 2018). Four shell-yielding operations were conducted here—Operation 31 in one of the structures in the north plaza group (Flanagan 2018), Operation 32 in a Postclassic shrine in the plaza unit (Harrison-Buck 2018), Operation 33 in a midden deposit (Shelhamer and Craig 2018), and Operation 49 inside a pocket *bajo* (Runggaldier, Harrison-Buck, and Krause 2020).

Operation 31 yielded 45% of the total shell found at Chulub, including several fragments of marine shell. Notably, a rectangular conch pendant was recovered from Zone 6, Square D, and an unidentified marine shell piece was found in Zone 10.

Only 23.8% of the individual shells found at Chulub were half of more complete; this figure is almost certainly influenced by the abundance of *Pomacea* shell, which were often recovered in a highly fragmented state (**Figure 14.6**). While 77 individual shells were collected at Chulub—the most of any site featured here—15.6% (n = 12) were from modern land snails (*Euglandina*).

No *Pachychilus* specimen were found at Chulub, probably because jute snails prefer fast-moving water, unlike the environment of the Crooked Tree Lagoon. However, Chulub yielded the most *Unionidae* of any site—four out of seven individual specimens were found in Operation 31. Chulub also had the most *Pomacea* specimen of any site (n = 61). This too is likely due to its proximity to lagoonal environments.



Figure 14.6 Pomacea shell from Chulub (LCB 8232).

Interpretations and Conclusions

This data, based on the frequency and condition of shells found at four BREA sites, helps to illuminate the diet and practices of the ancient Maya in the eastern Belize River Watershed, particularly during the Terminal Classic and Postclassic periods. The biggest difference between the shell assemblages of the middle and lower watersheds is the differential distribution of *Pachychilus* and *Unionidae* shells: substantial numbers of jute snail shells were found at the middle Watershed sites of Ik'nal and Saturday Creek, although interestingly Ik'nal only yielded one species (*P. Indiorum*). This distribution is probably due to the preference of *Pachychilus* for shallow but swift-moving waters, characteristics that apply to the Belize River in this area for at least parts of the year (dry season). In contrast, *Unionidae* specimen were only recovered at lower Watershed sites, closer to the Crooked Tree Wildlife Sanctuary (i.e., Ek'Tok and Chulub). At these sites, *Pomacea* and *Euglandina* shells were more consistently distributed across sites.

In many ways, Ek'tok and Saturday Creek—both larger ceremonial centers—had more similarities in shell composition than they had with the other site in their portion of the Watershed (**Figure 14.7**). While a low proportion of marine shell was found at Chulub (3.6%) and Ik'nal (7.4%), the occurrence of marine shell was much higher at Saturday Creek (17.4%) and Ek'Tok (25%). Many *Strombidae* shells showed signs of having been "worked," including slicing, smoothing, and rounding of the tabercles. One notable example is a conch pendant recovered at Chulub, a rectangular piece with three drilled holes.

Across the watershed, marine shells were commonly found in elite or sacred spaces, in association with other artifacts like animal bone, turtle carapace, debitage, and ceramic sherds. The presence of marine shell at these sites underscores its importance as a prestige, and sometimes sacred, item (McKillop 2004:263). It also begs more questions about the exchange of these items inland.

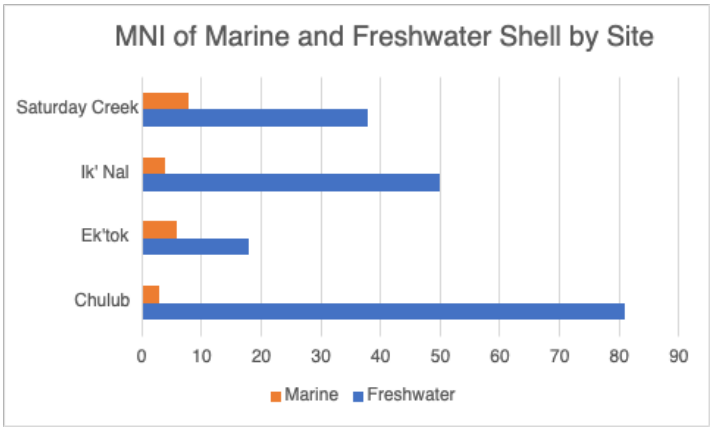

Figure 14.7 Proportion of marine to freshwater and terrestrial snails at featured BREA Sites.

Perhaps one of the most interesting findings overall was the inconsistency of jute snail shells. Some sites had more of one species than the other, and the present species had different rates of alteration. It is unclear if these differences can be attributed to environment, human preferences, or other factors. More than half showed signs of human alteration, either through body punctures or spire-lopping, likely indicating their role in dietary subsistence (Healy et. al 1990:171).

Pomacea and *Pachychilus* shells have been shown elsewhere in the southern Maya lowlands to have been deposited in ceremonial contexts (Halperin et. al 2003:207), a purpose that may have occurred at these sites. This may explain the cache of *Pomacea* found at Ik'nal, and a possible purpose of jute in shrine contexts.

Whether for status or subsistence, marine and freshwater shells played a role both in the ancient Maya way of life and continue to play an important role in the greater ecological context of the Belize River Watershed.

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Chapter 15

A Small-Scale Study of Archaic Artifact Distribution and Post-Depositional Processes in and Around Crooked Tree Island, Belize

Fiona Haverland and Marieka Brouwer Burg

Introduction

Unlike the ancient Maya, preceramic Archaic sites in Belize have been under-studied (Stemp et al. 2021). The investigation of Archaic period sites has been made even more difficult by the lack of stratified deposits and corresponding radiocarbon dates to help solidify a chronology for this poorly understood time period (see Brouwer Burg and Harrison-Buck 2024). The purpose of this study is to analyze the distribution of artifacts from five Archaic sites on and around Crooked Tree Island to better understand how original contexts may have been disturbed by post-depositional processes. These sites include Crawford Bank South, Nancy Bight, Birds Eye View, Oklahoma Pond, and Joe Goff (**Figure 15.1**), all of which were investigated during the January 2022 season by the Northern Belize Archaic Adaptive Strategies (NBAAS) Project, directed by Dr. Marieka Brouwer Burg. Using ArcGIS Pro, we conducted a distributional analysis of chert tools and debitage at each site, primarily focusing on artifact weight and location category (**Table 15.1**). We also executed a Least Cost Path analysis to demonstrate possible pathways from chert-bearing soils to the sites included in this study. These analyses help to explain the post-depositional movement and distributional patterns of chert artifacts, as well as the activities performed at these sites, based on their proximity to the Northern Belize Chert-bearing Zone (NBCZ).

Introduction to the Study Area

Crooked Tree Island is an area of the northern coastal plain of Belize within the lower reaches of the Belize River Watershed. The Yucatan Limestone Platform forms the bedrock of this area (Walker and Walker n.d.:31), and overlying soils are generally acidic sand or sandy-clay (Brouwer Burg and Harrison-Buck 2024). Chert does not occur naturally on Crooked Tree Island however, there are natural deposits of high quality, fine-grained chert located about 5 km distant in the NBCZ (Stemp and Harrison-Buck 2019). In fact, many of the chipped stone artifacts found at sites on Crooked Tree Island are made from chert most likely transported to the island from the NBCZ (see Stemp and Harrison-Buck 2019; Brouwer Burg and Harrison-Buck 2024: Figure 1).

There are two large lagoonal systems around Crooked Tree (Walker and Walker n.d.). The Crooked Tree Lagoons—Crooked Tree, Western, and Revenge Lagoons—surround Crooked Tree Island itself. Mexico and Jones Lagoons lie to the east and are connected to the Crooked Tree lagoonal system via a complex system of creeks and wetlands (Walker and Walker n.d.:41). These lagoonal systems act as water storage for the Belize River Watershed during flooding periods. Because of this, the water levels in these lagoons vary drastically throughout the year (Ramsar 2000). Some areas are only periodically inundated during the wet season and are almost dry during the dry season. Other areas are permanently inundated (Ramsar 2000). The flow of water through these systems also reverses during flood events in the wet season, allowing more water to flood into the lagoons (Pyburn 2003:123; Walker and Walker n.d.:41). The constant flow of water into and out of the lagoons allows for the buildup of organic-rich alluvium in areas of annual inundation (Walker and Walker n.d.:34).

The area is made up of a mosaic of biodiverse habitats. These ecosystems include subtropical moist broadleaf forest, pine savanna, mangrove, wetland, and littoral biomes, among others (Boles 2017; Walker and Walker n.d.). The high biodiversity of the area means that there are many natural resources that can be utilized by local populations. White-tailed deer, peccary, and paca (locally called 'gibnut') are common game animals hunted by Crooked Tree locals in modern and historical periods. Traditional fishing catches from the lagoons include the Mayan Cichlid, the Yellowjacket Cichlid, the Bay Snook, and the Blue Catfish (Walker and Walker n.d.). Plant resources, such as logwood, a high-quality hardwood species, are also available in this area, and were likely exploited in the past, as they are today (Brouwer Burg and Harrison-Buck 2024:Figure 7; Stemp and Harrison-Buck 2019:4). Seasonal changes in water level and flow help support a large, healthy, species-diverse animal population in the area, including migratory birds and estuarine fish that only visit the area seasonally. Due to the high environmental diversity on and around Crooked Tree Island, and the seasonal changes in flora and fauna, the area has been utilized by many groups across time for a variety of resources, as evidenced by the multiple sites at which artifacts from different time periods have been found (Harrison-Buck et al. 2018). These resources likely included many of the same plants and animals that are still present in the area and utilized regularly by local populations today.

The hydrology and biodiversity of the Crooked Tree area means that there are many natural and human-driven processes that can affect the movement and distribution of archaeological artifacts after deposition. These processes include, but are not limited to bioturbation, sediment transport, erosion or deposition from the seasonal changes in the lagoon's water level, wind erosion, and modern human activity. Bioturbation refers to the movement of artifacts through the actions of animals and plants. This is a major factor in the vertical, post-depositional movement of artifacts in tropical environments, though the magnitude of this movement is not yet fully understood and likely varies greatly based on a number of complex factors (Araujo 2013). In tropical environments, burrowing animals like ants, termites, earthworms, and small mammals play a significant role in bioturbation, generally moving artifacts upwards in the soil (Araujo 2013:2125). Plant activity, especially the uprooting of trees,

can also have an effect on the post-depositional movement of artifacts (Balek 2002). At sites along the edges of the lagoons, seasonal flood events and changes in water level likely influence the spatial distribution and post-depositional movement of artifacts. Though directionality shifts by season, there is continual water flow through the Crooked Tree lagoonal systems (for a diagram of seasonal water flow, see Walker and Walker n.d.:41), which likely leads to continual sediment transport throughout the system, especially during flood events (Fondriest Environmental, Inc. 2014). Depending on water flow, this process could also transport artifacts of varying sizes, though further study of the hydrology of the Crooked Tree lagoon system is needed to determine what size of artifacts would be affected, and where they might be deposited. In the pine savannah environments surrounding the lagoons, wind erosion of sandy soils and deflation of stratigraphy can lead to the exposure and "pedestaling" of artifacts on the surface (Brouwer Burg et al. 2023:Figure 3.21). This soil deflation can lead to a mixing of artifacts from different temporal contexts. Post-depositional movement of artifacts via the actions of modern humans is also prevalent. Activities like plowing agricultural fields or construction can disturb the original context of a site.

Site Summaries and Discussion of Post-Depositional Processes

Three of the sites selected for this analysis—Crawford Bank South, Nancy Bight, and Birds Eye View—are located on the shore of Crooked Tree Lagoon (**Figure 15.1**). Crawford Bank South is north of the causeway that straddles the lagoon. It is in a mixed hardwood swamp with some dunes close to the shore (Brouwer Burg et al. 2023:64-67). A total of 19 shovel test pits (STPs) were performed at Crawford Bank South and 17 of those were positive. Most positive STPs contained either only chert debitage or a mix of chert debitage and some Maya period or historical artifacts (Brouwer Burg et al. 2023:Table 3.7). There were two surface collection locations where three chipped chert tools were collected (Brouwer Burg et al. 2023). Possible post-depositional processes that have impacted this site include bioturbation, sediment transport, erosion or deposition from the seasonal changes in the lagoon's water level, and human activity.

Nancy Bight is north of Crawford Bank on "a sandy rise that looks out over a wetland that exists year-round" (Brouwer Burg et al. 2023:61-63). A total of 28 STPs were performed at Nancy Bight and 11 were positive, mostly containing debitage or micro debitage. While there were lithics on the ground surface, no artifacts were collected from surface scatters (Brouwer Burg et al. 2023:Table 3.5). Artifacts at this site could have been affected by post-depositional processes, such as bioturbation and water movement in the lagoon.

Birds Eye View is south of the causeway. A portion of the site is on cleared land, to the south of which is a mixed hardwood swamp with a few dunes close to the shoreline (Brouwer Burg et al. 2023:70-72). A total of 16 STPs were performed at this site during the 2022 season, three of which were positive for micro debitage (Brouwer Burg et al. 2023:Table 3.10). Surface scatters were collected from 12 locations around the Birds Eye View area, and consisted of a

mixture of chipped tools, debitage, and fire cracked rock. More surface scatters were noted and mapped, but not collected.



Figure 15.1 Sites with Archaic components included in this study.

The site of Oklahoma Pond is near an inland pond on Crooked Tree Island. Like the surrounding lagoons, its water levels change with the wet and dry seasons, and the locations of some STPs are seasonally underwater. The age of this pond is in question, and possibly appeared relatively recently, based on local knowledge (Brouwer Burg et al. 2023:73-74). Six STPs were performed here, all of which were sterile (Brouwer Burg et al. 2023:Table 3.11). Two chipped tools were collected from the ground surface close to one of the STP locations. Possible post-depositional processes acting at this site include bioturbation, seasonal water level changes, and modern human activity.

The Joe Goff site is to the east, across Crooked Tree lagoon and is not on Crooked Tree Island (**Figure 15.1**). The site is located in a fire-affected pine and oak savanna. It is also within the NBCZ, so the soil is chert bearing (Brouwer Burg et al. 2023:79-83). A total of 13 STPs were performed at the Joe Goff site (Brouwer Burg et al. 2023:Table 3.13). These STPs were divided into four transects, each of which was three STPs long (Brouwer Burg et al. 2023:Figure 3.20). One STP was dug in isolation to the transects in the road-path (see **Figure 15.2**). While 10 STPs were positive, no diagnostic Maya or historical artifacts were found at this site. There

were also seven surface collection locations, which yielded a mix of chipped tools and debitage. Post-depositional processes that could have acted on artifacts at this site include bioturbation, wind erosion, and wildfires.

Analytical Methods

Lab Analysis of Artifacts

The lithic artifacts collected from the five sites described above were cataloged using the BREA lab protocol (see Runggaldier, Phillips, and Brouwer Burg 2018). First, we separated artifacts from the same provenience into the categories of debitage, chipped tools, and in one case, fire-cracked rock. Non-formal chipped tools were separated from debitage based on evidence of retouching. Any use-wear on debitage was noted. Each individual artifact was weighed, and its length and width measured. Based on this information we calculated the average artifact weight for each shovel test pit and surface collection, as well as the total weight. This analytical data was then integrated into a spatial analysis, described below.

GIS and Spatial Analyses

For each site, we created three heat maps showing different attributes (**Figures 15.3** and **15.5**). The first map shows the artifact category for each shovel test pit and surface collection location, as described in **Table 15.1**. This table indicates the types of artifacts found at each location. Heat maps representing the total and average artifact weight at Joe Goff and Birds Eye View were also created. This was not done for the other three sites because not enough artifacts were collected or processed due to time and space constraints. The maps were analyzed visually for patterns, as there was not enough data to conduct a meaningful statistical analysis. Comparing these heat maps revealed patterns in the density and types of artifacts at each site.

Category	Artifact Type
1	No artifacts/negative
2	Chert debitage
3	Chert debitage and tools
4	Chert debitage and Historic/Maya period artifacts
5	Chert debitage, chert tools, and Historic/Maya period artifacts
6	No chert but Historic/Maya artifacts
7	Chert tool (debitage status unknown or uncollected)
8	Unworked chert nodules/chert outcrop

Table 15.1 Artifact type categories used to describe shovel test pit and surface collection locations (from Brouwer Burg et al. 2023:Table 3.1).

We also created a number of Least Cost Path (LCP) maps to demonstrate the distance and possible routes from chert sources to sites where chert tools were found. We used three points on the edge of the chert-bearing zones as sources, as they were the closest points to Crooked Tree Island. The ending points were the sites of Nancy Bight, Birds Eye View, and Oklahoma Pond. These sites were chosen for this analysis based on their locations. Nancy Bight and Birds Eye View are on the edge of Crooked Tree Lagoon and are the northernmost and southernmost sites on the island included in this analysis. Oklahoma Pond is the closest site to a known chert source to the west of Crooked Tree Island. These cost paths modeled the difficulty of travel through various ecosystems and had friction values from 1 to 10 (**Table 15.2**). We ran two LCP iterations, one that represented travel during the wet season and the other representing the dry season. This was to account for seasonal water level changes that may have affected ease of travel through various ecosystems.

Ecosystem	Dry Season Friction Values	Wet Season Friction Values
Agricultural Uses	6	6
Lowland Broad-leaved Moist Forest	4	4
Lowland Broad-leaved Moist Shrub Forest	6	6
Lowland Savanna	1	2
Mangrove and Littoral Forest	8	8
Shrubland	4	4
Urban	6	6
Water	2	2
Wetland	7	3

Table 15.2 Friction values used for cost surfaces.

Results

Heat Maps

Visual inspection of the heat maps revealed possible patterns and clusters in the data. As shown in **Figure 15.2**, at the site of Joe Goff Transects 3 and 4 (marked by the orange box) have a higher percentage of Category 3 shovel test pits, which contain chert debitage and tools, when compared to Transects 1 and 2 (50% versus 16%). Transects 3 and 4 also have a cluster of shovel test pits and surface collections that have a high average artifact weight as well as a high total artifact weight (**Figure 15.3**). Additionally, artifact counts are higher around Transects 3 and 4, with a total of 69 artifacts in this area compared to 23 found at Transects 1 and 2.

Joe Goff is broadly located in a lowland pine savanna ecosystem; however, based on the satellite imagery shown in **Figure 15.2**, Transects 3 and 4 are located in a cluster of trees, and Transects 1 and 2 are located in a more open landscape. The difference in microenvironment is a possible cause for this difference in artifact distribution. Transects 1 and 2 have a low density of vegetation, meaning erosion may be more prevalent there than in the higher vegetation density of the trees surrounding Transects 3 and 4. Transects 1 and 2 are also closer to the dirt road running through the area, and with lower vegetation density, artifacts could be more visible. Human activity in the area could have removed some of the larger artifacts from the ground surface at Transects 1 and 2 that may have been left alone at Transects 3 and 4. Also, a cultural explanation for this difference in artifact distribution must also be considered. Perhaps the immediate area around Transects 3 and 4 was more highly utilized by past populations than the area around Transects 1 and 2. However more investigation is needed at this site to fully

understand this difference in the distribution of artifacts, and what the causes for this difference may be.



Figure 15.2 Shovel test pit and surface collection locations at Joe Goff symbolized by category (see Brouwer Burg et al. 2023:Figure 3.20).

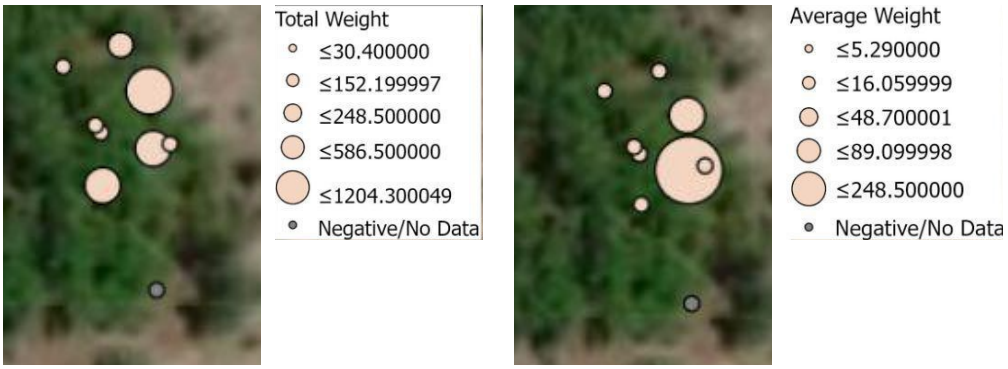

Figure 15.3 Total weight (left) and average weight (right) of artifacts from Joe Goff transects 3 and 4.

Birds Eye View also revealed visual clusters in artifact category data. In **Figure 15.4** there is a small cluster of Category 4 (positive for chert debitage and Maya/historic artifacts)

locations at the northern margin of the site (marked by the orange box labeled 1). This cluster represents an area where chert debitage and Maya or historic artifacts were found in the same locations. There is also a large stretch of locations marked as Category 2 (positive for chert debitage) to the south (represented by the orange box labeled 2). This is a line of locations where only chert debitage was found. Many of these shovel test pits and surface collections are very close to the waterline of the lagoon. A relatively low proportion of the Birds Eye View artifacts were lab processed due to time constraints. However, heat maps of artifact weight (**Figure 15.5**) show a cluster of locations to the south with high total artifact weights (between 681.8 and 1204.3 g) but lower average weights (between 9.47 and 25.51 g). Both chipped tools and chert debitage were found at all three locations in this cluster. The artifact counts at two of these three locations are also very high, with over 70 artifacts collected at each. All three of these locations were surface collections, implying that these artifacts may have been exposed or moved here by post-depositional processes. Perhaps bioturbation or changes in water level played a part, as the surface scatters are located in a vegetation-dense lowland broad-leaved moist scrub forest and are relatively close to the lagoon's waterline.



Figure 15.4 Shovel test pit and surface Collection locations at Birds Eye View symbolized by category (see Brouwer Burg et al. 2023:Figure 3.12).

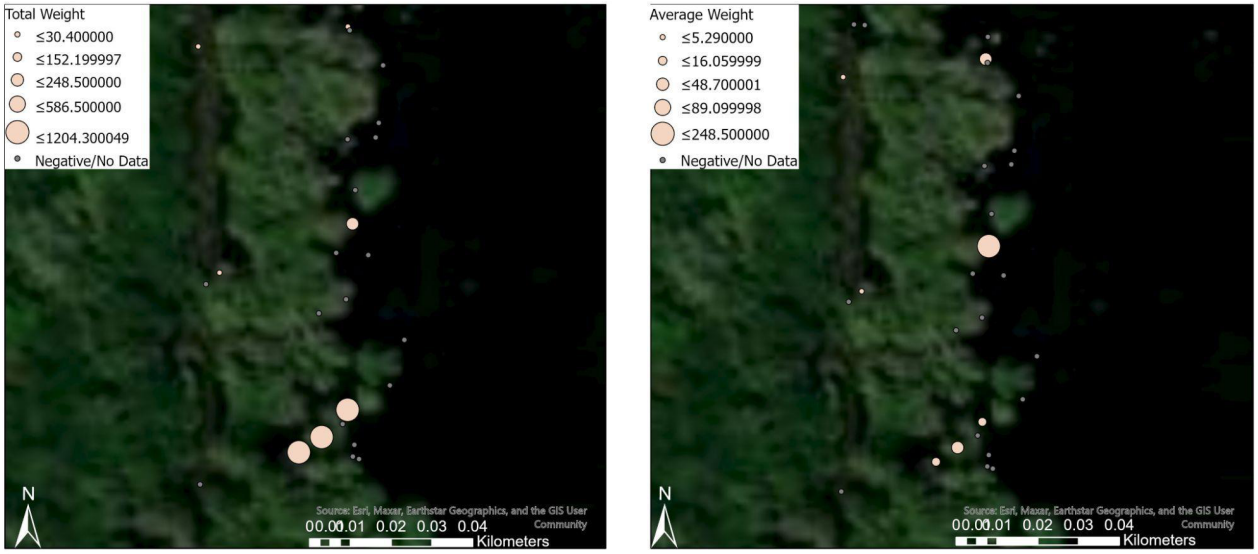

Figure 15.5 Total weight (left) and average weight (right) of artifacts from Area 2 at Birds Eye View.

There are two clusters of interest at Crawford Bank South (**Figure 15.6**). At the northernmost part of the site there is a cluster of Category 4 (positive for chert debitage and Maya/historic artifacts) locations (marked by the orange polygon labeled 1). Just south of it is a cluster of Category 2 (positive for chert debitage) locations (labeled 2). Debitage was found in both Clusters 1 and 2, however historical and Maya artifacts were also found in Cluster 1. Similar to the concentrations of chert debitage at Birds Eye View, the clusters at Crawford Bank South create a pattern of debitage very close to the shoreline of the lagoon. Notably, tools were only found at one location in the Crawford Bank clusters, at the southern edge of Cluster 2. The absence of many formal tools in the same area as a substantial amount of debitage could point to the possibility that Archaic populations were making or retouching tools but were not leaving finished tools at these sites. This pattern could also have been influenced by post-depositional processes such as water level changes, bioturbation or human activity in the movement of artifacts in these areas.

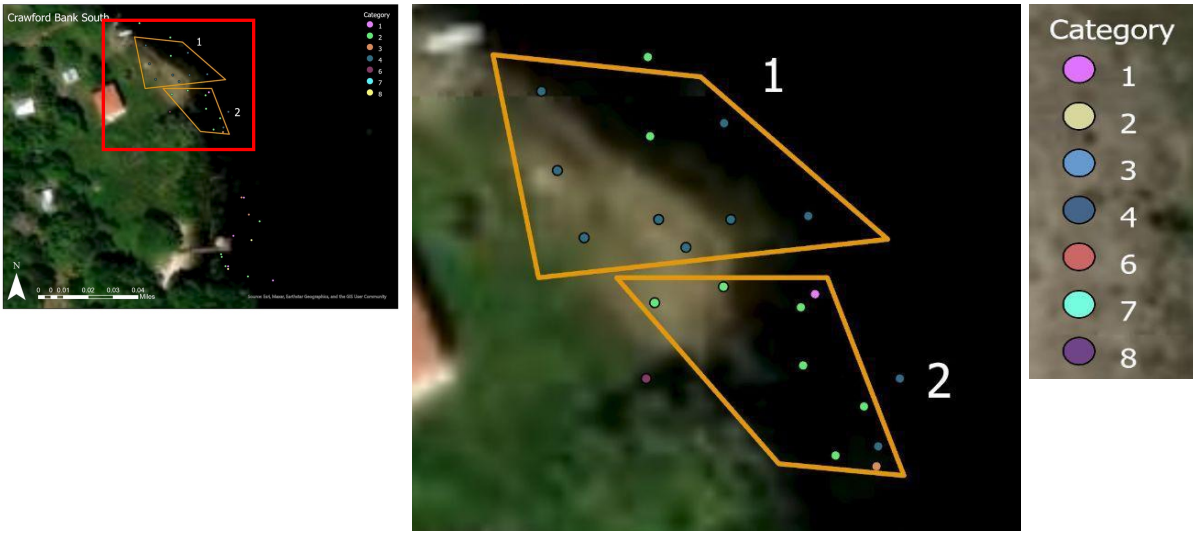

Figure 15.6 Shovel test pit and surface Collection locations at Crawford Bank South symbolized by category (see Brouwer Burg et al. 2023:Figure 3.10).

Nancy Bight has three main clusters in artifact category data (**Figure 15.7**). The first (labeled 1) is a line of negative shovel test pits to the north of the site. Cluster 2 is also made up of mostly negative locations. This is important to note because it demonstrates where artifacts are not. More investigation could help to reveal why there are no artifacts in these places when there is a dense cluster of artifacts nearby. Cluster 3 is directly to the east of Cluster 2 and continues the pattern of dense clusters of debitage very close to the edge of the lagoon with very few chipped tools nearby. Category 2 locations also continue south down the shoreline with a similar distribution of chipped tools.



Figure 15.7 Shovel test pit and surface collection locations at Nancy Bight symbolized by category (see Brouwer Burg et al. 2023:Figure 3.9).

Unfortunately, there is not much data from Oklahoma Pond, making it difficult to find any patterns at this site (Brouwer Burg et al. 2023:Figure 3.14). All shovel test pits were negative, and two chipped tools were found on the surface (Brouwer Burg et al. 2023:Table 3.11). Also, Oklahoma Pond itself may not be very old according to local knowledge. The two chipped tools at the site could have been moved there by human activity, as the ground surface seemed disturbed and a local informant suggested that human construction or development could have taken place in the area.

Least Cost Path Analysis

The Least Cost Path analysis shows that chert is relatively easy to find near Crooked Tree Island, even though it is not naturally occurring on the island itself. As seen in **Figure 15.8**, the closest chert-bearing soils are within 3-5 km of the island, and paths to and from these chert sources do not change drastically from the dry to the wet season. This implies that high quality chert from the NBCZ was a relatively accessible resource year-round. This idea is strengthened

by the ubiquity of high-quality chert artifacts recovered from many sites with Archaic artifacts on Crooked Tree Island, including the ones described above.

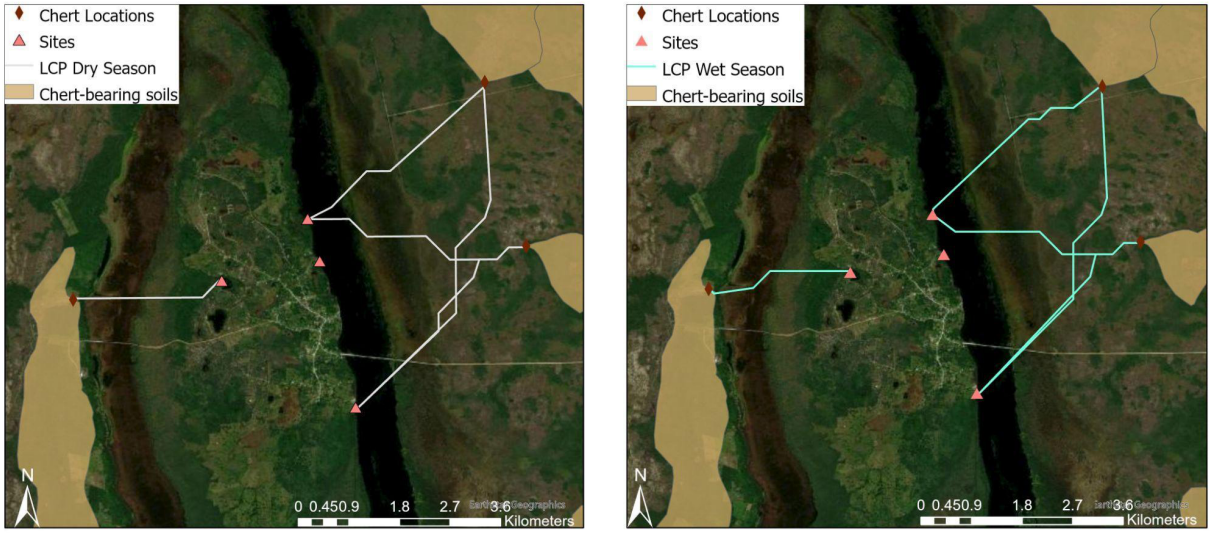

Figure 15.8 Least cost path projections between chert sources and sites discussed above.

Interpretations and Discussions

The most striking spatial pattern found in this study is the number of locations with abundant chert debitage but very few or no formal chipped tools. This pattern can be seen at all three sites located on the shore of Crooked Tree Lagoon (i.e., Nancy Bight, Crawford Bank South, and Birds Eye View), but is most pronounced at Birds Eye View. This suggests that tools were being resharpened in these areas, while the tools themselves were removed and presumably discarded elsewhere in the course of other activities. The diverse microenvironments surrounding these sites, as well as the lagoon itself, provide a broad array of resources that would have been attractive to Archaic populations, so these debitage scatters may represent the remnants of resource extraction locales where stone tools with a sharp cutting edge were required (see Brouwer Burg and Harrison-Buck 2024).

Before any definitive conclusions can be made, however, we must emphasize the fact that all three of these "sites" have likely been disturbed by various post-depositional processes over the course of the last ~3000 years. Sediment studies from Western Lagoon have shown that it was a perennial wetland until about 2000 BCE, and then transitioned into a seasonally wet/dry system (see Harrison-Buck et al. 2024). It is likely that Crooked Tree Lagoon underwent a similar transition although the lagoon has not fully dried up in recent memory and always retains a decent-sized channel of freshwater, according to locals. In addition to its proximity to Black Creek, which connects the system to the Belize River, it appears that Crooked Tree Lagoon was always characterized by higher energy water events capable of translocating artifacts far from their original locations (Brouwer Burg, Harrison-Buck, and Krause 2023). The back-and-forth

movement generated by the lagoon filling and draining could and likely did dislocate artifacts regularly over the years, mixing and churning them in the surrounding matrix.

Based on the data gathered here and the issues discussed above, it is difficult to tell what these sites with Archaic components may have been used for, or whether any of the artifacts found were in their original context. However, by comparing the five sites included in this study to each other, some interpretations can be made. The distribution of artifacts at Joe Goff is noticeably different from those of Nancy Bight, Crawford Bank South, and Birds Eye View, which share certain similarities. The clusters of artifacts at Joe Goff include both formal tools and chert debitage, while the clusters at the other three sites are mostly positive for debitage, with relatively few formal tools found. This could reflect differences in site use, post-depositional processes, or, most likely, both. Oklahoma Pond was nearly sterile when compared to the other sites, which may reflect its infrequent or nonexistent Archaic occupation. The three sites on the lagoon are also very close to the site of Crawford Bank, where the BREA team found a diagnostic Archaic Lowe point (Harrison-Buck et al. 2018); further analysis of this assemblage revealed that chipped tool production most likely did not take place at Crawford Bank based on the types of flakes and debitage found at the site (Stemp and Harrison-Buck 2019:2). More in-depth data collection and analysis is needed at Nancy Bight, Crawford Bank South, and Birds Eye View; however, it is possible that the same is true for these sites, given the similarities in location and environment.

This study only scratches the surface of the complexity of these sites. More data collection and in-depth analysis is needed to make definitive conclusions, but the spatial patterns discussed here could be used in future operations to inform excavation placement and understanding of post-depositional processes.

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Chapter 16

Future Directions for BREA

Eleanor Harrison-Buck and Marieka Brouwer Burg

Research conducted by the Belize River East Archaeology (BREA) team over the last 13 years has expanded our understandings of the deep history of human-environment interaction in this area over the last 6,000 or so years—from the Archaic, or preceramic, groups that originally inhabited the region, to the Maya and onto the subsequent Contact period and its successive colonial incursions (Brouwer Burg and Harrison-Buck 2024; Brouwer Burg, Harrison-Buck, and Krause 2023; Harrison-Buck et al. 2017, 2018, 2020). Quite apart from the settlement vacuum proposed by Chase and Garber (2004) for the mid-to-lower Belize Valley, this area has been inhabited for generations by Maya, their Archaic predecessors, and their many, many descendants who continue to live and thrive there today.

Our work in 2023 added significant information to our understandings of human-landscape interactions in the lower reaches of the Belize River watershed, specifically in the Crooked Tree Wildlife Sanctuary (CTWS). Our reconnaissance in this area has identified numerous ancient Maya sites between Chau Hiix and Altun Ha (**Figure 16.1**)—two of the largest Maya centers in this area of the watershed (Buck and Murata 2020; Buck, Murata, and Robinson 2022; Murata et al. 2018; Norris et al. 2015). Taking a long view of this deep history, our project has focused on identifying the physical, natural, and cultural factors that attracted people to this area for millennia. Water is a critical resource that this area has largely in abundance, as these wetlands serve to accommodate seasonal flooding of the Belize River and the lagoons were rich sources of aquatic species that were mass harvested likely at the change from dry to wet season (Harrison-Buck 2014, 2021; Harrison-Buck et al. 2018, 2024). During dry season and extended droughts, the lagoons of the CTWS likely remained a reliable source of freshwater, as there are some springs in the area. Undoubtedly, the rich ecology and high biodiversity was the primary reason for the persistent occupation in the CTWS. In the area, we count at least six different ecosystem types: lowland broadleaf moist forest, lowland broadleaf moist scrub forest, savanna, shrubland, mangrove/littoral swamp, wetland/riparian zones, in addition to the open water habitats of the lagoons, streams, and rivers crisscrossing the CTWS.

People in the past must also have been drawn to the rich, arable margins of the wetlands, which were conducive to not only fish-trapping, but also wetland agriculture (Harrison-Buck et al. n.d.). We note that many of the larger Maya settlements in the area are located in proximity to wetlands (e.g., Chau Hiix, Chulub, Ek'Tok, Jabonche, and Xtabentun). One of the most valuable resources for both the Maya and Archaic peoples in this area is the Northern Belize Chert-Bearing Zone (NBCZ), which consists primarily of a scrub forest where fine quality honey brown chert can be quarried and made into excellent tools (Brouwer Burg and Harrison-Buck

2024). Additionally, there are parts of this region where brackish lagoons were attractive to the Maya for salt production, likely via the leaching of salty soils (Murata 2023).

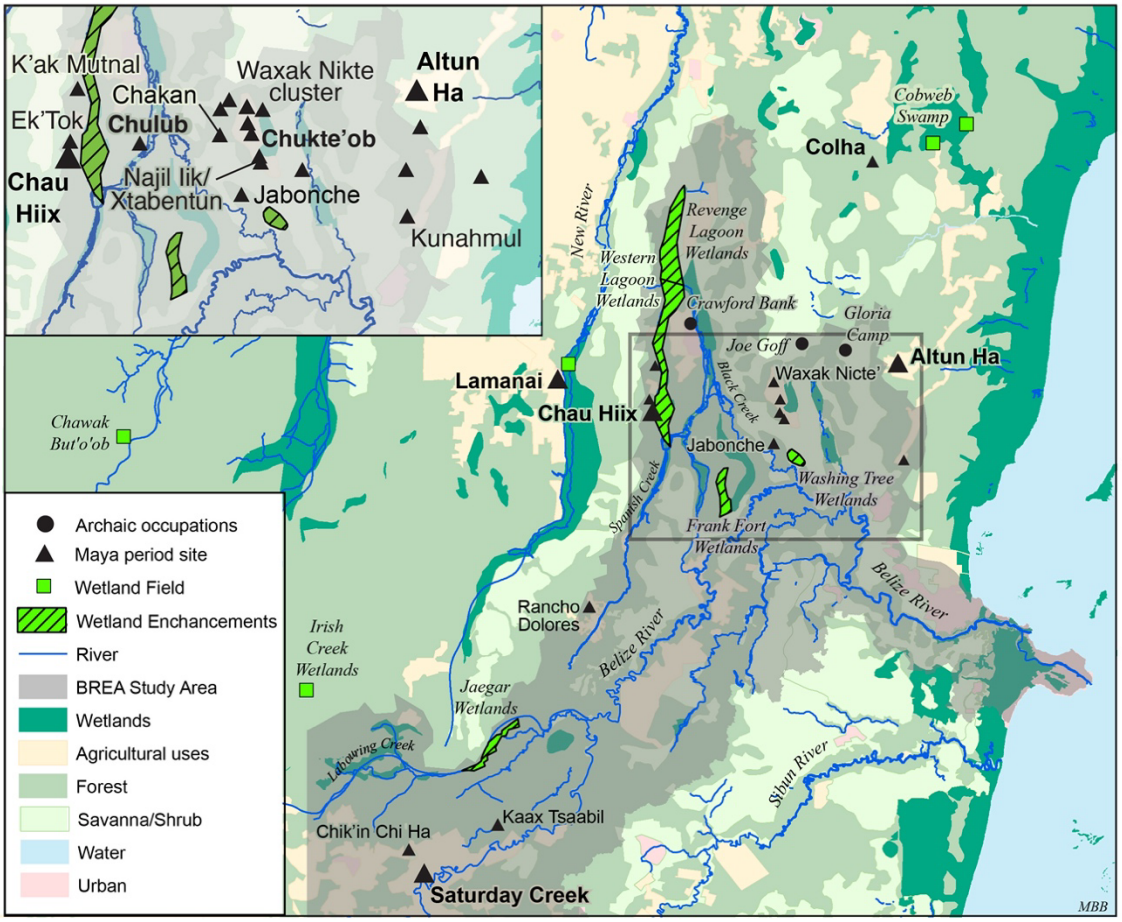

Figure 16.1 Belize River East Archaeology (BREA) project area with sites discussed in text (map by M. Brouwer Burg).

To study these many different aspects of human life in the past, we have gathered an interdisciplinary research team, with experts in archaeology, geomorphology, geoarchaeology, ecology, fauna, remote sensing and geospatial analytical sciences. The expertise of these consultants shows in the types of research questions we have pursued as well as the level of nuanced analyses and interpretations we have produced in the chapters of this report.

Future Research Objectives

In our future research, we will continue to focus on examining the interactions between past human groups and their surroundings and will continue to investigate the archaeology in these various environments and the long-term occupation—from Archaic to Maya times. We

will focus primarily on sites in 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 (Harrison-Buck 2014 [see **Figure 16.1**]). Our future program of research will continue to be centered around two separate but complementary components of research aimed at documenting two different periods of history—the pre-ceramic and the Maya. Below, we discuss our future goals regarding these two components of research for the upcoming field seasons.

Archaic Occupation

The pre-ceramic period is a component of the BREA research that has grown in importance since it was first recorded in 2017 at the Crawford Bank site located along the shores of the Crooked Tree Lagoon (Brouwer Burg and Harrison-Buck 2024; Brouwer Burg, Harrison-Buck, and Krause 2023; Harrison-Buck et al. 2018, 2020, 2024). We plan to continue our search for Archaic occupation throughout the CTWS—a protected 167 km^2 area of fresh and brackish lagoons connected by streams and seasonal wetlands. Among these wetlands is Western Lagoon, which contains a series of modified linear canal features, which were first reported by K. Anne Pyburn (2003) in the vicinity of Chau Hiix (see **Figure 16.1**). In 2019, we excavated a series of these canals (Krause et al. 2020) and dated the canals using 26 radiocarbon dates, which indicate that they were initially constructed by Archaic inhabitants and continued to be used by their Formative Maya descendants (approximately 2000 BCE to 200 CE). Our investigations relied on remote sensing imagery and revealed a vast network of linear channels and ponds in the CTWS (**Figure 16.2**). These linear canals and ponds resemble ancient fish-trapping facilities documented in the Bolivian Amazon (Blatrix et al. 2018; Erickson 2000). Yet, the CTWS fish-trapping facilities predate these Amazonian examples by a thousand years or more. We have just published the results of this study, which shows that this vast network of canals and ponds were designed to channel annual flood waters into source ponds for fish trapping and are the earliest large-scale Archaic fish-trapping facility ever recorded in Central America (Harrison-Buck et al. 2024). Our aim in future research is to continue to test for Archaic occupation along the shoreline of the Western Lagoon to identify the inhabitants who constructed and used these landscape-scale features for fish-trapping.

The Western Lagoon is one of several inland wetlands in the CTWS that is situated within a mosaic of other environments, including lowland broadleaf forests, mangrove swamps, and pine savannas. Our current research has been focused on understanding human-environment interactions and change over time in this highly biodiverse patchwork of ecosystems, documenting the use and modifications of seasonal freshwater lagoons and wetland environments, as well as so-called 'marginal' landscapes (e.g., savanna and shrubland). In recent years, we developed a predictive geospatial model that allows us to identify areas that rate "highly suitable" areas for Archaic occupation (see red areas in **Figure 16.3**); the results of this

novel geospatial application were recently published in the *Journal of Anthropological Archaeology* (Brouwer Burg and Harrison-Buck 2024).

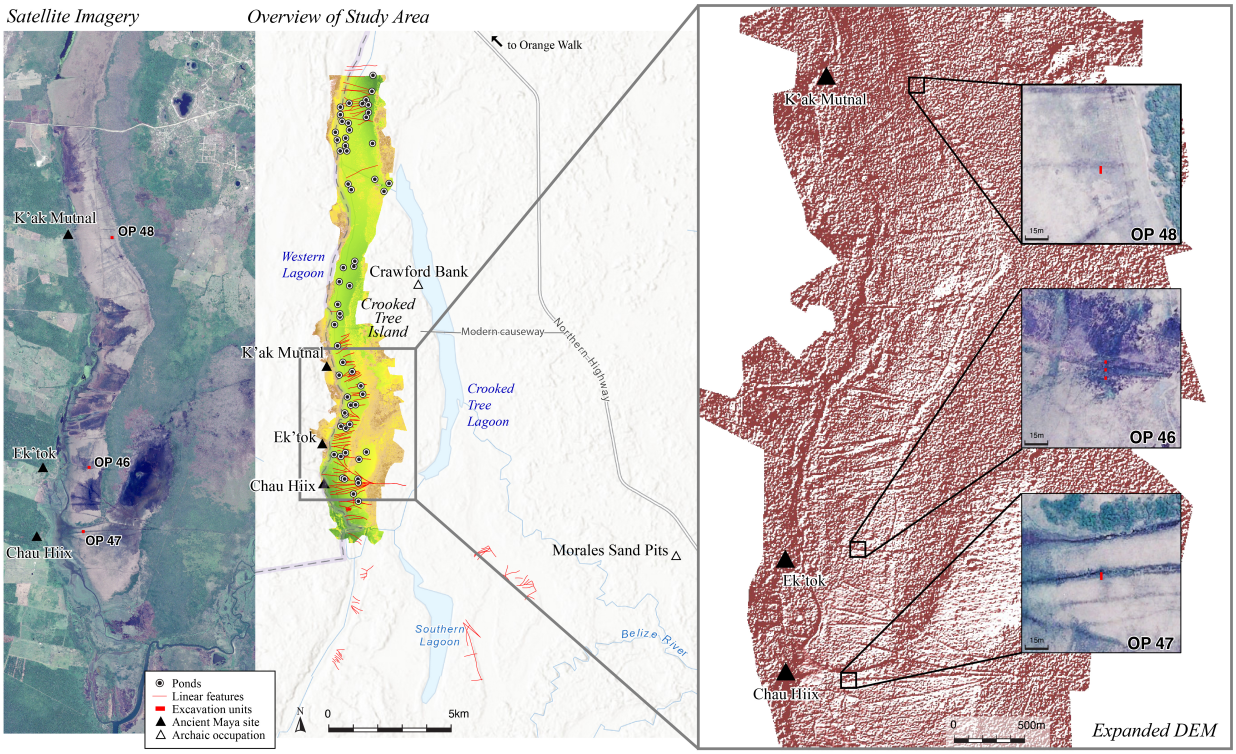

Figure 16.2 Linear canal features in Western Lagoon along with previous excavations carried out by BREA. Note locations of sites mentioned in text (map by M. Brouwer Burg).

These "hot spots" cluster in ecotonal areas and may have been preferred locales for Archaic habitation as they are proximate to wetlands with available water, contain stands of hardwood and sandy soils conducive for growing root crops like manioc, and have raw material for stone tools within easy reach. Archaic habitation sites noted elsewhere, such as the Lowe Ranch and Ladyville sites are located in similar environments and are also proximate to the coast (**Figure 16.3;** Kelly 1993; MacNeish 1981, 1982; MacNeish et al. 1980; MacNeish and Nelken-Terner 1983).

During field reconnaissance in 2024, we plan to ground-truth some of the high suitability areas from our geospatial study located in the ecotonal environments found around the CTWS, including the wetlands around Washing Tree village where one of these hotspots is located (**Figures 16.2** and **16.3**). Given its proximity to water, hardwood, and savanna (hunting grounds), we suspect that the area likely has Late Archaic occupation. As part of our future field work, we plan to conduct a series of shovel test pits and, if sites are identified, will carry out targeted test excavations to approximate a) the vertical and horizontal breadth of any Archaic lithic scatters, b) whether we can identify stratified deposits and perhaps dateable material, and c) if other diagnostic artifacts are present. Well-dated Archaic deposits are very rare in Belize and

thus, this occupation has the potential to add another key line of evidence to our paltry understandings of the Archaic lithotechnological complex.

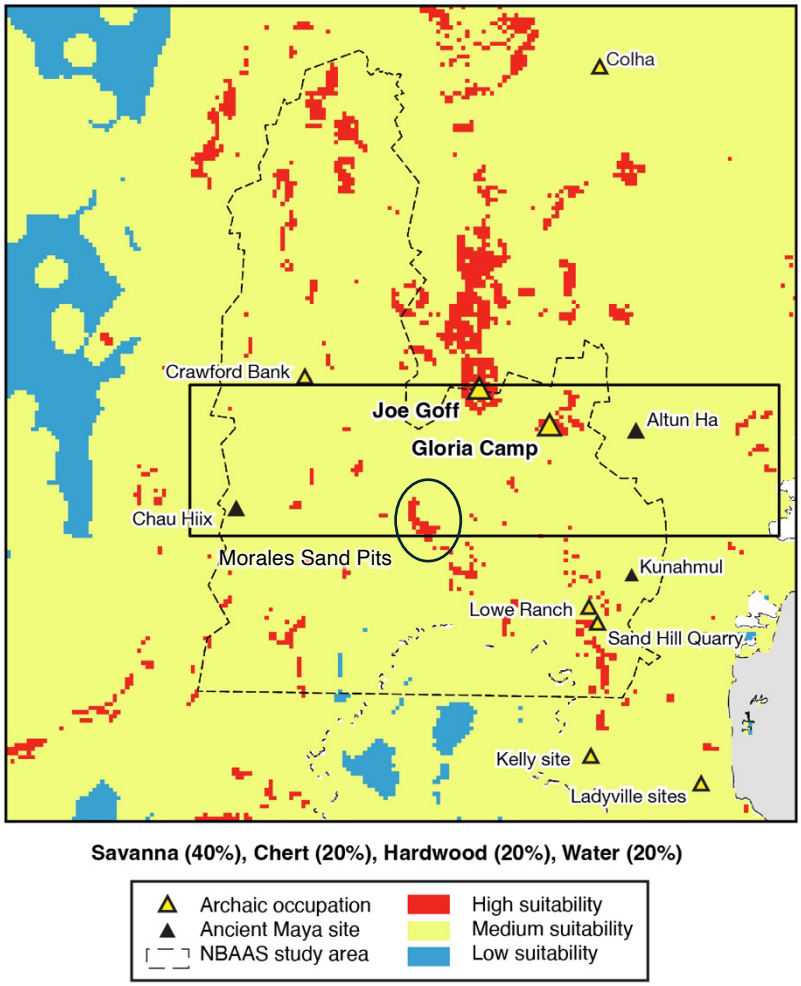

Figure 16.3. **Map showing transect with high suitability areas for Archaic occupations (map by M. Brouwer Burg).**

We also hypothesize that the "high suitability" areas around Joe Goff and Gloria Camp as well as those closer to the coast may comprise multiple Archaic activity areas, ranging from quarrying and tool production to habitation sites. While surface finds and test excavations at Joe Goff and Gloria Camp show evidence of the quarrying and tool production, we have not yet firmly identified in this area any evidence of habitation. Therefore, we plan to carry out more extensive shovel test-pitting in the vicinity of both sites during the 2024 field seasons. If sites are identified in the "high suitability" areas here or closer to the coast, east of Altun Ha, we will target these areas for select test excavation. If the Lowe Ranch and Ladyville Archaic sites can serve as a point of comparison, we anticipate that excavations will reveal a range of activities, including artifacts like ground stone bowls indicative of food-processing and possible longer-

term habitation. To gain insight into the Archaic diet, any ground stone artifacts we find will be tested for starch grain analyses.

Maya Occupation

The second component of our research builds on our prior investigations examining the deep history of human-environment interactions in the lower Belize River watershed, focusing on the documentation of ancient Maya settlement in this area. The BREA study area encompasses two major ceremonial sites—Chau Hiix and Altun Ha (**Figure 16.1**). In the last several years, we have carried out survey and reconnaissance of settlement in an east-west transect between these two dominant centers. To the west, in the vicinity of the modern-day community of Biscayne, we have documented three secondary Maya centers (i.e., Xtabentun, Jabonche, and Waxak Nicte') as well as a number of minor site centers (Ek'Tok and Kunahmul) and numerous peripheral hamlets and production sites (Chulub, Najil Iik, Chukte'ob, among others [refer to **Figure 16.1** and see chapters in Brouwer Burg and Harrison-Buck, eds. 2023; Harrison-Buck, ed. 2018, 2020; Harrison-Buck and Brouwer Burg, eds. 2022]).

In the last couple years, our team has successfully incorporated LiDAR-equipped drones as an expedited form of survey, reconnaissance, and mapping of ancient settlement in this area (Willis and Murata 2023). Our team carried out survey and mapping using LiDAR-mounted drones to map the settlement around some of the larger centers, including Jabonche, Xtabentun, and Altun Ha. As a major ceremonial center, Altun Ha was initially mapped with a transit and investigated from 1964-1970 by Dr. David Pendergast (Pendergast 1979, 1982, 1990). During the field seasons in 2022 and 2023, we carried out a series of drone flights over the site and have produced a more accurate map of not only the site center, but also the hinterland settlement surrounding the site core (**Figure 16.4**).

During the course of our mapping efforts, our team performed ground survey in an area to the west of the main center of Altun Ha just outside of the area that has been developed for tourism. In our preliminary reconnaissance, we were granted permission to access a part of the center west of the main plaza in an area that is now privately owned but was included in David Pendergast's original map of the site. Here, we identified several sizeable range structures, including a couple of new structures not included on his map, and multiple elite plaza groups. Here, we identified a ballcourt (**Figure 16.5**). This pair of structures was mapped by Pendergast as Structures C1 and C2 but at the time was not identified as a ballcourt. We plan to return to Altun Ha in 2024 to excavate this important find, which is currently vulnerable to land clearing. Regular clearing is occurring in this and the adjacent plaza area to the south, which we nicknamed the Brenda Lopez (BL) plaza after the owner. While this area looks like insignificant vacant terrain, during reconnaissance we detected a dense midden of marine shell suggestive of production. In the freshly plowed field, thousands of whole and fragmentary marine shell had been churned up and were visible on the surface. We plan to target this area for testing in future seasons with the hope of finding evidence for finished shell production.

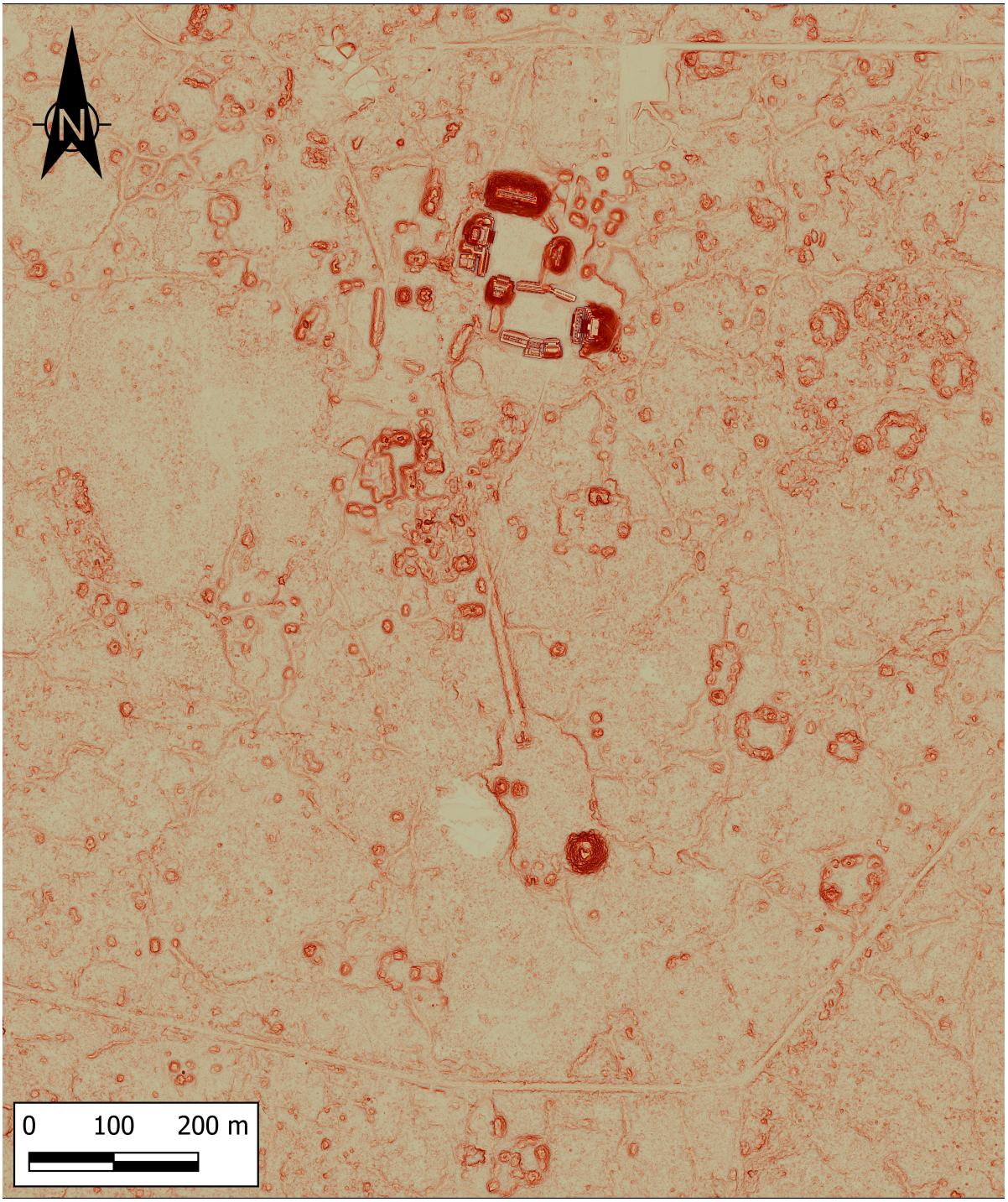

Figure 16.4 LiDAR map of Altun Ha (map produced by M. Willis)

Altun Ha is roughly 10km (more than 6 miles) from the Caribbean Coast. With no pack animals, the transport of this quantity of shell would have involved substantial effort and was likely an ongoing affair, rather than a singular event. Excavation is necessary to clarify why and how so much marine shell was procured and how it was being used in the site core. The surface finds suggest that many of the shells are unworked, indicating that food may have been one of

the primary reasons for its mass harvesting. Altun Ha is located within an expanse of broadleaved moist forest, which could have translated to more arable land in the past, but many of the lagoons around this site are brackish. Given much of the surrounding land around the site today is not under cultivation, it seems questionable whether large-scale maize agriculture was a viable means of supporting the large Maya population that once inhabited this area. The dense marine shell concentration may indicate that aquatic resources were the primary food source, although excavations may also reveal that the shell itself was used, perhaps secondarily, in large-scale craft production activities. In either case, the finds suggest that such marine resources were procured on a large-scale and that aquatic foods, rather than agricultural produce, may have served as the primary subsistence economy.

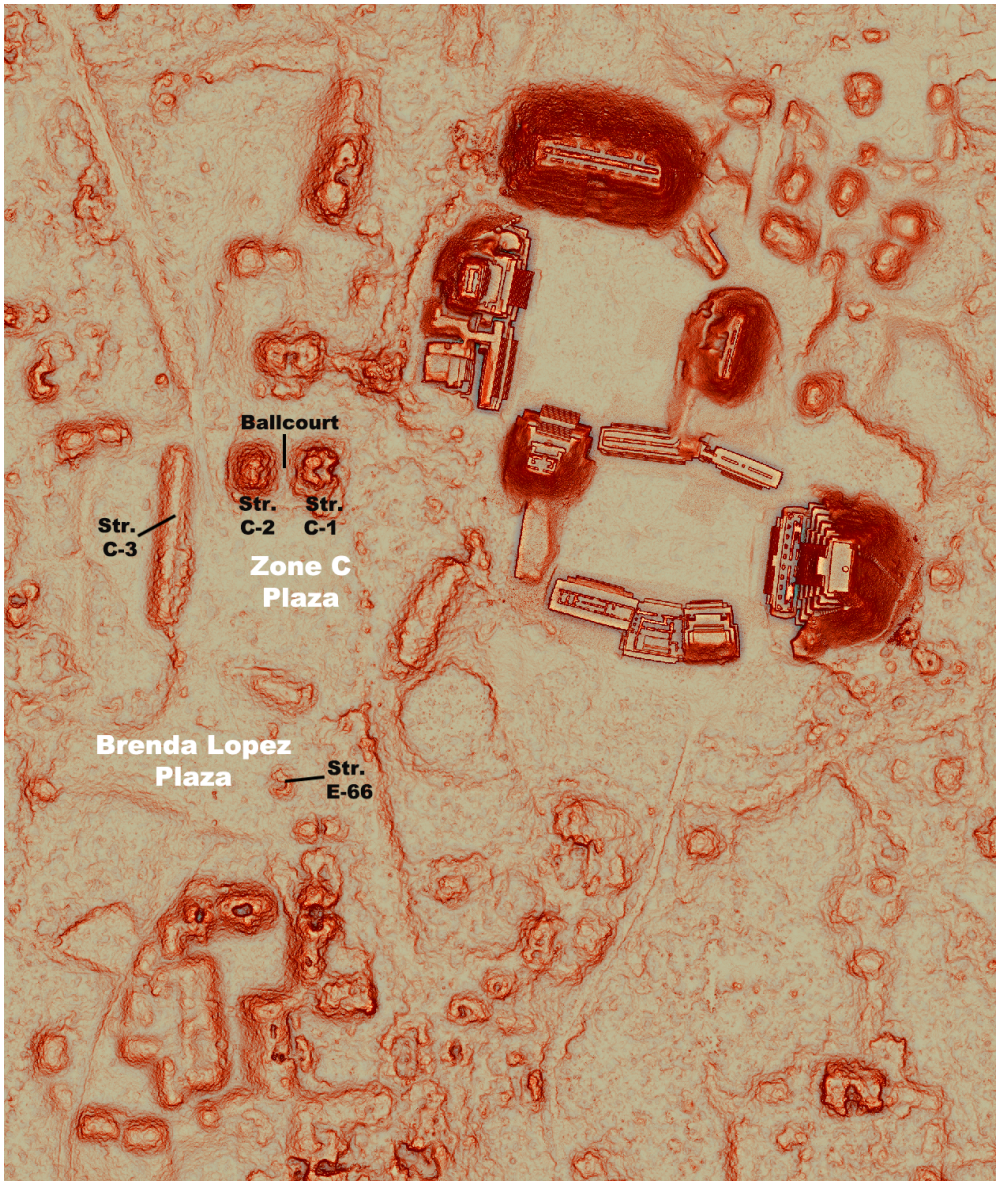

Figure 16.5 Close-up of the area of investigation at Altun Ha (map produced by M. Willis).

A final area we plan to investigate in 2024 is in a lithic production locale, identified roughly 2km west of Altun Ha. We plan to carry out test excavations at Chan Colha, a site with a massive quantity of broken tranchet bit axes and wasters visible on the surface. This dense deposit of solid lithic debris is suggestive of mass tool production. This distinctive type of axe is diagnostic of the Middle Preclassic Maya (ca. 900-500 BCE). Excavations aim to test this thick lithic deposit in 2024 seasons, in the hopes of exposing an earlier Archaic occupation directly below the early Maya occupation.

Concluding Thoughts

One final goal for future field seasons is to develop several new exhibits for the Crooked Tree Museum and Cultural Heritage Center, which features the results of the BREA field work. Since its opening in 2018, we have significantly expanded our understanding of the Archaic and ancient Maya period in the lower Belize River Watershed. Our aim is to expand our Archaic display, which will detail the most recent preceramic findings from the area in and around Crooked Tree. Additionally, we are hoping in the next few years to roll out a special exhibit on the paleoenvironmental reconstructions that we have carried out over the last five years, detailing the process for analyzing sediments and other aspects of the surrounding landscape. The Crooked Tree Museum and Cultural Heritage Center will continue to provide an important space for telling the story of human-environment interaction through time in the lower Belize River Watershed and for sharing this rich history with the community, now and in the future.

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