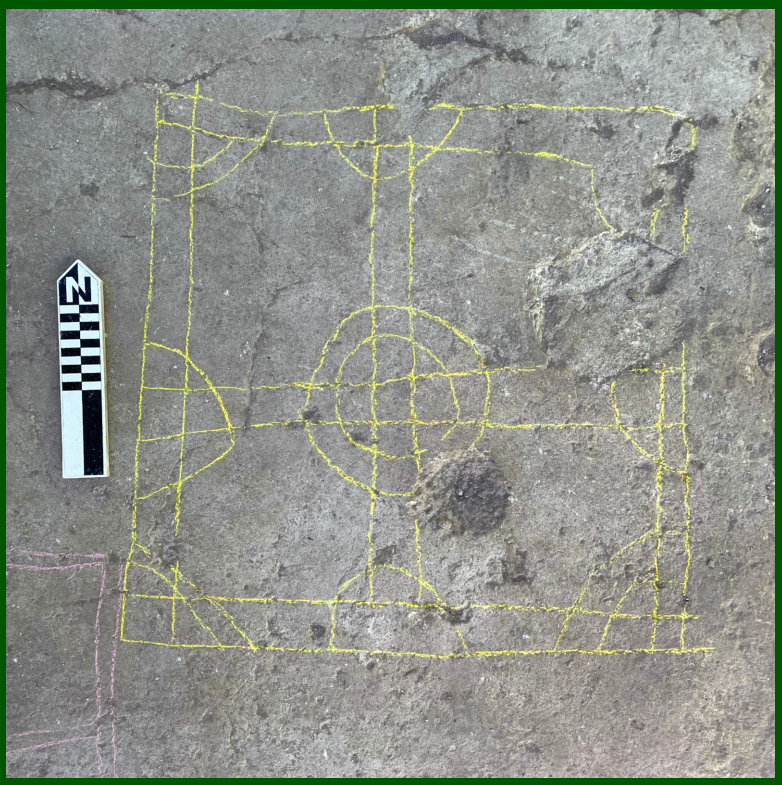
The 2022 Season of the Belize Estates Archaeological Survey Team

EDITED BY

Brett A. Houk



Papers of the
Chan Chich Archaeological Project,
Number 15
Texas Tech University • Lubbock, Texas
2022

Belize Estates Archaeological Survey Team

BEAST

Orange Walk District, Belize, Central America

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EDITED BY

Brett A. Houk

WITH CONTRIBUTIONS BY

Gabrielle Blowers
Leann Castillo
Alexandra Cox
Bridgette Degnan
Anna DesHotels
Tomás Gallareta Cervera
Brett A. Houk
Anna C. Novotny
Claire Novotny
Tera Stocking

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Chan Chich Archaeological Project

CCAP

Chan Chich, Belize - Central America

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Department of Sociology, Anthropology, and Social Work
Texas Tech University • Lubbock, Texas

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Cover art: Photograph of patolli Board 8 at Gallon Jug Structure B-4 by Brett A. Houk.

Acknowledgments

Well, that was weird. The 2022 season of the Belize Estates Archaeological Survey Team (BEAST) and the Chan Chich Archaeological Project (CCAP) should have happened in 2020 and then again in 2021. Twice canceled, we finally returned to the field in May 2022 to find a great many things changed. To say that 2022 ran smoothly would be unkind to the truth; but, to quote Tomás Gallareta's July 25 Instagram post, "That was hard; we made it through the field season!" This report, our first to be published since 2019, wraps up the 2022 field season, not with a bow but with a bandage.

We could not do our work without permission from the Government of Belize and the landowners. We extend our gratitude to Dr. John Morris at the Institute of Archaeology (IA) in Belize for being a longtime supporter of our research. Dr. Morris retired from the IA in 2022, and, although he met with me to go over our permit application, Dr. Melissa Badillo, the Interim Director of Research, signed our permit, for which we are grateful. We look forward to working with Dr. Badillo in 2023! The other staff members at the IA provided assistance throughout the summer season, including Josue Ramos and Antonio Beardall.

Malcolm Robinson, the general manager of Gallon Jug Estate, kindly granted us permission to excavate at Chan Chich and Gallon Jug in 2022. We would also like to thank Michael Bowen and Bowen & Bowen, Inc. for tolerating us for another season and for once again letting us use Chan Chich Lodge as our field camp. At Chan Chich Lodge, Anabella De La Rosa, Esmerelda De La Rosa, Emil Flota, and Elijio Coh facilitated our stay. We would like to thank all the staff at the lodge and in Gallon Jug for being kind and helpful to our group. At Gallon Jug, Anivar Bolanos helped us coordinate with workers from Sylvester Village. Darby McPhail and David Lugo, the field directors for the Virginia Tech's Belize Jaguar Project, provided helpful advice and shared their shape files with us.

John Morris, representing Texas Tech, and Brett Houk at the Institute of Archaeology in Belmopan.

The project staff for the season included Gabrielle (Gabi) Blowers, Leann Castillo, Alexandra (Alex) Cox, Anna DesHotels, Bridgette Degnan, Tomás Gallareta Cervera, Claire Novotny, Anna C. Novotny, Tera Stocking. Oscar, Tomás's and Claire's 21-month-old son, served as the project's mascot, Covid-vector, and ambassador to the world at large.

The BEAST project staff in 2022. From left to right: Brett Houk, Alex Cox, Tera Stocking, Bridgette Degnan, Leann Castillo, Anna DesHotels, Gabi Blowers, Claire Novotny, Oscar, Anna Novotny, and Tomás Gallareta Cervera.

The 2022 summer season marked the fifth with funding from the Alphawood Foundation. I would like to thank the board of directors of Alphawood for funding the project. Although she no longer works for Alphawood, Kristin Hettich was tremendously helpful and a huge advocate for the archaeology portfolio at Alphawood while she was there. I cannot overstate her importance to the success of our research.

As always, we could not have accomplished anything in the summer without the assistance of our field and lab assistants. This summer, those were Delita Coh, Denbert Moh, Edmil Moh, Edwardo Olivarez, Elias Romero, Esmeralda De La Rosa, Fidel Alvarado, Hipolito Moh, Jacinto Villamil, Jermi Diylin Serminia, Jerry Serminia, Jerviany Serminia, Jezron Carrillo, Johnny Carcamo, Jose Aquino, Jose Cortes, Josselyn Olivarez, Julian Velasquez, Kristopher Majarrez, Leonardo Moh, Levy Blanco, Lohanny Cordova, Luis Romero, Luis Romero, Jr., Lusbin Monroy, Manuel Cordova, Marie Ical, Miguel Velasquez, Nahaman Gutierrez, Narciso Pott, Petrona Ical, René Castro, Rudy Thompson, Shaliny Moh, Vidal Ku, Wayne Tush, Yorling Gutierrez, and Zair Perrera.

As we close the door on 2022, we can peek into 2023 by thanking Dr. Juan C. Fernandez Diaz at Darren Hauser at the National Center for Airborne Laser Mapping at the University of Houston for collecting lidar data from our

The BEAST project staff and field assistants on the final day in the field. Front row (left to right): Jacinto Villamil, Edwardo Olivarez, Lusbin Monroy, Vidal Ku, Wayne Tush, Hipolito Moh, Anna DesHotels, Anna Novotny, Bridgette Degnan, Leann Castillo, Alex Cox, Claire Novotny, and Gabi Blowers. Back row (left to right): Brett Houk, Jose Cortes, Rudy Thompson, Nahaman Gutierrez, Tera Stocking, Lohanny Cordova, Marie Ical, Petrona Ical, Jerviany Serminia, Luis Romero, Jr., Johnny Carcamo, and Tomás Gallareta Cervera.

permit area in May 2022. Although we have included a few lidar teaser images in this report, our analysis of the data is only just beginning. We'll save that discussion for 2023. We also want to thank Jason Yaeger at the University of Texas at San Antonio for coordinating with Juan and Darren and the other Principal Investigators involved in the lidar campaign. Additionally, we are looking forward to working with Dr. Elma Kay, the Managing Director of Belize Maya Forest Trust (BMFT), next year. BMFT owns the land on which many of the sites we hope to inspect in 2023 are located.

Finally, the authors of the chapters in this report deserve thanks for all their hard work. Writing technical reports is a labor of love. Ray Wallace kindly produced several lidar visualizations included in the report. Dr. David Lentz at the University of Cincinnati examined two samples from Norman's Temple for us, and we are extremely grateful.

Adios, 2022. Don't let the door hit you on the way out.

Brett A. Houk, December 30, 2022

An Introduction to the ~~2020~~ ~~2021~~ 2022 Season of the Belize Estates Archaeological Survey Team and the Chan Chich Archaeological Project

Brett A. Houk

This report details the preliminary results of the ~~2020~~ ~~2021~~ 2022 season of the Belize Estates Archaeological Survey Team (BEAST) and the Chan Chich Archaeological Project (CCAP). Covid-19 and the ensuing global shutdown canceled the planned 2020 and 2021 seasons. May 30, 2022, marked our delayed and somewhat rocky return to fieldwork. A minor Covid outbreak among our research team, poor weather conditions, incompetence on the part of Howard University, and post-pandemic brain fog all impacted our work in 2022, but we ultimately survived a short 5-week long field season and accomplished many of our modest goals. Also twice delayed, we had a successful mission to collect light detection and ranging (lidar) data in May 2022 that was part of a multi-project campaign by the National Center for Airborne Laser Mapping (NCALM) at the University of Houston. It is too early to report on the results, but maps generated from the lidar data pepper the chapters in this report.

This report summarizes the preliminary results of the 2022 field season. This chapter includes details on dates, staff, permits, funding, and so on; examines the difficulties we faced restarting our work; provides a teaser of the beautiful lidar we acquired in 2022; and presents short summaries of the 2022 investigations.

RESEARCH AREA

As established by the Institute of Archaeology (IA) in June 2014, the CCAP and BEAST permit covers approximately 590 km^2 in northwestern Belize (Figure 1.1). The research area includes Gallon Jug Ranch and portions of the newly established Belize Maya Forest Trust (BMFT). Houk and Zaro (2014) discuss the history of land sales that resulted in the configuration of the permit area prior to the sale of Laguna Seca and Yalbac tracts in 2021 to a consortium of more than a dozen conservation organizations, including The Nature Conservancy, which established the BMFT (Global Conservation 2022).

The CCAP and BEAST conducted archaeological work at Chan Chich and Gallon Jug in 2022. Additionally, as discussed below, NCALM collected lidar data over our entire permit area in May 2022.

PROJECT TIME LINE, STAFF, AND CONSULTANTS

The fieldwork phase of the summer session of the project began on May 30, 2022, with the arrival of the project staff (Table 1.1) and ended on July 7, 2022. Our arrival was largely uneventful, even though two junior staff missed their connections and did not reach Belize until May 31. Our departure, however,

Houk, Brett A.
2022 An Introduction to the ~~2020~~ ~~2021~~ 2022 Season of the Belize Estates Archaeological Survey Team and the Chan Chich Archaeological Project. In *The 2022 Season of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 1–16. Papers of the Chan Chich Archaeological Project, Number 15. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

was traumatic. Circumstances forced us to abandon two project members, a baby, and an overheating van in the middle of the jungle with no cell coverage. All the humans survived, but the van did not.

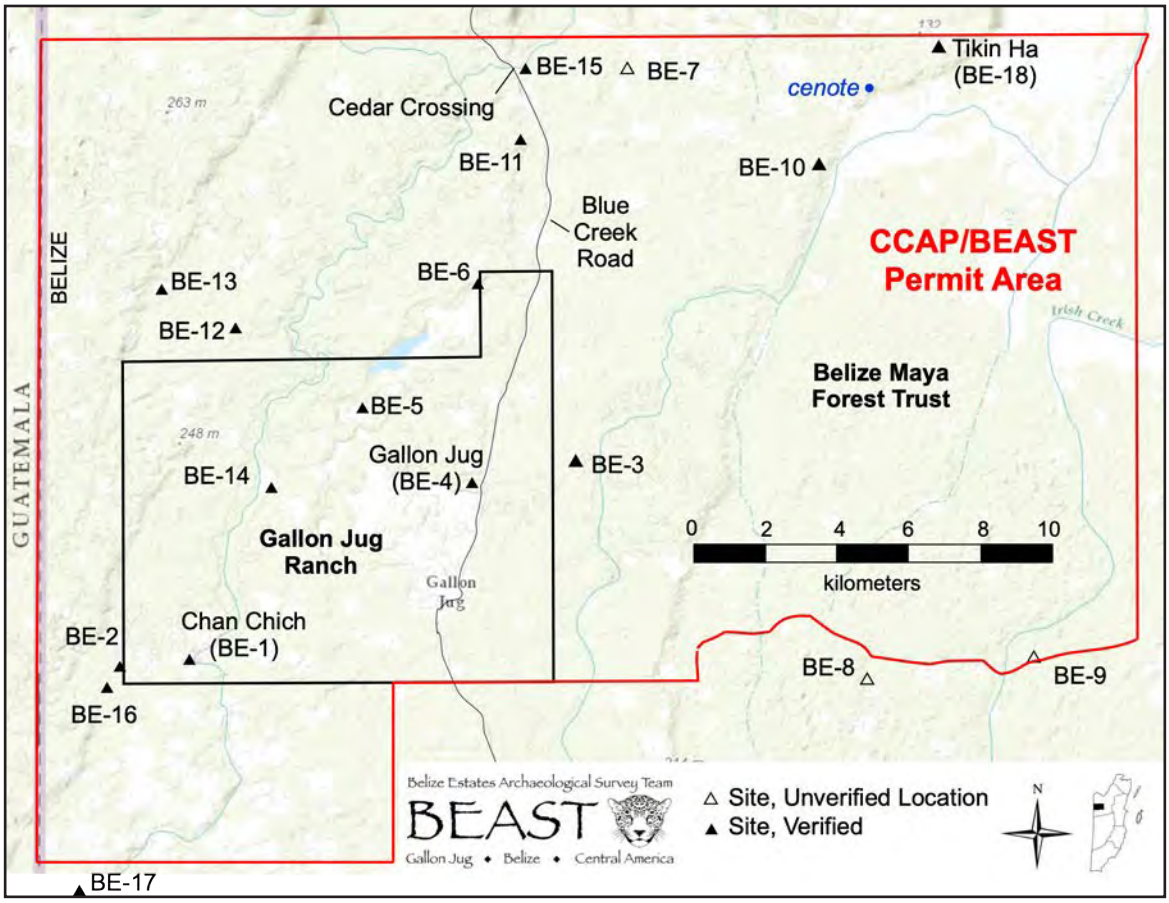

Figure 1.1. Map of the CCAP/BEAST permit area showing the locations of Chan Chich (BE-1) and Gallon Jug (BE-4). See Table 8.1 for a list of BE sites.

Table 1.1. List of 2022 Project Staff

Name	Role	Affiliation
Dr. Brett A. Houk	Project Director	TTU
Gabrielle Blowers	Field Archaeologist	TTU
Leann Castillo	Assistant Bioarchaeologist	TTU
Alexandra Cox	Project Surveyor	TTU
Bridgette Degnan	Operation (Op) Director	UC Santa Barbara
Anna DesHotels	Field Archaeologist	TTU
Dr. Tomás Gallareta Cervera	Op Director/Social Media Director	Kenyon College
Dr. Anna Novotny	Project Bioarchaeologist	TTU
Dr. Claire Novotny	Associate Project Director	Kenyon College
Tera Stocking	Lab Director	University of Kentucky

PROJECT FUNDING AND PERMITTING

Two separate grants from Alphawood Foundation of Chicago supported the lidar campaign in May and the summer field season. Additionally, CCAP is part of a multi-disciplinary team investigating Maya marketplaces at sites across northwestern Belize. That work is funded by a grant from the National Science Foundation (NSF) to Dr. Eleanor King of Howard University. Due to Covid, CCAP was the only project on the grant to operate in 2022, but, unfortunately, Howard University failed to transfer the funds to Texas Tech in time for us to use them this season.

The Institute of Archaeology (IA), part of the Belizean National Institute of Culture and History, issued Permit No. IA/H/2/1/22(10) to Houk for the investigations at Chan Chich and Gallon Jug. At the time the permit was issued, Dr. Melissa Badillo served as Interim Director of the IA. The landowners of Gallon Jug Ranch gave us permission to conduct the research on their property.

CHALLENGES IN 2022

Our return to the field after three years could have gone better and probably could have gone worse. We can break the challenges into the following areas: financial, Covid, labor, and vehicles. Our initial problems began long before we departed the United States for Belize when it proved difficult to establish a sub-award agreement with Howard University and secure the transfer of the TTU share of a collaborative NSF grant. We began the process of setting up the agreement with Howard in December 2021 and received the funds two business days before we departed for the field on May 30, 2022. By this point, we had purchased airfare, paid for room and board, and received an advance for the other related costs, so we were unable to spend any NSF money in 2022.

Our Covid problems included general brain fog among the staff—forgetting how to calculate the hypotenuse of a triangle, for example—and a minor Covid outbreak that began with Oscar, our 21-month-old patient zero, took out his parents (two of the three field supervisors), infected a junior staff member, and spread to Oscar's nanny and the nanny's sister, one of our workers. We were forced to shut down the work at Norman's Temple for a week, and Anna Novotny had to run the excavations at Gallon Jug, while Claire Novotny quarantined.

We have always had trouble finding workers, but the pandemic made things much worse. Everyone who lives on the Gallon Jug property either works for Bowen and Bowen or is a family member of an employee. There is no pool of idle workers sitting around waiting to be hired. Normally, staff at Chan Chich Lodge invite friends and family members to come stay with them and work for us for a month or so, and we had built up a good group of trained excavators who returned each summer. However, after three years with no such opportunities, our core excavators did not return. We were left with a small group of entirely new workers who had no archaeological training. We ended up dismissing 20 percent of our full-time labor force after about two weeks for substandard and unprofessional performance.

Our other source of labor prior to the pandemic was hiring guys from Gallon Jug on the weekends. While this was not ideal—our labor force would literally triple in size on Saturdays and Sundays—we managed to make it work for multiple seasons, and we had some very good excavators working with us on their days off. Three factors changed this in 2022: some of our regular excavators left during the pandemic; Gallon Jug changed its work schedule, requiring some staff to work on Saturdays and Sundays; and the jaguar researchers from Virginia Tech raised their pay rate. Taking those in order, several former project employees, including

the guy who acted as foreman and driver for the weekend crew, left Gallon Jug over the course of the pandemic. His absence created unforeseen complications in getting workers from Sylvester Village to our excavation sites. The second factor, Gallon Jug's changed work schedule, meant that we could no longer predict when guys had days off or how many guys would be available on the weekends. The third factor meant that even long-time team members preferred to work for the jaguar researchers instead of us. When two guys instead of 10 showed up on the first weekend, we learned that Virginia Tech had raised their pay rate, so we matched it to compete for workers. This solved one problem but created another. We were able to hire more guys on weekends, but those same guys asked us to hire their children and/or wives to work in the field. Because we were still short of our labor requirements, we ended up hiring even more workers who had no previous archaeological experience.

A fourth challenge was vehicle related. We had to rent at least one truck that could accommodate an infant car seat for Oscar. We rent our vehicles from a pilot in Blue Creek, and his "fleet" does not include many vehicles that you might consider suitable for a car seat. We ended up with a truck that could just barely fit a car seat, but it overheated and died one day. Its replacement, a beat-up passenger van with only one row of passenger seats and a leaky windshield, had a similar fate. It overheated on the way to the airport on our last day deep in the Yalbac Hills between the Gallon Jug Ranch and Kilo 8, the BMFT gate outside of Spanish Lookout. The five passengers with early flights pressed on in the surviving truck, leaving Oscar and his parents in the jungle with a crippled van, most of our drinking water to fill the van's radiator, and no cell coverage. Thankfully, Chan Chich Lodge was able to send a truck to transport the humans to the airport, and the three managed to catch their flight home. As it turns out, one of the five passengers in the functioning truck had Covid at the time, but luckily no one else contracted the virus despite the close quarters and a shared water bottle.

AN OVERVIEW OF THE 2022 SEASON

Lidar

We have dreamed of collecting lidar data on the CCAP/BEAST permit area for over a decade; Chase et al. (2011) first demonstrated the power of this new technology for investigating the built environment in the dense forests of Belize the year before we resumed our work at Chan Chich in 2012. Although the project has been working at Chan Chich off and on since 1996 and on the BEAST permit area since 2013, we have explored very little of the overall study region. The greatest barriers to conducting survey are the small number of actively maintained roads in our permit area and the fact that we conduct most of our work during the summer, which is the rainy season. Except for a few all-weather roads that link Chan Chich, Gallon Jug Ranch, and Sylvester Village, most "roads" across the property are impassible after the rains start. Lidar, which can map the ground surface from the air, even through the forest canopy, has, until 2022, been an archaeological fantasy for us.

Thanks to a generous grant from the Alphawood Foundation, and after three years of working with NCALM, we finally turned that fantasy into reality. Delayed by Covid in 2020 and by an "off field landing," weather, and bureaucracy in 2021, NCALM successfully flew approximately 650 km^2 for us in May 2022 (Figure 1.2). We are in the early stages of analyzing the lidar data, but already we have identified multiple unrecorded sites with ball courts and/or causeways, areas with dense terracing, large artificial canals, zones of dense settlement, and low-lying areas with apparent raised fields. Marcello Canuto and Francisco

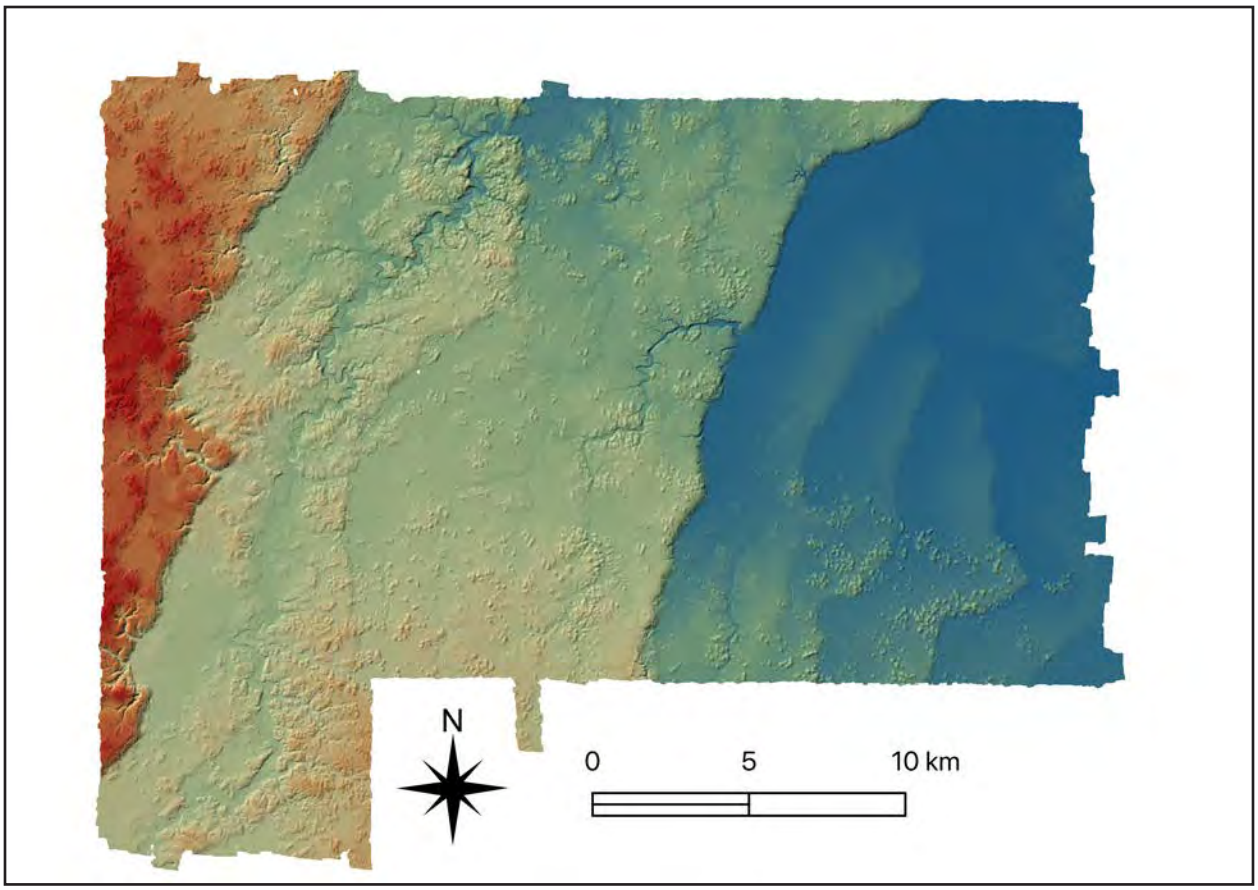

Figure 1.2. A digital elevation model (DEM) of the approximately 650 km^2 of lidar data collected by NCALM over the CCAP/BEAST permit area.

Estrada Belli at the Middle American Research Institute (MARI) at Tulane University are assisting us with creating various visualizations of our large dataset, and students working at MARI's GIS Lab are digitizing visible mounds and features as part of this collaboration. Our lidar team includes Dr. Amy Thompson at The University of Texas at Austin (UT) and Dr. Heather Richards-Rissetto at the University of Nebraska-Lincoln. Through a data sharing arrangement, we are also collaborating with Dr. Tim Beach and Dr. Sheryl Luzzadder-Beach, who are both at UT, and Dr. Kat Brown and Dr. Jason Yaeger, who are both at the University of Texas at San Antonio, on the Booth's River section of our permit area where the potential for raised fields and other hydrological modifications is high.

Our greatest fear was that the lidar data would reveal a large unrecorded group immediately adjacent to Chan Chich—like the "citadel" at El Pilar (Ford 2014)—but, fortunately our original map, based on a theodolite-established grid and made using tape/pace and compass, proved to be pretty accurate. That is not to say that we did not see "new" things in the data around Chan Chich, and we have already identified several features to ground truth in 2023. Notably, the lidar data appear to confirm the presence of an intersite *sacbe* connecting Chan Chich and Kaxil Uinic (Figure 1.3). Tom Harding, the original manager of Chan Chich Lodge, reported that such a feature was visible in satellite images of the area way back in 1996 (Houk et al. 1996), but we have not been able to confirm it in the field.

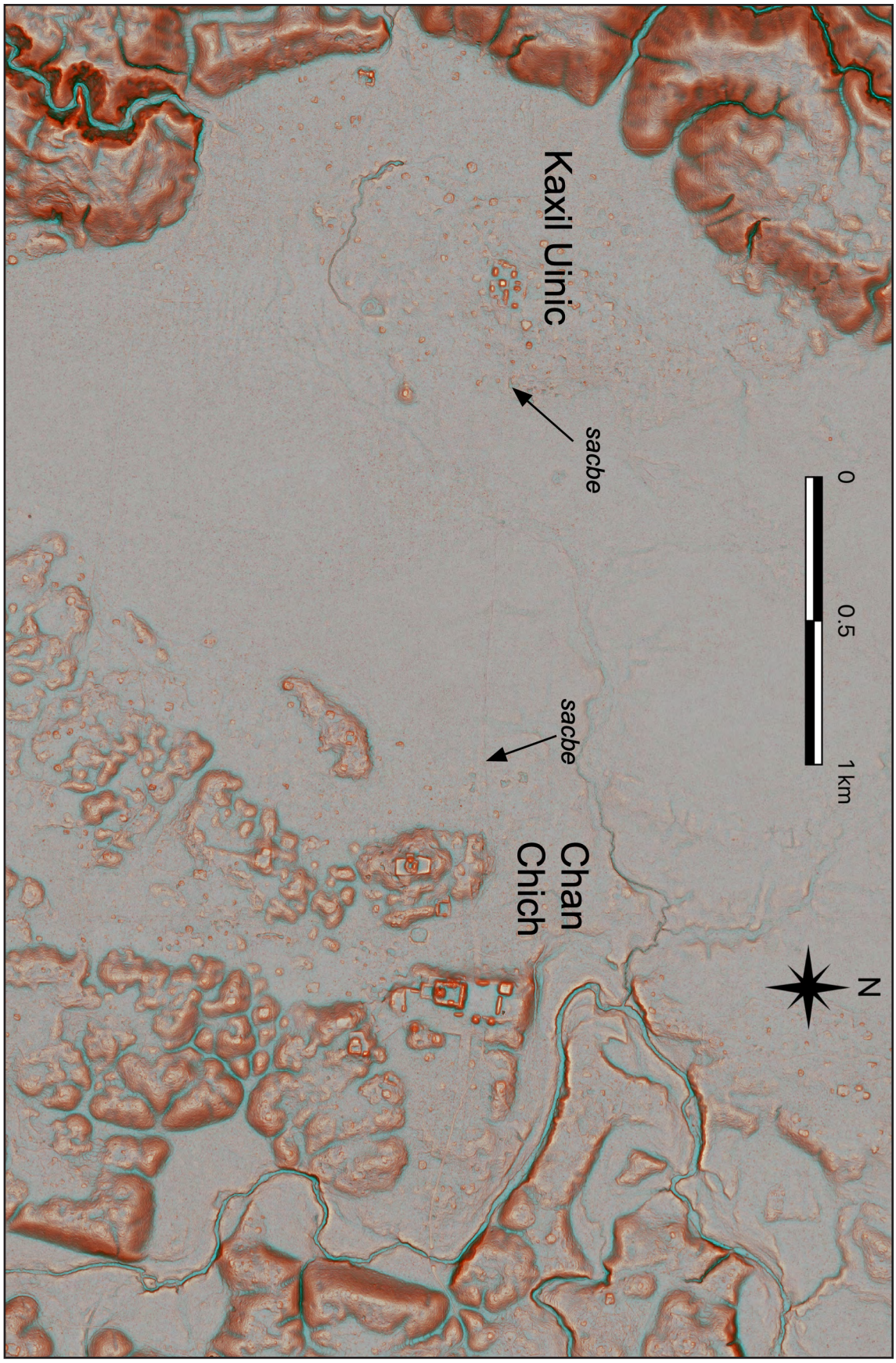

Figure 1.3. Red-relief image map (RRIM) showing Chan Chich and Kaxil Uinic and the *sacbe* connecting the two sites.

The first candidate for ground truthing at Chan Chich is a possible E Group 1.9 km northeast of the Main Plaza (Figure 1.4). While E Groups are common in the Belize River Valley to the south and in the Petén to the west, they are exceedingly rare in northwestern Belize, and we have not yet identified any E Groups in our permit area. The second area of interest is a modified hilltop 900 m southeast of the Main Plaza and 515 m south of Norman's Temple (Figure 1.5a). The hilltop has a square plaza with several low mounds on it and an elevated, attached platform on its western edge. The most interesting feature, however, is an apparent monumental ramp—which may be a modified natural ridge—that runs from the southern edge of the plaza downhill for a horizontal distance of 185 m. We propose to ground truth this feature to determine if it is artificially constructed. The third area of interest is a low hill in the bajo that separates Chan Chich and Kaxil Uinic to the west (Figure 1.5b). Situated about 500 m west/southwest of Norman's Temple, this hill contains four formal courtyard groups. The spatial boundedness of this group of courtyards could indicate they share a related function. Another feature we plan to inspect is a possible canal northwest of the Main Plaza that appears artificial, possibly draining the low-lying area between Norman's Temple and the Upper Plaza into the aguada at the base of the North Plaza (Figure 1.5c).

Beyond the Chan Chich and Kaxil Uinic area, the lidar data show remarkable and wonderful things that archaeologists have never visited. A large site with a double ball court and a causeway (Figure 1.6), *albarradas* or other forms of walls (Figure 1.7; Figure 1.8b), a zone of dense settlement near the base of the

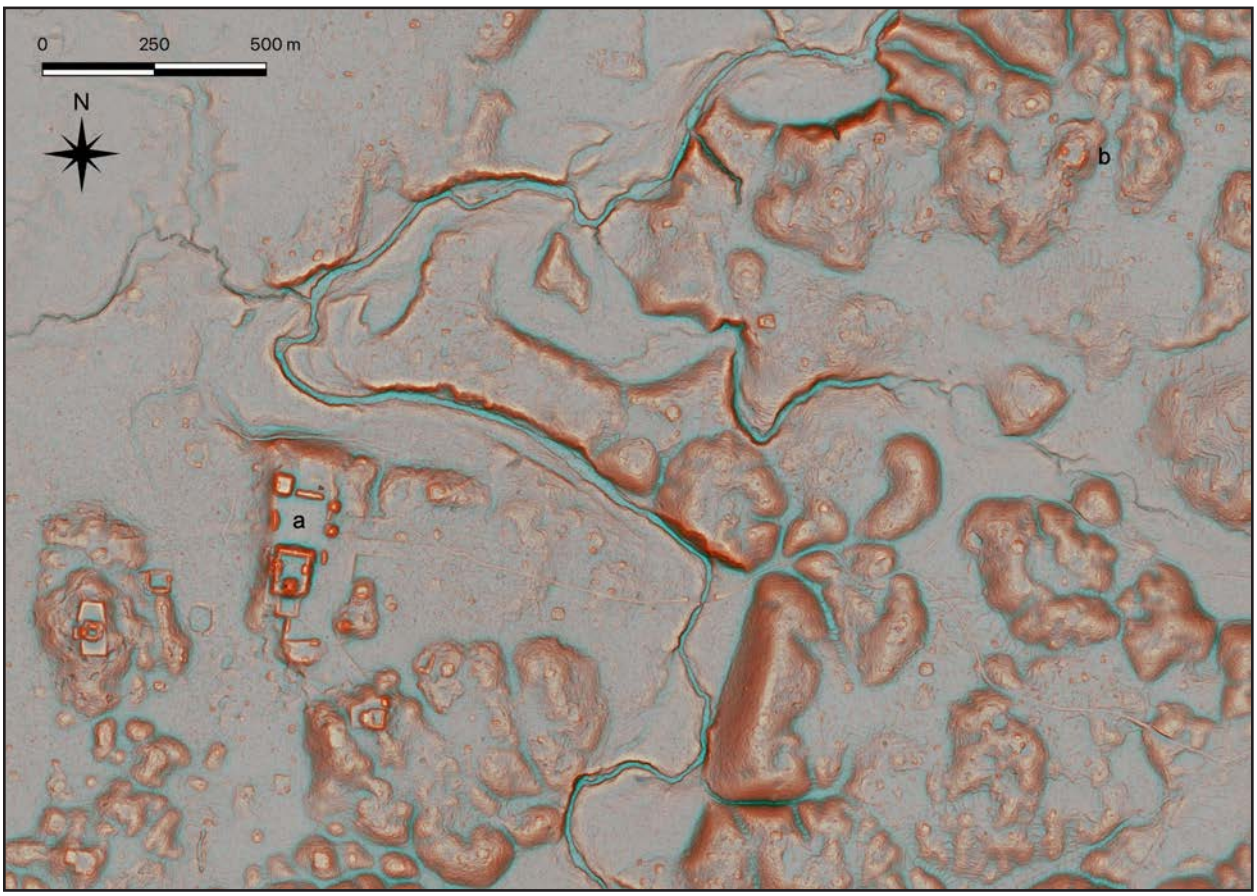

Figure 1.4. RRIM of (a) Chan Chich with possible (b) E Group 1.9 km to the northwest.

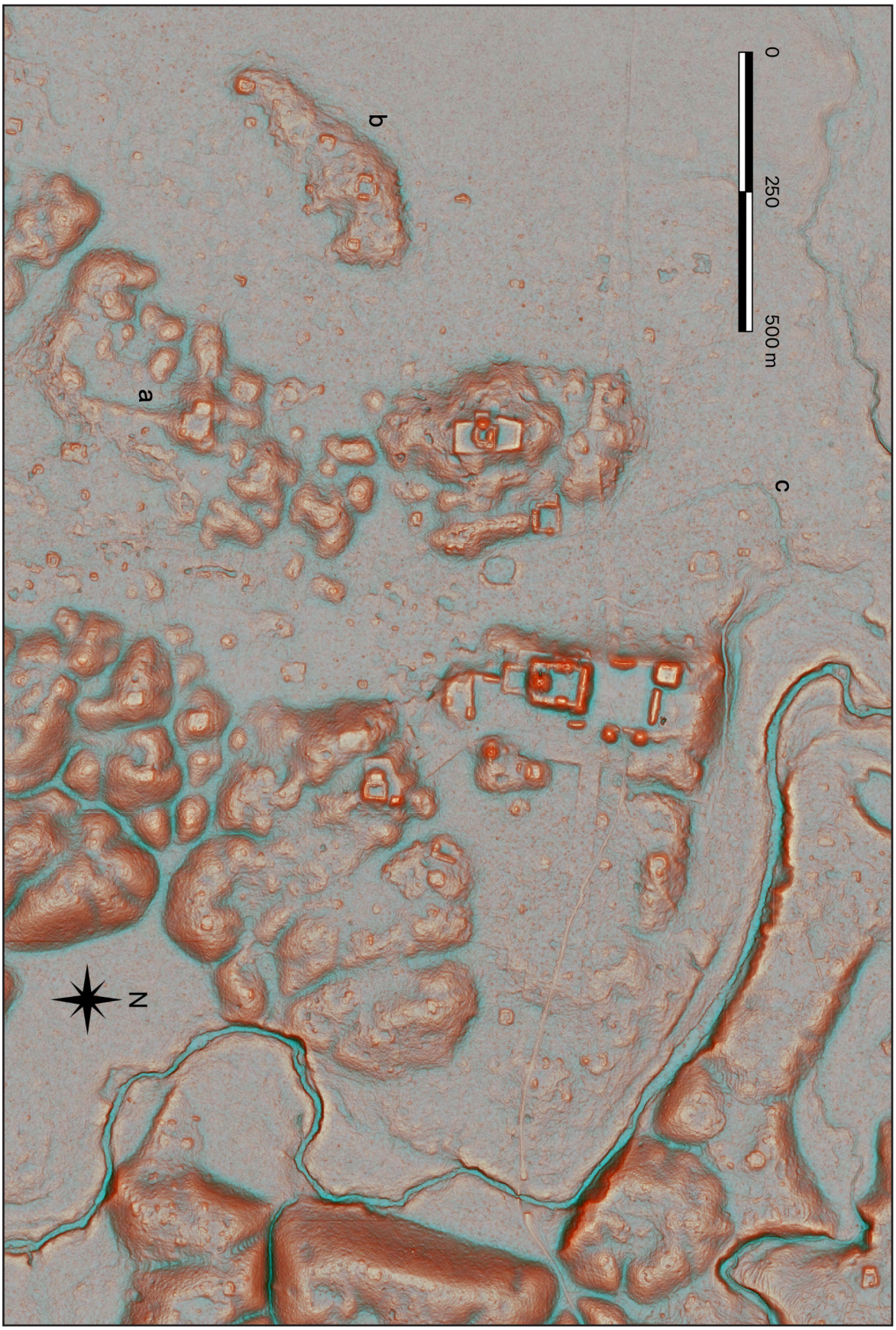

Figure 1.5. RRIM of Chan Chich showing features to be ground truthed: a) hilltop courtyard with possible monumental ramp, b) cluster of courtyards on hill southwest of Norman's Temple, c) possible artificial canal.

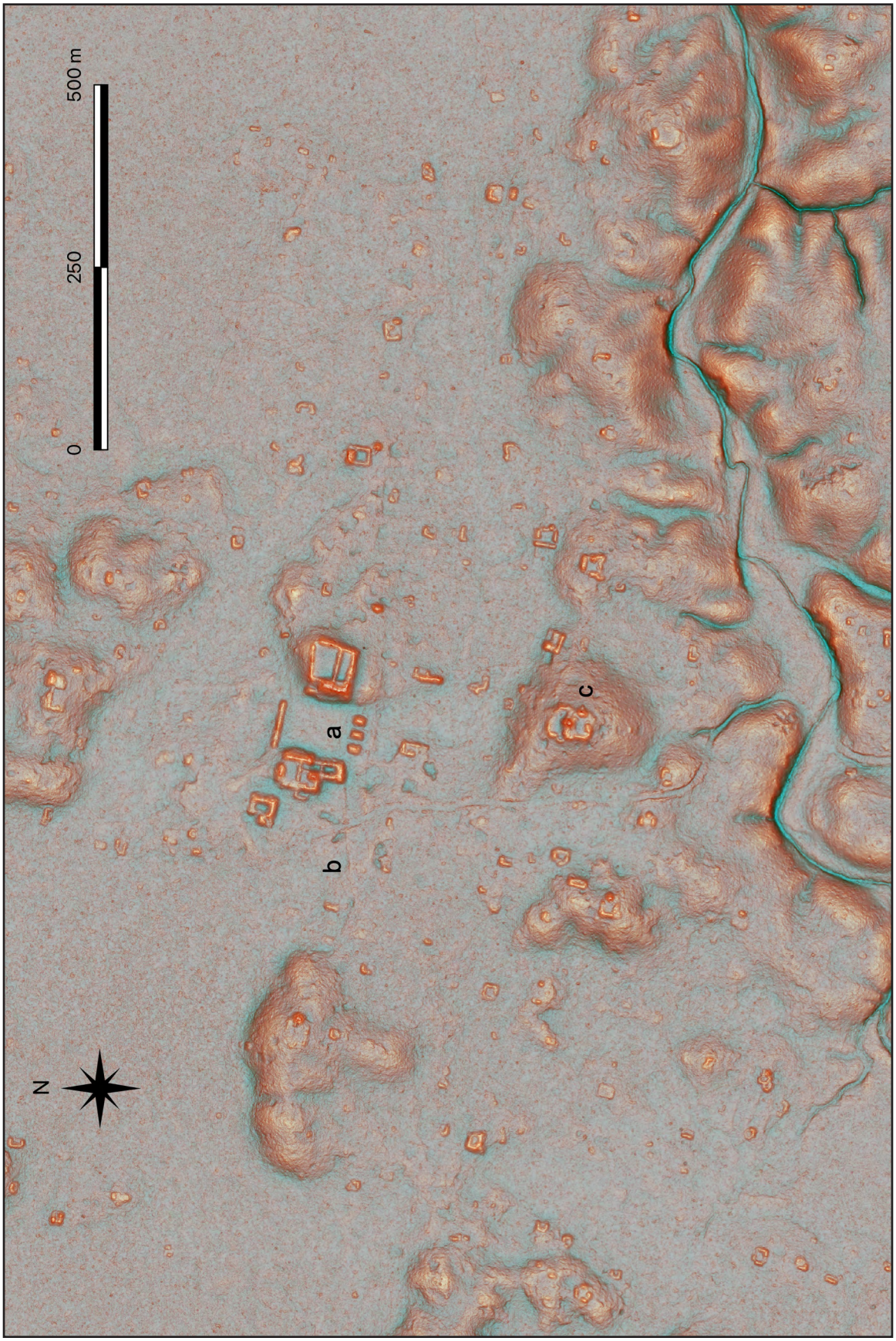

Figure 1.6. RRIM of unrecorded site with (a) a double ball court (b) a parapet lined *sacbe*, and (c) large hilltop group.

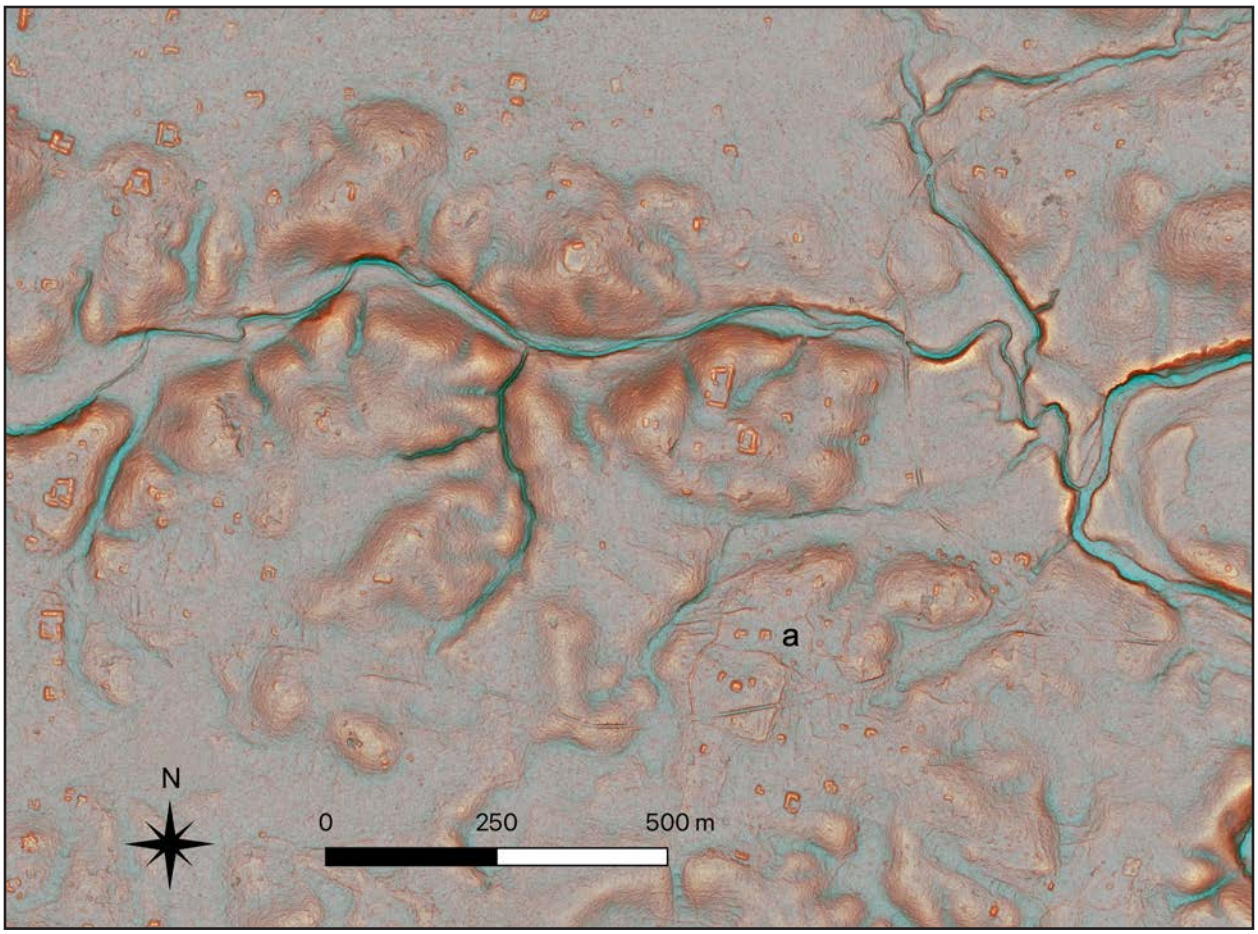

Figure 1.7. Zone of settlement south/southeast of the unrecorded site with the double ballcourt: a) *albarradas* or other walls around residential groups.

La Lucha Escarpment (Figure 1.8), extensive terracing, and raised fields (Figure 1.9) are just a few of the new discoveries awaiting verification and study.

Norman's Temple at Chan Chich

At Chan Chich, Tomás Gallareta Cervera directed Operation CC-21 at the Norman's Temple complex. Gallareta Cervera and Houk (Chapter 2, this volume) focused on continued excavations of a terminal artifact deposit at the northern base of Structure C-2, which Ashley Booher (2016) first documented (Figure 1.10). We also excavated more of a room on the summit of Structure C-2 in the same courtyard, hoping to find preserved graffiti like that encountered by Booher (2016) in the western end of the same room. While we did find some graffiti on small section of preserved plaster, the preservation was overall very poor in the section of room excavated in 2022. We did, however, encounter a sub-bench burial of an adult male, interred in an extended supine position, with his head to the west (Figure 1.11). Interestingly, the burial showed signs of reentry, with the left fibula removed, other bones displaced, and charcoal scattered in the fill around the skeleton.

North Plaza at Chan Chich

Since 2017, we have been investigating the possibility that the North Plaza at Chan Chich functioned as a marketplace during the Late Classic (see Degnan et al. 2017). These investigations are part of our larger interest in

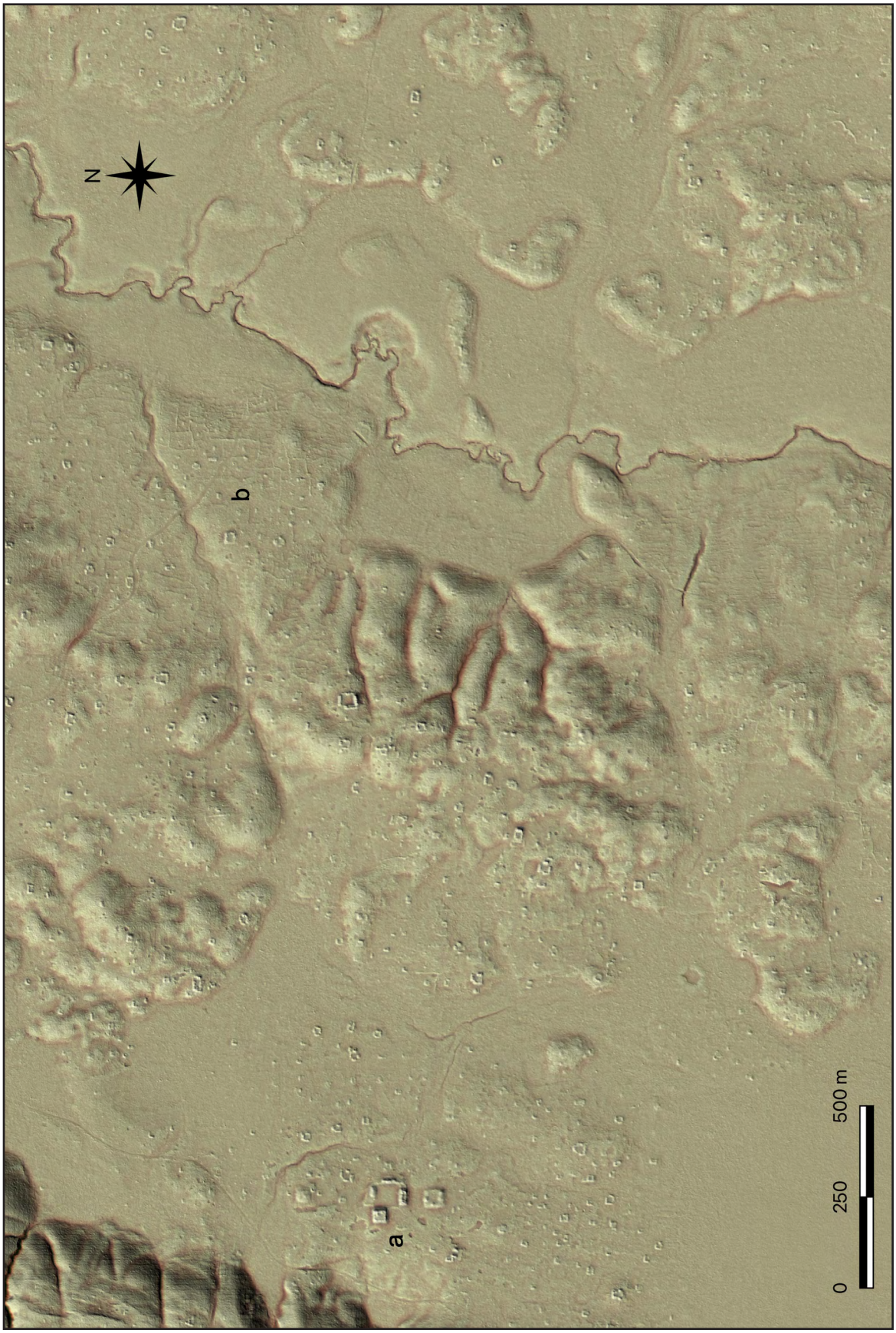

Figure 1.8. Enhanced hillshade of (a) Montaña Chamaco (BE-13) and dense settlement at the base of the La Lucha Escarpment. Note the (b) *albarradas* associated with some structures.

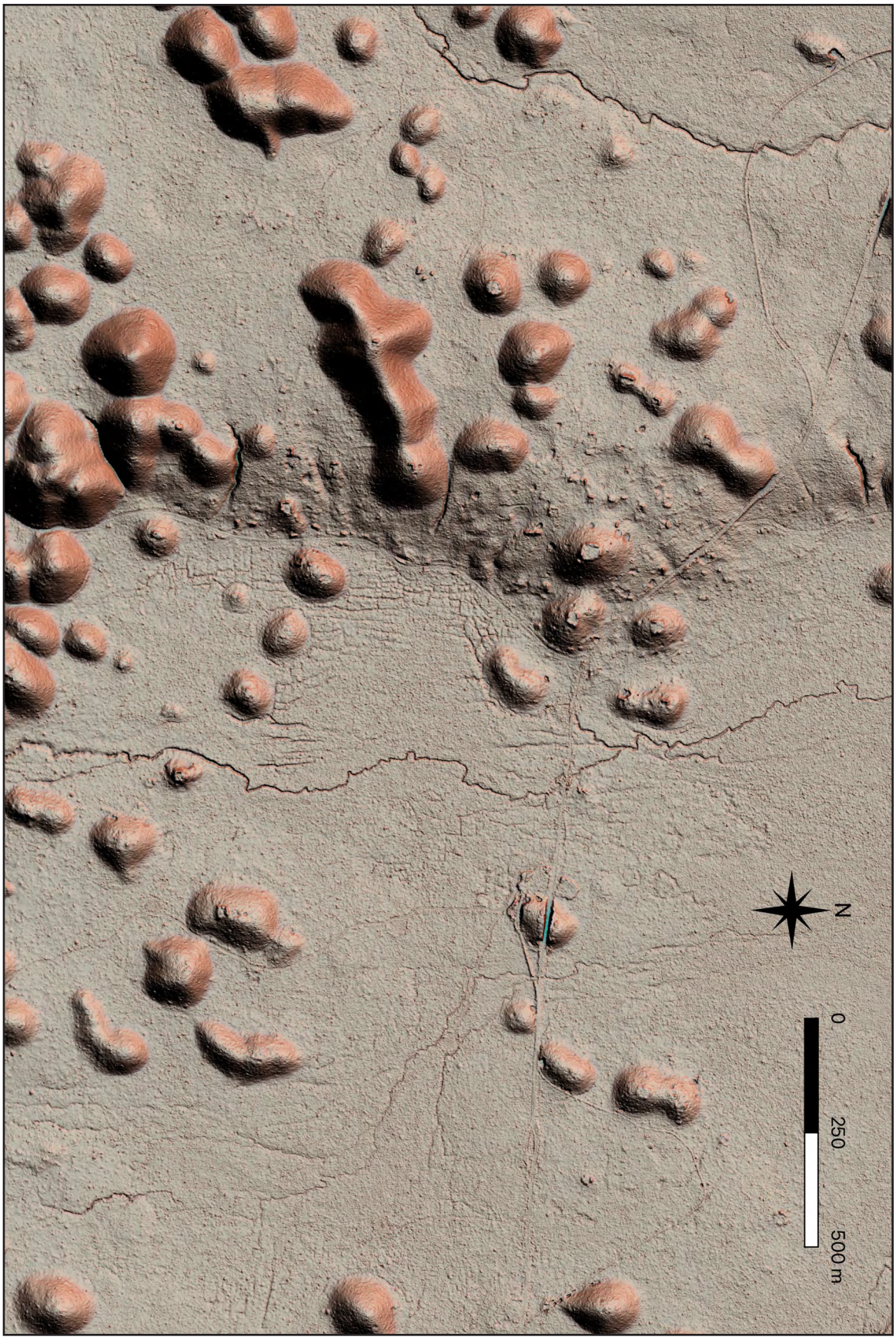

Figure 1.9. Enhanced hillshade of possible raised fields at Wamil (BE-08).

Figure 1.10. Chert spear points found in the above-floor artifact deposit at the Norman's Temple complex, Chan Chich.

Figure 1.11. Anna Novotny (left) and Leann Castillo excavating Burial CC-B24 at Structure C-2, Chan Chich.

trade and economy in the region. In 2022, we conducted extensive work in the North Plaza as part of a multi-project, regional study of possible marketplaces in northwestern Belize, funded by the National Science Foundation (NSF). Well, the work was supposed to be funded by an NSF grant, but the prime institution, Howard University, proved incapable of awarding Texas Tech our share of the funding in time for us to use the money. Therefore, our existing Alphawood Foundation grant funded the fieldwork portion of our research.

Bridgette Degnan supervised our investigations at the North Plaza, which included systematic shovel testing to identify possible activity areas, shallow strip trenches to look for architecture like vendor's stalls, shallow block excavations, and chronology test pits (Degnan et al., Chapter 3, this volume). Pending analysis of the excavated material, our results appear to support the hypothesis that the area served as a marketplace or, at least, as a specialized lithic production area. We documented a chert tool production area and a separate obsidian workshop (Figure 1.12). Other indications of marketplace activity included spindle whorls, ground stone artifacts, and an isolated human tooth, which could be evidence of a "dentist" at the North Plaza. Work at Piedras Negras has documented apparent tooth extraction and modification at a marketplace (Schnell and Scherer 2021). Funds from NSF will cover the analysis of the North Plaza materials in 2023.

Figure 1.12. Bridgette Degnan (left) supervising the excavations of the apparent obsidian workshop in the North Plaza at Chan Chich.

Mapping and Excavations at Gallon Jug

In 2022, Claire Novotny continued excavations at Gallon Jug, Courtyard B-1 (Novotny et al., Chapter 4, this volume), where her team had discovered numerous patolli boards incised into the plaster floor of the northern building in 2019 (Novotny and Houk 2021). Crews removed the backfill from Structure B-4 and re-exposed the buried patolli floor. This season, we used colored chalk to highlight the faint incisions into the plaster and improve the visibility of the boards for photographs (Figure 1.13). The chalk does not damage the floor or the boards and has essentially the same chemical composition as the plaster on the floor. Careful study of the floor under various lighting conditions revealed eight distinct boards representing multiple styles, including one non-Maya style from central Mexico. Excavations in the chultun in the courtyard's center recovered a burial, which had been discovered near the end of the 2019 season. As Anna Novotny and Leann Castillo discuss in Chapter 4 of this volume, radiocarbon analysis of bone from the burial returned an unexpected date. New excavations targeted Structure B-3 on the eastern side of the courtyard.

ORGANIZATION OF THIS VOLUME

In Chapter 2, Gallareta Cervera and Houk describe the 2022 excavations at Norman's Temple at Chan Chich, which focused on Structures C-1 and C-2. Bridgette Degnan and colleagues discuss the fieldwork phase of the North Plaza marketplace study in Chapter 3. Claire Novotny and colleagues present the results of the Gallon Jug excavations at Courtyard B-1 in Chapter 4. Anna Novotny and Leann Castillo discuss in Chapter 5 the analyses of Burial GJ-B03, recovered from a chultun at Courtyard B-1 at Gallon Jug, and Burial CC-B24 from Norman's Temple at Chan Chich. Because we lugged the very bulky and expensive pXRF analyzer all the way to Belize, Degnan and Houk present the results of obsidian source analyses from 2019 and 2022 in Chapter 6. Tera Stocking updates the lab manual in Chapter 7. Finally, Chapter 8 updates the project lists through 2022.

Figure 1.13. Marie Ical (left) and Petrona Ical highlighting a patolli board at Gallon Jug, Structure B-4, using chalk.

REFERENCES CITED

Booher, Ashley
2016 Results of the 2016 Norman's Temple Complex Investigations at Chan Chich. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 39–65. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Chase, A. F., D. Z. Chase, J. F. Weishampel, J. B. Drake, R. L. Shrestha, K. C. Slatton, J J. Awe, and W. E. Carter
2011 Airborne Lidar, Archaeology, and the Ancient Maya Landscape at Caracol, Belize. *Journal of Archaeological Science* 38(2):387–398.

Degnan, Bridgette, Kevin A. Miller, and Brett A. Houk
2017 Archaeological Investigations at an Epicentral Lithic Workshop: Structure A-6 and the North Plaza Debitage Deposit, Chan Chich, Belize. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 97–142. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Ford, Anabel
2014 Using Cutting-edge Lidar Technology at El Pilar, Belize-Guatemala in Discovering Ancient Maya Sites—There is Still a Need for Archaeologists. *Research Reports in Belizean Archaeology* 11:271–280.

Global Conservation
2022 Greater Belize Maya Forest. Electronic document, https://globalconservation.org/projects/greater-belize-maya-forest/, accessed October 5, 2022.

Houk, Brett A., Hubert R. Robichaux, and Jeffrey Durst
1996 Results of the 1996 Season. In *The 1996 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Hubert R. Robichaux, pp. 21–30. Papers of the Chan Chich Archaeological Project, Number 1. Center for Maya Studies, San Antonio, Texas.

Houk, Brett A., and Gregory Zaro
2014 An Introduction to the 2014 Season of the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 1–19. Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Claire, and Brett A. Houk
2021 Ancient Maya Patolli from Gallon Jug, Belize. *Latin American Antiquity* 32(3):647–654.

Schnell, Joshua, and Andrew Scherer
2021 Classic Maya Dental Interventions: Evidence for Tooth Extractions at Piedras Negras, Guatemala. *Bioarchaeology International* 5(1–2):47–67.

The 2022 Investigations at Norman's Temple, Chan Chich, Belize

Tomás Gallareta Cervera and Brett A. Houk

During June and July 2022, Tomás Gallareta Cervera and Brett A. Houk directed the fifth season of Alphawood-funded research at the site of Chan Chich, Belize. Our 2022 excavations under Operation CC-21 (Op CC-21) focused on Norman's Temple, an elite residential group located southwest of the site's main center. We specifically targeted Structures C-2 and C-3, located on the north and south sides of the small courtyard at the center of the Norman's Temple complex. Our two objectives were to recover more graffiti and burial information from Structure C-2 and extend our knowledge of the abandonment-related above-floor artifact deposit at the base of Structure C-3 (Booher 2016; Houk 2016, 2020). This chapter describes the 2022 excavations; we have not yet completed the analysis of the artifacts collected in 2022. Our excavations completed our goals by revealing the following:

- Evidence of a large once-vaulted room in the center of the south face of Structure C-2.
- The presence of graffiti that may correspond to a "Mat Sign" on the room's northern wall.
- A primary burial, extended in a pronated position, below the bench and against the north wall of the room.
- Evidence of ritual activity in the room, including apparent burial reentry.
- Hundreds of sherds, a partial vessel, debitage, stone tools, obsidian, and shell remains belonging to the abandonment-related above-floor artifact deposit at the base of Structure C-3.
- Architectonic evidence that complements our overall understanding of the Western Plaza.

PREVIOUS INVESTIGATIONS AT NORMAN'S TEMPLE

Norman's Temple, named after Norman Evanko (1942–2022), the main bartender at Chan Chich Lodge from 1989 to 2002, comprises a complex of architecture on the summit of a prominent hill southwest of the Western Plaza (Figure 2.1). The Norman's Temple complex includes a small, elevated courtyard in the center of a large, modified hilltop to the west of the Upper Plaza and southwest of the Western Plaza. Structures entirely enclose the courtyard, which measures 18 m east-west by 11 m north-south. The courtyard sits in the center of an elongated, artificial platform that leveled the hilltop. Excavations determined the platform was filled with as much as 1.77 m of rocks and dirt on its southern edge (Booher 2016:21). A series of low, discontinuous platforms, some of which had masonry walls, almost surrounds the modified hilltop.

Prior to this season, the Chan Chich Archaeological Project (CCAP) excavated the

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2022 The 2022 Investigations at Norman's Temple, Chan Chich, Belize. In *The 2022 Season of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 17–38. Papers of the Chan Chich Archaeological Project, Number 15. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

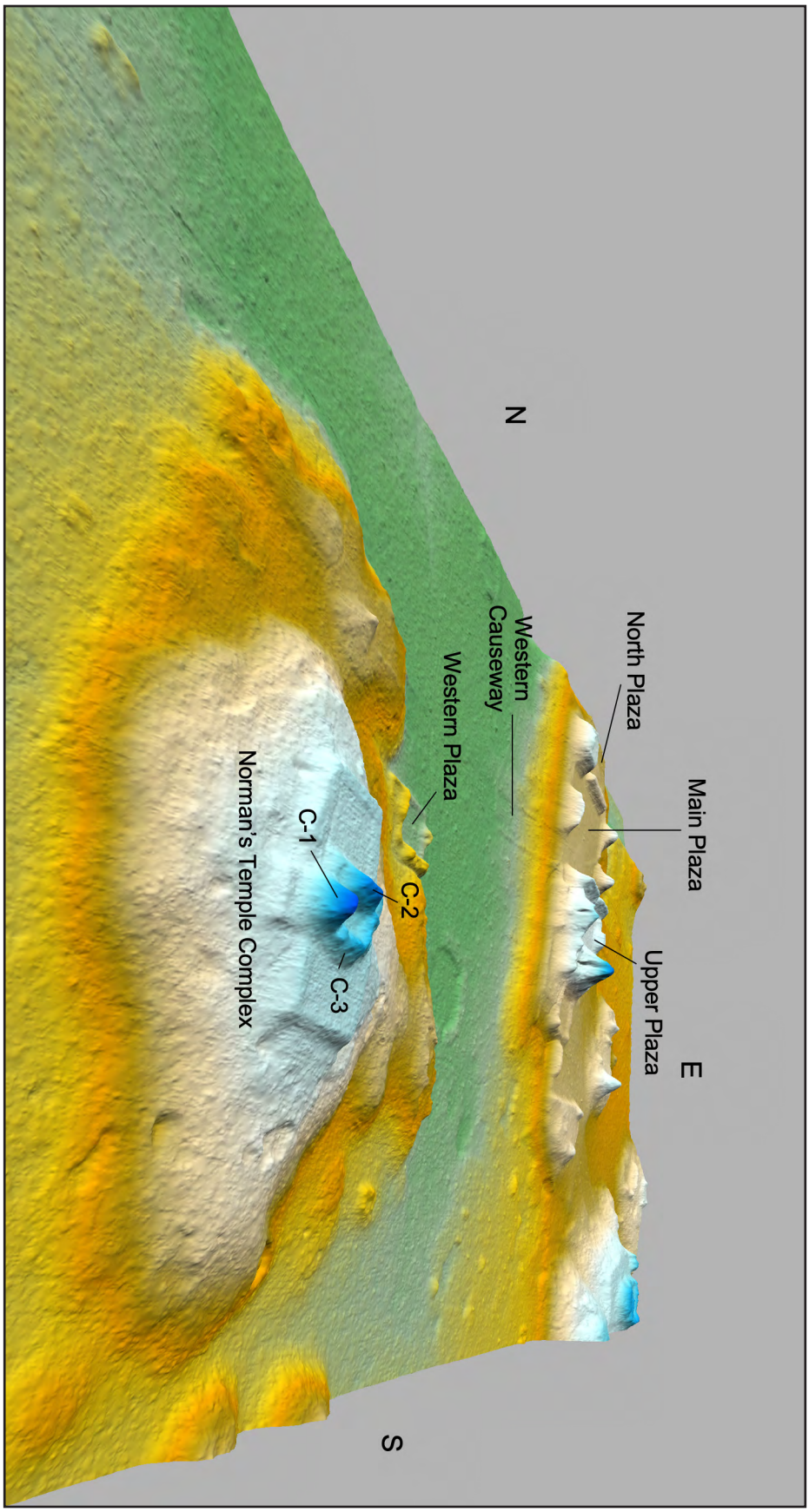


Figure 2.1. A 2.5D colorized, hillshade image with 2X vertical exaggeration of the Chan Chich site core, with Norman's Temple in the foreground.

Norman's Temple complex during the 1990s and more extensively during the 2016 field season (Figure 2.2). Richard Meadows (1998) encountered a moderately dense deposit of artifacts on top of the first floor of the plaza at the base of Structure C-1. Artifacts recovered included a figurine fragment, a ceramic whistle, imitation Fine Orange ceramic sherds, and a thin biface fragment. Owen Ford and Amy Rush (2000) also found exotic artifacts, including a partially reconstructable Fine Orange bowl, broken on the steps to Structure C-2. Finally, Ashley Booher directed the 2016 field season at Norman's Temple under Op CC-16. Booher (2016) and her team excavated the third deposit of terminal artifacts, resting on the courtyard floor at the north base of Structure C-3. Recovered artifacts include abundant ceramic sherds, a ceramic pendant, part of a ceramic whistle, obsidian blades, lithic tools, a polished stone celt, a modified shell, faunal remains, and ground stone artifacts (see Houk 2020).

Houk (2020) recently analyzed these deposits and others from the site and concluded the deposits formed around the time the residents abandoned the group. Contextual data suggest the Maya deposited the artifacts while the courtyard was actively being maintained or shortly after the residents had stopped maintaining it—the deposits rest directly on the final courtyard floor, not on collapse debris or post-abandonment sediment (Houk 2020). However, because the Maya never cleaned up or removed the deposits, maintenance activities did not occur following the creation of these features. Houk (2020:96) concluded that the Norman's Temple deposits are "both peri-abandonment and abandonment-related deposits" and the "target of the abandonment-related features was elite residential architecture, not large public structures."

Booher's (2016) extensive excavations included work on Structure C-2, a 4- to 5-m tall range building occupying the courtyard's northern side. Booher's (2016) excavations on Structure C-2 exposed a Late Classic burial (Burial CC-B15) under an apparent bench (see also Novotny et al. 2016). Moreover, she observed evidence of ancient Maya graffiti on the plaster on the western and northern walls of the room. Unfortunately, the graffiti was fragmented and poorly preserved, with no identifiable elements (Booher 2016).

2022 RESEARCH QUESTIONS

During the 2016 field seasons, the CCAP completed its planned investigations at the Norman's Temple complex (Booher 2016). Still, the unexpected discovery of graffiti in a room on Structure C-2 and the unusually dense above-floor terminal artifact deposit at the base of Structure C-3 prompted the project to propose additional excavations. Therefore, during the 2022 field season, we expanded on the 2016 objectives by attempting to expose more of the dense terminal deposit at the base of Structure C-3. These proposed investigations align with the project's goal of understanding the archaeological signature of major cultural events such as the Classic Maya collapse and the "peri-abandonment" features of the built environment.

Additionally, we excavated the center of the summit of Structure C-2 to look for other graffiti by exposing more of the room Booher (2016) investigated. Booher (2016) had only exposed the western end of the central room on the summit and deduced that the room had a bench because the burial she encountered rested on a lower plaster surface. Therefore, we proposed to expose more of the room to better understand the building's form and function.

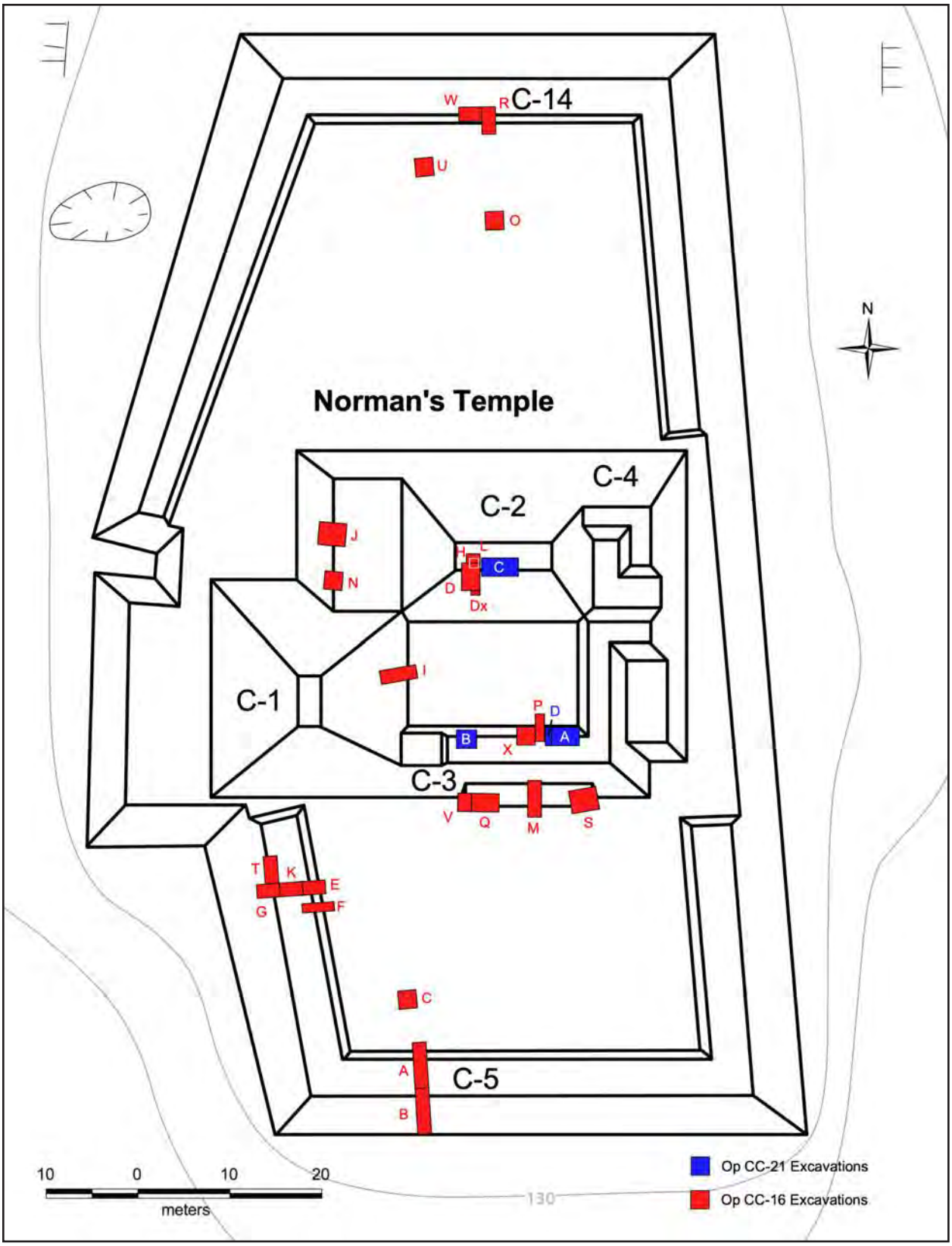


Figure 2.2. Locations of suboperations in Op CC-16 (2016) and Op CC-21 (2022) at Norman's Temple complex.

RESEARCH METHODOLOGY

Our fieldwork took place for over five weeks, from June 1 to July 7, 2022, with a Covid-19 shutdown from June 7 through June 10. Field staff and local workers from Chan Chich Lodge and Sylvester Village conducted the excavations, overseen by Tomás Gallareta Cervera. Anna DesHotels served as a field assistant prior to the Covid-19 outbreak. In addition, Anna Novotny and Lean Castillo carried out burial excavations (see Novotny and Castillo, Chapter 5, this volume).

The 2022 excavations were assigned Op CC-21 and comprised four suboperations (Table 2.1). All excavations followed the Chan Chich Archaeological Project Field Manual guidelines by Houk and Zaro (2015).

This season, our photography recording technique changed. Previously we used DSLR cameras in JPG format to record archaeological features. In 2022, smartphone cameras were sophisticated enough to take detailed high-resolution images. Because of their portability and flexibility, we decided to switch to smartphone photography for the field; we specifically used the Apple iPhone 13 Pro. Photographs were saved and stored in a virtual shared album in the cloud and afterward transformed from HEIC to JPG format and exported to the project's Mac mini in the field laboratory. DSLRs were still used for laboratory photography of important artifacts.

Furthermore, we used the iPhone 13 Pro lidar function to create 3D models of our excavation units through the application Scaniverse. The app combines distance measurements captured from many angles to reconstruct the 3D geometry of the scene. At the same time, it generates a high-resolution color texture to project onto the geometry (https://scaniverse.com/).

RESULTS

Excavations at Structure C-2

Exploration at this elite vaulted residence was focused on Subop CC-21-C, strategically placed at the center of Structure C-2's summit (see Figure 2.2). After locating the 2016 unit, we estimated the location of the room's northeastern corner and placed a 2-x-2-m unit. This strategy was successful in locating the northern spine and eastern dividing walls. Ultimately, we had to expand the unit an additional 2 m to the west to allow for the recovery of Burial CC-B24, described below.

Table 2.1. Norman Temple 2022 Summary of Suboperations and Lots

Area	Subop	Dimensions (m)	Purpose
South side of courtyard at base of Structure C-3 near eastern end of courtyard	CC-21-A	2 x 3	Recover more information from an abandonment-related above-floor artifact deposit at the base of Structure C-3.
South side of couryard at base of Structure C-3 near western end of courtyard	CC-21-B	2 x 2	Locate architectural features, such as floors, at the western end of Structure C-3.
South face of Structure C-2's summit	CC-21-C	2 x 4	Uncover more of the 2016 graffiti at Structure C-2.
Extension of Subop CC-21-A to the west	CC-21-D	2 x 0.7	Recover more information from an abandonment-related above-floor artifact deposit at the base of Structure C-3 and connect Subop CC-21-D to Subop CC-16-P.

Topsoil (Lot CC-21-C-01) consisted of very dark brown (10YR 2/2) soil, small rocks, and some large carved stones and white marl interpreted here as melted stucco material (Table 2.2). These large stones were located roughly in an east-to-west direction, and their form corresponded to capstones collapsed from the vaulted roof. The vault spring and three rows of vault stones were located *in situ*. We excavated about 2.4 m below the datum of collapse debris (Lot CC-21-C-02) until we uncovered a plaster surface (Lot CC-21-C-03). The debris consisted of large and medium-sized boulders that were part of the vaulted roof's fill and collapsed vaulted stones. Our excavations clipped an old unit from 1998, Subop CC-05-K. This 1-x-3.5-m unit straddled the spine wall separating the northern rooms from the southern rooms on Structure C-2. The old unit exposed a small portion of one of the structure's northern rooms but did not extend far enough south to expose any of the southern room (Ford and Rush 2000:41, 44).

The plaster surface in the room was complex (Figure 2.3). Based on Booher's (2016) excavations in the western end of the room, we believe this surface is the top of a large bench; it extended across the entire unit. Most of the stucco was preserved and showed considerable evidence of burning (Figure 2.4). We collected a sample of burned plaster and possibly organic material (Sample CC-21-S08) from the surface of the bench and submitted it to David Lentz at the University of Cincinnati for analysis, but Lentz's analysis was inconclusive. He reported it is "probably some kind of polymeric substance with a background of calcium carbonate" (David Lentz, personal communication, December 30, 2022). Soot and staining on the northern wall suggest that multiple fires were set before the structure collapsed and after the interment of Burial CC-B24 (Lot CC-21-C-07), discussed below. The surface also shows patching or repairing work, especially at the northwestern corner of the unit (Figure 2.5) and a carved geometrical groove that we interpret as a patolli board (see below).

Table 2.2. Summary of Lots in Subop CC-21-C

Subop	Lot	Lot Description
CC-21-C	01	Topsoil
	02	Collapse debris
	03	Bench
	04	East wall
	05	North wall
	06	Construction fill
	07	Burial CC-B24
	08	Floor

Burial CC-B24

Burial CC-B24 was excavated under Lot CC-21-C-03 by Anna Novotny and Leann Castillo (Figure 2.6). The burial was uncovered while excavating the northwestern corner of the room under a burned, patched section of the bench. We excavated a small section of the bench to recover the burial; our cut through the bench measured approximately 1.8 m east-west by 0.60 north-south. Excavators encountered dry-laid cobble fill around the burial, which was placed directly on top of a plaster floor (Lot CC-21-C-08) and at the base of the north wall in the room. The skeletal material was well preserved, and the individual lay in an extended, prone position with the head to the west. Like the room, the floor was also burned in sections suggesting a burning event (Figure 2.7). This was particularly noticed on the floor underneath the burial when it was removed. Additionally, the burial had an associated whole ceramic vessel, polychrome ceramic sherd and a shell pendant (Figure 2.8); excavations yielded about 20 fragments of debitage and 50 ceramic sherds in the unit. Novotny and Castillo (Chapter 5, this volume) observed that some skeletal elements were disturbed and others, such as the left fibula, were missing, suggesting a burial re-entry ritual. Moreover, evidence of burning and charcoal was encountered

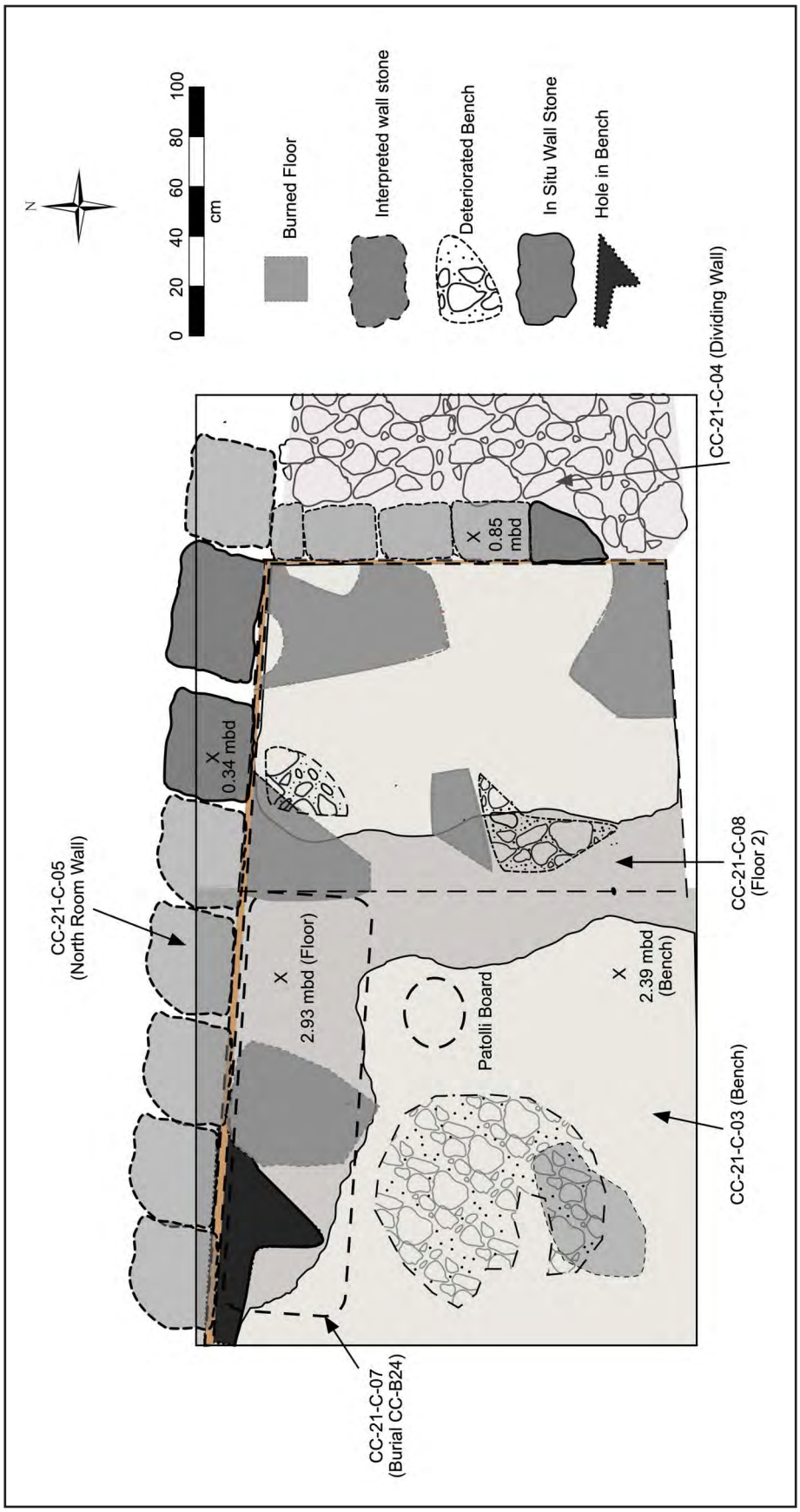


Figure 2.3. Plan Map of Subop CC-21-C. See Novotny and Castillo (Chapter 5, this volume, Figure 5.4) for a detailed map of Burial CC-B-24.

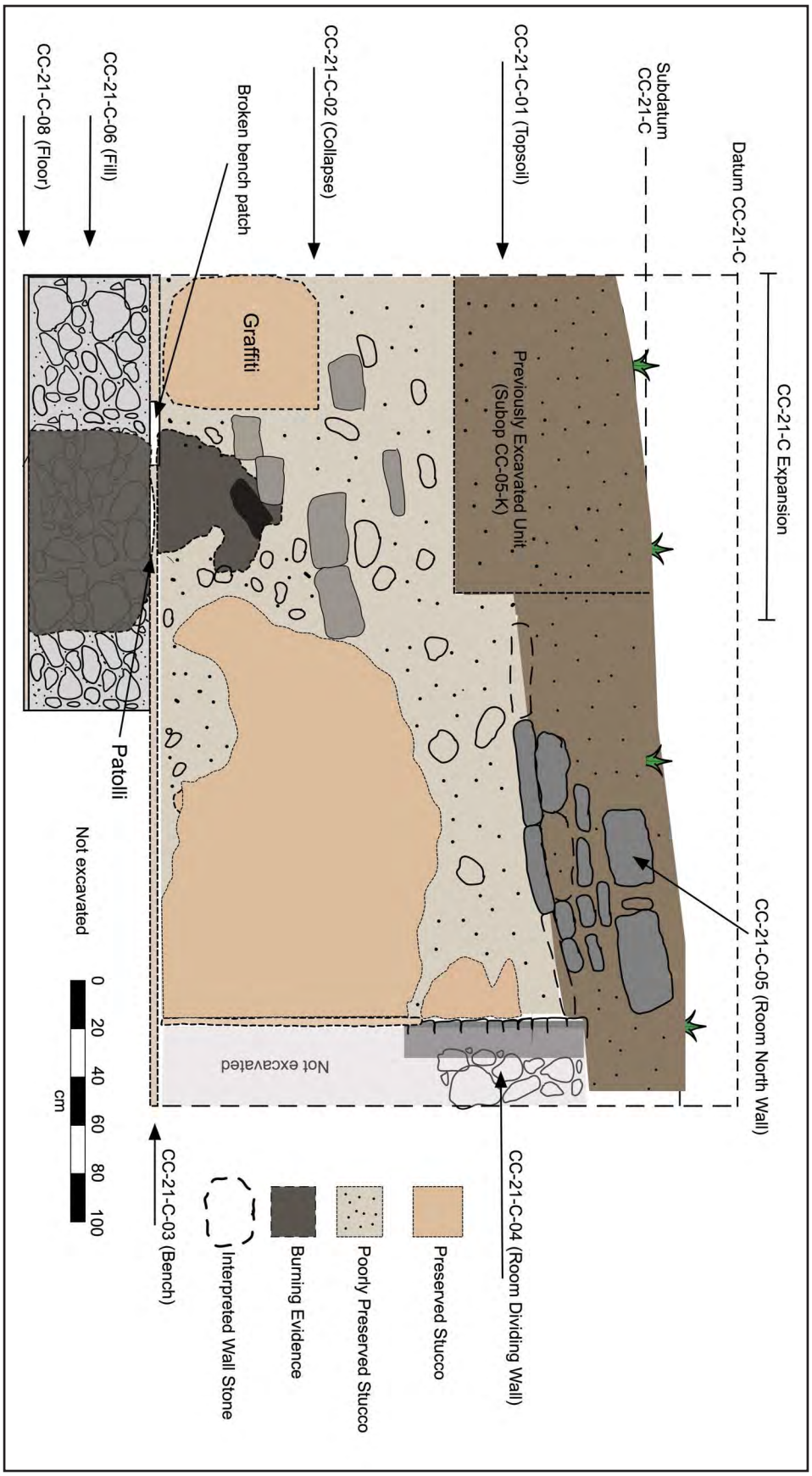


Figure 2.4. Subop CC-21-C north cross-section.

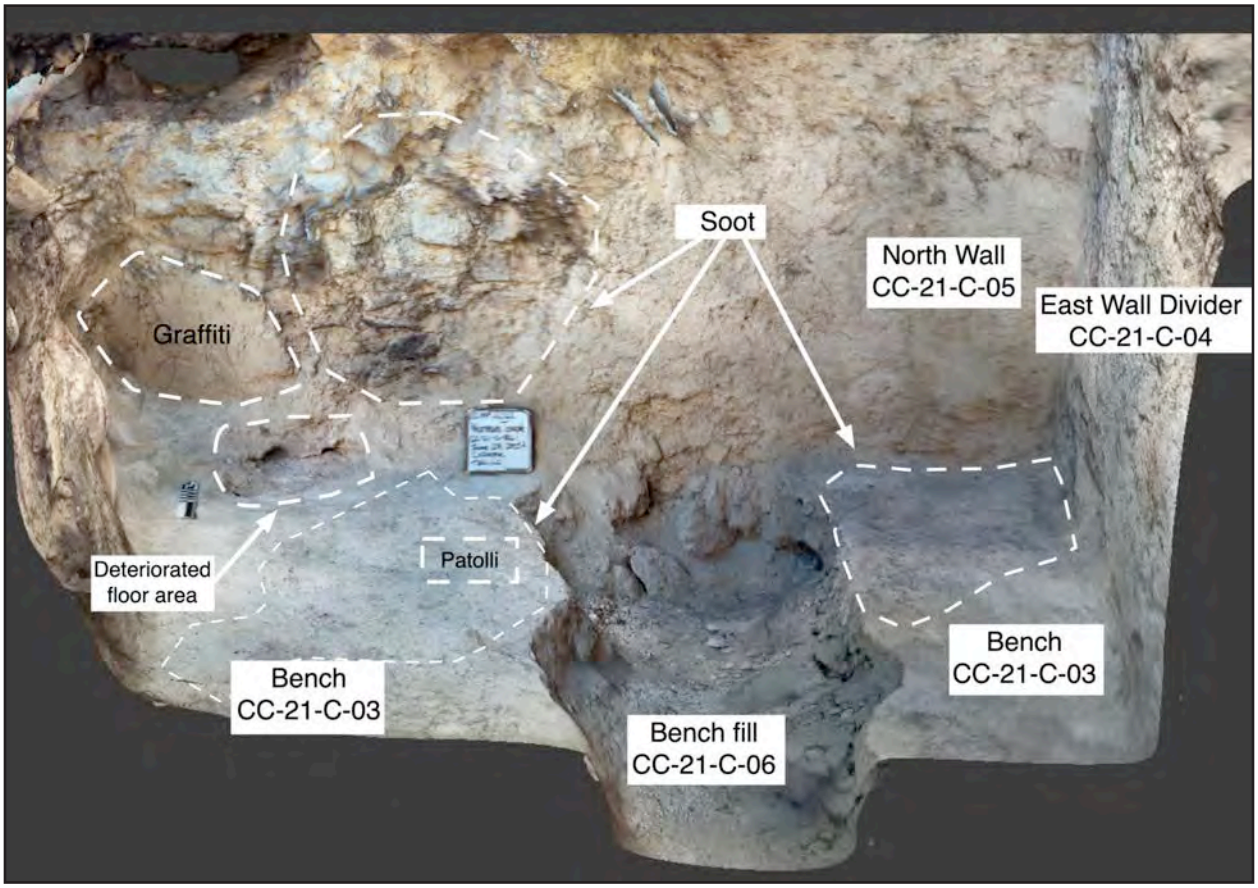


Figure 2.5. Annotated Scaniverse model of Subop CC-21-C looking at the north wall.

throughout the grave space and the bones of the left femur and pelvis (Novotny and Castillo, Chapter 5, this volume). Radiocarbon sample CC-21-S14 (UGAMS# 61671), consisting human bone from Burial CC-B24, dates this individual to cal. AD 675–876 (Table 2.3). A charcoal sample (Sample CC-21-S13) was sent to David Lentz for species identification from charcoal associated with the burial/re-entry. The results of the analysis will be presented in a future study of ritual and burial practices at Chan Chich.

Graffiti in Structure C-2, Eastern Room

As reported previously, excavations at Chan Chich have yielded considerable evidence of graffiti (Booher 2016; Gallareta Cervera et al. 2016). Specifically, graffiti has been observed at the looters' trench of Structure A-15 (Houk 1998:94) and Structure A-1E (Gallareta Cervera et al. 2018:35–39) in the Upper Plaza, benches in Structure C-6 in the Western Plaza (Harrison 2000:81–82), and Structure C-2 in the Norman's Temple complex (Booher 2016:54). Evidence of graffiti is found consistently where the plaster is preserved on spine walls or benches of elite residences. Some elements include a possible fer-de-lance pattern, patolli boards, triangular-shaped designs with hatch marks (possibly representing a vernacular structure), the bodies of a large and a small individual, vertical lines, and a "mat design" (see Robicsek 1975:184). Evidence of graffiti is dependent on the preservation of the stucco, which, after over 1,000 years of neglect, tends to be poor. Evidence tends to be fragmented, and interpretations of these designs are preliminary.

Figure 2.6. Project bioarchaeologists Anna Novotny (left) and Leann Castillo excavating Burial CC-B24.

As mentioned before, Subop CC-21-C was placed on Structure C-2 strategically to uncover the central room. Based on Booher's (2016) excavations of the western end of the room, we hypothesized the presence of graffiti in the room's plastered walls. Due to this, we left a 20-cm balk between the room's north and east walls and our excavations to preserve the graffiti. While removing the collapse debris in the balk, we carefully observed the stucco remains for cultural evidence of grooves and scratches. Unfortunately, only a little plaster was preserved. Excavations revealed mostly carved stones on the room's walls. Moreover, preserved plaster was primarily flat and unmarked. The soot on the floor and the northern wall suggests a burning event, which negatively affected the preservation of the plaster.

The stucco surface of the wall was fragile and badly eroded, so we cleaned it using light brushes and wooden tools. We recovered two graffiti images, one from the north wall and one from the bench surface. To record the graffiti, we used two methods: first, we photographed the graffiti from the same position using LED lights from multiple angles to capture all the grooves and scratches, and second, we used Adobe Lightroom to combine the images, increase the contrast, and transform the composite image into a black and white image. This process successfully popped out most of the graffiti on the spine wall. For the graffiti on the floor, which was significantly better preserved, we used the highly effective

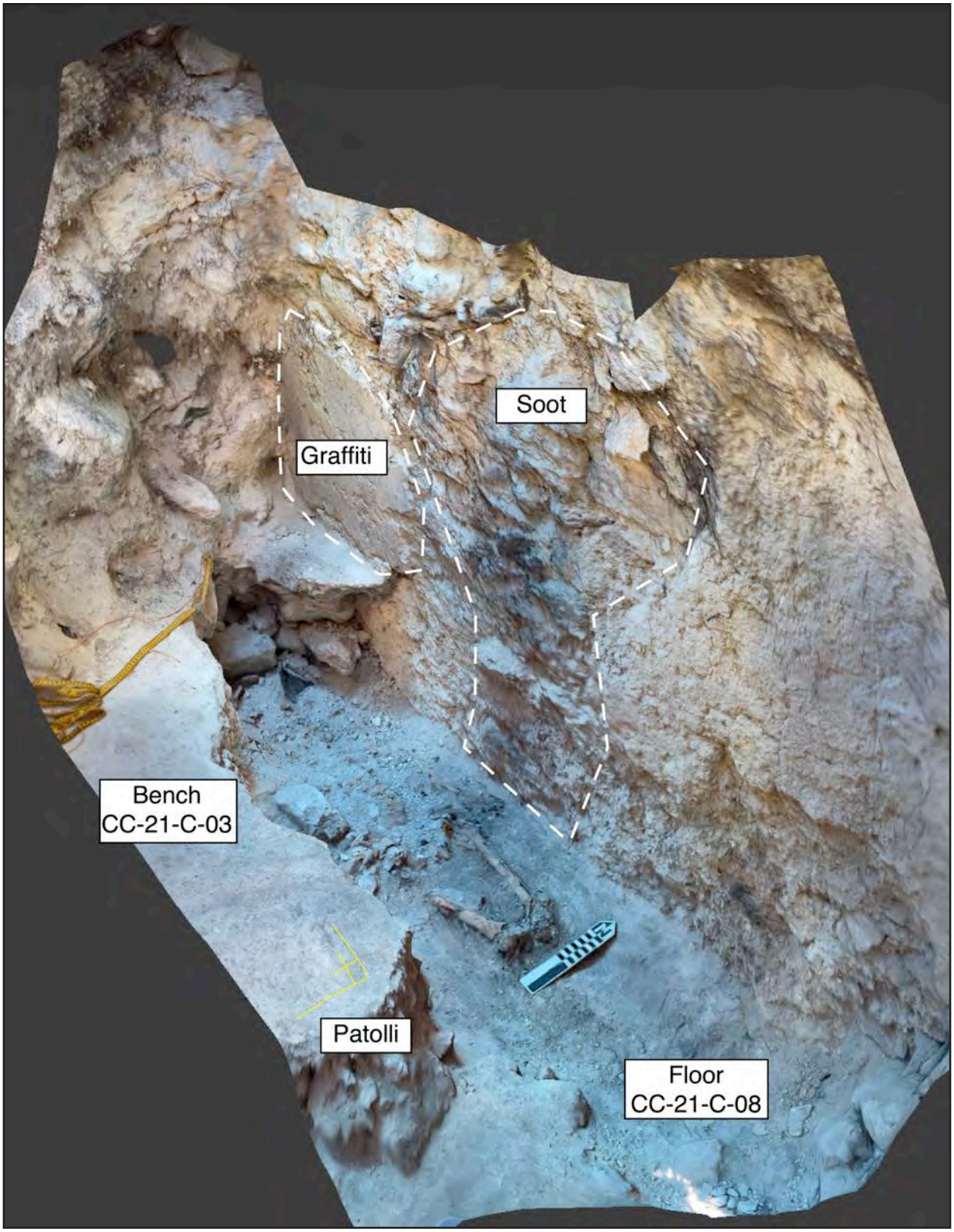


Figure 2.7. Scaniverse model of Burial CC-B24. View to the northwest.

Figure 2.8. Burial CC-B24 artifacts. Left: reconstructed bowl; right: shell ornament.

Table 2.3. Radiocarbon Dates from Structure C-2

Context	Lab Sample	Sample # CC-	Material	$\delta^{13}C$,‰	^{14}C age (BP)	±	2σ Calibrated Age Range
Burial CC-B15, Lot CC-16-L-03	PSUAMS 1324	16-S01	Charcoal	n/a	1165	35	AD 771–970
Burial CC-B15, Lot CC-16-L-03	UGAMS 59522	16-S02a	Bone	-5.0	960	20	AD 1028–1157
Burial CC-B15, Lot CC-16-L-03	UGAMS 61672	16-S02b	Bone	-4.4	1280	25	AD 675–777
Burial CC-B24, Lot CC-21-C-07	UGAMS 61671	21-S14	Bone	-4.35	1250	25	AD 675–876
Burial CC-B24, Lot CC-21-C-07	UGAMS 61675	21-S10	Charcoal	-26.63	1230	20	AD 702–881

method of chalk tracing implemented by Claire Novotny and colleagues (Chapter 4, this volume) at Gallon Jug.

The first graffito was low on the north wall (Lot CC-21-C-05), almost directly above Burial CC-B24. The surviving plaster measured approximately 60 x 60 cm and was the only preserved area (the east wall presented some poorly preserved stucco fragments). The graffiti was located about 30 cm above the bench's surface and consisted of multiple grooved lines of different lengths and thicknesses (Figure 2.9). The pattern is unclear, but the authors of this chapter suggest that it might be a "mat sign." We also hypothesize that it might be a throne room made of rushes (Robicsek 1975:101, Figure 65) or a thatched roof (Robicsek 1975:135, Figure 145). Alternatively, a perhaps more daring interpretation of the grooves is an object set in flames, possibly alluding to the fire event evidence we found in this room.

The second graffito was also located on the western section of the room on the bench. The image measures approximately 20 x 20

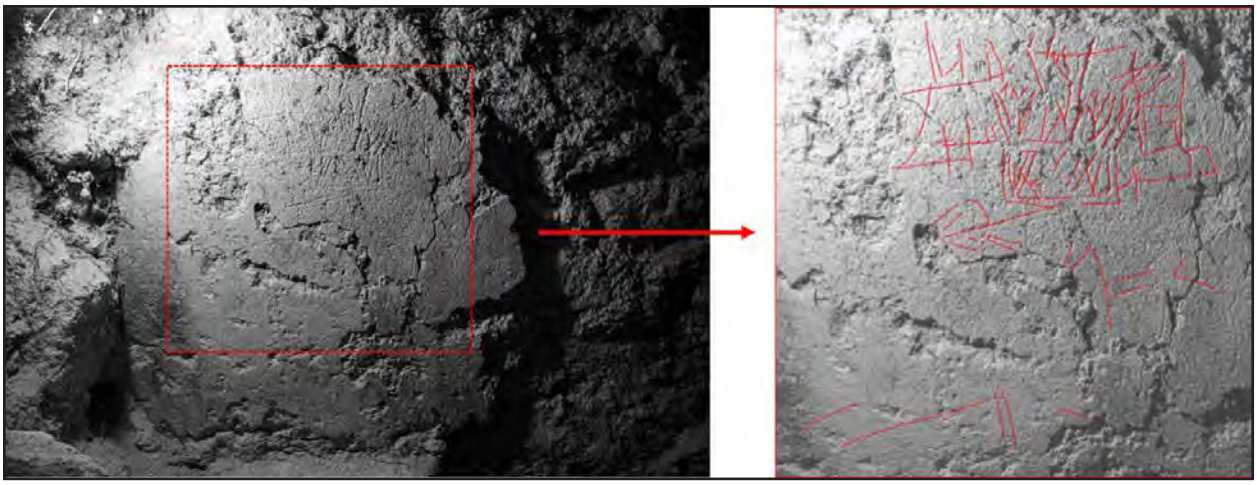


Figure 2.9. Composite image of graffiti in Subop CC-21-C.

cm, consisting of two lines converging at a 90-degree angle and a small square (Figure 2.10). The authors suggest that the pattern corresponds to a patolli board. A similar pattern, albeit larger and without an associated burial, was located on a bench in Structure A-12 in the Upper Plaza (Gallareta Cervera and Houk 2019:45), perhaps suggesting a local pattern in elite residences.

Backfilling Subop CC-21-C

To protect our excavated graffiti from the elements and preserve it for future study, we implemented the same technique we used for backfilling the graffiti of Structure A-1E, Room 2, in the 2018 field season (see Gallareta Cervera et al. 2019:39). After excavation and documentation concluded, we gradually backfilled the eastern room by placing a retaining wall made of cut stones from the

Figure 2.10. Possible patolli graffiti on the bench in Subop CC-21-C.

collapse debris approximately 15 cm in front of the graffiti wall. We backfilled the space between the graffiti and the retaining wall with screened dirt from our excavations, periodically adding height to the retaining wall backfilling progressed.

Structure C-2 Sequence

Our excavations suggest the following sequence for Structure C-2 as observed in Subop CC-21-C:

- Our earliest features are the floor in the room and spine wall of building, which forms the north wall of the room in Subop CC-21-C. The north wall of the room appears to continue below the top of the floor, but we did not penetrate the floor to explore the construction sequence more carefully
- We did not observe any evidence of wall re-plastering, so we have to assume that the graffiti was carved at any time between the room's construction and its abandonment.
- Burial CC-B24 was laid on the floor in the approximate center of the room up against the north wall and covered by dry-laid fill of large and medium-sized rocks and the plaster surface of a large bench. We are inferring that the upper plaster surface is a bench based on context and comparisons to other benches at the site. We did not expose enough of the room to find the front of the bench. We also cannot determine if the burial was placed when the bench was constructed or if the bench was built first and the burial interred later.
- Fragments of burned stucco mixed into the sub-bench fill suggest that the bench might have been cut through following a burning event. Moreover, charcoal mixed in the burial near the pelvis and charcoal or soot staining on the north wall below the bench, as well as disturbed and/or missing skeletal material point to a re-entry ritual.
- Following the re-entry, the bench was resealed, albeit poorly, since two holes in the surface of the bench against the north wall hinted at the location of the burial.
- A patolli board was carved into the surface of the bench at some point.
- Finally, more burning evidence, including a zone of burned organic-looking material on the surface of the bench might indicate other fire-burning rituals.

Excavations at Structure C-3

To recover more information about the above-floor artifact deposit first documented by Booher (2016), we opened Subops CC-21-A and CC-21-D at the base of Structure C-3 on the south side of the courtyard. After locating the 2016 unit, Subop CC-16-P, we placed CC-21-A at the southeast corner of the courtyard, at the base of the southern arm of Structure C-3. Our excavations started by placing a 2-x-3-m unit, which we dug from north to south (Figure 2.11). The first excavation levels were dedicated to removing the topsoil and collapse debris (Table 2.4). The first, Lot CC-21-A-01, consisted of a thick layer of very dark brown soil (10YR 4/3) with some artifacts, such as ceramic sherds. The collapsed debris (Lot CC-21-A-02) had the peculiarity of having two different dirt colors: brown in the south and grayish in the north (Figure 2.12). The grayish-brown soil results from topsoil merging with plaster from the collapsed architecture (Figure 2.13). The collapsed debris was thick; we excavated approximately 1.5 m down until we reached preserved architecture, the courtyard floor (Lot CC-21-A-05) and the remains of the platform face of Structure C-3 (Lot CC-21-A-04). The preserved portion of the masonry platform face consisted of four courses of roughly

Figure 2.11. Opening photograph of Subop CC-21-A-01, facing east.

Table 2.4. Summary of Lots in Subops CC-21-A and -D

Subop	Lot	Lot Description
CC-21-A	01	Topsoil
	02	Collapse debris
	03	Above-floor abandonment-related artifact deposit
	04	Platform face
	05	Floor
CC-21-D	01	Topsoil and collapse debris
	02	Above-floor abandonment-related artifact deposit

carved rectangularly stones, about 50 cm tall. The architecture is similar, albeit less well-preserved, to the wall excavated in Subops CC-16-P and CC-16-X by Booher (2016:Figure 2.17).

A significant concentration of artifacts was observed in a grayish brown sediment in the southwest corner of the unit, including more than 500 ceramic sherds, debitage, a chert projectile point, and the distal fragment of a pink granite metate (Figure 2.14). Due to its location and quantity of artifacts, we concluded that this context was part of the abandonment-related above-floor artifact deposit (Lot CC-21-A-03). The deposit is draped against the structure's platform and on the courtyard floor (Figure 2.15). We recovered over 700 ceramic sherds, a complete ceramic vessel, two pieces of obsidian, an unmodified shell, ground stones, and about 20 lithic tools. Some of the most significant artifacts include sherds of a Fine Orange tripod bowl, anthropomorphic vessel supports, and a carved plate (Figure

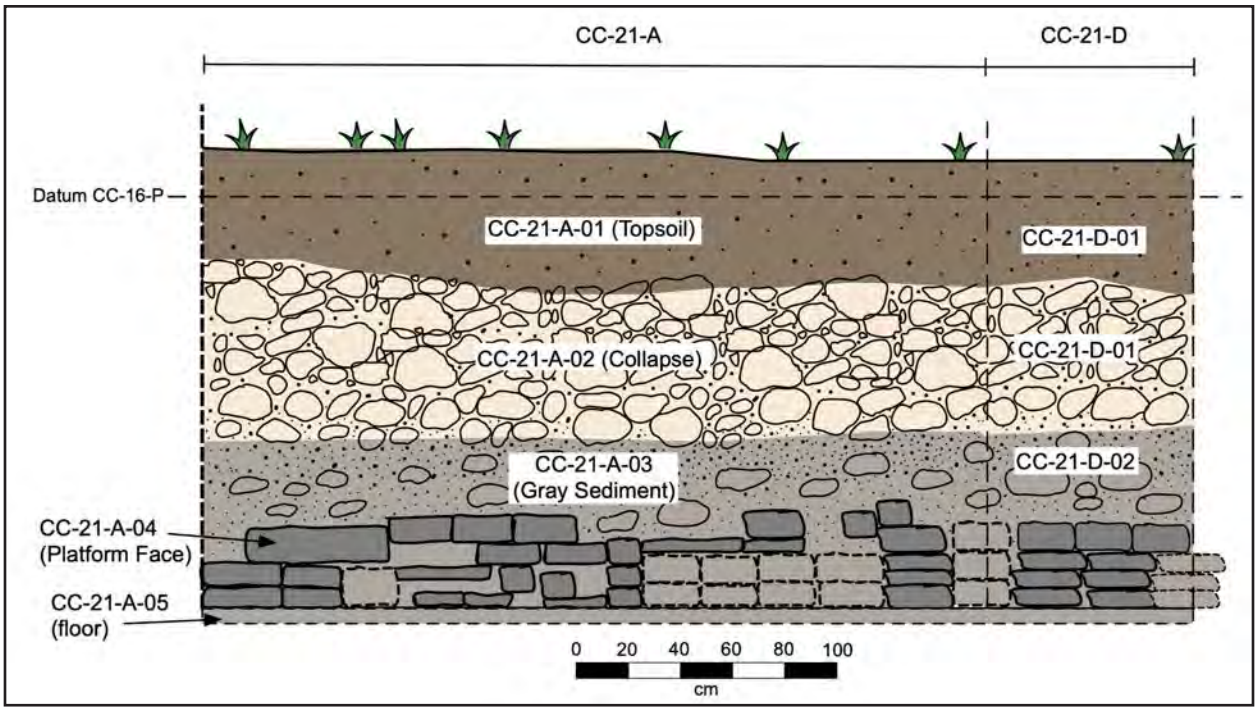


Figure 2.12. Subop CC-21-A south elevation drawing.

Figure 2.13. Collapse debris (Lot CC-21-A-02) excavation, view to the south.

Figure 2.14. Pink granite metate fragment in the above-floor artifact deposit in Subop CC-21-A.

Figure 2.15. Ceramic concentration on courtyard floor and platform face of Structure C-3.

2.16). Other important artifacts include three chert spear points, a ceramic spindle whorl, and ceramic fragments with repair holes (Figure 2.17). All the artifacts were in a grayish-white matrix below the collapse debris of Structure C-3 (Figure 2.18).

We placed an additional unit (Subop CC-21-D) to the east of Subop CC-21-A to connect our

Figure 2.16. Fine Orange grater bowl (left and bottom right) and eroded, anthropomorphic vessel feet (top right) from the above-floor artifact deposit in Lot CC-21-A-02.

Figure 2.17. Chert spear points (left), ceramic spindle whorl (top right), and drilled sherds (bottom right) from the above-floor artifact deposit in Lot CC-21-A-02.

Figure 2.18. Photograph of Subop CC-21-A showing the courtyard floor and Structure C-3 platform face, after the above-floor artifact deposit had been excavated. View to the south.

excavations to Booher's Subop CC-16-P (see Figure 2.2). This extension measured 1 by 2 m. The excavated deposits were similar in composition to those in Subop CC-21-A. We recovered multiple artifacts in the topsoil and collapsed debris (CC-21-D-01) until we reached the artifact deposit level (Lot CC-21-D-02). The layer consisted of very compacted gray sediment mixed with small rocks. We were able to recover about 50 more sherds, all of them severely eroded.

A final unit, Subop CC-21-B, was a 2-x-2-m suboperation located on a slope at the western part of Structure C-3, about 3 m east of the courtyard's southwest corner. Subop CC-05-D from 1998 was placed in a similar location but failed to yield any significant data, with the unit mainly consisting of 30 cm of white marl and sterile. Recent studies have suggested that peri-abandonment deposits might be located underneath thick layers of white marl (Hoggarth et al. 2020). The purpose of Subop CC-21-B was to find the layers of marl and keep excavating down to search for a possible ceremonial deposit. The topsoil (Lot CC-21-B-01) was very dark brown and had small pebbles (Table 2.5). About 50 ceramic sherds and 11 lithic tools were located on this level, suggesting that the unit had yet to be excavated. It was clear, however, that the northern section of the unit was disturbed. Under the topsoil, we observed a layer of collapsed debris consisting of dark brown matrix (Lot CC-21-B-02). The western section of the unit consisted of medium-sized, compact rocks, which

Table 2.5. Summary of Lots in Subop CC-21-D

Subop	Lot	Lot Description
CC-21-B	01	Topsoil
	02	Collapse debris/backfill

suggested we were excavating the backfill of the 1998 unit. However, the eastern side of the unit does not seem to be excavated. We found about 85 sherds, debitage, and ground stone tools. After excavating several centimeters more, the context of Subop CC-21-B remained unclear. Numerous boulders, seemingly placed intentionally, and compact dirt suggested our excavations were in backfill. Due to this and time constraints imposed by our Covid shutdown, we decided to close the unit.

FINAL THOUGHTS

Our excavations in the Upper Plaza yield new information about the ritual and construction history of the Norman's Temple complex in particular and the site of Chan Chich in general. For example, the presence of ancient graffiti, a primary burial, and evidence of burning events in the central vaulted room of Structure C-2 are significant. These data complement other evidence of ceremonial deposits, burials, and graffiti found within Norman's Temple elite architecture, contributing considerably to the data on ceremonial activities in the Maya area. Similarly, numerous ceramic sherds, elite broken pottery, a polychrome vase, and spearpoints also contribute to our data on the life of ritual objects and their disposal at the site. As we process, analyze, and interpret the data from the 2022 excavations at Norman's Temple, we will have a fuller understanding of the ceremonial lives of ancient Maya elites at the archaeological site of Chan Chich.

REFERENCES CITED

Booher, Ashley
2016 Results of the 2016 Norman's Temple Complex Investigations at Chan Chich. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 39–66. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Ford, Owen, and Amy E. Rush
2000 1998 Excavations at the Western Groups. In *The 1998 and 1999 Seasons of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 41–48. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeology Research Laboratory, The University of Texas at Austin

Harrison, Ellie
2000 Structure C-6: Excavations of an Elite Compound. In *The 1998 and 1999 Seasons of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 71–92. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, the University of Texas, Austin.

Gallareta Cervera, Tomás, Bridgette Degnan, Cora Mikolajczyk, Tyler Seale, Molly Masterson, and Rachel Naasz
2019 The 2018 Investigations in the Upper Plaza at Chan Chich, Belize. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 23–66. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Hoggarth, Julie A., J. Britt Davis, Jaime J. Awe, and Christophe Helmke
2020 Reconstructing the Formation of Peri-Abandonment Deposits at Baking Pot, Belize. *Ancient Mesoamerica* 31:139–149.

Houk, Brett A.
2016 Signs of the Times: Terminal Classic Surface Deposits and the Fates of Maya Kingdoms in Northwestern Belize. In *Ritual, Violence, and the Fall of the Classic Maya Kings*, edited by Gyles Iannone, Brett A. Houk, and Sonja A. Schwake, pp. 203–222. University Press of Florida.
2020 Contextual and Compositional Comparisons of Abandonment-Related On-Floor Deposits at Chan Chich, Belize. *Ancient Mesoamerica* 31:89–98.

Houk, Brett A., and Gregory Zaro
2015 *The Chan Chich Archaeological Project Field Manual*. Papers of the Chan Chich Archaeological Project, Number 9. Department of Sociology, Anthropology, and Social Work, Texas Tech University.

Hutson, Scott R.
2011 The Art of Becoming: The Graffiti of Tikal, Guatemala. *Latin America Antiquity* 22:403–426.

Meadows, Richard
1998 Test Pit Program in Group C. In *The 1997 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 59–66. Papers of the Chan Chich Archaeological Project, Number 3. Center for Maya Studies, San Antonio, Texas.

Scaniverse
2022 Scaniverse - 3D Scanner with LiDAR for iPhone and iPad. Electronic document, https://scaniverse.com, accessed November 17, 2022.

Trik, Helen, and Michael E. Kampen
1983 *The Graffiti of Tikal*. Tikal Report No. 31. The University Museum, University of Pennsylvania, Philadelphia.

The 2022 Chan Chich North Plaza Marketplace Study

Bridgette Degnan, Alexandra Cox, Anna DesHotels, Gabrielle Blowers, and Brett A. Houk

In 2022, the Chan Chich Archaeological Project (CCAP) started formal investigations to test the hypothesis that the North Plaza functioned as a marketplace during its final occupation phase in the Late/Terminal Classic period. This study builds upon previous work on lithic tool production in the North Plaza and is part of a regional research collaboration to identify ancient Maya marketplaces, a growing focus in the larger study of Maya market economies (Degnan et al. 2017; Degnan and Houk 2019; King 2015; Ruhl et al. 2018).

This chapter describes the research methodology and excavations during the 2022 field season. Artifact analysis, including ceramic analysis to determine chronology, is scheduled to take place during the 2023 field season.

PREVIOUS INVESTIGATIONS

During 2013 excavations at Structure A-5—a range building bounding the northern edge of the Main Plaza—the CCAP found a staircase on the northern side of the structure, indicating use of the space to the north, now called the North Plaza (Houk et al. 2013; Figure 3.1). In 2017, the CCAP started a long-term research objective to understand the function of the North Plaza, first focusing on the nature of lithic production activity in the space. Bridgette Degnan directed the first excavations in the plaza on Structure A-6 and the adjacent debitage deposit during the 2017 field season (Degnan et al. 2017) and subsequent excavations on the eastern side of the North Plaza floor during the 2018 field season (Degnan and Houk 2019). The 2017 and 2018 excavations were both classified as Operation (OP) CC-18 (Figure 3.2).

The first phase of the 2017 investigations focused on understanding the architectural form and function of Structure A-6, a structure on the southeastern edge of the North Plaza. Three suboperations on the structure showed that in its terminal construction phase during the Late Classic period it was a low platform with no masonry superstructure. The final phase of the building represents a minor Late Classic remodeling of the platform's surface; cobble fill and a new floor raised the summit of the platform about 15 cm. The building had a prior construction phase dating to the Late Preclassic period based on associated ceramics. Additionally, cut stones from this early phase stylistically resemble Late Preclassic architecture from the Upper Plaza (Degnan et al. 2017:110, 113).

Excavations documented an abundance of lithic production debris, including broken bifaces and production tools, on both the surface of the terminal phase architecture and in the fill below it, indicating that lithic production activity occurred throughout the Late Classic period construction and remodeling. We did not encounter a similar concentration of lithic artifacts in the Late Preclassic construction

Degnan, Bridgette, Alexandra Cox, Anna DesHotels, Gabrielle Blowers, and Brett A. Houk
2022 The 2022 Chan Chich North Plaza Marketplace Study. In *The 2022 Season of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 39–64. Papers of the Chan Chich Archaeological Project, Number 15. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

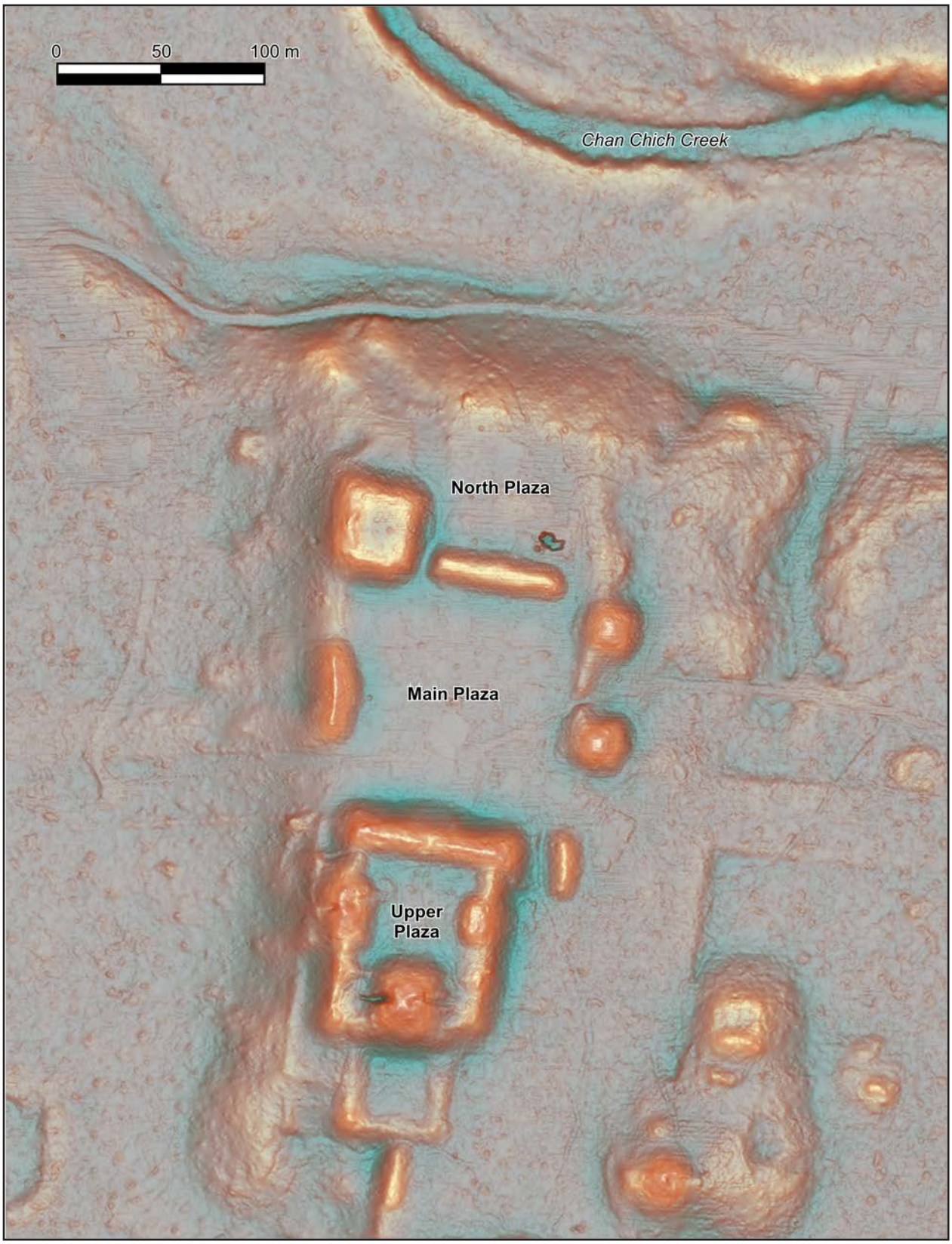


Figure 3.1. Red Relief Image Map (RRIM) of Chan Chich site core based on 2022 lidar data.

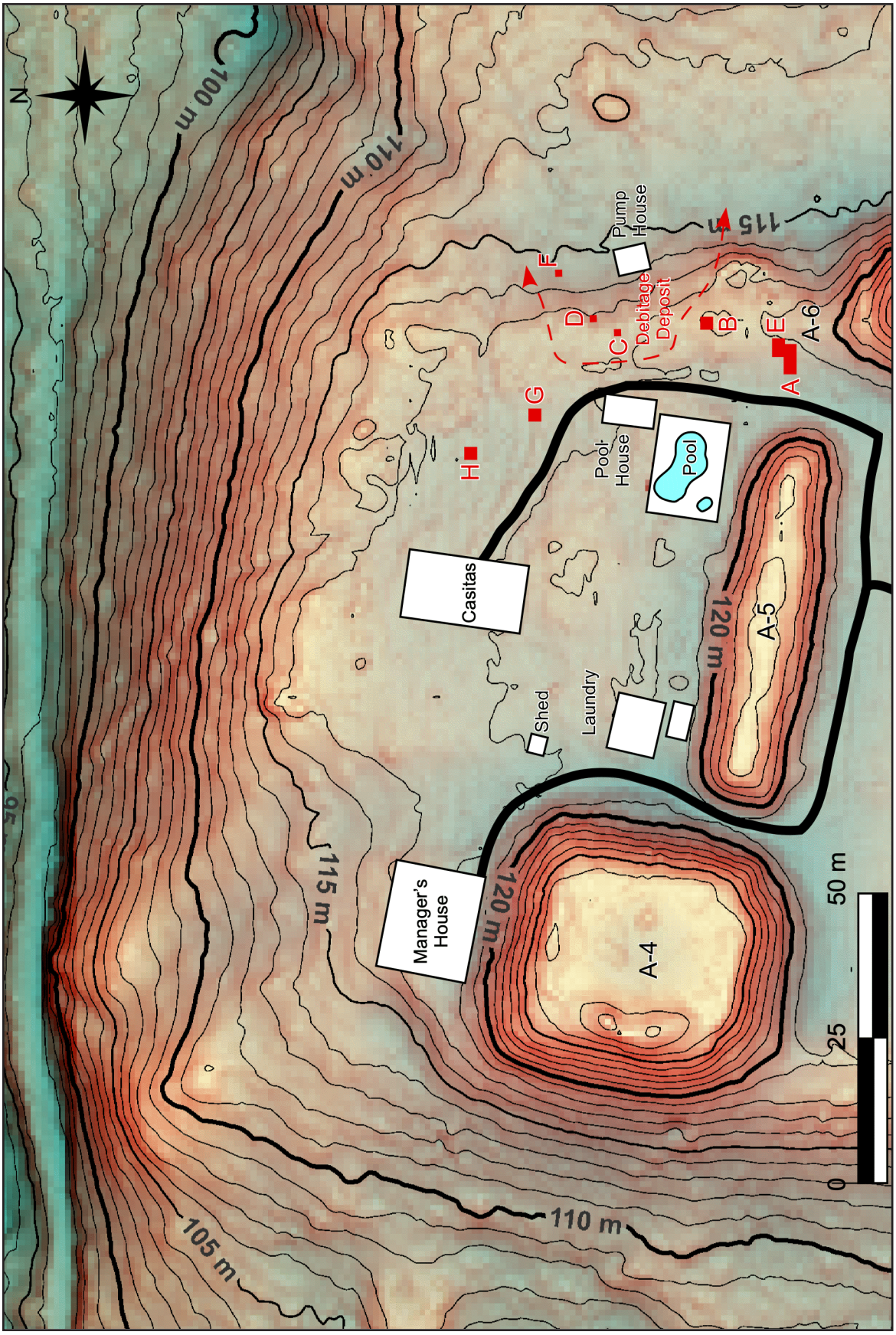


Figure 3.2. RRIM of the North Plaza and Op CC-18's 2017 excavations (Subops CC-18-A–F) and 2018 excavations (Subops CC-18-G and -H), the documented extent of the debitage deposit on the eastern edge of the plaza, and visible modern impacts.

phase, indicating that the structure originally served another purpose.

The second phase of the 2017 excavations included three 1-x-1-m test pits that evaluated the extent and density of the debitage deposit extending to the north of Structure A-6 and sloping down to the east (see Figure 3.2). Subsequent work showed that the debitage deposit covers minimally 585 m^2 (Degnan and Houk 2019:72). The deposits dated to the Late/Terminal Classic period and ranged from 30 to 50 cm thick. Degnan and colleagues (2017) concluded that lithic production on and around Structure A-6 was centered on late-stage production, likely on preforms that were transported to the plaza, and may have included on-site tool maintenance.

In 2018, Degnan and Houk (2019) confirmed that lithic production extended beyond Structure A-6 and into the eastern portion of the North Plaza floor. Two shallow 2-x-2-m units, Subops CC-18-G and -H, explored the final plaza floor in the North Plaza northwest of the debitage deposit (see Figure 3.2). Although one unit encountered modern disturbance related to Chan Chich Lodge (CCL), the second, Subop CC-18-H, recovered nearly 2,220 pieces of debitage.

RESEARCH DESIGN AND FIELD METHODS

The previous research conducted in the 2017 and 2018 field seasons showed evidence of skilled production and localized activity that is consistent with other indicators that the space may have once operated as a marketplace. Fortuitously, our preliminary marketplace investigations aligned with an effort by other scholars in northwestern Belize to investigate possible marketplaces in the eastern Three Rivers adaptive region (TRR). Eleanor King took lead on this initiative and applied for a collaborative National Science Foundation (NSF) Senior Archaeology Award grant. The team represents eight different research projects investigating possible marketplaces at Blue Creek, Bolsa Verde, Chan Chich, Chawak But'o'ob, Dos Hombres, Gran Cacao, Hun Tun, La Milpa, Ma'ax Na, N950 (a small site on a transect between Dos Hombres and Gran Cacao), and Tz'unun (King et al. 2020).

Research Objectives

To ensure consistency, the eight projects are sharing standard research questions and methods, with minor modifications to account for site-specific conditions. King and colleagues (2020) envision the NSF-funded work as the initial phase of a long-term study. The guiding hypothesis for the long-term research is that "an integrated system of interlinked marketplaces existed in the TRR by the Late Classic" (King et al. 2020:9). This hypothesis implies a regional distribution system of goods through marketplaces at the larger centers existed, that borders between sites were permeable, and that households across the region had access to multiple marketplaces and, thus, would have similar distributions of craft goods (King et al. 2020:9). To identify marketplaces, "this project proposes to use a configurational approach and a cross-culturally developed set of marketplace indicators to investigate the hypothesized existence of an integrated regional marketing system" (King et al. 2020:1). In other words, each team will look for archaeological correlates of marketplace activities, based on a set of assumptions outlined in the proposal (see King et al. 2020:Table 1).

The specific objectives for the NSF-funded work are (1) to demonstrate that marketplaces existed at large sites and as nodes within the larger system of distribution at smaller sites in the region, (2) to compare ceramic goods between marketplaces, (3) to evaluate if the configurational approach is useful

for identifying marketplaces, and (4) to assess how well projects can cross-share information in a region. The idea behind the configurational approach is that marketplaces have cross-cultural characteristics, which have archaeological correlates (Table 3.1). While none of these indicators are sufficient alone to identify a marketplace, the presence of multiple indicators builds a stronger case (King et al. 2020:9).

Field Methods

To collect comparable data, the NSF proposal outlines consistent methods to be used by the collaborating projects in the field and lab. However, the proposal allows for a degree of flexibility in methods based on site-specific factors. For example, because the North Plaza at Chan Chich is within the landscaped confines of CCL, we did not collect soil samples or do tree sampling, as other projects will.

The North Plaza investigations focused on examining the area thoroughly to uncover any possible buried structures (cf. Cap 2015; Dahlin et al. 2010) and to determine chronology, construction sequence, range of goods, and activity/discard areas within the plaza. The methods we employed are modified slightly from the proposal based on actual on-the-ground conditions. We also modified our methods to investigate a possible obsidian workshop in the western half of the North Plaza. Those methods are discussed together in a separate subsection below. To separate the NSF work from our previous North Plaza excavations, we designated the 2022 investigations as Op CC-22.

Mapping

We had proposed using a Total Data Station (TDS) to produce a contour map of the North Plaza, including its platform, which is steeply sloping and heavily vegetated. Ultimately, we decided not to use the TDS because we anticipated being able to use lidar data to produce a contour map more efficiently. As discussed by Houk (Chapter 1, this volume), the National Center for Airborne Laser Mapping provided us with lidar data, which we used to produce the base maps for the figures in this chapter. We used the TDS to establish a 5-m grid across the North Plaza. In practice, we used the TDS to establish baselines and a tape and compass to layout out most of the grid points. We also used the TDS to map individual excavation/collection units and surface finds.

Degnan and Houk searched for the rebar datums from the 2017 mapping work (see Willis et al. 2017) but were unable to find any. This created

Table 3.1. Summary of Key Market Indicators

Indicator	Description
Location within site	Plaza near site center, but not main ceremonial plaza
Layout	Large, open space Limited number of entrances/exits Monument marking main entrance Water source nearby
Specialized structures	Judges' stand Range of stalls, from impermanent to permanent
Artifacts	Variably distributed within the marketplace space
Soil chemistry	Distinctive soil signatures

a problem with matching the 2022 excavations with the rest of the excavations at Chan Chich. We established three new datums for this year's excavations by setting large nails in concrete. Most of the points that needed mapping were visible from at least one of these three datums (NPA, NPB, and NPC). We set up secondary datums as needed, but we removed these nails at the end of the field season.

Cox and Degnan laid out a 5-m grid across a 65-x-80-m area in the North Plaza and marked every grid point with a wooden stake (Figure 3.3). Starting at the base of Structure A-5 (Figure 3.4), the grid stretched 65 m north to where the level plaza floor starts to drop off towards Chan Chich Creek. The eastern edge of the grid started at the base of Structure A-6 and extended 80 m west, where the plaza again drops slightly in elevation (and where the CCL manager's house stands today). We designated the southernmost line running east-west as 0N and the center line running north-south as 500E. We use this coordinate system to refer to excavation locations throughout this chapter. For example, the wooden stake 10 m north of the southernmost line and 15 m to the west of the center line is location 10N, 485E.

Most of the North Plaza is an open, manicured lawn maintained by CCL employees. Several modern structures in this area obstructed excavations. From east to west, these are: the swimming pool, the pool house, a stone-laid pathway, Cabanas 14 and 15 (known as the casitas), an electrical transformer, the laundry

Figure 3.3. Alexandra Cox leveling the TDS and Gabi Blowers looking on. Photo facing east, with the pool house and pool screen visible in the background.

Figure 3.4. Shovel test markers along the 0N gridline. The closest wooden stake marks location 0N, 525E. Photo facing west, with Structure A-5 visible on the left side and the screened-in pool visible on the right.

house, the water softener building, and a shed. Additional disturbances include underground utilities that extend from some of these structures, a disturbed area to the east of the casitas where CCL once tried to drill a water well, and large trees throughout the plaza. Overall, the architectural disturbances are concentrated on the southern end of the plaza, which limited our ability to investigate activities at the base of Structure A-5. The northern and eastern edges of the plaza are unmanicured jungle. We cut transects through the jungle as needed to map the northern and eastern edges of the grid. Some sections had large leaf piles—from raking the manicured areas of the lodge—that we avoided. Modern trash was particularly common in the unmanicured portion of the plaza, but these disturbances were only surface level.

Over the course of the field season, we mapped all the staked grid points, the corners of all excavation units, surface finds, shovel tests, and vertical datums using the TDS. In the case of shovel tests, most of which had been excavated before they were mapped, we shot one point near the edge to capture the surface elevation of those excavations. We also mapped environmental and manmade disturbances in the plaza. This included the trees throughout the plaza, the casitas, the pathways, and exposed parts of PVC pipes. We mapped the edges of the manicured area to show how the excavations extended into the forest.

To tie these measurements into previous excavations, we relocated two previous datums within the asphalt of the road in the Main Plaza. These points have known UTM coordinates. Using the TDS, we worked our way from main datum NPA in North Plaza back into the Main Plaza where the two known points could be shot in and added to the job file. To do this, we set up the TDS, shot to a new point, moved the TDS to that new point, and shot back to the previous point. This was repeated several times. We used these points to determine the location of this year's excavations. However, we are not comfortable with the level of error in this method, particularly with respect to the elevations of our three new datums. The mapping data will be corrected in 2023 and tied into the newly acquired lidar data.

Shovel Testing

We designed a shovel test survey to systematically sample subsurface deposits across the North Plaza. Excavators dug a shovel test about 25 cm to the southwest of each wooden stake marking the 5-m intervals of the grid, modern disturbances allowing (Figure 3.5). Each test was roughly 30 cm in diameter and 10–15 cm deep. During the 2018 excavations, the CCAP concluded that the North Plaza floor was eroded but laid roughly 10 cm under the ground surface. Therefore, while none of the shovel tests came down upon a plaster floor, the depth was sufficient to capture terminal artifact distribution across the plaza. We labeled each shovel test as its own lot in Subop CC-22-ST.

We processed the material recovered from the shovel tests in the field. We water screened the matrix through 1/16-inch mesh to recover micro-artifacts, under the assumption that artifactual material could have been ground down from repeated trampling in a marketplace. We collected the full matrix of each shovel test in a 5-gallon bucket and then ran it through two tiers of screens. The first was a ¼-inch screen that collected the large fraction, and the second was a 1/16-inch mesh (common window screen) that collected the small fraction. We set up an in-field processing station (Figure 3.6). First, we secured the window screen across the top of a 5-gallon bucket using bungee cords around the outside of the bucket's rim. Then, we placed the ¼-inch screen on top of the bucket. We ran water over the full matrix from each shovel test; anything larger than

Figure 3.5. Gabi Blowers digging shovel test CC-22-ST-16. View facing southwest, with Structure A-5 visible in the background and the laundry house visible on the right.

Figure 3.6. Delita Coh (left) and Lohanny Cordova processing shovel tests. The large fraction lays to the right on the screen as they finish water-screening the small fraction. View to the north, with Casita 14 visible in the background.

¼ inch was collected as large fraction on the upper screen, and anything smaller than ¼ inch but larger than 1/16 inch was collected as small fraction on the window mesh. For some samples, we used laundry detergent to aid in breaking down soil and lumps of clay to pass through the window screen.

After all the matrix was run through these screens, we laid it out to dry. When dry, we removed larger rocks and roots and bagged the remaining material as "large fraction" or "small fraction." Artifact analysis of material recovered from the shovel tests will take place in 2023.

Strip Trench Excavations

We supplemented the shovel test data with four 0.5-m wide strip trenches to remove topsoil and expose the final plaza floor. These kinds of trenches have revealed buried features in the Upper Belize River Valley (Yaeger et al. 2004) and at Colha in northern Belize (King, personal communication, 2021). The goal of the trenches, in addition to collecting artifacts, was to identify possible marketplace stalls.

Each strip trench extended either north-south or east-west across the grid. To increase horizontal control, we split each 5-m grid interval in half and assigned each half its own lot number. Therefore, each lot is roughly 2.5 m long and 0.5 m wide, with some variation due to modern disturbances when laying out the grid. When a strip trench overlapped with a shovel test, the field crew first collected the shovel test from within the bounds of the strip trench.

Crews placed the excavated matrix from each lot in 5-gallon buckets. In some cases, the crew screened every bucket through ¼-inch mesh, but in other cases they screened every other bucket for a 50 percent screened sample. The crew visually sorted the matrix in every non-screened bucket to look for diagnostic ceramics, stone tools, and special finds. With this method, the crew did not have to spend extended time sifting through the matrix to collect dozens, sometimes hundreds, of small pieces of debitage that were common throughout the plaza and which had been characterized already by the shovel testing. The following descriptions note when this method was used ("50 percent screen").

Chronology Unit Excavations

To determine overall chronology and stratigraphy, we excavated three 1-x-2-m test pits placed in distinct parts of the plaza. These were the only excavations to extend deeper than 15 cm. Consistent with methodology for the strip trench excavations, crews placed the excavated matrix from each lot in 5-gallon buckets and either screened every bucket or a 50 percent screened sample.

Surface finds

We collected lithic tools visible on the surface of the North Plaza but not part of an excavation unit or shovel test as surface finds under Subop CC-22-SF. Cox mapped the location of each surface find with the TDS.

Special Methods to Investigate Possible Obsidian Workshop

On June 12, when Luis Romero, a CCL employee, assisted us in the field on his day off, he pointed out an area on the western edge of the plaza where employees often notice small pieces of obsidian (Figure 3.7). Degnan and Houk did an informal walking survey of this area and noted a scattering of small broken obsidian blades and a lot of obsidian microdebitage. The density and size of artifacts were consistent with in-situ production activity, so we adapted our research plan to investigate further.

Figure 3.7. Western side of the North Plaza where obsidian blades and microdebitage are visible on the surface. View to the north.

Shovel Testing

To get a grasp on the boundaries of this zone, we designed a second shovel test survey, Subop CC-22-OB, to supplement the full-scale survey of the plaza. Cox laid out a 2.5-m grid in this area by placing additional markers at mid-points of the 5-m grid (Figure 3.8). The field crew excavated these shovel tests using a post-hole digger, with each test approximately 17.5 cm in diameter and 10 cm in depth. We collected the full matrix from each shovel test in a 5-gallon bucket and processed it in the field, consistent with the full shovel test survey.

Surface Collections

To understand the density of obsidian microdebitage in this area, we conducted a series of surface collections in the areas where the most obsidian was visible on the surface. For each surface collection, we collected all obsidian, including microdebitage, on the surface within a 25-cm radius of an arbitrary central point. To do this, a crew member carefully scraped the surface with a trowel and collected all the visible obsidian within the circular collection area. Each collection was given its own lot number in Subop CC-22-SF.

Shallow Excavations

We opened Subop CC-22-H, a 1-x-6 m shallow excavation unit, to investigate our hypothesis that this area functioned as an obsidian workshop that was contemporaneous with other activity occurring across the North Plaza.

Figure 3.8. Wooden stakes marking shovel tests on the western side of the plaza. Stakes with orange flagging tape are part of the original 5-m grid (Subop CC-22-ST), while stakes with pink flagging tape are part of the 2.5-m grid (Subop CC-22-OB). View to the west, with the manager's house visible in the background.

Using the results from the surface collections, we placed the new suboperation in an area with a particularly dense concentration of obsidian.

We split the suboperation into six horizontal lots, each measuring 1-x-1 m. Because the debitage did not extend very deep into the topsoil, we excavated the top 10 cm of topsoil matrix for the odd numbered lots (Lots CC-22-H-01, -03, and -05) and the top 5 cm of topsoil matrix for the even numbered lots (Lots CC-22-H-02, -04, and -06). Because so much of the obsidian material was microdebitage, we screened all of the matrix for the two lots in the center of the unit, Lots CC-22-H-03 and -04, through 1/16 in mesh, consistent with the shovel test screening method, to ensure we recovered the full range of obsidian artifacts. We screened the remaining four lots through ¼-inch screen (Lots CC-22-H-01, -02, -05, and -06).

SUMMARY OF EXCAVATIONS AND SURFACE COLLECTIONS

This section describes the suboperations excavated under Op CC-22 during the 2022 field season. In total, we opened 10 suboperations. The suboperations consisted of two series of shovel tests, four strip trenches, a 1-m wide shallow trench, three chronology units, and surface collections (Figure 3.9, Table 3.2).

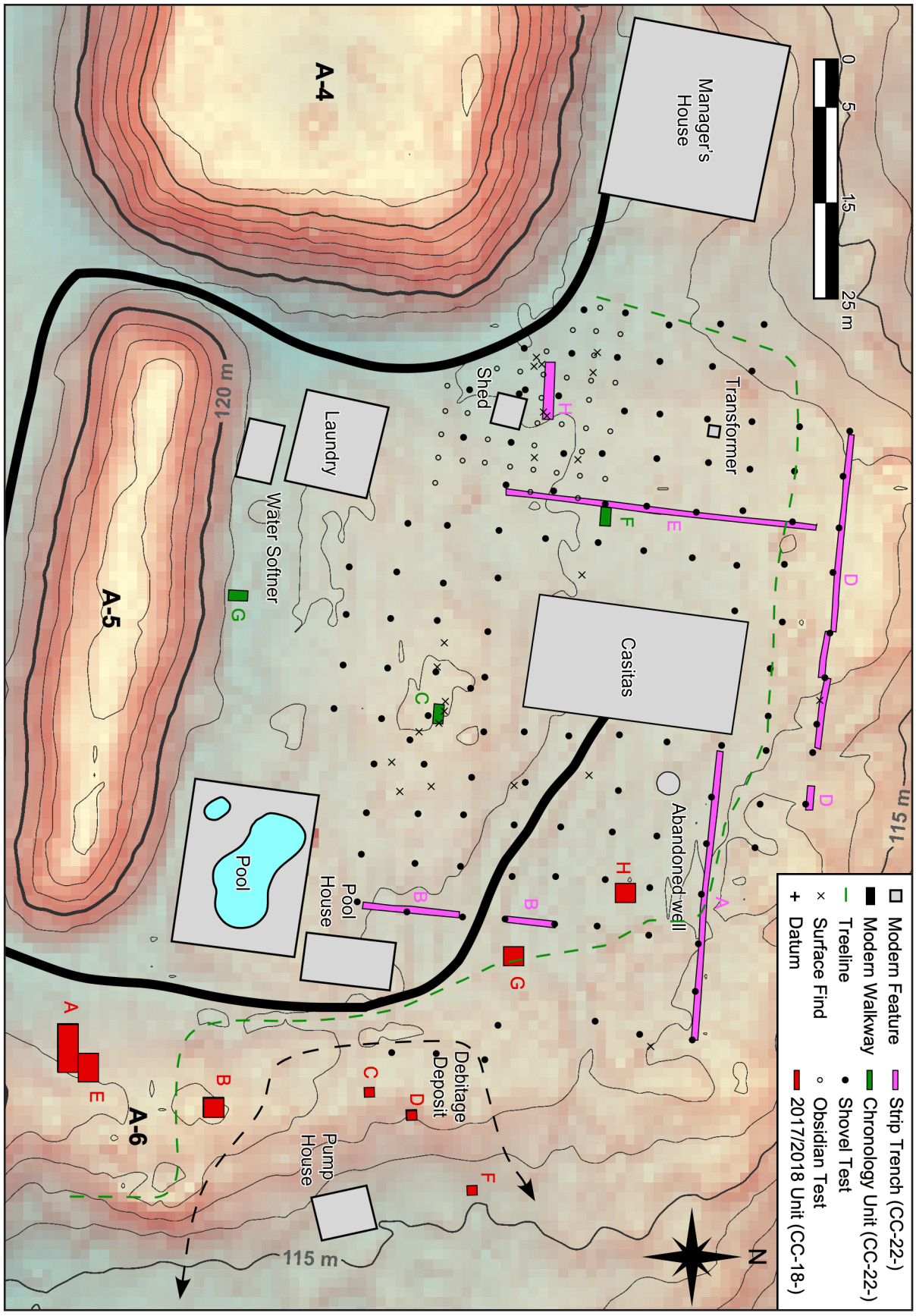


Figure 3.9. RRIM of Op CC-18 and Op CC-22 excavations alongside modern disturbances in the North Plaza.

Table 3.2. Summary of Suboperations and Type

Suboperation	Description
CC-22-A	Strip trench
CC-22-B	Strip trench
CC-22-C	Chronology
CC-22-D	Strip trench
CC-22-E	Strip trench
CC-22-F	Chronology
CC-22-G	Chronology
CC-22-H	Wide shallow trench
CC-22-OB	Shovel test
CC-22-SF	Surface finds
CC-22-ST	Shovel test

Two of the strip trenches, Subops CC-22-B and CC-22-E, were placed fully in the manicured area of the North Plaza, Subop CC-22-A was partially in the manicured lawn and partially past the tree line, and Subop CC-22-D was fully past the tree line. Since artifact analysis is ongoing, this discussion contains preliminary results from the excavations.

North Plaza Shovel Test Survey

In total, the field crew excavated and processed 111 shovel tests under Subop CC-22-ST (Figure 3.10). The first shovel test was conducted on June 2, 2022, and the last shovel test was processed on June 23, 2022. The total matrix recovered from each test varied slightly depending on the presence of larger rocks and tree roots.

Strip Trench Excavations

The field crew excavated four narrow strip trenches across the plaza (see Figure 3.9). We opened the first strip trench, Suboperation CC-22-A, on June 4, 2022, and closed the fourth strip trench, Suboperation CC-22-E, on June 22, 2022. Combined, the strip trenches were 110 m in length, 0.5 m wide, and roughly 15 cm deep, for a total of 8.25 m^3 of excavated matrix.

Although we found no architectural features in the strip trenches, these excavations will aid the shovel test survey in documenting the distribution of artifacts across the plaza.

Suboperation CC-22-A

We placed Suboperation CC-22-A on the northeastern portion of the plaza, bound by a septic tank to the east and a large leaf pile to the north. Lot CC-22-A-01 started at grid location 55N, 525E; it and other lots extended half a meter to the south along the 55N gridline. In total, it was 30 m long and comprised 12 lots (Figure 3.11).

The matrix throughout this suboperation was a moist topsoil (10YR 2/2, very dark brown). The first three lots were in the unmanicured jungle and had thick layers of decomposing organic material on the surface alongside modern ceramic tiles and nails. We screened every bucket for the first five lots and used the 50 perfect screening method for the remaining seven lots.

Around grid location 55N, 510E, between Lots CC-22-A-06 and CC-22-A-07, there was a somewhat circular matrix change. The center of this area was 10YR 8/3 (very pale brown), surrounded by 10YR 4/1, dark gray. Interpretation of this feature is inconclusive, as it could have been from a tree that the lodge filled in, rather than an architectural feature.

Suboperation CC-22-B

We placed Subop CC-22-B on the eastern side of the plaza, roughly 15 to 20 meters from Structure A-6. Lot CC-22-B-01 started at grid location 20N, 515E; it and other lots extended to the north and a half meter to the west of the 515E line. In total, this suboperation was 15 m long and comprised six lots. A stone path running from the pool entrance to the casitas

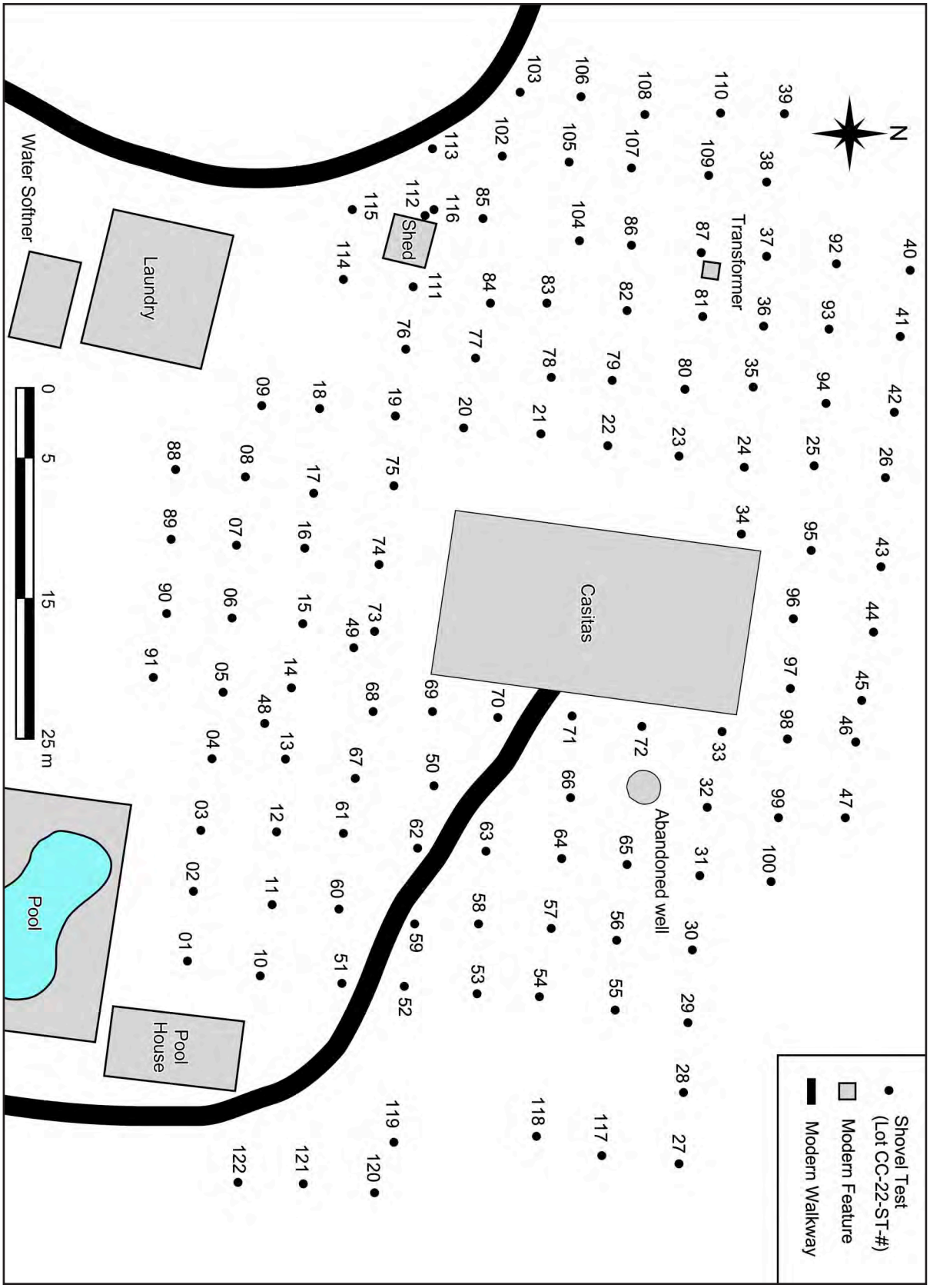


Figure 3.10. Map of visible modern impacts and the North Plaza shovel test survey, Subop CC-22-ST, with lot numbers.

Figure 3.11. Narcisso Pott (left) and Miguel Velasquez screening. On the left side, Subop CC-22-A extends into the jungle. Crew working at Subop CC-22-B visible in the background. Photo facing east.

cuts across this section of the plaza; the first four lots were located to the south of the path and the remaining two lots to the north (Figure 3.12). The path was created by laying down a layer of gravel and cement paving stones on top, so it likely caused minimal disturbance to the subsurface material. The southern lots are slightly elevated, which may at least partially be due to backfill from the construction of the pool in the late 1990s. For example, in Lots CC-22-B-01 and -02 we found soft rocks with small green-blue flecks that were consistent with the decorative concrete that lines the inside of the pool. It is likely that this was the area where the concrete was prepared during construction. These modern disturbances were not present in Lots CC-22-B-03 through -06, where the matrix was characteristic of eroded plaza floor and subfloor fill.

The matrix in this suboperation was topsoil filled with small to medium rocks. There was a high density of lithic debitage throughout the entire suboperation, but the density was especially high in the southern lots. We screened every bucket for Lots CC-22-B-01 to CC-22-B-03. For the remainder of the lots (Lot CC-22-B-04 through CC-22-B-06), we used the 50 percent screening method described in the methodology section.

Suboperation CC-22-D

We placed Suboperation CC-22-D along the very northern edge of the plaza, past the tree

Figure 3.12. View of backfilled Subop CC-22-B. Lots CC-22-B-01 through -04 are visible in front of the pool house. Lots CC-22-B-05 and -06 extend off the left side of the photograph. View to the southeast.

line separating the manicured lawn maintained by CCL staff and into the jungle (See Figure 3.9). The longest strip trench of the four, Suboperation CC-22-D ran 35 m across the northern edge of the plaza and had 14 lots. Lot CC-22-D-01 started at grid location 65N, 460E and it and other lots ran east. Nearly all lots extended a half meter to the north of the wooden stakes, except Lots CC-22-D-09 and -10, which extended to the south of the wooden stakes because of a tree blocking the northern path. There is a break between Lots CC-22-D-13 and -14 where a trail cuts from the manicured lawn down to Chan Chich Creek (Figure 3.13).

The matrix in this suboperation was a dark, moist topsoil with roots and rocks throughout. Throughout the entire suboperation, modern material, including nails, screws, glass, plastic, and modern animal bones, was visible on the surface alongside artifacts. There were large limestone rocks throughout the westernmost lots (Lots CC-22-D-01, -02, and -03), one of which in Lot CC-22-D-02 may have been faced. The remaining lots had medium to small rocks throughout.

Suboperation CC-22-E

We placed Suboperation CC-22-E on the western side of the plaza, roughly 10 m west of the CCL casitas. In total, Subop CC-22-E measured 30 m long and had 12 lots. Lot CC-

Figure 3.13. Photo of Lot CC-22-D-13 look west towards Lot CC-22-D-01 (out of frame). Lots CC-22-D-09 and -10 are located to the south of the tree obstructing the 64N gridline. View to the west.

22-E-01 started at grid location 30N, 470E, and subsequent lots extended north and a half meter to the east of the wooden stakes. Small, light-colored gravel was scattered across the surface of all lots in this suboperation. This material is likely from the old path to the casitas, which once connected to the trail to the manager's house, and the area where Cabana 13 used to be before it was destroyed by a tree fall in the early 2000s. The gravel did not continue past the surface.

The matrix throughout Subop CC-22-E was a dark, moist topsoil. The two southernmost lots, Lots CC-22-E-01 and -02 had medium to large rocks throughout. We did not encounter any architectural features.

Chronology Units

We excavated three chronology units in different locations throughout the plaza to understand the overall stratigraphy and chronology. We opened the first chronology unit, Subop CC-22-C, on June 5, 2022, and closed the third chronology unit, Subop CC-22-G, on June 25, 2022. These were the only excavations to extend past the terminal floor-level. Two of the three units revealed prior construction phases and resurfacing events under the terminal phase North Plaza floor, potentially dating to the Late Preclassic period.

Suboperation CC-22-C

We placed the first chronology unit in the southern portion of the plaza, about 10 m south of the CCL casitas, near grid location 15N, 500E (see Figure 3.9). This southern area of the plaza is rocky and slightly raised, with visible cores, preforms, and broken tools scattered on the surface. The raised area, which follows the 118-m contour line, is clearly visible on the lidar-derived maps (see Figures 3.1 and 3.2, for example) extending across the southern half of the North Plaza. In its terminal phase, it may have been a raised, unfinished platform. Our excavations show that this area had several remodeling events associated with lithic production activity.

Subop CC-22-C had a high density of lithic debitage throughout the vertical extent of the unit. The first two lots consisted of topsoil

mixed with rocky fill (10YR 3/2, very dark grayish brown). The thickest debitage layers started at Lot CC-22-C-03 and continued for roughly half a meter, separated by three surfaces: a packed dirt surface, an eroded but partially preserved plastered floor (Lot CC-22-C-05), and a third eroded marly floor (Figure 3.14). Some pockets of debitage in Lots CC-22-C-03 and -04 were so tightly packed there was little to no soil between the individual artifacts. In the construction fill between each surface, excavators found small to medium rocky fill surrounding the lithic debris. The matrix under the third and final surface was a rocky construction fill, with larger limestone rocks, some eroded and potentially faced, on the western side of the unit (Lot CC-22-C-07).

We employed the 50 percent screening method for Lot CC-22-C-03, -06, and -07 and a 33 percent screening method for Lot CC-22-C-04 (visually scanning every two of three buckets for only ceramics and special finds). Subsequent ceramic analysis will help determine if the lithic production in this area of the plaza was contemporaneous with lithic production at Structure A-6.

Suboperation CC-22-F

We placed Subop CC-22-F, the northernmost chronology unit, on the western side of the casita in the North Plaza (see Figure 3.9). We avoided several modern disturbances when placing this unit. First, Cabana 13 used to be a few meters to the north (the plumbing pipe is still visible above the surface). The current casita has an entrance and path extending from its eastern side, but the casita used to have an entrance on the western side, with a walkway coming from the Main Plaza to the casita. This walkway was constructed by laying down gravel and placing wooden pavers overtop and did not intrude into the surface. Finally, the laundry house, manager's house, and an electrical transformer are nearby. We placed Subop CC-22-F to avoid these disturbances, as well as any underground piping extending from them.

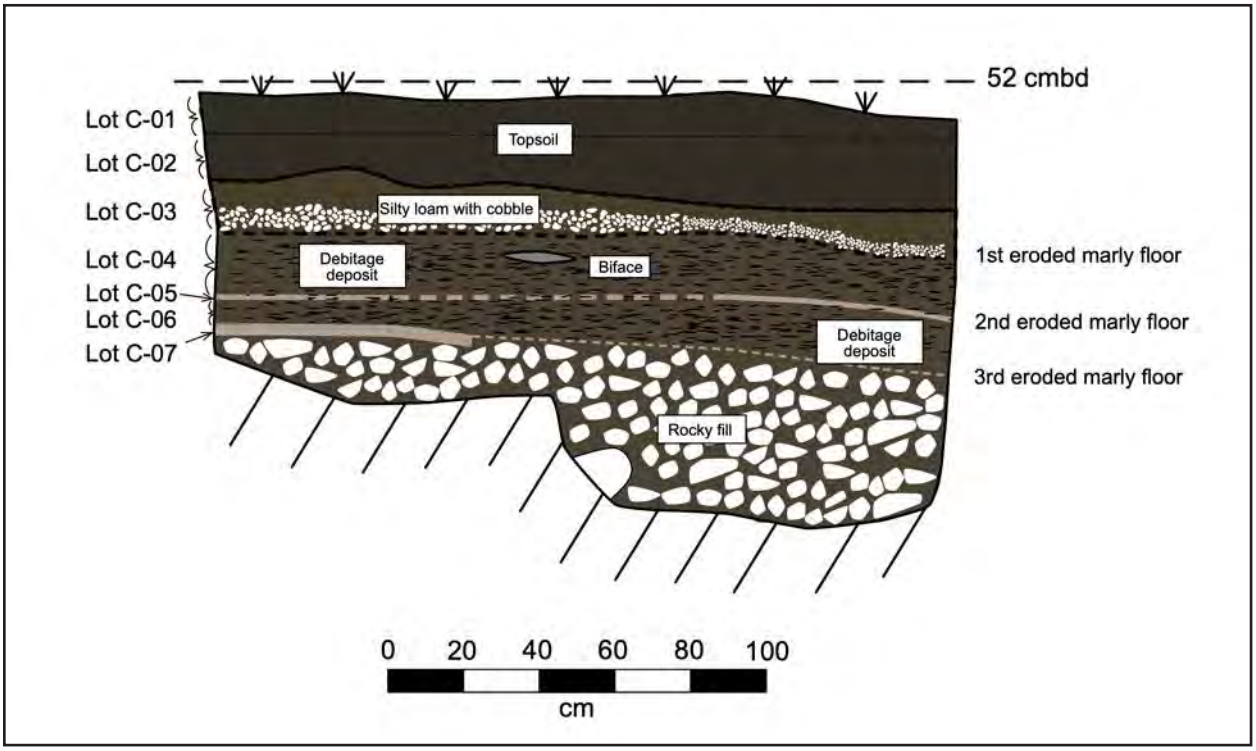


Figure 3.14. Subop CC-22-C north wall profile.

We found no architectural features in Subop CC-22-F, which was excavated to a half meter depth in two lots to maintain vertical control. The matrix was consistently moist clay loam (10YR 2/2, very dark brown) with cultural material throughout, including ceramics, lithic tools, and debitage.

Suboperation CC-22-G

Subop CC-22-G was placed at the base of Structure A-5, roughly at the center point of the structure. There is an old water pump 10 to 15 meters west of the unit, near the laundry house. To the north, there is a narrow ditch running from the pool to the laundry house, the imprint of a pipe that used to run across the plaza.

Subop CC-22-G was excavated in nine lots (Figure 3.15). The first layers consisted of topsoil and collapse debris from Structure A-5 (Lots CC-22-G-01–03). There were two plastered floors, the first Lot CC-22-G-04 and the second Lot CC-22-G-07, below the collapse debris. The deeper plaster floor was built atop three large, faced stones forming a wall or part of a platform (Figure 3.16). The fill was consistent with Preclassic period fill, which subsequent ceramic analysis may also support.

Surface Finds

During the field season, we collected 23 surface finds, each as their own lot under Subop CC-22-SF. The majority of the surface finds were lithic tools noticed in the field (see Figure 3.9). Five of the lots, Lots CC-22-SF-14–18, were obsidian samples collected to survey

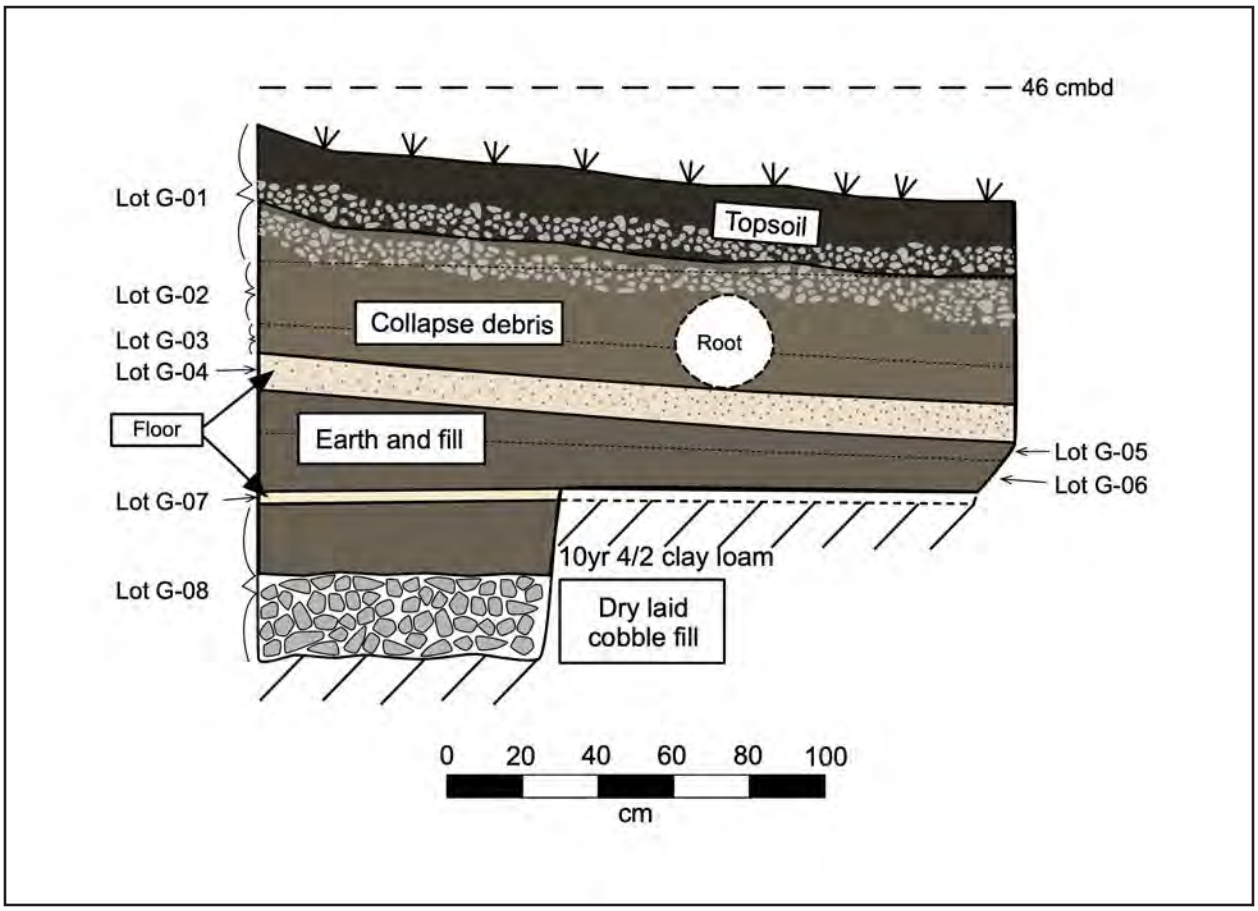


Figure 3.15. Subop CC-22-G west wall profile.

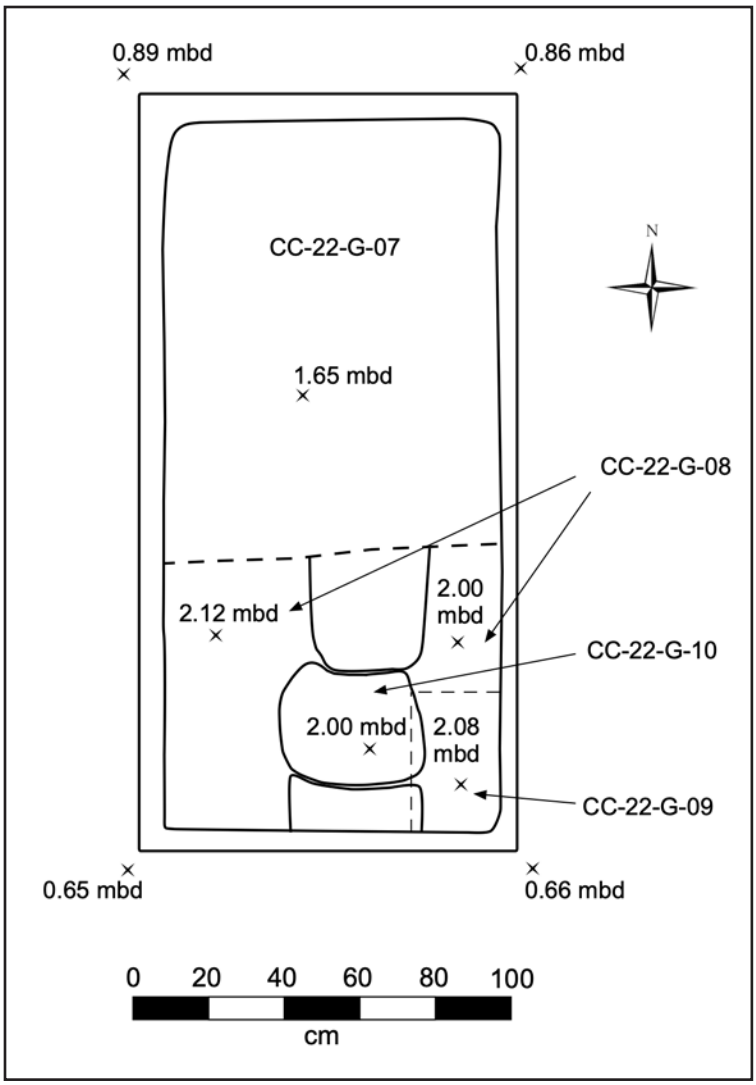


Figure 3.16. Plan view of Subop CC-22-G.

the density of microdebitage at the possible obsidian workshop (see discussion below).

Possible Obsidian Workshop

To investigate the possible obsidian workshop, we first executed a supplemental shovel test survey to define the bounds of the workshop. The field crew excavated and processed an additional 35 shovel tests, each as its own lot under Subop CC-22-OB (Figure 3.17). Additionally, we collected five surface samples under Subop CC-22-SF (Lots CC-22-SF-14–18) to identify an area with dense concentration of obsidian material on which to place Subop CC-22-H. We chose an area just north of the CCL shed and about 15 m north of the laundry house, between two large trees (Figures 3.18, Figure 3.19). While we have not completed the lab analysis of the artifacts from Subop CC-22-OB yet, many of the shovel tests encountered large quantities of obsidian microdebitage.

Subop CC-22-H ran 1 m north-south and 6 m east-west. For horizontal control, each 1-x-1 m block was recorded as its own lot, for a total of six lots. Lot CC-22-H-01 started at the eastern side of the unit, and lots were assigned sequentially so that Lot CC-22-H-06 was the westernmost lot. We excavated the first 10 cm of the odd numbered lots and 5 cm of the even numbered lots for a total excavated volume of 0.45 m^3.

Like the area surrounding Subop CC-22-C, the ground appears slightly raised and the surface is scattered with medium sized cobbles. During excavation, the field crew noted that obsidian material was concentrated at the surface-level. Significantly, there is also a possible alignment of five medium to large rocks running north-south through Lots CC-22-H-05, CC-22-ST-112, and CC-22-ST-116 (Figure 3.20). This alignment could be consistent with architectural stalls and is similar to another potential alignment of stones found running north-south on Structure A-6 (see Degnan et al. 2017).

The excavation of Subop CC-22-H was largely focused on the recovery of obsidian artifacts to understand the nature and extent of obsidian blade production. We recovered a large number of obsidian blades, ranging in size from a few centimeters to a few millimeters. These results

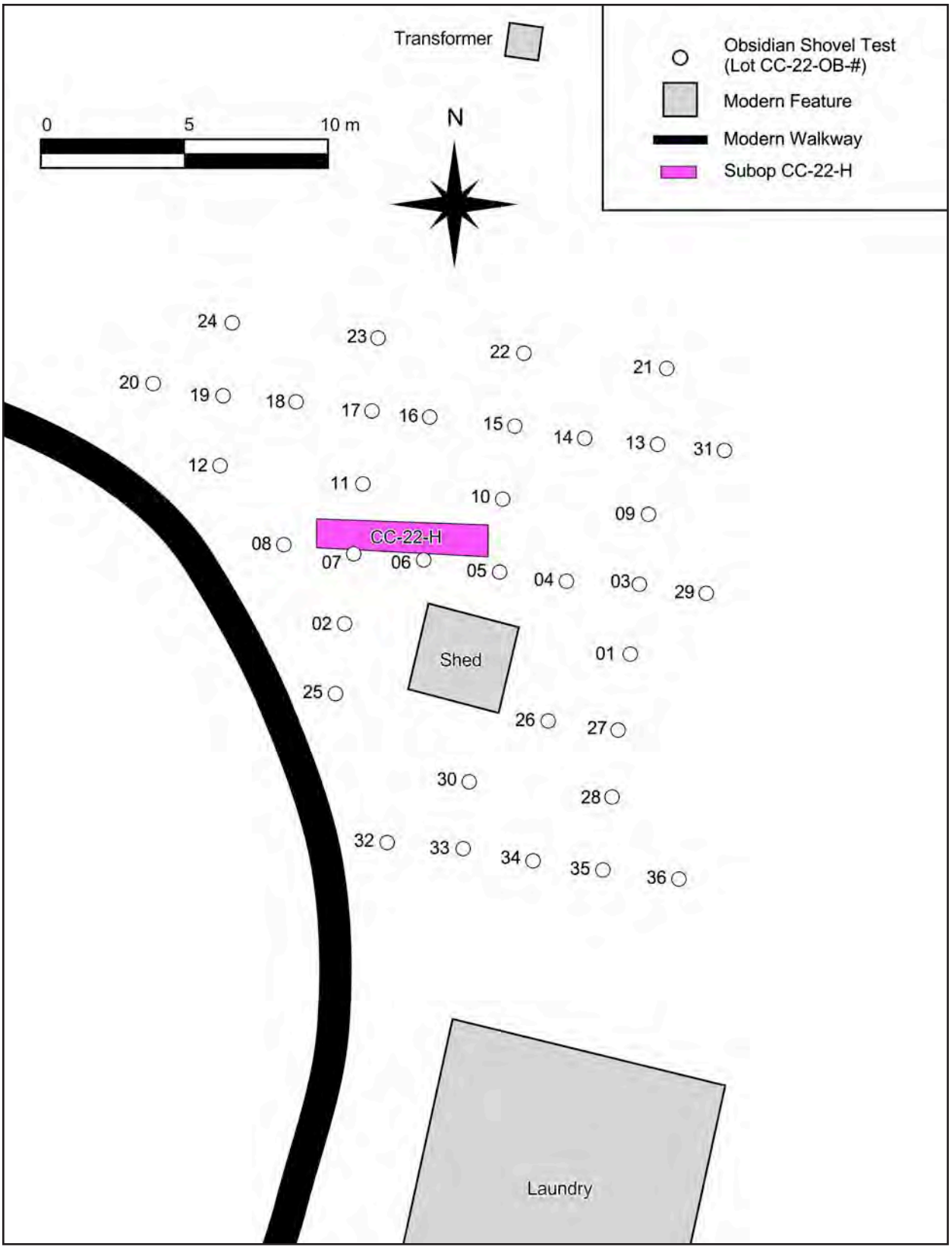


Figure 3.17. Map of obsidian shovel test survey Subop CC-22-OB and Subop CC-22-H.

Figure 3.18. Subop CC-22-H before excavation, with orange string delineating the horizontal lots. Lot CC-22-H-01 is the 1-x-1-m unit in the foreground, with the most rocks and root disturbance, while Lot CC-22-H-06 is the 1-x-1-m unit at the base of the tree visible in the center of the image. Surface finds CC-22-SF-14 and -15 are marked by orange flagging tape inside the boundaries of Lot CC-22-H-01. View to the west, with Structure A-4 visible in the background.

Figure 3.19. Subop CC-22-H before excavation, showing the relative location of the CCL shed and Structure A-4 to the right. View to the south.

will be discussed following the 2023 lab analysis.

FUTURE INVESTIGATIONS

The 2017, 2018, and 2022 excavations at the North Plaza indicate that lithic production occurred in several locations across the North Plaza: late-stage biface manufacture on and around Structure A-6 and likely extending to the central area of the North Plaza (Subop CC-22-C) and potential obsidian prismatic blade production on the western side of the plaza. Artifact analysis of material from the shovel test surveys and excavations from this field season will shed light on activity across the plaza, and ceramic analysis will allow us to establish a chronology for the space.

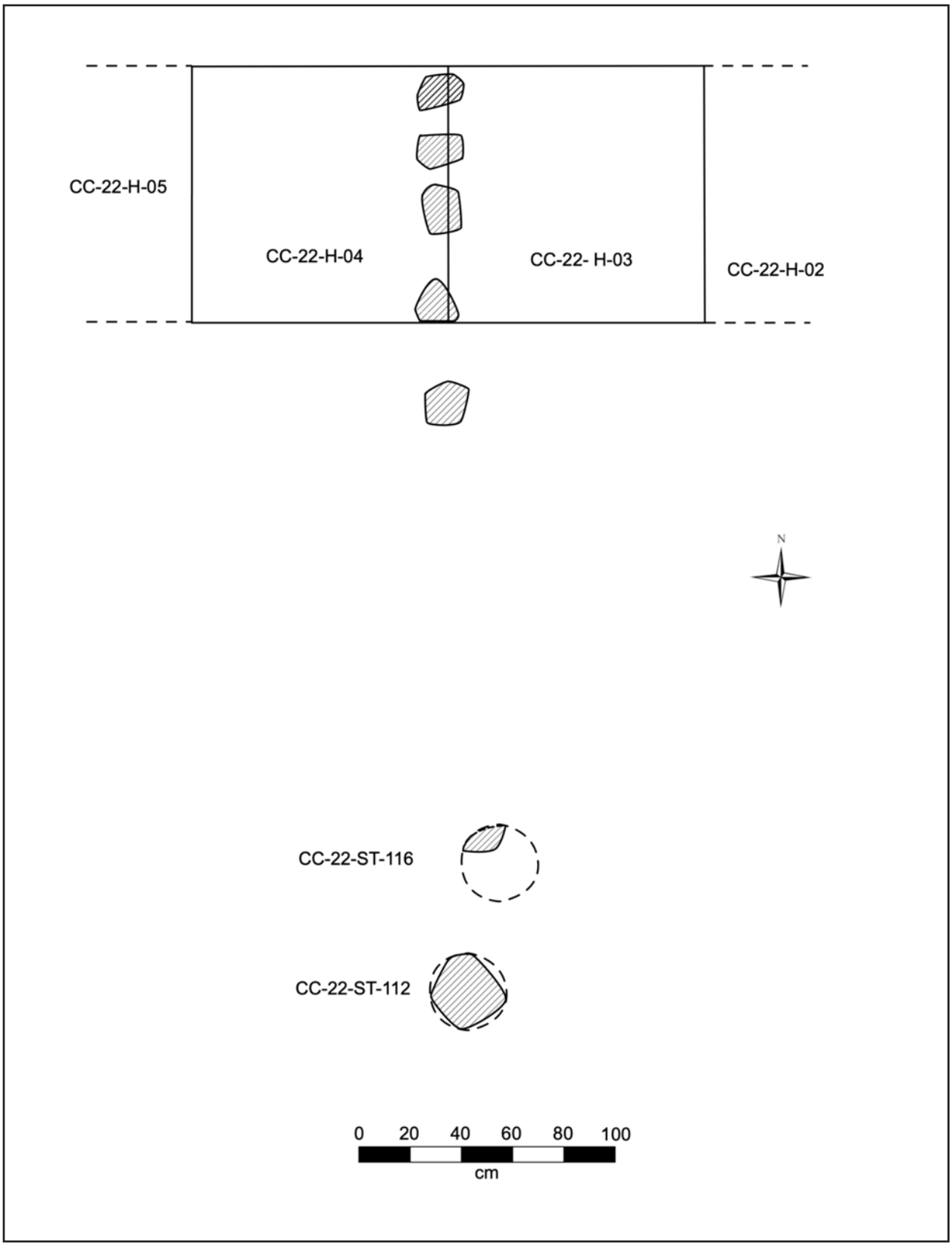


Figure 3.20. Plan view of Subop CC-22-H with Lots CC-22-ST-112 and -116.

REFERENCES

Cap, Bernadette
2015 How to Know It When We See It: Marketplace Identification at the Classic Maya Site of Buenavista del Cayo, Belize. In *The Ancient Maya Marketplace: The Archaeology of Transient Space*, edited by Eleanor M. King, pp. 111–137. University of Arizona Press, Tucson.

Dahlin, Bruce H., Daniel Bair, Tim Beach, Matthew Moriarty, and Richard E. Terry
2010 The Dirt on Food: Ancient Feasts and Markets among the Lowland Maya. In *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica*, edited by John Edward Staller and Michael Carrasco, pp. 191–232. Springer, New York.

Degnan, Bridgette, and Brett A. Houk
2019 Continued Investigations at an Epicentral Lithic Workshop in the North Plaza at Chan Chich, Belize. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 67–92. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Degnan, Bridgette, Kevin Miller, and Brett Houk
2017 Archaeological Investigations at an Epicentral Lithic Workshop: Structure A-6 and the North Plaza Debitage Deposit, Chan Chich, Belize. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 97–142. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

King, Eleanor
2015 *The Ancient Maya Marketplace: The Archaeology of Transient Space*. Tucson, AZ: University of Arizona Press.

King, Eleanor, Marisol Cortes-Rincon, and Rissa Trachman
2020 Collaborative Research: Exploration of Maya Marketplaces in the Three Rivers Region of Northwestern Belize. Grant proposal submitted to the National Science Foundation Senior Archaeology Award Program, August 28, 2020. Manuscript on file, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Ruhl, Thomas, Nicholas Dunning, and Christopher Carr
2018 LiDAR Reveals Possible Network of Ancient Maya Marketplaces in Southwestern Campeche, Mexico. *Journal of Mesoamerican Studies* 40(3):83–91.

Willis, Mark D., Julia Kleine, Marcus Schwimmer, Paul Schwimmer, and Chet Walker
2017 Mapping at Chan Chich. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 157–166. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Yaeger, Jason, Minette C. Church, Richard M. Leventhal, and Jennifer Dornan
2004 Maya Caste War Immigrants in Colonial British Honduras: The San Pedro Maya Project, 2000–2003. *Research Reports in Belizean Archaeology* 1:103–114.

Results of the 2022 BEAST Season at Courtyard B-1, Gallon Jug, Belize

Claire Novotny, Brett A. Houk, and Anna C. Novotny

The 2022 season of the Belize Estates Archaeological Survey Team (BEAST) included the intensive investigation of a residential group (Courtyard B-1) located 165 m east of the Main Plaza at the site of Gallon Jug (Figure 4.1). In 2022, we revisited Courtyard B-1 to clarify structure dimensions and functions and excavate the burial encountered in the chultun in 2019 (see Novotny et al. 2019). The site is located in a tropical broadleaf forest just north of the cleared pastures of Gallon Jug Ranch, and Courtyard B-1 is on a hilltop between the Main Plaza and the modern road between Blue Creek and Gallon Jug. This research was initiated as part of the overall Chan Chich Archaeological Project (CCAP) mandate to clarify the relationship between the paramount site of Chan Chich and the surrounding settlements.

The 2022 excavations took place over the course of four weeks, from June 1 until June 24. The excavation team directed by Dr. Claire Novotny consisted of local laborers from Chan Chich Village and Sylvester Village, staff member Gabrielle Blowers, and CCAP bioarchaeologist Dr. Anna Novotny, aided by assistant bioarchaeologist Leann Castillo. Preliminary analysis of artifacts and skeletal remains took place from July 3 to July 6, 2022, at the project's field lab at Chan Chich Lodge.

Courtyard B-1 is a well-preserved residential group consisting of four structures built around a shared patio, which rests on a partially modified hill elevating the buildings about 5 m above the surrounding ground surface (Figure 4.2). The group measures 25 x 20 m with a total interior patio area of 180 m^2. A chultun located in the center of the patio likely was used for storage and then repurposed for the interment of an individual. Structure B-1 is 12 m long and defines the eastern side of the group. It is flanked by two openings allowing access to the interior patio at the northeastern and southeastern corners. The western side of the group is defined by Structure B-3, a 25 m long-range structure that articulates at its northwestern corner with Structure B-4 (15 m long east-west) and at its southwestern corner with Structure B-2 (12 m long). The resulting horseshoe shape gives a sense of privacy and limited access, though there may have been an entryway in the center of Structure B-3, which we aimed to confirm through excavation this season (see below). Preliminary ceramic analysis suggests that Courtyard B-1 was constructed during the Early Classic period (AD 250–500), though its final occupation phase dates to the Late Classic period (AD 600–850). A Terminal Classic (AD 850–1000) ^{14}C date (2σ cal AD 907–1020) from a burial recovered during the 2019 season suggests that at least some portion of the site was occupied at that time.

Novotny, Claire, Brett A. Houk, and Anna C. Novotny
2022 Results of the 2022 BEAST Season at Courtyard B-1, Gallon Jug, Belize. In *The 2022 Season of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 65–92. Papers of the Chan Chich Archaeological Project, Number 15. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

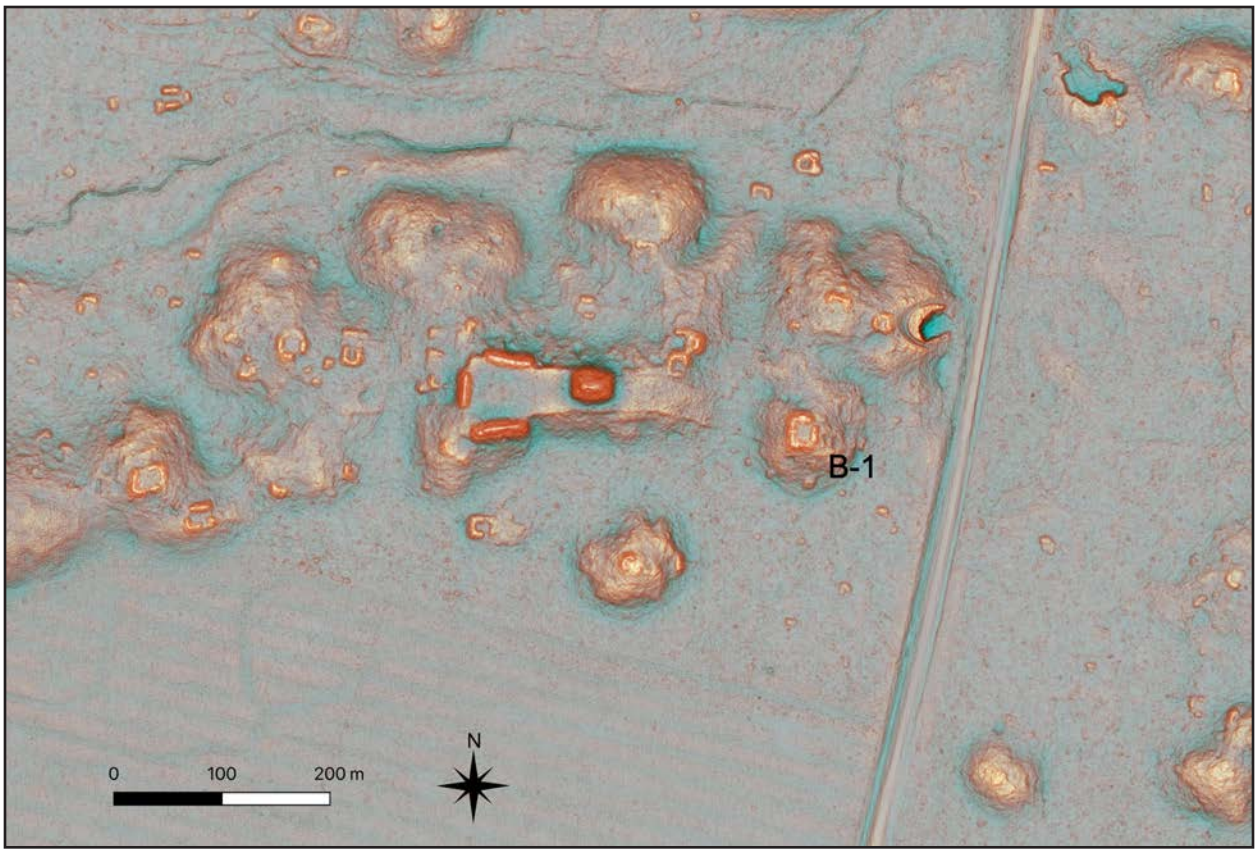


Figure 4.1. Red-relief image map of Gallon Jug site core and Courtyard B-1 derived from 2022 lidar data.

BACKGROUND

The site of Gallon Jug is 200 m north of pastures cleared by the Gallon Jug agribusiness. The site core and its associated courtyard groups are set on low-lying limestone hills covered with tropical broadleaf forest. Though the land 200 m south of the Main Plaza has been extensively cleared with bulldozers for the cultivation of corn and sugarcane as well as for cattle pastures, the area immediately surrounding Gallon Jug is forested, and archaeological remains are relatively well-preserved. The nearest monumental site core is Punta de Cacao, 5 km north of Gallon Jug. It is one of the largest sites in the region, with a site core consisting of two plazas, a ball court, and 10 courtyards as well as several courtyards in outlying groups (Guderjan et al. 1991:61; Robichaux et al. 2015). Though Punta de Cacao is among the largest sites in the region, its hinterlands are poorly understood, as is its relationship to Gallon Jug.

A team from the Rio Bravo Archaeological Project, directed by Thomas Guderjan, first mapped Gallon Jug and conducted limited testing during their 1990 field season (Guderjan et al. 1991). During the same season, Jason Yaeger (1991) conducted a settlement survey of cleared pastures north of the Gallon Jug airstrip and west of the Blue Creek road, an area of 325 acres (Houk et al. 2018:104). An intermediate area abutting the forest that contains the Gallon Jug Main Plaza and Courtyard B-1 was under cultivation at the time and was not surveyed. Yaeger's team recorded and mapped a total of 245 archaeological features dating from the Middle Preclassic through the Late Classic periods, including 111 artifact scatters, 97 large floors (> 25 m^2), and 35 floors (Yaeger 1991:Table 4). The BEAST

team revisited the pastures surrounding the Gallon Jug agribusiness in 2013 and 2016 to map the pastures using a drone to create a Digital Elevation Model (DEM) of topographic features, some of which were confirmed on the ground (Houk et al. 2018). The visual analysis of the DEM data helped our understanding of site density and the damage done by agricultural clearing to settlements in the permit area (Houk et al. 2018:Table 5.2). Though the structure density of the Gallon Jug site core is defined as an urban core with 340.74 structures per km^2, the drone survey area immediately south is classified as "vacant" with only 2.42 structures per km^2 (Houk et al. 2018:112; see Canuto et al. 2018). The presence of high grasses and agricultural clearing during the 1980s and 1990s likely affected the visibility and preservation, respectively, of the settlement pattern in the cleared pastures.

Gallon Jug's tallest structure is a 15-m high temple-pyramid or range building on the west end of an irregularly shaped, east-west plaza (see Figure 4.1). Guderjan's crew mapped the plaza and several courtyard groups surrounding it and excavated six 1-x-1-m test pits to collect chronological information. However, they did not document or map the presence of Courtyard B-1, which is more than 100 m east of their mapped structures. Guderjan's team excavated three test pits 2 m from the bases of Structures 1, 2, 3, and 4 in the Gallon Jug Main Plaza, and recovered Late Preclassic materials from the units on the western side of the plaza (Guderjan et al. 1991). They also excavated test pits into two courtyards south of the Main Plaza, which revealed undifferentiated Classic period ceramics and relatively shallow bedrock (~40 cm below the surface).

In 2018, BEAST initiated investigations at the site of Gallon Jug. Excavations into the western side of the plaza uncovered an Early Classic platform, dubbed Esperanza by excavators (Houk 2019:13). Ceramic evidence included Preclassic types in mixed-fill contexts, suggesting that this material was re-deposited from a Preclassic occupation elsewhere. In addition, three extremely weathered stelae, a possible fourth stela, and a possible altar were found in the plaza, though test units did not recover any artifacts or caches associated with the monuments (Houk 2019). Occupational continuity and monumental architecture suggest some degree of community cohesion and leadership during a time period that is not clearly understood at the nearby sites of Chan Chich and Punta de Cacao (Houk 2019:15).

In 2019, excavations at Courtyard B-1 extended our knowledge about the occupational history of Gallon Jug and its relationship with regional settlements. Courtyard B-1 was likely founded during the Early Classic period (AD 250–600), but possibly earlier during the Late Preclassic period (Novotny et al. 2019). Ceramic evidence suggests that all four structures were occupied during the Late Classic period and likely abandoned sometime during the Terminal Classic period, after AD 850. The individual interred beneath the floor in the western room of Structure B-2 lived during the Terminal Classic period (cal AD 907–1020), indicating that people were at least living in the area at this time and may have revisited the group to bury this person. The structures that comprise Courtyard B-1 were used for different activities, likely including daily tasks such as grinding corn and sleeping, but also specialized ritual activities indicated by burning episodes on plaster floors and patolli boards incised into the plaster floor of Structure B-4. The patolli boards were an important discovery from the 2019 season, since the styles are found in the northern Maya lowlands (i.e., Chichen Itza and Dzibilchaltun) and even Teotihuacan in the Mexican highlands (Novotny and Houk 2021). This suggests that whoever incised these patolli was aware of a wider Mesoamerican tradition associated with different styles of patolli. Our

research at Gallon Jug this season built on our excavations of Structures B-1, B-2, B-3, B-4 and the chultun (Novotny et al. 2019). Though much was discovered, gaps remained in our knowledge about the group, and the goal of the 2022 season was to fill in these gaps and address lingering questions.

RESEARCH DESIGN

Our interest in Gallon Jug lies primarily in the courtyard groups that comprise the greater settlement. These groups are well-preserved and offer the opportunity to pursue household-related topics such as the creation of social identity and degree of economic exchange with other communities. Since socio-political processes are predicated on daily activities enacted in and around residential dwellings, our excavations of Gallon Jug courtyard groups are contributing to our understanding of the relationship between centralized political authority at Chan Chich during the Preclassic and Classic periods and the daily lives of Maya people living in regional settlements.

First, our 2019 excavations into Structure B-3, the western structure, were limited and we could not clarify its form or function in relation to the rest of the group. Second, we encountered a burial in the chultun located in the center of the courtyard, but time constraints prevented us from completing our excavations. Finally, we were unable to establish the interior dimensions of Structure B-4, a large platform mound that defines the northern edge of the courtyard. A second goal of revisiting Structure B-4 was to further investigate the series of patolli boards incised into the final phase plaster floor (Novotny and Houk 2021). The boards depart stylistically from other examples found at Chan Chich, and they seem unique to the Maya lowlands as well. Visible replastering events of the floor of Structure B-4 raised the question of whether incising patolli boards into floors was a sustained practice by residents of the courtyard group or if the ones from the final occupation phase were a singular event. Thus, our research this season focused on Structures B-4 and B-3 and the chultun.

Our guiding questions were: were there patolli boards incised into earlier phases of the plaster floor? What were the final internal dimensions of Structure B-4? What was the construction sequence of Structure B-4? What was the function of Structure B-3 in relation to the rest of the courtyard group? What can the chultun burial tell us about regional mortuary practices or health and mobility of the local population?

Given these questions, our objectives for Structure B-4 were to remove the backfill dirt to reexamine the patolli boards, to find the eastern and western walls, and to excavate beneath the final phase architecture. Our objective for Structure B-3 was to reveal *in situ* artifact deposits and architectural features. The objective for the chultun was to remove the backfill dirt and carefully excavate the *in situ* interment and associated artifacts.

METHODOLOGY

To address these objectives, we undertook horizontal excavations at Courtyard B-1, specifically of Structures B-3 and B-4 and the chultun. Excavations at Courtyard B-1 were conducted as part of Operation GJ-02 and included 22 Suboperations (Subops GJ-02-AC–AV), which covered an area of 55.96 m^2 (Figure 4.2; Table 4.1). Units at Structure B-3 varied in size but were placed to encounter and follow architectural features and address questions about the architectural composition of the structure.

Units at Structure B-4 varied in size as well; the initial units were placed to remove backfill from 2019, while later units were placed to follow the final phase floor to locate walls.

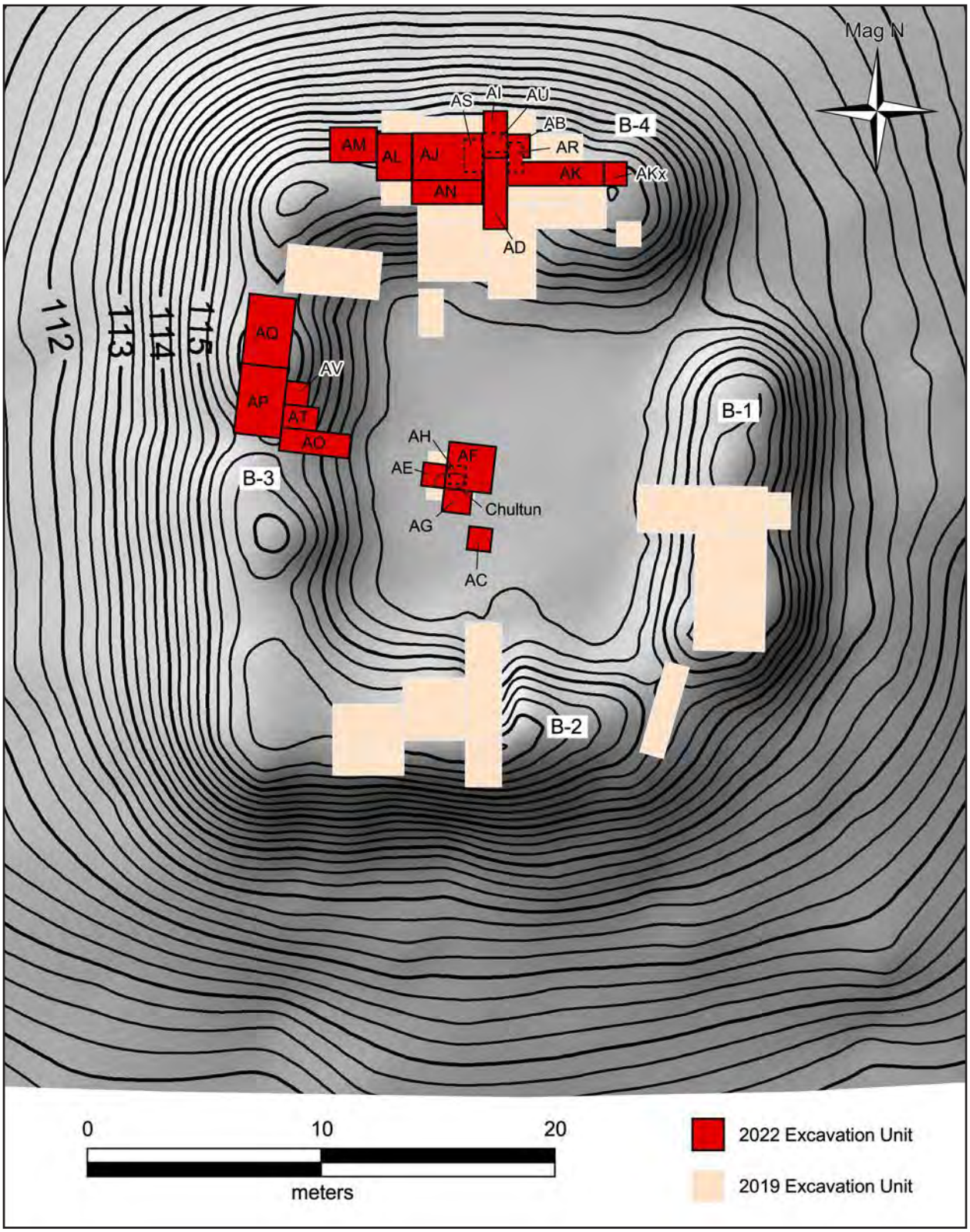


Figure 4.2. Shaded relief map with 0.25-m contours of Gallon Jug Courtyard B-1 showing 2019 and 2022 suboperations (Op GJ-02)

Table 4.1. Summary of 2022 Suboperations in Op GJ-02 by Structure

Structure	Subop	Size (m)	Purpose
B-4	AD	1 x 3	Remove backfill from the 2019 season to investigate earlier construction phases of Str. B-4
	AI	1 x 2	Remove backfill from the 2019 season to investigate earlier construction phases of Str. B-4
	AJ	3 x 2	Remove backfill from the 2019 season to investigate earlier construction phases of Str. B-4
	AK	1 x 4	Remove backfill from the 2019 season and locate the eastern wall of Str. B-4
	AKx	1 x 1	Locate the eastern wall of Str. B-4
	AL	2 x 1.5	Remove backfill from the 2019 season and locate the western wall of Str. B-4
	AM	1.5 x 2	Locate the western wall of Str. B-4
	AN	4 x 1	Remove backfill from the 2019 season and reveal southern wall of Str. B-4
	AR	1.3 x .6	Excavate beneath floor to investigate earlier cultural deposits of Str. B-4
	AS	1.4 x .8	Excavate beneath floor to investigate earlier cultural deposits of Str. B-4
	AB	1 x 1	Remove backfill from the 2019 season
	AU	1 x .8	Investigate possible subfloor deposits in Str. B-4
B-3	AO	3 x 1	Investigate the architectural features and artifacts associated with Str. B-3
	AQ	2 x 3	Investigate the architectural features and artifacts associated with Str. B-3
	AP	2 x 3	Investigate the architectural features and artifacts associated with Str. B-3
	AT	1 x 1.5	Follow architecture of Str. B-3 identified in GJ-02-AP
	AV	1 x 1	Follow architecture of Str. B-3 identified in GJ-02-AP
Chultun	AF	2 x 2	Remove backfill from 2019 season and locate chultun
	AE	1 x 1	Clarify western edge of chultun and expose courtyard surface
	AH	.7 x .8	Remove backfill from 2019 season from the interior of the chultun and expose burial
	AG	1.2 x 1	Clarify southern edge of chultun and expose courtyard surface
	AC	1 x 1	Locate chultun and expose courtyard surface

Once the backfill had been removed and additional units excavated down to the floor in the room on Structure B-4, we carefully swept the floor to expose the patolli boards. Our methods for recording the boards are described below in the excavation summary. We also excavated opportunistic units into and beneath the Structure B-4 floor to test for burials or subfloor deposits; we placed these units to avoid damaging any of the preserved patolli boards.

Units initiated over the chultun measured 2 x 2 m and were placed to locate the chultun mouth and then remove the backfill from 2019. In all excavations at Gallon Jug, we used pickaxes and shovels to remove significant layers of backfill

and collapse debris and smaller geopicks, trowels, and brushes to clarify architectural features and carefully uncover floor surfaces.

The following sections include an overview of excavations at Gallon Jug. The excavation process of each suboperation is described in detail, and preliminary interpretations of our findings are included.

RESULTS

Structure B-3

Structure B-3 is a mound located at the western border of Courtyard B-1. The structure is 2 m tall and measures 25 m north-south by 5 m east-west. It is connected to Structure B-2 at the southwestern corner of the courtyard and to Structure B-4 at the northwestern corner. The topography included a slight swale in the center of the structure that was framed by mounded areas of collapsed debris with trees growing from them. We had previously theorized that the swale could be a stairway providing formal access to the group. The two smaller prominences represent the corners of interior rooms where collapse material had built up over time. Our objective this season was to test these hypotheses. The 2022 excavations of Structure B-3 were conducted under Subops GJ-02-AO, -AP, -AQ, -AT, and -AV (see Figure 4.2; Table 4.2).

Excavation began by opening three units on Structure B-3, two on the summit (Subops GJ-02-AP and -AQ) to investigate the architecture and one on the eastern, courtyard-facing side of the structure to clarify how the building articulated with the courtyard surface (Subop GJ-02-AO). The courtyard surface was poorly preserved, and identifiable architectonic features, such as a staircase, were not observed. A step was slightly visible in the northern profile as two cut block stones slumped to the west onto the courtyard surface.

Table 4.2. Summary of Lots at Structure B-3

Lot (GJ-02-)	Lot Description
AO-01	Topsoil
AO-02	Collapse Debris
AO-03	Floor
AP-01	Topsoil
AP-02	Collapse Debris
AP-03	Collapse Debris
AP-04	Wall
AP-05	Floor
AP-06	Construction Fill
AP-07	Platform Face
AP-08	Wall
AQ-01	Topsoil
AQ-02	Collapse Debris
AQ-03	Wall
AQ-04	Bench
AQ-05	Floor
AQ-06	Wall
AT-01	Topsoil
AT-02	Collapse Debris
AT-03	Floor
AT-04	Wall
AV-01	Topsoil
AV-02	Collapse Debris
AV-03	Wall
AV-04	Floor

Subop GJ-02-AP was a 2-x-3-m unit oriented north-south on the summit of Structure B-3; this suboperation aimed to investigate the summit architecture, including possible rooms. However, excavators encountered the rectangular summit of a platform constructed of carved limestone blocks. We cleared 1.91 x 1.2 m of the platform but did not identify its northern or eastern edges. We exposed two walls forming the platform's western and southern edges; Lot GJ-02-AP-07 runs north-south and abuts Lot GJ-02-AP-04, which runs east-west (Figure 4.3). Lot GJ-02-AP-04 was a south-facing wall constructed of six courses of modified limestone blocks. It was resting on a

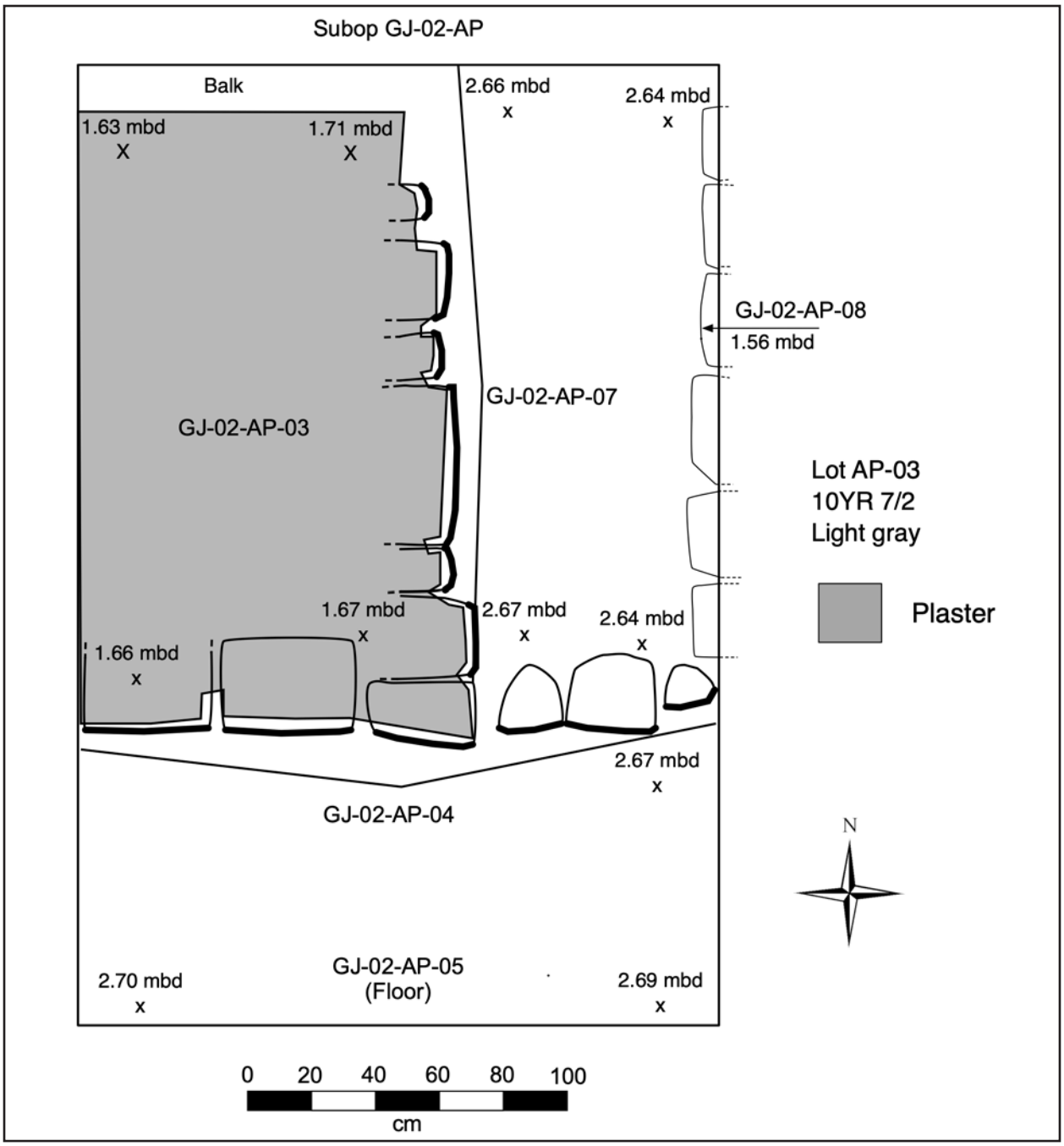


Figure 4.3. Plan map of Subop GJ-02-AP showing the platform and void.

floor (Lot GJ-02-AP-05) whose plaster rolls up along the bottom of the wall, suggesting that it was plastered in antiquity. In total, we exposed a section 1.77 m long by 1 m high of Lot GJ-02-AP-04 and discovered that it corners and runs north, forming a courtyard-facing wall (Lot GJ-02-AV-03).

The north-south running wall, Lot GJ-02-AP-07, was 1.08 m high and 1.78 m long and constructed of three or four courses of modified limestone blocks. It does not seem to have been plastered and was constructed on a highly eroded plastered surface. The eroded surface is the same elevation as the floor to the south. As we clarified the dimensions of Lot GJ-02-

AP-07, our excavations quickly revealed the back of the eastern-facing wall that paralleled Lot GJ-02-AP-07 and created a 1.78-x-0.82-m rectangular void (see Figure 4.3). The space seems to have been intentionally filled in with loose, grayish-brown soil and medium to small rocks with only a few artifacts. The void is difficult to interpret, but since the platform sits on a level surface and Lot GJ-02-AP-04 is an outward-facing wall, perhaps the void was filled in as part of a remodeling event that extended the eastern (courtyard)-facing wall of the structure further into the courtyard.

Subop GJ-02-AQ was a 3-x-2-m unit oriented north-south and placed north of Subop GJ-02-AP on the summit of Structure B-3. It is likely that the northern edge of the suboperation is close to the southern edge of Subop GJ-02-X, which was excavated in 2019 (Novotny et al. 2019:19–21). Those excavations encountered the eastern (courtyard)-facing wall of the structure but no rooms. As we removed collapse debris, we identified the back side of the eastern (courtyard)-facing wall (Lot GJ-02-AQ-03) and the southern doorway facing the courtyard, which indicated that we were inside a room. Lot GJ-02-AQ-03 was constructed of multiple courses of modified limestone blocks covered in plaster; the exposed section of the wall was 1.49 m long by 1.05 m high. Collapse debris consisted of half a dozen vault spring stones that fell into the room as the roof collapsed; these were photographed and removed (Figure 4.4). Artifacts were sparse, but we recovered ceramic sherds, debitage, and ground stone.

We encountered a 0.31-m high bench (Lot GJ-02-AQ-04) and a small (1.4 m long by 0.70 m wide) section of a plastered floor (Lot GJ-02-AQ-05) that aligned with the doorjamb (Figure 4.5). We followed Lot GJ-02-AQ-03 south until we found where the plaster from the bench rolled up a preserved section of the southern wall (Lot GJ-02-AQ-06). The preserved section of Lot GJ-02-AQ-06 was constructed of multiple courses of modified limestone blocks covered in plaster; the exposed section measured 0.93 m high by 0.48 m wide.

Our excavations cleared 3 x 1.5 m of a room with a 0.31-m high plastered bench separated by a party wall from an adjacent platform. The

Figure 4.4. Photograph of the collapsed vault stones. View to the south.

Figure 4.5. Photograph of Subop GJ-02-AQ showing the bench (Lot GJ-02-AQ-04) and floor (Lot GJ-02-AQ-05). View to the south.

room has a bench and artifacts that suggest it was used for domestic purposes. Interestingly, it is only the second bench discovered in the group; the other bench was in Structure B-2 to the south (Novotny et al. 2019). The vault spring stones recovered from inside the room indicate that the room had a vaulted, masonry ceiling. However, no vault stones were encountered in the southern area of our excavations, suggesting that the platform was left open, or covered with a perishable structure for which we have no preserved evidence. The platform rises ~1 m above the room floor. The platform shares a wall with the room, and the collapse debris on top of the platform sloped to the south suggesting that the party wall supporting the vault slumped south while the vaulted stones fell inside the room. The platform is enigmatic because there were hardly any artifacts associated with it, and so its function remains unclear. The platform borders a space that is likely an entrance way granting access to Courtyard B-1 from the west. We were not able to identify a wall opposite to the platform, though we assume that there is one there. Our preliminary interpretation is that this was a residence and an entrance way into the group that allowed access from the vantage of the Main Plaza.

Structure B-4

Structure B-4 is 20 m long by 5 m wide and 2 m tall and forms the northern edge of Courtyard B-1 at the site of Gallon Jug. In 2019, our excavations confirmed that this was an unvaulted platform with a masonry foundation and well-preserved plaster floor (Novotny et al. 2019. The excavated portion of the summit floor of Structure B-4 was 2.7 m wide by 9.25 m long and not divided by internal walls. There were no vault stones recovered, and because of the width of the structure, the amount of collapse debris, and the low heights of the preserved walls, we infer that the building would have low walls (~1 m high) delineating the interior room and a perishable superstructure and roof. In 2019, we were unable to fully clear the interior of the structure or find the corners of the summit walls because of extensive tree growth and time constraints. A significant discovery in 2019 was the presence of multiple patolli boards incised into the summit floor of

Structure B-4 (Novotny et al. 2019; Novotny and Houk 2021). We documented the game boards through Structure for Motion (SfM) photogrammetry, but the incising was faint and difficult to see. Thus, our objectives for Structure B-4 for the 2022 season included: 1) remove the 2019 backfill to reveal the patolli boards for further analysis and recording, 2) establish new excavation units to find the northwestern corner and the eastern wall of the summit architecture, and 3) excavate beneath the summit floor to look for earlier phases of architecture and *in situ* artifacts.

We established new suboperations to remove the backfill dirt from the summit of the structure (see Figure 4.2; Table 4.3). In 2019, we placed a thin layer of screened dirt on the floor and covered it with construction plastic, followed by a 0.40-m thick layer of backfill dirt and stones. We removed backfill in Subops GJ-02-AD, -AI,-AB,-AK,-AJ, -AN, and -AL, excavating until we reached the floor. Because of the care we took in backfilling, the patolli boards incised into the floor were well-preserved (see below).

After removing the backfill, we established new units on the western (Subop GJ-02-AM) and eastern (Subop GJ-02-AKx) sides of the structure to find the summit walls. There was significant root disturbance on the eastern side of the structure, and we were not able to identify the wall. However, we did encounter the western wall of the structure after removing 0.90 m of collapse debris, which exposed the floor and

Table 4.3. Summary of Lots at Structure B-4

Lot (GJ-02-)	Lot Description
AD-01	Backfill
AD-02	Floor
AD-03	Other
AD-04	Construction Fill
AD-05	Construction Fill
AD-06	Construction Fill
AD-07	Wall
AD-08	Floor
AI-01	Backfill
AI-02	Floor
AI-03	Wall
AI-04	Construction Fill
AI-05	Construction Fill
AI-06	Floor
AI-07	Wall
AJ-01	Backfill
AJ-02	Floor
AK-01	Backfill
AK-02	Floor
AK-03	Collapse Debris
AKx-01	Topsoil
AKx-02	Collapse Debris
AKx-03	Floor

Table 4.3. (continued)

Lot (GJ-02-)	Lot Description
AL-01	Backfill
AL-02	Floor
AL-03	Collapse Debris
AM-01	Topsoil
AM-02	Collapse Debris
AM-03	Floor
AN-01	Backfill
AN-02	Floor
AN-03	Wall
AR-01	Construction Fill
AR-02	Wall
AR-03	Wall
AR-04	Floor
AR-05	Floor
AS-01	Floor
AS-02	Floor
AS-03	Construction Fill
AS-04	Wall
AS-05	Floor
AB-01	Backfill
AU-01	Floor
AU-02	Construction Fill

the lower portion of the western structure wall (Lot GJ-02-AM-04). We excavated a 1 m long section where the plaster rolls up from the floor to the wall. Though the northwestern corner of the structure was not preserved, we could estimate where the northern summit wall may have formed a corner with the western wall. The dimensions of the building are estimated at 13.5 m long by 2.7 m wide. Our new excavations exposed more patolli boards incised into the western section of the floor.

After establishing the structure dimensions, we excavated through the final floor to explore earlier construction phases. To preserve the patolli boards, we excavated portions of the floor with no boards or boards that were highly eroded or fragmented. In total, our excavations revealed four construction phases but did not reach bedrock (Figure 4.6).

The earliest documented construction phase of Structure B-4 included more than 0.8 m of limestone and chert cobble construction fill, a silty brownish-gray soil, and artifacts. Artifacts included abundant ceramic sherds, ground stone, lithic tools, and debitage. A charcoal sample (GJ-02-S09) collected from the northwestern corner of the unit dates this construction phase to the beginning of the Late Classic period, 1440 ± 20 RCYBP (UGAMS# 61676, charcoal, $\delta^{13}C$ = -27.08‰). The 2σ calibrated date range is cal AD 594–650. The fill supported a thick plaster floor and an associated wall running east-west. It consisted of unmodified limestone cobbles covered in plaster (visible to the south) and three to four courses of modified limestone blocks with their faced sides visible to the north (Figure 4.7). The exposed portion of the wall was 2.6 m long by 0.27 m high by 0.33 m wide. We could not identify a corresponding wall to the north, but if it was beneath the final phase wall, then the width of the earlier structure would have been about 1.5 m wide.

The second phase included the addition of a north-south running wall (Lot GJ-02-AR-03) that abuts the east-west wall and rests on top of the floor (Figure 4.8). The exposed wall segment was 0.88 m log by 0.24 m wide and 0.14 m high and consisted of two courses of irregularly shaped limestone cobbles. The

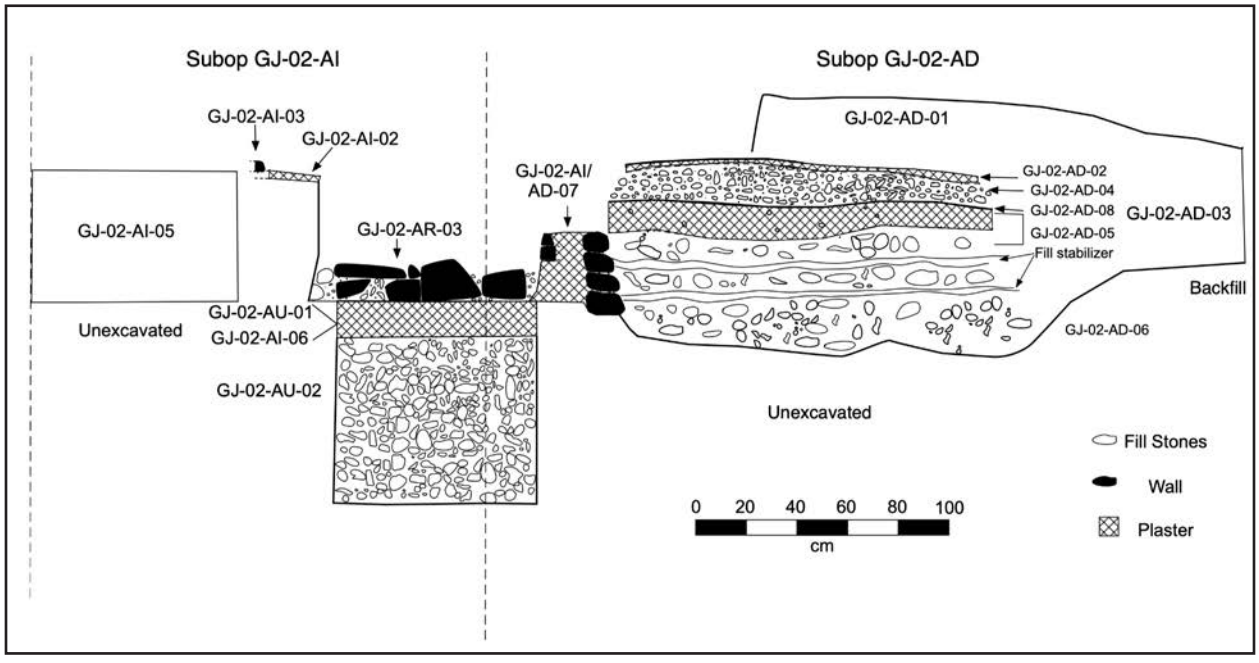


Figure 4.6. Eastern profile of Subops GJ-02-AD and -AI, Structure B-4.

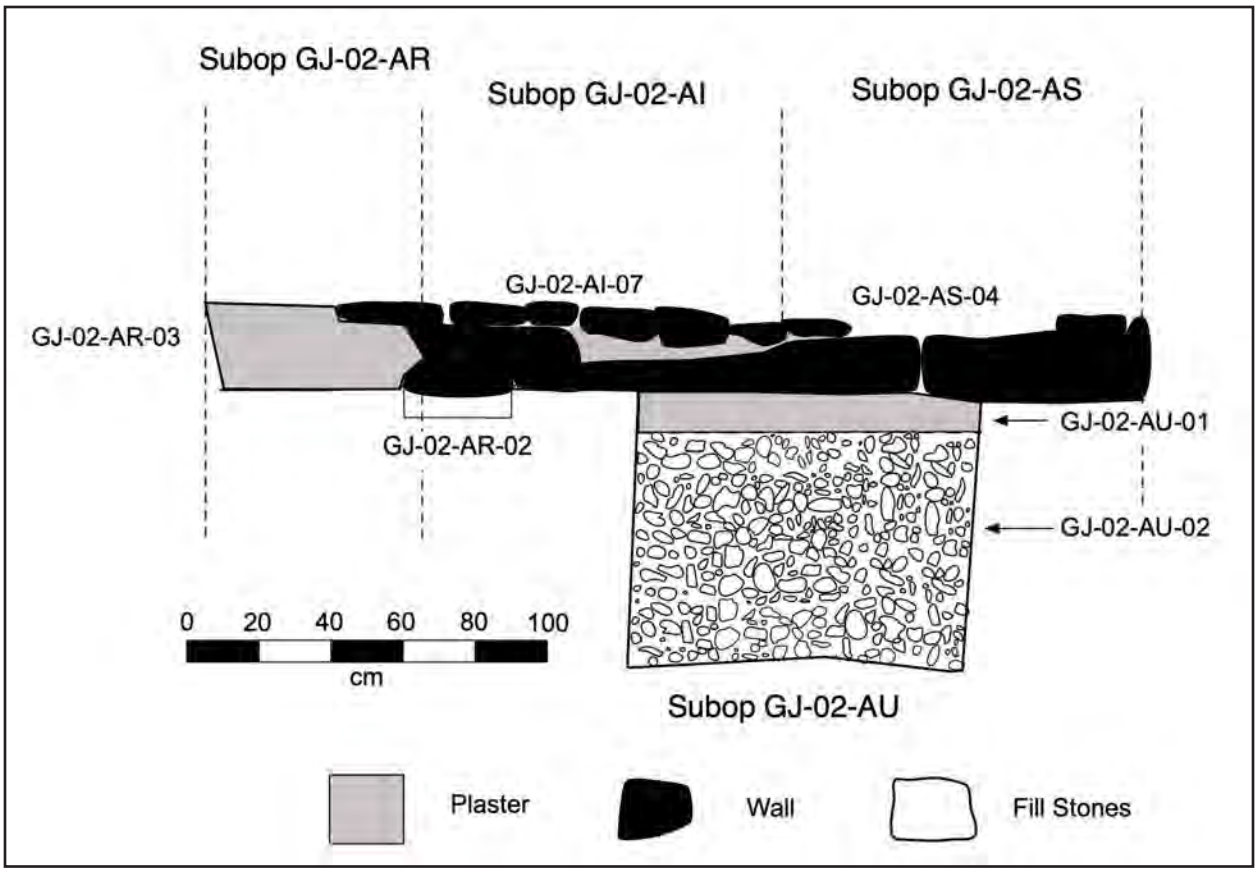


Figure 4.7. Southern profile of Subops GJ-02-AR and -AD showing the earlier construction phase.

plaster from the floor does not roll up here as it does on the east-west wall (Lot GJ-02-AR-02), indicating that it was constructed later, possibly as a construction pen ahead of further renovations.

The next construction phase was characterized by a major renovation and expansion to the south (see Figure 4.6). A thick layer of large limestone cobble fill covered the earlier architecture in the northern part of the building. In the south, a 0.5-m thick layer of alternating limestone cobbles and plaster stabilized the construction of a new, thick plaster floor. No patolli boards were found incised onto this floor. The summit walls were likely constructed during this phase as well.

The fourth and final construction phase included a layer of limestone pebble and dirt fill followed by a high-quality plaster floor and the plastered steps and balustrades identified in 2019. The structure reached its final dimensions of 13.5 long by 2.7 m wide. The patolli were incised into the final phase floor, which was repaved at least twice. We carefully peeled back one of the later paving events (~2 cm thick; Lot GJ-02-AS-01) to see if there were preserved patolli on the underlying surface. The earlier paving was pockmarked and not as well-preserved (or as well-made) as the final phase floor. No patolli boards were present here either.

Patolli Boards

Patolli are interpreted as facilitating gaming and/or divination rituals and are found throughout Mesoamerica (Walden and Voorhies 2017), including on a bench in Structure C-6 in the Western Plaza (Harrison 2000) and on a bench in Structure A-12 in the Upper Plaza at Chan Chich (Gallareta Cervera and Houk 2019:Figure

Figure 4.8. Photograph of Phase 1 and 2 architecture. View to the east.

2.22). During the 2022 season, crews working at Chan Chich uncovered another partial patolli on a bench in Structure C-2 at the Norman's Temple complex (Gallareta Cervera and Houk, Chapter 2, this volume). Patolli are often interpreted as cosmograms linking humans to the cosmic universe and are found in the Maya lowlands in structures with a religious function, such as temples, or in structures where rituals may have been enacted, such as in elite residences, ritual buildings, or "men's houses" (Walden and Voorhies 2017; Yaeger 2005). For example, Structure C-6 at Chan Chich was interpreted as an elite residence that transitioned to a ceremonial function with the remodeling of a room that then housed the burial of an important individual in a bench on which a patolli was carved (Harrison 2000). The Structure C-6 patolli is a cross-and-frame style patolli (Type II), as categorized by Swezey and Bittman (1983) and Zralka (2014); this is the most commonly found style in the Maya lowlands.

As detailed elsewhere (Novotny et al. 2019; Novotny and Houk 2021), the Gallon Jug patolli boards consist of styles that are not well represented in the Maya lowlands. A more recent study by Jaroslaw Zralka (2014) on Maya graffiti synthesized other stylistic categories of patolli boards. His types build on those of Swezey and Bittman (1983) and Miriam Gallegos (1994) and include more recent discoveries from the Maya region. We use his types to contextualize the Gallon Jug patolli (Figure 4.9).

In 2019, we found it difficult to document the patolli because the lines are faint, overlapping, and blend in with the natural cracks in the floor. We used photogrammetry to try to make a 3D model but the faint lines and uniform plaster color confounded our attempts. One of our goals this season was to revisit the patolli and try to document them again. In an effort to better understand the patolli's stylistic composition and the extent of the incising, we experimented with new methods for documenting the boards.

This season, Houk tried to draw the boards using traditional plan-mapping methods and a 1-x-1-m mapping grid, beginning with the easternmost incisions. The grid, however, cast shadows on the floor, making already hard to

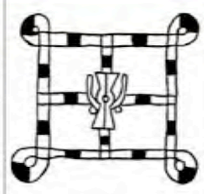
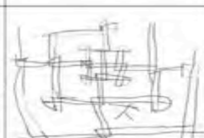
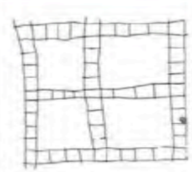
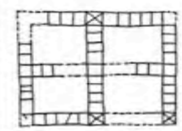
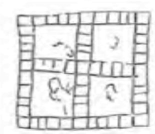
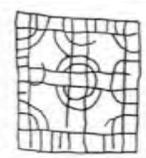
Patolli type	Description of the patolli type	Illustration	Sites or places where patolli were documented	References
I	Cruciform design enclosed in a square with rounded corners that stick outside (coil-like elements)		**1) Maya area:** - Nakum (Str. Y); - Rio Bec B (Str. 6N1); **2) outside of MA:** - Borbonico Codex; - Borgia Codex (p. 62); - Vaticanus B Codex (p. 67); - Vindobonensis Codex (p. 19 and 20); - Teotihuacan; - Tom-131 site, petroglyph (Tomatlan area, Jalisco)	Gallegos 1994, 2001; Hermes and Żrałka 2012; Mountjoy and Smith 1985; Swezey and Bittman 1983
I-A variant	Similar to Type I but board has interweaving bands in its interior which form a single playing unit with a square or rectangle		**1) Maya area:** - Chicanna (Str. II); - Chichen Itza (*El Arco*); **2) outside of MA:** - Teotihuacan; - Tula	Andrews and Andrews 1980; Euan et al. 2005; Gallegos 1994, 2001; Martin and Schmidt 2009; Sánchez 1996; Swezey and Bittman 1983
I-B variant	Zoomorphic version of Type I in which a board is shown in the form of a twisting snake		**1) Maya area**: not known although one example may come from Uxmal **2) outside of MA:** Teotihuacan	Andrews and Andrews 1980: 99; Gallegos 1994, 2001; Sánchez 1996
I-C variant	Patolli board of Type I inscribed inside a larger board of the same type which might be enclosed by the third and the largest board		**1) Maya area:** not known (although one example may come from Chicanna Str. II); **2) outside of MA:** Teotihuacan	Andrews and Andrews 1980; Gallegos 1994, 2001; Sánchez 1996
II	Cruciform design enclosed within a square (or rectangle); the whole patolli board is divided into many fields (usually ca. 50)		**1) Maya area:** - Becan (Str. IV); - Calakmul (Str. VII); - Nakum (Strs. 60-2, U, Y); - Naranjo (Str. B-18); - Pomona (slab covering drain); - Rio Bec (various structures); - Tikal (Strs.5D-32, 5D-54 and 6F-27); - Tz'ibatnah, (Casa de las Pinturas); - Uxmal (Temple of the Magican); - Xunantunich (Strs. A-11 and A-20); **2) outside of MA:** - Tula (Palacio Quemado)	Gallegos 1994, 2001; Morales and Fialko 2010; Morales and Valiente 2009; Patrois and Nondédéo 2009; Smith 1977; Swezey and Bittman 1983; Trik and Kampen 1983; Żrałka and Hermes 2009
II-A variant	Has X-like signs in one or several fields, usually in the corners and in the fields where a cruciform design connects the square		**1) Maya area:** - Dzibilnocac (Str. A1) - Nakum (Str. A) - Tikal (Strs. 5D-38, 5G-4 and Maler's Palace); - Seibal (altar accompanying Stela 10); - Xunantunich (Str. A-11) **2) outside of MA:** Teotihuacan	Gallegos 1994, 2001; Smith 1977; Swezey and Bittman 1983; Tozzer 1913; Trik and Kampen 1983; Yaeger 2005
II-B variant	Contains figures or other elements made inside the board		**1) Maya area:** - Palenque (Temple of Inscriptions); **2) outside of MA:** Tonalamatl de Aubin codex (p. 19)	Gallegos 1994, 2001; Ruz 1992; Swezey and Bittman 1983
II-C variant	Has bent lines on the corners and in the places where the cruciform design connects with the overall square pattern of the board		**1) Maya area:** - Copan (Oropendola Structure); - Holmul (Group II, Str. A); **2) outside of MA:** not known	Baron 2008; Estrada-Belli 2012
III	Cruciform design enclosed by a circle		**1) Maya area:** - Chicanna (Str. II) - Chichen Itza (El Mercado) ; - Dzibilchaltun (Str. 1-sub); - La Mar (stone lintel); - San Lorenzo (petroglyph on a rock); - Tikal (Str. 5G-8); - Uxmal (Adivino) **2) outside of MA:** not known	Andrews and Andrews 1980: 99, and Fig. 115; Gallegos 1994, 2001; Swezey and Bittman 1983; Trik and Kampen 1983

Figure 4.9. Zralka's typology of patolli boards (from Zralka 2014:147–148, Table 2).

see lines even harder to see. In addition, plan-mapping was not time efficient—it took 1.5 hours to measure and draw four small lines using the graphic design application Graphic on an iPad. After several suggestions—including fingerprint dust and Sharpies—Leanne Castillo proposed using colored chalk to highlight the incisions. Chalk has the added benefit of being 96 percent calcium carbonate, the primary component of Maya plaster. Using it would not introduce a foreign substance to the floor, and it could be erased with a wet cloth.

Using pink and yellow chalk, we found that tracing the incised lines worked well. The technique became more effective when we used an LED light panel to apply different angles and intensities of light, which revealed more subtle incisions. In many cases it was possible to confirm a suspected line by touch, running a finger across the surface to verify the incision, followed by highlighting it with chalk. The chalk did not so much fill the incisions as highlight them; although the chalk lines are much thicker than the patolli incisions, they accurately convey the shape of individual boards.

Project members Marie Ical and Petrona Ical proved adept at manipulating the LED light and seeing and tracing even faint lines (Figure 4.10). We traced seven complete patolli boards and three areas with other incisions, some of which may be remnants of older boards. While retracing the boards for photographs, Marie and Petrona discovered an eighth board, and Marie pointed out that the natural light was different than it had been the day before. Because the

Figure 4.10. Petrona Ical (left) and Marie Ical with the LED light tracing the patolli.

yellow chalk proved to be more visible, we used it to trace most boards, however, we used pink chalk when a board overlapped another. The colors do not indicate sequence; we could not reliably establish a sequence of board creation.

Once the boards had been drawn, Houk photographed each board with an iPhone 12 Pro, and then used Scaniverse to create a 3D model of the entire floor (also using an iPhone 12 Pro), as well as smaller models of individual boards (Figure 4.11). To describe the boards spatially, Houk established a string line on the floor beginning at the western edge of the room and running east-west at 90 degrees. The line was marked with a Sharpie every 0.5 m. He recorded board locations by measuring the maximum east, west, north, and south points relative to this line. East and west limits are expressed as meters east of the western end of the baseline. North and south limits are expressed as centimeters north (+) and south (-) of the baseline. He determined board dimensions by measuring maximum length parallel to each axis of the board and recorded board orientation using a Suunto compass (Table 4.4).

Descriptions of Boards

The visible boards and other marks occupy a large section of the floor in Structure B-4, measuring 6.25 m east-west (from 1.57 m to 7.8 m east of the start of the baseline) by 2 m north south (from 0.5 m north of the baseline to approximately 1.5 m south of the baseline). The majority of the definable boards occur between 1.57 m and 5.10 m east of the start of the baseline (see Figure 4.11).

Board 1. One of the best-preserved boards, Board 1 was excavated in 2022 for the first time (Figure 4.12). It is the western most of the discovered boards; the southwestern corner of the board reaches the southern edge of the

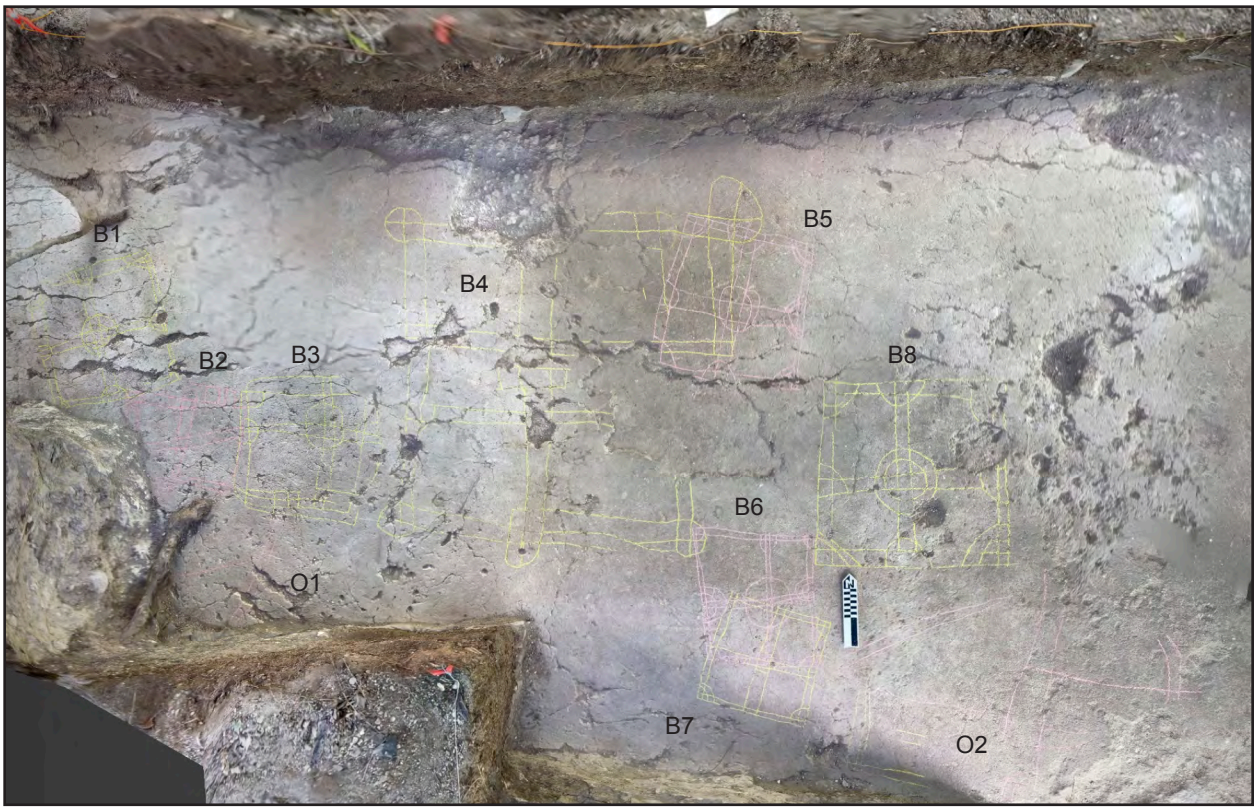


Figure 4.11. Scaniverse rendering of the patolli floor showing Boards (B) 1–8 and Others (O) 1 and 2.

Table 4.4. Patolli Board Attributes

Board	Type	Orientation	Dimensions		Location of Edge on Mapping Grid			
			N-S	E-W	West	East	North	South
1	II-C	342°	49 cm	47 cm	1.57 m	2.09 m	N: +0.22	S:-0.37 m
2	II/II-C	10°	41 cm	42 cm	1.96 m	2.36 m	N: -0.29 m	S: -0.66 m
3	II/II-C	5°	53 cm	51 cm	1.96 m	2.36 m	N: -0.24 m	S: -0.75 m
4	I	0°	136 cm	141 cm	2.90 m	4.26 m	N: +50 cm	S: -90 cm
5	II-C	20°	54 cm	50 cm	3.86 m	4.43 m	N: +0.36 m	S: -0.25 m
6	II-C	355°	46 cm	40 cm	3.98 m	4.50 m	N: -0.79 m	S: -1.24 m
7	II-C	20°	38 cm	39 cm	3.96 m	4.55 m	N: -0.97 m	S: -1.44 m
8	II-C	1°	65 cm	68 cm	4.40 m	5.10 m	N: -0.23 m	S: -0.87

excavated area in the western part of the room. Though Board 1 partially overlaps Board 2, its lines are more deeply incised. The design is a cruciform shape framed with a square, though the width of border frames is uneven. There are arcs at the places where the cruciform arms connect with the frame and a circle in the center. This board and Board 6 are oriented west of north. The style is closest to Zralka's Type II-C variant; this variant has been found in the Maya area at Copán and Holmul and is not found outside of the Maya region (Zralka 2014:148, Table 2; see Figure 4.10).

Figure 4.12. Color-enhanced photograph of Board 1. View to the north.

Board 2. Board 2 is roughly square with an interior cruciform shape that intersects with the frame, but not in an even manner (Figure 4.13; pink board). The southwest and northeast corners have boxes outside of the frame. The southwest corner and western edge were partially obscured by unexcavated collapse debris. The eastern frame only has one line, and the east-west center lines are askew, creating quadrants of irregular size and shape. It partially overlaps Boards 1 and 3. There are arcs at the east/center, southeast, and northwest corners of the frame. The style of the board is closest to a Type II cross-and-frame board with some elements of Type II-C (Zralka 2014:148, Table 2). Type II boards are the most common in the Maya region but have also been found at Teotihuacan.

Board 3. Board 3 is also irregular, partially overlapping the eastern edge of Board 2 (Figure 4.14). It has atypical frames with rounded western corners and an off-center central element. The style of the board is closest to a Type II cross-

Figure 4.13. Photograph of Board 2 (pink). View to the north.

Figure 4.14. Color-enhanced photograph of Board 3. View to the north.

and-frame board with some elements of Type II-C (Zralka 2014:148).

Board 4. The largest board is Board 4. It consists of a cruciform shape framed by a square with coils curving outwards on the corners (Figure 4.15). The northeast corner is odd and may have been redrawn; that is, there are two "corners," with one extending farther east than the rest of the board. A large section of the east side is missing where there is a 75-x-30-cm gap in the patolli floor plaster. Here, an earlier surface is exposed about 0.5 cm below the top of the final floor. The design also features two east-west center bars and an east-west rectangular element in the center, both of which are unique to this board. Board 4 overlaps Boards 5 and 6. Board 4 is a Type I board in Zralka's catalog (2014:147, Table 2). In the Maya region this style has been found at Nakum and Río Bec. Outside of the Maya region this style has been found in several pre-Columbian Aztec and Mixtec codices, Jalisco petroglyphs, and at Teotihuacan (Swezey and Bittman 1983).

Board 5. Board 5 overlaps the northeast corner of Board 4 (Figure 4.16; pink board). It has a cruciform design framed with a square shape with arcs where the cruciform intersects the frame. The central element is idiosyncratic in that its circles are not concentric, but one circle with an internal arc on the eastern side. The frame widths are variable. This board is a Type II-C variant with some irregularities (Zralka 2014:148, Table 2).

Board 6. A small board that overlaps Boards 4 and 7, Board 6 also has a cruciform interior framed by a square with arcs at the corners and where the cruciform intersects the frame (Figure 4.17; pink board). There is a circle

Figure 4.15. Color-enhanced photograph of Board 4. View to the north.

in the center of the board. The board's shape is slightly trapezoidal, and its orientation is atypically west of north. It is a Type II-C variant with irregularities (Zralka 2014:148, Table 2).

Board 7. Board 7 is rectangular with some ladder-like designs on the central east-west frame and two boxes on the central north-south frame (see Figure 4.17; yellow board). It overlaps Board 6. Three of four corners have arc designs, but the center does not have a circular element. This is a Type II-C variant as well (Zralka 2014:148, Table 2).

Board 8. This is a very regular board and larger than most (Figure 4.19). It has the interior cruciform shape framed by a square with arcs at the corners where the cruciform intersects the frame. The central element is two concentric circles. Board 8 does not overlap any other boards. Though it is quite regular in form and the incisions are deep, some lines cross out of the frame. It is closest to the door of the room. It may be that this was one of the last boards carved. It is clearly a Type II-C variant (Zralka 2014:148, Table 2).

Figure 4.16. Color-enhanced photograph of Board 5. View to the north.

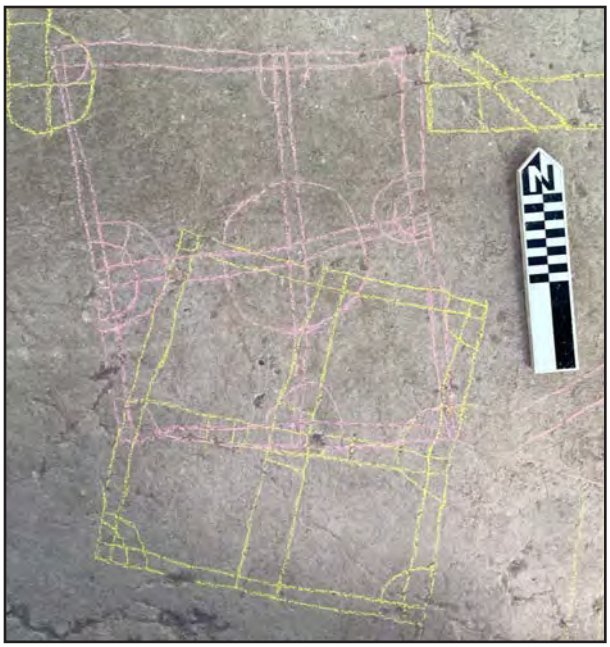


Figure 4.17. Photograph of Board 6 (pink) and Board 7 (yellow). View to the north.

Figure 4.18. Photograph of Board 8. View to the north.

Other Designs

Other 1: South of Boards 2 and 3 are two faint curving parallel lines that run generally north-south and one intersecting east-west line (east of root; Figure 4.19).

Other 2: South and east of Board 8 (Figure 4.20), there is a faint, large, possible double line curved element with a few other stray marks (pink) and a heavily eroded square board (yellow).

Other 3: Located in the eastern part of the room (Figure 4.21), there were faint indications of an eroded square board and two stray marks. These were destroyed in order to investigate earlier architectural phases of Structure B-4.

Conclusion

Structure B-4 was constructed in at least four phases. The earliest documented phase dates to the middle of the beginning of the Late Classic period (cal AD 594–650) when the structure

Figure 4.19. Photograph of Other 1, in faint pink lines. View to the north.

Figure 4.21. Scaniverse rendering of Other 2. View to the north.

Figure 4.22. Color-enhanced photograph of Other designs 3. View to the north.

may have been a relatively narrow platform with a finely plastered floor and wall. The earlier architecture was covered and the new structure extended towards the courtyard to the south, forming the expansive final phase summit room with a wide doorway, plastered steps, and balustrades leading down to the courtyard. The estimated final dimensions of the summit room measured 13.5 m long by 2.7 m wide, with a total area of 36.45 m^2. The walls were about 1 m high and would have supported a perishable superstructure, likely wattle and daub upper walls and a thatch roof. The platform was a large, open structure with no internal divisions and a single south-facing entrance.

New patolli boards were exposed this season, and we refined our documentation of the previously recovered boards. With new techniques and new eyes, we were able to clarify the stylistic composition of the boards. The most prevalent style at Gallon Jug is the Type II-C variant that is relatively rare in the Maya lowlands (Boards 1, 3, 5, 6, 7, and 8). It has been identified in the Oropendola structure at Copán and in Group 2, Structure A at Holmul (Zralka 2014:148, Table 2), which are both civic-ceremonial structures. The Type II, cross-and-frame board that is so common at other Maya sites (especially Nakum, Xunantunich, and Copán, among others) is only present at Gallon Jug in eroded examples, such as Board 2. Additionally, many Type II boards are oriented with the cardinal directions; two of the Gallon Jug patolli are oriented north-south—Board 8, a Type II-C variant and Board 4, a Type I board—although all of the boards are within 20 degrees of magnetic north.

Board 4 is the largest patolli board that we identified this season. In 2019 we had documented portions of the board but, by using a different light source this season, we were able to see one cohesive design instead of scattered lines. It is remarkable because there are only two other known examples of this type in the Maya lowlands—on a bench in Structure Y at Nakum and at Structure 6N1 at Río Bec (Zralka 2013:147, Table 2). According to Zralka (2013), this style is mostly found in codices from central Mexico, including the Codex Borbonico, the Codex Vaticanus B, and the Codex Vindobonensis. Archaeological examples were found at Teotihuacan and as a petroglyph from the Tom-131 site in Jalisco, Mexico (Zralka 2014:147, Table 2). The example from Gallon Jug most closely resembles the board in the Mixtec Codex Vindobonensis, which has a horizontal central element (Codex Vindobonensis, pg. 19, after Zralka 2014:145; see Figure 4.10). Type I appears over considerable geographic distance and a very long time span but seems to be rooted in central Mexico. Its presence on the floor of a platform at the relatively minor site of Gallon Jug is something that we will explore further.

The other marks incised into the floor may be related to the boards or the patolli game. Zralka and others have documented graffiti surrounding patolli boards at other sites and theorize that they play an unknown role in the game (Zralka 2014:151). One of our theories is that the people responsible for incising the boards at Gallon Jug may have been practicing their designs before incising Boards 4 and 8 into the floor.

Our excavations attempted to identify earlier versions of patolli boards, but we were unsuccessful. Part of the reason is that we did not want to destroy the patolli boards and so we chose to remove only the parts of the floor with no patolli or very eroded boards. If the patolli were a one-time occurrence, then the styles suggest that perhaps they were incised during the Terminal Classic period, after AD 850. The individual buried beneath the floor in Structure B-2 died during the Terminal Classic period (cal AD 907–1020), providing further evidence for a Terminal Classic occupation.

The ceramic deposit associated with the patolli dates mainly to the Late Classic (AD 600–810) period; perhaps the patolli were incised as part of a termination ritual upon abandonment of the site.

Chultun Excavations

The chultun in the center of Courtyard B-1 was first identified and partially excavated during the 2019 season, at the end of which it was backfilled (Novotny et al. 2020). On June 1, Anna Novotny and Leann Castillo established Subop GJ-02-AF, a 2-x-2-m unit placed in the center of the courtyard with the aim of reopening the chultun (see Figure 4.2; Table 4.5).

Table 4.5. Summary of Lots at the Chultun

Lot (GJ-02-)	Lot Description
AE-01	Topsoil
AE-02	Floor
AF-01	Topsoil
AF-02	Other
AF-03	Floor
AG-01	Topsoil
AG-02	Construction Fill
AG-03	Floor
AH-01	Backfill
AH-02	Grave Fill
AH-03	Other
AH-04	Burial GJ-03

Excavations quickly revealed the northeastern edge of the chultun, and we opened units to the south (Subop GJ-02-AG) and west (Subop GJ-02-AF) to fully expose the opening. The courtyard surface was plastered, and in these suboperations we saw parts of it preserved up to the edge of the chultun mouth, which suggests that the chultun was incorporated into the built environment of the courtyard. It was likely smoothed with plaster and capped with a stone.

After exposing the mouth of the chultun, which measured 1.80 m by 1.75 m, we established Subop GJ-02-AH to remove the 2019 backfill (Lot GJ-02-AH-01) down to the level of the burial and then excavate Burial GJ-B03. The chultun is roughly shoe shaped, with the "toe" of the shoe extending east beneath the courtyard floor (Figure 4.23). Excavators encountered bone in the eastern chamber of the chultun after removing 1.22 m of backfill. Lot GJ-02-AH-02 included grayish brown grave fill, which was screened for small pieces of skeletal material and artifacts. Several large rocks had been placed in a semi-circle around the body and there were artifacts recovered, including sherds and freshwater shell fragments (see Figure 5.9). The interment was tightly flexed, hands held next to the face, with the head oriented to the south, facing west. It was surrounded by gravel fill as well as eroding plaster from the sides of the chultun. There was a rock supporting the poorly preserved cranial fragments, with a partial biface placed beneath the rock. Skeletal elements were drawn and then removed from the chultun. Samples were taken for radiocarbon and isotopic analysis. A fragment of bone (Sample GJ-02-10) from the burial returned a radiocarbon age of 1440 ± 20 RCYBP (UGAMS# 61673, bone, $\delta^{13}C$ = -9.62‰). The 2σ calibrated date range is cal AD 1527–1795. The sample intercepts the radiocarbon curve three times, but the largest intercept (74.3 percent) is cal AD 1633–1666 (see Houk, Chapter 8, Tables 8.15 and 8.16, this volume). The 2σ calibrated date range falls in the Late Postclassic/early Colonial period. This timeframe is surprising and we are submitting the sample to another lab for further testing. See Novotny and Castillo (Chapter 5, this volume) for more detailed osteological and mortuary analysis.

Figure 4.23. Mouth of the chultun. View to the northeast.

CONCLUSION

Our goal for the 2022 season was to revisit Courtyard B-1 at Gallon Jug and fill in several gaps in our understanding about the function of Structures B-3 and B-4. Our objective for Structure B-3 was to reveal *in situ* artifact deposits and architectural features to determine the function and architectural layout of the building. In Structure B-4, we wanted to clarify the context of the patolli boards and identify new ones, establish the final dimensions of the summit room, and excavate beneath the final phase architecture to look for earlier construction phases. Our main objective for the chultun was to excavate the *in situ* interment encountered in 2019 and its associated artifacts.

Our excavations of Structure B-3 revealed two architectural components: a platform that may have bordered an entrance way leading into the group and a vaulted residential room with a wide, plastered bench. There were not very many artifacts present in the vicinity of the platform, which would make sense if it was a high-traffic area that was kept clean. The room had some ceramics, debitage, and ground stone, which are all expected artifacts from a domestic context. So far, there is evidence of only one other bench in the group, the one from Structure B-2. The two benches support our interpretation that it is a residential group that also was used for different activities, including food preparation, tool retouching, and ritual practices.

We deepened our understanding of Structure B-4 this season, especially in relation to its architectural dimensions and phases, as well as activities related to its final use. A version of the structure dating to the beginning of the Late Classic period was likely much smaller, with at least one wall built in a refined manner with shaped masonry that was carefully plastered. The structure was later expanded, likely sometime during the Late Classic period (AD 600–810). Residents incised patolli of various styles into the western and central areas of the structure during the later part of the Late Classic or the Terminal Classic periods, after which ceramics and other materials were left on the floor as part of a termination ritual.

We expanded our knowledge about the patolli boards this season as well. Revisiting

them with different documentation methods resulted in fascinating clarifications related to their style. The Type II-C variant dominates our assemblage of patolli boards, with some examples perhaps signifying "rough drafts" of the design, while Board 8 could be the final, playable version. The Type I board (Board 4) was a revelation, since we previously thought it was a jumble of lines instead of a cohesive board. The style seems to have its roots in the central Mexican highlands and is prevalent in pre-Columbian and colonial-period codices. It is also known from a Terminal Classic example from Nakum. While the chronology necessitates further investigation, it is possible that a board of this type at Gallon Jug supports a Terminal Classic occupation phase for the site. Furthermore, since the boards seem to have been made during a short time span, they may be part of a termination ritual. Our research into the architectural and regional context of the patolli is ongoing.

The chultun excavations revealed the interment of a single individual who was buried in a flexed position with their head to the south, facing west. The surprising Late Postclassic/ early Colonial period radiocarbon age of this individual requires further testing and consideration.

REFERENCES CITED

Canuto, Marcello A., Francisco Estrada-Belli, Thomas G. Garrison, Stephen D. Houston, Mary Jane Acuña, Milan Kováč, Damien Marken, Philippe Nondédéo, Luke Auld-Thomas, Cyril Castanet, David Chatelain, Carlos R. Chiriboga, Tomáš Drápela, Tibor Lieskovský, Alexandre Tokovinine, Antolín Velasquez, Juan C. Fernández-Díaz, and Ramesh Shrestha
2018 Ancient Lowland Maya Complexity as Revealed by Airborne Laser Scanning of Northern Guatemala. *Science* 361(6409).

Gallareta Cervera, Tomás, Brett A. Houk, and Claire Novotny
2018 The Development of Terminal Preclassic and Early Classic Royal Architecture at Chan Chich, Belize. *Research Reports in Belizean Archaeology* 15:141–151.

Gallegos Gómora, Miriam Judith
1994 Un patolli prehispánico en Calakmul, Campeche. *Revista Española de Antropología Americana* 24:9–24.

Guderjan, Thomas H., Michael Lindeman, Ellen Ruble, Froyla Salam, and Jason R. Yaeger
1991 Maya Settlement in Northwestern Belize. In *The 1988 and 1990 Seasons of the Rio Bravo Archaeological Project*, edited by Thomas H. Guderjan, pp. 55–88. Maya Research Program and Labrinthos, Culver City, California.

Harrison, Ellie
2000 Structure C-6: Excavations of an Elite Compound. In *The 1998 and 1999 Seasons of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 71–94. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, The University of Texas, Austin, Texas.

Houk, Brett A.
2019 An Introduction to the 2018 Season of the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 1–22. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Houk, Brett A., Mark Willis, and Greg Zaro
2019 The 2016 Gallon Jug Drone Survey Revisited. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 103–116. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Claire, Amy Copper, and Anna C. Novotny
2019 Results of the 2019 BEAST Season at Courtyard B-1, Gallon Jug, Belize. In *The 2019 Seasons of the Belize Estates Archaeological Project*, edited by Brett A. Houk. Papers of the Chan Chich Archaeological Project, Number 14. Department of Sociology, Anthropology, and Social Work. Texas Tech University, Lubbock, Texas.

Novotny, Claire, and Brett A. Houk
2021 Ancient Maya Patolli from Gallon Jug, Belize. *Latin American Antiquity* 32(3):647–654.

Robichaux, Hubert R., Kristen Hartnett, Cadace Pruett, and Alexandra Miller
2015 *Archaeological Investigations at Punta de Cacao, an Ancient Maya Town-sized Settlement in Orange Walk District, Northwest Belize, Central America: The University of the Incarnate Word Project, 2001–2004*. Occasional Papers, Number 18. Center for Archaeological and Tropical Studies, The University of Texas at Austin.

Swezey, William R., and Bente Bittman
1983 El rectángulo de cintas y el patolli: nueva evidencia de la antigüedad, distribucíon, variedad y formas de practicar este juego precolombino. *Mesoamérica* 6:374–416.

Walden, John, and Barbara Voorhies
2017 Ancient Maya Patolli. In *Prehistoric Games of North American Indians: Subarctic to Mesoamerica*, edited by Barbara Voorhies, pp. 197–218. The University of Utah Press, Salt Lake City.

Yaeger, Jason R.
1991 Preliminary Report of the Gallon Jug Settlement Survey. In *The 1988 and 1990 Seasons of the Rio Bravo Archaeological Project*, edited by Thomas H. Guderjan, pp. 89–93. Maya Research Program and Labrinthos, Culver City, California.
1995 The 1995 Excavations at San Lorenzo. In *Xunantunich Archaeological Project: 1995 Field Season*, edited by Wendy Ashmore and Richard Leventhal. pp.112–138. University of California, Los Angeles.

Zralka, Jaroslaw
2014 *Pre-Columbian Maya Graffiti: Context, Dating, and Function*. Wydawnictwo Alter, Krakow, Poland.

Bioarchaeological Analysis of Human Skeletal Remains from Chan Chich and Gallon Jug, Belize: The 2022 Field Season

Anna C. Novotny and Leann Castillo

This report details the preliminary osteological analysis of human remains recovered during the 2022 field season of the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. Excavation teams recovered human remains from the Norman's Temple complex at Chan Chich and Courtyard B-1 at Gallon Jug. Burials are listed in the narrative below according to burial number and provenience. Each section reports the archaeological context from which the remains were recovered, including grave location, grave type, time period during which the interment occurred, position and orientation of the skeleton, and any grave goods recovered. The subsequent section describes osteological data for each individual including the approximate percentage of remains recovered, age at death, biological sex, dentition, and pathologies, if present.

All skeletal data were collected in accordance with the *Standards for Collection of Data from Human Skeletal Remains* (Buikstra and Ubelaker 1994). Standards is a compilation of techniques used in osteological analysis that outlines methods of determining age at death, biological sex, pathological conditions, and cultural modifications to the body. As much of these data as possible were collected for each individual. Analysis of the dentition was done according to *Standards* and supplemented by Simon Hillson's (1996) text *Dental Anthropology* and Timothy D. White's and Pieter A. Folkens' (2005) text *The Human Bone Manual*. Pathologies were identified with reference to *Identification of Pathological Conditions in Human Skeletal Remains* (Ortner 2003). We have refrained from citing the above texts in the report except where necessary.

CHAN CHICH BURIAL CC-B24, LOT CC-21-C-07

Archaeological Context

The Norman's Temple complex is located about 400 m west of the Chan Chich site center on the highest hill outside the site core. The complex consists of an enclosed courtyard bounded by three buildings constructed on top of a platform measuring 110 m by 65 m. Prior excavations were carried out in 1997, when a test pitting program investigated construction episodes of Courtyard C-1, and 1998, to better understand the architectural nature of the courtyard. In sum, these excavations revealed a Late Preclassic construction and Terminal Classic abandonment with no Early Classic component. The 1998 excavations also revealed several on-floor deposits likely associated with abandonment of the group. In 2016 excavations at Norman's Temple resumed. The Structure C-2 excavation goals included exposing and assessing the summit rooms and to reveal

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additional artifact deposits on floors or benches (Booher 2016:41).

Booher's 2016 excavations of the Structure C-2 summit unearthed the northwest corner of a room, which contained a bench. Plaster adhered to the north wall of the room and was marked with graffiti. Below the graffiti, in the northwest corner of the room, a small hole was observed in the plaster surface, which had an irregular texture. Excavations removed the bench surface and revealed the capstones of Burial CC-B15 (Figure 5.1). Burial CC-B15 was placed in a haphazard cist constructed of three shaped limestone blocks that demarcated the grave space within the bench fill. The body was intrusive into the bench and laid on a previous floor. The burial consisted of the primary interment of a young adult male individual, head oriented to the east, in a tightly flexed position on the left side . A Cameron incised bowl (Figure 5.2) was recovered near the pelvis along the western edge of the grave space. Several shell artifacts were recovered from the grave, including an intact shell labret (Figure 5.3) and two obsidian blades. A radiocarbon date from charcoal within the grave returned an age range of cal AD 771–970 (Sample CC-16-S01; Booher 2016:58).

During the 2022 field season, Dr. Gallareta-Cervera excavated at Norman's Temple with the goal of further exploring the summit architecture of Structure C-2. Suboperation (Subop) CC-21-C consisted of a 2-x-4-m unit placed to investigate the east side of the central room in Structure C-2. The north and east sides of the unit were marked by the north wall of the structure and the eastern wall of the central room, respectively. Excavations exposed portions of the northern and eastern interior walls of the room, including a patch

Figure 5.1. Photograph of Burial CC-B15 from 2016, view to the north. Photograph by Ashley Booher.

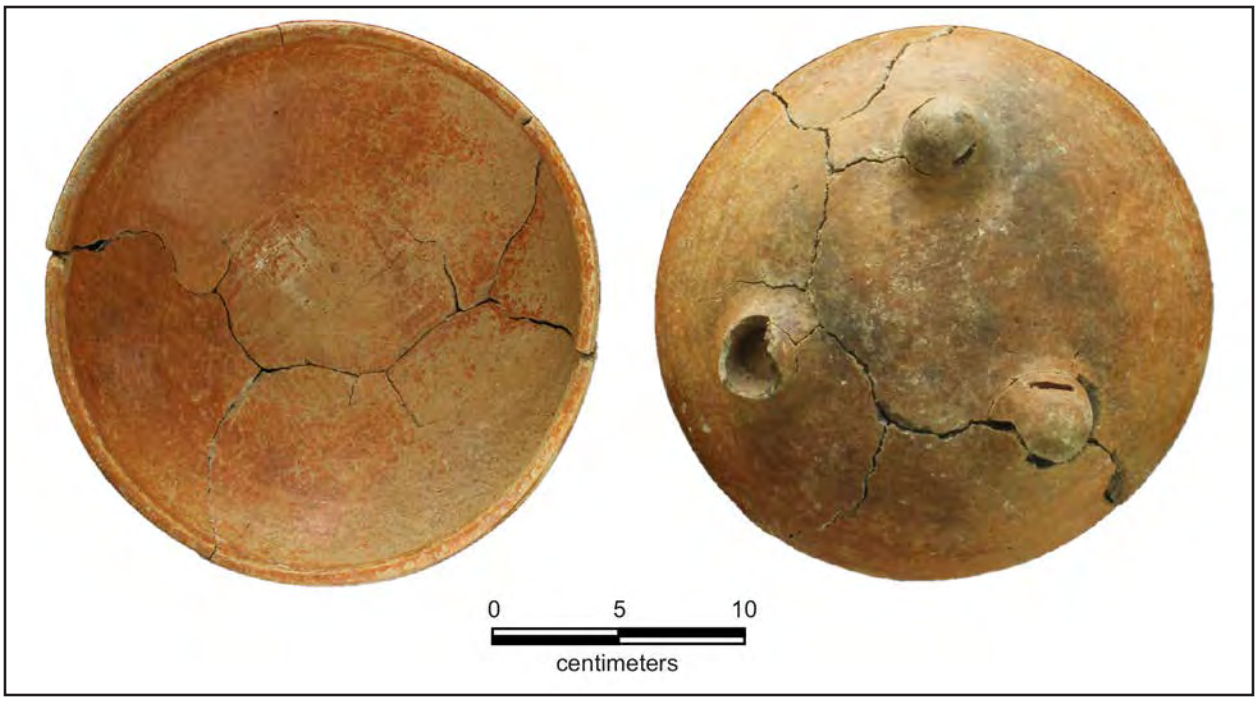

Figure 5.2. Reconstructed Cameron Incised bowl from Burial CC-B15 (Lot CC-16-L-02), interior (Left) and exterior (right), Spec. # CC2508-01. After Booher (2016:60, Fig. 2.15).

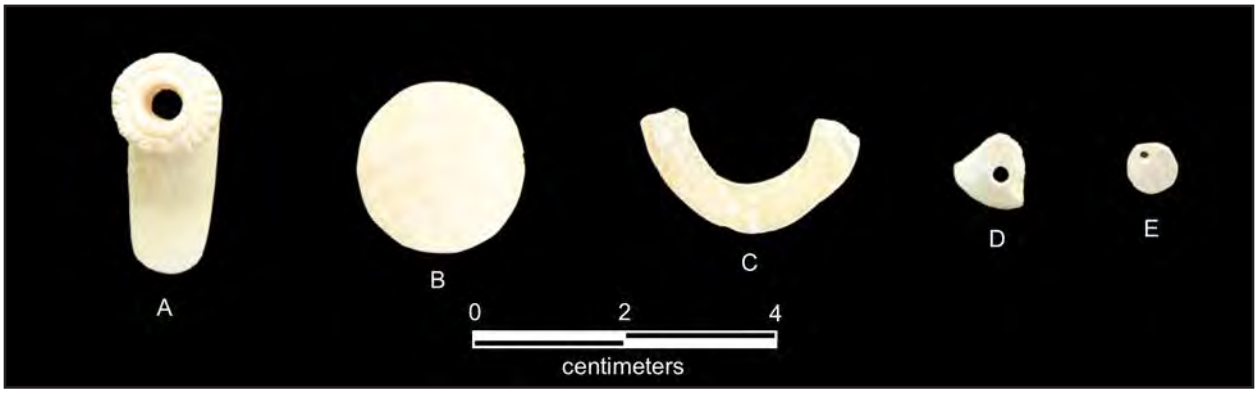

Figure 5.3. Shell artifacts from Burial CC-B15 (Lot CC-16-L-02). A: labret (Spec. # CC2510-01); B: disc (Spec. # CC2510-06); C: adorno disk fragment (Spec. # CC2510-05); D: triangular bead (Spec. # CC2510-02); E: disk bead (Spec. # CC2510-04). After (Booher 2016:60, Fig. 2.14).

of preserved plaster on the northern wall with graffiti, and the surface of a large bench approximately 2.4 m below datum. The space excavated in 2022 is the east side of the same room excavated by Booher in 2016. After reaching the plaster surface, a rough area of plaster with two irregular holes in it against the northern wall was observed suggesting a patch (see Gallareta Cervera and Houk, Chapter 2, this volume). The plaster on the wall above the patch showed black discoloration suggestive of smoke damage. Lot CC-21-C-06 was a 2-x-0.5-m area excavated through the apparent patch in the northwestern corner of Subop CC-21-C. As discussed by Gallareta Cervera and Houk (Chapter 2, this volume), excavators encountered human skeletal remains in the fill below the patch. In Lot CC-21-C-07 we embarked on the excavation of the grave space. Burial CC-B24 was recovered from within

the same room and bench as Burial CC-B15 described above.

The body was laid on a plaster surface, presumably the room's floor, and a haphazard cist was constructed around the body with dry fill of medium and large sized stones. The individual was laid in an extended, supine position with head to the west (Figure 5.4). The right arm was flexed at the elbow and laying on the abdomen. The left arm and left leg were disturbed in antiquity; the left fibula was missing, the left patella was out of place, and the bones of the left arm were disarticulated. In addition to the missing elements a concentration of charcoal located under the left os coxa and the charring of several skeletal elements suggest a small fire or smoldering embers were placed in the grave after the body skeletonized (Figure 5.5). Flecks of charcoal were observed in the fill throughout the grave space. There was a broken black ceramic vessel to the left side of the cranium, towards the northwest, between the cranium and the north wall. The only object in the grave besides the ceramic vessel was a small, broken shell ornament recovered near the left shoulder. The ceramic vessel suggests a Late Classic date for the interment. Samples of charcoal and human bone were selected for AMS radiocarbon dating. A radiocarbon date from the bone sample returned a 2-sigma age range of cal AD 675–876 (Sample CC-21-S14;

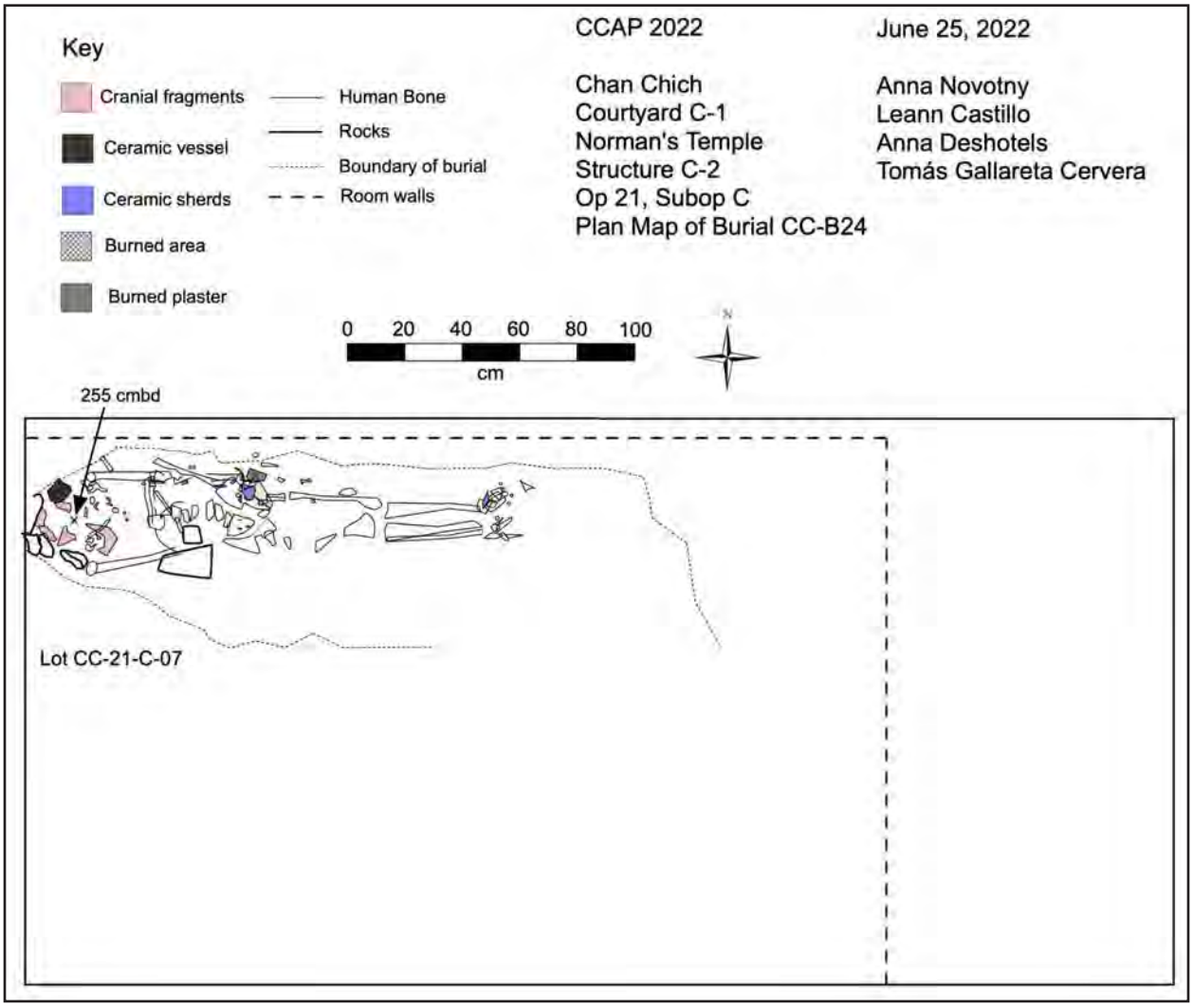

Figure 5.4. Plan Map of Burial CC-B24 (Lot CC-21-C-07).

Figure 5.5. Plan view photograph of Burial CC-B24 (Lot CC-21-C-07).

see Table 2.3, this volume). The charcoal fragment returned a 2-sigma radiocarbon date of cal AD 702–881 (Sample CC-21-S10; see Table 2.3, this volume).

Osteological Analysis

The individual was moderately well preserved, with approximately 50–75 percent of the skeleton available for analysis (Table 5.1).

Age and Sex

Skeletal elements indicative of age were not well preserved, however all epiphyses observable were fused, indicating that the individual was an adult at the time of death. There was moderate occlusal wear on several teeth. The crown of one maxillary third molar was recovered, not in occlusion, and root formation had not begun. The developmental stage of the tooth indicates an age at death of late adolescence or early adult hood.

Preservation of the pelvis and skull were fair. The left and right ilia were fairly well preserved, and the greater sciatic notches were assessed in the field; both were scored as ambiguous. The carpals and metacarpals were measured in the lab according to procedures outlined in Mastrangelo and colleagues (2011) and Torres and colleagues (2018). Based on the discriminant function equations calculated using these measurements, sex estimation is probable female.

Table 5.1. Burial CC-B24 Skeletal Inventory*

Element	Side	Completeness	Burning
Frontal	L/R	0	
Parietal	L/R	50%/50%	
Occipital	L/R	>25%/>25%	
Temporal	L/R	50%/50%	
Sphenoid	L/R	>25%/>25%	
Zygomatic	L/R	>25%/>25%	
Maxilla	L/R	>25%	
Palatine	L/R	Unid	
Mandible	L	>25%	
	R	>25%	
Clavicle	L		
	R		
Scapula	L	75%	
	R	75%	
Patella	L	75%	
	R	75%	
Sacrum	-	50%	
Ilium	L	50%	X
	R	50%	
Ischium	L	100%	X
	R	100%	
Pubis	L/R	>25%/>25%	
Acetabulum	L	100%	X
	R	100%	
Auricular surface	L/R	>25%/>25%	
C1	-	Unid	
C2	-	75%	
C7	-	0	
T10	-	75%	
T11	-	75%	X
T12	-	75%	X
L1	-	75%	X
L2	-	75%	X
L3	-	75%	X
L4	-	75%	X
L5	-	75%	X
C3-6	-	Fragments	
T1-T9	-	Fragments	

Table 5.1. (continued)

Element	Side	Completeness	Burning
Manubrium	-	>25%	
Sternal body	-	50%	
Rib 1	L	100%	
	R	50%	
Rib 2	L	Unid	
	R	Unid	
Rib 11	L	50%	
	R	Unid	
Rib 12	L	50%	
	R	Unid	
Rib 3-10	L/R	Unid	
Hyoid	-	100%	
Humerus	L	75%	
	R	75%	
Radius	L	75%	
	R	75%	
Ulna	L	75%	
	R	75%	
Femur	L	50%	X
	R	50%	
Tibia	L	50%	
	R	50%	
Fibula	L	0	
	R	75%	
Talus	L	>25%	
	R	>25%	
Calcaneus	L	>25%	
	R	>25%	
Hands			
Carpals		100%	
Metacarpals		100%	X
Hand phalanges		100%	X
Feet			
Tarsals		50%	
Metatarsals		50%	
Pedal phalanges		50%	

* The completeness category “Unid.” indicates that there were fragments present, but the specific bone or side was not identifiable. The number “0” means no skeletal element was recovered.

Dentition

Three maxillary teeth and seven mandibular teeth were recovered (Table 5.2). None of the teeth were filed or inlaid. All teeth show small amounts of attrition to the incisal or occlusal surface, suggesting a relatively young age at death. No pathologies were observed, besides a very small about of calculus on the LC_1. The same tooth, LC_1, was discolored possibly by exposure to fire.

Pathology and Trauma

There was minor porosity observed on the bodies of the lower thoracic and lumbar vertebrae suggesting the early stages of osteoarthritis. Otherwise, there was no evidence of pathology or trauma to the skeleton.

Conclusion

Burial CC-B24 consists of the primary interment of a probable female, young adult individual. She was placed in an extended, supine position with head to the west within dry fill of a bench in the central room of Structure C-2. One ceramic vessel was placed in the grave, and a broken fragment of shell ornament was also recovered. Charcoal was encountered throughout the grave space and the bones of the left femur and pelvis, as well adjacent vertebrae of the lower back and left hand, were discolored in a way consistent with exposure to fire (Figure 5.6). The color was dark brownish red to black suggesting that the fire was not very hot, approximately between 200 and 350 degrees Celsius (van Hoesel et al. 2019). The discolored skeletal elements are immediately below the black stains on the north wall of the room that were observed above and below the level of the plaster bench surface. One interpretation is that the grave was reentered after skeletonization and embers or a small, smoky fire was placed close to the left hip. The left fibula could have been removed and the left patella displaced at the time the burning occurred. Charcoal collected from within the grave space and a sample of human bone was submitted for AMS radiocarbon dating to clarify the reentry timing. The radiocarbon dates are discussed below.

As mentioned above, the individual in Burial CC-B24 was recovered from the same summit room and bench as Burial CC-B15, found in 2016 (Booher 2016). The body position and orientation differed between the two burials. Burial CC-B15 was in a flexed position with head to the east and Burial CC-B24 was in an extended, supine position with head to the west. There is clear evidence that the living re-opened the grave of Burial CC-B24, and new radiocarbon dates from Burial CC-B15, which we submitted in 2022, suggest that the living may have also reentered that burial, as discussed below. The first bone sample submitted returned a 2-sigma radiocarbon date of cal AD 1074–1157 (Sample CC-16-S02a; Figure 5.7; see Table 2.3, this volume). A second bone sample from the same bone, a femur, was submitted for analysis and returned a 2-sigma radiocarbon date of cal AD 675–777 (Sample CC-16-S02b; Figure 5.7; see Table 2.3, this volume). This Late Classic date is consistent with other radiocarbon dates from Norman's Temple as well as relative dating of ceramics. We therefore consider the date from

Table 5.2. Dental Inventory of Burial CC-B24

RM^3	RM^2	RM^1	RP^4	RP^3	RC^1	RI^2	RI^1	LI^1	LI^2	LC^1	LP^3	LP^4	LM^1	LM^2	LM^3
X					X	X									
	X	X	X	X		X				X				X	
RM_3	RM_2	RM_1	RP_4	RP_3	RC_1	RI_2	RI_1	LI_1	LI_2	LC_1	LP_3	LP_4	LM_1	LM_2	LM_3

Figure 5.6. Photograph of the pelvis and left hand of Burial CC-B24 (Lot CC-21-C-07) showing charcoal and burned plaster. View to the west.

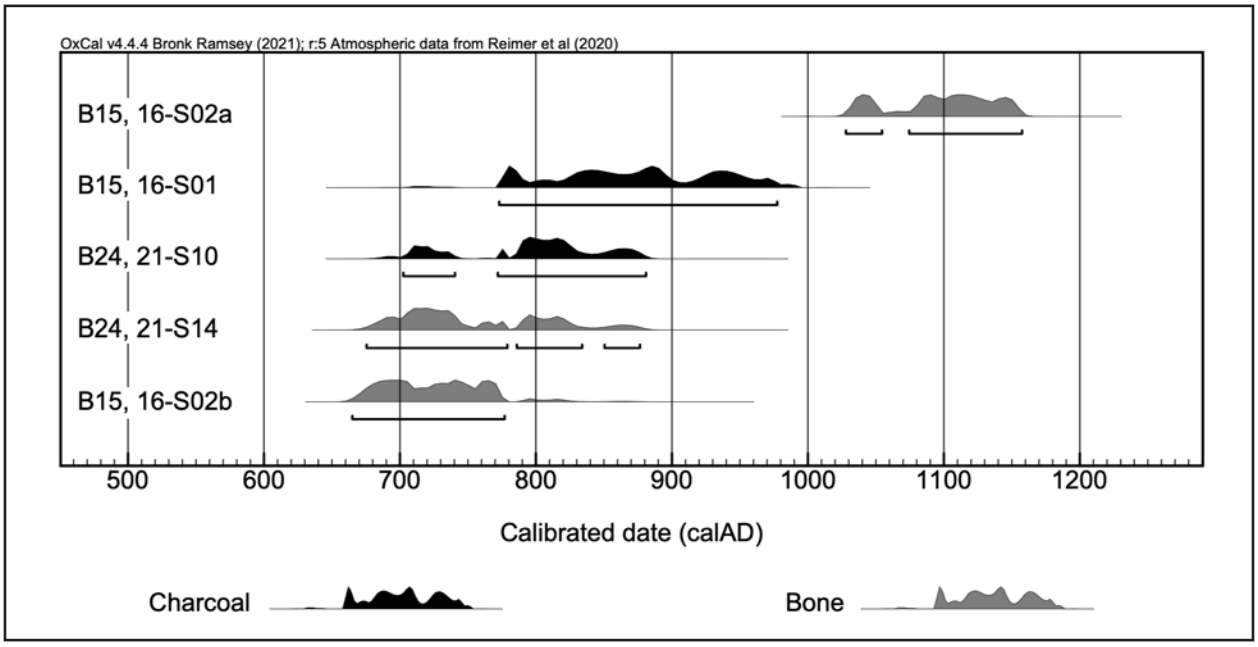

Figure 5.7. Radiocarbon sequence from Structure C-2, Burials CC-B15 and CC-B24.

Sample CC-16-S02a to be erroneous. As there is no evidence of human occupation of Chan Chich after AD 950, we interpret the date as the result of soil contamination of the bone (Alexander Cherkinsky, University of Georgia, personal communication, December 21, 2022).

The sequence of radiocarbon dates from charcoal samples and human remains anchors the mortuary activity in Structure C-2 in time (see Figure 5.7). The dates from the bodies of Burials CC-B24 and CC-B15 suggest that the two individuals were buried within the same 100-year period during the Late Classic period. The charcoal sample from Burial CC-B24 indicates that the burning event associated with reentry into the grave occurred within the century after the original interment. It is not clear whether this was the only reentry event; the fibula could have been removed at a different time. The date range from Burial CC-B15 is slightly wider, but also suggests there may have been an episode of reentry into Burial CC-B15 in the century or two after the original interment.

There is abundant epigraphic evidence for ancient Maya use of fire in mortuary contexts (e.g., Fitzsimmons 1998; Medina and Sanchez 2007; Scherer 2015; Stuart 1998). Stuart (1998:397) points to several Classic period inscriptions that describe rituals associated with fire-making including the phrase "fire enters his/her tomb." Examples of this phrase are found on monuments at Seibal, Tonina, and Piedras Negras (Stuart 1998:398). Archaeological evidence of fire within tombs, including burned human skeletal remains and burned artifacts, has been found at Piedras Negras Burials 10 and 13, as well as within several tombs from Copan (Stuart 1998:399). The pattern of burning on the bones in Piedras Negras Burial 13 and the Copan tombs suggest the bones were burned after the remains were skeletonized (Scherer 2015:128–129).

Stuart (1998) and Scherer (2015) describe fire as a regenerative, animating, and dedicatory agent in modern and ancient Maya worldview. Warmth is associated with vitality, life, and godliness. Bringing fire into contact with human skeletal remains would be an animating, revitalizing event possibly associated with ancestor veneration. The reentry into CC-B24 and evidence for the presence of fire within and around the tomb is consistent with the archaeological and epigraphic data from other sites in the Maya lowlands.

GALLON JUG BURIAL GJ-B03, LOT GJ-02-A-07

Archaeological Context

Burial GJ-B03 was first investigated in 2019, but, due to time constraints, excavations had to be resumed in 2022. Locating the chultun opening was slightly difficult due to it no longer being visible on the surface. A 2-x-2-m excavation unit over the possible chultun opening and later two 1-x-1-m units were used to expand and uncover more of the chultun opening to the west and southwest of the unit (Novotny et al. 2019; Figure 5.8). The goal was to uncover the chultun and recover any cultural material within the subterranean feature.

The chultun is roughly shoe shaped, with a smaller chamber measuring 1.15 m (north/south) by ~1 m (east/west) extending north under the courtyard floor (Novotny et al. 2019). Several limestone blocks were uncovered at the base of the chamber; the eastern and northern edges of the chultun held the human remains, Burial GJ-B03 (Novotny et al. 2019). Cultural material, including a freshwater snail shell, ceramics, and lithic debitage, was recovered from the burial context. Infield observations showed that the body was that of one adult individual placed in a flexed position, with head oriented to the south, in a simple cist delineated by the unworked limestone blocks (Figure 5.9).

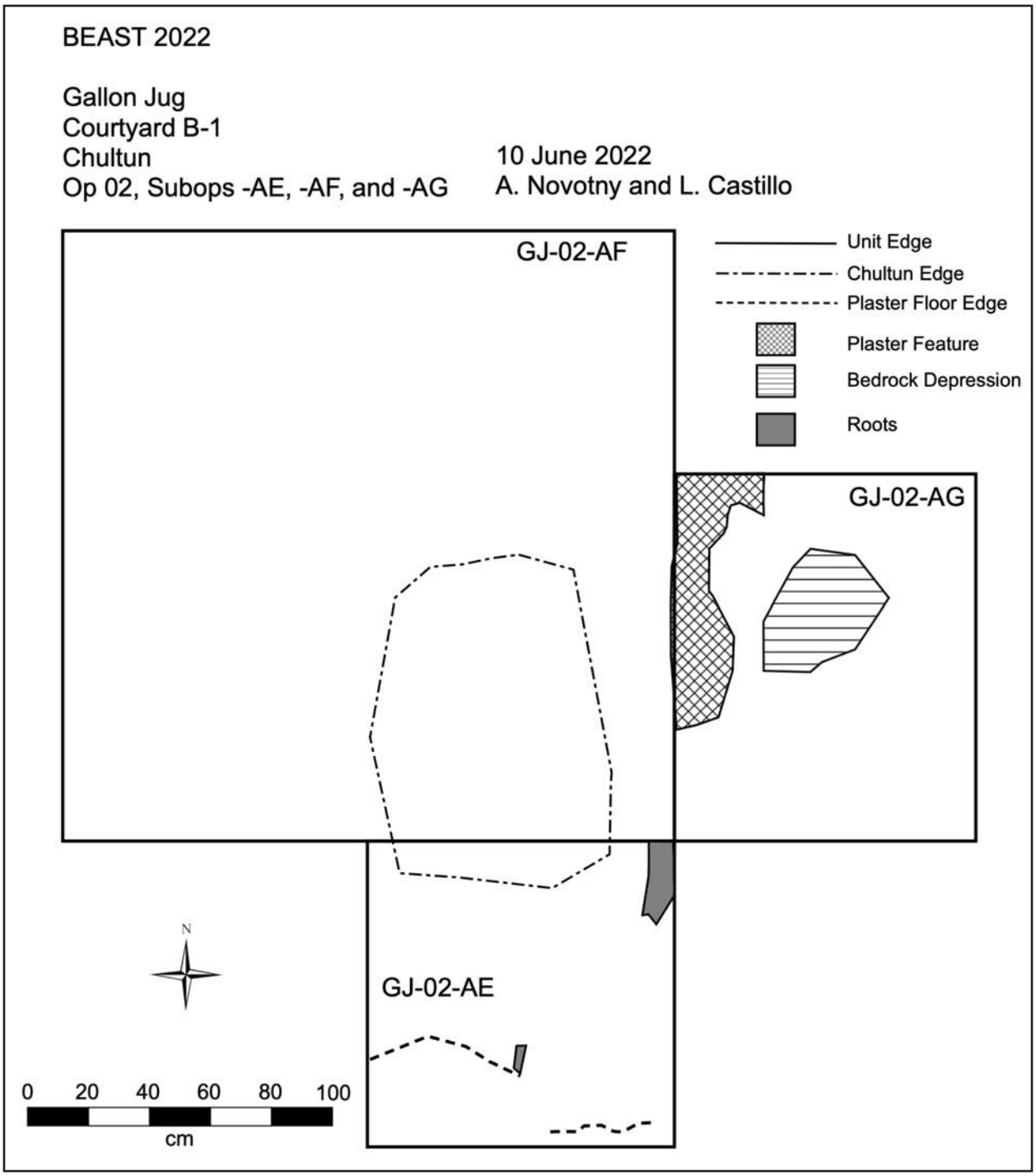

Figure 5.8. Plan map of 2022 surface excavation units at the chultun (Subops GJ-02-AE, -AF, and -AG).

One sample of human bone was taken for AMS radiocarbon dating in 2019, but there was not sufficient collagen preserved to produce a date (Novotny et al. 2019). Another sample was taken this 2022 field season and the radiocarbon analysis returned a 2-sigma date range of cal AD 1633–1666 (Sample GJ-02-S10; see Novotny et al., Chapter 4, this volume). If correct, this date suggests Burial GJ-B03 is a Postclassic or early Historic period interment. Another round of testing will be done to confirm this date.

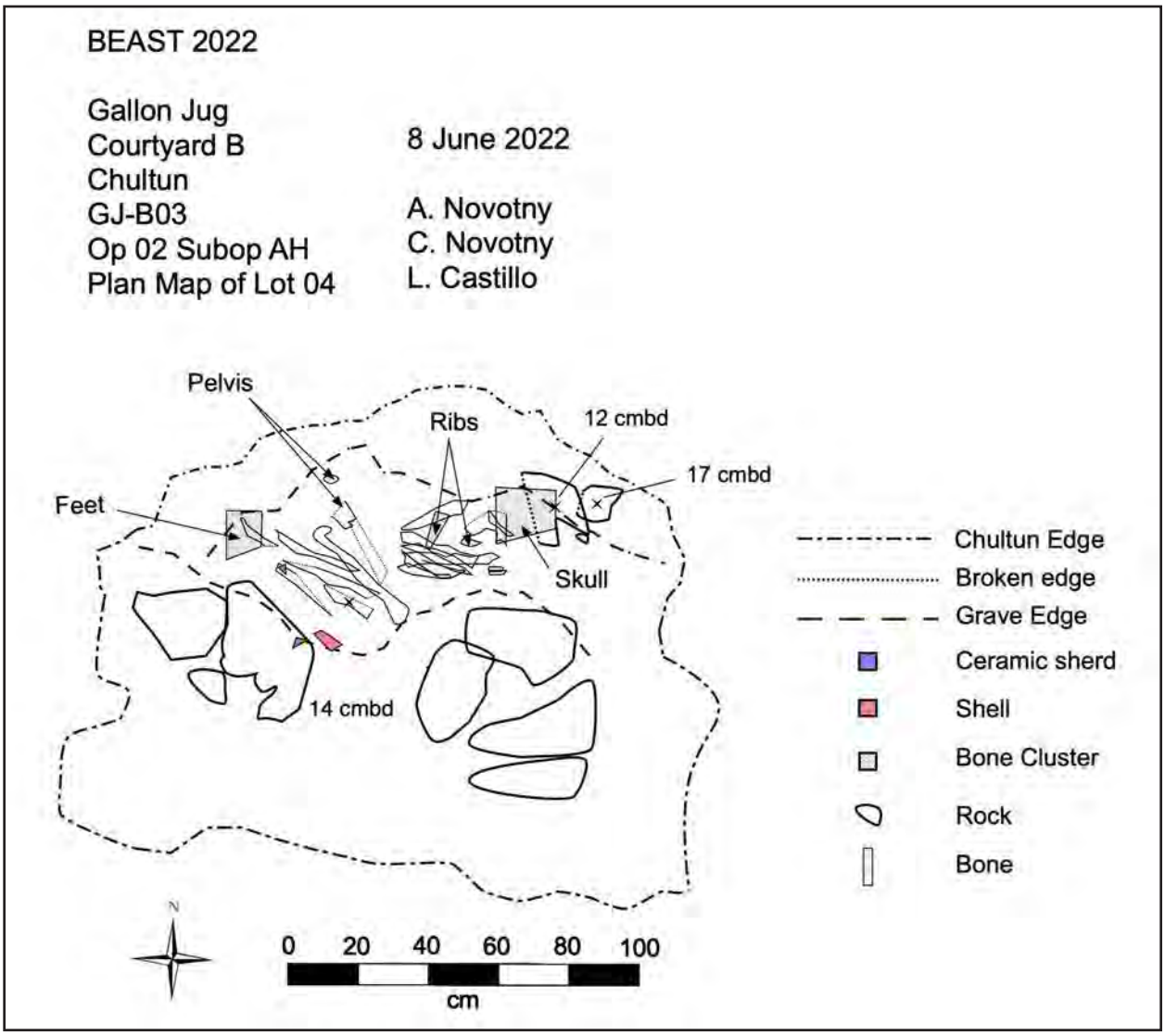

Figure 5.9. Plan Map of Burial GJ-B03 (Lot GJ-02-AH-04).

Osteological Analysis

Skeletal elements were recovered from all regions of the body. The entire skeleton was not well preserved in the ground and many elements disintegrated upon removal. No carpals or tarsals were recovered. The cranium of the individual was poorly preserved due to a possible ceiling collapse of the plaster in the chultun.

Age and Sex

Based on field observations of skeletal development, age at death was estimated as adult. Sex could not be estimated for the individual due to poor bone preservation and missing elements.

Dentition

No teeth were recovered from Burial GJ-B03.

Pathology and Trauma

There was no pathology or trauma visible, due to poor preservation, on Burial GJ-B03.

Conclusion

Burial GJ-B03 consisted of the primary interment of one individual in a chultun. The living created a simple cyst of unworked limestone rocks around the body, which they laid in a flexed position on its right side with head to the south. While it is likely that the entire skeleton was present, preservation was poor, and not all elements were observed for analysis. There were no clear grave goods placed with the individual, although excavators collected several artifacts from the matrix around the skeleton. A sample of bone was taken for radiocarbon analysis; the ceramics from the fill in the chultun will be analyzed later.

REFERENCES CITED

Booher, Ashley
2016 Results of the 2016 Norman's Temple Complex Investigations at Chan Chich. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 39–66. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology and Social Work, Texas Tech University, Lubbock.

Buikstra, Jane E., and Douglas H. Ubelaker
1994 *Standards for Data Collection from Human Skeletal Remains*. Research Series No. 44. Arkansas Archaeological Survey, Fayetteville, Arkansas.

Fitzsimmons, James L.
1998 Classic Maya Mortuary Anniversaries at Piedras Negras. *Ancient Mesoamerica* 9(2):271–278.

Hillson, Simon
1996 *Dental Anthropology*. Cambridge University Press, Cambridge.

Mastrangelo, Paola, Stefano De Luca, and Gabriela Sánchez-Mejorada
2011 Sex Assessment from Carpal bones: Discriminant Function Analysis in a Contemporary Mexican Sample. *Forensic Science International* 209(196):1–15.

Medina Martín, Cecilia and Mirna Sánchez Vargas
2007 Posthumous Body Treatments and Ritual Meaning in the Classic Period Northern Petén: A Taphonomic Approach. In *New Perspectives on Human Sacrifice and Ritual Body Treatments in Ancient Maya Society*, edited by Vera Tiesler and Andrea Cucina, pp. 102–119. Springer, New York.

Novotny, Claire, Amy Copper, Anna C. Novotny
2019 Results of the 2019 BEAST Season at Gallon Jug, Belize. In *The 2019 Seasons of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk. pp. 57–92. Papers of the Chan Chich Archaeological Project, Number 14. Texas Tech University, Lubbock.

Ortner, Donald J.
2003 *Identification of Pathological Conditions in Human Skeletal Remains*. 2nd ed. Academic Press, New York.

Reimer, Paula J., William E. N. Austin, Edouard Bard, Alex Bayliss, Paul G. Blackwell, Christopher Bronk Ramsey, Martin Butzin, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M. Grootes, Thomas P. Guilderson, Irka Hajdas, Timothy J. Heaton, Alan G. Hogg, Konrad A Hughen, Bernd Kromer, Sturt W. Manning, Raimund Muscheler, Jonathan G. Palmer, Charlotte Pearson, Johannes van der Plicht, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Christian S. M. Turney, Lukas Wacker, Florian Adolphi, Ulf Büntgen, Manuela Capano, Simon M Fahrni, Alexandra Fogtmann-Schulz, Ronny Friedrich, Peter Köhler, Sabrina Kudsk, Fusa Miyake, Jesper Olsen, Frederick Reinig, Minoru Sakamoto, Adam Sookdeo, and Sahra Talamo
2020 The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon* 62(4):725–757.

Scherer, Andrew
2015 *Mortuary Landscapes of the Classic Maya: Rituals of Body and Soul*. University of Texas Press, Austin.

Stuart, David
1998 "The Fire Enters His House": Architecture and Ritual in Classic Maya Texts. In *Form and Meaning in Classic Maya Architecture*, edited by Stephen D. Houston, pp. 373–325. Dumbarton Oaks, Washington, DC.

Torres, Guillermo, Antinea Menéndez Garmendia, Gabriela Sánchez-Mejorada, and Jorge A. Gómez-Valdés
2020 Estimation of Gender from Metacarpals and Metatarsals in a Mexican Population. *Spanish Journal of Legal Medicine* 46(1):12–19.

Welsh, W. Bruce M.
1988 *An Analysis of Classic Lowland Maya Burials*. BAR International Series 409. British Archaeological Reports, Oxford, England.

White, Tim D., and Pieter A. Folkens
2005 *The Human Bone Manual*. Academic Press, New York.

van Hoesel, Annelies, Fenke H. Reidsma, Bertil J. H. van Os, Luc Megens, and Freek Braadbaart
2019 Combusted Bone: Physical and Chemical Changes of Bone During Laboratory Simulated Heating Under Oxidising Conditions and Their Relevance for the Study of Ancient Fire Use. *Journal of Archaeological Science: Reports* 28:1–13.

Results of pXRF Analysis of Obsidian Artifacts from Chan Chich, Gallon Jug, Kaxil Uinic Ruins, and Kaxil Uinic Village

Bridgette Degnan and Brett A. Houk

This chapter describes the methods and results of portable X-ray fluorescence spectrometry of obsidian artifacts collected by the Chan Chich Archaeological Project (CCAP) and the Belize Estates Archaeological Survey Team (BEAST) between 2012 and 2022. In all, we analyzed 507 artifacts, which the projects collected from a wide range of contexts at the sites of Chan Chich, Gallon Jug, Kaxil Uinic ruins, and Kaxil Uinic village, the site of a historic San Pedro Maya settlement. As discussed below, by comparing our results to published source data, we have identified five preliminary obsidian sources in our sample. We use ceramic data to examine how access to different sources changed through time.

BACKGROUND

Texas Tech University completely renovated the Archaeology Lab in the Department of Sociology, Anthropology, and Social Work in 2018, gutting the old lab space in Holden Hall and building a new classroom, teaching assistants' office, storage space, and processing lab. To outfit the new lab, the university purchased a 3D printer, four total data stations with data collectors, several microscopes, and a pXRF device.

An exhaustive review of the pros and cons of using pXRF to analyze obsidian is beyond the scope of this interim report chapter, however the technology has been used successfully by numerous projects in Mesoamerica, and published elemental data are available for the known Mesoamerican obsidian sources. Obsidian, because it can be traced back to a specific source, has long been used to study ancient Maya trade routes (see Dreiss 1988; Hammond 1972; Healy et al. 1984; Nelson 1985; Sidrys 1976; Stemp et al. 2011, for example).

In August 2019 the authors spent two days analyzing 330 obsidian artifacts, representing most of the obsidian collected during the 2012 through 2019 field seasons. During the 2022 season, Degnan, Anna DesHotels, and Leann Castillo analyzed an additional 177 specimens, most of which (92 percent) came from the North Plaza at Chan Chich (Table 6.1).

Table 6.1. Specimens Analyzed in 2019 and 2022 by Site

Site	2019	2022	Total
Chan Chich	291	175	466
Gallon Jug	17	2	19
Kaxil Uinic	2	0	2
Kaxil Uinic village	20	0	20
Total	330	177	507

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2022 Results of pXRF Analysis of Obsidian Artifacts from Chan Chich, Gallon Jug, Kaxil Uinic Ruins, and Kaxil Uinic Village. In *The 2022 Season of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 107–118. Papers of the Chan Chich Archaeological Project, Number 15. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

METHODS

We analyzed our obsidian artifacts on an Olympus Vanta M Series pXRF. The Vanta M Series has a sensitive large area silicon drift detector and a 50 kV X-ray tube with a rhodium (Rh) anode (Olympus 2019). We used the factory-installed GeoChem method with the heavy elements beam set for 10 seconds and the light elements beam set for 20 seconds. Johnson and colleagues (2021) evaluated the accuracy of the Vanta M using the GeoChem method and concluded the Vanta M, like other tested models, "performed well," but that the GeoChem method had errors as great as 9 percent for strontium. These errors can be reduced with slope corrections, which we did not use.

Data

Alongside the elemental data from the pXRF analysis, we consider provenience and metric data for each obsidian specimen. We also rely on two external data sets that contain elemental concentrations for obsidian from Mexican, Guatemalan, and Honduran volcanic sources.

We analyzed all the obsidian artifacts collected between 2012 and 2022 that were large enough to reliably analyze on a pXRF (i.e., greater than 1 cm^2 in area). Many studies only include specimens larger than one centimeter long and three millimeters thick, although there are correctional measures that can be used to get reliable measurements from artifacts smaller than this minimum cut-off (Frahm 2016). These corrections were not applied here but can be considered in future studies to either refine the readings for the smallest specimens in our collection or expand the sample size.

After analysis with the Olympus pXRF, we matched the resulting elemental data with provenience and metric data to provide information on site context and physical characteristics. We include the following information for each obsidian specimen: (1) site (Chan Chich, Gallon Jug, Kaxil Uinic ruins, or Kaxil Uinic village), (2) provenience information (Operation-Suboperation-Lot), (3) weight, (4) completeness, (5) form, and (6) the temporal period, as designated through ceramic associations. Most of the obsidian artifacts are prismatic blades or blade fragments, but there are some debitage, bifaces, unifaces, and core fragments as well (Table 6.2). All obsidian specimens recovered during the 2022 field season were analyzed in the field lab to record physical attributes (form, subform, completeness, weight, length, width, and thickness).

Table 6.2. Number of Specimens by Artifact Form

Form	2019	2022	Total
Blade	282	122	404
Debitage	33	44	77
Biface	10	0	10
Core	0	6	6
Uniface	5	0	5
Unanalyzed	0	5	5
Total	330	177	507

Ceramic temporal periods were assigned by the authors based on analysis conducted by Fred Valdez and Lauren Sullivan. Ceramic analysis for the 2022 field season is outstanding, therefore temporal assignments are only available for specimens collected in 2019 or earlier. Table 6.3 shows the distribution of major temporal periods associated with the 2019 analyzed obsidian samples. Out of the 330 obsidian samples analyzed, 21 do not have an assigned temporal period, either because the obsidian specimen was a surface find or because there were no ceramics found in context with it. These and the 2022 obsidian specimens are included in the row "Undetermined."

Table 6.3 Distribution of BEAST Obsidian Specimens Across Major Time Periods

Time Period	2019	2022
Preclassic	47	0
Early Classic	22	0
Late Classic	240	0
Total	309	0
Undetermined	21	177

Obsidian Source Data

In our analysis, we compare the elemental data from the BEAST samples to elemental data from known obsidian sources. The known samples come from two data sets: one supplied by Geoffrey Braswell (Braswell's collection) and the Peabody-Yale Reference Obsidian (PYRO) sets (Braswell, personal communication, 2020; Frahm 2019). We compare our data to all Mexican and Central American volcanic sources in these data sets (Figure 6.1).

Braswell's collection contains geochemical data from El Chayal, Guinope, Ixtepeque, La Esperanza, Otumba, San Martín Jilotepeque (SMJ), Ucareo, Pico de Orizaba, Zacualtipán, and Zaragoza. For each source listed, the reference collection holds between 10 and 30 samples, which Braswell collected himself. Braswell (personal communication, 2020) used a Bruker Model III pXRF to analyze the reference specimens (see also Stroth et al. 2019).

The PYRO sets are open-source obsidian source data that have been published to facilitate transparency, accuracy, and reproducibility in X-ray fluorescence analysis (Frahm 2019). The samples in this data set were processed using multiple sourcing techniques, including NAA, EDXRF, and a PYRO-recommended calibration. While the PYRO sets contain obsidian samples from sources across the world, we only included sources in modern-

Figure 6.1. Map of western Central America and Mexico with known obsidian sources and Chan Chich.

day Mexico and Guatemala (La Joya, Sierra de Pachuca [Pachuca], and El Chayal).

Prior to analysis, we hypothesized that the most of the obsidian at Chan Chich was from sources like El Chayal, Ixtepeque, and SMJ because these three sources accounted for 98 percent of the 1,675 obsidian artifacts analyzed by Beckwith (2013:Table 5.4) from sites on the Programme for Belize, immediately north of the BEAST permit area. Beckwith (2013:2, 31) used a Bruker Tracer III-V+ pXRF to conduct his analysis, which was the first use of pXRF in the Belizean half of the Three Rivers adaptive region.

ANALYSIS

This section contains a preliminary review of the geochemical data obtained in our pXRF analysis. In this review, we overlay ratios of elemental concentrations in parts per million (PPM) for the CCAP and BEAST obsidian specimens atop the same ratios for the obsidian sources. We then visually group BEAST specimens that have similar geochemical signatures to specific obsidian sources. We use these preliminary group assignments to explore trends in obsidian sources from the Preclassic to Late Classic periods at Chan Chich. Because the sample sizes are small from the other sites, we did not analyze the temporal data for Gallon Jug, Kaxil Uinic ruins, or Kaxil Uinic village. In the future, we plan to conduct formal statistical analyses on these obsidian artifacts.

Elemental Ratios

Ratios of rubidium, strontium, zirconium, and iron are common in obsidian elemental analyses because they capture a large portion of the geochemical variation across obsidian sources. Figures 6.2 and 6.3 plot elemental ratios for the BEAST specimens with the Braswell and PYRO source data overlaid in varying color and shape. Figure 6.2 plots the ratio of rubidium to zirconium (Rb/Zr) against the ratio of strontium to zirconium (Sr/Zr). Figure 6.3 plots the ratio of iron to rubidium (Fe/Rb) against the ratio of rubidium to zirconium (Rb/Zr).

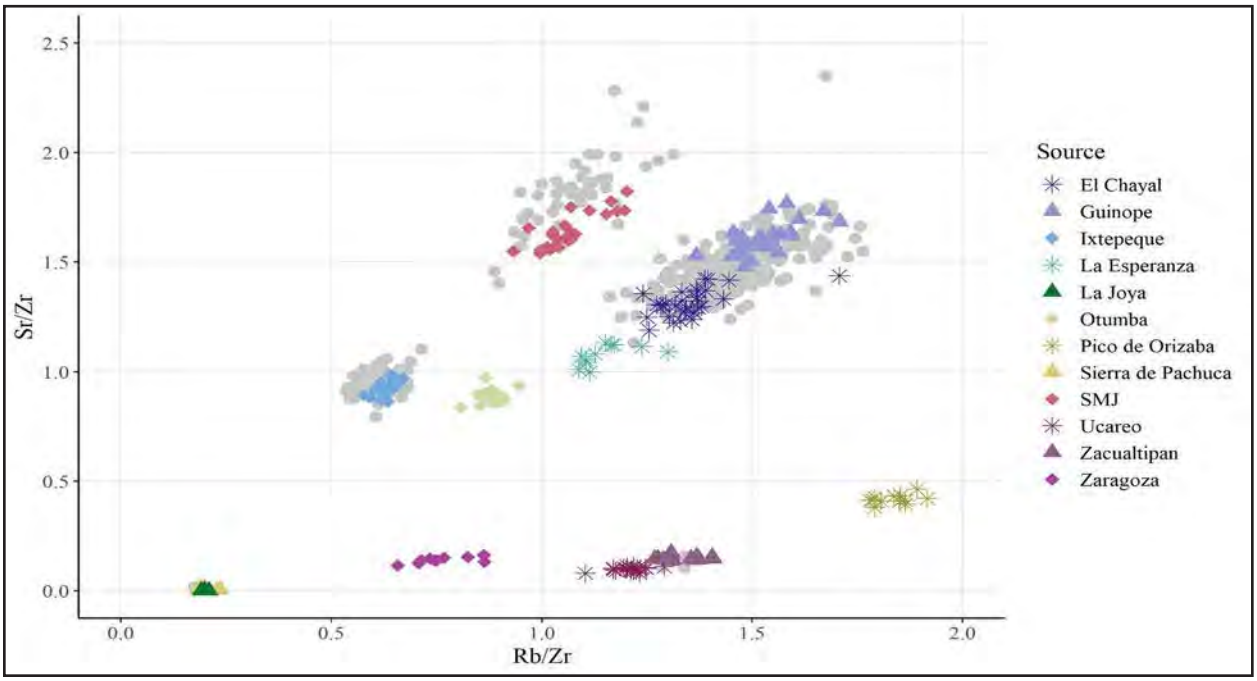


Figure 6.2. Plot of Rb/Zr by Sr/Zr with BEAST specimens in gray and the Braswell and PYRO source data overlaid.

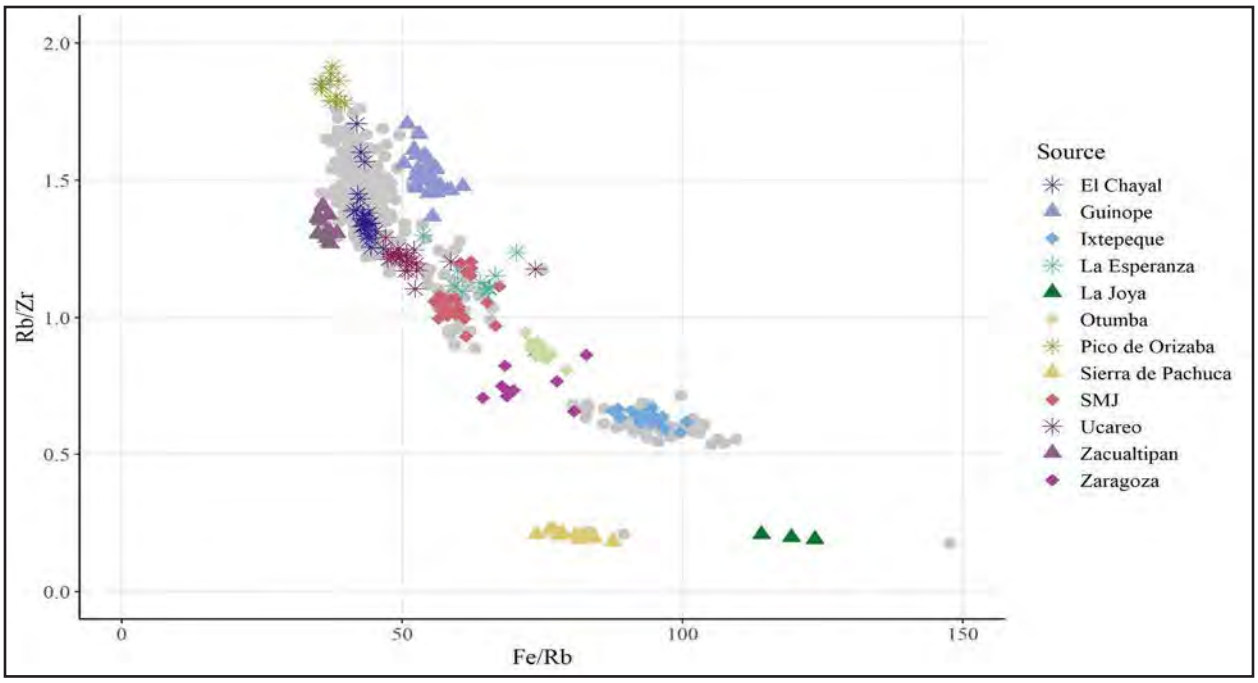


Figure 6.3. Plot of Fe/Rb by Rb/Zr with BEAST specimens in gray and the Braswell and PYRO source data overlaid.

Weight Sensitivities

As mentioned above, researchers often exclude small specimens from geochemical analysis due to concerns that the instrument will not be able to reliably measure them. Figures 6.4 through 6.8 show elemental concentrations (in PPM) by weight class, separated into specimens weighing more than a gram, those weighing between 0.5 grams and 1 gram, and those weighing less than 0.5 grams. These figures show that specimens weighing less than a gram are not consistently outliers. Therefore, the preliminary results presented in this chapter will not limit artifacts based on weight. Future analyses will remove statistical outliers.

RESULTS

Our preliminary results show that the vast majority of BEAST samples were from the three Guatemalan sources of El Chayal, Ixtepeque, and SMJ (98.6 percent), while a small number of specimens were from Central Mexican sources of Sierra de Pachuca and Zacualtipán (0.6 percent). We were unable to confidently match four specimens with an obsidian source (Undetermined, 0.8 percent). Figures 6.9 and 6.10 show the preliminary source assignments for the BEAST obsidian using the same elemental ratios presented in Figures 6.2 and 6.3.

By Site

Tables 6.4 and 6.5 show the source assignments by site. Chan Chich accounts for about 92 percent of the analyzed artifacts. The majority of these came from El Chayal (366 specimen, or 79 percent), with an additional 51 artifacts coming from Ixtepeque (11 percent) and 43 artifacts from SMJ (nine percent). Three obsidian artifacts came from central Mexican sources: two from Pachuca and one from Zacualtipán. We were unable to determine the source of three Chan Chich obsidian artifacts.

The obsidian assemblage for Gallon Jug totaled 19 artifacts. Fifteen of these (79 percent) came from El Chayal, and the remaining four from

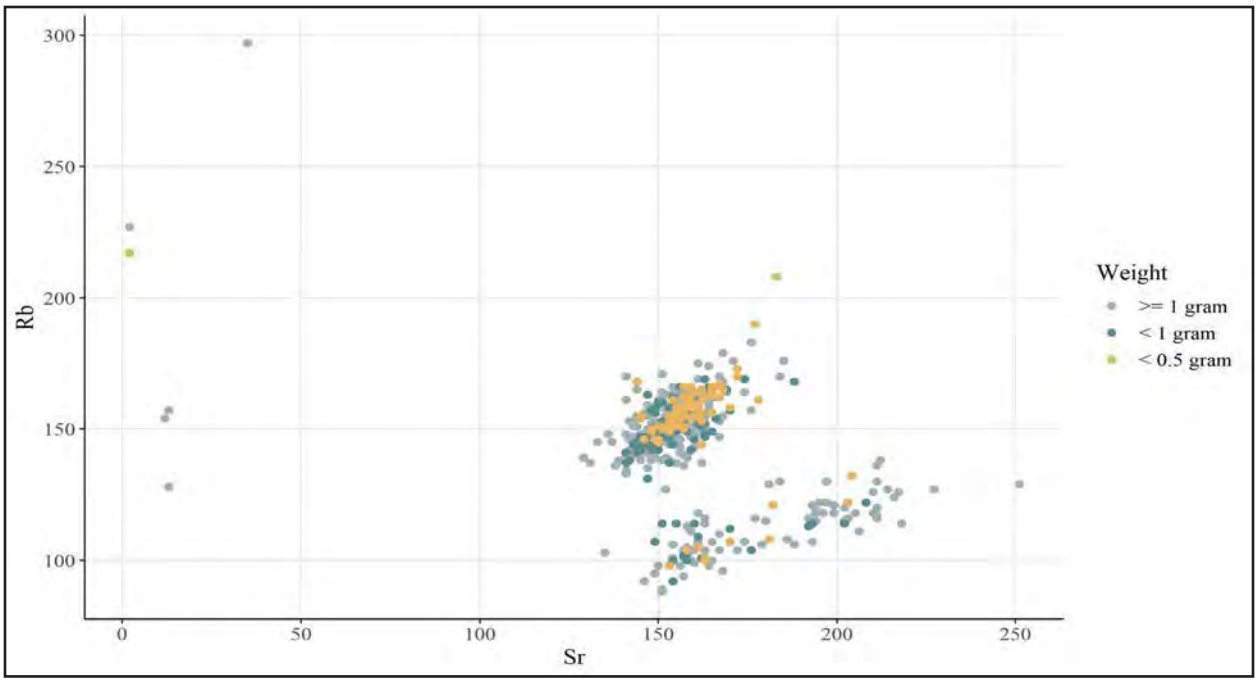


Figure 6.4. Plot of Sr by Rb with weight class.

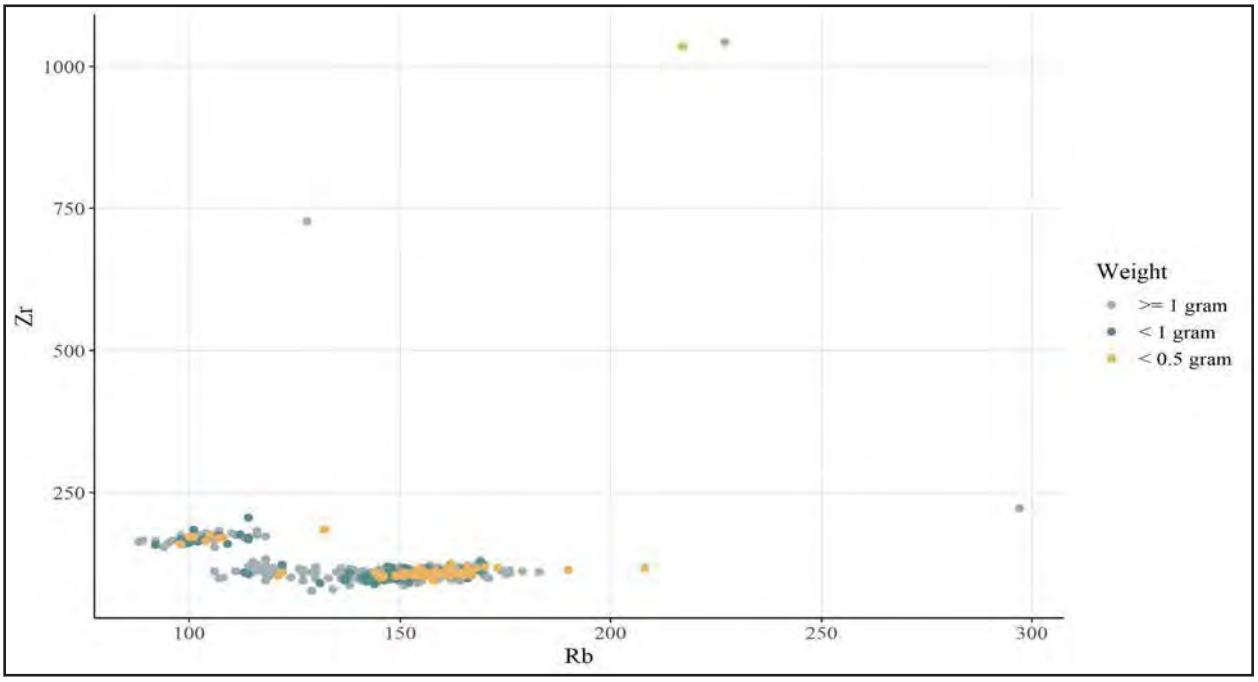


Figure 6.5. Plot of Rb by Zr with weight class.

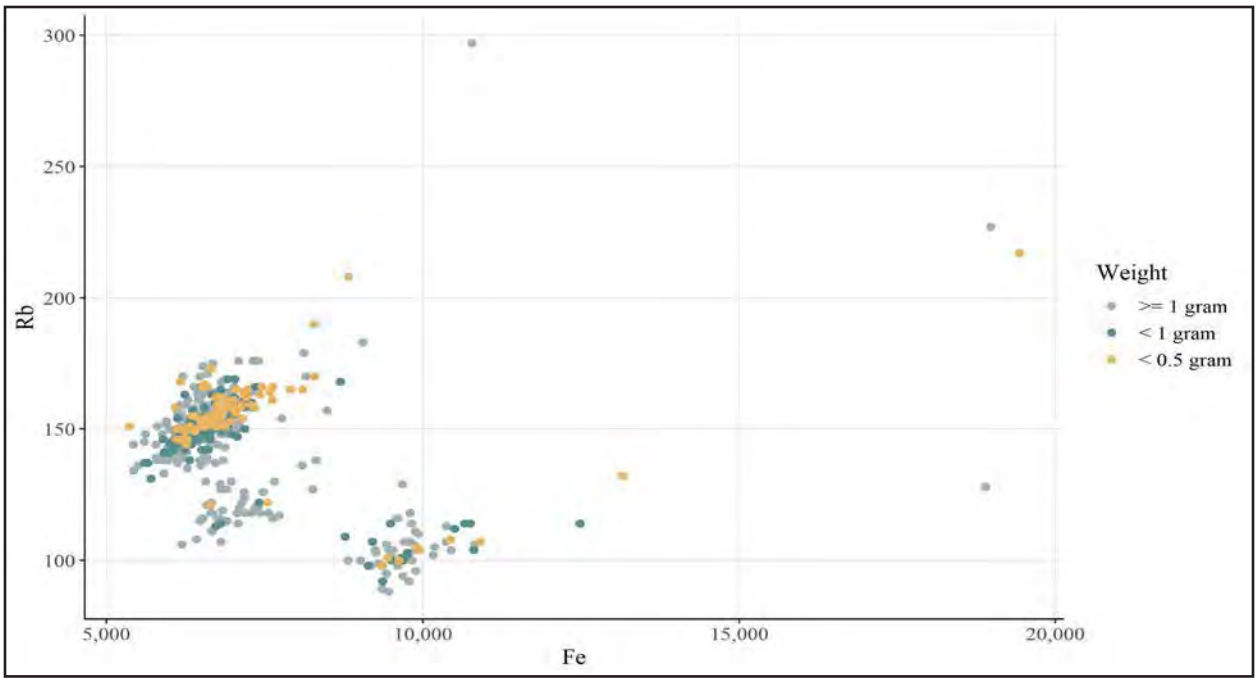


Figure 6.6. Plot of Fe by Rb with weight class.

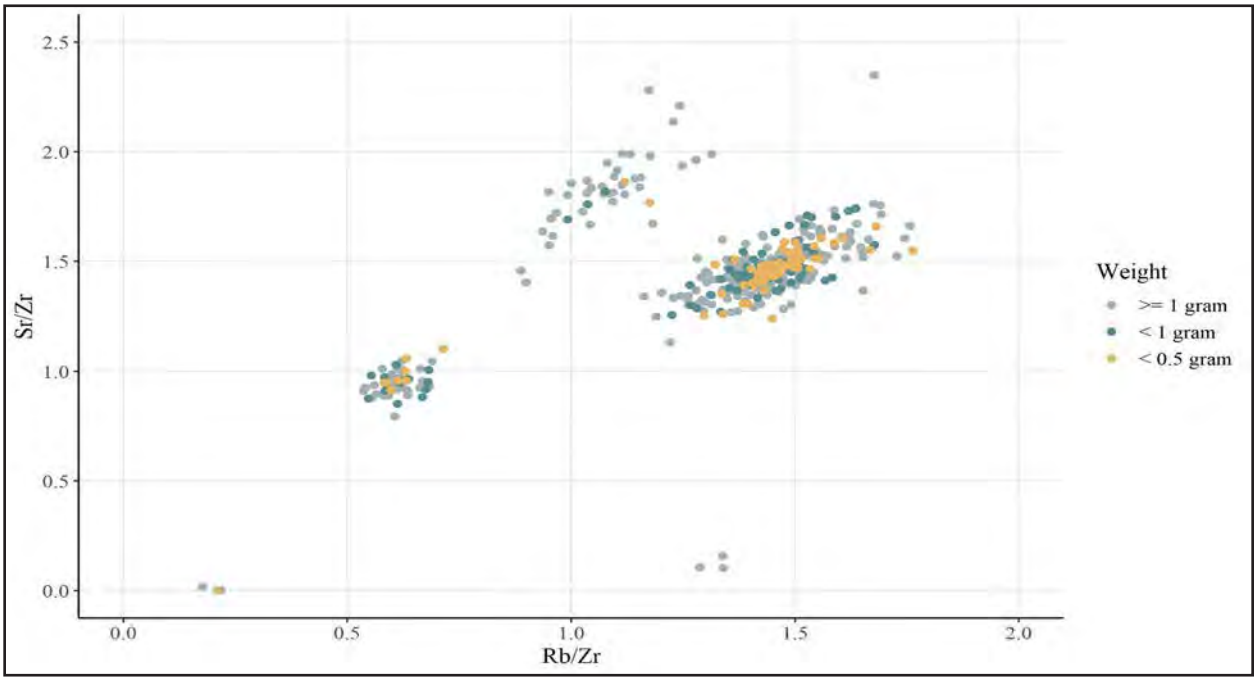


Figure 6.7. Plot of Rb/Zr by Sr/Zr with weight class.

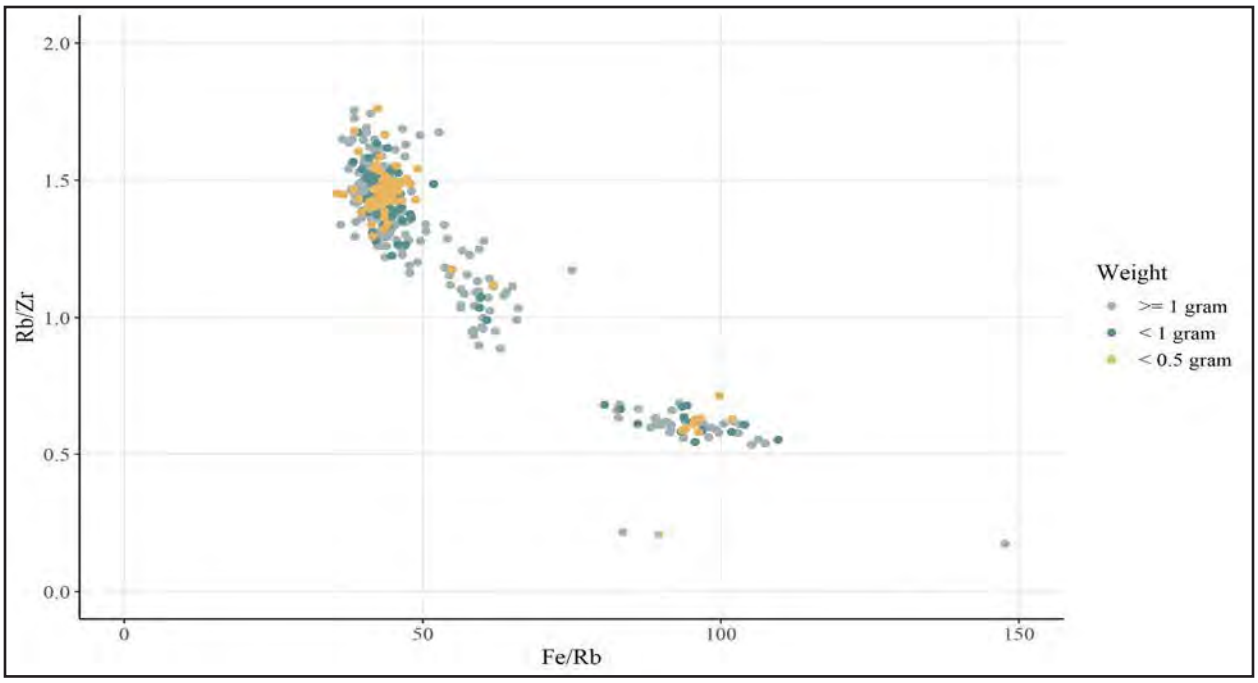


Figure 6.8. Plot of Fe/Rb by Rb/Zr with weight class.

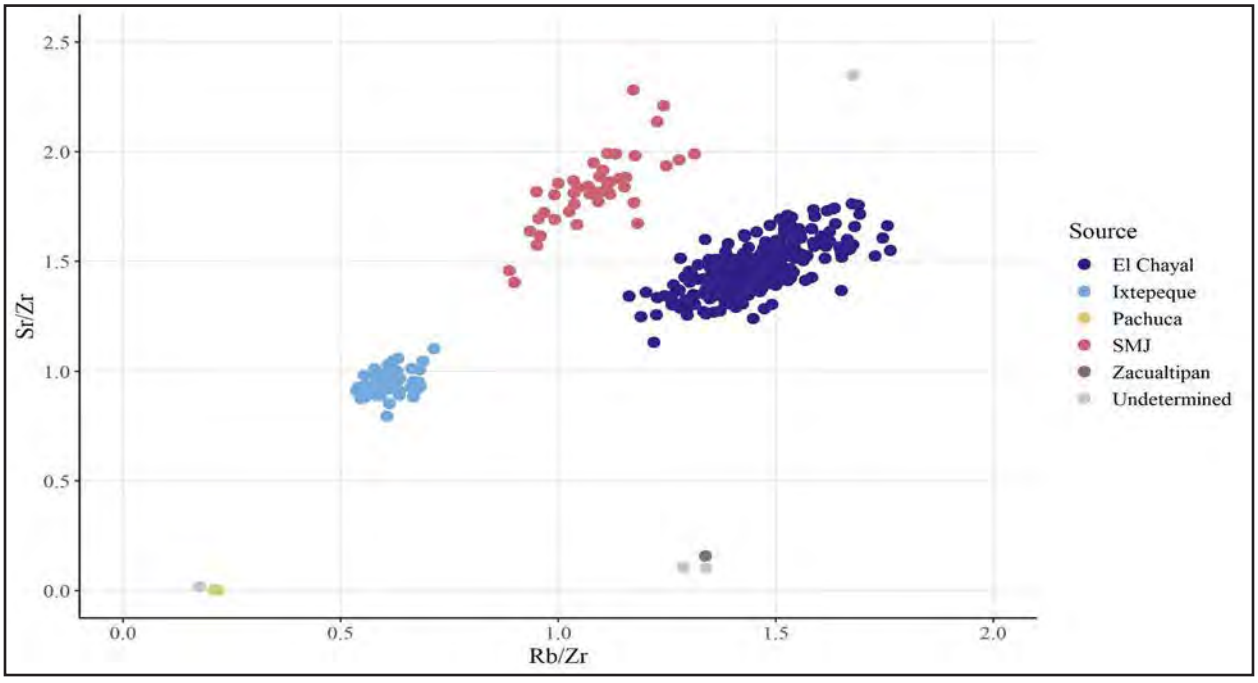


Figure 6.9. Plot of Rb/Zr by Sr/Zr with preliminary source assignments for BEAST specimens only.

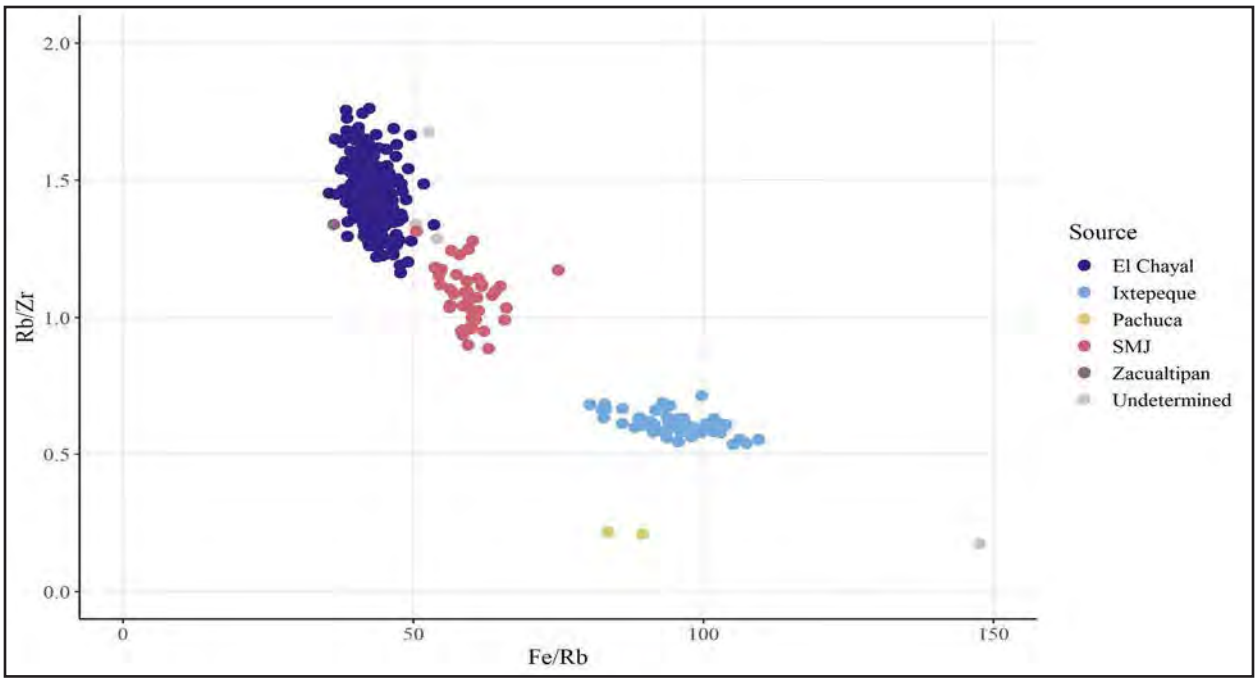


Figure 6.10. Plot of Fe/Rb by Rb/Zr with preliminary source assignments for BEAST specimens only.

Table 6.4. Counts of Preliminary Source Assignments by Site

Preliminary Source	Chan Chich	Gallon Jug	Kaxil Uinic	Kaxil Uinic Village	Total
El Chayal	366	15	2	14	397
Ixtepeque	51	4	0	5	60
Pachuca	2	0	0	0	2
SMJ	43	0	0	0	43
Zacualtipán	1	0	0	0	1
Undetermined	3	0	0	1	4
Total	466	19	2	20	507

Table 6.5. Percentages of Preliminary Source Assignments by Site

Preliminary Source	Chan Chich	Gallon Jug	Kaxil Uinic	Kaxil Uinic Village	Total
El Chayal	79%	79%	100%	70%	78%
Ixtepeque	11%	21%	0%	25%	12%
Pachuca	0%	0%	0%	0%	0%
SMJ	9%	0%	0%	0%	8%
Zacualtipán	0%	0%	0%	0%	0%
Undetermined	1%	0%	0%	5%	1%
Total	100%	100%	100%	100%	100%

Ixtepeque. Kaxil Uinic's assemblage was two obsidian artifacts, which both came from El Chayal. Finally, of the twenty artifacts from Kaxil Uinic Village, 14 came from El Chayal (70 percent), five from Ixtepeque (5 percent), and the last from an undetermined source.

By Time Period

By considering the time period associated with the obsidian artifacts, we can see a clear and changing pattern in the primary obsidian source throughout the occupation of Chan Chich (Table 6.6). As stated earlier, because ceramic analysis is ongoing for the 2022 field season, we do not have the ceramic chronology for artifacts recovered during the 2022 season. These are included in the "Undetermined" column in Table 6.6.

Table 6.6 shows the preliminary source assignments for Chan Chich artifacts by major time period. During the Preclassic period, the majority of obsidian came from SMJ (66 percent). In the Early Classic period, the majority of obsidian came from Ixtepeque (81 percent). Then, in the Late Classic period, the majority of obsidian came from El Chayal (85 percent). The Late Classic period also sees the first obsidian outside of the Guatemalan sources, at Pachuca and Zacualtipán.

DISCUSSION

While just the presence of obsidian at Chan Chich and the surrounding sites indicates that the people living in these places participated in long-distance exchange, this preliminary analysis allows us to begin to understand their obsidian trade networks. All sites in our analysis relied primarily on obsidian from the Guatemalan sources El Chayal, Ixtepeque, and SMJ. This pattern is consistent across other sites in the region, suggesting potential for a regional obsidian network (e.g., Beckwith 2013:Table 5.4).

Our preliminary analysis suggests that the Chan Chich obsidian market was fairly concentrated, with a dominant source prevailing in each major time period, and that dominant source having a higher share of the market with each subsequent time period. In the Preclassic, SMJ was the dominant source, accounting for 66 percent of obsidian artifacts, and by the Late Classic period, El Chayal accounted for 85 percent of obsidian artifacts. At the same time, in the Late Classic period there was an expansion in the number of obsidian sources as well as the distance between Chan Chich and the sources. In general, there is a large expansion of the number of Late Classic period obsidian artifacts compared to the Early Classic and Preclassic periods. Two factors likely contribute to the overwhelming dominance of

Table 6.6. Chan Chich Obsidian Sources with Preliminary Source Assignments by Time Period

Preliminary Source	Preclassic	Early Classic	Late Classic	Undetermined	Total
El Chayal	9	3	178	176	366
Ixtepeque	6	17	18	10	51
SMJ	31	1	8	3	43
Pachuca	0	0	2	0	2
Zacualtipan	0	0	1	0	1
Undetermined	1	0	2	0	3
Total	47	21	209	189	466

Late Classic specimens: Chan Chich's own site history and excavation bias. The site reached its maximum size in the Late Classic period and all the visible architecture that we have tested dates to that period. Second, most of our research has targeted Late Classic buildings and features—including work at Norman's Temple, the causeways, and Courtyard D-4—and even our questions about earlier occupations at the site require us to first excavate through Late Classic deposits. The data are only going to be more skewed toward the Late Classic period once we add in the material collected in 2022. The 175 obsidian artifacts from Chan Chich are likely all from Late Classic contexts.

This analysis shows the utility of using pXRF to analyze obsidian artifacts in the field and provides incentive for further analyses. In the short term, we plan to increase our confidence in the preliminary source assignments and add chronology data to the 2022 specimens. This analysis also complements our ongoing work at the North Plaza, where 2022 excavations found a potential obsidian workshop.

Data Notes

Weight: Nineteen samples from the 2019 analysis were missing weight measurements. Additionally, any sample that was recorded as less than 1 g is categorized as 0.5 g for the purpose of analysis.

Retested specimens: In 2022, we retested nine specimens that the 2019 testing identified as potential outliers. The retested data for all specimens show consistent elemental measurements. The retested specimens include the three artifacts we identify as Pachuca and Zacualtipán. These artifacts are categorized as being analyzed in 2019, but we use the 2022 measurements in our analysis.

REFERENCES

Beckwith, Walter I.
2013 Maya Obsidian of the Three Rivers Region, Belize. Unpublished MA thesis, The University of Maine, Orono.

Dreiss, Meredith L.
1988 *Obsidian at Colha, Belize: A Technological Analysis and Distributional Study Based on Trace Element Data*. Papers of the Colha Project, Vol. 4. Texas Archeological Research Laboratory, The University of Texas at Austin, and Center for Archaeological Research, The University of Texas at San Antonio.

Frahm, Ellery
2019 Introducing the Peabody-Yale Reference Obsidians (PYRO) Sets: Open-Source Calibration and Evaluation Standards for Quantitative X-ray Fluorescence Analysis. *Journal of Archaeological Science: Reports* 27:101957.

Frahm, Ellery
2016 Can I Get Chips with That? Sourcing Small Obsidian Artifacts Down to Microdebitage Scales with Portable XRF. *Journal of Archaeological Science: Reports* 9:448–467.

Hammond, Norman
1972 Obsidian Trade Routes in the Mayan Area. *Science* 178(4065):1092–1093.

Healy, Paul F., Heather I. McKillop, and Bernie Walsh
1984 Analysis of Obsidian from Moho Cay, Belize: New Evidence on Classic Maya Trade Routes. *Science* 225(4660):414–417.

Johnson, Lucas R. Martindale, Jeffrey R. Ferguson, Kyle P. Freund, Lee Drake, and Daron Duke
2021 Evaluating Obsidian Calibration Sets with Portable X-Ray Fluorescence (ED-XRF) Instruments. *Journal of Archaeological Science: Reports* 39:103126.

Nelson, F. W.
1985 Summary of the Results of Analysis of Obsidian Artifacts from the Maya Lowlands. *Scanning Electron Microscopy* 1985(2):631–649.

Olympus
2019 Vanta Specifications. Electronic document, https://www.olympus-ims.com/en/.downloads/download/?file=285216224&fl=en_US&inline, accessed on October 20,2022.

Sidrys, Raymond V.
1976 Classic Maya Obsidian Trade. *American Antiquity* 41(4):449–464.

Stroth, Luke, Raquel Otto, James T. Daniels Jr, and Geoffrey E. Braswell
2019 Statistical Artifacts: Critical Approaches to the Analysis of Obsidian Artifacts by Portable X-ray Fluorescence. *Journal of Archaeological Science: Reports* 24:738–747.

W. James Stemp, Elizabeth Graham, and Jessica Goulet
2011 Coastal Maya Obsidian Trade in the Late Postclassic to Early Colonial Period: The View from San Pedro, Ambergris Caye, Belize. *The Journal of Island and Coastal Archaeology* 6(1):134–154.

The 2022 Lab Manual

Updated by Tera Stocking

This chapter presents updates to the procedures used in the Belize Estates Archaeological Survey Team's (BEAST) field laboratory (Figure 7.1). Updates regulate lab practices so that artifact processing remains consistent, enabling easier access to collected artifacts and their analyses and facilitating more efficiently compiled and presented data. This chapter is meant to act as a handbook for those who work in the BEAST field laboratory by providing basic information on 1) how to use the project's electronic database, 2) how to process artifacts, and 3) how to analyze basic artifact categories, such as lithics. This update preserves most of the language of the 2015 Lab Manual by Van Oss (2015), which built on previous work by Nettleton (2013) and Phillips (2014). Van Oss's (2015) helpful "Tips" have been retained.

Figure 7.1. Leann Castillo (left) and Bridgette Degnan analyzing obsidian in the BEAST field lab in 2022. Tera Stocking is working on the FileMaker Pro database in the background.

THE DATABASE

BEAST uses a FileMaker Pro relational database to record most aspects of project activities—from opening elevations to final artifact analysis (see Houk 2014). In the lab, the master database regulates artifact processing, cataloging, and analysis and records all information obtained during those activities. Combining the forms filled out by the project members in the field with those forms filled out in the lab creates this master database. Lab forms draw information directly from excavation forms so that artifacts are processed in the lab using the same database. This system enables tracking and cross-referencing of all data collected and observed and provides a way to track artifacts as they move from the field and through the lab. The database, then, holds all the information needed for analysis and synthesis in the publication of the season's results in reports, articles, and theses. The following sections outline the process for combining field and lab databases and how to use the database to regulate lab activities most efficiently.

Stocking, Tera (updater)
2022 The 2022 Lab Manual. In *The 2022 Season of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 119–140. Papers of the Chan Chich Archaeological Project, Number 15. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Syncing iPads and Merging Databases

The procedure for syncing the iPads used by excavators in the field has been streamlined since the 2015 edition of the Lab Manual, which itself was simplified from the original process (see Van Oss 2015; Nettleton 2013). Starting in 2014, master databases were no longer pushed back to the iPads (Houk 2014). In our experience, it was not necessary for each investigator to have a complete database until the end of the season when data analysis began. At the beginning of the season each iPad was equipped with an empty template of the field database; the file name included the appropriate operation number, iPad number or name, and date. As excavators completed forms on the iPads, the project director and/or lab director imported the iPad databases onto the lab computer and then combined them with the master database on the computer, generally at the beginning or end of the workday. The original forms remained in one database on the excavator's iPad, and the lab computer—a Mac mini, which can be carried to and from Belize each season—then held a copy of each updated field database in addition to the updated lab master copy. Each field database held only the forms necessary to that particular operation, freeing space on the iPad and saving time in the lab. We found this greatly expedited our process. Syncing occurred as necessary this season as in prior seasons, but as a general rule we combined the field and lab databases at the end of every day. This allowed for easier check-in of artifacts the next morning. Once the master database in the lab contained records of the artifacts excavated and delivered to the lab, the processing of these artifacts could begin.

To sync a field iPad with the lab computer, first plug in the iPad. In the Finder window that pops up, select the appropriate iPad from the menu on the left-hand side of the window. Then select File Maker Go app 19. In a separate window, navigate to the Lab Master Database. Select "new folder" and name it after the field location of the iPad you are syncing followed by "field to lab database;" for example, "Gallon Jug Field to Lab Database." Then select the file that you wish to transfer from the field iPad to the computer and drag it into the appropriate field to lab database. This transfer should only take a few seconds. Once the file is transferred, rename it with that day's date (for example, "6-10-2022 Gallon Jug field to lab database"). This method allows us to restore files from the previous databases should an error occur. Previous seasons have had a folder for each operation and one to contain master databases. This allows excavators and the lab director to keep track of when information was last imported to the computer. To rename a file, in the Finder simply click the name of the desired file, pause briefly, and then click again to select just the file's name. Once it is highlighted, modify it as needed.

Once the field database is synced with the lab computer, you can transfer its information to the Lab Master Database. The Lab Master Database houses all of the project's Filemaker data since 2012. To transfer the data from the field database, first open the lab master database, then, in a new window, open the field database to be combined with the master. When merging field and lab databases, the only forms that usually need to be imported are the Suboperation Definition forms and Lot Definition forms. Other forms, like Burial, Sample, or Datum forms, should be synced using this same process as needed. Begin with the highest order from that needs to be updated first (Table 7.1), which is typically the Suboperation Definition form. It is important to import the higher order forms first because the lower order forms must link to them.

To import Suboperation forms, select it under Excavation Forms>Suboperations in both open databases, located in the drop-down menu

Table 7.1. Relationships Between Higher and Lower Order Forms

Higher Order	Lower Order
Site Summary Form	Operation Definition Form
Operation Definition Form	Suboperation Definition Form
Suboperation Definition Form	Lot Form, Datum Form, Field Drawings, Shovel Tests
Lot Form	Photolog, Sample Form, Burial Form, Cache Form
Burial Form	Individual Burial Form

on the left-hand corner of the window. When transferring information from field databases with more than one operation, preform a search for the appropriate suboperations by clicking find at the top of the window, then type in the Op designation, for example "GJ-02," then click enter. Once this has been completed, click Sort in the top right-hand corner and then highlight "Full Subop" and move it to the right-hand column in the pop-up menu. Once moved, click Sort, and the program will organize the forms by Subop. Once both open databases have had the desired forms sorted using the same system, the files can be imported from the field database to the master database. Click anywhere in the master database to make it the active file before importing the forms from the desired field database into the master. Then select File>Import Records>File. A pop-up menu will ask you to select the file to import; select the name of the field database file that you have just sorted and click import. There will be another pop-up menu, which specifies the source and target layouts. Be sure both options match (i.e., the source should be Suboperations and the target should be Current Table ("Suboperations"). Ensure that "Full Subop" is selected as the matching criterion and that "Update matching records in found set," "Add remaining data as new records," and "Preserve External Container" are all selected (Figure 7.2). Then click Import.

Tip: When sorting any type of form in a database, be sure you are sorting all of the forms by clicking Show All on the left hand side of the FileMaker Pro window. Otherwise, you will not sort all of the forms, confusing your syncing or searching process.

A third pop-up menu will appear when the import is complete, telling you how many modifications it has made and how many errors (if any) have occurred. Close this menu by clicking OK. Once this is complete, the Subop Definition forms will have been successfully imported into the master database. The above steps then must be repeated for Lot Forms and any other necessary forms, like Sample Forms, in one field database. When sorting forms in both databases, select Full Lot #, for Lot Forms, Full Burial # for Burial Forms, etc.

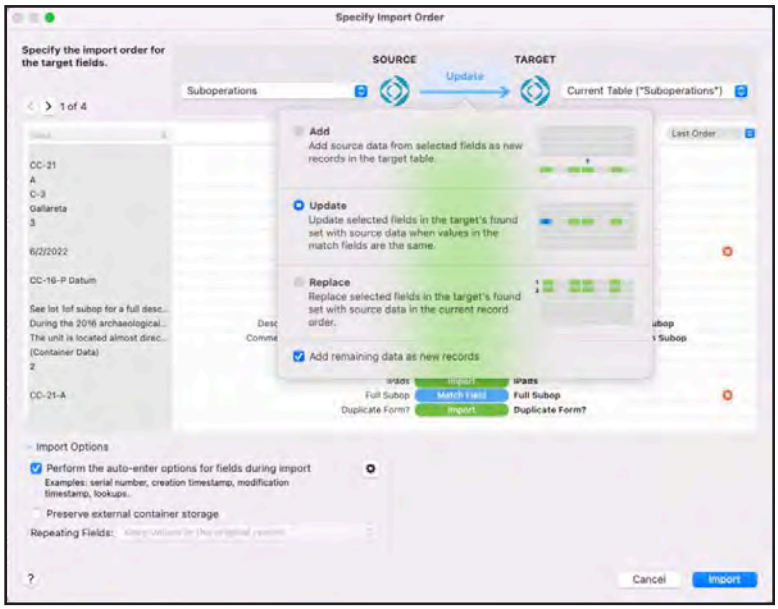


Figure 7.2. Window displaying options during syncing process between field and master databases. Click on the blue "Update" arrow between "SOURCE" and "TARGET" to toggle the import options.

Ensure that both databases show the same type of Excavation Form to be merged. The whole process must then be repeated for each field-to lab database.

Be aware that the database may duplicate information. We are still trying to ascertain what may cause this.

Summary

Though this process seems a bit cumbersome, it is useful for maintaining consistent records and ensuring that a copy of each version of the database is stored on the lab computer. In the event that a database becomes corrupted—through improper importation of files, for example—it can be reconstructed using the backup copies. The database is searchable and can produce results much faster than other collection and recording methods could. Additionally, the lab forms that keep track of the number and types of artifacts collected automatically draw information from the excavation forms so that lab operations run smoothly and efficiently. The next section explains how the Lab Master Database regulates daily activities and how the Lab Forms are used to keep track of the artifacts we process.

LAB PROCESSING

Basic Overview of Artifacts' Movement through the Lab

The 2022 season saw thousands of artifacts from three different operations move through the lab. We recorded the arrival, processing, cataloging, and analysis of each set of artifacts in the Lab Master Database, and we had set physical check points for each of these stages of artifact processing (Figure 7.3). For example, each artifact collected in the field was first placed in a cloth bag labeled with the following information: provenience (site-op-subop-lot), date, excavator, artifact type, bag number out of

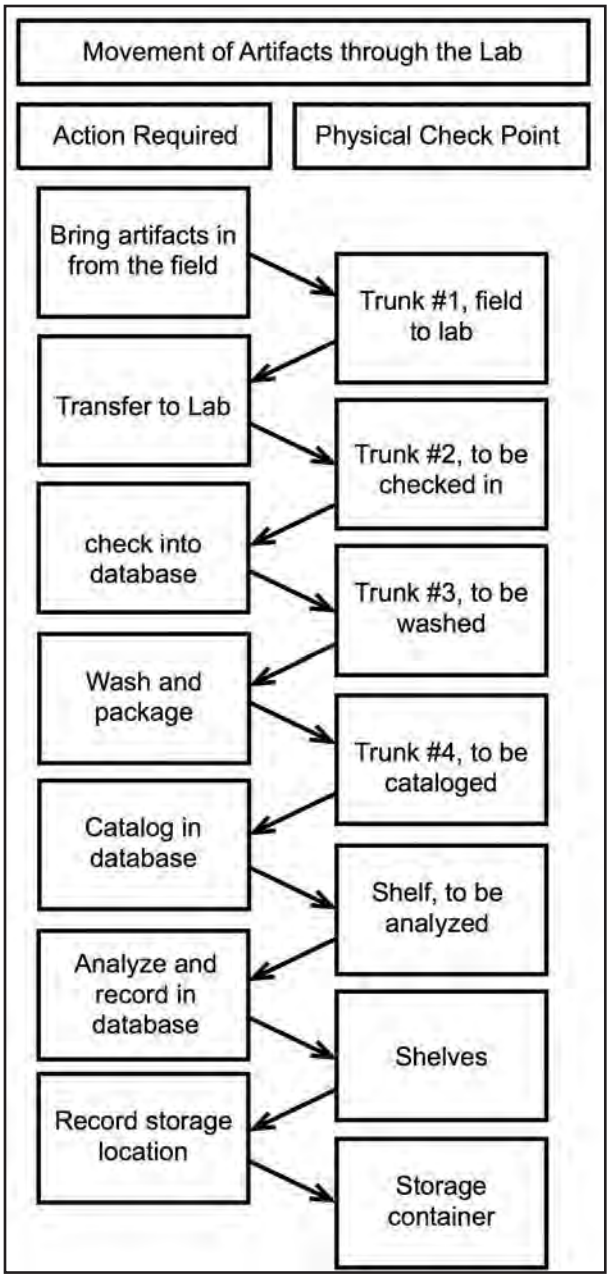


Figure 7.3. Chart demonstrating how artifacts generally move through the lab.

the total number of bags, and a rough number of the artifacts inside. Additionally, cloth bags would sometimes have small paper tags with this same information. Field crews would place these bags in a trunk labeled "Field to Lab" outside the lab when they brought them in from the field. Lab personnel would then move the artifacts through the process laid out in Figure 7.3. Artifacts are first checked-into the lab,

then washed, dried, packaged, cataloged, and analyzed. Each of these steps is defined in the following sections.

Check-In

In order to keep track of exactly what has been excavated, BEAST records each cloth artifact bag and its material, its provenience, and an approximate count of artifacts inside as it comes into the lab. This allows for the tracking of artifacts through the excavation and washing processes. After artifacts are brought in from the Field to Lab trunk, they can be placed in a second Check-In trunk to await their electronic registration into the Lab Master Database.

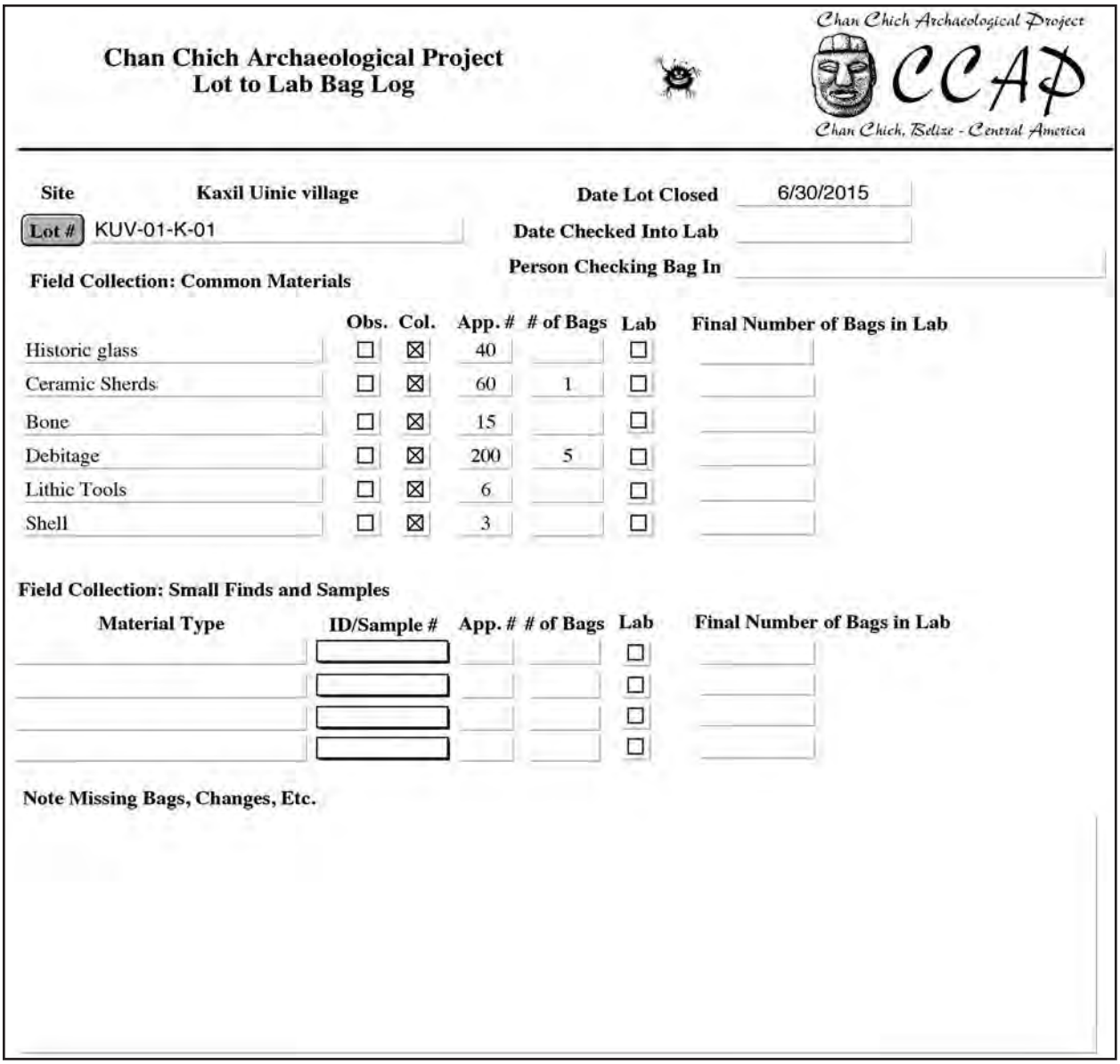
Artifacts cannot be checked into the lab until their associated closed Lot form has been imported into the Lab Master Database. To check-in an artifact or a set of artifacts, open the most recent Lab Master Database and select the Lot-to-Lab Bag Check In Form under the Lab Forms dropdown menu on the left side of the FileMaker Pro window (Figure 7.4). Then, click in the blank field next to "Lot #" and scroll down to select the Lot number that corresponds to the information on the cloth artifact bags you wish to check-in. Once selected, if the database is current, lots closed in the excavation forms already synced with the master database will auto-populate the information in the Lot-to-Lab Bag Check In Form to display what the excavators have recorded for this lot. This means that if the excavator has logged five bags of ceramics and three bags of lithics from Lot CC-14-S-7, then those numbers will automatically appear in the fields indicated in the Lot-to-Lab Bag Check In Form. Once these appear, ensure that all bags are present and check the box next to the material indicating it has been received in the lab. Additionally, enter the number of bags received in the lab next to this box (see Figure 7.4). Once all materials from this lot have been recorded, you can move on to the next set of artifacts from a different lot. If any discrepancies appear during this process—you may have one fewer bags than expected, for example—they should be cross-checked with the excavator at the end of the day so that any mistakes can be rectified. With this and all other forms in the FileMaker Pro system, files are saved automatically, so once one task is complete, simply move on to the next.

> **Tip**: When checking artifacts into the lab, the form in the FileMaker Pro system will present all artifacts from one lot. So that no artifact bags are counted twice or missed, all artifacts from one lot should be checked in at one time. This allows any discrepancies to be easily visible and mended.

Washing

Once artifacts have been checked-in, move them to the washing trunk, which this year sat on the veranda of the lab. All artifacts that enter the lab must be cleaned so that analysts can better assess each artifact. By far the most time consuming process in the lab, each material or type of artifact must be washed so that it remains intact while removing as much of the soil as possible. I elaborate on these processes in the following sections, first presenting a general washing process, then explaining how each type of artifact should be cleaned. A general reference chart that includes how each material ought to be packaged also appears after these explanations for clarity's sake.

Remove artifacts awaiting washing from the trunk one bag at a time and clean each according to the appropriate methods for that material. For this, use the water from the garden hose or sink in the lab. Once an artifact has been cleaned, place it on a metal screen to dry along with all other artifacts from that bag. It is essential that you place the cloth artifact bag and the field



Chan Chich Archaeological Project
Lot to Lab Bag Log

Chan Chich Archaeological Project
CCAP
Chan Chich, Belize - Central America

Site Kaxil Uinic village — **Date Lot Closed** 6/30/2015

Lot # KUV-01-K-01 — **Date Checked Into Lab**

Person Checking Bag In

Field Collection: Common Materials

	Obs.	Col.	App. #	# of Bags	Lab	Final Number of Bags in Lab
Historic glass	☐	☒	40		☐	
Ceramic Sherds	☐	☒	60	1	☐	
Bone	☐	☒	15		☐	
Debitage	☐	☒	200	5	☐	
Lithic Tools	☐	☒	6		☐	
Shell	☐	☒	3		☐	

Field Collection: Small Finds and Samples

Material Type	ID/Sample #	App. #	# of Bags	Lab	Final Number of Bags in Lab
				☐	
				☐	
				☐	
				☐	

Note Missing Bags, Changes, Etc.

Figure 7.4. Check In Form as it appears in FileMaker Pro.

tag, if present, under the screen containing its artifacts. This enables the lab director and assistants to maintain provenience, which is the most important thing we do in the field lab. To reiterate, DO NOT misplace the provenience of any artifact. Ensure that each bag correlates to exactly what came out of it, particularly if space is limited and screens contain more than one set of artifacts (Figure 7.5).

Tip: When cleaning multiple bags of one type of artifact from one lot or context, try to keep them together throughout the washing and packaging process so that, when cataloging, all of these artifacts can be kept together under one catalog number. Otherwise, cataloging, and, more importantly, analysis will be completed incorrectly.

Once cleaned artifacts are completely dry, write catalog tags with the provenience information—the exact count of artifacts, the current day's date, the material, and the lot number—and place them in small, plastic

Figure 7.5. Artifacts drying on screen with cloth artifact bags indicating the exact provenience of each material. Photo by Sarah Van Oss.

tag-bags. Leave the "Catalog #" section blank for the moment; this will be filled out later. Then place each artifact or set of artifacts in a clear, plastic bag along with the catalog tag in its smaller bag. If multiple bags are needed for the same material type from a given lot, write Bag 1 of 3, Bag 2 of 3, and so forth on each artifact tag and list the number of artifacts in each bag and the total artifacts as 200 of 300, for example. Doing this will ensure that anyone analyzing the artifacts will know there are multiple bags. After the dry artifacts have been placed in plastic bags, take them inside and place them in the cataloging trunk to await cataloging in the master database.

BEAST has conducted excavations in both ancient and historic contexts, resulting in a variety of artifacts. Each artifact type requires a different washing process, so here I explain each for the materials BEAST has encountered in its excavations and which cleaning technique to use.

Prehistoric Ceramics

Ceramic sherds represent a large percentage of excavated materials at Chan Chich and other ancient Maya sites. Usually made from local materials, the quality of these artifacts varies from terrible to remarkable. When washing prehistoric ceramics, submerge handfuls of sherds in a bowl of clean water and scrub each one with the toothbrush to clean most of the dirt from the sherds. Be careful that the sherds are not under the water for more than 15 minutes because they have a tendency to disintegrate in the water. Additionally, use caution with those sherds that have incised or painted designs because too rigorous scrubbing will remove the designs from the ceramic. When these appear it is best to keep more dirt on the sherd rather than lose the designs that can be used to determine the time period to which a particular context dates. When packaging, make sure that the ceramics are completely dry. Though this may take a day or two during the rainy season, water in the plastic bags can damage the artifacts by causing mold or disintegration.

Lithic Debitage and Tools

Debitage, or those lithics that result from the production of stone tools, represents the second most common artifact type to come through the lab. Like ceramics, wash lithics with clean water and a toothbrush. Lithics are more

Tip: Refresh your water often when washing any kind of artifact. Smaller artifacts can be lost in the dirt at the bottom of a washing bowl, and filthy water can replace dirt already removed from an artifact. As a general rule, once you can feel silt on the bottom of your bowl, replace the water.

durable than ceramics, so do not worry as much about damaging them. However, be aware that some stone tools have other materials still adhering to the tool, like the one in Figure 7.6 that displays the remains of hafting material, in this case asphultum, on its proximal end. When these are observed, take caution when washing so that this evidence is not erased.

Ground Stone

Like lithics, ground stone artifacts (manos and metates) should be washed with a toothbrush and water to remove the soil. So far, BEAST has chemically test ground stone or lithic tools to determine for what the Maya could have used them. If this becomes a research priority, these tools should be cleaned off carefully with a dry brush to preserve any biological data present on the artifacts.

Historic Glass Bottles

BEAST has conducted investigations at historic sites in the permit area. Glass bottles present a prevalent type of artifact brought in from these investigations. To clean the bottles, use dish soap and water with a toothbrush to clean both inside and out. Often, the bottles come into the lab with soil caked inside. To loosen the dirt, we utilized chaining pins, rolled strips of aluminum foil, and toothpicks so that we could gently remove the dirt from the interior of the bottles without breaking the glass. If these methods are insufficient, bottles should be soaked overnight in clean water with a

Figure 7.6. This spear point still has hafting material on its proximal end. Therefore, exert caution when washing this artifact so as not to remove this material. Photo by Sarah Van Oss.

small amount of soap. The next day, empty the bottle of the water and silt. If necessary, soak overnight a second or third night as needed. Slowly, the dirt will loosen and pour out of the bottle (Phillips 2014). This process may require several days depending on the amount of dirt inside the bottle. Remove as much dirt and algae as possible with a small tooth or bottlebrush. Dry completely and package in large plastic bags.

Historic Glass

Like the historic glass bottles, glass shards should be cleaned with soap and water. This should be executed with extreme caution to avoid accidental cuts.

Historic Metal

Clean metal with only a dry toothbrush, as water will worsen any rust on the artifacts, in order to remove as much of the soil and roots as possible (Phillips 2014). As with historic glass, use caution to avoid cuts to the skin on metal artifacts, as this can result in infection.

Historic Ceramics

Historic ceramics, unlike prehistoric ceramics, are more durable as they are fired at higher temperatures and glazed. Therefore, clean historic ceramics with a toothbrush and water, with a small amount of soap if necessary.

Human and Faunal Bone

Needless to say, the upmost care should be used when handling human bone. Remove soil gently with a dry toothbrush, using bamboo tools when needed to clean caked on soil. Wooden tools should only be used with caution with an orientation horizontal to the bone so that they do not scratch the exterior. Water may be used sparingly, but bone should never be submerged in water, as this will cause damage (Anna Novotony, personal communication to Houk, 2015). Remove as much soil as possible from bone, including the interior, particularly when exporting these biological remains to the United States. When the removal of soil presents too much risk to the integrity of the bone, leave it intact and allow analysts to clean it further when the bone can be examined in a controlled environment.

Jute *Shell*

Clean *jute* shells by soaking them for a short time in clean water, then gently tapping the outside with a finger or rubber toothbrush end to clean out any soil on the interior of the shell. A toothpick may also be used to loosen the dirt inside the shells. Scrub the outside with a toothbrush to clean extra soil from the exterior. If all soil cannot be extracted from all of the shells, this should be noted in analysis (Phillips 2014).

Other Shell

Other shell brought into the lab can be river shell, marine shell, or unidentifiable shell. Some river shell has a very delicate, white composition, and we found that water only disintegrated the shell. For this reason, clean river shell gently with a damp toothbrush, with hardly any water present. Shell artifacts that are of unknown types of shell should be cleaned in this manner as well to preserve the integrity of the artifacts. Most marine shell can be cleaned with water and a toothbrush.

Charcoal and Soil Samples

Samples should not be washed; rather, re-package charcoal into plastic bags with a catalog tag for export and analysis. Soil samples should be kept in cloth bags until they are analyzed.

Packaging

After drying completely, artifacts should be packed with their catalog tags in clear, plastic bags (Table 7.2). The exception to this rule

Table 7.2. Washing and Packaging Quick Guidelines

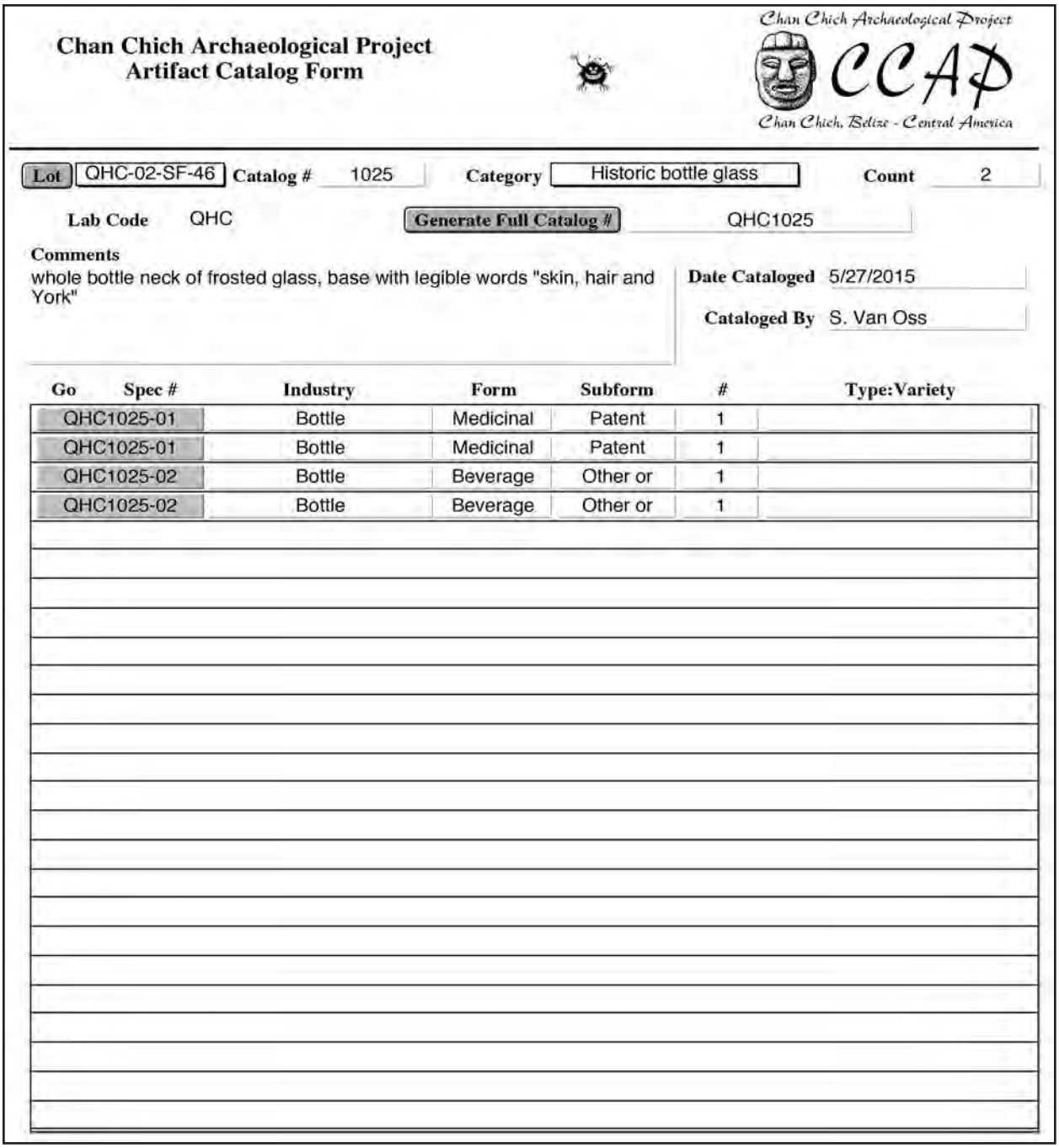
Material	Washing Method	Packaging
Ceramics	Water and toothbrush; be careful of damaging the slip and any designs.	Plastic bags
Charcoal samples	DO NOT WASH. Carefully remove soil or sediment with sterile metal tools before weighing and repackaging.	Plastic bags
Faunal bone	Clean gently with toothbrush and wooden art tools or a toothpick and very little water.	Plastic bags
Historic ceramics	Soap can be used on historic ceramics if necessary, but generally water and a toothbrush will do.	Plastic bags
Historic glass	Soap and water with a toothbrush.	Plastic bags
Historic glass bottles	Soak with dish soap in clean water and then clean with toothbrush.	Plastic bags
Human bone	Very gently clean with a dry brush; use water only when absolutely necessary.	Aluminum foil packets
Jute shell	Soak for a short time in water, tap gently to remove dirt from inside the shell, and scrub outside with a toothbrush.	Plastic bags
Lithics	Scrub with water and toothbrush.	Plastic bags
Metal	Brush with dry toothbrush; do not use water.	Plastic bags
Other shell	Clean with a damp toothbrush.	Plastic bags
Soil samples	DO NOT WASH.	Plastic bags or cloth bags
Special finds	Check with the operation director or project director before washing special finds.	Plastic bags or special packaging for specific artifact

is human bone. Each bone or set of related bone should be stored and shipped in small, aluminum foil packets with provenience information written on each packet (Anna Novotny, personal communication to Houk, 2015).

CATALOGING

After washing excavated artifacts, catalog them in the Lab Master Database so that we have an exact record of everything brought into the lab. Cataloging assigns a unique number to each artifact class from each lot and represents a preliminary type of analysis. Lab staff create an Artifact Catalog form for each class of artifacts (ceramic sherds, debitage, stone tools, etc.) that contains the exact artifact count in addition to its provenience information (Figure 7.7). In this form, each type of material from each context receives a unique catalog number that includes the lab code for each operation. For example, a bag of historic glass bottles from Lot QHC-02-T-01 receives a different catalog number than historic glass shards from the same lot.

Note: Field bags often come in with labels saying "Bag 1 of 3," etc. This should be taken into account when checking artifacts in, washing, and packaging. But, often field bags hold more artifacts than plastic storage bags, so catalog tags should be labeled with new "Bag # of total #" when all of one type of artifact from one context has been washed and is being repackaged or cataloged. If washed all together, this can be done before cataloging, but it can also be done during the cataloging process.



Chan Chich Archaeological Project
Artifact Catalog Form

Chan Chich Archaeological Project
CCAP
Chan Chich, Belize - Central America

Lot: QHC-02-SF-46 | Catalog #: 1025 | Category: Historic bottle glass | Count: 2

Lab Code: QHC | Generate Full Catalog #: QHC1025

Comments: whole bottle neck of frosted glass, base with legible words "skin, hair and York"

Date Cataloged: 5/27/2015

Cataloged By: S. Van Oss

Go	Spec #	Industry	Form	Subform	#	Type:Variety
	QHC1025-01	Bottle	Medicinal	Patent	1	
	QHC1025-01	Bottle	Medicinal	Patent	1	
	QHC1025-02	Bottle	Beverage	Other or	1	
	QHC1025-02	Bottle	Beverage	Other or	1	

Figure 7.7. Artifact Catalog Form as it appears in FileMaker Pro.

When cataloging these artifacts, use only one catalog number for all of one type of artifact from a specific lot. If after washing, the lab has three bags of historic bottles from Lot QHC-02-T-01, they should all receive the same catalog number on their catalog tags. This will allow for an easier analysis process because all of the artifacts are accounted for in one form, rather than many—an error that results in confusion for analysts and lab workers alike.

Select Artifact Catalog Form in the Lab Master Database under the Lab Forms section in the drop-down menu on the left of the FileMaker Pro window. Then create a new form by clicking New Record in the upper right hand

corner of the window. Select the appropriate lot number from the drop-down menu next to Lot # (see Figure 7.7). Then enter the exact, total count of the artifacts (even if in multiple bags), the date, the first initial and last name of the person cataloging the artifacts, and any necessary comments (if there are multiple bags, that should be mentioned in the comments). Click "Generate Full Catalog #," and enter this number and the letters that precede it onto the paper catalog tag accompanying the artifacts. If there is more than one bag of one type of artifact, be sure that each tag has the same catalog number and a label that says "Bag x of y" (where the second number is the total number of bags), and replace each tag in its small plastic bag and then place this inside the bag with its artifacts so that the label is visible. Once each tag has been completed, move cataloged artifacts to the "To Be Analyzed" shelves, which are organized by site, operation, and material type.

ANALYSIS

This season, BEAST project members divided analysis in the field between the operation and laboratory directors and other analysts. Due to time constraints and the volume of lithic material excavated, limited analysis was completed during the 2022 season. In the lab, we analyzed lithic tools (including obsidian), ground stone artifacts, and *jute* shells, and conducted some preliminary analyses of special finds.

Each artifact undergoing analysis receives another form in the FileMaker Pro database that assigns the artifact a Spec. #, an extension of its catalog number that allows investigators to examine and record data from each specimen. To assign a Spec. #, select Artifact Analysis Form from the same dropdown menu where the other Lab Forms are located. Select New Record in the right hand corner, and select the appropriate Full Catalog Number from the dropdown list. The form will auto-populate the correct provenience information. These forms make it possible to collect and store data in one, searchable database allowing investigators to easily access this information for synthesis in publications and reports.

Spec. #s are created by assigning each artifact a unique two-digit identification after its catalog number. For example, if one context produced three lithic tools with the catalog number CC0555, the first will receive a Spec. # of 01, the second 02, and so on. The form will generate a Full Spec. # by appending the Catalog # in front of the Spec. # assigned by the analyst. This differentiates the tools, while maintaining their relationship to one another via the initial catalog number. Each tool is then evaluated. Enter the date analyzed and the name of the analyst.

To do this, proceed down the form to fill out each section as it applies to a particular artifact. Sub-fields will auto-fill as more general information is selected. For example, if "Stone" is selected as the Category, options including "Battered Stone," "Chipped Stone," "Ground Stone," and so on will become available as the Industry. Selecting "Ground Stone" will restrict the choices for artifact Form to common ground stone artifact types. Some artifact forms are further classified by subforms. Follow these and the other prompted fields—including measurements, weight, burning, battering or use wear present, material and its quality, and any other notable features—to properly file the data collected from each artifact (Figure 7.8).

Additionally, each artifact should also receive its own plastic bag and tag after analysis. Make a new analysis tag with the Spec. #, provenience information, the current date, the form, and the weight of the object. Place this tag in a plastic tag bag, which you then place inside the plastic artifact bag. This tag replaces the catalog tag,

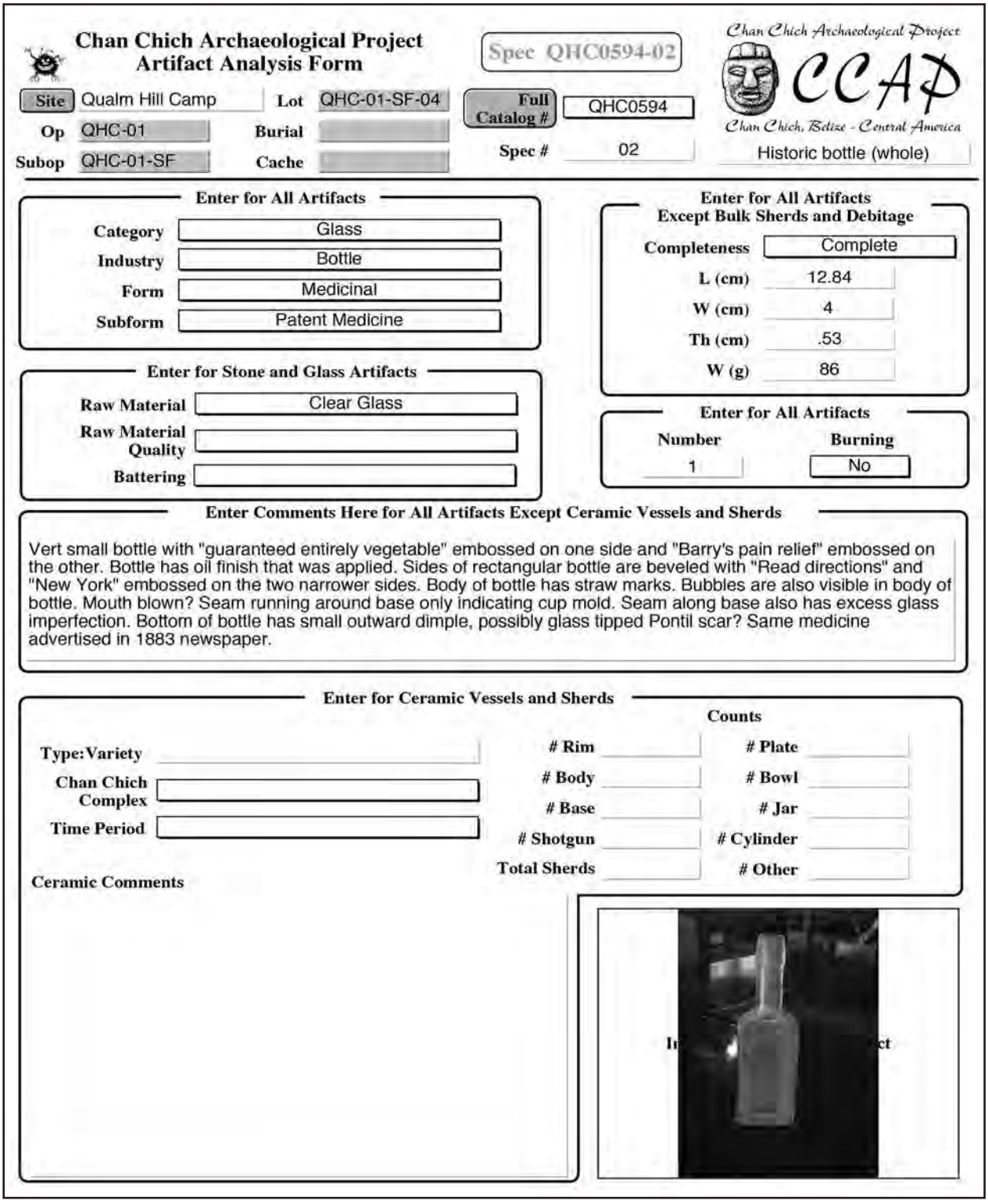


Figure 7.8. Artifact Analysis Form as it appears in FileMaker Pro.

and each analyzed artifact will receive one with its unique Spec. # number. After these steps, artifacts can be moved onto "Analyzed" shelves to await inventory and storage.

The following sections outline what analysts take into account when evaluating the different types of artifacts examined in the field lab. These guidelines ought to change with new information and research goals. The process for lithic, *jute* shell, and ground stone analysis follow here: these basic practices remain consistent year to year.

Chipped Stone Analysis

This season, most of the analysis of stone artifacts consisted of lithic tools and ground stone due to their ubiquity and time constraints that limited our ability to look at the more general debitage. As a general rule debitage comprises those artifacts formed during the production of tools, while tools often display a definite and intentional form. Though the Maya did make tools of convenience from debitage, this soft rule applies broadly and is useful in teaching new lab assistants about lithics.

After an artifact is designated a flake or lithic tool, determine its proper orientation to take measurements. In lithic analysis, the proximal end represents the unutilized or hafted end on tools or the end containing the percussion platform on a flake. The distal end is opposite the proximal end and is often the utilized end on tools. Take the length of tools and flakes by measuring the distance from the proximal end to the distal end. Width represents the greatest distance perpendicular to the length. Measure thickness by taking the thickest distance between both faces at angles as close to ninety degrees as possible to the other two measurements (Phillips 2014). Record all of these to the nearest millimeter. Take weights to the nearest tenth of a gram. Calculate measurements on tools that do not possess these features, like cores or ground stone artifacts, in three dimensions, taking care to measure as perpendicularly as possible.

Debitage

For flakes, the ventral side represents that face that would have been snug against the original core, only revealing itself after the flake's removal. That is referred to as the interior surface in Figure 7.9. The dorsal side is the

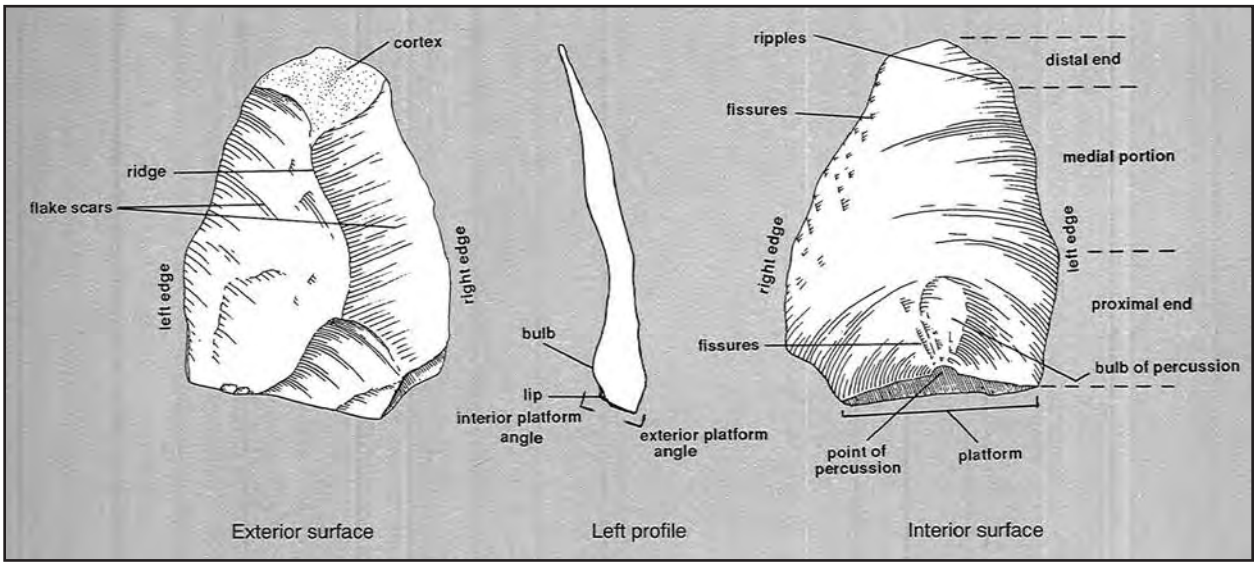


Figure 7.9. Terminology for the analysis of flakes (after Debenath and Dibble 1994:Figure 2.3).

exterior surface of the flake that faced away from the center of the core. On primary and secondary flakes, the dorsal side will display cortex (the rough exterior of unworked stone that, when removed, reveals a finer grained, workable material) or scars where other flakes have been taken off.

Unless otherwise instructed by the Project Director or an Operation Director, debitage is analyzed in bulk, grouped by material type and flake type. Thus, when analyzing flakes, divide them first by material (chert or chalcedony, etc.) and then by the type of flake: primary, secondary, tertiary, or shatter. Primary flakes are the first to come off during the knapping process and have 100 percent cortex on the dorsal face. Secondary flakes have some cortex remaining, and tertiary flakes have none at all. Shatter is not a flake in that it does not have a percussion platform, but these fragments result from the tool making process. After classifying these, enter the count but do not enter measurements for length, width, or thickness, unless there is only one flake in the category. All flakes of one type, e.g. all of the primary chert flakes, receive the same Spec. #. Weigh all of the flakes together and enter the total weight. Take note of any burning present on these flakes.

Tools

To analyze tools, examine all aspects of the artifact. Classification and type identification is particularly important in this process. To do this, we use David Hyde's (2003) master's thesis as a basis for evaluation. Like other lithic artifacts, we take the measurements and weight of each artifact. We then determine the artifact's form and sub-form(s) based on Hyde's specifications and enter this information into the artifact analysis form. For example, under the chipped stone artifact category, bifaces, by definition, show shaping and work on both faces of a tool, whereas unifaces are worked on only one side. Cores are those artifacts that result when flakes are taken off of an initial stone or cobble, leaving scars and removing cortex. Following Hyde's (2003) specifications fill out the artifact analysis form according to the correct specification of each tool.

On each lithic tool, also search for battering or use wear along its margins. Battering often looks like fingernail impressions in foam, crescent-shaped and fairly shallow. However, battering can also result in the removal of entire flakes or breakage of the tool. Note where this battering appears and how severely it manifests in the appropriate selection menus and comment section of the analysis form. Also note any burning—often indicated by red or dark discoloration of the raw material, crazing, cracking, and heat spalling—present on the artifact, the raw material type, and raw material quality.

Ground Stone Analysis

Ground stone is also a lithic artifact industry, however the specifications of these artifacts require a different type of analysis than other lithic tools. Ground stone artifacts most commonly consist of manos and metates, used by ancient and modern people for the grinding of grains and other substances. For the distinction of these, use as a basis *Cerros Report Volume II: The Artifacts* (Garber 1993) or Kilgore (2016). Outlined in those sources are the different distinctions of the types of manos—distinguished by their cross-sections and their plan shape—and metates—differentiated by their overall shape.

Like other lithic tools, take length, width, and thickness measurements on each ground stone artifact. Generally length indicates the longest linear distance between two points on an artifact. Width represents the largest linear measurement perpendicular to the length, and thickness represents the third dimension that

measures the largest distance between two faces of an artifact. Weight is taken in grams. Also evaluate ground stone artifacts for evidence of use wear—what usually feels like very smooth surfaces—present on the grinding faces of an artifact and note these in the comment section of the analysis form. Additionally, ground stone often consists of a different kind of raw material than chipped stone lithic tools. For example, granite is a prevalent ground stone material type found at Chan Chich. Kilgore (2016:Figure 6.5) has examples of different types or raw material found by the projects.

In 2015, the lab examined numerous of manos that did not fit into any of the categories presented by the Cerros report (Garber 1993). These artifacts regularly displayed plans with rectangular centers and ends that tapered to a rounded point. These consistently appeared with a virtually square cross-section, having measurements in width and thickness that were less than 1 mm different from one another (Figure 7.10). Therefore, we created a "Square" sub-form option in our FileMaker Pro software to accommodate these specific artifacts.

Jute Analysis

When analyzing *jute* shell, divide each catalog number into separate species groups. Though there are many species of *jute*, the two that appear most often at Chan Chich are *Pachychilus indiourm* and *Pachychilus glaphyrus* (Phillips 2014). The first of these appears smaller and has a smooth exterior, where the latter is larger

Figure 7.10. Mano displaying a nearly square cross-section with a rectangular plan and tapering ends. Photo by Sarah Van Oss.

Figure 7.11. *Jute* shells. *Pachychilus glaphyrus* (left); *Pachychilus indiourm* (three shells to the right). Photograph courtesy of Terry Powis.

in general and has more defined ridges on its outer shell (Figure 7.11). According to Phillips (2014:141), "If identification to species is not possible, *Pachychilus* sp. should be the label used." Having determined the species of the shells, weigh those of the same type as a group and record them in one collective analysis form. Enter the count and total weight. Note whether any soil remains inside of the shells in the comment section.

Also take note of any perforation or spire lopping in these shells in the comment section. The first three shells in Figure 7.11 have been spire-lopped; that is, the tip of the shell has been removed to access the animal inside. Perforation also appears very often and looks as if a needle has poked a hole in the shell, likewise to access to the animal inside for consumption. These features present evidence of processing of the *jutes* as foodstuffs for historic and prehistoric populations and should be recorded in the comments section of the analysis form.

LABELING AND PHOTOGRAPHY

All artifacts that receive a Spec. # should be labeled with that number directly on the artifact. This prevents artifacts from losing their provenience if their identification tags are lost or damaged. To label most artifacts, use a pH neutral pen to write an artifact's Spec. # in small but legible print away from the edges of the artifact and in an unobtrusive space (Nettleton 2013). Once dry, this then should be covered in a layer of clear nail polish so that the ink stays put. If clear nail polish is not available, Acryloid B-72 may be used in its place (see next section for how to make Acryloid B-72). On some artifacts that are dark in color, place a layer of white-out on the artifact and let it dry. Then write the Spec. # on the white-out and seal with clear nail polish or Acryloid B-72.

These artifacts should also be photographed, and those photos uploaded into their corresponding artifact analysis forms. Take most photos on a black felt background in a natural light. Also be sure that each photo either contains the Spec. # tag for the artifact or that each frame number and associated artifact are recorded on a photolog. Photos should also include a scale. For darker artifacts, a white background may be used. Photograph obsidian according to the methods presented by Phillips (2014). Lay out two pieces of PVC pipe with a piece of clear plastic stretched between them and a white background underneath. Place the obsidian on the plastic and photograph. This allows for light to pass through the obsidian revealing its transparency and finer details (Phillips 2014).

ACRYLOID B-72 AND CERAMIC RECONSTRUCTION

This season, the lab director reconstructed a ceramic vessel and partial ceramic vessel excavated from the Norman's Temple burial. An Acryloid B-72 solution was utilized to adhere the broken pieces of ceramic together. To make this solution, combine Acryloid B-72 pellets with acetone. This season, an old pill bottle served as an Acryloid solution container. First mark on the container the desired amount of liquid solution with a permanent marker by filling it first with the same amount of water. Pour out the water and fill the container with

> **Tip**: When using Acryloid B-72 to cover Spec. #s on artifacts, the solution can become opaque when drying, obscuring the number. If this occurs, dilute the solution with a bit of acetone so that the adhesive substance dries clearer.

the desired amount of Acryloid B-72 pellets. Multiply the desired final amount of solution by 0.2 to achieve the amount of grams of Acryloid B-72 necessary for a 20 percent solution, which is the most useful for our purposes (Nettleton 2013). For example, if we were to make a 20-percent solution and the desired amount was 100 mL, the number of grams of Acryloid B-72 pellets would be 20 grams. Fill the container with this correct measurement of pellets, then cover these with acetone up to the line previously marked on the container. Let the mixture sit and the acetone will dissolve the Acryloid B-72 pellets to make the adhesive solution. After the pellets have completely dissolved, the glue is ready (Nettleton 2013). If the glue starts to thicken too much, small amounts of acetone may be used to thin the solution back to the desired consistency.

> **Note**: Though this translation of milliliters to grams is not exact, it is accurate enough for work in the lab.

To reconstruct ceramic vessels, we used this solution to bind broken pieces back together. To support those sherds during this process, we employed sand and cloth field bags. Fill a bucket or plastic container with enough sand

Figure 7.12. Vessel during reconstruction using sand to support drying pieces.

to support the entire vessel. Place cloth artifact bags cut along the seam on the sand to act as a barrier between the artifact and the sand so that grains do not get trapped in the Acryloid B-72. Reconstruct the vessel first without any glue on top of these bags, using sand to support all of the pieces so that each joint is as tight as possible (Figure 7.12). Once the entire vessel is laid out in this way, begin adding glue with a paintbrush to those seams that connect the largest, weight-bearing pieces. This allows those smaller pieces to rest more easily in the reconstruction and prevents over-stressing these smaller fragments. Glue small sections together first, proceeding then to glue already reconstructed sections to each other, until the vessel takes form. Occasionally, individual sections also need support while drying, so smaller sand and cloth supports can be made in other containers or to one side of the original.

This facilitates the reconstruction of the entire vessel because all of the pieces will have been glued properly. Let these pieces dry completely, which may take a while in the humidity, but will occur. Once all of the pieces are secured, pack and store the vessel safely in a container with padding to protect the vessel from breakage during transportation or storage.

STORAGE, INVENTORY AND ORGANIZATION

Artifact storage at CCAP is located on site. As artifacts move through the lab, they are stored on shelves to await analysis and then are moved to "Analyzed" shelves so that they are easily accessible throughout the season. However, with the plethora of artifacts excavated this season, the lab became more and more crowded, so we moved some of the artifacts to five-gallon plastic buckets outside of the lab. We later employed this system to store the artifacts at the end of the field season. Once analyzed artifacts required relocation, each was moved to a "Lab Bucket," each of these labeled with a number. We also used large trunks and smaller plastic tubs to store some artifacts, labeled Trunk 1, Trunk 2, and so forth, independent of the Lab Bucket numbers. The lab director made a hand-written list of the contents in each bucket that was later converted to an Excel spreadsheet. Each list contained the Spec. # or Catalog # of each artifact, the number of bags present, and the lot from which it came. This enables an easy, searchable database that details each artifact's or set of artifacts' location, facilitating retrieval. These buckets and trunks were then closed tightly and stored in a secured storage facility at the lodge for the coming season.

Note: The Acryloid solution allows for a reversible reconstruction. If necessary, undo the adhesive with acetone added gradually to the location until the glue breaks down.

Inventory was also taken of the field and lab equipment. Like the artifacts, lists detailed in which container (i.e., trunk, lab bucket, etc.) each item was stored. These too are now Excel spreadsheets. The easiest way to take this type of inventory is to conduct it simultaneously with packing at the end of the season. Likewise, this recording enables project members to see what has been broken or used up during the season and what needs to be purchased for the succeeding one. The list of things to buy for the project should be given to the project director. Field and lab equipment then are stored in a safe, dry place to await the following season.

REFERENCES CITED

Garber, James F.
1986 *Archaeology at Cerros, Belize, Central America: Vol. 2 The Artifacts*. Southern Methodist University Press, Dallas.

Houk, Brett A., and Gregory Zaro
2014 An Introduction to the 2014 Season of the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 1–19. Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Hyde, David
2003 Lithic Technological Organization in the Three Rivers Region of the Maya Lowlands. Unpublished M.A. Thesis, Department of Anthropology, Washington State University, Pullman.

Kilgore, Gertrude
2016 An Update on Ground Stone Artifacts from the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 147–170. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Nettleton, Carolyn
2013 The 2013 Chan Chich Archaeological Project Lab Manual. In *The 2013 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 81–92. Papers of the Chan Chich Archaeological Project, Number 7. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Phillips, Lori
2014 The 2014 Chan Chich Archaeological Project Lab Manual Update. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 137–144. Papers of the Chan Chich Archaeological Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Phillips, Lori, and David Sandrock
2014 Preliminary Analysis of Historic Bottles from Qualm Hill Camp. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 131–135. Papers of the Chan Chich Archaeological Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Van Oss, Sarah
2015 The 2015 Lab Manual. In *The 2015 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 189–208. Papers of the Chan Chich Archaeological Project, Number 10. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Project Lists for the 1996 through 2022 Seasons

Compiled by Brett A. Houk

This chapter includes lists of sites, operations, tombs, burials, caches, stone monuments, and radiocarbon dates recorded by the Chan Chich Archaeological Project (CCAP) since its inception in 1996 and the Belize Estates Archaeological Survey Team (BEAST) since 2013. It is meant to serve as a reference document for future seasons and is updated each year.

SITES

Table 8.1 lists Maya sites on and near the Gallon Jug (GJ) and Belize Maya Forest Trust (BMFT) properties with Belize Estate (BE) designations. As noted by Sandrock (2013) and Sandrock and Willis (2014), BEAST assigned BE numbers to previously named sites and to newly discovered sites with four or more structures, the tallest of which must be at least

Table 8.1. Recorded BE Sites (UTM Zone 16N)

BE #	Site Name	Property	Original Source	UTM N	UTM E
1	Chan Chich	GJ	Guderjan (1991)	19 40 412	2 75 875
2	Kaxil Uinic (E'kenha)	BMFT	Guderjan et al. (1991)	19 40 538	2 73 381
3	Punta de Cacao	BMFT	Guderjan et al. (1991)	19 46 100	2 86 728
4	Gallon Jug	GJ	Guderjan et al. (1991)	19 45 700	2 83 688
5	Laguna Verde	GJ	Guderjan et al. (1991)	19 47 250	2 80 970
6	Laguna Seca	GJ/BMFT	Guderjan et al. (1991)	19 51 232	2 83 858
7	Qualm Hill (ruin)	BMFT	Guderjan et al. (1991)	19 57 116	2 87 644
8	Wamil	BMFT	Guderjan et al. (1991)	19 40 892	2 94 663
9	Sierra de Agua	BMFT	Guderjan et al. (1991)	19 41 519	2 00 324
10	Gongora Ruin	BMFT	Guderjan et al. (1991)	19 54 400	2 93 459
11	Ix Naab Witz	BMFT	Sandrock (2013)	19 55 187	2 85 854
12	La Luchita	BMFT	Sandrock (2013)	19 50 011	2 77 178
13	Montaña Chamaco	BMFT	Sandrock (2013)	19 51 187	2 75 043
14	Sylvester Camp	GJ	Sandrock (2013)	19 45 510	2 78 128
15	Qualm Hill camp	BMFT	Sandrock and Willis (2014)	19 57 213	2 85 282
16	Kaxil Uinic village	BMFT	Thompson (1963)	19 40 073	2 73 487
17	Sak Mut	BMFT	Houk et al. (2017)	19 34 386	2 72 740
18	Tikin Ha (formerly Xma Ha Ak'al)	BMFT	Houk et al. (2017)	19 58 096	2 96 807

Houk, Brett A. (compiler)
2022 The Chan Chich Archaeological Project: 1996 to 2022 Project Lists. In *The 2022 Season of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 141–188. Papers of the Chan Chich Archaeological Project, Number 15. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

4 m high including structure and substructure or basal platform, that are not within 1 km of another recorded site BE site. The list of BE sites will expand greatly once the project's lidar data have been analyzed.

In addition to prehistoric sites, a number of historic sites are present in and near the BEAST survey area. Table 8.2 includes a list of those visited by the CCAP or BEAST or reported by other researchers. Significant historic sites are also assigned BE numbers.

Table 8.2. Known and Reported Historic Sites

Name	Location	Description	Source(s)
Kaxil Uinic village BE-16	Approximately 500 m south of BE-2 on BMFT land.	In 2012, the CCAP re-located the remains of the historic Maya village and *chicle* camp known as Kaxil Uinic and its associated *aguada*. The village was probably settled in the 1880s, and was closed in 1931 by the Belize Estate Co. BEAST mapped and excavated the site in 2015, recording seven three-stone hearths and multiple artifact scatters, which included turn of the century glass bottles and cast iron pots. BEAST returned to the site in 2016 and mapped additional surface finds, hearths, and mounds. The 2016 work included archival research in Jamaica and England.	Bonorden (2016); Bonorden and Houk (2015, 2016, 2019, 2022); Bonorden and Kilgore (2015, 2016); Booher et al. (2016); Houk (2012); Houk and Bonorden (2015); Houk et al. (2015, 2022); Harrison-Buck et al. 2018; Thompson (1963)
Qualm Hill camp BE-15	Immediately west of Cedar Crossing on the west bank of the Río Bravo.	A 215-x-90-m scatter of historic artifacts that likely represents the location of Qualm Hill (also known as Quam or Quam Hill), which was "the seasonal headquarters of the British Honduras Company during the mid 1800s" (Cackler et al. 2007:124). Qualm Hill is historically important as the site of a "Chichina" Maya raid led by Marcus Canul in 1865 (Bristowe and Wright 1888:27–28), yet artifacts recovered from the 2015 survey and excavation generally post-date the raid. The site, which primarily consists of surface artifact deposits, has been disturbed in recent years by individuals scavenging the historic logging equipment and modern loggers camping in the middle of the historic camp.	Bonorden (2016); Bonorden and Houk (2016; 2022); Bonorden and Smith (2015); Bristowe and Wright (1888:27–28); Houk et al. (2015); Cackler et al. (2007:124)
El Infierno logging camp	Reportedly 1 km east of Guatemala border, northwest of Gallon Jug	This site is mentioned in reference to the location of the Maya site of El Infierno, which is described as "behind" the logging camp; no other details provided.	Guderjan et al. (1991:61)
Unnamed	Approximately 75 m southwest of BE-13, 50 m west of a swamp	BEAST located a possible abandoned *chiclero* camp, as evidenced by a small collection of bottles, in 2013.	Sandrock (2013)

OPERATIONS

To date, the CCAP has conducted excavations at Chan Chich and Kaxil Uinic ruins, and BEAST has made surface collections of isolated finds and at Qualm Hill camp and conducted excavations there, at Kaxil Uinic village, at Gallon Jug, and at Tikin Ha. Operations numbers are assigned sequentially by site, preceded by a site abbreviation. Thus, the first operation at Chan Chich is designated Op CC-01. Table 8.3 lists the operations that have been assigned through the 2022 season.

Table 8.3. List of Operations Opened by CCAP and BEAST

Op	Season	Definitions	Subops	Source(s)
CC-01	1997	Excavations on the northern stairs of Structure A-1	A–C	Houk (1998)
CC-02	1997	Excavations at the Upper Plaza	A–J	Robichaux (1998)
CC-02	1998	Excavations at the Upper Plaza, including landing of Structure A-1	K–W	Robichaux et al. (2000)
CC-02	1999	Excavations at the Upper Plaza including summits of Structures A-1 and A-13	X–AK	Robichaux (2000)
CC-03	1997	Excavations at the ball court	A–E	Ford (1998)
CC-04	1997	Test pits in Group C	A–C	Meadows (1998); Houk (2020)
CC-04	1998	Test pit in Plaza C-2	D	Ford and Rush (2000); Houk (2020)
CC-05	1998	Excavations at Courtyard C-1	A–L	Ford and Rush (2000); Houk (2020)
CC-06	1998	Excavations at Group H	A–F	Houk and Zaro (2015); Meadows and Hartnett (2000)
CC-07	1999	Excavations at Structure C-6	A–E	Harrison (2000)
CC-08	1999	Excavations at Structure A-11	A–B	Houk (2000)
CC-09	2001	Excavations at Plaza C-2	A–M	Unpublished field notes
CC-10	2012	Excavations at the Upper Plaza	A–F	Kelley (2014); Kelley et al. (2012)
CC-10	2013	Excavations at the Upper Plaza	G–T (plus Ix)	Kelley (2014); Kelley et al. (2013)
CC-11	2013	Excavations at Structure A-5	A–R (plus Fx)	Herndon et al. (2013)
CC-12	2014	Excavations at the Upper Plaza, Chan Chich Dynastic Architecture Project	A–T (plus Ax)	Herndon et al. (2014, 2015)
CC-13	2014	Excavations at the Back Plaza	A–N (plus ST, seven shovel tests)	Herndon et al. (2015); Vazquez (2014); Vazquez et al. (2014)
CC-14	2014, 2015	Excavations associated with processional architecture including the Eastern and Western Causeways, Courtyard D-1, Structure D-48, Structure C-17, and Structure C-18A, and Structure D-36	A–AW (plus Ex, ARx, AMx, and SF)	Booher (2016a); Booher et al. (2015); Booher and Houk (2016); Booher and Nettleton (2014); Houk and Booher (2020); Houk et al. (2015)

Table 8.3. List of Operations Opened by CCAP and BEAST (continued)

Op	Season	Definitions	Subops	Source(s)
CC-15	2016–2018	Excavations at the Upper Plaza, Chan Chich Dynastic Architecture Project. The 2016 through 2018 seasons focused on chronology building and the northern part of the plaza.	A–Z, AA, BB, CC, DD, EE, FF, GG, HH, II, JJ, and KK (plus Bx, Kx, and Px)	Booher et al. (2016); Gallareta Cervera et al. (2017; 2019); Houk (2016)
CC-16	2016	Excavations at Norman's Temple complex.	A–X (plus Dx)	Booher (2016b); Booher et al. (2016); Houk (2020); Houk and Booher (2020)
CC-17	2017	Excavations at Courtyard D-4	A–U (plus Ix, Ox, and ST)	Kilgore (2018); Kilgore et al. (2017)
CC-18	2017, 2018	Excavations at Structure A-6/ North Plaza lithic workshops and debitage deposit	A–H	Degnan (2018); Degnan and Houk (2019); Degnan et al. (2017)
CC-19	2019	Excavations in Upper Plaza, primarily at Structures A-12 and A-13 in 2019	A–V (plus Qx)	Gallareta Cervera and Houk (2019)
CC-20	2019	Salvage excavations on the summit of Structure A-4 to recover a cache discovered by cell tower contractors	A–E	Houk, Bedrosian, and McKinney (2019)
CC-21	2022	Excavations at Norman's Temple complex.	A–D	Gallareta Cervera and Houk (Chapter 2, this volume)
CC-22	2022	Marketplace investigations at the North Plaza, Chan Chich.	A–H (plus OB, SF, and ST)	Degnan et al. (Chapter 3, this volume)
CC-23	2022	Excavations at Structure D-36	A	Houk 2022 field notes
GJ-01	2018	Excavations in the plaza at Gallon Jug in 2018	A-U	Houk (2019); Kilgore, unpublished field notes
GJ-02	2019, 2022	Excavations at Courtyard B-1 at Gallon Jug in 2019 and 2022	A–AU (plus Kx)	C. Novotny et al. (2019, Chapter 4, this volume); Novotny and Houk (2021)
GJ-03	2019	Test pit excavations at Gallon Jug settlement groups in 2019	A–G	C. Novotny et al. (2019)
KU-01	2012	All excavations at Kaxil Uinic in 2012	A–H	Harris (2013); Harris and Sisneros (2012); Houk (2012); Houk et al. (2012, 2013)
KUV-01	2015, 2016	All excavations at Kaxil Uinic village in 2015 and 2016.	A–AD (plus Rx and SF)	Bonorden (2016); Bonorden and Houk (2016, 2022); Bonorden and Kilgore (2015, 2016); Harrison-Buck et al. (2019); Houk (2012); Houk and Bonorden (2015, 2020); Houk et al. (2015, 2022)
QHC-01	2014	Surface collections made by BEAST at Qualm Hill Camp	SF	Phillips and Sandrock (2014); Sandrock and Willis (2014)

Table 8.3. List of Operations Opened by CCAP and BEAST (continued)

Op	Season	Definitions	Subops	Source(s)
QHC-02	2015	All excavations at Qualm Hill camp made by BEAST in 2015	A–S and SF	Bonorden (2016); Bonorden and Houk (2016, 2022); Bonorden and Smith (2015); Houk et al. (2015)
SF-01	2014	Surface collections made by BEAST that were not associated with a site	SF1–SF3	FileMaker Pro database
TH-01	2019	Test excavations at Tikin Ha in 2019	A–H, LT, and SF	Houk et al. (2020); Houk, Zaro, et al. (2019)

SPECIAL DEPOSITS

Table 8.4 lists the burials thus far recorded by CCAP and BEAST. Table 8.5 lists the tombs and crypts documented at the site, including a looted tomb first recorded by Guderjan (1991). Table 8.6 includes the two caches in the list of special deposits. Figure 8.1 shows the locations of all burials excavated in the Upper Plaza at Chan Chich, and Figures 8.2 and 8.3 include plots of the radiocarbon ages for burials with AMS dates on bone or charcoal (see Table 8.17).

Table 8.4. List of Burials

Burial	Year	Lot	Context	Source(s)
CC-B1	1997	CC-4-A-3	Primary burial in Late Preclassic fill, Courtyard C-1	Meadows (1998)
CC-B2	1997	CC-2-J-6	Tomb 2, Terminal Preclassic burial in Upper Plaza	Houk et al. (2010)
CC-B3 (4, 6)	1998	CC-5-C-3 and -H-2	Secondary scatter of human bone associated with surface deposit of artifacts on steps of Structure C-2; Terminal Classic (?). Burials CC-B3, -B4, and -B6 combined by Frank and Julie Saul into Burial CC-B3.	Ford and Rush (2000)
CC-B5	1998	CC-6-C-9	Late Classic (?) primary burial beneath Courtyard H-3	Meadows and Hartnett (2000)
CC-B7	1998	CC-4-D	Secondary scatter of human bone associated with surface deposit of artifacts on steps to Structure C-6; Terminal Classic (?)	Ford and Rush (2000)
CC-B8	1999	CC-7-B	Primary Terminal Classic burial beneath bench in Structure C-6	Harrison (2000)
CC-B9	2001	CC-9-G-7	Primary burial of a child in Structure C-12 patio; Late Classic (?)	Unpublished field notes
CC-B10	2012–2013	CC-10-A-8 (extends into CC-10-G)	Primary (?) subfloor, simple cist, burial, poorly preserved; early Late Preclassic. Interment consisted of a single, adult individual, likely of a young age at death. The presence of 19 unmodified dog teeth suggests that an animal was placed in the grave with the human individual. Oldest burial yet excavated at Chan Chich.	Kelley (2014); Kelley et al. (2013); Novotny et al. (2017)

Table 8.4. List of Burials (continued)

Burial	Year	Lot	Context	Source(s)
CC-B11	2014	CC-12-D-9	Primary burial of an adult in a small crypt in Structure A-1. The burial is associated with the penultimate construction phase and was encountered beneath the central landing on the structure. The small crypt contained four complete vessels. Likely associated with Cache CC-C1. Charcoal from the burial dates to the Late Classic, but a sample of bone from the burial, which was processed in 2022, dates to the Late Preclassic (see Figures 8.2 and 8.3 and Table 8.17). The skeletal material appears to be in secondary context, suggesting a complex ritual deposit.	Herndon et al. (2014); Novotny et al. (2015)
CC-B12	2014	CC-14-F-3	Primary, simple found in dry-laid fill within a bench, very close to the surface in Structure D-1. Burial contained a single shallow Achote Black bowl with nubin feet and post-firing graffiti—incised quadripartite designs—on two exterior sides and in the middle of the vessel's interior.	Booher (2016); Booher and Nettleton (2014); Novotny et al. (2015)
CC-B13	2014	CC-12-H-13	Primary burial of robust adult in a small crypt associated with the penultimate phase of Structure A-18 in the Upper Plaza. No grave goods.	Herndon et al. (2014); Novotny et al. (2015)
CC-B14	2015	CC-14-J-04	Primary burial of adult female buried in a seated position within a bench in Structure D-1. She was interred with a piece of antler, a small shell bead, a *jute* shell, and a mold-made ceramic spindle whorl.	Booher (2016a); Booher et al. (2015); Mitchell and Booher (2015); Novotny et al. (2015)
CC-B15	2016, 2022	CC-16-L-02	Late Classic; primary interment of a single, young adult, male individual interred in a simple cist within a bench in Structure C-2. The individual was placed in a tightly flexed position with head to the east. Grave goods included a small, modified shell, a shell labret, two obsidian blades, and a complete Cameron Incised bowl. In 2022, we submitted two bone samples from the burial for AMS dating. The first bone sample submitted returned a 2-sigma radiocarbon date of cal AD 1074–1157 (Sample CC-16-S02a; see Figure 5.7 Table 2.3, this volume). A second bone sample from the same bone, a femur, was submitted for analysis and returned a 2-sigma radiocarbon date of cal AD 675–777 (Sample CC-16-S02b; see Figure 5.7 and Table 2.3, this volume). This Late Classic date is consistent with other radiocarbon dates from Norman's Temple as well as relative dating of ceramics. See Figures 8.2 and 8.3 and Table 8.17.	Booher (2016b); A. Novotny et al. (2016; Chapter 5, this volume)

Table 8.4. List of Burials (continued)

Burial	Year	Lot	Context	Source(s)
CC-B16	2016, 2017	CC-15-G-11, -13, and -14	Discovered in 2016, but only partially excavated, Burial CCB-16 was located in Crypt 1 in the Upper Plaza. The burial dates to the Early Classic period. Excavations on the crypt were completed in 2017. Burial CC-B16A, excavated in 2016, consisted of bones of the left foot, an articulated right leg, and an articulated right wrist and hand (Novotny et al. 2016). Burial CC-B16B was excavated in 2017 and was the primary interment of a single adult male in an extended and prone position with hands on the pelvis and the right leg crossed over the left. Burials CC-B16C and CC-B16D were clusters of human bone likely associated with Burial CC-B16A. The best explanation is that an individual was buried in crypt, perhaps in a flexed position given the position of the right leg (CC-B16A), and disturbed by the interment of CC-B16B before decomposition was complete. The primary individual was buried with a bib-helmet head pendant, which may indicate he was a member of the ruling family.	Gallareta Cervera et al. (2017); Houk (2016); Novotny et al. (2016, 2017)
CC-B17	2017	CC-15-N-4	Burial CC-B17 is a Late Preclassic burial of a young to middle age adult found shallowly buried beneath the plaza surface of the Upper Plaza. The individual was placed in an extended position with the head oriented to the north. A complete Society Hall Impressed bowl was intentionally placed over the skull. Subsequent excavations encountered Burial CC-B22 3 meters to the north of this burial (see below). A radiocarbon sample from this burial returned a 2-sigma calibrated date range of 154 BC–AD 27.	Gallareta Cervera et al. (2017); Novotny et al. (2017)
CC-B18	2017	CC-17-C-9	Late Classic Burial CC-B18 was found within the southeast corner of a bench in Structure D-41, in Couryard D-4. Burial CC-B18 consisted of two individuals. Individual CC-B18A was in a flexed position in the western part of the burial area, oriented east-west. No cranium was found with this individual. The second skeleton, Individual CC-B18B was also in a flexed position in the northeastern corner of the burial, oriented east-west.	Kilgore (2018); Kilgore et al. (2017); Novotny et al. (2017)

Table 8.4. List of Burials (continued)

Burial	Year	Lot	Context	Source(s)
CC-B19	2018	CC-15-V-07	The remains of two adults were recovered from Early Classic construction fill in the northeast corner of the Upper Plaza, one young in age and one possibly a male. The bones were in a secondary context, and it is not clear how they came to be commingled. The color and root etchings on the bone surface are similar but could be due to their common deposition in the primary context from which they were recovered. Ceramics from the context suggest these individuals were deposited in the Early Classic period, and a single radiocarbon date suggests one of the individuals died near the end of the Late Preclassic period or the beginning of the Early Classic period.	Gallareta Cervera et al. (2019); Novotny, Hughes, and Gallareta Cervera (2019)
CC-B20	2018	CC-15-V-16	Burial CC-B20 was the primary interment of an older individual, possibly a female, in a stone-lined crypt (Crypt 2) with capstones. The crypt was constructed on an earlier floor within a platform in the northeast corner of the Upper Plaza. The burial did not include grave goods. The skeletal elements were extremely well preserved, particularly the skull, but it is not immediately clear why the bones were so well preserved in this context. The lack of soil surrounding the bones, which is acidic and remains damp in the tropical climate of Belize, may have contributed to their good preservation. There were several pathologies identified, but none that were acute or unexpected for an individual of advanced age. The interment dates to the Early Classic period.	Gallareta Cervera et al. (2019); Novotny, Hughes, and Gallareta Cervera (2019)
CC-B21	2018	CC-15-EE-06	Burial CC-B21 consists of the secondary interment of one individual who died during the Late Preclassic period. Although fragmentary, the few diagnostic elements suggest the individual was a possible female of middle to older adulthood. The secondary deposit was not marked by any formal grave architecture and dated to the Late Preclassic or Early Classic period based on ceramics found within the fill.	Gallareta Cervera et al. (2019); Novotny, Hughes, and Gallareta Cervera (2019)

Table 8.4. List of Burials (continued)

Burial	Year	Lot	Context	Source(s)
CC-B22	2019	CC-19-A-03	Burial CC-B22 was first discovered in 2018 as part of Subop CC-15-R, but the burial was not excavated until 2019. The interment contained one, adult individual, probably a male. The skull was covered by a Society Hall bowl and an unslipped jar were found next to the left humerus. A single radiocarbon sample returned a 2-sigma date range of 200–91 cal BC (PSUAMS# 6913; Sample CC-19-S15), confirming the Late Preclassic date for this burial. See Burial CC-B17, which is roughly contemporaneous and approximately 3 m to the south.	Gallareta Cevera and Houk (this volume); Novotny, Bedrosian, and Copper (2019)
CC-B23			Number inadvertently skipped.	
CC-B24	2022	CC-21-C-07	Burial CC-B24 consists of the primary interment of a probable female, young adult individual. She was placed in an extended, supine position with head to the west within dry fill of a bench in the central room of Structure C-2. One ceramic vessel was placed in the grave, and a broken fragment of shell ornament was also recovered. The grave shows signs of reentry. Charcoal was encountered throughout the grave space and the bones of the left femur and pelvis, as well adjacent vertebrae of the lower back and left hand, were discolored in a way consistent with exposure to fire. The left arm and left leg were disturbed in antiquity; the left fibula was missing, the left patella was out of place, and the bones of the left arm were disarticulated. The ceramic vessel suggests a Late Classic date for the interment. Samples of charcoal and human bone were selected for AMS radiocarbon dating. A radiocarbon date from the bone sample returned a 2-sigma age range of cal AD 675–876 (Sample CC-21-S14; see Table 2.3, this volume). The charcoal fragment returned a 2-sigma radiocarbon date of cal AD 702–881 (Sample CC-21-S10; see Table 2.3, this volume).	Novotny and Castillo (Chapter 5, this volume)
GJ-B01	2019	GJ-02-N-03	The skeletal remains present in Burial GJ-B01 were too fragmented to provide any detail as to who the individual was in life. The fragmentary state of the remains strongly suggests that the body decomposed elsewhere and was disinterred for an unknown amount of time prior to being re-interred in Structure B-1.	C. Novotny et al. (2019); Novotny, Bedrosian, and Copper (2019)

Table 8.4. List of Burials (continued)

Burial	Year	Lot	Context	Source(s)
GJ-B02	2019	GJ-02-O-07	The interment of one older adult, probable male was made into subfloor construction fill without any formal grave architecture in Structure B2. No grave inclusions were recovered. The only bones of the skull present were fragments of occipital and parietal, as well as six teeth. Although not well preserved, skeletal elements from the all other regions of the body were present and well-articulated, indicating that it was a primary interment. The absence of the skull in an interment where all other bones were represented, and the presence of red pigment suggest that the individual was subject to a mortuary ritual sometime after the body was originally placed under the floor. This may have occurred to inter a second individual, Burial GJ-B04 (see below), under the floor. A single radiocarbon date from the burial returned a calibrated 2-sigma date range of AD 907–1020 (PSUAMS# 6914; Sample GJ-S02). The Terminal Classic date for the burial is unexpectedly late.	C. Novotny et al. (2019); Novotny, Bedrosian, and Copper (2019)
GJ-B03	2019, 2022	GJ-02-A-07	Crews encountered Burial GJ-B03 near the eastern and northern edges of the chamber in a chultun, located in the approximate center of Courtyard B-1 at Gallon Jug in 2019. Burial GJ-B03 was not fully excavated due to time constraints, and excavations resumed in the 2022 field season. Burial GJ-B03 consisted of the primary interment of one individual in a chultun. The living created a simple cyst of unworked limestone rocks around the body, which they laid in a flexed position on its right side with head to the south. While it is likely that the entire skeleton was present, preservation was poor, and not all elements were observed for analysis. There were no clear grave goods placed with the individual, although excavators collected several artifacts from the matrix around the skeleton. A radiocarbon sample of bone collected in 2022 from the burial returned a 2-sigma date range of cal AD 1633–1666 (Sample GJ-02-S10; see Novotny et al, Chapter 4, this volume). If correct, this date suggests Burial GJ-B03 is a Postclassic or early Historic period interment. Another round of testing will be needed to confirm this date.	C. Novotny et al. (2019); Novotny, Bedrosian, and Copper (2019); Novotny and Castillo (Chapter 5, this volume)

Table 8.4. List of Burials (continued)

Burial	Year	Lot	Context	Source(s)
GJ-B04	2019	GJ-02-O-09	Burial GJ-B04, an adult, probably male, was interred in a simple pit grave within sub-floor fill in Structure B-2. He was interred in a flexed position with head oriented to the south. No artifacts were recovered from the grave space. Burial GJ-B04 was stratigraphically lower than Burial GJ-B02, however the missing facial bones and teeth and the red pigment found on Burial GJ-B02 suggest that the interment of Burial GJ-B04 may have disturbed Burial GJ-B02	C. Novotny et al. (2019); Novotny, Bedrosian, and Copper (2019)

Table 8.5. List of Crypts and Tombs

#	Season	Provenience	Location	Source(s)
Tomb 1	--	Structure C-31	Looted tomb referred to as the King's Tomb; Late Classic (?)	Guderjan (1991)
Tomb 2	1997–1999	Upper Plaza, CC-2-J-06	Tomb 2, Terminal Preclassic tomb in Upper Plaza (Burial CC-B02)	Houk et al. (2010); Robichaux (1998, 2000); Robichaux et al. (2000)
Crypt 1	2016, 2017	Upper Plaza, Subop CC-15-G	Early Classic crypt in northern part of Upper Plaza (Burials CC-B16A–C)	Gallareta Cervera et al. (2017); Houk (2016)
Crypt 2	2018	Upper Plaza, Subop CC-15-V	Early Classic crypt built on Middle Preclassic floor in the northeastern corner of the Upper Plaza (Burial CC-B20)	Gallareta Cervera et al. (2019); Houk (2019); Novotny et al. (2019, 2022)

Table 8.6. List of Caches

Cache #	Season	Provenience	Context	Source(s)
CC-C1	2014	CC-12-D-8	Structure A-1, penultimate phase. This cache contained 17 obsidian blades, found loose but grouped together in fill, resting on one of the capstones of Burial CC-B11.	Herndon et al. (2014)
CC-C2	2019	CC-20-E-?	Central area of Structure A-4 platform. Initially discovered by contractors excavating pits for a new cell tower, this cache contained at least four pairs of lip-to-lip bowls and two obsidian blades. Ceramics suggest the cache dates to ca. AD 250.	Houk, Bedrosian, and McKinney (2019)

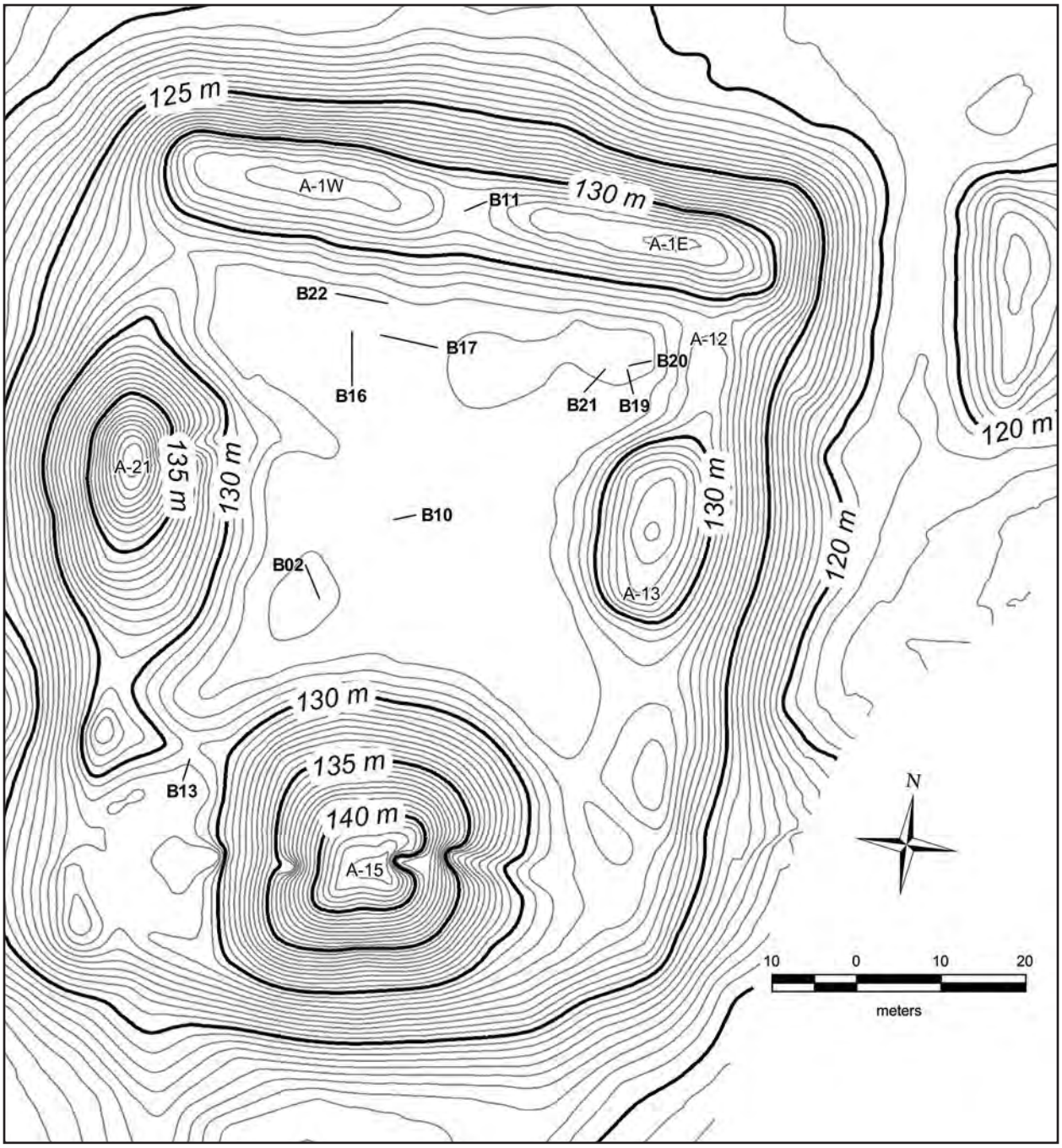


Figure 8.1. Locations of burials in the Upper Plaza at Chan Chich.

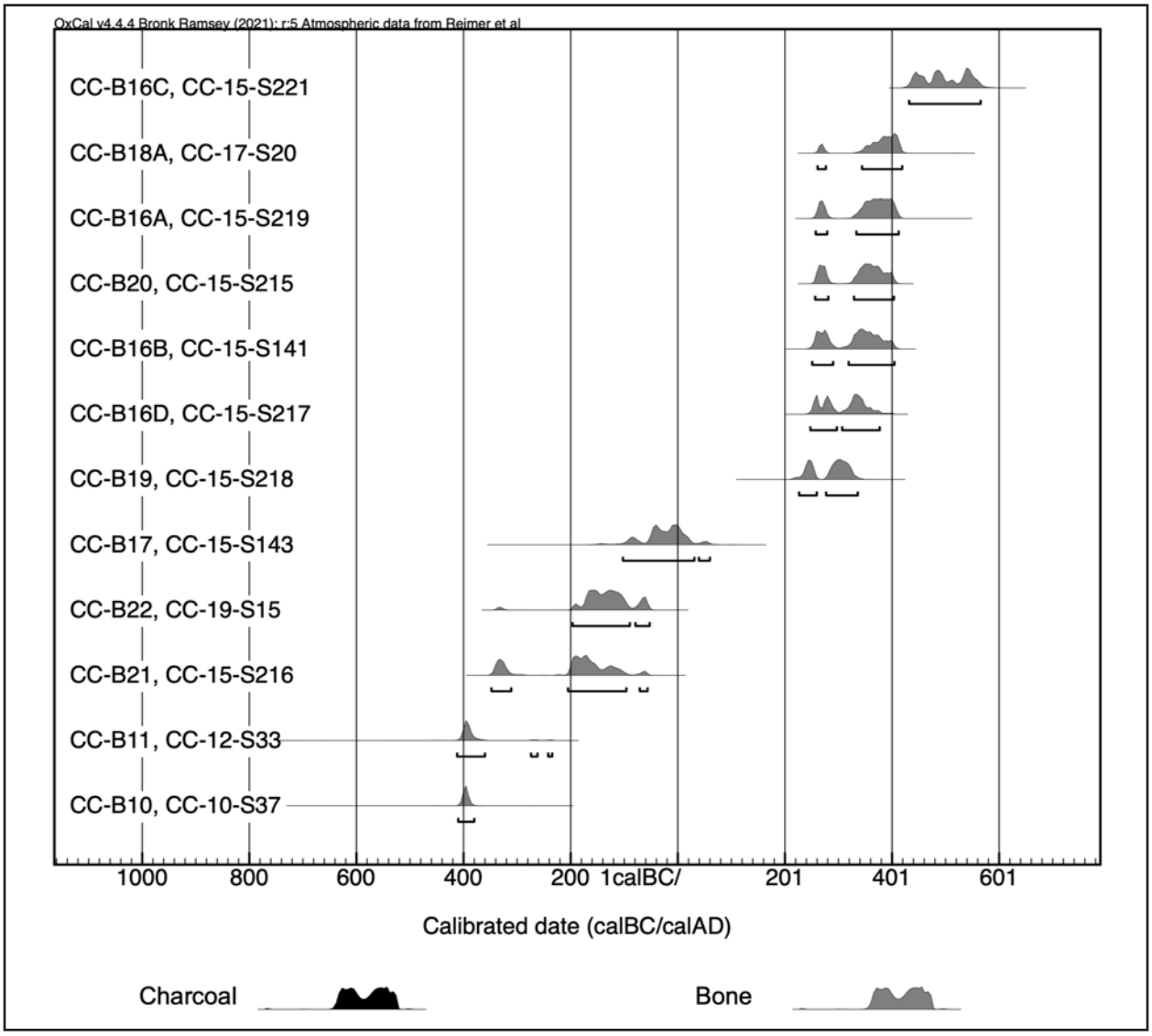


Figure 8.2. Radiocarbon dates from Preclassic and Early Classic period burials.

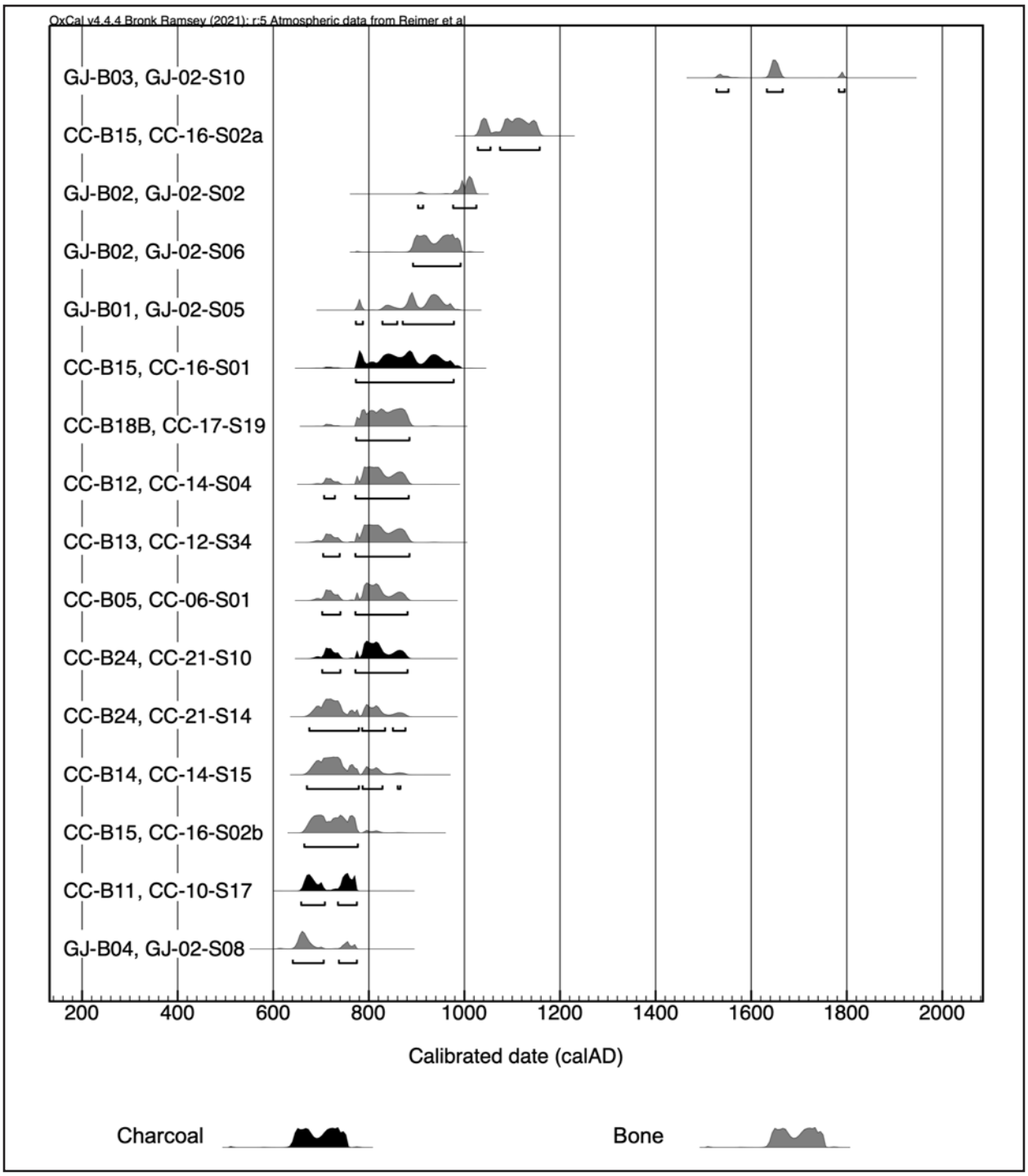


Figure 8.3. Radiocarbon dates from Late Classic, Terminal Classic, and Postclassic burials.

STONE MONUMENTS

Table 8.7 lists the stone monuments recorded within the CCAP and BEAST permit area. To date, no monuments with legible texts or dates have been found in the area. The only monuments with evidence of carving are Stela 1 at Kaxil Uinic (see Harris and Sisneros 2012; Thompson 1939) and Stela 2 at Tikin Ha (see Houk, Zaro et al. 2019).

Table 8.7. Recorded Stone Monuments in CCAP/BEAST Permit Area

BE #	Site	#	Location	Description	Source(s)
1	Chan Chich	Stela 1	Main Plaza, base of Structure A-2	Uncarved and burned stela	Guderjan (1991:43)
2	Kaxil Uinic	Stela 1	Main plaza, base of Structure 3	Broken in two pieces, heavily eroded stela with evidence of carving, illegible; 1.95 m tall, 80 cm wide, 55 cm thick	Guderjan et al. (1991); Harris and Sisneros (2012:52); Thompson (1939)
		Altar 1	Main plaza, base of Structure 3	Round, limestone altar (ca. 130 cm diameter; 30 cm thick), uncarved	Guderjan et al. (1991); Harris and Sisneros (2012:56–56); Thompson (1939)
3	Punta de Cacao	Stela 1	Plaza A, near base of Structure A-5	Uncarved stela	Robichaux (2004:200)
		Possible stela or altar	Plaza A, in front of Structure A-5	Large, uncarved block of stone, 82 x 82 x 40 cm, broken into two parts.	Hartnett (2005)
4	Gallon Jug	Stela 1	Northern part of the plaza in front of Structure 4	Upright, small uncarved stela with a hole in it. Dimensions not reported.	Kilgore, unpublished 2018 field notes
		Stela 2	Southwestern corner of the plaza between Structures 2 and 3.	Uncarved, broken, and laying flat stela. Dimensions not reported.	Kilgore, unpublished 2018 field notes
		Stela 3	Eastern end of the plaza, west of the southwest corner of Structure 1.	Uncarved stela discovered by Houk “floating” above the plaza in the roots of a fallen tree. Stela is 1.41 x 0.68 x 0.25 m.	Houk, unpublished 2018 field notes
		Stela 4?	Eastern end of the plaza, west of the of Structure 1.	Group of limestone fragments near centerline of Structure 1 which may be a broken, uncarved stela.	Houk, unpublished 2018 field notes

Table 8.7. Recorded Stone Monuments in CCAP/BEAST Permit Area (continued)

BE #	Site	#	Location	Description	Source(s)
4	Gallon Jug (cont)	Altar 1?	Approximate center of the plaza.	Small, broken, uncarved altar. Dimensions not reported.	Kilgore, unpublished 2018 field notes
7	Qualm Hill	Stela 1	Northeastern corner of Plaza A	Uncarved stela, laying flat; 1.8 m long, 0.6 m wide, and 0.4 m thick	Cackler et al. (2007:121)
		Altar 1	Plaza B	Broken in half, plain altar measuring 1.5 m in diameter and 1 m thick	Cackler et al. (2007:123)
10	Gongora Ruin	Stela 1	In plaza in front of Structure 1	Small, uncarved stela. Note that BEAST was unable to re-locate this monument in 2014.	Guderjan et al. (1991:81); Sandrock and Willis (2014)
11	Ix Naab Witz	Stela 1	Upper plaza near southwestern corner of Structure 6	Small, uncarved stela, 1.05 m tall, 40–60 cm wide, 35 cm thick	Sandrock (2013)
18	Tikin Ha	Stela 1	Main Plaza, base of Structure A-9	Stela 1 was found face down in front of Structure A-9. As noted upon our initial inspection in 2017, it appears that looters had originally cleaned around this monument and attempted to lift it. The monument is uncarved and measures 128 x 78 cm, with a thickness of 35 cm. It is clearly broken at one end, if not both ends. A second fragment found nearby may have been part of Stela 1 and measures 68 x 60 cm, with a thickness of 32 cm. Upon clearing debris from the stela, we collected nearly 90 Tepeu 3 sherds, with a few possible Postclassic sherds in the mix.	Houk, Zaro, et al. (2019)
		Stela 2	Main Plaza, southeastern corner between Structures A-3 and A-4, with Altar 2	Set 23 cm east of Altar 2, the base of this stela is *in situ*, but the upper portion is broken into approximately 16 large fragments and a half dozen small fragments (Figure 8.3). The base is 34 cm thick, 122 cm wide, and 42 cm tall. The base extends another 43 cm below the surface. The top is too fragmented to estimate the monument's original height. Traces of faint carving are present on one fragment from the top portion of the monument, but no hieroglyphs were observed. The stela and altar pair may be associated with a formal entrance into the plaza through the gap between Structures A-3 and A-4.	Houk, Zaro, et al. (2019)

Table 8.7. Recorded Stone Monuments in CCAP/BEAST Permit Area (continued)

BE #	Site	#	Location	Description	Source(s)
18	Tikin Ha (cont)	Stela 4	Between Groups A and B	Plain, broken stela set midway Between East Plaza and Courtyard A-5. The monument faces east-west (its long axis is oriented 10° east of north), toward the two architectural groups and may be associated with an unmapped sacbe connecting the two groups. The base is *in situ*, but the top of the stela is broken off, laying to the east of the base. Base is 75 cm tall (above ground surface), 97 cm wide, and 43 cm thick. The top is broken into two pieces and would have added 61 cm to the height of the monument.	Houk, Zaro, et al. (2019)
		Altar 1	Courtyard A-3	Altar 1 sits in the center of Courtyard A-3, framed by Structure A-17 to the west and Structure A-18 to the south. The primary piece lies flat and measures 100 x 80 cm, is oriented 71° east of north, and is 32 cm thick. It does not appear to be carved, but it is eroded and obscured by roots making it difficult to determine with certainty. Several smaller stone fragments lie just west of the monument and may have broken off it.	Houk, Zaro, et al. (2019)
		Altar 2	Main Plaza, southeastern corner between Structures A-3 and A-4, with Stela 2	Set only 23 cm west of Stela 2, this eroded, uncarved altar is approximately 35 cm thick, 108 cm long, and 78 cm wide (see Figure 8.4). Small pieces have spalled off its edges, so it was originally larger. It is oriented approximately 16° west of north. In plan view, it is roughly rectangular with rounded corners. Excavations beneath the monument did not encounter a cache. The stela and altar pair may be associated with a formal entrance into the plaza through the gap between Structures A-3 and A-4.	Houk, Zaro, et al. (2019)
		Altar 3	Courtyard D-1	Altar 3 sits in the central area of Courtyard D-1. This small, uncarved monument measures 100.5 cm long by 85 cm wide and is 15 cm thick. It is rectangular in plan view.	Houk, Zaro, et al. (2019)

Figure 8.4. Photo of Tikin Ha Altar 2 (left) and Stela 2 (right), shattered into multiple pieces. The base of Stela 2 is *in situ* and upright in the approximate center of the photograph. Camera facing northeast.

RADIOCARBON DATES

Table 8.8 presents the results of radiocarbon samples run by the project from 2012 to 2015. Table 8.9 presents the calibrated age ranges and isotope data for those same samples. Table 8.10 presents the results of samples from Chan Chich for the 2016 and 2019 seasons. Table 8.11 includes the calibrated ages of the radiocarbon samples from Chan Chich the 2016 to 2019 seasons, and Table 8.12 presents the results of radiocarbon samples from BEAST in 2019. Table 8.13 presents the calibrated ages of the radiocarbon samples from Tikin Ha and Gallon Jug from the 2019 season. Table 8.14 presents the isotope data for 2018 samples from human bone. Radiocarbon samples processed after the 2022 season, which include some samples excavated in previous seasons, are in Tables 8.15 and 8.16. Table 8.17 compiles the radiocarbon dates from burial context. Note that some burials have bone and charcoal dates. The differences between the two types of samples are likely related to ritual practices of burial reentry (Burials CC-B15 and -B24, for example) and reinterring an ancestor's bones in a new location (Burial CC-B11, for example).

Table 8.8. Radiocarbon Samples from the 2012 to 2015 Seasons

Area	Context	Sample #s	Comments	PSU #	UCIAMS #	Modern Fraction	±	$D^{14}C$ (‰)	±	^{14}C age (BP)	±
Upper Plaza	Lot CC-10-C-7	CC-10-S12	Charred material. This sample came from a midden in the northern part of the Upper Plaza. This midden is above floor Lot CC-10-C-8.	6390	154684	0.7273	0.0013	-272.7167	1.3023	2560	15
Upper Plaza	Lot CC-10-C-8	CC-10-S16	Charred material. This sample comes from subfloor fill associated with the oldest floor in the northern part of the Upper Plaza.	6386	151874	0.7271	0.0019	-272.9396	1.9490	2560	25
Upper Plaza	Lot CC-10-C-4	CC-10-S03	Charred material. This sample is from the second plaster floor above the midden in the northern part of the Upper Plaza.	6385	151873	0.7561	0.0020	-243.8584	2.0222	2245	25
Upper Plaza	Lot CC-10-H-4	CC-10-S28	Charred material.This sample is associated with dense artifact deposit within northern platform buried in Upper Plaza.	6397	154691	0.7631	0.0013	-236.8672	1.3000	2170	15
Upper Plaza	Lot CC-12-O-8	CC-12-S16	Charred material.This sample comes from the lowest (fifth) identified layer of the 20-cm thick compact dirt surface that covers most of the southern part of the Upper Plaza.	6393	154687	0.7669	0.0013	-233.0904	1.2797	2130	15
Upper Plaza	Lot CC-12-O-4	CC-12-S14	Charred material. This sample comes from the second identified layer of the 20-cm thick compact dirt surface that covers most of the southern part of the Upper Plaza.	6392	154686	0.7941	0.0015	-205.9289	1.4563	1850	15
Upper Plaza	Lot CC-12-D-6	CC-12-S08	Charred material. This sample is from the plaster cap that patched the floor above Burial CC-B11.	6396	154690	0.8289	0.0016	-171.1195	1.5594	1510	20

Table 8.8. Radiocarbon Samples from the 2012 to 2015 Seasons (continued)

Area	Context	Sample #s	Comments	PSU #	UCIAMS #	Modern Fraction	±	$D^{14}C$ (‰)	±	^{14}C age (BP)	±
Upper Plaza	Lot CC-12-D-7	CC-12-S13	Charred material. This sample comes from a charcoal rich layer of fill covering Burial CC-B11.	6394	154688	0.8292	0.0014	-170.7725	1.4281	1505	15
Upper Plaza	Lot CC-12-C-4	CC-12-S03	Charred material. This sample is from the subfloor fill of the final floor in a room on Structure A-18.	6391	154685	0.8489	0.0013	-151.0105	1.3403	1315	15
Upper Plaza	Lot CC-12-D-9	CC-12-S17	Charred material. This sample comes from Burial CC-B11 in the penultimate phase of Structure A-1.	6387	151875	0.8494	0.0023	-150.5843	2.2638	1310	25
Upper Plaza	Lot CC-12-A-4	CC-12-S05	Charred material. This sample is from the final phase of construction in a room in Structure A-1 (from the floor).	6395	154689	0.8512	0.0014	-148.8458	1.4124	1295	15
Back Plaza	Lot CC-13-M-3	CC-13-S14	Charred material. This sample comes from a probable cooking feature in Structure A-23. Will help date terminal occupation.	6388	151876	0.8554	0.0023	-144.6185	2.2870	1255	25
Str. D-1	Lot CC-14-F-3	CC-14-S04	Bone. This sample is human bone from Burial CC-B12 in Structure D-1.	6418	154712	0.8589	0.0017	-141.0115	1.6736	1220	20

Table 8.9. Calibrated Age Ranges and Isotope Data for Radiocarbon Samples from 2012 to 2015 Seasons

Sample #	$\delta^{13}C$ (‰ VPDB)	$\delta^{15}N$ (‰ Atm N2)	%C	%N	C:N	From	To	%
CC-10-S12						799 BC	766 BC	95.4
CC-10-S16						805 BC	569 BC	95.4
CC-10-S03						390 BC	280 BC	95.4
CC-10-S28						355 BC	171 BC	95.4
CC-12-S16						204 BC	96 BC	95.4
CC-12-S14						AD 91	AD 231	95.4
CC-12-S08						AD 435	AD 608	95.4
CC-12-S13						AD 540	AD 602	95.4
CC-12-S03						AD 659	AD 764	95.4
CC-12-S17						AD 658	AD 768	95.4
CC-12-S05						AD 667	AD 768	95.4
CC-13-S14						AD 673	AD 863	95.4
CC-14-S04	-10.49	8.83	52.73	18.60	3.31	AD 713	AD 885	95.4

Table 8.10. Radiocarbon Samples Processed from Chan Chich (2016 and 2019) by Lot

PSU AMS#	Sample # CC-	Lot CC-	Material	fraction Modern	±	$D^{14}C$ (‰)	±	^{14}C age (BP)	±
1278	15-S016	15-A-08		0.7354	0.0020	-264.6	2.0	2470	25
3029	15-S119/120	15-A-27	multiple charcoal	0.7102	0.0015	-289.8	1.5	2750	20
5222	15-S197	15-AA-05	single charcoal	0.8578	0.0015	-142.2	1.5	1230	15
1277	15-S005	15-B-03		0.8535	0.0019	-146.5	1.9	1275	20
1280	15-S022	15-B-04		0.7340	0.0018	-266.0	1.8	2485	20
1282	15-S045	15-B-07		0.7384	0.0018	-261.6	1.8	2435	25
1327	15-S029	15-B-08		0.7238	0.0037	-276.2	3.7	2595	45
1283	15-S050	15-B-10		0.7335	0.0020	-266.5	2.0	2490	25
1285	15-S054	15-B-11		0.7308	0.0024	-269.2	2.4	2520	30
1284	15-S051	15-B-15		0.7215	0.0022	-278.5	2.2	2620	25
1276	15-S004	15-C-04		0.7960	0.0018	-204.0	1.8	1835	20
1279	15-S019	15-C-05		0.7951	0.0018	-204.9	1.8	1840	20
1325	15-S007	15-C-07		0.7545	0.0033	-245.5	3.3	2265	40
1326	15-S023	15-C-08		0.7516	0.0026	-248.4	2.6	2295	30
1281	15-S034	15-C-10		0.7300	0.0018	-270.0	1.8	2530	20
1328	15-S039	15-C-11		0.7351	0.0027	-264.9	2.7	2470	30
5457	15-S221	15-EE-04	XAD amino acids	0.7634	0.0014	-236.6	1.4	2170	15
5454	15-S216	15-EE-06	XAD amino acids	0.7654	0.0016	-234.6	1.6	2145	20
5266	15-S201	15-EE-07	single charcoal	0.8146	0.0016	-185.4	1.6	1645	20
5225	15-S203	15-FF-11	multiple charcoal	0.7352	0.0026	-264.8	2.6	2470	30
1286	15-S059	15-G-04		0.7897	0.0022	-210.3	2.2	1895	25
2724	15-S065	15-G-13	multiple charcoal	0.7940	0.0014	-206.0	1.4	1855	15
2725	15-S063	15-G-14	multiple charcoal	0.8055	0.0014	-194.5	1.4	1735	15
2726	15-S067	15-G-14	multiple charcoal	0.8007	0.0017	-199.3	1.7	1785	20
2727	15-S070	15-G-14	multiple charcoal	0.8078	0.0014	-192.2	1.4	1715	15
2728	15-S071	15-G-14	single charcoal	0.8013	0.0015	-198.7	1.5	1780	15
2729	15-S073	15-G-14	multiple charcoal	0.7350	0.0014	-265.0	1.4	2475	15
2976	15-S141	15-G-14	XAD amino acids	0.8066	0.0017	-193.4	1.7	1725	20
5455	15-S217	15-G-14	XAD amino acids	0.8053	0.0014	-194.7	1.4	1740	15
5456	15-S219	15-G-14	XAD amino acids	0.8095	0.0016	-190.5	1.6	1700	20
2730	15-S138	15-G-19	multiple charcoal	0.8035	0.0015	-196.5	1.5	1760	15
2731	15-S137	15-G-21	multiple charcoal	0.7288	0.0014	-271.2	1.4	2540	20
2750	15-S079	15-I-09	multiple charcoal	0.7627	0.0014	-237.3	1.4	2175	15
5226	15-S206	15-JJ-06	single charcoal	0.7446	0.0014	-255.4	1.4	2370	20
5223	15-S198	15-KK-06	single charcoal	0.7389	0.0015	-261.1	1.5	2430	20
2732	15-S130	15-L-16	multiple charcoal	0.7617	0.0014	-238.3	1.4	2185	15
2733	15-S126	15-L-17	single charcoal	0.7702	0.0015	-229.8	1.5	2100	20
2734	15-S075	15-M-12	single charcoal	0.8081	0.0014	-191.9	1.4	1710	15
3030	15-S083/085	15-M-17	multiple charcoal	0.7406	0.0014	-259.4	1.4	2415	20

Table 8.10. Radiocarbon Samples Processed from Chan Chich (2016 and 2019) by Lot (continued)

PSU AMS#	Sample # CC-	Lot CC-	Material	fraction Modern	±	$D^{14}C$ (‰)	±	^{14}C age (BP)	±
2735	15-S086	15-M-21	single charcoal	0.7371	0.0014	-262.9	1.4	2450	20
2736	15-S087	15-M-22	single charcoal	0.7356	0.0014	-264.4	1.4	2465	20
2737	15-S088	15-M-23	single charcoal	0.7306	0.0014	-269.4	1.4	2520	15
2738	15-S127	15-M-24	single charcoal	0.7390	0.0013	-261.0	1.3	2430	15
2977	15-S143	15-N-04	XAD amino acids	0.7763	0.0020	-223.7	2.0	2035	25
5229	15-S212	15-P-09	multiple charcoal	0.7378	0.0017	-262.2	1.7	2445	20
2748	15-S092	15-Q-02	single charcoal	0.5727	0.0012	-427.3	1.2	4475	20
2749	15-S117	15-Q-09	single charcoal	0.7608	0.0014	-239.2	1.4	2195	15
5221	15-S188	15-T-04	single charcoal	0.8303	0.0014	-169.7	1.4	1495	15
5443	15-S218	15-U-07	>30kDa gelatin	0.8009	0.0018	-199.1	1.8	1785	20
5208	15-S144	15-V-09	single charcoal	0.8016	0.0018	-198.4	1.8	1775	20
5453	15-S215	15-V-15	XAD amino acids	0.8078	0.0014	-192.2	1.4	1715	15
5216	15-S175	15-V-19	single charcoal	0.7364	0.0015	-263.6	1.5	2455	20
5217	15-S177	15-V-19	multiple charcoal	0.7314	0.0014	-268.6	1.4	2510	20
5218	15-S181	15-V-20	single charcoal	0.7184	0.0014	-281.6	1.4	2655	20
5219	15-S183	15-V-21	single charcoal	0.7277	0.0014	-272.3	1.4	2555	20
5215	15-S166	15-Z-07	multiple charcoal	0.7320	0.0013	-268.0	1.3	2505	15
5227	15-S208	15-Z-08	multiple charcoal	0.7364	0.0014	-263.6	1.4	2460	20
5228	15-S209	15-Z-08	single charcoal	0.7346	0.0014	-265.4	1.4	2480	15
5209	15-S152	15-Z-09	single charcoal	0.7369	0.0013	-263.1	1.3	2450	15
5210	15-S154	15-Z-09	single charcoal	0.7367	0.0014	-263.3	1.4	2455	20
5211	15-S155	15-Z-09	single charcoal	0.7369	0.0015	-263.1	1.5	2455	20
5211	15-S155	15-Z-09	single charcoal	0.7369	0.0015	-263.1	1.5	2455	20
5211	15-S155	15-Z-09	single charcoal	0.7369	0.0015	-263.1	1.5	2455	20
5212	15-S158	15-Z-11	multiple charcoal	0.7440	0.0023	-256.0	2.3	2375	25
5213	15-S160	15-Z-11	single charcoal	0.7382	0.0016	-261.8	1.6	2440	20
5214	15-S165	15-Z-11	multiple charcoal	0.7414	0.0018	-258.6	1.8	2405	20
5444	15-S220	15-Z-12	>30kDa gelatin	0.7216	0.0018	-278.4	1.8	2620	25
5220	15-S185	15-Z-18	single charcoal	0.7281	0.0014	-271.9	1.4	2550	15
1324	16-S01	16-L-03	charred material	0.8651	0.0034	-134.9	3.4	1165	35
2975	17-S19	17-C-10	XAD amino acids	0.8607	0.0018	-139.3	1.8	1205	20
2720	17-S08	17-E-04	single charcoal	0.8607	0.0014	-139.3	1.4	1205	15
2722	17-S14	17-I-06	multiple charcoal	0.8635	0.0015	-136.5	1.5	1180	15
2721	17-S06	17-J-03	multiple charcoal	0.8536	0.0014	-146.4	1.4	1270	15
2723	17-S10	17-Q-05	single charcoal	0.8640	0.0016	-136.0	1.6	1175	15
6913	19-S15	19-A-03	Human bone	0.7678	0.0014	-232.2	1.4	2120	15
6912	19-S03	19-A-05	Faunal bone	0.7587	0.0014	-241.3	1.4	2220	15
6650	19-S12	19-L-12	Charcoal	0.8495	0.0019	-150.5	1.9	1310	20

Table 8.10. Radiocarbon Samples Processed from Chan Chich (2016 and 2019) by Lot (continued)

PSU AMS#	Sample # CC-	Lot CC-	Material	fraction Modern	±	$D^{14}C$ (‰)	±	^{14}C age (BP)	±
6647	19-S04	19-N-04	Charcoal	0.8276	0.0018	-172.4	1.8	1520	20
6648	19-S07	19-N-05	Charcoal	0.8430	0.0018	-157.0	1.8	1370	20
6649	19-S09	19-O-07	Charcoal	0.8034	0.0016	-196.6	1.6	1760	20
6651	19-S14	19-S-07	Charcoal	0.8435	0.0020	-156.5	2.0	1370	20

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot

Sample # CC-	Lot* CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
15-S016	15-A-08	Floor construction; south of stone alignment. Possibly equivalent to Floor 5 in 15-C.	2470	25	767–482 BC	94.6	767–434 BC
15-S016	15-A-08	Floor construction; south of stone alignment. Possibly equivalent to Floor 5 in 15-C.	2470	25	442–434 BC	0.8	767–434 BC
15-S043	15-A-15	Floor 11; south of stone alignment. Deepest Floor.	2700	35	911–804 BC	95.4	911–804 BC
15-S119/120	15-A-27	Floor 6, south of Blanca	2750	20	968–964 BC	0.8	968–833 BC
15-S119/120	15-A-27	Floor 6, south of Blanca	2750	20	931–833 BC	94.6	968–833 BC
15-S197	15-AA-05	looted bench in Room 2 of Str. A-1SE	1230	15	AD 694–745	35.9	AD 694–875
15-S197	15-AA-05	looted bench in Room 2 of Str. A-1SE	1230	15	AD 764–780	16.8	AD 694–875
15-S197	15-AA-05	looted bench in Room 2 of Str. A-1SE	1230	15	AD 788–875	42.7	AD 694–875
15-S005	15-B-03	Terminal use of Structure A-1	1275	20	AD 675–770	95.4	AD 675–770
15-S022	15-B-04	Top of MPC/LPC Structure?	2485	20	766–540 BC	95.4	766–540 BC
15-S045	15-B-07	Embedded in top of floor CC-15-B-07	2435	25	749–648 BC	21.3	749–407 BC
15-S045	15-B-07	Embedded in top of floor CC-15-B-07	2435	25	667–640 BC	6.8	749–407 BC

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot (continued)

Sample # CC-	Lot CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
15-S045	15-B-07	Embedded in top of floor CC-15-B-07	2435	25	589–578 BC	1.0	749–407 BC
15-S045	15-B-07	Embedded in top of floor CC-15-B-07	2435	25	564–407 BC	66.3	749–407 BC
15-S029	15-B-08	Structure Fill?	2595	45	841–736 BC	73.4	841–547 BC
15-S029	15-B-08	Structure Fill?	2595	45	689–663 BC	5.4	841–547 BC
15-S029	15-B-08	Structure Fill?	2595	45	648–547 BC	16.6	841–547 BC
15-S050	15-B-10	MPC/LPC fill in cut	2490	25	744–536 BC	95.1	744–524 BC
15-S050	15-B-10	MPC/LPC fill in cut	2490	25	525–524 BC	0.3	744–524 BC
15-S054	15-B-11	MPC/LPC floor	2520	30	795–728 BC	29.3	795–542 BC
15-S054	15-B-11	MPC/LPC floor	2520	30	717–708 BC	1.0	795–542 BC
15-S054	15-B-11	MPC/LPC floor	2520	30	694–542 BC	65.1	795–542 BC
15-S051	15-B-15	MPC/LPC fill in cut (in CC-15-B-15, floor)	2620	25	826–782 BC	95.4	826–782 BC
15-S004	15-C-04	Top of compact dirt floor	1835	20	AD 128–236	95.4	AD 128–236
15-S019	15-C-05	Floor 3	1840	20	AD 125–238	95.4	AD 125–238
15-S007	15-C-07	Floor 5	2265	40	401–346 BC	38.3	401–206 BC
15-S007	15-C-07	Floor 5	2265	40	322–206 BC	57.1	401–206 BC
15-S023	15-C-08	Floor 6	2295	30	406–354 BC	75.1	406–231 BC
15-S023	15-C-08	Floor 6	2295	30	291–231 BC	20.3	406–231 BC
15-S034	15-C-10	Floor 8	2530	20	794–746 BC	42.7	794–552 BC
15-S034	15-C-10	Floor 8	2530	20	686–666 BC	13.5	794–552 BC
15-S034	15-C-10	Floor 8	2530	20	644–552 BC	39.2	794–552 BC
15-S039	15-C-11	Floor 9	2470	30	768–476 BC	92.4	768–431 BC
15-S039	15-C-11	Floor 9	2470	30	464–453 BC	1.2	768–431 BC
15-S039	15-C-11	Floor 9	2470	30	445–431 BC	1.8	768–431 BC
15-S221	15-EE-04	dates fill of platform, NE UP	2170	15	355–292 BC	58.4	355–171 BC
15-S221	15-EE-04	dates fill of platform, NE UP	2170	15	231–171 BC	37.0	355–171 BC
15-S216	15-EE-06	Burial CC-B21	2145	20	351–302 BC	20.1	351–106 BC
15-S216	15-EE-06	Burial CC-B21	2145	20	211–106 BC	75.3	351–106 BC
15-S201	15-EE-07	Lot CC-15-EE-07	1645	20	AD 342–429	94.2	AD 342–505
15-S201	15-EE-07	Lot CC-15-EE-07	1645	20	AD 497–505	1.2	AD 342–505
15-S203	15-FF-11	below Floor 3 of Crystal	2470	30	768–476 BC	92.4	768–431 BC
15-S203	15-FF-11	below Floor 3 of Crystal	2470	30	464–453 BC	1.2	768–431 BC

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot (continued)

Sample # CC-	Lot CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
15-S203	15-FF-11	below Floor 3 of Crystal	2470	30	445–431 BC	1.8	768–431 BC
15-S059	15-G-04	"Burning event" in crypt fill	1895	25	55 BC–AD 175	91.8	55 BC–AD 211
15-S059	15-G-04	"Burning event" in crypt fill	1895	25	AD 191–211	3.6	55 BC–AD 211
15-S065	15-G-13	Fill of capstones, north wall of crypt	1855	15	AD 87–107	6.5	AD 87–227
15-S065	15-G-13	Fill of capstones, north wall of crypt	1855	15	AD 121–227	88.9	AD 87–227
15-S063	15-G-14	Burial 16/Crypt context	1735	15	AD 247–353	92.5	AD 247–379
15-S063	15-G-14	Burial 16/Crypt context	1735	15	AD 368–379	2.9	AD 247–379
15-S067	15-G-14	Burial 16/Crypt context	1785	20	AD 140–197	14.1	AD 140–328
15-S067	15-G-14	Burial 16/Crypt context	1785	20	AD 208–262	48.2	AD 140–328
15-S067	15-G-14	Burial 16/Crypt context	1785	20	AD 277–328	33.1	AD 140–328
15-S070	15-G-14	Burial 16/Crypt context	1715	15	AD 257–298	30.7	AD 257–387
15-S070	15-G-14	Burial 16/Crypt context	1715	15	AD 320–387	64.7	AD 257–387
15-S071	15-G-14	Burial 16/Crypt context	1780	15	AD 174–192	2.3	AD 174–330
15-S071	15-G-14	Burial 16/Crypt context	1780	15	AD 212–264	50.8	AD 174–330
15-S071	15-G-14	Burial 16/Crypt context	1780	15	AD 275–330	42.4	AD 174–330
15-S073	15-G-14	Burial 16/Crypt context	2475	15	762–537 BC	95.4	762–537 BC
15-S141	15-G-14	Burial CC-B16B	1725	20	AD 252–384	95.4	AD 252–384
15-S217	15-G-14	Burial CC-B16D	1740	15	AD 243–346	95.4	AD 243–346
15-S219	15-G-14	Burial CC-B16A	1700	20	AD 257–296	15.7	AD 257–399
15-S219	15-G-14	Burial CC-B16A	1700	20	AD 321–399	79.7	AD 257–399
15-S138	15-G-19	Crypt Floor	1760	15	AD 237–333	95.4	AD 237–333
15-S137	15-G-21	Fill of Crypt Floor	2540	20	796–748 BC	60.5	796–556 BC
15-S137	15-G-21	Fill of Crypt Floor	2540	20	685–667 BC	10.4	796–556 BC
15-S137	15-G-21	Fill of Crypt Floor	2540	20	641–587 BC	19.6	796–556 BC

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot (continued)

Sample # CC-	Lot CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
15-S137	15-G-21	Fill of Crypt Floor	2540	20	581–556 BC	4.9	796–556 BC
15-S079	15-I-09	Floor 3 of Blanca	2175	15	355–291 BC	63.0	355–175 BC
15-S079	15-I-09	Floor 3 of Blanca	2175	15	232–175 BC	32.4	355–175 BC
15-S206	15-JJ-06	Blanca steps	2370	20	508–499 BC	2.3	508–395 BC
15-S206	15-JJ-06	Blanca steps	2370	20	492–395 BC	93.1	508–395 BC
15-S198	15-KK-06	inside Blanca steps	2430	20	735–689 BC	15.5	735–408 BC
15-S198	15-KK-06	inside Blanca steps	2430	20	663–648 BC	3.8	735–408 BC
15-S198	15-KK-06	inside Blanca steps	2430	20	546–408 BC	76.2	735–408 BC
15-S130	15-L-16	Top of stone feature (outside)	2185	15	358–281 BC	65.4	358–185 BC
15-S130	15-L-16	Top of stone feature (outside)	2185	15	258–245 BC	2.3	358–185 BC
15-S130	15-L-16	Top of stone feature (outside)	2185	15	236–185 BC	27.8	358–185 BC
15-S126	15-L-17	Inside of stone features	2100	20	182–52 BC	95.4	182–52 BC
15-S075	15-M-12	Floor 3 of East Upper Plaza Construction Sequence	1710	15	AD 257–296	23.3	AD 257–390
15-S075	15-M-12	Floor 3 of East Upper Plaza Construction Sequence	1710	15	AD 321–390	72.1	AD 257–390
15-S083/085	15-M-17	Fill of Preclassic platform floor	2415	20	728–717 BC	2.1	728–406 BC
15-S083/085	15-M-17	Fill of Preclassic platform floor	2415	20	707–694 BC	2.5	728–406 BC
15-S083/085	15-M-17	Fill of Preclassic platform floor	2415	20	542–406 BC	90.8	728–406 BC
15-S086	15-M-21	Floor 6 of East Upper Plaza Construction Sequence	2450	20	751–683 BC	31.9	751–413 BC
15-S086	15-M-21	Floor 6 of East Upper Plaza Construction Sequence	2450	20	669–637 BC	11.5	751–413 BC
15-S086	15-M-21	Floor 6 of East Upper Plaza Construction Sequence	2450	20	622–617 BC	0.6	751–413 BC

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot (continued)

Sample # CC-	Lot CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
15-S086	15-M-21	Floor 6 of East Upper Plaza Construction Sequence	2450	20	591–413 BC	51.5	751–413 BC
15-S087	15-M-22	Construction Fill	2465	20	762–482 BC	94.8	762–434 BC
15-S087	15-M-22	Construction Fill	2465	20	441–434 BC	0.6	762–434 BC
15-S088	15-M-23	Surface of posthole	2520	15	787–746 BC	32.0	787–552 BC
15-S088	15-M-23	Surface of posthole	2520	15	686–666 BC	16.2	787–552 BC
15-S088	15-M-23	Surface of posthole	2520	15	644–552 BC	47.2	787–552 BC
15-S127	15-M-24	Inside of Post hole	2430	15	730–692 BC	12.1	730–411 BC
15-S127	15-M-24	Inside of Post hole	2430	15	659–652 BC	1.7	730–411 BC
15-S127	15-M-24	Inside of Post hole	2430	15	544–411 BC	81.6	730–411 BC
15-S143	15-N-04	Burial CC-B17	2035	25	154–140 BC	1.9	154 BC–AD 27
15-S143	15-N-04	Burial CC-B17	2035	25	113 BC–AD 27	92.7	154 BC–AD 27
15-S143	15-N-04	Burial CC-B17	2035	25	AD 42–47	0.8	154 BC–AD 27
15-S212	15-P-09	below Floor 3 of Blanca	2445	20	750–648 BC	28.6	750–411 BC
15-S212	15-P-09	below Floor 3 of Blanca	2445	20	668–639 BC	9.4	750–411 BC
15-S212	15-P-09	below Floor 3 of Blanca	2445	20	590–577 BC	1.6	750–411 BC
15-S212	15-P-09	below Floor 3 of Blanca	2445	20	568–411 BC	55.8	750–411 BC
15-S092	15-Q-02	Fill of Floor 1 of SE Upper Plaza Construction Sequence	4475	20	3335–3211 BC	60.8	3335–3033 BC
15-S092	15-Q-02	Fill of Floor 1 of SE Upper Plaza Construction Sequence	4475	20	3193–3151 BC	13.5	3335–3033 BC
15-S092	15-Q-02	Fill of Floor 1 of SE Upper Plaza Construction Sequence	4475	20	3138–3088 BC	18.0	3335–3033 BC
15-S092	15-Q-02	Fill of Floor 1 of SE Upper Plaza Construction Sequence	4475	20	3057–3033 BC	3.0	3335–3033 BC
15-S117	15-Q-09	Fill of dismantled Floor 4 of SE Upper Plaza	2195	15	358–278 BC	61.0	358–199 BC

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot (continued)

Sample # CC-	Lot CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
15-S117	15-Q-09	Fill of dismantled Floor 4 of SE Upper Plaza	2195	15	259–199 BC	34.4	358–199 BC
15-S188	15-T-04	dates fill in bench, Room 1, Str. A-1SE	1495	15	AD 544–605	95.4	AD 544–605
15-S218	15-U-07	Burial CC-B19	1785	20	AD 140–197	14.1	AD 140–328
15-S218	15-U-07	Burial CC-B19	1785	20	AD 208–262	48.2	AD 140–328
15-S218	15-U-07	Burial CC-B19	1785	20	AD 277–328	33.1	AD 140–328
15-S144	15-V-09	floor above Burial CC-B20	1775	20	AD 170–194	2.9	AD 170–336
15-S144	15-V-09	floor above Burial CC-B20	1775	20	AD 211–336	92.5	AD 170–336
15-S215	15-V-15	Burial CC-B20	1715	15	AD 257–298	30.7	AD 257–387
15-S215	15-V-15	Burial CC-B20	1715	15	AD 320–387	64.7	AD 257–387
15-S175	15-V-19	Lot CC-15-V-19	2455	20	752–682 BC	34.2	752–416 BC
15-S175	15-V-19	Lot CC-15-V-19	2455	20	670–613 BC	16.4	752–416 BC
15-S175	15-V-19	Lot CC-15-V-19	2455	20	593–428 BC	44.1	752–416 BC
15-S175	15-V-19	Lot CC-15-V-19	2455	20	422–416 BC	0.8	752–416 BC
15-S177	15-V-19	Lot CC-15-V-19	2510	20	784–732 BC	23.3	784–544 BC
15-S177	15-V-19	Lot CC-15-V-19	2510	20	691–661 BC	15.8	784–544 BC
15-S177	15-V-19	Lot CC-15-V-19	2510	20	650–544 BC	56.3	784–544 BC
15-S181	15-V-20	surface under Burial CC-B20	2655	20	837–797 BC	95.4	837–797 BC
15-S183	15-V-21	surface under Burial CC-B20	2555	20	801–751 BC	85.0	801–590 BC
15-S183	15-V-21	surface under Burial CC-B20	2555	20	684–667 BC	4.5	801–590 BC
15-S183	15-V-21	surface under Burial CC-B20	2555	20	636–626 BC	1.0	801–590 BC
15-S183	15-V-21	surface under Burial CC-B20	2555	20	615-590 BC	5.0	801–590 BC
15-S166	15-Z-07	dates Floor 3 of NW UP	2505	15	772–737 BC	19.4	772–548 BC
15-S166	15-Z-07	dates Floor 3 of NW UP	2505	15	689–663 BC	15.9	772–548 BC
15-S166	15-Z-07	dates Floor 3 of NW UP	2505	15	647–548 BC	60.2	772–548 BC
15-S208	15-Z-08	Floor 3 of NW UP	2460	20	756–679 BC	35.3	756–430 BC
15-S208	15-Z-08	Floor 3 of NW UP	2460	20	671–606 BC	20.1	756–430 BC
15-S208	15-Z-08	Floor 3 of NW UP	2460	20	600–430 BC	40.0	756–430 BC
15-S209	15-Z-08	Floor 3 of NW UP	2480	15	761–540 BC	95.4	761–540 BC

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot (continued)

Sample # CC-	Lot CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
15-S152	15-Z-09	Floor 4 of NW UP	2450	15	749–684 BC	36.8	749–415 BC
15-S152	15-Z-09	Floor 4 of NW UP	2450	15	667–641 BC	11.7	749–415 BC
15-S152	15-Z-09	Floor 4 of NW UP	2450	15	588–579 BC	1.1	749–415 BC
15-S152	15-Z-09	Floor 4 of NW UP	2450	15	561–415 BC	45.8	749–415 BC
15-S154	15-Z-09	Floor 4 of NW UP	2455	20	752–682 BC	34.2	752–416 BC
15-S154	15-Z-09	Floor 4 of NW UP	2455	20	670–613 BC	16.4	752–416 BC
15-S154	15-Z-09	Floor 4 of NW UP	2455	20	593–428 BC	44.1	752–416 BC
15-S154	15-Z-09	Floor 4 of NW UP	2455	20	422–416 BC	0.8	752–416 BC
15-S155	15-Z-09	Floor 4 of NW UP	2455	20	752–682 BC	34.2	752–416 BC
15-S155	15-Z-09	Floor 4 of NW UP	2455	20	670–613 BC	16.4	752–416 BC
15-S155	15-Z-09	Floor 4 of NW UP	2455	20	593–428 BC	44.1	752–416 BC
15-S155	15-Z-09	Floor 4 of NW UP	2455	20	422–416 BC	0.8	752–416 BC
15-S158	15-Z-11	dates Floor 6 of NW UP	2375	25	534–529 BC	1.0	534–394 BC
15-S158	15-Z-11	dates Floor 6 of NW UP	2375	25	519–394 BC	94.4	534–394 BC
15-S160	15-Z-11	dates Floor 6 of NW UP	2440	20	748–685 BC	24.6	748–409 BC
15-S160	15-Z-11	dates Floor 6 of NW UP	2440	20	666–642 BC	7.4	748–409 BC
15-S160	15-Z-11	dates Floor 6 of NW UP	2440	20	586–581 BC	0.5	748–409 BC
15-S160	15-Z-11	dates Floor 6 of NW UP	2440	20	556–409 BC	62.9	748–409 BC
15-S165	15-Z-11	dates Floor 6 of NW UP	2405	20	703–696 BC	0.8	703–402 BC
15-S165	15-Z-11	dates Floor 6 of NW UP	2405	20	541–402 BC	94.6	703–402 BC
15-S220	15-Z-12	dates Floor 6 of NW UP	2620	25	826–782 BC	95.4	826–782 BC
15-S185	15-Z-18	bedrock of NW UP sequence	2550	15	798–756 BC	91.1	798–596 BC
15-S185	15-Z-18	bedrock of NW UP sequence	2550	15	680–671 BC	2.5	798–596 BC
15-S185	15-Z-18	bedrock of NW UP sequence	2550	15	605–596 BC	1.8	798–596 BC
16-S01	16-L-03	Burial CC-B15	1165	35	AD 771–970	0.954	AD 771–970
17-S19	17-C-10	Burial CC-B18B, tibia	1205	20	AD 769–886	95.4	AD 769–886

Table 8.11. Calibrated Age Ranges for 2016 and 2019 Samples by Lot (continued)

Sample # CC-	Lot CC-	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
17-S08	17-E-04	dense artifact concentration in the southwestern corner between Structures D-42 and D-43	1205	15	AD 771–883	95.4	AD 771–883
17-S14	17-I-06	floor (at S04-019) in northern room of Structure D-42	1180	15	AD 775–890	95.4	AD 775–890
17-S06	17-J-03	plaster of the c-shaped bench Structure D-42	1270	15	AD 681–770	95.4	AD 681–770
17-S10	17-Q-05	very dense artifact concentration on the courtyard surface in the northwestern corner	1175	15	AD 775–893	95.4	AD 775–893
19-S15	19-A-03	Burial CC-B22	2120	15	197–90 BC	83.1	197–53 BC
					80–53 BC	12.4	
19-S03	19-A-05	Construction fill, below Burial CC-B22	1370	20	322–206 BC	84.2	365–206 BC
19-S03	19-A-05	Construction fill, below Burial CC-B22	1370	20	365–346 BC	11.2	365–206 BC
19-S12	19-L-12	polychrome ceramic deposit	1760	20	AD 660–717	70.9	AD 660–767
19-S12	19-L-12	polychrome ceramic deposit	1760	20	AD 742–767	24.5	AD 660–767
19-S04	19-N-04	dates floor associated with Structure A-13 4th	1310	20	AD 432–490	19.8	AD 432–601
19-S04	19-N-04	dates floor associated with Structure A-13 4th	1310	20	AD 532–601	75.6	AD 432–601
19-S07	19-N-05	construction fill	1370	20	AD 639–676	95.4	AD 639–676
19-S09	19-O-07	Floor 3 of Upper Plaza	2220	15	AD 229–340	95.4	AD 229–340
19-S14	19-S-07	f ill directly on top of the possible stairway east of Str. A-13	2120	15	AD 639–676	95.4	AD 639–676

Table 8.12. Charcoal Samples Process by BEAST (2019) by Lot

PSU AMS#	Sample #	Lot	Material	fraction Modern	±	D^{14}C (‰)	±	^{14}C age (BP)	±
6914	GJ-02-S02	GJ-02-O-07	Human bone	0.8765	0.0016	-123.5	1.6	1060	15
6483	TH-01-S04	TH-01-LT-01	Faunal bone	0.8524	0.0018	-147.6	1.8	1285	20

Table 8.13. Calibrated Age Ranges for 2019 BEAST Samples by Lot

Sample #	Lot	Context	^{14}C age (BP)	±	Calibrated age (AD/BC)	% under curve	2σ Age Range
GJ-02-S02	GJ-02-O-07	Burial GJ-B02	1060	15	AD 968–1020	93.4	AD 907–1020
GJ-02-S02	GJ-02-O-07	Burial GJ-B02	1060	15	AD 907–915	2	AD 907–1020
TH-01-S04	TH-01-LT-01	*In situ* bone cord holder pin, looters' trench, Structure B-11	1285	20	AD 669–729	58.8	AD 669–769
TH-01-S04	TH-01-LT-01	*In situ* bone cord holder pin, looters' trench, Structure B-11	1285	20	AD 736–769	36.6	AD 669–769

Table 8.14. Isotope Data for Radiocarbon Samples, 2017 through 2019 Seasons*

PSU AMS#	Sample #	Lot	Burial	Material	Fraction Modern	±	$D^{14}C$ (‰)	±	^{14}C age (BP)	±	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	%C	%N	C:N
5456	CC-15-S219	CC-15-G-14	CC-B16A	XAD amino acids	0.8095	0.0016	-190.5	1.6	1700	20	-10.4	9.3	30.3	10.8	3.27
2976	CC-15-S141	CC-15-G-14	CC-B16B	XAD amino acids	0.8066	0.0017	-193.4	1.7	1725	20	-11.1	8.2	16.0	5.8	3.22
5455	CC-15-S217	CC-15-G-14	CC-B16D	XAD amino acids	0.8053	0.0014	-194.7	1.4	1740	15	-10.8	9.2	28.7	10.3	3.26
2977	CC-15-S143	CC-15-N-04	CC-B17	XAD amino acids	0.7763	0.0020	-223.7	2.0	2035	25	-11.4	10.0	8.7	3.0	3.42
2975	CC-17-S19	CC-17-C-10	CC-B18B	XAD amino acids	0.8607	0.0018	-139.3	1.8	1205	20	-12.7	9.4	14.0	5.0	3.29
5443	CC-15-S218	CC-15-U-07	CC-B19	>30kDa gelatin	0.8009	0.0018	-199.1	1.8	1785	20	-8.9	9.8	45.7	16.1	3.31
5453	CC-15-S215	CC-15-V-15	CC-B20	XAD amino acids	0.8078	0.0014	-192.2	1.4	1715	15	-11.7	8.6	28.4	10.2	3.25
5454	CC-15-S216	CC-15-EE-06	CC-B21	XAD amino acids	0.7654	0.0016	-234.6	1.6	2145	20	-10.6	10.1	22.8	7.9	3.35
6912	CC-19-S03	CC-19-A-05	N/A	Faunal, >30kDa gelatin	0.7587	0.0014	-241.3	1.4	2220	15	-8.2	8.1	42.6	15.3	3.25

*Isotope data was not available for most bone samples from the 2019 season as of December 2019.

Table 8.15. Radiocarbon Samples from the 2022 Field Season by Lot

UGAMS#	Sample #	Context	Lot	Material	$\delta^{13}C$,‰	$\delta^{18}O$,‰	$\delta^{13}C$,‰	$\delta^{15}N$,‰	C/N	^{14}C age years, BP	±
59518	CC-06-S01	Burial CC-B05	CC-06-C-09	bone	-7.25	-5.02	-10.02	9.82	3.25	1230	20
61669	CC-10-S37	Burial CC-B10	CC-10-A-08	bone	-8	-3.44	-11.75	9.34	3.5	2330	20
59519	CC-12-S33	Burial CC-B11	CC-12-D-09	tooth	-5.35	-6.09	-18.68	11.55	4.62	2320	25
59520	CC-12-S34	Burial CC-B13	CC-12-H-13	bone	-8.33	-6.14	-18.72	10.75	4.54	1220	25
59521	CC-14-S15	Burial CC-B14	CC-14-J-04	bone	-6.58	-7.52	-10.37	8.96	3.32	1260	25
59523	CC-15-S221	Burial CC-B16C	CC-15-G-14	bone	-6.62	-6.29	-12.76	9.13	3.53	1560	20
59522	CC-16-S02a	Burial CC-B15	CC-16-L-02	bone	-5	-8.05	n/a	n/a	n/a	960	20
61672	CC-16-S02b	Burial CC-B15	CC-16-L-02	bone	-4.4	-6.28	n/a	n/a	n/a	1280	25
59524	CC-17-S20	Burical CC-B18A	CC-17-C-10	bone	-9.87	-5.42	-11.98	8.63	3.36	1680	20
61674	CC-21-S06	Collapse debris, Structure C-2	CC-21-C-06	charcoal	-27.87	n/a	n/a	n/a	n/a	1210	25
61675	CC-21-S10	Burial CC-B24	CC-21-C-07	charcoal	-26.63	n/a	n/a	n/a	n/a	1230	20
61671	CC-21-S14	Burial CC-B24	CC-21-C-07	bone	-4.35	-5.8	n/a	n/a	n/a	1250	25
61673	GJ-02-S10	Burial GJ-B03	GJ-02-AH-04	bone	-9.62	-7.32	n/a	n/a	n/a	260	20
61676	GJ-02-S09	Structure B-4 Sub2	GJ-02-AU-01	charcoal	-27.08	n/a	n/a	n/a	n/a	1440	20
59525	GJ-02-S05	Burial GJ-B01	GJ-02-N-03	bone	-7.94	-6.26	-25.41	10.5	7.61	1150	20
59526	GJ-02-S06	Burial GJ-B02	GJ-02-O-07	bone	-8.74	-5.23	-13.63	9.23	3.49	1110	20
59527	GJ-02-S08	Burial GJ-B04	GJ-02-O-09	bone	-8.49	-8.2	n/a	n/a	n/a	1350	30

Table 8.16. Calibrated Age Ranges for 2022 BEAST Samples by Lot

UGAMS#	Sample #	Context	Lot	Material	$\delta^{13}C$,‰	^{14}C age years, BP	±	Calibrated Age (AD/BC)	% under curve	2σ Age Range
59518	CC-06-S01	Burial CC-B05	CC-06-C-09	bone	-7.25	1230	20	AD 702–740	20.7	AD 702–881
								AD 772–881	74.8	
61669	CC-10-S37	Burial CC-B10	CC-10-A-08	bone	-8	2330	20	411–381 BC	95.4	411–381 BC
59519	CC-12-S33	Burial CC-B11	CC-12-D-09	tooth	-5.35	2320	25	243–235 BC	1.1	413–235 BC
								275–263 BC	2.0	
								413–361 BC	92.4	
59520	CC-12-S34	Burial CC-B13	CC-12-H-13	bone	-8.33	1220	25	AD 704–739	12.4	AD 704–885
								AD 772–885	83.1	
59521	CC-14-S15	Burial CC-B14	CC-14-J-04	bone	-6.58	1260	25	AD 670–779	80.0	AD 670–866
								AD 787–828	14.7	
								AD 860–866	0.7	
59523	CC-15-S221	Burial CC-B16C	CC-15-G-14	bone	-6.62	1560	20	AD 433–566	95.4	AD 433–566
59522	CC-16-S02a	Burial CC-B15	CC-16-L-02	bone	-5	960	20	AD 1028–1054	21.0	AD 1028–1157
								AD 1074–1157	74.5	
61672	CC-16-S02b	Burial CC-B15	CC-16-L-02	bone	-4.4	1280	25	AD 675–777	95.4	AD 675–777
59524	CC-17-S20	Burial CC-B18A	CC-17-C-10	bone	-9.87	1680	20	AD 262–277	9.2	AD 262–420
								AD 345–420	86.2	
61674	CC-21-S06	Collapse debris, Structure C-2	CC-21-C-06	charcoal	-27.87	1210	25	AD 707–727	4.9	AD 707–888
								AD 772–888	90.5	
61675	CC-21-S10	Burial CC-B24	CC-21-C-07	charcoal	-26.63	1230	20	AD 702–740	20.7	AD 702–881
								AD 772–881	74.8	
61671	CC-21-S14	Burial CC-B24	CC-21-C-07	bone	-4.35	1250	25	AD 675–779	64.6	AD 675–876
								AD 786–834	25.1	
								AD 850–876	5.7	

Table 8.16. Calibrated Age Ranges for 2022 BEAST Samples by Lot (continued)

59525	GJ-02-S05	Burial GJ-B01	GJ-02-N-03	bone	-7.94	1150	20	AD 773–787	7.3	AD 773–978
								AD 828–859	9.8	
								AD 871–978	78.3	
59526	GJ-02-S06	Burial GJ-B02	GJ-02-O-07	bone	-8.74	1110	20	AD 892–992	95.4	AD 892–992
59527	GJ-02-S08	Burial GJ-B04	GJ-02-O-09	bone	-8.49	1350	30	AD 641–705	72.1	AD 641–775
								AD 737–775	23.3	
61673	GJ-02-S10	Burial GJ-B03	GJ-02-AH-04	bone	-9.62	260	20	AD 1527–1552	12.1	AD 1527–1795
								AD 1633–1666	74.3	
								AD 1783–1795	9.0	
61676	GJ-02-S09	Structure B-4 Sub2	GJ-02-AU-01	charcoal	-27.08	1440	20	AD 594–650	95.4	AD 594–650

Table 8.17. Radiocarbon Dates from Burials Sorted by Burial Number

Season*	Burial	Sample#	Lab	Lab #	Material	^{14}C age (BP)	±
2022	CC-B05	CC-06-S01	UGAMS	59518	bone	1230	20
2022	CC-B10	CC-10-S37	UGAMS	61669	bone	2330	20
2014	CC-B11	CC-12-S17	UCIAMS	151875	charred wood	1310	25
2022	CC-B11	CC-12-S33	UGAMS	59519	tooth	2320	25
2015	CC-B12	CC-14-S04	UCIAMS	154712	bone	1220	20
2022	CC-B13	CC-12-S34	UGAMS	59520	bone	1220	25
2022	CC-B14	CC-14-S15	UGAMS	59521	bone	1260	25
2016	CC-B15	CC-16-S01	PSU	1324	charred wood	1165	35
2022	CC-B15	CC-16-S02a	UGAMS	59522	bone	960	20
2022	CC-B15	CC-16-S02b	UGAMS	61672	bone	1280	25
2018	CC-B16A	CC-15-S219	PSU	5456	XAD amino acids	1700	20
2017	CC-B16B	CC-15-S141	PSU	2976	XAD amino acids	1725	20
2022	CC-B16C	CC-15-S221	UGAMS	59523	bone	1560	20
2018	CC-B16D	CC-15-S217	PSU	5455	XAD amino acids	1740	15
2017	CC-B17	CC-15-S143	PSU	2977	XAD amino acids	2035	25
2022	CC-B18A	CC-17-S20	UGAMS	59524	bone	1680	20
2017	CC-B18B	CC-17-S19	PSU	2975	XAD amino acids	1205	20
2018	CC-B19	CC-15-S218	PSU	5443	>30kDa gelatin	1785	20
2018	CC-B20	CC-15-S215	PSU	5453	XAD amino acids	1715	15
2018	CC-B21	CC-15-S216	PSU	5454	XAD amino acids	2145	20
2019	CC-B22	CC-19-S15	PSU	6913	>30kDa gelatin	2120	15
2022	CC-B24	CC-21-S10	UGAMS	61675	charcoal	1230	20
2022	CC-B24	CC-21-S14	UGAMS	61671	bone	1250	25
2022	GJ-B01	GJ-02-S05	UGAMS	59525	bone	1150	20
2019	GJ-B02	GJ-02-S02	PSU	6914	XAD amino acids	1060	15
2022	GJ-B02	GJ-02-S06	UGAMS	59526	bone	1110	20
2022	GJ-B03	GJ-02-S10	UGAMS	61673	bone	260	20
2022	GJ-B04	GJ-02-S08	UGAMS	59527	bone	1350	30

*Season indicates when the sample was run, not when the burial was excavated.

STUDENT RESEARCH

Much of the research conducted by CCAP and BEAST supports graduate student thesis projects. Beginning with the 2012 season, seven graduate students and one undergraduate have collected thesis data through CCAP or BEAST research (Table 8.16).

Table 8.16. List of Theses Resulting from CCAP and BEAST Research

Harris, Matthew C.
2013 A Short Walk from Paradise: Initial Excavations at Kaxil Uinic. Unpublished MA thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Kelley, Krystle
2014 Establishing the Acropolis: Two Seasons of Investigations in the Upper Plaza of Chan Chich, Belize. Unpublished MA thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Vazquez, Edgar
2015 In Service of the King: The Form, Function, and Chronology of Courtyard A-3 at Chan Chich, Belize. Unpublished MA thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Booher, Ashley M.
2016 Assessing the Form and Function of the *Sacbeob* and Associated Structures at Chan Chich, Belize. Unpublished MA thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Bonorden, Alyssa Brooke
2016 Comparing Colonial Experiences in Northwestern Belize: Archaeological Evidence from Qualm Hill Camp and Kaxil Uinic Village. Unpublished MA thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Sandrock, David
2017 BEAST Mode: Two Seasons of Archaeological Survey on the Gallon Jug-Laguna Seca Property in Northwestern Belize. Unpublished MA thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Degnan, Bridgette
2018 An Evaluation of Ancient Maya Urban and Suburban Lithic Production at Late Classic Chan Chich, Belize. Unpublished honors thesis, University of Virginia, Charlottesville.

Kilgore, Gertrude B.
2018 Maya Household Identity and Domestic Activity Areas at Courtyard D-4, Chan Chich, Belize. Unpublished master's thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

REFERENCES CITED

Bonorden, Alyssa Brooke
2016 Comparing Colonial Experiences in Northwestern Belize: Archaeological Evidence from Qualm Hill Camp and Kaxil Uinic Village. Unpublished master's thesis, Department of Anthropology, Texas Tech University, Lubbock.

Bonorden, Brooke, and Brett A. Houk
2015 Navigating the Cultural Landscape of 19th-Century Belize: An Archaeological Examination of Kaxil Uinic Village. Paper presented at the 6th Annual South-Central Conference on Mesoamerica, The University of Texas at San Antonio.
2016 Archaeological Investigations at Kaxil Uinic and Qualm Hill, Two Colonial Period Sites in Northwestern Belize. *Research Reports in Belizean Archaeology* 13:337–347.
2019 Kaxil Uinic: Archaeology at a San Pedro Maya Village in Belize. In *Archaeologies of the British Empire in Latin America*, edited by Charles Orser, Jr., pp. 13–35. Springer International Publishing, Cham, Switzerland.
2022 Power and Politics on the Late Colonial Frontier of British Honduras. In *3,000 Years of War and Peace in the Maya Lowlands: Identity, Power, and Politics*, edited by Geoffrey E. Braswell, pp. 330–351. Routledge, New York.

Bonorden, Brooke, and Gertrude Kilgore
2015 Results of the 2015 Excavations at Kaxil Uinic Village. In *The 2015 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 105–144. Papers of the Chan Chich Archaeological Project, Number 10. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.
2016 Results of the 2015 Excavations at Kaxil Uinic Village. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 81–134. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Bonorden, Brooke, and Briana N. Smith
2015 Results of the 2015 Excavations at Qualm Hill Camp. In *The 2015 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 67–104. Papers of the Chan Chich Archaeological Project, Number 10. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Booher, Ashley
2016a Assessing the Form and Function of the *Sacbeob* and Associated Structures at Chan Chich, Belize. Unpublished master's thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.
2016b Results of the 2016 Norman's Temple Complex Investigations at Chan Chich. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 39–66. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Booher, Ashley, Valorie Aquino, Brooke Bonorden, and Brett A. Houk
2016 A Beginning, an Ending, and a Reoccupation: The 2016 Season of the Chan Chich Archaeological Project. Paper presented at the 14th Annual Belize Archaeology Symposium, San Ignacio, Belize.

Booher, Ashley, Alyssa Farmer, Paisley Palmer, and Valorie V. Aquino
2015 Results of the Processional Architecture Excavations at Chan Chich. In *The 2015 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 19–66. Papers of the Chan Chich Archaeological Project, Number 10. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Booher, Ashley, and Brett A. Houk
2016 Investigating Processional Architecture at Chan Chich, Belize. *Research Reports in Belizean Archaeology* 13:261–271.

Booher, Ashley, and Carolyn Nettleton
2014 Results of the Preliminary Sacbe Excavations at Chan Chich. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 91–110. Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Bristow, Lindsay W., and Philip B. Wright
1888 *Handbook of British Honduras for 1888-89, Comprising Historical, Statistical, and General Information Concerning the Colony*. William Blackwood and Sons, Edinburgh and London.

Bronk Ramsey, Christopher
2017 Methods for Summarizing Radiocarbon Datasets. *Radiocarbon* 59(2):1809–1833.

Cackler, Paul R., Stanley L. Walling, David M. Hyde, and Fred Valdez, Jr.
2007 Qualm Hill: Reconnaisance, Rediscovery, and Mapping. In *Research Reports from the Programme for Belize Archaeological Project*, edited by Fred Valdez, Jr., pp. 117–125. Occasional Papers, Number 8. Mesoamerican Archaeological Research Laboratory, The University of Texas at Austin.

Degnan, Bridgette
2018 An Evaluation of Ancient Maya Urban and Suburban Lithic Production at Late Classic Chan Chich, Belize. Unpublished honors thesis, University of Virginia, Charlottesville.

Degnan, Bridgette, and Brett A. Houk
2019 Continued Investigations at an Epicentral Lithic Workshop in the North Plaza at Chan Chich, Belize. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 67–92. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Degnan, Bridgette, Kevin A. Miller, and Brett A. Houk
2017 Archaeological Investigations at an Epicentral Lithic Workshop: Structure A-6 and the North Plaza Debitage Deposit, Chan Chich, Belize. In *The 2017 Season of the Chan*

Chich Archaeological Project, edited by Brett A. Houk and Claire Novotny, pp. 97–142. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Ford, Owen
1998 Excavations at the Ballcourt. In *The 1997 Season of the Chan Chich Archaeological Project,* edited by Brett A. Houk, pp. 53–58. Papers of the Chan Chich Archaeological Project, Number 3. Center for Maya Studies, San Antonio, Texas.

Ford, Owen, and Amy E. Rush
2000 1998 Excavations at the Western Groups. In *The 1998 and 1999 Season of the Chan Chich Archaeological Project,* edited by Brett A. Houk, pp. 41–48. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, The University of Texas at Austin.

Gallareta Cervera, Tomás, and Brett A. Houk
2019 The 2019 Investigations in the Upper Plaza at Chan Chich, Belize. In *The 2019 Seasons of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 13–48. Papers of the Chan Chich Archaeological Project, Number 14. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Gallareta Cervera, Tomás, Brett A. Houk, and Paisley Palmer
2017 The 2017 Investigations in the Upper Plaza at Chan Chich, Belize. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 33–68. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Gallareta Cervera, Tomás, Bridgette Degnan, Cora Mikolajczyk, Tyler Seale, Molly Masterson, and Rachel Naasz
2019 The 2018 Investigations in the Upper Plaza at Chan Chich, Belize. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 23–66. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Guderjan, Thomas H.
1991 Chan Chich. In *Maya Settlement in Northwestern Belize*, edited by Thomas H. Guderjan, pp. 35–50. Maya Research Program, San Antonio, Texas, and Labyrinthos, Culver City, California.

Guderjan, Thomas H., Michael Lindeman, Ellen Ruble, Froyla Salam, and Jason Yaeger
1991 Archaeological Sites in the Rio Bravo Area. In *Maya Settlement in Northwestern Belize*, edited by Thomas H. Guderjan, pp. 55–88. Maya Research Program, San Antonio, Texas, and Labyrinthos, Culver City, California.

Harris, Matthew C.
2013 A Short Walk from Paradise: Initial Excavations at the Ruins of Kaxil Uinic, Belize. Unpublished master's thesis, Department of Anthropology, Texas Tech University, Lubbock.

Harris, Matthew C., and Vincent M. Sisneros
2012 Results of the 2012 Excavations at Kaxil Uinic Ruins. In *The 2012 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 45–64. Papers of the Chan Chich Archaeological Project, Number 6. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Harrison, Ellie
2000 Structure C-6: Excavation of an Elite Compound. In *The 1998 and 1999 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 71–94. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, The University of Texas at Austin.

Harrison-Buck, Eleanor, Brett A. Houk, Adam R. Kaeding, and Brooke Bonorden
2019 The Strange Bedfellows of Northern Belize: British Colonialists, Confederate Dreamers, Creole Loggers, and the Caste War Maya Refugees of the Late Nineteenth Century. *International Journal of Historical Archaeology* 23(1):172–203.

Hartnett, Kristen M.
2005 The 2003 Excavations in Plaza A at Punta de Cacao. In *Punta de Cacao Archaeological Project: An Interim Report on the 2003 Field Season*, edited by Hubert R. Robichaux, pp. 10–35. University of the Incarnate Word, San Antonio, Texas.

Herndon, Kelsey E., Ashley Booher, and Brett A. Houk
2013 Results of Excavations at Structure A-5 at Chan Chich. In *The 2013 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 39–62. Papers of the Chan Chich Archaeological Project, Number 7. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Herndon, Kelsey E., Gregory Zaro, Brett A. Houk, Samantha Mitchell, and Erica Gallis
2014 The 2014 Excavations of the Chan Chich Dynastic Architecture Project. In *The 2014 Season of the Chan Chich Archaeological Project,* edited by Brett A. Houk, pp. 31–68. Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Herndon, Kelsey, Gregory Zaro, Brett A. Houk, David Sandrock, Edgar Vazquez, and Ashley Booher
2015 Investigating Urban Form and Kingship: Preliminary Results of the 2014 Chan Chich Archaeological Project. *Research Reports in Belizean Archaeology* 12:339–346.

Houk, Brett A.
1998 Excavations at Structure A-1. In *The 1997 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 25–30. Papers of the Chan Chich Archaeological Project, Number 3. Center for Maya Studies, San Antonio, Texas.
2000 Excavations at the Temple of the Jaguar Skull. In *The 1998 and 1999 Seasons of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 101–104. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, The University of Texas, Austin.

2012 Kaxil Uinic: A Report on Archival Investigations and Reconnaissance of the Historic Maya Village. In *The 2012 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 31–44. Papers of the Chan Chich Archaeological Project, Number 6. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

2016 An Introduction to The 2016 Season of the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 1–38. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

2017 An Introduction to the 2017 Season of the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 1–32. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

2019 An Introduction to the 2018 Season of the Chan Chich Archaeological Project and the Belize Estates Archaeological Survey Team. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 1–22. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

2020 Contextual and Compositional Comparisons of Abandonment-Related On-Floor Deposits at Chan Chich, Belize. *Ancient Mesoamerica* 31:89–98.

Houk, Brett A., Hillary Bedrosian, and Taylor McKinney

2019 Salvage Archaeology at Structure A-4 at Chan Chich. In *The 2019 Seasons of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 49–56. Papers of the Chan Chich Archaeological Project, Number 14. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Houk, Brett A., and Brooke Bonorden

2015 The Frontier Colonial Experience of the Maya at Kaxil Uinic, Belize. Paper presented at the 114th American Anthropological Association Annual Meeting, Denver, Colorado.

2020 The "Borders" of British Honduras and the San Pedro Maya of Kaxil Uinic Village. *Ancient Mesoamerica* 31:554–565.

Houk, Brett A., Bonorden, Brooke, and Gertrude Kilgore

2022 Living on the Edge: Kaxil Uinic Village and the San Pedro Maya in Belize. In *Coloniality in the Maya Lowlands: Archaeological Perspectives*, edited by Kasey Diserens Morgan and Tiffany C. Cain, pp. 147–170. University Press of Colorado, Boulder.

Houk, Brett A., and Ashley Booher

2020 All the World's a Stage: The Late Classic Built Environment of Chan Chich, Belize. In *Approaches to Monumental Landscapes of the Ancient Maya*, edited by Brett A. Houk, Barbara Arroyo, and Terry G. Powis, pp. 152–170. University Press of Florida, Gainesville.

Houk, Brett A., Ashley Booher, and Brooke Bonorden
2015 Ritual Studies and BEASTly Activities at Chan Chich, Qualm Hill, and Kaxil Uinic: The 2015 Season. Paper presented at the 13th Annual Belize Archaeology Symposium, San Ignacio, Belize.

Houk, Brett A., Matthew C. Harris, and Krystle Kelley
2012 Return to Paradise: Renewed Investigations at Chan Chich, Belize. Paper presented at the 10th Annual Belize Archaeology Symposium, San Ignacio, Belize.

Houk, Brett A., Matthew C. Harris, Krystle Kelley, and Vincent M. Sisneros
2013 The 2012 Investigations at Chan Chich and Kaxil Uinic. *Research Reports in Belizean Archaeology* 10:179–186.

Houk, Brett A., Hubert R. Robichaux, and Fred Valdez, Jr.
2010 An Early Royal Maya Tomb from Chan Chich, Belize. *Ancient Mesoamerica* 21:229–248.

Houk, Brett A., Mark D. Willis, and Gregory Zaro
2017 Two Newly Recorded Sites in Northwestern Belize: Sak Mut and Xma Ha Ak'al. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 191–202. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Houk, Brett A., and Gregory Zaro
2015 Lithic Production and Domestic Economy in an Ancient Maya Neighborhood at Chan Chich, Belize. *Research Reports in Belizean Archaeology* 12:127–134.

Houk, Brett A., Gregory Zaro, and Mark D. Willis
2020 Tikin Ha and Ancient Maya City Planning in the Eastern Three Rivers Adaptive Region. *Research Reports in Belizean Archaeology* 17:93–104.

Houk, Brett A., Gregory Zaro, Mark D. Willis, Julia Kleine, Briana Smith, Bridgette Degnan, and Rafael Guerra
2019 Initial Report on Tikin Ha and its Implications for Ancient Maya Political Organization in the Three Rivers Adaptive Region. In *The 2019 Seasons of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 93–142. Papers of the Chan Chich Archaeological Project, Number 14. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Kelley, Krystle
2014 Establishing the Acropolis: Two Seasons of Investigations in the Upper Plaza of Chan Chich, Belize. Unpublished master's thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Kelley, Krystle, Rose Leach, and Erica Gallis
2013 Under the Surface: Excavations in the Upper Plaza at Chan Chich. In *The 2013 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 15–26. Papers of the

Chan Chich Archaeological Project, Number 7. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Kelley, Krystle, Kevin A. Miller, and Ashley Booher
2012 Chan Chich: 2012 Investigations of the Upper Plaza. In *The 2012 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 19–30. Papers of the Chan Chich Archaeological Project, Number 6. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Kilgore, Gertrude B.
2018 Maya Household Identity and Domestic Activity Areas at Courtyard D-4, Chan Chich, Belize. Unpublished master's thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Kilgore, Gertrude, Claire Novotny, Alyssa Farmer, and Rebecca Schultz
2017 Results of the 2017 Excavations at Courtyard D-4, Chan Chich, Belize. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 69–96. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Meadows, Richard
1998 Test Pit Program in Group C. In *The 1997 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 59–66. Papers of the Chan Chich Archaeological Project, Number 3. Center for Maya Studies, San Antonio, Texas.

Meadows, Richard K., and Kristen M. Hartnett
2000 Archaeological Excavations at Group H: Investigating Craft Production and Domestic Architecture at Chan Chich, Belize. In *The 1998 and 1999 Seasons of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 15–40. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, The University of Texas at Austin.

Mitchell, Samantha, and Ashley Booher
2015 Digitization to Realization: The Utilization of Structure from Motion, ESRI ArcScene, and 3D printing to Identify Taphonomic Processes and Digitally Preserve Burial CC-B14. In *The 2015 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 163–174. Papers of the Chan Chich Archaeological Project, Number 10. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Anna C., Ashley Booher, and Samantha Mitchell
2015 Bioarchaeological Analysis of Human Skeletal Remains from Chan Chich, Belize. In *The 2015 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 145–162. Papers of the Chan Chich Archaeological Project, Number 10. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Anna, Ashley Booher, and Valorie V. Aquino
2016 Bioarchaeological Analysis of Human Skeletons from Chan Chich, Belize: The 2016 Field Season. In *The 2016 Season of the Chan Chich Archaeological Project*, edited by Brett A.

Houk, pp. 67–80. Papers of the Chan Chich Archaeological Project, Number 11. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Anna, Tomás Gallareta Cervera, Briana Smith, and Gertrude Kilgore
2017 Bioarchaeological Analysis of Human Skeletons from Chan Chich, Belize: The 2017 Field Season. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 143–156. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Anna, Hannah Hughes, and Tomás Gallareta Cervera
2019 Bioarchaeological Analysis of Human Skeletal Remains from Chan Chich, Belize: The 2018 Field Season. In *The 2018 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 93–102. Papers of the Chan Chich Archaeological Project, Number 13. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Anna, Leann Castillo, Tomás Gallareta Cervera, Brett A. Houk, and Claire Novotny
2022 Nobody Puts Grandma in the Corner: An Osteobiography of an Elite Female from Chan Chich, Belize. Paper presented at the 18th Belize Archaeology Symposium, San Ignacio, Belize.

Novotny, Claire, Amy Copper, and Anna C. Novotny
2019 Results of the 2019 BEAST Season at Gallon Jug, Belize. In *The 2019 Seasons of the Belize Estates Archaeological Survey Team*, edited by Brett A. Houk, pp. 57–92. Papers of the Chan Chich Archaeological Project, Number 14. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Novotny, Claire, and Brett A. Houk
2021 Ancient Maya Patolli from Gallon Jug, Belize. *Latin American Antiquity* doi:10.1017/laq.2021.11.

Phillips, Lori, and David Sandrock
2014 Preliminary Analysis of Historic Bottles from Qualm Hill Camp. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 131–135. Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Reimer, Paula J., William E. N. Austin, Edouard Bard, Alex Bayliss, Paul G. Blackwell, Christopher Bronk Ramsey, Martin Butzin, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M. Grootes, Thomas P. Guilderson, Irka Hajdas, Timothy J. Heaton, Alan G. Hogg, Konrad A Hughen, Bernd Kromer, Sturt W. Manning, Raimund Muscheler, Jonathan G. Palmer, Charlotte Pearson, Johannes van der Plicht, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Christian S. M. Turney, Lukas Wacker, Florian Adolphi, Ulf Büntgen, Manuela Capano, Simon M Fahrni, Alexandra Fogtmann-Schulz, Ronny Friedrich, Peter Köhler, Sabrina Kudsk, Fusa Miyake, Jesper Olsen, Frederick Reinig, Minoru Sakamoto, Adam Sookdeo, and Sahra Talamo
2020 The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon* 62(4):725–757.

Reimer, Paula J., Edouard Bard, Alex Bayliss, J. Warren Beck, Paul G. Blackwell, Christopher Bronk Ramsey, Caitlin E. Buck, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M. Grootes, Thomas P. Guilderson, Haflidi Haflidason, Irka Hajdas, Christine Hatté, Timothy J. Heaton, Dirk L. Hoffmann, Alan G. Hogg, Konrad A. Hughen, K. Felix Kaiser, Bernd Kromer, Sturt W. Manning, Mu Niu, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Richard A. Staff, Christian S. M. Turney, and Johannes van der Plicht

2013 IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP. *Radiocarbon* 55(4):1869–1887.

Robichaux, Hubert R.

1998 Excavations at the Upper Plaza. In *The 1997 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 31–52. Papers of the Chan Chich Archaeological Project, Number 3. Center for Maya Studies, San Antonio.

2000 Looking Down On The Public: 1999 Excavations on the Upper Plaza. In *The 1998 and 1999 Seasons of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 57–70. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, The University of Texas, Austin.

2004 Archaeological Research at the Punta de Cacao ruins in Northwestern Belize: Community Analysis Using the Multi-Nuclei Model of Geography. *Research Reports in Belizean Archaeology* 1:197–209.

Robichaux, Hubert R., Jennifer Jellen, Alexandra Miller, and Jennifer Vander Galien

2000 Report on the 1998 Excavations on the Upper Plaza. In *The 1998 and 1999 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 49–56. Papers of the Chan Chich Archaeological Project, Number 4. Mesoamerican Archaeological Research Laboratory, The University of Texas at Austin.

Sandrock, David

2013 Preliminary Results of the 2013 Gallon Jug and Laguna Seca Survey and Reconnaissance. In *The 2013 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 63–80. Papers of the Chan Chich Archaeological Project, Number 7. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Sandrock, David, and Mark D. Willis

2014 Results of the 2014 Field Season of the Belize Estates Archaeological Survey Team. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 111–129. Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Thompson, J. Eric S.

1939 *Excavations at San José, British Honduras*. Publication 506. Carnegie Institution of Washington, D. C.

1963 *Maya Archaeologist*. University of Oklahoma Press, Norman.

Vazquez, Edgar
2014 In Service of the King: The Form, Function, and Chronology of Courtyard A-3 at Chan Chich, Belize. Unpublished master's thesis, Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Vazquez, Edgar, Ashley Booher, and Brett A. Houk
2014 Results of Excavations at the Back Plaza (Courtyard A-3) at Chan Chich. In *The 2014 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk, pp. 69–89. Papers of the Chan Chich Archaeological Project, Number 8. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.

Willis, Mark D., Julia Kleine, Marcus Schwimmer, Paul Schwimmer, and Chet Walker
2017 Mapping at Chan Chich. In *The 2017 Season of the Chan Chich Archaeological Project*, edited by Brett A. Houk and Claire Novotny, pp. 157–166. Papers of the Chan Chich Archaeological Project, Number 12. Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock.