Report on the Third Field Season of the Rio Frio Regional Archaeological Project (RiFRAP) (June-July 2022, January 2023)

Edited by: Jon Spenard Ph.D.

Occasional Paper No. 3
Department of Anthropology
California State University San Marcos
San Marcos, CA

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Chapter 1: Introduction and Summary of the Third Field and Lab Season of the Rio Frio Regional Archaeological Project

Jon Spenard
(California State University San Marcos)

Mike Mirro
(PaleoWest Archaeology)

From 12 June to 7 July 2022, the Rio Frio Regional Archaeological Project (RiFRAP) conducted its third season of investigations in the Mountain Pine Ridge Forest Reserve (**Figure 1**). Those investigations were supplemented by short lab and field seasons running simultaneously from 7 January through 21 January 2023. The chapters in this report detail those investigations, incorporating the results of that latter short season. The goals of the two seasons were to commence investigations on the ancient Maya monumental site of Nohoch Batsó that we recorded at the end of June 2019 (Spenard et al. 2020), and to process the backlog of recovered artifacts from our 2018 and 2019 field seasons that the COVID-19 pandemic prevented us from completing earlier. Located in the Rio Frio valley between Rio Frio Caves C and E, Nohoch Batsó is just the second ancient Maya site ever recorded in the Mountain Pine Ridge Forest Reserve, and with our work there over the two seasons reported here, it is the first to be systematically investigated. We had also planned to continue investigations into the potential pre-ceramic period use of Domingo Ruiz cave. Unfortunately, the road to it was impassable during both trips. Nevertheless, analysis was conducted on a selection of faunal remains exported from that cavern. The results of that study are given by Sasson and Spenard in this report. Other project-related activities occurred during 2022 that also are reported in this volume. In April 2022, a 37 km^2 section of the RiFRAP concession area was surveyed by aerial lidar as part of the National Center for Airborne Laser Mapping's (NCALM) Belize 2022 Collaborative LiDAR Campaign. Additionally, results of radiocarbon assays from Rio Frio Cave A and Domingo Ruiz Cave were received from BetaAnalytic lab.

Project staff included PI, Dr. Jon Spenard, and co-director Mr. Michael Mirro, M.A.. Foreign field crew consisted of Dr. Konane Martinez, Mr. Andres Berdeja, Mr. Franklin Quiroz, Ms. Mikaela Weber, Mr. Adam Niesely, Ms. Alisha Pico, Ms. Alyssa Ransom, Ms. Lorrie Gregory, and Mr. Joe Gravino. Local project foreman was Mr. Javier Mai, and other local staff included Mr. Antonio Mai, Mr. Moses Flores, Mr. Eric Mai, Mr. Javier Mai Jr, Mr, Mr. Asmid Mai, Mr. Ronald Mai, Mr. Luis Mai, Ms. Clemencia Mai, and Ms. Mirna Mai.

June-July Field Season Objectives

1) To conduct survey and preliminary test excavations at Nohoch Batsó to determine the extent of the site core and establish its chronology.
2) Survey Domingo Ruiz Cave and conduct excavations to understand the possible pre-ceramic use of it.

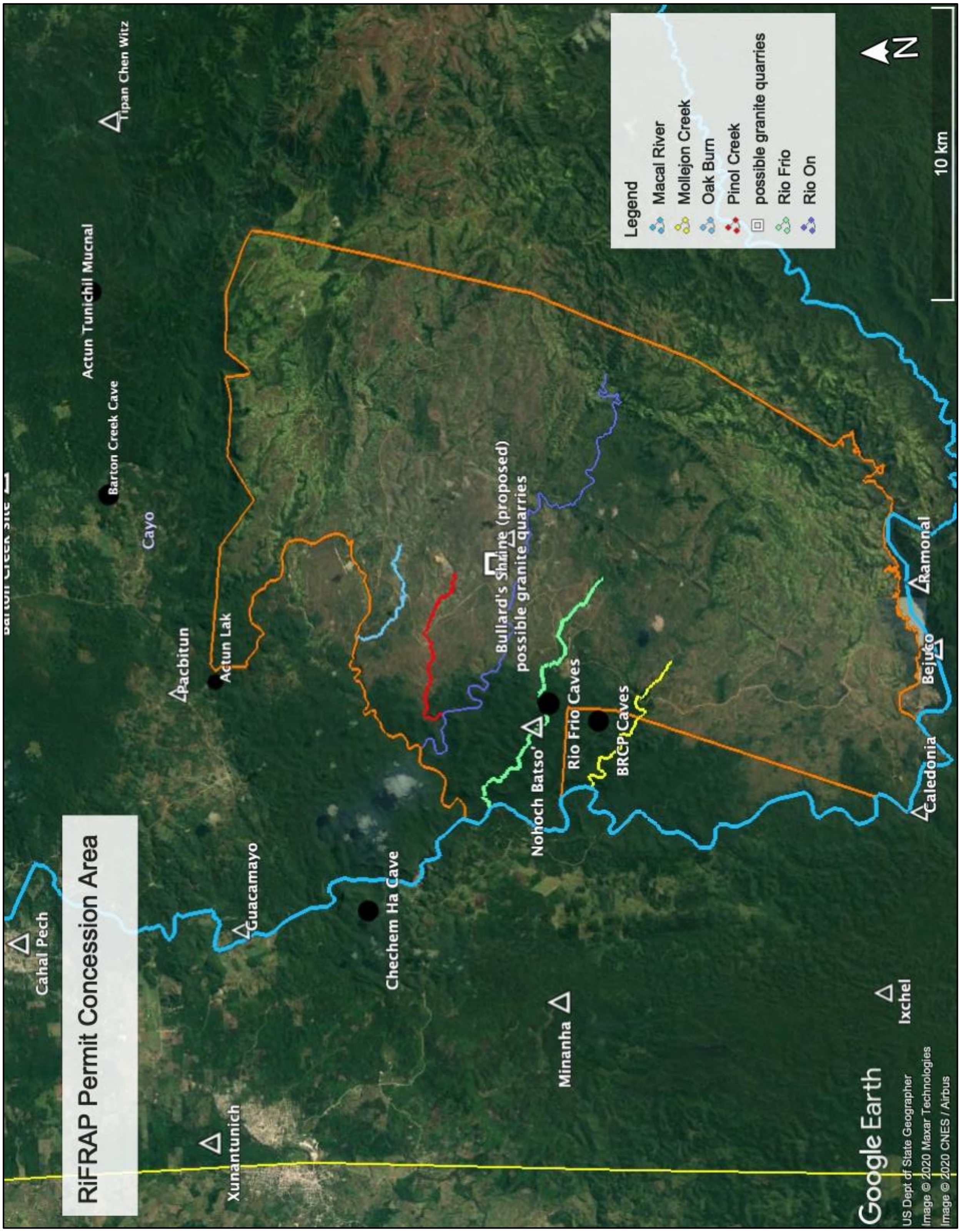

Figure 1. Satellite image showing RiFRAP permit concession area and other known pre-Hispanic Maya archaeological sites in the region. Orange polygon is the permit boundaries, triangles are Maya settlements, and solid circles are caverns.

A brief discussion of the results of the June-July 2022 season is to contextualize the January mini-season objectives. A more comprehensive summary is presented below and in the chapters that follow. Our investigations at Nohoch Batsó focused on Plaza 1 due to the presence of a stela and a looter's trench dug into the back of Structure 1. We hoped to encounter a dedicatory cache below the monument, and to clean the looter's trench to understand the construction sequence, all to begin establishing the site's chronology. Due to time constraints and periods of unfavorable weather that did not permit safe access to the site, our stela excavations were terminated when reaching a partially intact plaster floor. On days we could not reach the site, we conducted pedestrian survey on the Mountain Pine Ridge, focusing on the Pinol Sands area. While there, Mr. Javier Mai from San Antonio, Cayo informed us that he knew of several mounds nearby that turned out to be a multi-component, industrial-scale, ancient Maya granitic rock quarry and ground stone implement workshop site. We have named this site the Buffalo Hill Quarries and an initial report of it by Mirro and colleagues is included in this volume. Additionally, a portion of the project's permit area was included in the 2022 NCALM Belize aerial LiDAR survey. Although the final data are still being processed, preliminary results revealed another sizeable plaza to the north of the site core, a pyramid, and small platform with four structures on its corners. Both the pyramid and platform are on a hilltop above the newly identified plaza.

January Season Objectives

1) Process, inventory, conduct preliminary analysis, illustrate, and 3D model artifacts collected during the 2018 and 2019 field seasons.
2) Continue excavations in Nohoch Batsó Plaza 1 that were unable to be completed in June-July season.
3) Ground truth a possible plaza and hilltop pyramid complex at Nohoch Batsó as revealed through recently acquired LiDAR data from NCALM's 2022 Belize campaign.
4) Continue survey of the Buffalo Hill Quarries.

Overview of Results

This section provides an executive summary of the activities and overall findings of the June-July 2022 and January 2023 field and lab seasons.

Nohoch Batsó

Both the summer and January seasons were primarily dedicated to surveying and conducting preliminary investigations at Nohoch Batsó. The work was accomplished by three teams working simultaneously. One team conducted GNSS-aided survey of the site core. Another conducted excavations in front of Stela 1 to search for a cache affiliated with the monument. The third team cleaned and refilled the looter's trench on the back (east) side of Structure 1. In the process, they screened all removed back dirt for discarded artifacts. Each of these activities is discussed separately in the chapters that follow.

When setting up a screening station for the Stela 1 unit, we uncovered a second stela in the south corner of Plaza 1. Like Stela 1, it is made from phyllite and is uncarved. The two monuments flank the front staircase of Structure 1, an arrangement that suggested a third stela might be found at the building's centerline. An exploratory horizontal trench was excavated in the January season to test that hypothesis. A cut granitic rock block was uncovered near the expected position, but not in situ. It remains unclear if it is a snapped stela top or if it was a construction block. Nonetheless, the top of a structure centerline cache or capped burial was uncovered. Time did not permit its excavation and it was left undisturbed for future field seasonss. Though we did not excavate it, it clearly cut through an intact plaster floor, suggesting it accompanied the terminal construction phase of the plaza. A cache of six miniature vessels had been placed atop the cache capstones. The vessels are pinch pots that resemble the Late Classic period "finger pots" commonly found at Caracol (Chase and Chase 1998). Those vessels were removed, although most were incomplete.

The stela excavations and looter trench cleaning operations were variably successful. The Stela 1 excavations encountered a partially intact plaster floor during the summer session. Excavations were halted at then because no cache had been uncovered. The unit was reopened in January 2023 during which time excavations proceeded through the plaster floor. Several layers of fill were encountered below but no other floors nor a cache were encountered. The fill appears to sit on a culturally sterile clayey paleosol. Time did not permit continuing the excavation to bedrock. Classification of the recovered artifactual material is ongoing, although most recovered ceramics appear to stylistically date to the Late and Terminal Classic periods. Several dense pockets of charcoal were encountered in the fill layers below the floor. They and the matrix surrounding them were collected for future radiocarbon dating and paleoethnobotanical analyses.

Looter trench cleaning operations involved screening back dirt piles to recover all artifacts left behind by the previous illicit excavators. We attempted to recover those objects to aid in helping to determine the structure's chronology and understand its use. Once the back dirt was completely removed from the trench, the walls of the excavation were scraped to reveal the underlying intact architecture that the previous excavation exposed. The trench cut through the architecture at an oblique angle making it difficult to identify the number of construction phases although at least three major ones appear likely. Artifacts recovered from the back dirt are still undergoing analysis, although several unslipped applique pieces were recovered. Those pieces are stylistically similar to the "face cache" vessels commonly recovered from Late Classic period contexts at the site of Caracol (Chase and Chase 1998) suggesting a similar date for the structure. No charcoal was collected during the operation due to the disturbed context.

Mapping was accomplished using a pole mounted SXBlue Platinum Global Navigation Satellite System (GNSS) receiver with Atlas H50 RTK correction capable of real-time sub-30 cm location solutions with data collected on an iPad running the Collector application. Due to field conditions discussed in more depth below, time constraints, and with the understanding that the NCALM LiDAR data would be available for future survey activities, our focus was on formally mapping components of the site core identified during the two 2019 visits (Spenard and Mirro 2020; Spenard et al. 2020). **Figure 2** is the completed map of the Rio Frio Valley. **Figure 3** is a

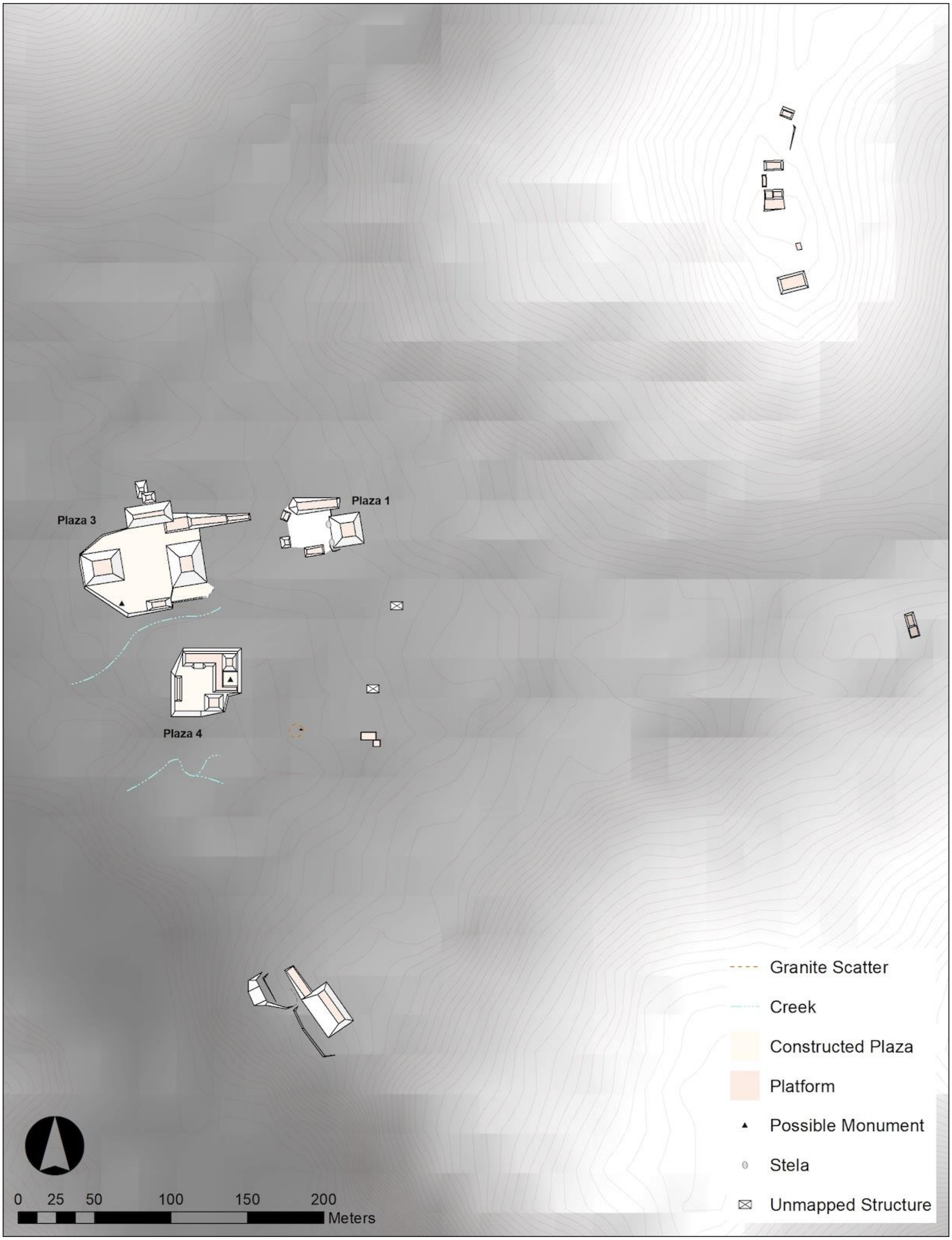

Figure 2. Map of Nohoch Batsó and known periphery settlement prior to LiDAR survey (map by M. Mirro).

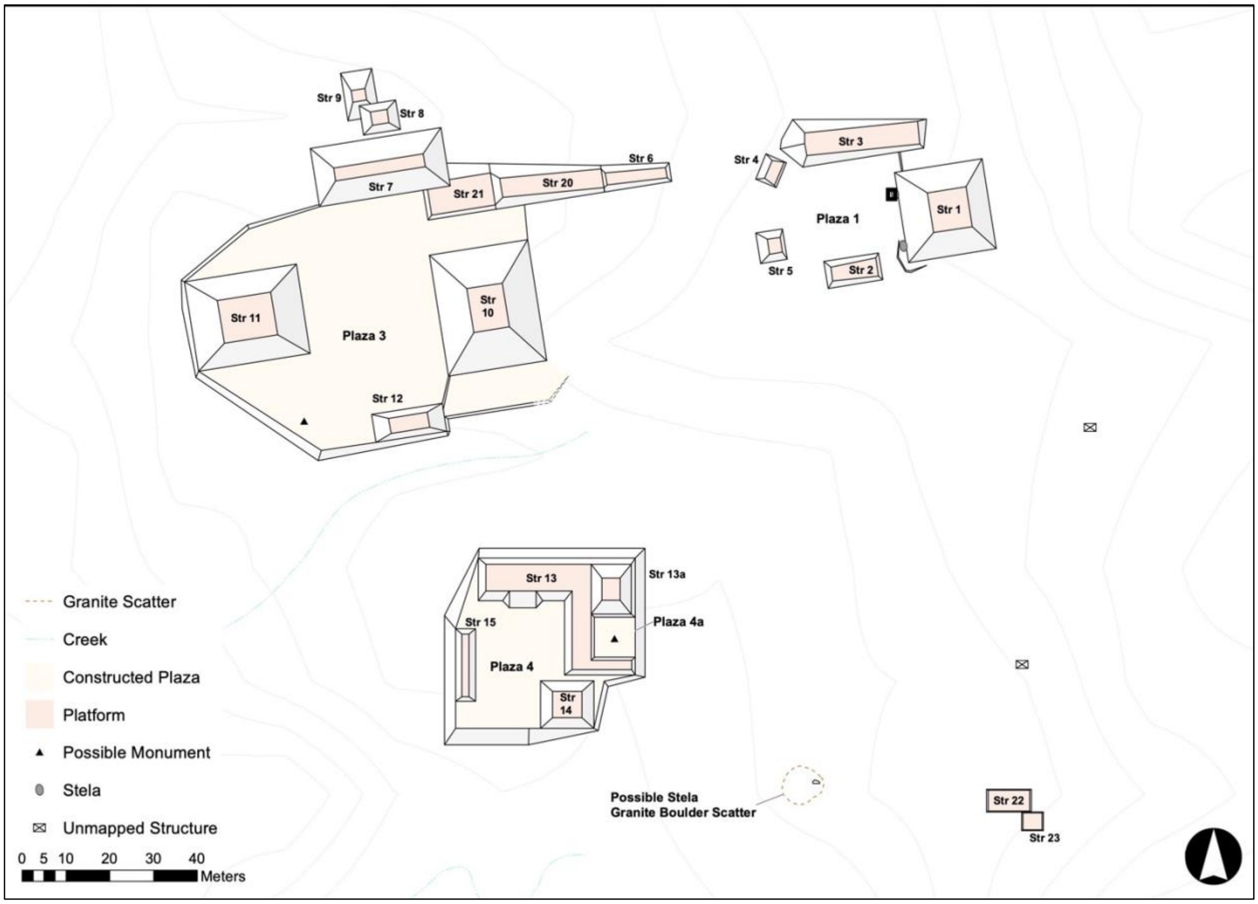

Figure 3. Map of Nohoch Batsó site core (map by M. Mirro).

detailed map of the site core. As discussed in more detail below, the NCALM survey revealed another monumental plaza, "Plaza 5" 200 m northwest of Plaza 3, the main plaza of the site. It was confirmed in December, but remains unmapped.

Buffalo Hill Quarries (MPR-2022-02)

Impassable roads and trails were an on-going barrier to our planned work during the summer session. The Caracol-Chiquibul road was under construction, and, in places, the roadway was being raised with clay fill. Heavy rains that fell throughout the summer field season made the road too slick at times to summit hilly areas. Moreover, that weather also resulted in the Rio Frio swelling, making crossing it to get to Nohoch Batsó hazardous. During those times, we conducted pedestrian survey near Pinol Sands. That area was chosen because we had previously surveyed nearby ridge tops where we recorded concentrations of lithic debitage (Mirro and Spenard 2020). Furthermore, local project foreman Mr. Javier Mai reported knowing of some mounds in the area.

The mounds were not part of a Maya settlement, instead, they were piles of conchoidal fractured granitic rock flakes, some–piles not flakes–were up to 2 m tall, and they surrounded numerous bedrock outcrops and excavated pits in the ground. Throughout the debitage piles we noted hammerstones, mano, metate, and other ground stone implement preforms, and other classes of artifacts indicating the mounds were, in fact, ancient Maya sites. The dark patination on and bulbous character of the many outcrops at the site are said to resemble a herd of buffalo when seen from across the valley. For that reason, we have named the site the Buffalo Hill Quarries.

To date, we have only begun to map the site and plan to begin intensive investigations of it during the summer 2023 season. A total of 16 hectares have been mapped currently, but time and other pressing research priorities prevented full documentation of the site. Furthermore, recently received aerial LiDAR data discussed below suggests the site may be up to four times its current known extent. Additionally, RiFRAP foreman Mai has reported other areas of similar mounds elsewhere in the Mountain Pine Ridge, suggesting that the Buffalo Hill Quarries are one of just several such sites in the reserve.

Belize 2022 Collaborative LiDAR Campaign

In April 2022, the National Center for Airborne Laser Mapping surveyed 37 km^2 of the RiFRAP permit area as part of their 2022 Belize Collaborative LiDAR Campaign. Data are still being analyzed, although Spenard presents several preliminary observations in this report. Among them are an additional plaza in the Nohoch Batsó site core, extensive residential areas on the surrounding hilltops, agricultural terracing, possible defensive features, rural shrines, additional quarry areas, settlement associated with the quarrying, and dozens of possible cave openings.

Laboratory Studies of Exported Materials from Rio Frio Cave A and Domingo Ruiz Cave

At the end of the summer season charcoal samples from Rio Frio Cave A and Domingo Ruiz Cave were exported for radiocarbon and paleoethnobotanical analysis. Among the exported samples from Rio Frio Cave A were immature corn cobs and carbonized remains from unidentified species recovered from excavations in the rock shelter entrance. The charcoal from Domingo Ruiz Cave was recovered from a buried pit below a surface ash deposit near the midpoint of the cave. The pit intruded into an orange-color matrix that is often assumed to predate the Maya. At the bottom of the pit were several polished animal bone fragments that appeared to have cut marks on them. That faunal material were exported and delivered to Dr. Aaron Sasson of the San Diego Natural History Museum for zooarchaeological analysis. Four pieces of charcoal were sent to BetaAnalytic Laboratories in Miama, FL for radiocarbon dating. Three of the charcoal samples were from Rio Frio Cave A, two of which were immature corn cobs. The fourth sample was one of the charcoal pieces recovered from the pit in Domingo Ruiz Cave.

The faunal bone and charcoal from Domingo Ruiz Cave were studied because their recovery context suggested they may have provided evidence of pre-ceramic period use of the cavern. The results of the zooarchaeological analysis were inconclusive. The bones were polished, but the nature of the polish was inconclusive. It may have been through human action or digestion. Furthermore, the damage tentatively identified as cutmarks was likely carnivore gnawing although human modification could not be ruled out. The results of the radiocarbon dating were similarly disappointing as it suggests a date range between 1680-1940 cal AD, in other words, modern.

The dates from Rio Frio Cave A were more expected. One of the immature corn cobs dates to the early part of the Late Classic period, 545-642 cal AD. That date is in line with the styles of ceramics identified at the site to date. The other two dates were much more surprising, revealing a Late Preclassic period use of that area of the cavern. The date ranges are 158 cal BC- 55 cal AD and 196 cal BC- 4 cal AD. Both samples were recovered from below an undisturbed tamped earth or eroded plaster floor. Excavations of the unit were halted before reaching culturally sterile matrix or bedrock due to time constraints.

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Chapter 2: Nohoch Batsó Plaza 1 Investigations

Jon Spenard
(California State University San Marcos)

Nohoch Batsó Plaza 1 (hereafter "Plaza 1") was the primary focus of investigations during the June-July 2022 and January 2023 seasons. As these activities were our first investigations at the site, they were probatory in nature, aimed at establishing a baseline chronology, and to study the construction sequence of the plaza. We chose Plaza 1 for these initial investigations because it held the then only known monument, suggesting a dateable dedicatory cache should be present below it. Furthermore, Structure 1, the eastern structure in the plaza, had a sizeable looter's trench in it cutting through several phases of architecture. Our operations involving the cleaning of that illicit excavation are discussed more fully by Berdeja and Spenard in the following chapter of this report. We placed two excavation units in the plaza, 22–NOH–PLZ1–STL1–EU01, the "Stela Unit," and 23–NOH–PLZ1–EU01, the "Centerline Unit" (**Figure 1**). The goal of the former was uncovering the presumed dedicatory cache and charcoal that could be used to provide a radiometric anchor for the site's chronology. Unfortunately, neither was recovered. The decision to place the Centerline Unit was made after another stela, Stela 2, was uncovered in the southeastern side of Plaza 1 in a position that suggested it and Stela 1 were a pair that flanked an outset staircase of the structure. In consideration of the past Maya preference for symmetry and centerline monuments, the Centerline Unit was established to determine if a third monument was present in the plaza. The likely top of a third toppled monument, tentatively labeled Stela 3, was uncovered as well as a cache of six miniature vessels resembling "finger cache" bowls placed on top of a covered architectural box that is likely a tomb.

22–NOH–PLZ1–STL1–EU01: The "Stela Unit"

As its nickname suggests, the "Stela Unit," (22-NOH-PLZ1-STL1-EU01) was established to probe in front of Stela 1 with the aim of uncovering its dedicatory cache if one was present. Click here[1] to see a 3D model of the monument. The pit measured 2 m x 2 m and was aligned to the cardinal directions, approximating the alignment of the plaza. Seven levels were excavated to culturally sterile matrix, presumed to be a paleosol predating the site. It reached a final depth of 138 cm below surface. A sub-unit excavated in the southeast corner of the unit reached 160 cm below surface. It uncovered another culturally sterile likely paleosol. The in-situ stela base was included in the excavated area to locate the bottom of the monument while digging (**Figure 2**).

Excavations uncovered three plaza floors labeled Floor 1 through 3 in order they were revealed (**Figure 3)**. That sequence aligns with the construction phases identified in the Structure 1 looter's trench discussed by Berdeja and Spenard in this report. Floor 1 is 15 cm below current ground surface and represents the terminal phase of construction. The top of Stela 1 was found to be laying on it, a position suggesting that the monument was broken as part of a termination event when the site was abandoned. Floor 2, the penultimate phase of the plaza is 30 cm below current

[1] https://tinyurl.com/a4cbvbzj

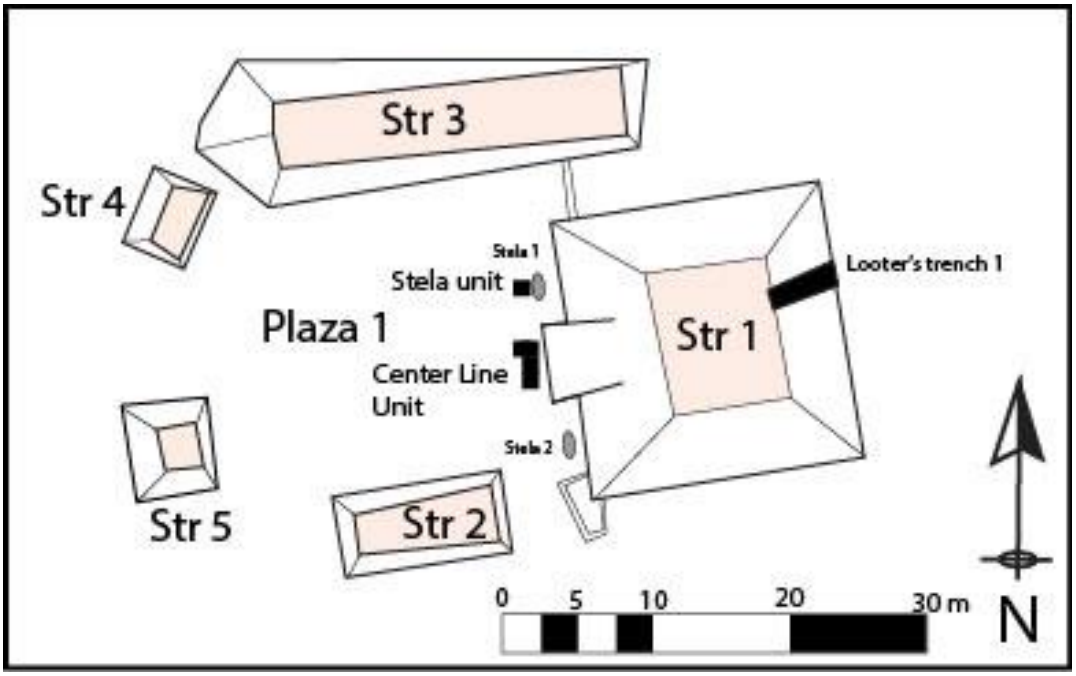

Figure 1. Map of Nohoch Batsó Plaza 1 showing location of units and monuments. Note that the excavation units are slightly exaggerated to depict their location clearly.

Figure 2. Image of the Stela Unit prior to start of excavation. Note that the top of the monument is in-situ. It was moved outside the bounds of the pit to facilitate excavation. Photo by J. Spenard.

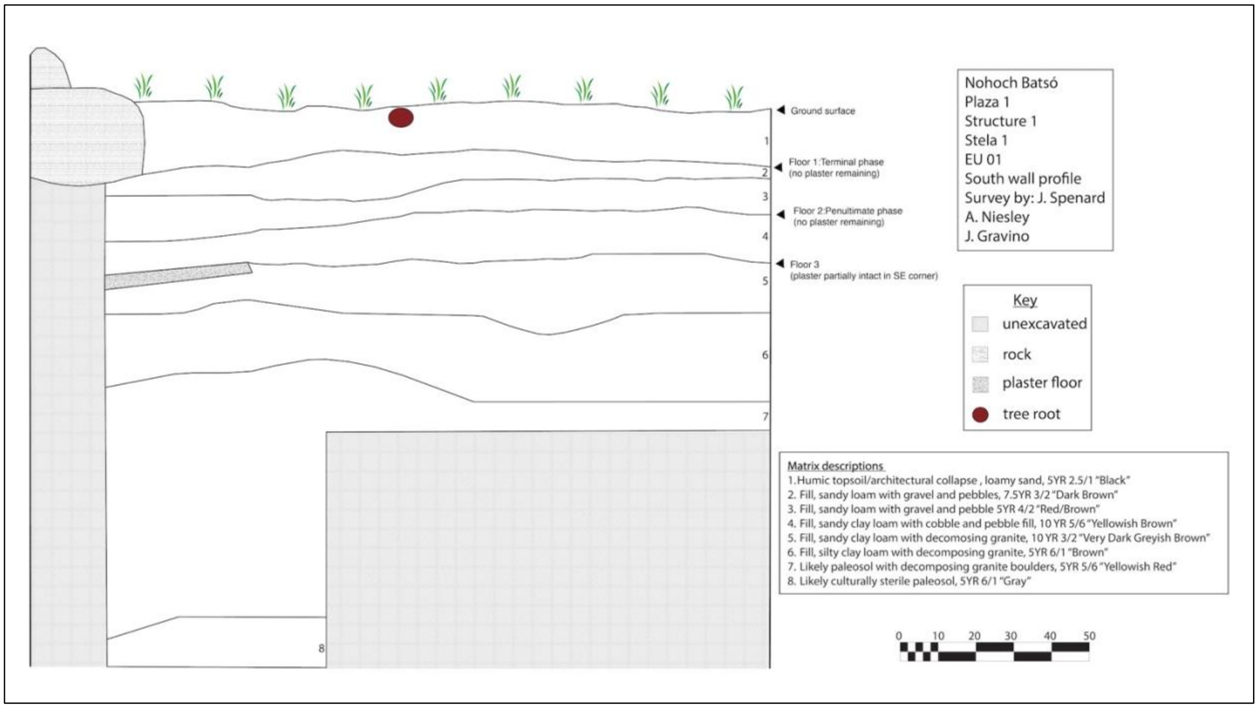

Figure 3. Profile of Stela Unit 1 south wall.

ground surface. Neither floor is intact. They were identified by plaster pebbles at the interface of matrix changes.

In the west side of the unit and at the same level as Floor 2, we encountered a round feature with much softer soil than the surrounding matrix. It continued for a depth of approximately 50 cm before terminating. Its walls were compact and harder than the interior suggesting it was a pit. Though not immediately adjacent to the stela, it was positioned near its centerline, indicating it may be a posthole. Further strengthening that hypothesis is the comparatively few artifacts recovered in it compared to the other layers in the unit. Only four sherds were uncovered whereas hundreds were collected from the surrounding levels. Averaging 40 cm in diameter, the single hole would have held a sizeable post rather than a scaffolding or ritual table. One interpretation of the feature is that the pole erected there was used for banner raising ceremonies performed in the plaza (Reese-Taylor and Koontz 2001). Future excavations of other monuments in the plaza should test for similar features associated with them.

Floor 3 is 40 cm below the current ground surface and appears to represent the earliest construction phase in the plaza. It also is the only level to retain some of the original plaster of its plaza floor. The plaster, up to 4 cm thick, occupies the entire eastern side of the unit, protruding out some 30 cm in front of the stela at which point it abruptly ends (**Figure 4**). The fill layers below remain undisturbed suggesting that the plaster floor disintegrated through natural processes rather than being intentionally broken up. The plaster floor has a downward slope as it approaches the foundations of Structure 1, likely an engineering design used to control water (Scarborough 2003). Whether water was simply channeled off or collected remains uncertain. Addressing that

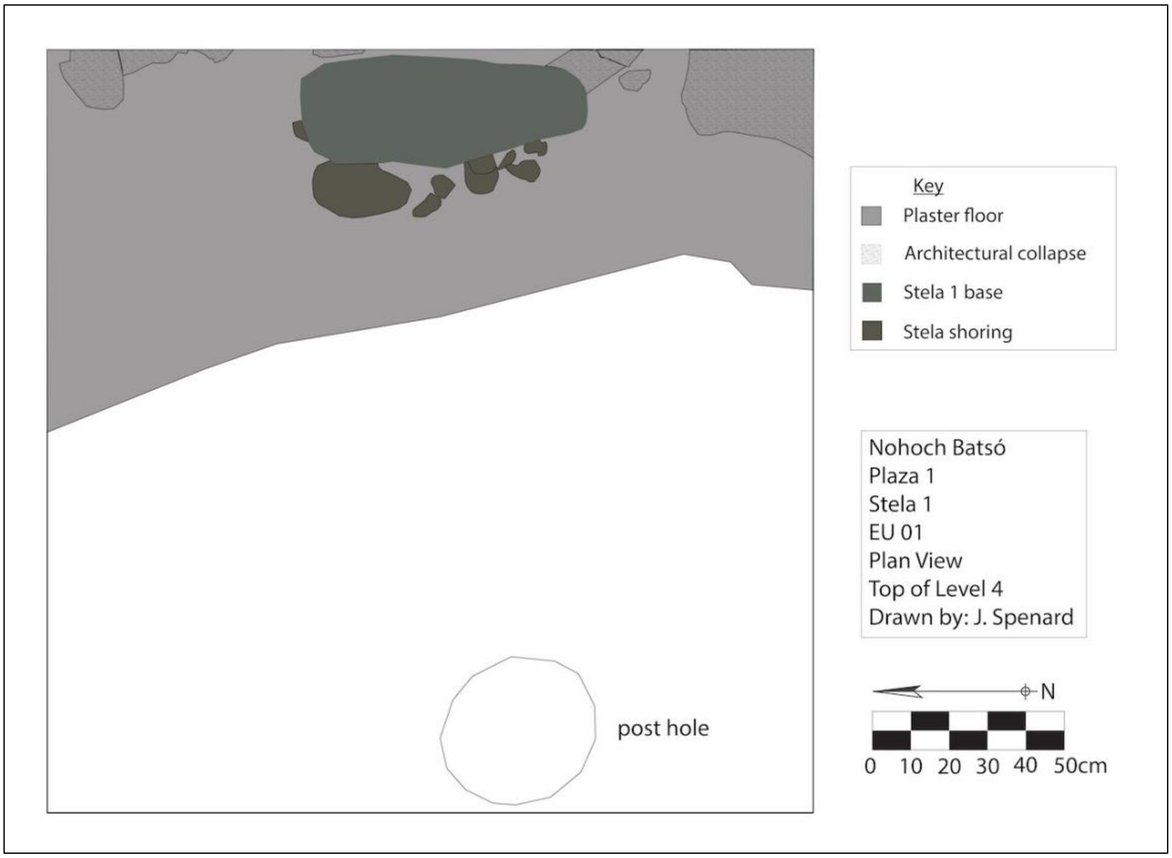

Figure 4. Plan view of the Stela Unit showing location of Stela 1 base and extent of the partially intact plaster of Floor 3.

question will require future studies that expose more of the plaster floor and the water management strategies used in the plaza.

Below Floor 3 are two fill layers of brown clayey matrix mixed with decomposing granite rocks (**Figure 5**). The top of the fill layer directly below the plaster floor may have been tamped, but only a small portion of it was exposed in a corner of the unit making a definitive assessment difficult. The origins of the fill soils are uncertain, but the presence of granite suggests they may have been collected from the bottom of the Rio Frio where that watercourse cuts to the contact point below the limestone. The two layers of fill are placed on top of what current evidence suggests is the native bottom soils of the valley, a sticky gray clay with extensive red and yellow mottling. Small decomposing granite boulders were intermixed in the matrix, but they were few. In the southwest sub-unit, the mottled clay transitioned into a purer gray clay.

Unfortunately, we did not encounter a dedicatory cache associated with Stela 1 as we had hoped. Instead, based on his work experience at Caracol, Javier Mai suggests, that if one was made, it may have been placed behind the monument. Future excavations studying the chronology of the plaza should target that side of the stela to test Mai's hypothesis. Though no dedicatory cache was encountered, one likely dating to after the site's abandonment was. After the humic layer was removed and the top of Floor 1 exposed, the broken tip of the stela was moved beyond the confines

Figure 5. Orthorectified photograph of the Stela Unit's south wall.

of the unit. A spiked cone censer, or censer lid, identified as Miseria Applique type (Smith and Gifford 1966:159) had been placed at the center edge of the southern side of the monument (**Figure 6**). Similar vessels have been recovered at nearby sites such as Caledonia (Awe 1985: 307), Caracol (Chase 1994), Rio Frio Cave C (Mason 1928: Figure 30), and Rio Frio Cave E (Pendergast 1970:44), where they date to the Late Classic period, but most commonly to the Terminal Classic. The position of the vessel in relation to the to the broken stela top is suggestive of someone having returned there after the site was abandoned and the monument toppled, placing the piece below, perhaps as a reverential cache or an act of remembrance (Stanton and Magnoni 2008).

The unit excavations also informed about the stela's origins. Its base protrudes into the fill layers below Floor 3 indicating it was erected when the plaza was first laid out. Stacks of rocks at the base of the monument but on top of the plaster floor provided structural shoring for it, perhaps an effort to keep it from toppling over during the subsequent construction phases that raised the plaza (see **Figure 4**). From the plastered floor to the fracture, the standing portion of the stela measures 85 cm tall, and its felled top is 108 cm tall (Spenard and Mirro 2020). When it was first


Figure 6. Nohoch Batsó Cache 1. Miseria Appliqué censer recovered from below central southern edge of the broken top of Stela 1. Photo by J. Spenard.

erected, Stela 1 thus stood 193 cm tall. For safety reasons, we did not excavate the entire plaster floor surrounding the stela, thus we were unable to determine exactly how deep it went below the plaza. Nevertheless, we placed a small tunnel into the unit wall 20 cm below the plaster floor at the nexus of the first layer of fill and underlying paleosol, but no evidence of the monument was encountered (**Figure 7**). As such, the stela continues for no more than 20 cm below the plaster making the monument at least 193 cm tall but no more than 213 cm.

Artifacts recovered from the excavations are still undergoing analysis, and as such little can yet be said about them definitively. Nevertheless, a few general notes are possible. Volcanic ash tempered wares are common, although they appear less regularly than calcite tempered specimens. Red slips are most common on them, suggesting they belong to the Late Classic period Belize Group. A few medial flange Peten Gloss ware orange polychrome plate fragments were recovered. Those too stylistically date to the Late Classic period, though the early part of it. Several unslipped sherds, likely from bowls and jars, were decorated with rows of punctations or incised wavy lines. Similarly decorated sherds have been recovered from Rio Frio Cave A (Mason 1928; Spenard 2018) and Rio Frio Cave E (Pendergast 1970). They have also been recorded from the caves at Pacbitun, where they commonly occur with Late Classic, Spanish Lookout phase materials (Spenard 2014). Other artifacts recovered from the stela unit include a polished bone ear spool (**Figure 8**), and an obsidian prismatic blade fragment with a snap fracture (**Figure 9**). Both were uncovered in the fill just above Floor 3 though not in direct association with one another.

Stela 2

As noted above, a second stela was uncovered in Plaza 1 (**Figure 10**). Click here[2] to see a 3D model of the monument. Like Stela 1, it is made of phyllite, is uncarved, and was snapped

[2] https://tinyurl.com/3s462cz3

Figure 7. Photograph of the eastern wall of the Stela Unit showing probatory trench to detect the base of the monument. Photo by J. Spenard.

Figure 8. Bone earspool recovered from Level 4 of the Stela Unit. Photo by J. Spenard.

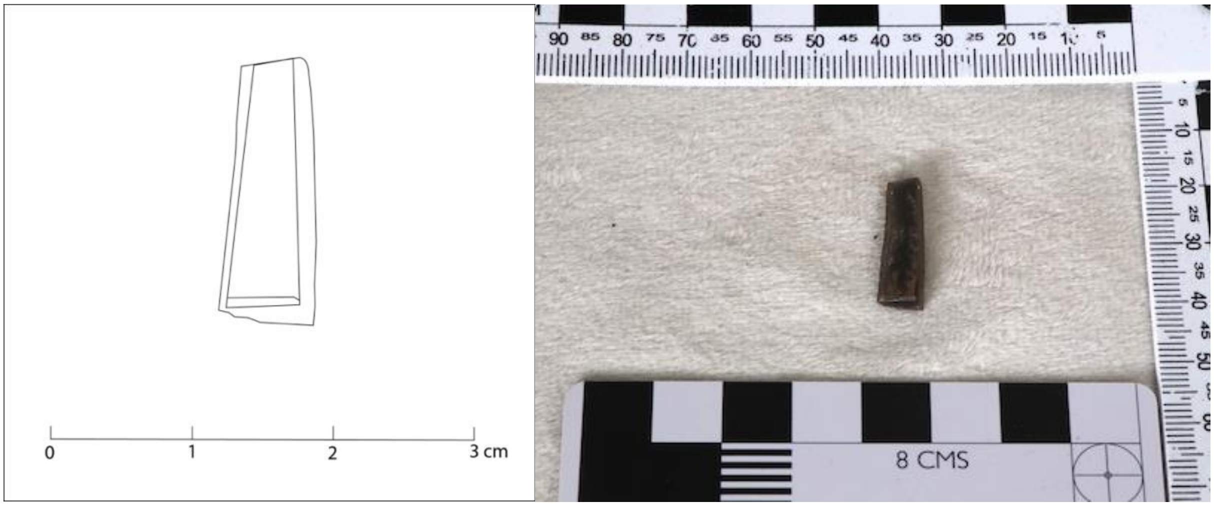

Figure 9. Drawing and photograph of obsidian blade fragment from Level 4 of the Stela Unit. Drawing and photo by J. Spenard.

Figure 10. Orthorectified photograph of Nohoch Batsó Stela 2 after it was uncovered.

in antiquity. It was erected in the southeast corner of the plaza in a similar architectural position as the other monument (see **Figure 1**). Both appear to have stood in stair side outsets (Loten and Pendergast 1984:9), flanking an outset staircase providing access to the summit of Structure 1. Considering their complimentary architectural position, one to the north and one to the south of Structure 1's axial staircase, and that they were both made of phyllite, the two monuments probably constitute a pair.

In its current condition, Stela 2 consists of the main body and four large fragments, three of which are spall near the top of the monument. The other fragment is near the bottom of the extant part of the stela, and it has been uplifted by a growing tree. The base of the stela has yet to be relocated, but it presumed to be nearby, perhaps under the tree. The toppled portion of the monument is 2 m tall. It has a squared top and parallel sides, measuring 85 cm wide. Due to its structural instability indicated by the spalling near the tip of the monument, we decided not to flip it, however, it is presumed to be uncarved.

Although formal excavations have yet to be been undertaken at the monument, clearing activities did recover some ceramic sherds (approximately 45). Unfortunately, they were highly weathered making identifications difficult. Nonetheless, some punctated utilitarian sherds resembling Late Classic types common to the area were noted.

23–NOH–PLZ1–EU01: The "Centerline Unit"

The decision to excavate the Centerline Unit was made after the discovery of Stela 2. Specifically, that monument's complimentary position to Stela 1, the two flaking what appears to be an outset staircase of Structure 1 suggested that another monument might be present the centerline of the building. The Centerline Unit was situated at the approximate mid-point between the two monuments to test that hypothesis. The unit was aligned to the cardinal directions, with Structure 1 to the east and the Stela unit to the north. It was placed in the plaza, adjacent to the presumed bottom of the staircase, assuming that if a monument were to be found, it would be in there, rather than on the structure.

The excavation started out as a 2 m x 1 m pit, with the long axis running north to south, but was expanded twice to uncover a cut granitic block in the north wall of the original unit. One of the extensions was a 1 m x 1 m square, the other a 1 m x 0.5 rectangle. The larger extension pit was added to the north wall of the original trench, and the smaller pit, referred to as the "Northwest Extension," was added to the western wall of that addition. In the end, the unit was "L" shaped, though for reasons discussed below, we will reopen it as a 3 m x 3 m pit in future seasons (**Figure 11**).

The uncovered block was rectangular with two dressed sides. It also appears to have been snapped, opposite one of the dressed sides suggesting that it too was the top of a monument (**Figure 12**). We have reserved the designation of "Stela 3" for it, anticipating that we will uncover the base in future field seasons. The piece measures 33.5 cm x 19.5 cm x 16 cm.

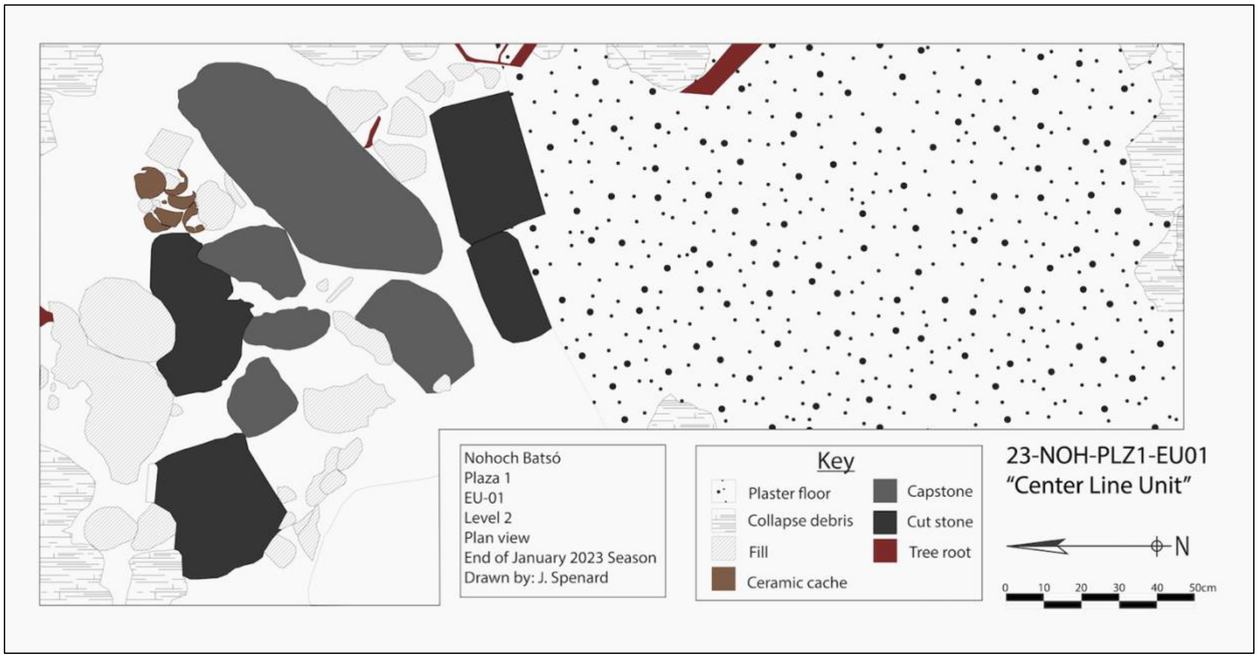

Figure 11. Plan view map of the bottom of the Centerline Unit before backfilling at the end of the January 2020 field season.


Figure 12. Photograph of the top of Nohoch Batsó "Stela 3," after being removed from the Centerline Unit. "Rite in the Rain" notebook added for scale. Photo by J. Spenard.

Excavations revealed a similar stratigraphy as that noted in the Stela Unit. The top layer was a humic root cap, but with the pit's location near the base of the stairs from Structure 1, much collapse debris was intermixed with it. Below that, at about 30 cmbs, was a loam of gravel and pebbles, and occasional cobbles. In Stela 1, we interpreted this matrix change as the fill below the terminal-phase floor of the plaza. Unlike Stela 1, and presumably Stela 2, the "Stela 3" block was recovered just above that transition, though some of the humic root cap and architectural collapse was below it. This positioning suggests that the monument originated further up on the structure, likely on a riser on the stairs, and that subsequent bioturbation led to its position at recovery. Excavation activities were halted near the end of the season when an intact plaster floor was reached at approximately 50 cm below surface throughout the southern extent of the unit and the top of an architectural box, likely a tomb, appeared throughout the northern parts of the unit (**Figures 13**). The relationship between the plaster floor from this unit and that uncovered in the Stela Unit remains uncertain and will be the target of investigations for future field seasons. The box was cut through the plaster floor though indicating that it was from a later construction event, likely the terminal or penultimate expansion of Structure 1 that also included raising of the plaza.

Due to time constraints, only a portion of the architectural box was uncovered during the field season. For that reason, we plan to expand the unit later. Nonetheless, four cut blocks in total were uncovered, two each on the north and south side of the pit. The box was covered with limestone and possibly slate/shale slabs, the largest measuring at 80 cm long and 30 cm wide. Sitting on the northern wall of the pit and in the northwest corner of the unit, we uncovered a cache of six miniature vessels that resemble the Ceiba Unslipped type commonly encountered in Late Classic period deposits at Caracol (e.g. Chase and Chase 2017:Figure 12). We have designated the vessels as Nohoch Batsó Cache 2 (**Figure 14**). Archaeologists working at Caracol refer to such

Figure 13. Orthorectified photograph of the bottom of the Centerline Unit before backfilling at the end of the January 2020 field season. Photos by J. Spenard.

Figure 14. Screenshot of 3D model of Nohoch Batsó Cache 2.

pots as "finger caches," as they commonly held human finger bones and were seemingly made for that purpose (Chase and Chase 1998:319). Similar vessels have been recovered from Caledonia where they also date to the Late Classic (Awe 1985:300). A possible charred bone fragment was recovered from one of the Nohoch Batsó bowls, suggesting they may have served a similar purpose as those found at Caracol, though that identification is awaiting confirmation. The other vessels from the cache were empty except for dirt. That material was kept for future floatation efforts to recover ethnobotanic materials and charcoal for radiocarbon dating.

Artifacts recovered from the Centerline Unit are still undergoing analysis, however; several familiar ceramic styles were noted. They are similar to the materials recovered in the Stela unit, including red slipped ash wares, likely belonging to the Late Classic period Belize group, as well as unslipped jar and bowl forms with meandering rows of punctations and incisions. Among the more interesting pieces are censer fragments that resemble the Chiquibul Scored Incised type defied by Awe (1985:312) at Caledonia, that make up a noticeable (but as of yet unquantified) portion of the assemblage (**Figure 15**). At Caledonia, the type dates to the Terminal Classic to Early Postclassic periods. At Caracol, the increase use of censers in public buildings marks a change in ritual practice during the Terminal Classic period (Chase and Chase 2010:4). Other notable artifacts recovered from the unit include granite mano, quartzite hammerstone, chert flakes, and cave formations.

Figure 15. Photograph of a Chiquibul Scored Incised type sherd recovered from the stela unit. Photo by J. Spenard.

Conclusion

Archaeological investigations in Nohoch Batsó Plaza 1 during the summer 2022 and January 2023 field season were the first conducted at the site. As such, their primary aim was to begin establishing the site's chronology, and we have achieved that goal. Surprisingly no charcoal or other organics were collected from the Stela Unit during the summer that could be used for radiometric dating. Quantities of it were recovered from that pit and the Centerline Unit during the January season, although it remains untested. Instead, ceramics provide the primary baseline for the site's chronology. Most identified styles date to the Late Classic-Terminal Classic periods, although some earlier and later styles are represented. The recovery of charcoal in several fill layers below the plaster floor in the Stela Unit will aid in determining when that monument was erected and the plaza established. Furthermore, when the contents of the architectural box uncovered in the Centerline Unit are revealed, they will inform about the date of the terminal phase of construction.

With an established chronology, we can begin addressing more broad and complex questions related to topics such as the function and use of the plaza and Nohoch Batsó's social and geopolitical role in the region. With at least two, but possibly three stela, and a significant quantity of censer fragments recovered during our investigations, the space appears to have been ritually focused. What role did the ritual serve, and how did it relate to events associated with Structure 10, the main pyramid at the site? Eastern structures are often associated with ancestors in the Maya region. Archaeologists at Caracol note that most eastern structures there contain at least one formal tomb, and other burials are found immediately west of the building (Chase and Chase 1994:56). Furthermore, they note that specialized cache vessels, including finger cache bowls are also commonly found in the plazas or in the buildings of those shrines. That pattern reflects what we have found so far in Plaza 1. As the eastern most structure in the easternmost plaza at Nohoch Batsó, was Structure 1 an ancestor shrine? If so, why was it, and not Structure 10, used for that purpose?

With a chronology that matches closely with those of nearby sites like Caledonia (Awe 1985; Healy et al. 1998); Las Cuevas (Moyes et al. 2012), and Minanha (Iannone 2001; 2005), as well as the now inundated sites of the Upper Macal region (Awe et al. 2005), what relationship did Nohoch Batsó have with them? With Caracol's rise to prominence after its famous defeat of Tikal at the end of the Early Classic period (Houston 1991; Martin 2005), and its dendritic road system stretching to the Macal River, ostensibly to control resources of the Mountain Pine Ridge (Chase et al. 2020), its presence was surely felt. Similarities noted in artifact patterns and ritual practices discussed in this chapter suggest a close relationship between the two sites, but its nature remains unclear. Looking more broadly Halperin and colleagues (2020) note sizeable demand for Mountain Pine Ridge-originating granite ground stone tools in the upper Mopan region during the Late Classic and Terminal Classic periods, though it begins to wane during the latter time as connections with other regions developed. Was Nohoch Batsó controlling the manufacture and distribution of ground stone objects being made at Mountain Pine Ridge sites like the Buffalo Hill Quarries (discussed by Mirro et al. this volume)? If so, what relationship did it have to the ground stone industry at Pacbitun (Skaggs et al. 2020)? Were they part of the same distribution chain or were they tied into other exchange networks? Answers to those questions may ultimately be found beyond the confines of Plaza 1, but our investigations of it described in this chapter have provided the chronological framework for Nohoch Batsó to begin to ask them and consider this newly recorded site's place in Maya history.

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Chapter 3: Data Recovery of Looter's Trench 1: 2022 Field Season

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Looter's trenches are an unfortunate reality in modern archaeology, but it can lead to important discoveries in determining the function of a single structure and/or site. For example, data recovered from a looter's trench at Tulakatuhebe Structure 8F8 at Caracol produced an empty urn and its associated lid (Chase and Chase1996:318) that conveyed the symbolic view of the "heavenly" and "underworld." RiFRAP's 2022 efforts at Nohoch Batsó included producing a detailed map of the site and conducting excavations of the eastern most portion of the site in Plaza 1 focusing on Structure 1's looter's trench. The looter's trench located is located on the backside (east facing) of Structure 1. It was important to investigate to determine a basic chronology of the site through ceramic analysis and determining potential building phases associated with Structure 1. Artifacts recovered from the looter's trench lost their original provenience from the previous looting activities making it difficult to give accurate estimated dates on the structures building phases through time, but we were able to identify three likely construction phases and 2 minor modifications in the exposed profile.

Methods

Survey of Nohoch Batsó was conducted at the beginning of the project's start using GPS equipment to get a super position of visible structures and features located near and around Structure 1 (**Figure 1**). The following workdays consisted of hiking through the broad leaf forest (**Figure 2**) to the site where data recovery started near half day and finished in the late afternoon of each workday.

The crew members were split into two equal groups, one group on the backside (east facing) of Structure 1, one group on the frontside (west facing) of Structure 1, and one smaller group that continued the recordation of features and structures in Nohoch Batsó's site core. The goal for the group on the backside (east facing) of the structure was to start reclearing the original looter's trench to uncover the base of Structure 1 using picks, shovels, and 1/8th inch screen mesh to screen the soil left by the looter's (**Figure 3**). This would help the team acquire a basic ceramic chronology and an approximation of the structure's perimeter once the spoil piles were cleared from the observable base of the east facing side of Structure 1. At the beginning and the end of each workday a photo was taken to record the progress of the reclearing of the looter's trench. Once the team had a better understanding of the observable base of the looter's trench, we started to remove soil and ruble from the inside of the structure (**Figure 4**). This process was tedious, but important for establishing a quantifiable number of artifacts to start producing a hypothetical

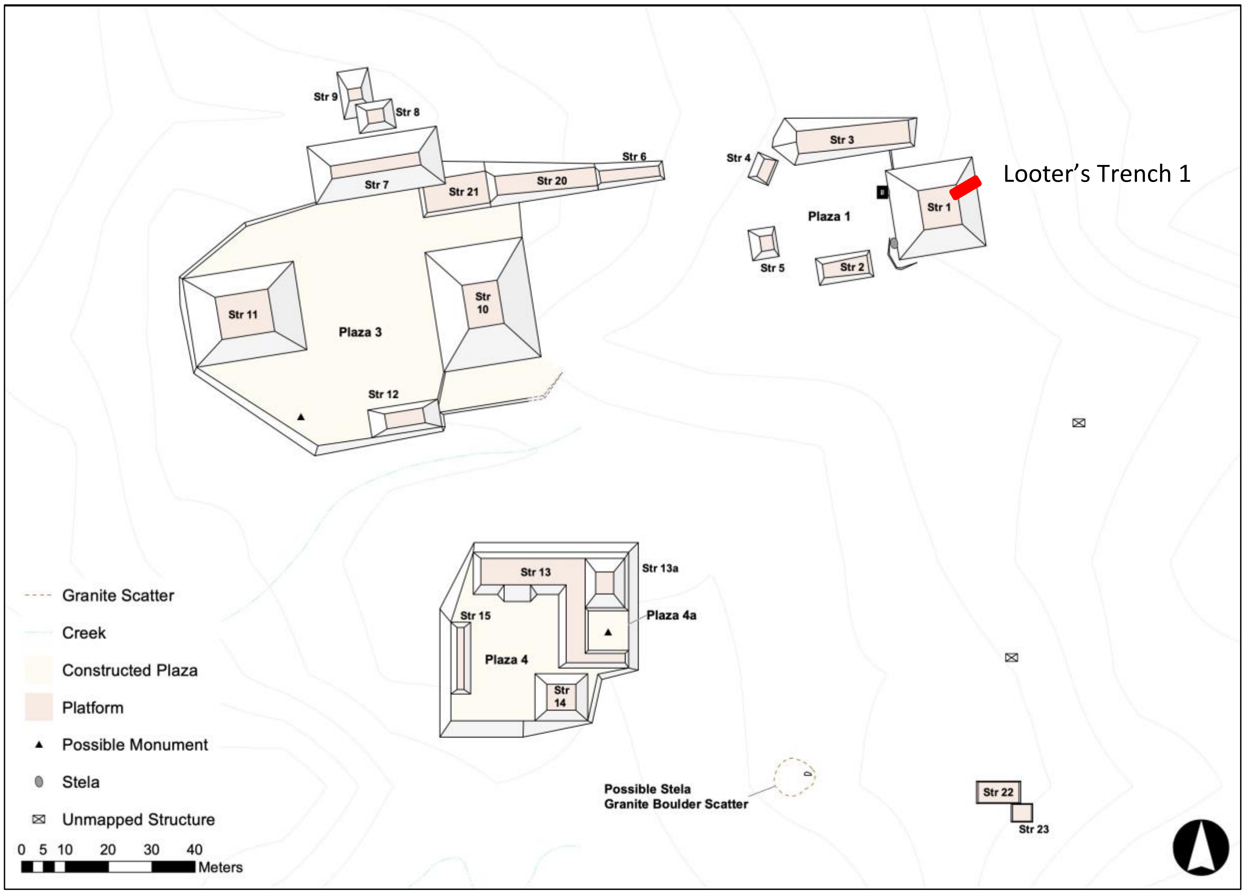

Figure 1. Map of Nohoch Batsó site core. Looter's Trench 1 is depicted as red rectangle.

Figure 2. Overview of Structure 11 hiking through the broad leaf forest to Structure 1 at Nohoch Batsó in the MPR, facing north.

Figure 3. Overview of the backside (east facing) of Structure 1, reclearing of Looter's Trench 1 spoils pile at the base, facing south.

Figure 4. Overview of Looter's Trench at start of day one (left), facing southwest. Overview of Looter's Trench at start of day two (right), facing west.

timeline through ceramic analysis. The process of reclearing the inside of the looter's trench also allowed the team to observe the structure's construction sequence.

The trench was originally excavated by looters in the center of the eastern face of Structure 1 in the eastern most area of Plaza 1. Structure 1 is a rectangular building at the eastern most structure of the site core of Nohoch Batsó (Spenard et al. 2020:93). The building descriptions and numbering system has been determined through the co-director's experience with Maya city-scapes in the broad leaf forested areas of the Cayo District in Western Belize. The soil of the broad leaf forested areas of the MPR are well drained and very fertile, ideal for agriculture.

The naming convention of the Looter's Trench was used to help define the specific portion and location within the valley terrace of Nohoch Batsó. YR-NOH-LTC-STR#-EU#. YR is the two-digit year the site was excavated; NOH is the acronym for Nohoch Batsó; LTC is the acronym for Looter's Trench; STR# is the acronym for the Structure number; and EU is the acronym for Excavation Unit number. The Looter's Trench excavated would be written as so; 22-NOH-LTC-STR1-EU1. It being the sole looter's trench of the structure, it would not need a numeric number following the acronym for LTC.

There were a handful of diagnostic ceramic sherds recovered from the Looter's Trench during the 2022 field season. Preliminary type identifications are presented in **Table 1**. Most of the recovered ceramics were utilitarian wares that varied in type, size, and shape.

Table 1. Diagnostic ceramic sherds recovered from 22-NOH-LTC-STR1-EU01.

Ceramic Type	Description	Period
Belize Red	Slipped ash ware, chalky volcanic temper body sherd	Late Classic
Cayo Unslipped	Utilitarian jar sherds, unslipped rim and body sherds	Late Classic
Polychrome	Slipped, a few sherds with a ring base, rim sherds	Classic
Augustine Red	Waxy red slip, neck and body sherds	Post-Classic

Structure Description

22-NOH-LTC-STR1-EU01

This excavation unit included the entirety of the Looter's Trench located at the base of the eastern face of Structure 1 that spanned to the platformed flat-top of the structure. This method was used to recover as much cultural material as possible from an area that has lost its original provenience. This unit was used to collect diagnostic ceramic sherds and to look at the stratigraphy from the center of the building to try and determine earlier building phases.

The collected artifacts consist mostly of unslipped utilitarian ceramics recovered from the rubble of the looters trench (**Figure 5**). The diagnostic ceramic sherds collected had lost their original provenience from the original looting (**Figure 6**). However, the data acquired gives us a rough idea of possible settlement dates according to their typology, see **Table 1**.

By the end of the season, we had cleaned the looter's trench, recorded the exposed visible building phases, and collected a full profile if the structure (**Figure 7**). Unfortunately, the trench cut into the structure at an angle making it difficult to observe the phases in profile. Nevertheless, it appears the structure experienced at least three major construction phases and two minor renovations/reconfigurations (**Figure 8**). Since the original excavation cut only partially into the construction, the identified phases are given temporary alphabetic labels here starting at the current

Figure 5. Planview of ceramic types, Belize Red body sherd (circled in red), Cayo Unslipped.(circled in black).

Figure 6. Closeup of possible Augustine Red body sherd (left). Closeup of Polychrome rim sherd and untyped, incised body sherd (right).

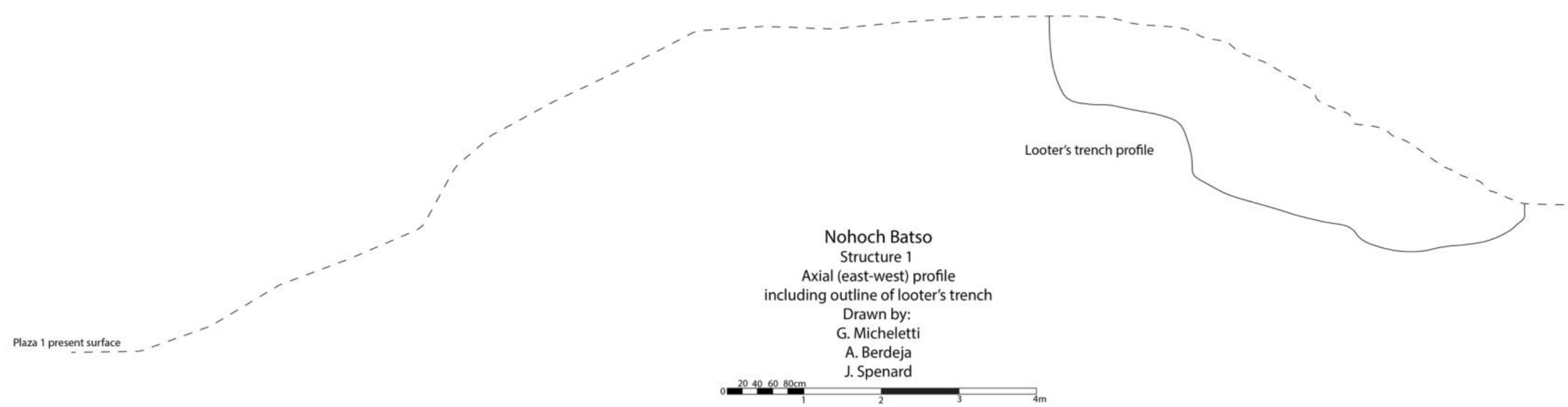

Figure 7. Axial profile of Structure 1 following alignment of lLoter Trench 1.

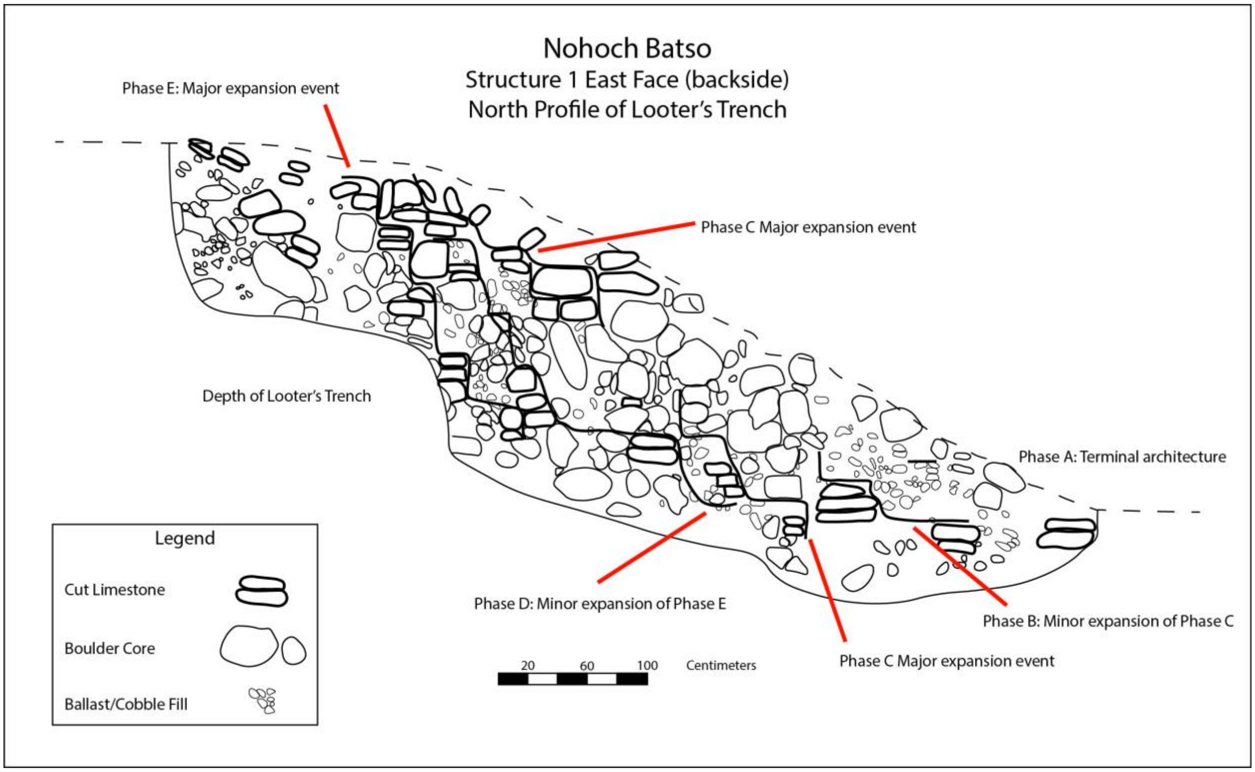

Figure 8. Profile of north wall of looter's trench (by G. Micheletti with notations by J. Spenard).

ground surface and moving into the center of the building. These should be renamed once stratigraphic excavations determine the full construction sequence.

Discussion

The investigation of the Looter's Trench located in the center of the east face of Structure 1 has been important for interpreting the possible function of the structure and understanding settlement's timeline through basic ceramic identification.

Identifying the earliest materials are significant because they can give a better insight into the earliest settlement of a specific site, especially given that deposits of equal or greater time depth have yet to be recovered from deeply buried strata (Andres et al. 2014:53). This is true for Nohoch Batsó, as preliminary investigation is in the beginning stages of interpretation. With further analysis and data recovery of specific types of ceramics *in situ* in deeply buried strata around Structure 1 we can start to develop a ceramic chronology that can be used adjacent to other dating techniques to start a timeline.

The selection of Structure 1 to start data recovery was important in understanding the entire site. According to Chase and Chase (1994), structure B20 suggests that it may have served as a prototype for the Late Classic period eastern "ancestral shrine," constructions that appear with great frequency in residential groups throughout Caracol (pg. 306). This may be relevant to Nohoch Batsó as a single ceramic nose decoration, likely from an anthropomorphic censer, was recovered from the unit placed in front of Stelea 1 from the frontside (west facing) of Structure 1. At Caracol, finger caches, and "face" caches (urns with modeled human faces) are often associated with single – and multiple – individual tombs, and all other classes of burials (Chase and Chase, 1996:311).

Future systematic excavations at Nohoch Batsó' will help identify more valuable data by analyzing material culture and understanding the potential ritual importance of Structure 1 through buried caches and burials that may be associated with the building. This could give the team more insight into the function of Structure 1, and where Nohoch Batsó fits into its connection with other eastern structure's function like those found in Caracol. But also looking at the bigger network of larger settlements and if we can see a connection with Caracol and Tikal to the west. What was Nohoch Batsó's main purpose during the Late classic period and its function during the Post Classic?

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Chapter 4: The Buffalo Hill Quarries Site

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Konane Martinez (California State University San Marcos)

During the 2022 field season, the RiFRAP conducted an unexpected opportunistic pedestrian survey along a ridge above the southern side of Pinol Creek at Pinol Sands (**Figure 1**). The survey was unplanned but inclement weather and impassable roads prevented us from getting to our targeted area of investigation those days. When survey efforts began, co-author Mai reported knowing of some mounds in the area and directed the team to them. The mounds turned out to be large debris piles from granitic rock quarries and ground stone implement workshops spread out over several hectares. The many outcrops dotting the hillside are said to look like a herd of buffalo from afar. The site was thus named the Buffalo Hill Quarries. The work performed there largely consisted of reconnaissance and mapping activities in the project GIS, and thus most of the collected data about the site is the map itself presented below in **Figure 2**. Locations of artifacts were also collected in the project GIS when they were encountered, but because we lacked permission from the Forest Department to clear any vegetation, only partial survey coverage was achieved. Future seasons will seek such permissions with the goal of achieving full survey coverage and to conduct stratigraphic excavations.

The Buffalo Hill Quarries site is located on the west side of the Chiquibul Road on a low, flat-topped granitic rock ridge south of Pinol Creek in the northern half of the Mountain Pine Ridge. As currently mapped, the Buffalo Hill Quarries span an area of approximately 16 hectares measuring 750 meters east-west and 550 meters north-south, but the full extent of the site remains undefined. It was observed to continue to the north and southwest along the ridge line, but time and other pressing research demands prevented further exploration and documentation during the field seasons. Moreover, recently received aerial LiDAR data discussed by Spenard in this volume reveals that the site may be significantly larger, perhaps up to four times its current mapped extent.

Within the 16 mapped hectares, we have identified 15 primary activity areas where granitic boulders and outcrops were quarried, and workshops where ground stone tool implements were made. We also recorded two low density chert flake scatters adjacent to a few of the activity areas. That the quarry and workshops were made by the ancient Maya is confirmed by the presence of earthenware ceramics seen throughout the site. Unfortunately, they are very heavily weathered although one sherd resembles a Late Classic period bowl form.

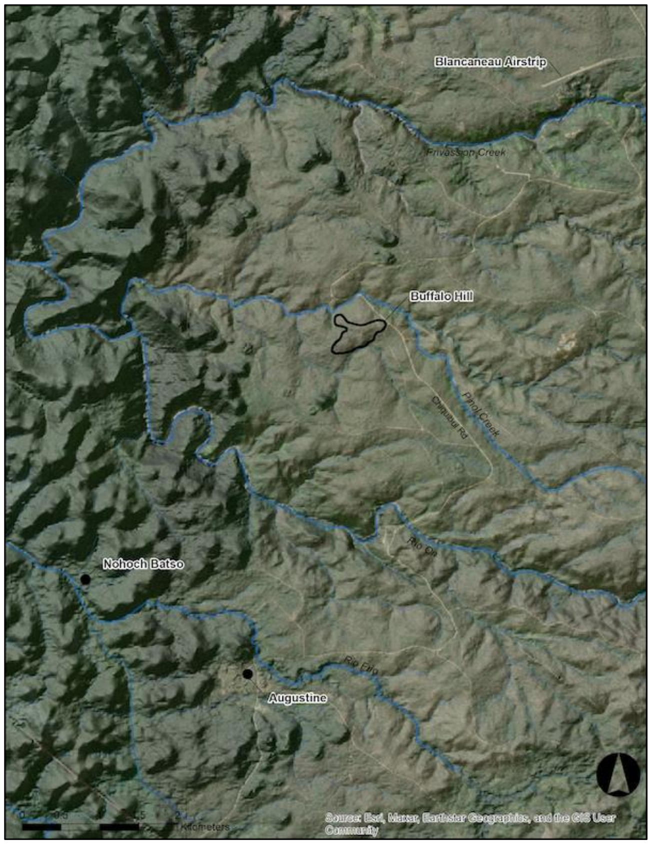

Figure 1. Regional map showing the location of the Buffalo Hill Quarries within the Mountain Pine Ridge Forest Reserve.

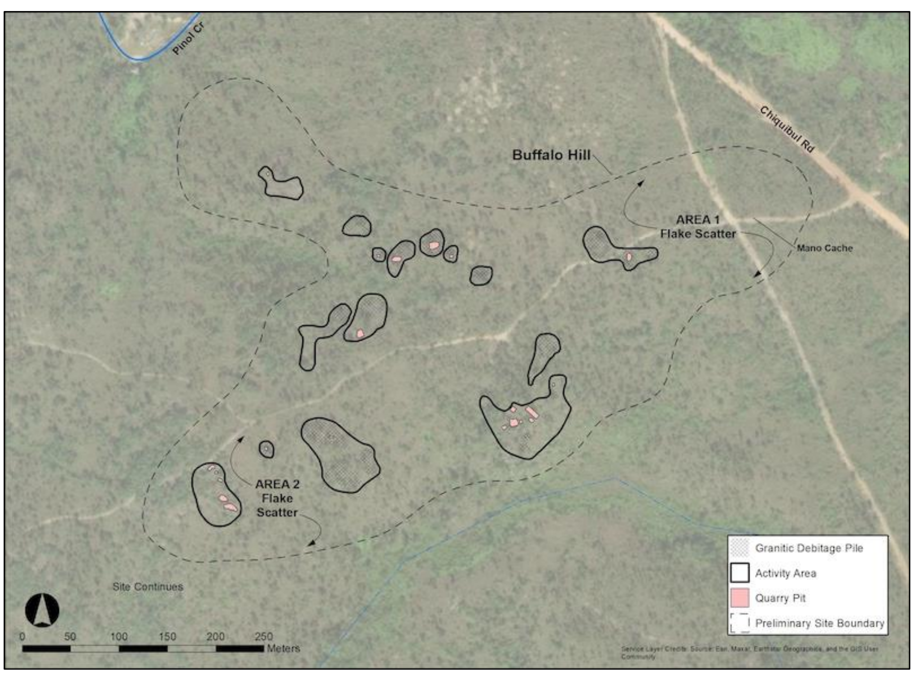

Figure 2. Current map of the Buffalo Hill Quarries site. Note that the site continues to the north and west.

When it comes to the activity areas, there is variability in their makeup. Some exhibit much more cultural activity and are more complex than others. Nonetheless, multiple implements were made in each workshop area. Minimally each activity zone contains piles of granitic rock debitage surrounding either a quarry pit, or outcrop or boulder exhibiting quarrying scars. The remainder of this chapter presents a catalog of common and unique features identified there to date. Discussions provide a general definition/description of it as well as quantities when they have been tabulated. We also draw on ethnographic, ethnohistoric, and archaeological studies of rock quarries and ground stone implement workshops within a global context by scholars such as Clark (1988), Cook (1982) Hayden (1987; see also Hayden and Nelson 1981), Nelson (1987), Schneider (1996, 2020; see also Schneider et al. 1995), and Searcy (2011) to interpret some of our findings.

Quarry Component Descriptions

Quarry Pits (**Figure 3**)

Quarry pits vary in size and depth across the site ranging from 1 to 2 meters in diameter and 20 to 30 cm deep to over 20 meters in length, 5 meters wide, and over a meter deep. Pit bases are often clear of debitage, but the water material is piled around the feature margins. Cut faces where slabs were removed, sometimes exhibiting flake scars, were observed on the margins of pits.

Figure 3. Example of a quarry pit. Note project member, F. Quiroz in center of image standing at the bottom of the pit. Project member J. Mai Sr. is on the rim of a debitage pile surrounding the pit on the left side of the image. Photo by J. Spenard.

Isolated Cut Faces (**Figure 4**)

These features consist of modified granitic boulders where slabs of material were removed from the rock face. They were often smaller scale than quarry pits and not excavated below the surface. Nevertheless, the are often surrounded by piles of reduction and quarrying waste.

Granitic Debitage (see Figures 3 and 4)

By far, granitic debitage accounts for most cultural material at the site. It is the byproduct of quarrying activities and percussion flaking to shape ground stone implements such as manos and metates. Debitage is found near modified boulders or bedrock and quarry pits as low mounds and berms up to 1.5 meters high to low density scatters near lesser worked faces. Debitage included flakes of stone, often exhibiting bulbs of percussion and other features of flaking. They range in size from 2 to 40 cm in length (**Figure 5**).

Hammer Stones (**Figure 6**)

Hammerstones are found throughout the site often mixed into the granitic debitage, on the ground surface near the margins of the activity areas, or in the quarry pits. In a few instances, they were clustered in groups of four to five. A total of 69 hammerstones has been mapped at the site. Overall, the tools range in size from 12 to 20 cm typically, although one, likely a two-handed hammer, was found to exceed 30 cm. Most were either spherical or disc shaped, though some asymmetrical cobbles were used. Many were broken into flakes and possibly repurposed. Raw

Figure 4. Example of an isolated cut face. Project members (L to R) M. Weber, A. Berdeja, F. Quiroz, and M. Mirro are standing on a granitic rock debitage pile surrounding the worked face.

Figure 5. Example of a large, conchoidally fractured granitic rock flake. Photo by J. Spenard.

Figure 6. Example of in situ quartzite hammerstone in a debitage pile. Photo by J. Spenard

material was imported to the site; however, several sources for quartzite have been documented nearby in the Mountain Pine Ridge Forest Reserve related to the Santa Rosa Group several kilometers to the east.

Mano Preforms (**Figure 7**)

Approximately 54 mano preforms were documented throughout the site, though that total likely underrepresents the actual number observed and present. Preforms in the earliest stages of reduction were often difficult to discern from debitage and weathered cobbles making a full count difficult. Several types of preforms and stages of reduction were observed. Identifying this class of artifact as a preform is problematic because many of the "preforms" have intentionally pointed or sharpened edges on them (**Figure 8**). That modification complicates classification efforts because similarly shaped stone picks were used by metateros in highland Guatemala when making ground stone implements (Hayden 1987; Hayden and Nelson 1981; Nelson 1987) (**Figure 9**). Those data suggest that perhaps some manos were discarded during production and repurposed into hammers used to make the tools. Future studies should focus on testing that hypothesis and, if some of the "preforms" were used as picks as the ethnographic data suggest, were they intentionally created from raw material or were they repurposed discarded preforms? If they were discarded preforms, what led to them being castoff?

Figure 7. RiFRAP team members (L to R, M. Mirro, A. Berdeja, and M. Weber) recording a large mano preform. Note that the team is standing on a low debitage pile. Photo by J. Spenard.

Figure 8. Example of a "mano preform" with a pointed end that was possibly repurposed into a pick tool. Photo by J. Spenard.

Figure 9. Photograph of Ramon Ramos using a flaked stone pick (circled) in the initial stages of form a basalt block into a metate. Adapted from Hayden 1987:Figure 2.7.

*Metate Preforms (***Figure 10**)

Metate preforms were present, but they proved to be even more difficult to confidently identify than mano preforms. Those we confidentially identified typically exhibited pecking scars and evidence of shaping. Slabs of stone that lacked shaping were observed throughout the site, and may represent earlier stages of production; however, they were not tabulated. A total of 10 metate preforms were observed. These items varied in shape and size, although most were circular with a diameter 35 to 45 cm and a thickness 5 to 10 cm.

Bedrock Milling Features (**Figure 11**)

Bedrock milling features consist of shallow ovoid to circular basins cut into bedrock outcrops exhibiting lightly polished grinding surfaces. Features measure between 25 to 32 cm in diameter or length and were between 3 and 8 cm deep. A total of 10 were documented throughout the site.

Ethnographic analogy suggests that such features were likely a byproduct of mano production. In particular, Hayden (1987) and Nelson (1987; see also Hayden and Nelson 1981) published images of mano creation in highland Guatemala from the late 1970s that show the tip of the tool resting in a gravel cupule similar in size and shape as the milling features recorded at the Buffalo Hill Quarries (**Figure 12**). Although the authors do not discuss the cupule directly, their description of the shaping process indicates its origins. Specifically, they note that the preform is turned continually as it is pecked. Future investigations of these components of the site should test for limited mounds of sand below the features to verify their origins (Skaggs et al. 2020).

*Monument Preform (***Figure 13**)

A single, broken monument preform was observed within a quarry pit. The object was approximately 60 to 70 cm long and tapered from 20 cm wide to 10 cm longitudinally. The lateral margins showed evidence of pecking and shaping. Granitic rock monuments are rare but have been recorded at sites around the Mountain Pine Ridge. Spenard discusses a possible granitic monument at the site of Nohoch Batsó in this report. Awe and colleagues (2005:104) also report on the recovery of a granite stela from the site of Bajo del Lago. Yet, both of those monuments are significantly larger than the preform we recorded in the Buffalo Hill Quarries. Determining its function will likely require the discovery of other pieces like it elsewhere.

Possible Shrine or Workbench (**Figure 14**)

On the eastern side of a quarry pit backfilled with local sediments is a shaped granitic rock purposefully erected in an infilled quarry pit. In 1963, William Bullard recorded a possible shrine associated with a granite outcrop in the region. The block we recorded is much smaller than what he reported, but his discovery suggests ritual was a component of production. Alternatively, this feature may represent some kind of workstation. In her discussion of the Antelope Hill quarries

Figure 10. Example of a very late stage metate preform. Photo by F. Quiros.

Figure 11. Example of a bedrock milling feature. Photo by A. Berdeja.

Figure 12. Image of late stage mano shaping in highland Guatemala. Note the cupule formed around the tip of the tool (circled) created as it was worked. Adapted from Hayden 1987:Figure 2.21.

Figure 13. Photograph of monument preform. Photo by M. Mirro.

Figure 14. Possible shrine or workbench erected in infilled quarry pit. Photo by K. Martinez.

in Arizona, Schneider (1996:304-305) notes, that "where blocks of stone were extracted and removed, level platforms were created and were used as workstations. The floors of these areas are literally paved with debris: debitage flakes; shatter; broken and discarded preforms; hammerstones; and hammerstone spalls." We will be conducting excavations of this feature this summer to learn more about its function at the site.

Discussion

What is the significance of the Buffalo Hill Quarries site? Although archaeologists working at Pacbitun have recently identified a ground stone implement workshop area there (Skaggs et al. 2020), the Buffalo Hill Quarries represents the only known workshop site directly associated with raw material extraction. Unlike the Tzib Group, the name given to the Pacbitun workshop, the Buffalo Hill Quarries are also unaffiliated with any major center. On a broader scale, recent sourcing studies of manos, metates, and other granitic rock implements recovered from sites throughout Belize and into the central Peten, Guatemala (Abramiuk and Meurer 2007; Brouwer

Berg et al. 2022; de Chantal 2019; Halperin et al. 2020; Shipley and Graham 1987; Tibbits 2016, 2020; Tibbits et al. 2022) have found that in almost all cases, the granitic rock of the Mountain Pine Ridge is widely preferred over stone from either of the other two plutons in Belize. That pattern of distribution suggests that it will likely be identified in adjacent regions of Mexico too, particularly at sites in southern Campeche and Quintana Roo. To be clear, ground stone implements at all studied sites are made from a variety of materials besides granitic rock, but when they are, the MPR source is preferred by far in almost all cases. Thanks to recent LiDAR surveys throughout the Maya lowlands (Canuto et al. 2018; Chase et al. 2014; Chase et al. 2014; Chase et al. 2011; Hutson 2015; Inomata et al. 2018; Prufer et al. 2015; Rosenswig et al. 2012; Stanton et al. 2019), we now know that the Classic period population easily reached into the millions in the southeastern region where MPR granite items have been recovered. What those survey data reveal is that the demand for Mountain Pine Ridge originating granites was significant and represents a major component of the domestic economy. Given the size of the site, the products from the Buffalo Hill Quarries would have been a major supplier meeting that demand, but it was certainly not the sole source. Moreover, project foreman Mai knows of similar other yet undocumented quarries in the Mountain Pine Ridge that we plan to reconnoiter in summer 2023.

Several questions for future research at the Buffalo Hill Quarries have resulted just from their documentation. Firstly, where were the quarry workers coming from? Were they a local community of full-time specialists or did itinerant work groups come up to the area from surrounding sites, such as Pacbitun. The LiDAR data of the Mountain Pine Ridge discussed by Spenard in this volume suggests some mounds nearby, but they are few and have yet to be ground truthed.

If the work was done by a local population, was the production and distribution centralized? At about 5.5 km distant, Nohoch Batsó is the closest Maya center to the quarries. What was the relationship between that site and the Buffalo Hill Quarries and other quarry sites on the Pine Ridge? Did Nohoch Batsó act as a distribution hub, or a marketplace where they were traded? Did it control all of the granite quarries or just some, or was the site uninvolved in those endevours?

What role did ritual play in the quarrying and manufacturing process? Beyond the outcrop-affiliated shrine feature Bullard identified in the early 1960s (Bullard 1963), Spenard (2014) documented a cave site a few kilometers north of the quarries that held an unusually large quantity of mano preforms compared to other caverns in the area. Does this suggest that some caves in the region were used for rituals to an Earth Lord like being who may have been considered the true owner of the rock being collected and worked? What of Bullard's shrine and the block at the Buffalo Hills? Are they ritual sites or something else?

Lastly, were ground stone implements finished at the quarry and workshop sites, or were preforms exported to surrounding sites? Are Mountain Pine Ridge quarries and sites like Pacbitun part of the same supply chains, or were they serving different ones?

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Chapter 5: Initial Observations of the NCALM Belize 2022 LiDAR Campaign Aerial Survey of the Mountain Pine Ridge

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In May 2022, the National Center for Airborne Laser Mapping, (NCALM), completed their Belize 2022 Collaborative LiDAR Campaign. A 37km^2 portion (plus buffer) of the RiFRAP permit area was included in that survey (**Figure 1**). The boundaries of the scan are as follows. The northern boundary is Privassion Creek. Line 2 marks the southern extent. The western side abuts portions of the RiFRAP permit area captured during the 2013 West-Central Belize LiDAR campaign (Chase et al. 2014). The eastern boundary was arbitrarily defined, running roughly from the intersection of Inner Circle and Raspa roads in the southeast to Big Rock Falls in the northeast.

The NCALM team used a Titan multispectral sensor mounted to a twin-engine Cessna aircraft. Products delivered to the author include classified point cloud data of 15 pulses/m^2, bare-earth DEM, DSM, and CHM at 50 cm resolution, as well as density pulse, density return, and density returns at ground datasets. Copies of those datasets have been delivered to the Institute of Archaeology on a portable hard drive. For a comprehensive discussion of NCALM's data collection and processing, readers are directed to Fernandez-Diaz et al. 2014.

This report presents initial observations about the cultural features noted in the DEM data supplied by NCALM. Two techniques were used to visualize the data, multidirectional hillshading, and degree-scaled scope with a Z Factor of 1 and an inverted semitransparent black color scheme (Nelson N.D.) (**Figure 2**). After the data were visualized, I identified cultural features through visual inspection, comparing the known to the unknown. For example, I located the Nohoch Batsó site core to understand how monumental architecture was represented. Next, I located the hilltop neighborhood east of it that we surveyed when we first identified the site (Spenard et al. 2020) to understand how smaller settlements were visualized in the data. Using those data as a benchmark, I inspected the LiDAR results for similar occurrences. Through that process, four general classes of cultural data were observed in the DEM, settlement, landscape modification (terracing), cave entrances, and quarries. As we continue processing the data, ground truth (Horn and Ford 2019; Reese-Taylor et al. 2016), and account for the vastly different vegetation patterns in the survey area (Cap et al. 2018; Crow 2007), I anticipate these data and the classes will be further refined.

Settlement

Monumental Architecture

Perhaps the most unexpected finding in the data was another monumental plaza at Nohoch Batsó (**Figure 3**). Labeled Plaza 5, it sits 250 m northwest of the site core and is of equal size to the other monumental groups there. Nonetheless, it has a noticeably different alignment. Whereas the site core has an 80° azimuth, Plaza 5 has an azimuth of 66°, roughly northeast-southwest. What

Figure 1. Satellite image showing RiFRAP permit concession area (orange polygon) and the area of the NCALM survey (yellow polygon).

those differences signify is currently unknown, but it may indicate the two areas have different chronologies. RiFRAP members F. Quiros and Javier Mai Sr. visited the plaza in January, confirming its presence. They provided the following description. The plaza sits in a swampy, low-lying area near a potential spring. The group rises 2.5 to 3 m above the surrounding ground surface. The facing stones on the platform were made from cut blocks of limestone and granitic rock. Five structures are arranged over the plaza. A range structure and possibly another ancillary building partially enclose the north side. The east side is similarly partially bound by a range structure. The west and south sides are open although one large mound or two conjoined mounds are on the southeast corner. Granitic flakes were noted on the complex, suggesting it may have acted as a marketplace for the distribution of ground stone implements produced at sites like the Buffalo Hill Quarries. Future investigations should focus on the nature and function of the plaza.

Northwest of Plaza 5 is what appears to be an artificially leveled hillside terrace upon which was sits another small plaza with four mounds on each of its corners. The architectural complex, heretofore unnamed, has a similar alignment at the other plazas at Nohoch Batsó. Discussions about the data with NCALM's director, Juan Carlos Fernandez Diaz, who also was also the center's lead on the 2013 West-Central Belize LiDAR Survey (Chase et al. 2014), and the PACUNAM LiDAR Initiative (Canuto et al. 2018) noted that the plaza was similar to defensive

Figure 2. Visualized LiDAR data as described in the text used to identify cultural features.

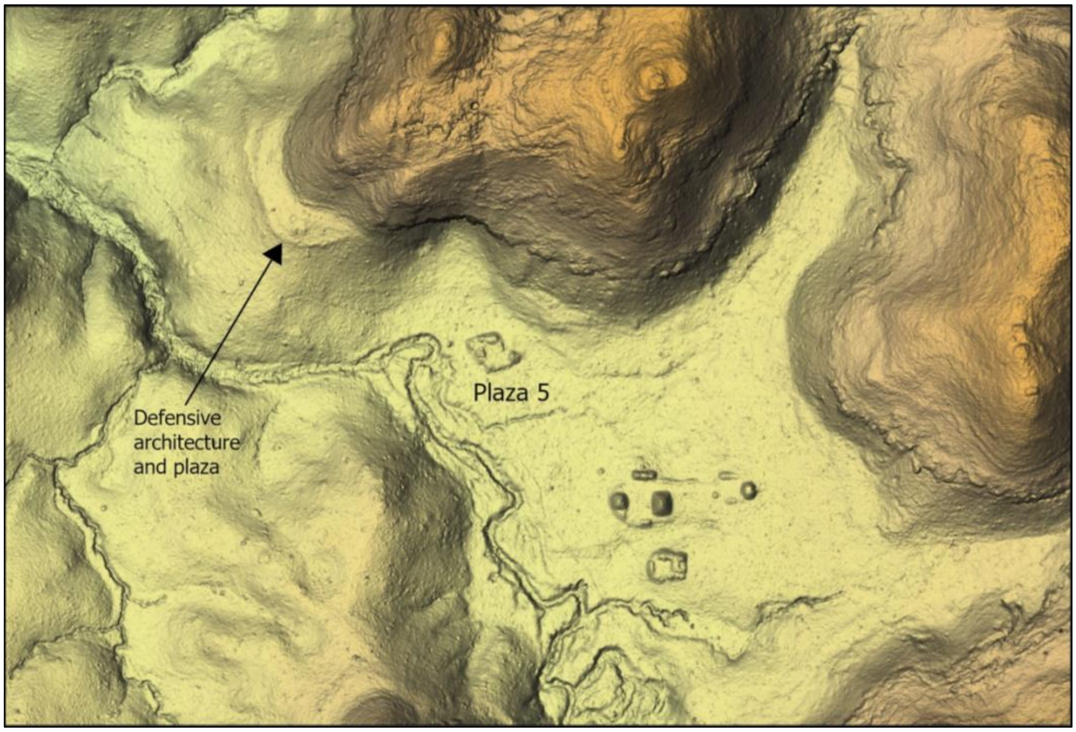

Figure 3. Visualized LiDAR data as described in the text of Nohoch Batsó site core and surrounding area showing locations of Plaza 5 and possible defensive architecture.

architecture identified in Guatemala (Fernandez Diaz, personal communication: February 2023). That hypothesis will need to be tested in future seasons; however, it should be noted that the plaza is strategically located, allowing views down the valley that provides the most direct and easiest traversed route to the area of the Mahogany site identified by Moyes and colleagues (2017). The presence of the small hilltop plaza may thus indicate hostilities between the two sites.

The other class of monumental architecture identified in the LiDAR data are what I am tentatively calling "rural ritual shrines," although their true purpose is currently unknown. Four have been identified (**Figure 4**). The criteria I use for identifying them is that they are groups of pyramids or ranges structures on formal, raised plazas but are significantly smaller than those in the site core. I call them rural because they are outside the site core. The closest is about 500 m east of Plaza 1, while the others are over 2.5 km distant. Three of the shrines are in remote locations today and appear to be intact, but one is close to the Chiquibul Road and appears to have been extensively damaged by looting activity.

Settlement

The recent rediscoveries of Nohoch Batsó (Spenard et al. 2020) and the Mahogany site (Moyes et al. 2017) confirmed that ancient Maya people were living in the area today designated as the Mountain Pine Ridge Forest Reserve, yet without any systematic survey having ever been done there, how dense the settlement was remained unknown when the NCALM LiDAR mission was flown. Suffice it to say that we now have a much better idea. Settlement was extensive but limited by expected geographic constraints (**Figure 5**). In particular, dense settlement is seen in almost all areas with limestone bedrock, whereas none is obvious in the areas underlain by granitic

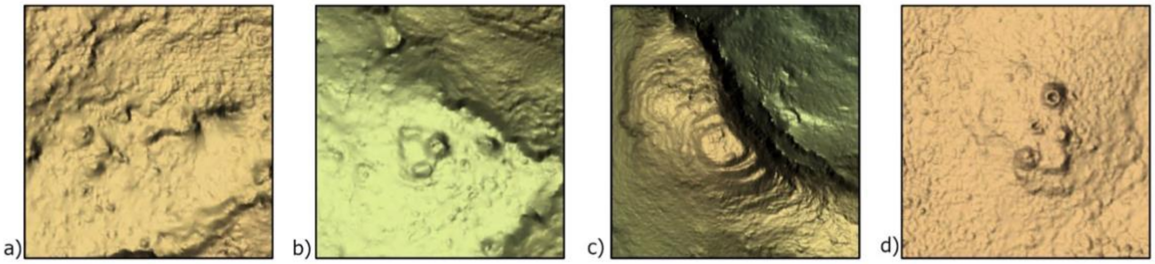

Figure 4. Composite image of four rural ritual shrines identified in the visualized LiDAR data. Shrines a) and b) are near possible cave entrances. Note the "donut"-shaped holes in the northern, eastern, and western flanking structures in d) likely represent extensive looting.

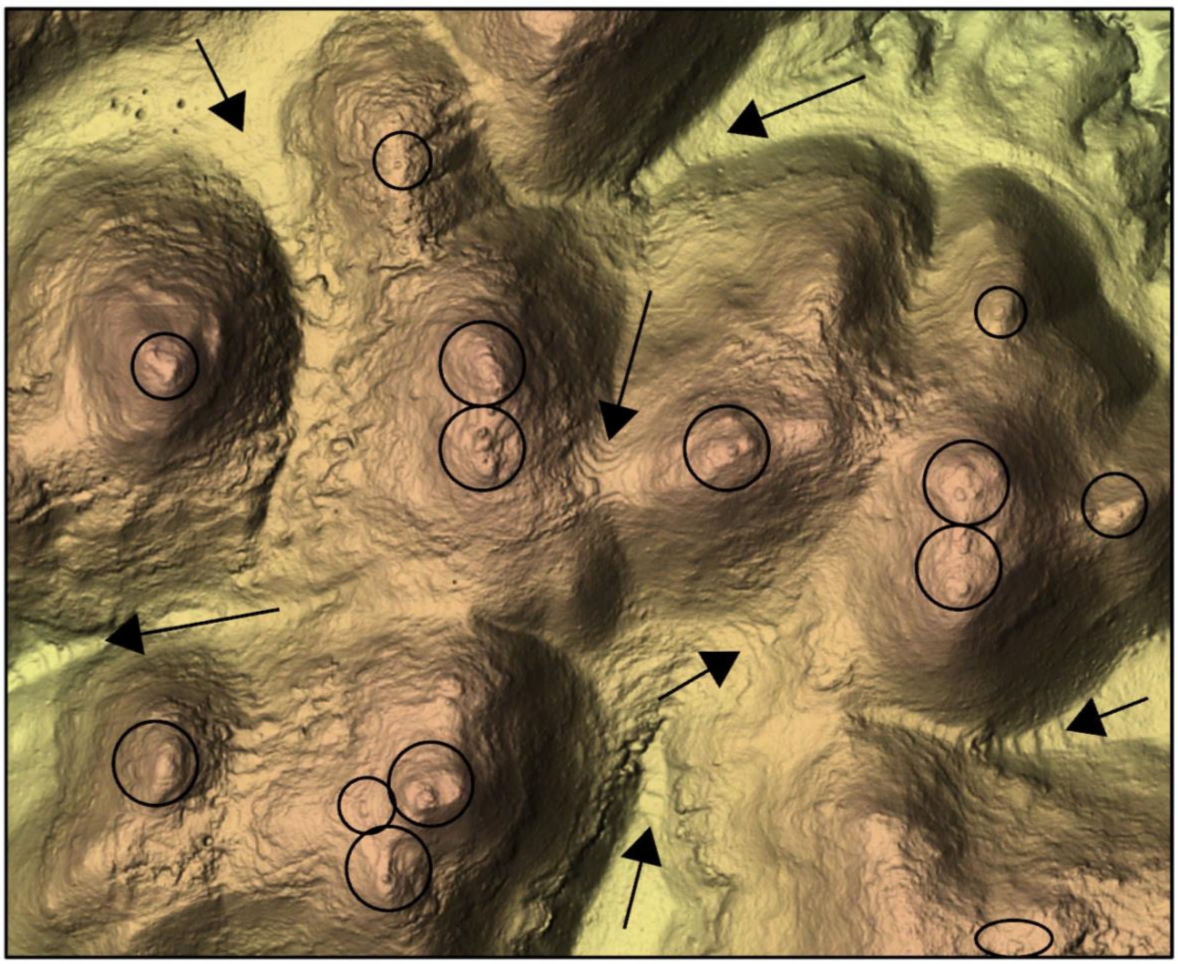

Figure 5. LiDAR data visualized as described in the text of a selection of the topography surrounding Nohoch Batsó showing hilltop residential platforms (circles) and agricultural terracing (arrows).

rock. This observation confirms earlier statements that the ancient Maya did not live on the Mountain Pine Ridge, at least within the survey bounds, because they could not farm there (i.e. Wright et al. 1959). Little settlement is found in the valleys and flat areas in the limestone regions. Instead, the preference was for hilltops. Most were artificially flattened with plazas upon which one or a few structures are haphazardly arranged. Often, the hillsides below the platforms are terraced, and for those with deep cutting bends, or those that have modestly gentle slopes the modifications usually continue to valley floors. This settlement pattern is seen in even the more isolated limestone hills, particularly those near the Buffalo Hill Quarries, which may be where the quarry workers lived.

Quarry Sites

The Buffalo Hill Quarries site extraction pits are visible in the LiDAR data as donut-shaped or U-shaped features (**Figure 6**). Several others resembling them are in areas along the same ridge, but we have yet to visit them. The largest pits are up to three times the diameter of the largest we recorded yet, suggesting that the portion we mapped is a secondary area and the central component of the site is yet undocumented. Moreover, if those features are confirmed to be pits, the actual size of the Buffalo Hill Quarries site would be closer to 50 hectares, over three times the current known size. Other possible quarry sites were noted in the DEM. One is found near the intersection of an unnamed trail and an unnamed feeder stream that flows in Pinol Creek near the second southwesterly bend in the western section of the 1963 Road. Another is on the west bank of Oak Burn creek where it turns sharply to the north after passing below San Miguel Road. There are several other possible isolated extraction pits throughout the granitic rocky regions of the northern survey area between Privassion Creek and Rio On.

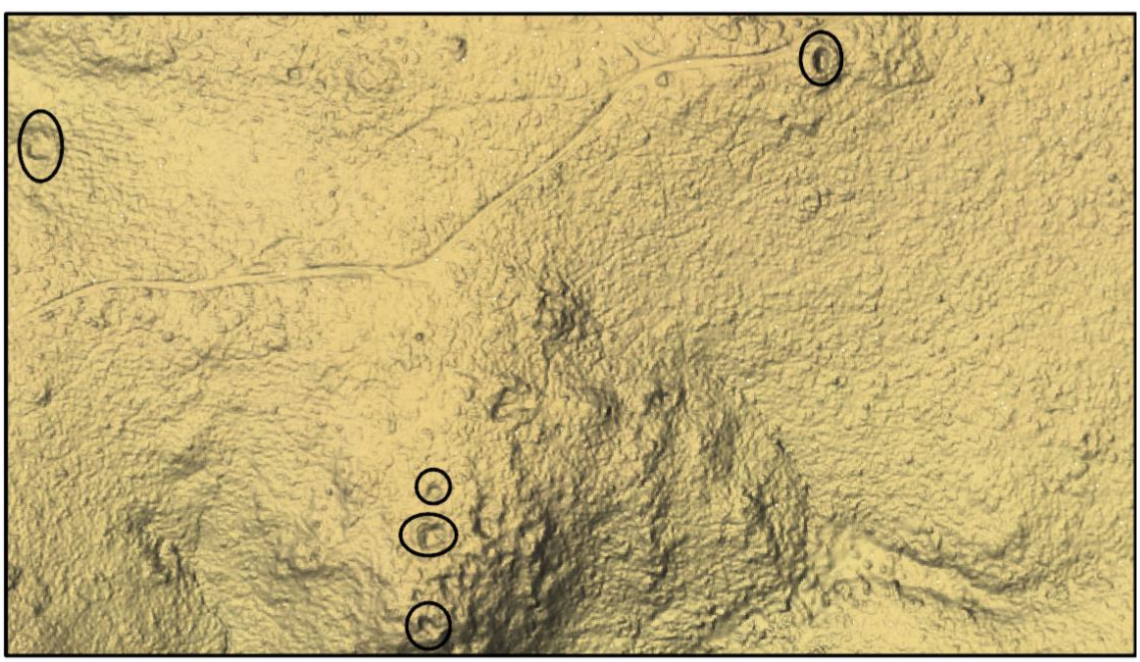

Figure 6. LiDAR data visualized as described in the text highlighting several extraction pits in the Buffalo Hill Quarries site (circled).

Caves and Karst

Over 70 possible cave entrances have been identified in the LiDAR data. Like the findings of Moyes and Montogomery (2016, 2019) and Weishampel and colleagues (2011) many of the entrances are sinkholes (**Figure 7**); however, horizontal entrances are suggested based on characteristics of the landscape, such as water courses flowing into the bases of hills (**Figure 8**). Furthermore, small black dots resembling the known entrances of caverns such as Closing Jaw and Rio Frio caves A and B, and Domingo Ruiz Cave are present on many hillsides.

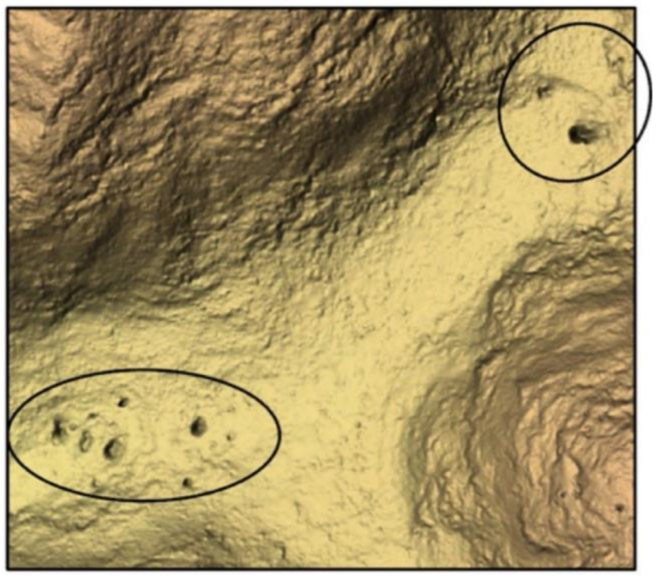

Figure 7. LiDAR data visualized as described in the text of an example of an area with multiple potential sinkhole entrances.

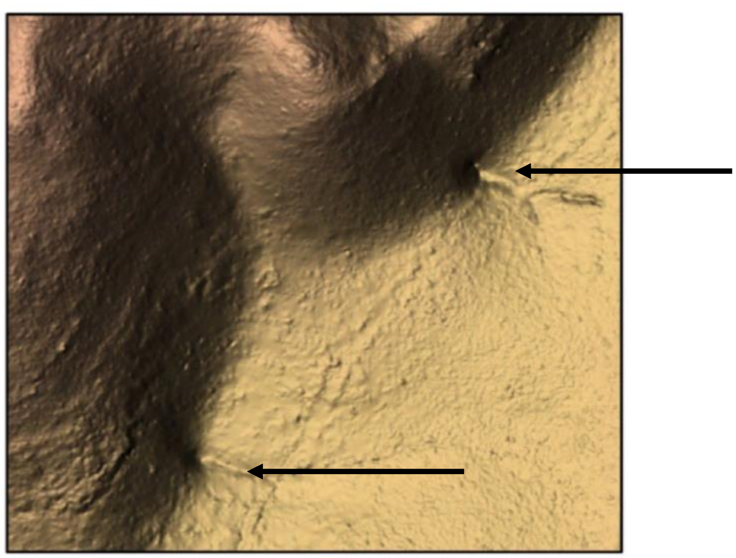

Figure 8. LiDAR data visualized as described in the text of two drainages flowing into the side of a hill, likely representing cave entrances.

Discussion

The Mountain Pine Ride is a region that has long been overlooked in Maya archaeology. The resultant lack of previous systematic survey there, coupled with the restrictions of working in a protected area, has required us to rely on local knowledge and fortuitous encounters to learn about the archaeological sites of the region. Our participation in NCALM's Belize 2022 Collaborative LiDAR Campaign offered us the opportunity to conduct a non-invasive prospection of a sizeable portion of our permit concession area to gain a better understanding of the kinds of cultural resources there. As our earlier work began to suggest, the reserve was not largely devoid of past Maya people or sites. Instead, like elsewhere in the Maya region, people clustered in urban centers while others lived in more rural settings. There, rural meant something different than remote. Thanks to the character of the topography, people still lived relatively close to their neighbors, just not quite as close as those in the urban areas. Nor did rural mean untouched wilderness. Instead, many of the hillsides in the areas underlain by limestone were dramatically transformed by agricultural terracing. While broad-leaf forest probably persisted in the some of the same areas it can be found today, one would only need to walk a few minutes, likely along well-trodden paths through the rough terrain, before coming across signs of others living in the area. What these LiDAR data tell us too is that some past Maya people lived parts of their daily lives even in the areas where soil conditions would not permit farming. Instead, they built houses and farmed where the soils would permit, most often on the closest limestone hills, and then commute to work in the granite quarries. In the end, no longer can we think about the Mountain Pine Ridge Forest Reserve as a place devoid of ancient Maya people and sites. Instead, the LiDAR data that are the subject of this report show the reserve to have been a well-populated place with a diverse inventory of archaeological sites. Because of the resources there (Graham 1987), particularly the granitic rock that was widely preferred throughout the eastern Lowlands for making ground stone implements (Brouwer Berg et al 2021; Shipley and Graham 1987; Tibbits et al. 2022), the archaeology there is otherwise unique in Belize and the Maya Lowlands in general.

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Chapter 6: Zooarchaeological Remains from Domingo Ruiz Cave

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Archaeological excavations in Domingo Ruiz Cave conducted in December 2019 uncovered a collection of potentially worked bone fragments from Unit 2 (Spenard and Martinez 2020). Readers are directed to that report for an in-depth discussion of the discovery and recovery contexts. In short, the faunal material was recovered from a buried pit feature cut into a stratigraphic level that suggested they may date to pre-ceramic times. Radiocarbon assays associated with that excavation are presented in the Chapter 4 in this volume. The faunal material was exported to the United States with permission from the Belize Institute of Archaeology for zooarchaeological study. The archaeological material was delivered to the senior author at the San Diego Natural History Museum who compared it to the type collection in that institutions zooarchaeological lab. The current chapter presents the results of that comparative study.

Unit 2, Level 2 (Figure 1)

Figure 1, left specimen

Scapula (glenoid fossa) of a medium mammal (smaller than a deer, larger than a rabbit). The surface of neck of the scapula and some edges of the fragment are shiny and exhibit polishing marks. Three deep scores and two pits can be observed on the scapula neck. It is very likely that these are a result of carnivore gnawing. With that said, the use of the bone as a tool cannot be ruled out.

Figure 1, middle specimen

Left scapula (glenoid fossa) of a rabbit (sylvilagus sp.). Upon comparing the scapula to three leporid species, inhabiting San Diego County, it was determined that the scapula is smaller than a Jackrabbit *(Lepus californicus*) thus, most likely it came from eastern cottontail (*Sylvilagus floridanus*).

Figure 1, right specimen

Skull fragments of a medium mammal (smaller than a deer, larger than a rabbit).

Unit 2, Feature 1 (Figure 2)

This bag contains two fragments, which most likely came from a single specimen. Both fragments are part of medium or large mammal tooth. The observed polish and striations are in fact natural and part of the tooth enamel. The tooth size suggests it is either a cheek tooth (premolar or molar) of a mammal larger than deer or a canine (tusk) of a medium (pig size) or large mammal (bear size).

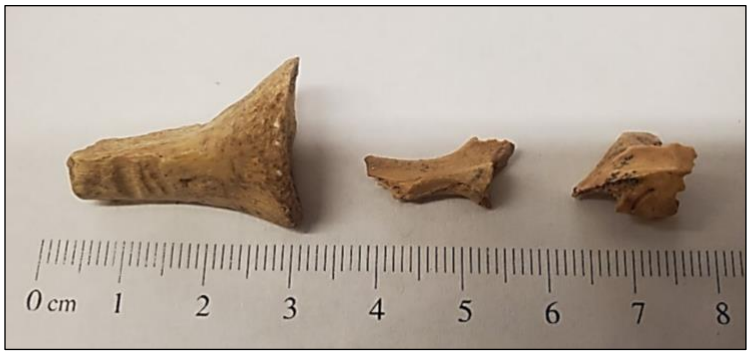

Figure 1. Zooarchaeological materials from Unit 2, Level 2. Photo by A. Sasson.

Figure 2. Zooarchaeological materials from Unit 2, Feature 1.Photo by A. Sasson.

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Chapter 7: Report on a Suite of Radiocarbon Dates from Rio Frio Cave A and Domingo Ruiz Cave

Jon Spenard (California State University San Marcos)

With only one radiocarbon date from Rio Frio Cave E, the ancient chronology of the Mountain Pine Ridge Forest Reserve is poorly defined. That assay reveals ritual use of an alcove in the cavern during the Late Classic period around CE 830 (Pendergast 1970:9). In general, ceramics published from Rio Frio Caves A, B, C, and E stylistically date to the same period, although some Early Classic styles have also been recovered (Mason 1928; Pendergast 1970). Stratigraphic excavations in Rio Frio Cave A and Domingo Ruiz Cave by the Rio Frio Regional Archaeological Project (RiFRAP) during the 2019 season recovered sizeable quantities of charcoal including fully carbonized fragments of juvenile corn cobs (Spenard et al. 2020; Spenard and Martinez 2020). Four pieces of charcoal, including two of the carbonized corn cob fragments, were submitted to BetaAnalytic Laboratories in Miami, Fl for radiocarbon dating. Three of submitted pieces were recovered from the rock shelter entrance of Rio Frio Cave A. The fourth piece was recovered from a pit below an ash lens in the dark zone of Domingo Ruiz cave. In this chapter, I summarize the contexts from which the charcoal was recovered, present the results of the analysis, and discuss their significance.

Table 1. Radiocarbon Determinations from Rio Frio Cave A and Domingo Ruiz Cave (2019 season)

Site	Provenience	Lab #	Conventional C-14 Age	Calibration Results (2σ)
Rio Frio Cave A	U2 L2	Beta - 656175	2050 +/- 30 BP	158 cal BC - 26 cal AD (94.8%) 50 - 55 cal AD (0.6%)
Rio Frio Cave A	U2 L3	Beta - 656176	2090 +/- 30 BP	178 - 38 cal BC (91.2%) 13 cal BC - 4 cal AD (2.8%) 196 - 185 cal BC (1.3%)
Rio Frio Cave A	U1 L5	Beta - 656174	1490 +/- 30 BP	545 - 642 cal AD (95.4%)
Domingo Ruiz Cave	U2 Feat. 1	Beta - 656177	120 +/- 30 BP	1799 - 1940 cal AD (67.2%) 1680 - 1740 cal AD (25.8%) 1752 - 1764 cal AD (2.4%)

Rio Frio Cave A Results

The units from which the three charcoal samples from Rio Frio Cave A were recovered from have complex, but well-defined stratigraphy consisting of successive overlapping ash and charcoal deposits (Spenard et al. 2020:9-15). Charcoal from Unit 1 Level 5 and Unit 2 Levels 2 and 3 and were submitted. Locations for both units were selected because they were adjacent to alcoves, which personal experience has shown are locations past Maya people sought for ritual activity. The placement of Unit 1 was also selected due to the presence of the densest ceramic scatter in the rock shelter portion of the cavern. We hypothesized that we would recover stylistically dateable ceramics from the deposit to aid in establishing the site chronology. Further considerations for the placement of Unit 2 included the presence of a constructed rock alignment that delineated the alcove as a distinct place in the rock shelter entrance area.

Beta-656174 This sample (carbonized corn cob) was retrieved from unit wall collapse while excavating Unit 1 Level 5. The collapse originated from a partially buried alcove in the cave wall abutting the excavation unit. Diagnostic ceramics were recovered throughout the excavation. Though they are awaiting formal analysis, styles from the Early and Late Classic periods were noted. At 545 - 642 cal AD, Beta-656174 falls within the expected date range.

Beta-656175 This sample (carbonized corn cob) was retrieved from a thick charcoal and ash deposit in Unit 2 Level 2 situated atop a partially preserved tamped or plaster floor. Ceramics and other artifacts were recovered from this same level, although their analysis is ongoing. Beta-656175 has two possible calibrated date ranges (**see Appendix A**) 158 cal BC - 26 cal AD, and 50 - 55 cal AD. Although ceramics from the caverns in the Rio Frio Valley, including Rio Frio Cave A, indicate primarily Late Classic period use (Mason 1928; Pendergast 1970), Late Preclassic period subterranean ritual is known for western Belize (Moyes et al. 2017; Spenard 2014). Moreover, this date aligns with Beta-656176, discussed below, both of which were recovered in situ from intact deposits. Considering the above, the radiocarbon dates fall in an expected range.

Beta-656176 This sample, (wood charcoal) was retrieved from matrix situated between two intact formal floors. It was collected from Unit 2 Level 3. Whether the floors are tamped earth or plaster remains undetermined. The single chunk of wood charcoal that was dated was one of several large pieces recovered from between the intact cultural floors. No evidence of disturbance was noted, indicating a sealed context. Ceramic sherds were also recovered from the level, although they are non-diagnostic pieces. Beta-656176 has three possible calibrated date ranges (**see Appendix A**), 178 - 38 cal BC, 13 cal BC - 4 cal AD, 196 - 185 cal BC. This range of dates is slightly older than Beta-656175, which was recovered from the stratigraphic level above it. For similar reasons given above for that other assay, the calibrated dates are accepted.

Domingo Ruiz Cave Results

The charcoal sample submitted from Domingo Ruiz cave was recovered in Unit 2, an excavation pit placed in the approximate center of the cavern (Spenard and Martinez 2020). There, two surface ash deposits adjacent to the edge of a large area of flowstone and boulders was noted. Several of the cave formations in the ceiling drip and areas of the flowstone receive water during rains today. Such areas of falling water were common locations of past Maya ritual activity. Furthermore, several caves in the region, such as Actun Tokbe, Barton Creek, Skeleton Cave, and Actun Yaxtel Ajaw contain similar small-scale burned areas, some of which have carbonized plant remains in them, suggesting a regional pattern. Such deposits have been interpreted as personal agricultural rituals (Mirro 2007; Morehart 2011). The Domingo Ruiz Cave Unit 2 excavation was situated over one of the two surface ash deposits, but little cultural material was uncovered below the surface. The matrix transitioned to a distinct orange-brown color after a few centimeters, indicating a paleosol was uncovered. Heavily polished bones were recovered from that level, suggesting pre-ceramic use of the cavern (see Sausson, this volume).

Beta 656177 This sample (wood charcoal) was retrieved from a small, buried pit feature below a buried ash lens. Few artifacts were recovered from the pit, but a possible ungulate tooth was recovered from the bottom of it. Beta-656177 has three possible calibrated date ranges (see **Appendix A**), 1799-1940 cal AD, 1680-1740 cal AD, and 1752-1764 cal AD. Domingo Ruiz cave was officially opened for tourism by the Forest Department in 2018, but it has long been known and has been visited by tourists (for example, https://belizeinstitute.wordpress.com/2013/07/24/a-river-runs-through-it/).

Additionally, in 1855, Mr. Miguel Augustin, a cattle rancher from Guatemala founded a settlement, "Augustin," on the land that Douglas D'Silva Forest Station was later built. He lived there until his death in 1898, after which the settlement was abandoned (Tzul 1993:16). It appears likely that Mr. Augustin knew of the caves in the area. Mason (1928:13) notes that "an old Indian" told his guide about the Rio Frio Caves "some thirty years ago." Mason recorded the Rio Frio Caves in 1928, and "some 30 years prior" would have been during Mr. Augustin's lifetime. The timing suggests Mason's "old Indian" is likely Mr. Augustin. The reason Augustin was abandoned is that Mr. Augustin was believed to have been a powerful wizard who could transform at will into a tiger. He was respected but also feared in life, and his passing caused great fear (Tzul 1993:16). Caves are among the most potent places on the landscape in Maya worldview, but the forces in them are ambivalent. They are sources of fecundity and the abodes of the ancestors, but they can also be used for nefarious purposes such as witchcraft (Brady 2005; Lucero and Gibbs 2007). Given the belief that Mr. Augustin was a "wizard," he likely knew of, visited, and likely used the caverns in the area, including Domingo Ruiz Cave. Given the above, the calibrated dates for Beta 656177 are accepted.

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Appendix A: Reports of Radiocarbon Dating Analyses

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ISO/IEC 17025:2017-Accredited Testing Laboratory

REPORT OF RADIOCARBON DATING ANALYSES

Jon Spenard

California State University San Marcos

Report Date: February 28, 2023

Material Received: February 17, 2023

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 656175	**1-003**	**2050 +/- 30 BP**	IRMS δ13C: -13.6 o/oo

(94.8%)	**158 cal BC - 26 cal AD**	**(2107 - 1924 cal BP)**
(0.6%)	**50 - 55 cal AD**	**(1900 - 1895 cal BP)**

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 77.48 +/- 0.29 pMC
Fraction Modern Carbon: 0.7748 +/- 0.0029
D14C: -225.24 +/- 2.89 o/oo
Δ14C: -232.05 +/- 2.89 o/oo (1950:2023)
Measured Radiocarbon Age: (without d13C correction): 1860 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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Jon Spenard — Report Date: February 28, 2023

California State University San Marcos — Material Received: February 17, 2023

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 656176	**1-007**	**2090 +/- 30 BP**	IRMS δ13C: -11.1 o/oo

(91.2%)	**178 - 38 cal BC**	**(2127 - 1987 cal BP)**
(2.8%)	**13 cal BC - 4 cal AD**	**(1962 - 1946 cal BP)**
(1.3%)	**196 - 185 cal BC**	**(2145 - 2134 cal BP)**

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 77.09 +/- 0.29 pMC
Fraction Modern Carbon: 0.7709 +/- 0.0029
D14C: -229.09 +/- 2.88 o/oo
Δ14C: -235.86 +/- 2.88 o/oo (1950:2023)
Measured Radiocarbon Age: (without d13C correction): 1860 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 656174	**1-002**	**1490 +/- 30 BP**	IRMS δ13C: -10.6 o/oo

(95.4%) **545 - 642 cal AD** **(1405 - 1308 cal BP)**

Submitter Material:	Charcoal
Pretreatment:	(charred material) acid/alkali/acid
Analyzed Material:	Charred material
Analysis Service:	AMS-Standard delivery
Percent Modern Carbon:	83.07 +/- 0.31 pMC
Fraction Modern Carbon:	0.8307 +/- 0.0031
D14C:	-169.30 +/- 3.10 o/oo
Δ14C:	-176.60 +/- 3.10 o/oo (1950:2023)
Measured Radiocarbon Age:	(without d13C correction): 1260 +/- 30 BP
Calibration:	BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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California State University San Marcos — Material Received: February 17, 2023

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 656177	**1-004**	**120 +/- 30 BP**	IRMS δ13C: -27.6 o/oo

(67.2%)	**1799 - 1940 cal AD**	**(151 - 10 cal BP)**
(25.8%)	**1680 - 1740 cal AD**	**(270 - 210 cal BP)**
(2.4%)	**1752 - 1764 cal AD**	**(198 - 186 cal BP)**

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 98.52 +/- 0.37 pMC
Fraction Modern Carbon: 0.9852 +/- 0.0037
D14C: -14.83 +/- 3.68 o/oo
Δ14C: -23.49 +/- 3.68 o/oo (1950:2023)
Measured Radiocarbon Age: (without d13C correction): 160 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL20)

(Variables: d13C = -13.6 o/oo)

Laboratory number **Beta-656175**

Conventional radiocarbon age **2050 ± 30 BP**

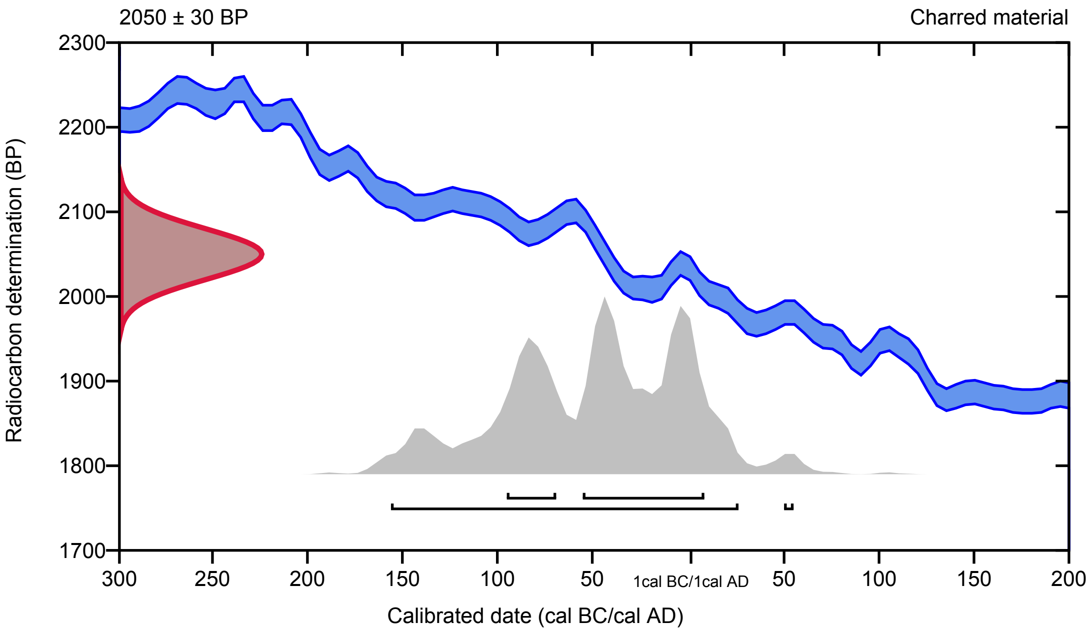
95.4% probability

(94.8%)	158 cal BC - 26 cal AD	(2107 - 1924 cal BP)
(0.6%)	50 - 55 cal AD	(1900 - 1895 cal BP)

68.2% probability

(49.1%)	57 cal BC - 8 cal AD	(2006 - 1942 cal BP)
(19.1%)	97 - 71 cal BC	(2046 - 2020 cal BP)

1-003



Database used

INTCAL20

References

References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337-360.

References to Database INTCAL20

Reimer, et al., 2020, Radiocarbon 62(4):725-757.

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL20)

(Variables: d13C = -11.1 o/oo)

Laboratory number **Beta-656176**

Conventional radiocarbon age **2090 ± 30 BP**

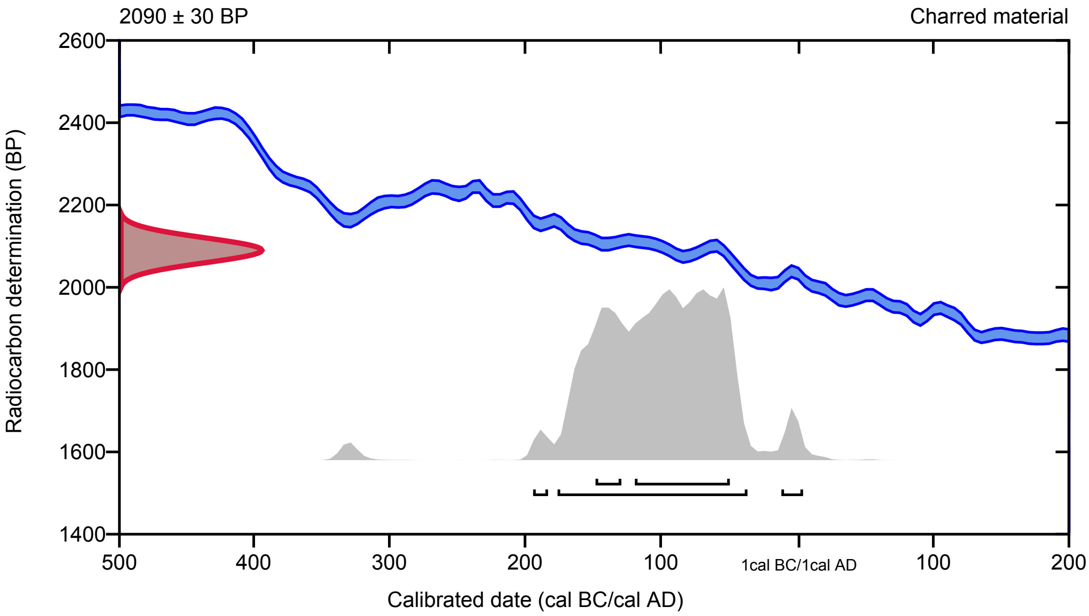
95.4% probability

(91.2%)	178 - 38 cal BC	(2127 - 1987 cal BP)
(2.8%)	13 cal BC - 4 cal AD	(1962 - 1946 cal BP)
(1.3%)	196 - 185 cal BC	(2145 - 2134 cal BP)

68.2% probability

(54.6%)	121 - 51 cal BC	(2070 - 2000 cal BP)
(13.6%)	150 - 131 cal BC	(2099 - 2080 cal BP)

1-007



Database used

INTCAL20

References

References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337-360.

References to Database INTCAL20

Reimer, et al., 2020, Radiocarbon 62(4):725-757.

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BetaCal 4.20

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL20)

(Variables: d13C = -10.6 o/oo)

Laboratory number **Beta-656174**

Conventional radiocarbon age **1490 ± 30 BP**

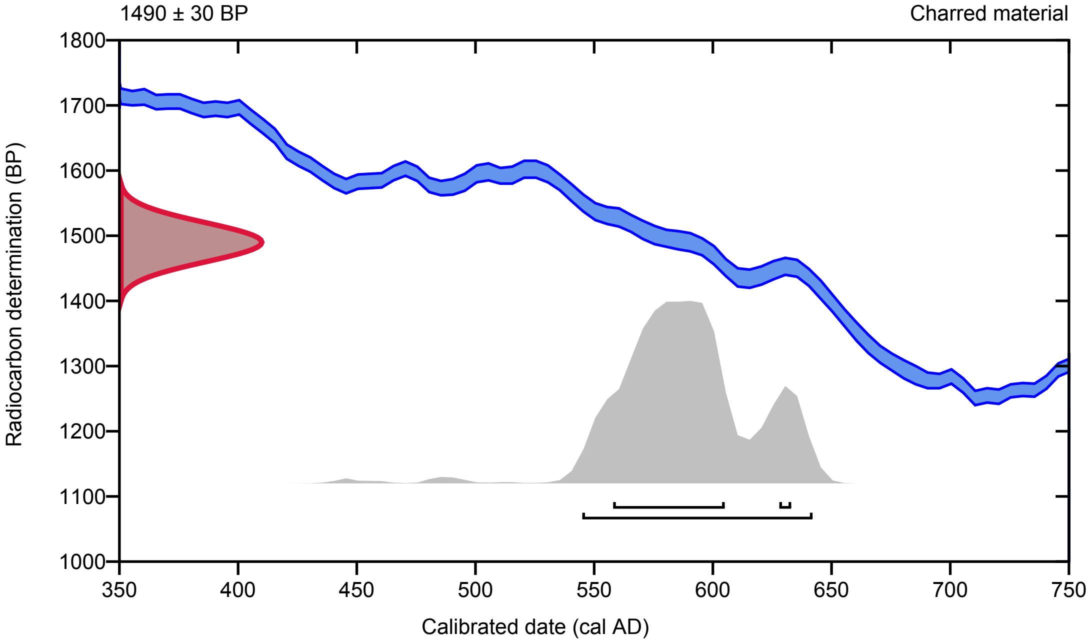
95.4% probability

(95.4%)	545 - 642 cal AD	(1405 - 1308 cal BP)

68.2% probability

(64.4%)	558 - 605 cal AD	(1392 - 1345 cal BP)
(3.8%)	628 - 633 cal AD	(1322 - 1317 cal BP)

1-002



Database used

INTCAL20

References

References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337-360.

References to Database INTCAL20

Reimer, et al., 2020, Radiocarbon 62(4):725-757.

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BetaCal 4.20

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL20)

(Variables: d13C = -27.6 o/oo)

Laboratory number **Beta-656177**

Conventional radiocarbon age **120 ± 30 BP**

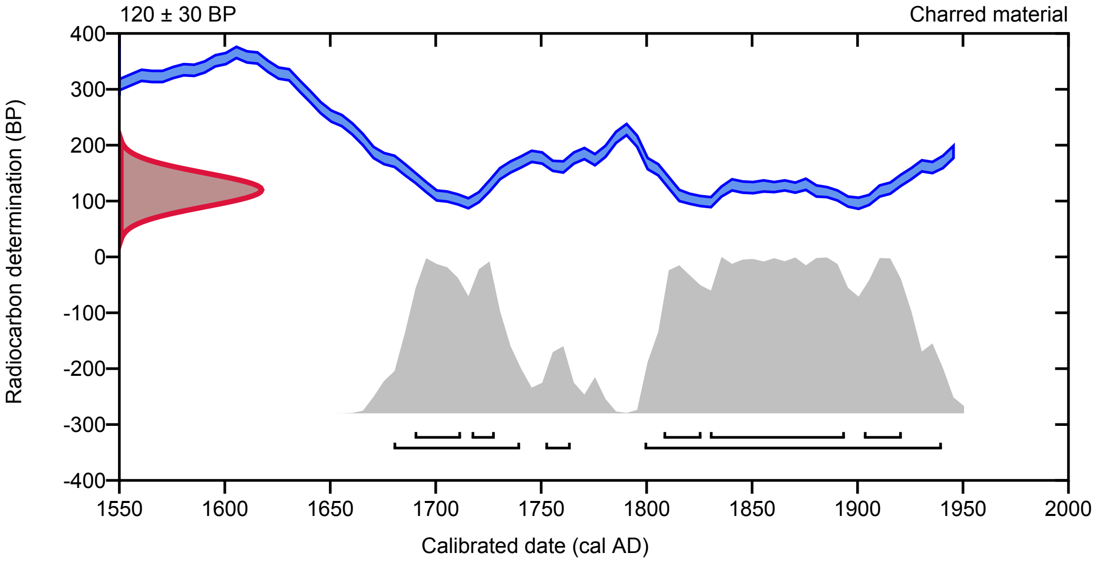
95.4% probability

(67.2%)	1799 - 1940 cal AD	(151 - 10 cal BP)
(25.8%)	1680 - 1740 cal AD	(270 - 210 cal BP)
(2.4%)	1752 - 1764 cal AD	(198 - 186 cal BP)

68.2% probability

(34.3%)	1830 - 1894 cal AD	(120 - 56 cal BP)
(11%)	1690 - 1712 cal AD	(260 - 238 cal BP)
(9.2%)	1903 - 1921 cal AD	(47 - 29 cal BP)
(8.4%)	1808 - 1826 cal AD	(142 - 124 cal BP)
(5.3%)	1717 - 1728 cal AD	(233 - 222 cal BP)

1-004



Database used

INTCAL20

References

References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337-360.

References to Database INTCAL20

Reimer, et al., 2020, Radiocarbon 62(4):725-757.

RiFRAP