Pacbitun Regional Archaeological Project (PRAP):

Report on the 2013 Field Season

Edited by

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Map showing the location of the Pacbitun Regional Archaeological Project (PRAP) permit area (in yellow).
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I would like to express my gratitude to the Institute of Archaeology in Belize, especially Drs. Jaime Awe and John Morris, for their continued support of the Pacbitun Regional Archaeological Project (PRAP). Fieldwork at Pacbitun in 2013 was supported by a grant through the Alphawood Foundation. Our research in 2013 could not have been as successful as it was without their financial support. The Department of Geography and Anthropology and the Education Abroad Office at Kennesaw State University are thanked for logistical support. I would also like to thank Mr. Alfonso Tzul, the landowner, who graciously allowed us to excavate on his private land. The excavations at Pacbitun would not have been possible without the hard work and dedication of my staff (Jenny Weber, Norbert Stanchly, George Micheletti, Jessie Griggs, Burnette, Jon Spenard, Sheldon Skaggs, and Jeff Powis), field school student (Sean Seiler), and my local field assistants from San Antonio Village. A special acknowledgement goes out to my local forman, Oscar Mai, for his immense help over the past field season. Paul Healy and Kong Cheong visited Pacbitun and provided key insights into our research in the site core. Enjoy your retirement Paul!
Archaeology and Heritage Preservation: A Collaborative Project

Jessie Griggs Burnette
(Georgia State University)

McAnany and Parks (2102) describe the phenomena of heritage disconnect and language loss by contemporary Maya peoples to pre-Hispanic cultural heritage in great detail. They use the phrase “heritage distancing” to discuss the contemporary habits of the Maya peoples of Honduras. The contemporary population is described as lacking a connection to the archaeological past while existing in a postmodern generation that values the prehistoric Maya, and often times ignores the contemporary. Prehistory is highlighted in tourism while contradicting social structures and pressures often stamp out traditional practices and suppress the use of native languages and identity. Archaeologists working at the site of Pacbitun in Belize are witnessing this parallel breakdown in social construct and identity.

In-herit, formerly known as MACHI (Maya Area Cultural Heritage Initiative), was founded by Patricia McAnany and Shoshaunna Parks in an effort to confront the aforementioned issues faced by contemporary Maya peoples living in archaeology-rich areas. We are following their lead at Pacbitun (Figure 1), and this paper highlights our first season of progress.

Figure 1. BKE director with local school children at PRAP field lab in San Antonio.
Background

The archaeology site of Pacbitun is located in the foothills of the Maya Mountains in the Cayo District of western Belize (Figure 2), approximately three kilometers east of the present-day Maya community of San Antonio. First inhabited about 800 BC, Pacbitun reached its peak of cultural development during the Late Classic Period (AD 600-900). At this time the site likely controlled an area of nine square kilometers. Ceramic analysis indicates that the site was possibly abandoned by the beginning of the tenth century. The Maya living in San Antonio today are refugee descendants who were forced to migrate from the Yucatan during the Caste War in the late 19th early 20th century (1847-1901).

Each year, Kennesaw State University runs an archaeological field school at Pacbitun under the direction of Terry Powis. The field school is four weeks long (month of June every year), with 5 to 15 undergraduate students from across the United States participating. Staff members consist of both undergraduate and graduate students from across North America. Our team has been working together on this interdisciplinary project for the past six years. The undergraduate students who attend this field school are all anthropology majors, and each year there is a good mix of archaeology and cultural anthropology students. This mixture of students has heightened our interest in engaging and collaborating with the people from San Antonio.

Figure 2. Entrance to the Pacbitun site.

Our bi-directional knowledge exchange project is coupled with the Pacbitun Regional Archaeology Project (from here on referred to as PRAP). PRAP is entering its 7th season. Last season was the 6th, and the official beginning of a formal bi-directional knowledge exchange program. In 2011, I attended the PRAP field school as an undergraduate. This is when I met the key players in the development of this project. A couple of local undergrads, a few land owners, and a little boy inspired me to go back to San Antonio not only as an archaeologist, but as an
archaeologist actively involved in giving back to the community in a way that they desired, and we could provide. These local village members identified what they saw as a major problem in their community. They initiated talks with our team on a daily basis about the rapid Yucatec language loss, and cultural shifts that were causing a massive generational divide within the Maya community. Their concerns are supported by data presented by UNESCO which specifically names the town of San Antonio and the Yucatec language as in “definite danger of language loss”. Powis, the PI of PRAP, saw it as I did, and quickly jumped at the opportunity to apply for the bi-directional knowledge exchange grant (BKE grant) from In-herit, through UNC-Chapel Hill, that allowed our team to begin this new arm of our project.

This paper does not reveal much quantitative data. However, it does expose the process of initiating and sustaining a collaborative project between the foreign academic community and the local populous. Creating a sustainable and positively impactful project is a more difficult task than one may think. The key to success is following the local community instead of leading. By this, I mean, listening, observing, learning, and evaluating the already existing foundations that the new project is going to be built upon. No praxis project begins with a clean slate. Agency must always be left in the hands of the local collaborator, if success and sustainability are the goals. Our job is to learn from the community, and then give back with our expertise (and grant funding, of course). We work together as evaluators, problem solvers, and educators to create a better future for a community that is struggling to overcome a self-identified problem.

**Project Description**

The initial field season was incredibly busy, as one may predict. Our team hit the ground running. We began with identifying a couple of local co-workers, and jumped right into informal interviews. Interviews are an irreplaceable step in the ethnography of the praxis based project. Ethnography is not common on an archaeology site, but must be carried out in order to properly assess the situation and to keep agency in the hands of the local community. We interviewed local business owners, NGO operators, farmers, community board members, teachers, professors, school administrators, recent high school graduates, young adults, and community elders. We reached out to as many socioeconomic categories as possible. We needed to know and understand how locals outside of our archaeology project viewed language loss and heritage.

The result was an overwhelming majority of folks vocalizing that they viewed the language loss as a major problem within the community, and that most youth did not understand their own heritage (Burnette and Powis 2014). Common feelings were that negative outside pressures were shaming the Maya community into neglecting and purposefully suppressing their own language. We found young adults and children would deny being able to speak Mayan, if asked to use their native language. After only a short time in the community, we were able to determine that some of the young generation that does, in fact, speak the language, often feel embarrassed to do so because it is understood to be a trait of a low class citizen; therefore, they simply refuse to use the language.

We were invited into the school system by the administrator. We spent time doing classroom observations in order to understand teaching style and curriculum patterns. At the request of the school administrator, we are working on creating a curriculum that introduces the
local archaeology, and is coupled with a heritage and language preservation program. Our initial solution to this was to create a children’s book written in Yucatec to be used as a classroom tool. A local anthropologist, named Fernando Tzib, teamed up with us, and brought forth a children’s book that he had in his possession. The book was created by a former student of his. We used the BKE funds to print copies of this book and distribute them throughout the community. At the end of the field season, Tzib was working on translating the book into Spanish and English. The plan is to then digitize it so that it may be used in a mobile classroom, already in the community, as a teaching tool in San Antonio. We also used grant funds to print classroom materials that had been created by a local community member. We printed language materials as well as historical materials. These were immediately given back to the community.

The most successful aspect of our first season was the field day for local students. Our team collaborated with the village school to provide kids with an opportunity to tour and excavate at Pacbitun (Figure 3). This portion of the project brought to life what knowledge exchange and collaboration is about. Local community members, who had been taught archaeology by our PI, were then (with us) teaching their own youth the archaeological process and the beginnings of a prehistory lesson. Students took part in excavations and screenings on site. This exposure is intended to heighten awareness of the effects of looting on archaeological sites while building interest in learning and understanding of the contemporary connection to the prehistoric.

Figure 3. Standard 5 students receive an archaeology lesson from Terry Powis at Pacbitun.
Our PRAP team, at the request of locals, also sponsored San Antonio Day, a traditional festival that has recently began to dwindle due to social pressure from outside sources, and a lack of funding. We sponsored a soccer game (Figure 4), and the traditional greasy pole event. Next season, we hope to also sponsor the traditional pig head dance.

![Figure 4. PRAP soccer team celebrates a victory in the San Antonio Day Soccer Tournament.](image)

Another exhilarating aspect of our project was to go to work with locals outside of the archaeology site, learning about their traditional jobs within the community. Our team members suited up and went to bakeries, farms, NGOs, artisan workshops, and bee keepers to learn about traditional lifestyle (Figure 5), and how it relates and responds to outside economic pressures and strain. This portion of the exchange also allowed us to begin our digital photo journal project that will ultimately be carried out by community members, and led by school children. The digital photo journal will be coupled with oral history collections and interviews of community elders to highlight local perception of heritage, and to promote Yucatec language preservation. Last season our team conducted oral history collection. However, it is our goal for next season to have local Maya students doing this themselves.
Conclusion and Future Project Goals

Continuation and follow-up goals are, in a sense, more important than initiating a project. This is why our ultimate goal of the project is to create a sustainable knowledge exchange program. These types of programs do not flourish overnight. They must be carefully cultivated and planned. Funding must be sought and awarded, while simultaneously putting into place mechanisms that will ultimately ensure the sustainability factor of the project. The initial goals of our knowledge exchange were simple. They were to work with the community to introduce archaeology to the local Maya population, with hope that this would inspire the young village members to learn more about the rich history and prehistory enveloping the community of which they are active members. Coupling this with a program that highlights the detrimental effects of language loss on a people, we hoped that the community would be excited to begin incorporating a new language development curriculum in the local schools. This is exactly what happened.

Now, moving forward to next season, we are working with the local school administration to create this curriculum which will begin as a hybrid course taught by myself and another PRAP team member during the final month of school. The course will incorporate local archaeology with history and prehistory lessons. We will be instructing the students on how to carry out an oral history project, and providing them the tools they need to photograph and record local culture. We will then assist in creating the digital journal from the material they have collected. The idea is to present the oral histories in Yucatec, marry them with the digital photo journal, and then give them back to the school system as a language teaching tool. The PRAP team members will be teaching the program so that the school system is not responsible for funding and recruitment of staff in the original seasons. As a fun addition to the already existing cultural day, currently hosted by the school, we will sponsor an end of the year Yucatec spelling bee. We know that the spelling bee alone is not going to bring back the use of the
Yucatec language. However, the goal is to spark an interest in the language so that when the curriculum becomes a part of daily life for the students they will be more likely to participate in the learning activities.

During the next field season, in order to secure the sustainability of the project, we are going to create a local knowledge exchange board to evaluate and continue local project development. It is our goal to see this project develop into a yearlong event instead of only a seasonal one. There is clearly much work left to be conducted. However, we at PRAP feel confident in our initial collaborations, and we are excited to see the developments, as observed in Figure 6, in seasons to come.

Figure 6. Local school students excavating at Pacbitun.
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Mcanany, Patricia, and Shoushana Parks
Archaeological investigations of Actun Lak cave and Actun Xtuyul rockshelter during the 2011 and 2012 field seasons resulted in the recovery of two unusual ceramic sherds discussed in this report. The piece from Actun Lak cave contains the only Primary Standard Sequence (PSS) text yet recovered from any cave in the study area, and is one of only a few texts known from the greater Pacbitun region. The sherd from Actun Xtuyul is a partial ceramic cast that was likely used to produce Ahk’utu’ Molded-carved vessels. This ceramic mold appears to be the first archaeologically discovered for any of the Terminal Classic period molded-carved types. The focus of this report is the hieroglyphic and iconographic programs of both sherds, although I provide brief descriptions of each recovery context in order to situate the objects, and to demonstrate the range of karst features that the pre-Hispanic Maya used around Pacbitun. The interested reader is directed to my dissertation for in depth locational descriptions of the two features (Spenard 2014).

The Actun Lak Sherd

Actun Lak cave is located on a hillside approximately 1.5 km southeast of Pacbitun. It measures 43 m long and its ceiling reaches upwards of 12 m high (Figure 1). Nevertheless, it is relatively narrow with an average width of only 5 m. The pre-Hispanic Maya extensively shaped the interior and exterior entrance areas during the Terminal Classic period with a variety of architectural constructions that include an earthen-rubble platform, terraces, and a hillside staircase connecting it to another cave downhill, as well as stalactite removal (Spenard 2012, 2013, 2014). The sherd under consideration in this report was recovered from the construction fill of a small terrace 5 m into the cave that abuts the cavern’s eastern wall and a significant drop to a large chamber below. Most ceramics from the construction fill belong to the Terminal Classic period (AD 700-900) Spanish Lookout phase, although pottery from earlier times was also encountered, material that includes the sherd discussed below. Among the Terminal Classic period pottery is an Altar Orange type bowl of the Fine Orange group was encountered at the bottom of the terrace near the entrance of Actun Lak indicates that the Maya made the modifications to the interior and exterior in the 9th century, and thus the sherd discussed here may have been an heirloom.
Figure 1. Plan view map of Actun Lak. The PSS sherd was recovered in Unit 5 adjacent to Terrace 1.

Sherd Description

The Actun Lak PSS sherd is a Sibal Buff-polychrome type from a bowl or vase form that has slightly in-sloping walls, a round, direct rim, and fine sandy paste, with possible volcanic tempering (see Smith and Gifford 1966:163 for type definition). The type dates to the Late Classic period (AD 550-700), its interior wall is decorated with an orange slip, and its exterior is glossy black, both surfaces of which are heavily eroded (Figure 2). The rim diameter measures 16.5 cm, and the wall thickness is 0.55 cm. The black decoration is disrupted by a wide band of
buff to orange slip just below the rim that provides a background for the red colored PSS text that was applied with a fine calligraphic style (see Boot 2005; Coe 1973; Grube 1991; Houston et al. 1989; Houston and Taube 1987; Mathews 1979; Stuart 1989 for discussions of PSS texts). The hieroglyphs likely comprise the first and last words of the dedicatory text for this vessel, as discussed below. One of the glyph collocations is complete, and approximately half of the other remains, and they measure 3 cm and 1.5 cm wide respectively. These two measurements suggest that each block in the complete text averaged 3 cm wide. Considering this calculated per-glyph average width with the vessel diameter, the original text most likely consisted of five blocks. As such, I label the two extant collocations as “A” and “E” in reference to their respective reconstructed locations (Figure 3).

A Reading of the Hieroglyphic Text

   Glyph A consists of a semi-legible prefix and a heavily damaged main sign. The prefix consists of a rounded top component, a horizontal bar-like element in the middle, and a “u” shaped bottom piece. This arrangement closely resembles of the a/ah syllables that start two PSS texts on a vessel recovered from Uaxactun (Figure 4) (Coe and Van Stone 2005:106). The syllable prefixes on the initial glyphs of those vessel texts consist of rounded zoomorphic heads, below which are single horizontal elements. A third component of both prefixes is a “u” shaped design at the base of the hieroglyphs. These similarities indicate that the prefix on glyph block A is a variant of the same element. Furthermore, although the main sign on of glyph block A on the Actun Lak sherd is badly eroded, its extant elements resemble the “mirror” grapheme found on other initial signs of PSS texts on other vessels (Figure 5) (e.g., Coe 1973; Grube 1991; Stuart 1989). Maya scribes used the glyph to announce that the proceeding text describes the manner in which the particular vessel was decorated (Stuart 1989).

   Glyph block E remains in much better condition than A. It is composed of a syllable prefix that resembles hi-/yi-, and a main sign that I was unable to identify (Figure 6). The position of glyph E as the final statement in the PSS suggests that it may be part of the name of the scribe who painted it, or it may refer to the contents of the vessel. Alternatively, the use of the initial glyph in position A, in addition to the appearance of the yi- syllable in the presumed fifth position in the PSS suggests that a more secure reading for this collocation is yich, “its surface [for writing]” (Figure 7) (e.g., Coe and Van Stone 2005:101). If this latter reading is correct then the entire text of the vessel likely simply stated that the vessel surface was prepared and painted.
Figure 2. Rim profile, line drawing, and photograph of Actun Lak PSS sherd.

Figure 3. Actun Lak PSS sherd labeling glyph blocks.

Figure 4. a. Photograph and drawing of Actun Lak PSS sherd glyph block A prefix; b. a/ah syllables from Uaxactun vessel (adapted from Coe and Van Stone 2005:106, 157).
Discussion

With the exception of two carved stone monuments, and a painted shell, hieroglyphic texts from Pacbitun have yet to be published (e.g., Healy 1990b; Healy et al. 2004; Helmke and Awe 2008, 2012; Helmke et al. 2006). This paucity of texts may be the result of archaeological sampling, or it may indicate that writing was uncommon at the site. Given that the site has an unusually large number of stone monuments for sites in the Belize Valley, the latter is the least likely explanation of the two (e.g., Healy 1990a). Either way, this sherd represents a significant
addition to the Pacbitun hieroglyphic corpus given the few known texts for the area, even though the current efforts to decipher it have made little progress. Undoubtedly, as future ceramic texts come to light, the content of this text will become better understood.

The Actun Xtuyul Mold

Actun Xtuyul (Termite Cave) is the upper component of a rockshelter complex on the hilltop above Actun Lak. It measures 13 m long, has a maximum depth of 3 m, and averages 2 m tall, and as such is more closely resembles a large alcove rather than a rockshelter. The surface matrix is speckled with large pebbles, and a series of aligned, single course, uncut limestone rock clusters are located just outside of the dripline in front of the main area. I encountered the partial ceramic mold discussed here on the floor and against the rear wall in the center of the feature. I sunk two excavations units to recover additional pieces of the object, but none were encountered (Spenard 2012).

Description of Mold

The Actun Xtuyul mold was part of a larger ceramic production cast, now lost, that had been broken, reshaped, and then drilled twice prior to its caching in the rockshelter (Figure 8). The reshaping likely resulted in a rounded form initially, but it was broken again when two biconical holes were drilled into the center of the repurposed object. This chain of events is evidenced by the lack of modification along the break that incorporates parts of the two holes on the viewer’s left, and the otherwise extensive reshaping along the remaining profile surfaces. In its current form, the artifact measures 8.249 cm long by 4.477 cm wide by 1.139 cm thick, and weighs 37.5g. It is sand and calcite tempered, and some magnetic nodules are visible on the surface of its dorsal surface. The impression surface is slightly concave rather than flat suggesting that the vessels it was used to produce would have been stamped after they were formed, as suggested by Werness (2003:3).

The iconographic program on the mold displays a right-facing individual (left-facing when cast) squatting on a twisted rope while their elbow rests on their bent knee (Figure 9). The individual wears a six-piece bracelet, that is possibly knotted and a crease in the hand delineates their palm. A set of grooved object, probably beaded feathers, runs the length of the arm three others float below it. These floating objects are highlighted by fine incised lines that indicate the veins and shafts of feathers that originate from a missing part of the scene (Figure 10). The squatting individual wears a beaded necklace, although the reworking of the piece has destroyed much of the detail at that part. The person also wears a six-piece anklet, and a possible loincloth appears behind the bent leg starting above the knee. A small indent at the front of the triangular foot defines the person’s big toe. The drill holes are located at one of the extant ends of the rope and the area behind the ankle. The objects in the lower register are difficult to identify, although another rope appears to go straight down beneath the main character’s toe, out of which pokes an unknown object. This position indicates that the extant scene is the upper register of the vessel. Another grooved object, likely a feather, floats at the bottom left of the piece heading off to another missing part of the scene to the left.
Figure 8. Photograph of front and rear of Actun Xtuyul ceramic cast showing shaping and biconical drilling modifications.
Figure 9. Photograph and line drawing of Actun Xtuyul ceramic cast.

Figure 10. Close up of details of feathers on ceramic mold, a. proposed beaded feather cluster beneath individual’s forearm; b. feather cluster abutting ankle showing tips of feathers.
Discussion

As elaborated below, the ceramic cast had likely been used in the creation of Terminal Classic to Early Postclassic period (AD 850-950) Ahk’utu’ Molded-carved vessels, a recently defined ceramic type (Helmke and Reents-Budet 2008). It is related to the Pabellon Molded-carved and Sahcaba Molded-carved pottery traditions first identified at Uaxactun, but its paste composition, slip colors, vessel form, and decorative modes clearly distinguish it from them (Helmke and Reents-Budet 2008:39; Smith and Gifford 1966:160, 162). The name is derived from the Mayan name for the vessel class, ya-k’u-tu-u, or “his/her-give-thing,” that is always written hieroglyphically on all known Primary Standard Sequence texts of the type (Helmke and Reents-Budet 2008:38).

I tentatively suggest here that the Actun Xtuyul mold was likely used to make Ahk’utu’ vessels, although that assignment is somewhat problematic. The type tends to be geographically oriented to the Belize River and its tributaries, although it reaches as far south as Caracol, a range that easily encompasses the greater Pacbitun region (Helmke and Reents-Budet 2008:43-45). Furthermore, the other two types are largely constrained to discrete areas beyond Belize (Helmke and Reents-Budet 2008:44). These geographic distributions thus suggest that the mold was used to produce Ahk’utu’ vessels. Nevertheless, researchers investigating the molded-carved tradition have reported on the occurrence of identical scenes at various sites indicating that the production molds were likely used to make several vessels, although they were unlikely to have been mass produced (e.g., Graham et al. 1980:164; Helmke and Reents-Budet 2008:38; Werness 2003:3-4). I compared the Actun Xtuyul mold’s iconographic program to other published examples of all three Molded-carved types, as well as an online photographic database of them, and concluded that it is a rare scene in the known corpus (e.g., Adams 1971; Coe 1982; Graham 1987; Graham et al. 1980; Helmke 2000; Helmke and Reents-Budet 2008 Sabloff 1972; Smith 1955; Werness 2003, 2007). The presence of a twisted cord that acts as framing device separating two vertical frames on the mold program distinguishes it from all known molded-carved scenes except for a vase recovered at Lamanai (Graham 1987:Figure 3d). Unfortunately, the part of the scene that would verify this observation was not recovered, although two spots on the vessel could accommodate the scene from the Xtuyul cast (Figure 11). Graham (1987:79) notes that the form of the vessel is common to central Belize, which suggests that it belongs to the Ahk’utu’ tradition. However, Helmke and Reents-Budet (2008:Figure 6) indicate that it belongs to another type, although they do not identify which one. For these reasons, the molded-carved vessel type that the cast was used to produce can only be speculated about until archaeologists recover one with the same iconographic program, although given current understandings of the geographic distributions of the types, Ahk’utu is the most likely.

The Actun Xtuyul mold is a unique item in the Pacbitun karstcape artifact assemblage, and it may represent the first archaeologically recovered production cast for any of the three Molded-carved types. I was unable to locate any references to others, even in conjunction with the ceramics that they were used to make. Instead, scholars studying the vessels tend to speculate about their manner of production based on the condition of the decorations, the walls of the object itself, or variances in minor details (e.g., Adams 1971:49; Graham 1987:79; Graham et al. 1980:164; Sabloff 1972:195; Smith 1955:43; Werness 2003:3-4). Their conclusions tend to
suggest that the elaborate decorations on the vessels were made by some combination of carving, gouging, incising, modeling, molding, or tracing. More recently, Helmke and Reents-Budet (2008:40-41) have observed that the size and clarity of Ahk’utu’ vessels lessen over time, suggesting to them that the later pots were likely produced from casts made from earlier ones, although whether their observation is applicable to the other Molded-carved types is unknown. The Actun Xtuyul specimen has a high level of detail, as discussed above, suggesting that post pressing modifications such as gouging, molding, and incising, would likely have been minimal on vessels produced by actual molds rather than vessels casts.

**Conclusion**

In this report, I have discussed two unusual ceramic sherds from two distinctive karst features in the Pacbitun region. One of the sherds was recovered from an architectural context within a cave and contained a red-painted Primary Standard Sequence text that adds to Pacbitun’s relatively scant hieroglyphic corpus. The second sherd was recovered in an alcove above a much larger rockshelter. The piece is a heavily modified production cast, likely the first of its kind, that was likely used to produce specialized local ceramics during the Terminal Classic to early Postclassic periods. Overall, the recovery of these two rare sherds demonstrate the significance and potential of intensively studying a variety of karst places for understanding the pre-Hispanic Maya.
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“And I'll Meet You Further on Up the Road”:
A Preliminary Report of the 2013 Causeway Excavations at Pacbitun, Belize

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Since 2010, the causeway system at the ancient Maya site of Pacbitun has been one of the archaeological research foci of the Pacbitun Regional Archaeological Project (PRAP). During the 2013 summer field season archaeological excavations focused on the peripheral Tzib Causeway which connects a plazuela group to a minor center, as well as portions of Tzul Causeway in the site core and in front of Tzul’s Cave. Research objectives continued to evolve around investigating construction styles- and dates, and the exploration of the relationship between these ancient roads and their associated structural features and caves.

Background

Ancient Maya causeways are raised roads, commonly referred to as sacbe (plural: sacbeob), which is the Yucatec Maya term for white road (e.g., Keller 2006, Normark 2006; Schwake 1999; Shaw 2001, 2008; Villa Rojas 1934). Consisting of dry-laid boulders at the base, topped with cobles and filled with gravel, the roads were plastered with powdered limestone and functioned as transport and communication routes and are assumed to reflect different levels of social, political, and ideological activities (Chase and Chase 2001; Cheetham 2004; Keller 2006; Normark 2006; Schwake 1999; Shaw 2008). The Pacbitun causeway system was fully mapped for the first time in 2010 during a survey between the site core and four previously recorded caves in the periphery (Actun Merech, Actun Pech, Tzul’s Cave, and Crystal Palace Cave) (Powis 2010; Weber 2011). It incorporates three named roads: Mai Causeway, Tzul Causeway, and Tzib Causeway (Figure 1) (Weber 2011; Weber and Powis 2011; Weber et al. 2012).
Mai Causeway begins adjacent to Structure 11 in the site core and runs east for approximately 273 m, before terminating in front of Structure 10 (Figure 2). The Tzul Causeway also starts at Structure 11 but runs south-west into the periphery where, after about 900 m, it intersects with another ancient Maya road which was named Tzib Causeway. Below this confluence, Tzul Causeway continues into the foothills for about 1.2 km and terminates in front of Tzul’s Cave. Tzib Causeway measures about 600 m in length, and connects a plazuela group to a minor center (Table 1) (Weber 2011).
Table 1. The Causeways at Pacbitun.

<table>
<thead>
<tr>
<th>Causeway</th>
<th>Length</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mai</td>
<td>Ca. 273 meters</td>
<td>Intrasite</td>
</tr>
<tr>
<td>Tzul</td>
<td>Ca. 2100 meters</td>
<td>Core-outlier intrasite</td>
</tr>
<tr>
<td>Tzib</td>
<td>Ca. 600 meters</td>
<td>Intrasite</td>
</tr>
<tr>
<td>SW Passage</td>
<td>Ca. 10 meters</td>
<td>Walkway</td>
</tr>
</tbody>
</table>

In an attempt to understand the complex connections the causeway system displays in-between the site center, various structures in the periphery, and the caves we decided to archaeologically investigate the causeways, the constructions directly associated with them, as well as the architecture located near those four caves. Since then, our goals are: (a) to ascertain the construction periods of the causeway system and its corresponding architecture; (b) to determine its political, social, economic, and/or religious function and relationship to other structures located in the site core, as well as to other structures located in the periphery (i.e., either alongside the causeway or at the opposite end); and (c) to determine how the caves were being used and who controlled access to them.

Field Investigations

Following the survey in 2010, the 2011 field research focused on excavations into the peripheral causeway intersection, connecting Tzul and Mai Causeways, as well as excavations into a mound adjacent to Crystal Palace Cave. In 2012, the main goal was to examine the nature and time frame of the causeways and associated buildings in the site core. For this, we targeted the only terminus complex at the site, Structure 10, Mai Causeway, as well as portions of Tzul Causeway. Excavation goals in 2013 represented a combination of both of these previous
research objectives, targeting causeway areas in the site core, as well as in the periphery. A total of six excavation units (Units CP5, TL6, TL7, TZ1, and TZ2) were placed into the causeway system during the 2013 field season. Two units (Units TL 6-7)) were placed into Tzul Causeway, two units were placed into Tzib Causeway (Units TZ1-2) and one unit (Unit CP5) was placed into Crystal Palace Mound adjacent to Crystal Palace Cave (Figure 3). All units were excavated in cultural levels by shovel, trowel, and pick ax (Table 2). Excavation and feature fill was screened using 1/4” mesh wire screen. During excavation, all cultural materials recovered were bagged by level. The materials recovered are currently undergoing analysis.

Figure 3. Locations of excavation units in the Pacbitun periphery (3) and site core (1), x-marked in red.
Table 2: Summary of excavated units.

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Size</th>
<th>Depth Excavated (Approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP5</td>
<td>50cm x 50cm</td>
<td>66 cm</td>
</tr>
<tr>
<td>CP5 – Extension 1</td>
<td>50cm x 50cm</td>
<td>92 cm</td>
</tr>
<tr>
<td>TL6</td>
<td>50cm x 50cm</td>
<td>38 cm</td>
</tr>
<tr>
<td>TL7</td>
<td>1m x 1m</td>
<td>77 cm</td>
</tr>
<tr>
<td>TZ1</td>
<td>1m x 1m</td>
<td>54 cm</td>
</tr>
<tr>
<td>TZ2</td>
<td>1m x 1m</td>
<td>85 cm</td>
</tr>
</tbody>
</table>

Excavations – Tzul Causeway (Units TL6 and TL7)

As mentioned, two units were placed into Tzul Causeway during the summer 2013 field excavations. One unit was placed into Tzul Causeway within the site core (TL6) and one was placed into Tzul Causeway in front of Tzul’s Cave (TL7).

Unit TZ6

Tzul Causeway had been documented to run from the vicinity of Structure 25 into the periphery of Pacbitun. During the survey conducted in 2010, bits and pieces of the causeway running between Structures 25 and 11 had been noted but since this area lies within dense vegetation and the surrounding vicinity of Structure 11 has been disturbed by various modern road constructions, no clear visible remnants of the causeway could be recorded. A preliminary analysis of data collected through terrestrial laser scanning in 2012 revealed what might be features of Tzul Causeway running from Structure 11 towards Structure 30. Due to the disturbed nature of the area, any structural elements are very subtle, if visible at all, and any prospective features have to be ground-truthed. Therefore, we placed one unit, TL6, just above the modern road, adjacent to Structure 5, in hopes to confirm any traces of causeway remnants (Figure 4). Unit TL6 was a 50 by 50 cm test unit and was excavated to a depth of ca. 38 cm to confirm the existence of causeway gravel (Figure 5). Causeway remnants appeared after the humus level (level 1) at about 20 cm (level 2). Main artifacts recovered were ceramic sherds.
Figure 4. Location of excavation unit TL6 in the Tzul Causeway, Site Core.
Unit TZ7

Unit TZ7 was a 1 m by 1 m test unit placed in viewshed of the Tzul’s Cave entrance, located about 25 m southwest from it. The unit was excavated to a depth of ca. 97 cm, with bedrock appearing at about 84 cm (Figure 6). The unit was comprised of four different layers. Artifacts recovered in this unit included ceramic sherds, slate fragments, and *jute*. 
Excavations – Tzib Causeway (Units TZ1 and TZ2)

Two test units were placed into Tzib Causeway. One unit (TZ1) was placed on the causeway’s northern termination point, in the vicinity of a temple structure. The other (TZ2) was placed at the causeway’s southern termination point, a plazuela group.

Unit TZ1

Unit TZ1 was a 1 m by 1 m test unit which was placed about 8 m below the temple. The unit was comprised of three different cultural layers and excavated to a depth of ca. 84 cm, with first signs of bedrock appearing at about 52 cm. Excavations exposed medium sized boulders at the bottom of level 1, at approximately 20 cm depth (Figure 7). Artifacts that were recovered in this unit included ceramic sherds, some lithic pieces, and slate.

Unit TZ2

Unit TZ2 was a 1 m by 1 m test unit, placed about 5 m southwest of the Tzib Causeway plazuela group. This shallow unit was excavated to bedrock at 58 cm depth (level 2), exposing causeway boulders about 15 cm below the humus layer (Figure 8). Artifacts recovered included ceramic sherds, lithic pieces, and obsidian fragments.
Figure 7. Exposed boulders of unit TZ1.

Figure 8. Exposed boulders of unit TZ2.
Excavations – Crystal Palace Cave (Unit CP5)

In 2011, four excavation units (Units 1-4) had been placed on the southern side of Crystal Palace Mound. This was done in hopes to expose possible stairs leading up to the mound, as well as to investigate stratigraphy. In addition to the units, it was also decided to clean the southern portion of the mound to expose parts of the collapsed structure. The excavations at Crystal Palace Mound revealed quite a few intriguing artifacts; however, additional archaeological excavations were needed to determine the full function of these intriguing architectural remains. While conducting terrestrial laser scanning (TLS) at Crystal Palace Cave, we took advantage of the locality and decided to place a unit (CP5) on top of the Crystal Palace Mound.

CP5

CP5 was a 50 by 50 cm test unit placed on top of Crystal Palace Mound. It was later expanded by an additional 50 by 50 cm unit to the east, forming Lot 1. Lot 1 was excavated to a depth of ca. 93. The material culture recovered in this unit included ceramic sherds, lithics, and slate. As with the excavations in 2011, the majority of the ceramics could be dated to Late Classic period.

Analysis and Discussion

Tzib Causeway and its Associated Structures

The two structures on either side of Tzib Causeway are certainly of interest in regards to the analysis of Tzib Causeway itself. Since they have not been excavated to date, we can only speculate about their function, relation to the causeway, and connection to Pacbitun. Cheetham (2004) notes that temple buildings would often start out as small ceremonial sites and transform into terminus groups. For the local elite it would be of interest to incorporate these groups by linking them to the site core and expanding their realm of power (Cheetham 2004). Since they relied on subsistence and labor from the domestic population living in the periphery, direct control of the surrounding area was of vital importance. The display of power in this periphery was a crucial necessity to solidify their dominance (Cheetham 2004). Tzib Causeway provides a good example for this kind of development. The housemound distribution in the periphery of Pacbitun is clustered just south of the intersection of Tzul and Tzib Causeways. More importantly, the Tzul Causeway is also located in close proximity to four water basins, or aguadas, which are aligned with a spring and ancient dug well in the mountains. Close water sources are certainly vital for farming, and settlement in close proximity to them is a logical consequence found in ancient agricultural settlement patterns. Elites residing in the Pacbitun site core, most likely relied on food provided by these peripheral farmers and had an interest in securing their loyalty to the site center (Weber 2011).

As with the Zopilote group at Cahal Pech, which was integrated into the site core through the Martinez Causeway, the temple, as well as the plazuela group, respectively on either end of Tzib Causeway, might have undergone this development (Cheetham 1993, 2004). Both sites might have started out as outlying ritual centers that were later integrated into the site core.
through the Tzib Causeway. Shaw (2008) agrees that a causeway, with practical and symbolic functions would have been the perfect project for elites seeking to integrate and manage the outlying population. The process of building major causeways could have served as a way to unify workers and establish a collective identity that would further the establishment of the territory as a single polity (Ashmore 1992; Shaw 2008). Ashmore (1992) states, that while the causeway itself might have served as a unifying medium, it would have also emphasized to any passengers the role and importance of the structures at its end (Ashmore 1992; Cheetham 2004). For Cheetham (2004), this type of development served as a functional continuation of the site core, rather than a cosmological layout design. One can argue that the addition of the causeway to the isolated structure created a new, cosmological entity that carried new meaning. For example, the earlier ideologies of the termini complex and plazuela group as peripheral ceremonial structures were transformed into a new assemblage or ideological territory once they were connected through Tzib Causeway to the site core (Weber 2011). In addition, Tzib Causeway does not run independently to Pacbitun proper but intersects with Tzul Causeway. In general, intersections in causeways, are referred to as hol can be (crossroads) and often served as a way to connect terminal architectural groups with a more well-defined site core (Shaw 2008).

Mathews and Garber (2004) argue that the crossroads also carried directional symbolism and played an important part in Maya ideology. While this might have eventually been the case, the landscape and buildings that would later surround the intersection might have been rather previously connected for the reasons mentioned above. The political and/or practical incentives that led to the incorporation of peripheral structures into the site core were overcoded, as new “wholes” were formed, e.g., an ideologic intersection (Normark 2006; Weber 2011).

**Incorporation of the Tzul Plazuela Group**

A recurring question in regards to the causeway system at Pacbitun has been: Why does a causeway lead to Tzul’s Cave but not to any of the other, culturally used caves in the periphery? For example, based on the ancient materials encountered, Crystal Palace Cave certainly had been culturally-used by the ancient Maya (Powis 2010). However, no causeway or ancient pathway leading to this cave has been identified. Cheetham (2004) hypothesizes that a reason why some peripheral architecture received a causeway connection while others did not might have been the presence of prior resident populations at some locations who had earned the seasoned right and seniority to oppose integration to the site core. Crystal Palace Cave might have been regarded as a ceremonial center in and out itself with Crystal Palace Mound serving as a ritual platform. If the cave’s ritual significance to the people around Pacbitun predated Tzul’s Cave, then this might have prevented the elite at the site core to create control over its access by building a road to it. The same goes for the other caves in Pacbitun’s close vicinity.

On the other hand, if we follow the argument of site incorporation, then we have to look towards other important structures surrounding the causeways. During the 2010 survey we recorded a plazuela group which lies just south of Tzul’s Cave. The structures are accompanied by what seem to be remnants of a wall, as well as a chultun, covered by slate slaps. During the 2013 field season, we noted that, although the Tzul Causeway ends in front of Tzul’s Cave, a passage seems to continue towards a large rock wall (Figure 9). Following the loose path beyond
the rock wall confirmed the suspension that it leads to the plazuela group and its associates features, recorded in 2010.

Figure 9. Pathway beyond Tzul’s Cave towards plazuela group.
Beyond the plazuela group lies the site of Sak Pol Pak, another minor center (Figure 10). Another hypothesis for the presence of Tzul Causeway and its path to Tzul’s Cave might have been an indented continuation with the purpose to incorporate the plazuela group, and eventually Sak Pol Pak, into the power realm of Pacbitun (Figure 11).

Figure 10. Pathway beyond Tzul’s Cave towards the plazuela group.

Figure 11. Causeway system with associated structures and potentially indented destinations.
Conclusions

The presence of causeways in general and the termination of Tzul Causeway in front of Tzul’s Cave in particular, certainly poses many questions about Pacbitun’s socio-political development. As we have mentioned before, behind a practical aspect for causeway constructions, certainly lies a political and ideological building intent. A road like Tzul Causeway which connected the site center to the domestic population, ensured easy transportation of subsistence goods and stood as a symbol of power domination. Tzib Causeway, along with its minor center and plazuela group, could have been connected for the same purpose at a later time, further establishing a visible and prominent link to the site center. These links, displayed in the presence of causeways, become even the more apparent in the absence of roads at other culturally used locations, like Crystal Palace Cave. Further investigations in and around the Pacbitun causeway system will hopefully aid in the further analysis of the site’s development and increase our understanding of the ancient Maya people who of once lived in and around Pacbitun and its hinterlands.
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Structural Associations in E Group Plazas: Preliminary Investigation of Structure 3 in Plaza A at Pacbitun

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The first indication of settlement and development along the Belize River dates back to the early Middle Preclassic (1000-700 BC). Not long after, evidence of rising complexity could be seen in agriculture and architecture. According to Doyle (2012:358), the Lowland Maya began to build monumentally around 700 BC in the form of platforms and other larger public architecture used for community events and ceremonies. One of the first recognized archetypes of this time is known as an E Group complex and can be found throughout the Maya Lowlands. Today, E Groups are commonly found at the core of Belize River Valley sites marking the location of the earliest community activities. Although the buildings function is still heavily debated, the ceremonial implication of the E Group is widely accepted.

Pacbitun’s site core, Plaza A, is home to one of the nine E Groups found in the Belize Valley area (Awe 2013). Investigations of the E Group architecture in Plaza A began back in the 1980s by Paul Healy (1990) and plaza floor investigations were resumed by Terry Powis in 2010. The site core saw an uninterrupted occupation from the Middle Preclassic (ca. 900 BC) to the Terminal Classic (ca. AD 900); reaching a pinnacle in the Coc Phase (AD 550-700). Structures 1 and 2, constructed first, were subsequently followed by Structures 4 and 5 in the Late Preclassic (300 BC – AD 100). The investigation of Plaza A continued this season with the goal of continuing to uncover Preclassic materials as well as to temporally correlate the northern structure (Structure 3) with the E Group architecture. This report will cover the details of the 2013 excavations of Structure 3. Future analysis of the data may allow us to provide a possible functional explanation and, more important to the research project, attempt to spatially and temporally correlate the structure with the E Group architecture by revealing the construction history.

Excavations of the summit and south face of Structure 3-1st reveal a single construction phase dating to the Terminal Classic Tzib Phase (AD 700-900). The structure would have had a single central staircase and did not show any indication of a superstructure at the summit. Test units near the southern base of the structure revealed a Late Preclassic floor with a series of cut stones possibly suggesting the elevation of an earlier structure (Structure 3-2nd) prior to and in preparation of the construction of Structure 3.

Structure 3

As previously mentioned, Structure 3 lies on the northern border of Pacbitun’s Plaza A (Figure 1); the northern face sloping down drastically several meters toward the ball court.
vicinity. Measurements prior to excavation revealed that the structure might have stood around 5 m tall from the plaza surface, was around 26 m in length (east-west), and around 12 m in width (north-south). Structure 3’s summit measures close to 15 m east-west and 4.5 m north-south. Furthermore, the building is oriented 98° west of north and its center line axis lies at 8° west of north. The structure was thought to have one or two terraces with a southern central inset staircase leading up to the summit. There are also two associated stelae on the southern face. Stela 11 is centered at the base of the staircase and Stela 5, no longer standing, would have stood closer to the southwestern corner of Structure 3.

![Figure 1. Photo of the clearing of Structure 3.](image)

**Excavation of Structure 3**

As previously stated, the clearing of Unit 2 revealed a single, central, possibly inset staircase which was heavily eroded and destroyed by tree roots and other natural forces. Three units were then set up during the course of the summer’s investigation. Previous investigations in the site core suggest that the primary axes of the structures contained the most valuable recovered remains (burials and caches). Therefore, to maximize our potential for recovering primary materials, these units were positioned on the structures central axes. Structure 3’s Unit 1, a 4 m × 4 m unit, was set up on the central axis at the summit. A 2 m east-west × 6 m north-south unit, Unit 2, was set up on the central axis of the southern face in search of the staircase and terraces. Finally, a 1 m × 1 m unit, Unit 3, was set up on the central axis of the southern base of Structure 3 directly in front of Stela 11. Initially, it was believed that the summit of Structure 3 may have held a superstructure; however, Unit 1 yielded no evidence to support this claim.
Unit 1

Level 1 consisted of a dark brown organic humus layer that ranged from about 12-18 cm but reached a depth of 41 cm at the center of the unit. The central area of the unit contained a few slate fragments that seem to be associated with the central axis. This was found to be a reoccurring theme during the excavation of Structure 3 as will be mentioned throughout this report. Level 2 was designated by more collapse debris with a light to medium dark brown soil. The only significant find was a single metate fragment.

Levels 1 and 2 constitute post-abandonment humus and collapse debris levels respectively. Level 1 was found throughout Unit 1 and consists of a dark brown loamy soil (Munsell 5YR 3/2) with pebble (<5 cm diameter) and stone (ca. 10-15 cm diameter) inclusions. The humus layer ranged in thickness between 16-30 cm. Recovered artifacts included unanalyzed ceramics and several unworked slate fragments.

Level 2 is collapse debris level with some mixing of overlying humus. The soils are light to medium dark brown (Munsell 7.5YR 4/2) and inclusions range from small pebbles to larger stones (ca. 5-20 cm). Some cut stones were noted within the collapse level. The level was found throughout the unit and thickness ranged from 3-42 cm. One special find, a metate fragment, was recovered from within Level 2.

Floor 1/Level 3

Level 3 lay just 20-30 cm below and consisted of poorly preserved flooring (Floor 1) that would have once spread across the entire summit of Structure 3. In better preserved areas, the plaster layer was as much as 4 cm in some areas and lay atop a 3-4 cm layer of marl mortar. In some areas, especially the central precinct of the unit/summit, the flooring was no longer present due to the lack of supporting ballast beneath these areas. Further excavation revealed that Floor 1 was constructed upon large core boulders ranging from 25-60 cm in depth using only the previously mentioned thin layer of marl for support resulting in the collapse through the voids of the core.

Level 3 was composed of approximately 70-90 cm of large boulder core (diameter >25 cm) that lay directly beneath Floor 1. Some marl inclusions were also noted (Munsell 7.5YR 7/2 – pinkish grey). This level produced a Preclassic to Late Classic range of ceramics including Joventud Reds and Savannah Oranges. Special finds in Level 3 consisted of chert, slate, andesite, jute, a marine shell bead, and a crab claw. Some possible human bone fragments were also recovered perhaps associated with Burial 3-1 (see below).

Burial 3-1/Level 4

The fill in Level 4 (85-115 cm) became more compact and was composed of a mixture of smaller stones (about half the size of Level 3) and marl (Munsell 7.5YR 8/3 – pinkish grey). During the removal of the core fill of Level 4, Burial 3-1 was discovered (Figure 2). The poorly preserved remains were originally thought to be deposited in a cyst; however, it was later concluded that the burial was in fact a simple burial following Welsh’s typology (1988), and was
placed beneath coring stones and laid upon a bed of small rubble stones (diameter = 3-5 cm) and marl. The remains were found on the central axis (8° west of north) at the summit of the stairs on the southern edge of Unit 1.

![Figure 2. Photo of the mapping of Burial 3-1 in Structure 3.](image)

Burial 3-1 was found in an extended supine position with arms placed at the side and feet crossed. The individual lay in the conventional Pacbitun position; head to the south, feet to the north. It was also noted that the cranium had been positioned to face the east. A second cranium, labeled Individual 1, was found in broken fragments and located to the south of the individual possibly representing a secondary burial of an ancestor. There are also several artifacts associated with Burial 3-1. Five Late Classic ash ware vessels (four fragmented bowls and one cylindrical vase) belonging to the Spanish Lookout complex (Gifford 1976) were placed along side of the individual (Figures 3 and 4). Vessel 1 was placed next to the left leg, Vessel 2 was at the right hip, Vessel 3 near the right shoulder, and Vessel 4 was positioned to the upper left of the cranium. Vessel 4 is a broken cylinder vase with polychrome painting and pseudo-glyphs that was placed laterally with the rim to the south. Vessel 5 will be discussed below. No special objects were placed inside these vessels.
Other associated artifacts include 3 perforated jade beads (Figure 5), 2 tubular and one rectangular, along with 2 shell disc beads all of which are thought to have been placed inside the mouth of the individual. Also, another large piece of slate was located at a slightly lower depth to the north and on the central axis with Burial 3-1.
Continuing in Level 4, to the east of Burial 3-1 and located near the center of Unit 1, a line of four north-south cut stones appeared to divide the eastern and western portions of Structure 3 and lay approximately 2.2 m below the surface. These were originally thought to represent a remnant face of an architectural unit; however, the cut stones only went two courses deep and were set atop another layer of construction composed of compact marl that continues on in the eastern half of the unit. The stones most likely separated the eastern marl fill from the western portion which is composed of a deep layer of loosely set boulder core with little or no fill. It was decided for safety purposes that excavations would continue only to the east of the central north-south alignment of cut stone. After further excavation, another line of north-south cut stones were found in the eastern half of the unit. It is likely the cut stones were taken from another structure and placed to act as a stabilizing mechanism prior to Burial 3-1. Other artifacts not associated with Burial 3-1 include ceramics, lithics, and jute shells. Also, another large piece of burnt but unworked slate was located below and to the north end of Burial 3-1.

Level 5, ranging from 1.1 to 1.7 m thick, is another construction core layer associated with Structure 3-1. It is composed of pinkish gray marl mixed with light brown (Munsell 7.5 YR 6/2); however, there are a few large boulder inclusions along with a few cut stones. The soft, decomposing cut stones were found at a depth of about 3.3 to 3.5 m below the surface of the
structure and may have been placed in a north-south alignment. They are approximately 20 cm in height and range from 20-60 cm in length. These dimensions suggest they may have been taken from a Preclassic building.

Level 6 is most likely another core layer of fill in Structure 3-1st; although it is possible that this layer could also represent displaced fill relating to an indeterminate structure (Structure 3-2nd). This layer would associate well with the Late Preclassic Floor 2 found in Unit 2 as will be discussed below. Level 6 is composed of a compact mottled layer of pink to yellowish-pink marl (Munsell 7.5YR 8/3) which is mixed with a dark grayish brown clay (Munsell 10YR 4/2) in a pattern resembling ‘heavenly hash’ ice cream. The level was about 75-80 cm thick and contained very few stone inclusions. Although few in number, the recovered ceramics date primarily to the Middle Preclassic and included examples of Savanna, Sayab Daub-striated, and Jocote including a Jocote Orange-brown spouted vessel fragment (Terry Powis, personal communication, 2013).

The composition of Level 6 is equivalent to Unit 2’s Level 7 (see below), which lies directly below Floor 2; a Late Preclassic construction episode. The absence of Floor 2 in Unit 1 suggests that the fill material was acquired from somewhere else. Furthermore, the absence of architectural features above Level 6 suggests that the layer was placed for the construction of Structure 3-1st. However, the presence of Level 6 and the cut stones in Level 5 both are indicative of a purposeful elevation of an earlier Preclassic structure (Structure 3-2nd) prior to and specifically for the establishment of Structure 3-1st.

Level 7, similar to Level 6 in Unit 2, consists of a dark reddish brown core (Munsell 5YR 3/2) and ranges from 50-58 cm in thickness. Ceramics recovered from this level appear to be associated with the late Middle Preclassic (ca. 500-300 BC) Jenny Creek Ceramic complex. They include several examples of the Jocote, Savanna, and Chunhinta ceramic groups (Gifford 1976:61-84). Identified types include Jocote Orange-brown, Chacchinic Red-on-orange-brown, Savana Orange:Rejolla variety, Reforma Incised, and Chunhinta Black (Terry Powis, personal communication, 2013).

Excavations within Unit 1 were halted at the beginning of Level 8 due to safety concerns and time constraints. This level is equivalent to Lot 1, Level 7 in Unit 2 (see below). It is a layer of large dry laid boulder core. Approximately 20 cm of this level was cleared before halting excavations. Level 8 was found at the same depth in Unit 1 as in Unit 2. The level is interpreted to be core for Structure 3-2nd. No artifacts were recovered. Excavation of Unit 1 was halted at approximately 5.5 m below the surface of the top of Structure 3.

Levels 6, 7 and 8 are likely layers of core associated with a Late Preclassic structure (Structure 3-2nd), of which only a remnant floor and some associated cut stones were noted in Unit 2. No architectural features of this Late Preclassic structure were noted in Unit 1 with the exception of these three layers of construction core, suggesting that the structure was partially razed prior to the construction of Structure 3-1st.
Unit 2

A 2 m × 6 m unit was set up in accordance with the central axis on the southern face of Structure 3 to capture its stairs and identify terracing (Figure 6). Unit 2 stretched from the summit of Structure 3 down to the north face of Stela 11. The stela actually leans heavily to the south and excavations revealed that the bottom portion angles into Unit 2. The unit is adjacent and central to Unit 1; again, to ensure maximum recovery of primary materials (e.g., burials and caches). Excavations revealed 7 stratigraphic layers of which 3 are associated with Structure 3 construction. Due to time constraints, the lowest level reached was Level 7 (ca. 6 m below summit surface) which consisted of a thick layer of compact marl mottled with dark brown clay soils.

Level 1 and 2 consisted of a humus layer and collapse debris respectively. Tree roots and other natural phenomena had destroyed much of the terminal stairs making it difficult to understand the architectural scheme. Level 1 ranged in thickness from 10-22 cm and like its equivalent in Unit 1, consists of a dark reddish-brown loamy soil (Munsell 5YR 3/2) with pebble (<5 cm diameter) and stone (ca. 10-15 cm diameter) inclusions.

Level 2 is consistent with its counterpart in Unit 1 but ranges in thickness from 18-90 cm. Just below lies the poorly preserved remains of the terminal stair architecture which leads up to the summit. No door was found at the summit further suggesting the lack of a superstructure. A large cedar tree stump located in the center of Unit 2 was the cause of the near total destruction of all remnants of the staircase. Therefore, most of our conclusions concerning the layout and scheme of the stairs are derived from section mapping of the unit.
Cache 3-1

The removal of the backing stones revealed the top of Level 3. This was composed of compact white and yellowish marl with inclusions soft cut stones. The central platform was well defined by these supporting cut stones. To continue with Level 3, it was decided to punch through the dividing wall between Unit 1 and Unit 2. Cache 3-1 was discovered at the northern most point of Unit 2 at a depth of 205 cm below Datum A. The contents of the cache include a crushed human skull facing west and a single Dolphin Head Red vessel. Although slightly higher in elevation, the cache is most likely associated with Burial 3-1 which lay just to the north in Unit 1, thus the skull is labeled Individual 2 and the vessel labeled Vessel 5. Similar to Individual 1, Individual 2 is most likely an ancestor placed in a secondary burial. Interestingly, several circular holes of varying sizes were also found drilled systematically through the top of the cranium (Figure 7).
Level 3 and Level 4, equivalent to Levels 4 and 5 in Unit 1, consisted of what little terminal stair architecture that lay in the original position. Level 3 ranged in thickness from 60 cm to 1.6 m. Level 4 ranged in thickness from 45 cm to 1.2 m. The stairs were mapped and then removed in search of better preserved backing stones. Only one full row and a few partial rows of backing stones lay neatly; this full row was located at the base and probably formed the first or second stair of the structure. The rest of the stairs were either moved or destroyed by the roots. However, some remnants of approximately five to six stairs including a single central platform (similar to Structure 2) appear in the profile of the unit. The treads appear to be ca. 40 cm in width except for the platform which may have measured around 130 cm in width. The rise of the stairs was around 35-40 cm on average. A single piece of slate at a depth of 369 cm below Datum A was found in a central location at the base of Unit 2 placed just above the large core stones that lay beneath.

Floor 2 was found below Level 4 at a depth of approximately 4.5 m below Structure 3 summit. This is a floor associated with what appears to be an earlier Late Preclassic structure, designated Structure 3-2nd. The floor is well preserved with a plaster thickness of approximately 4-5 cm. No burning was noted on the floor. The floor had been intentionally chopped, perhaps to enable the construction of Structure 3-1st. Lying stratigraphically atop the floor in the western portion of the unit were several large “soft” cut stones (aligned north-south) suggesting that Floor 2 was an earlier plaza floor subsequently overlain by a one-coursed structure. Unfortunately this could not be determined with confidence given the limits of the 2013 test excavation unit.

The three remaining levels (5, 6, and 7) are considered to be associated with the Late Preclassic structure (Structure 3-2nd) (Figure 8). A decision was made to limit the final excavations to a smaller sub-unit in Unit 2 measuring 2.5 by 1.8 m.
Level 5 consists of a midden deposit that is only found in the chopped portion of Floor 2. The material recovered includes ceramic, quartz, lithic and faunal remains, and a large quantity of ash and charcoal inclusions. A cursory examination of the Level 5 faunal remains by Stanchly indicates the presence of C. American river turtle (*Dermatemys mawii*), deer (Family Cerivdae) and agouti (*Dasyproctapunctata*) or paca (*Agouti paca*). Several slate fragments were also included. The soil is a dark brown (Munsell 7.5 YR 3/2) with black charcoal flecks (Munsell 5 YR 2.5/1) and ‘greasy’ in texture. Level 5 was not present throughout the subunit but was restricted to its western edge adjacent to the Floor 2 cut. The midden level ranged from 5-37 cm in thickness. Preliminary analysis of the ceramics determined that a number of transitional Late Middle to early Late Preclassic ceramic types were present including types from both the Jenny Creek and Barton Creek ceramic complexes (Terry Powis, personal communication, 2013). The ceramics appear to be mainly serving vessel fragments, including a fragment from a spouted vessel. Identified types include Jocote Orange-brown, Savana Orange: Savana variety, Savana Orange:Rejolla variety, and Sampaperro Red. Sierra Red, and Lechuga Incised (Terry Powis, personal communication, 2013).

Levels 6 and 7 were found directly below Floor 2 and are similar in matrix to Levels 5 and 6 in Unit 1. Level 6 is composed of a dark reddish brown (Munsell 5 YR 3/2) clay core and ranged from 14-26 cm in thickness. Level 7 was a thick, compact mottled layer of marl that was pink to yellowish-pink in color (Munsell 7.5 YR 8/3) mixed with ‘chunks’ of dark grayish brown clay (Munsell 10 YR 4/2), equivalent to Level 6 in Unit 1. The thickness of the level ranged from 82-110 cm. It was at this point that excavations came to an end due to time constraints. The maximum depth reached approximately 6.25 m below the summit surface. Lot 1 is a loose rubble and boulder core within the northern portion of the subunit. It is not clear if Level 7 cut through this lot, which is equivalent to the boulder core identified as Level 8 in Unit 1, or vice versa, since the lot was not excavated. Lot 1 measures approximately 67 cm north-south and 56 cm east-west within the subunit.

The recovered ceramics appear to be transitional representatives of the late Middle to early Late Preclassic (ca. 400-200 BC) Jenny Creek and Barton Creek ceramic complexes. They include several examples of the Jocote, Savanna, Joventud and Sierra ceramic groups. Identified types include Jocote Orange-brown, Savana Orange, Sierra Red, Sampopero and Reforma Incised (Terry Powis, personal communication, 2013).
Unit 3-Stela Unit

A 1 m by 1 m unit, Unit 3, was placed directly in front of and on the central axis of Stela 11. The sole purpose of the excavation was to attempt to find a stela cache or burial placed in front of or directly beneath Stela 11. Past excavations have recovered 2 sub-stela caches as well as two sub-stela burials (Healy 1990). The individuals found in these burials (Burial 1-3 and Burial 5-2) were suggested to be sacrificial victims (Healy 1990:259). The stela measures approximately 270 cm in diameter, 60 cm thick, and 1 m across. The length of Stela 11 is still unknown.
Level 1 ranges from 33-52 cm in thickness. Five large cut stones were uncovered in this level and appear to be placed on top of a plaza floor (Top of Level 2). Three of the stones form a north-south line in the western portion of the unit. Two cut stone lay at the base of the stela, one in the center and one to the east. The plaza flooring is approximately 4 m below the summit of Structure 3. The floor also seemed to be cut in between the western and central cut stones. The artifacts found included ceramics, shell, and chert. Before proceeding into the next level, it was decided to expand Unit 3 another meter to the south and a half meter to the west; therefore, Unit 3 measured 2m north-south by 1.5 m east-west. The purpose of this was to expose and follow the line of cut stones in the western portion of the unit. Only one other cut stone was found in the extension and was located in the central southernmost portion of Unit 3 and was not related to the other stones.

Due to time constraints, excavation focused on the northern half of the unit, designated Unit 3 sub. Due to the heavy lean of Stela 11, excavation continued to push further underneath the stela. However, the base was never reached. Level 2 was around 35-41 cm in thickness. A partial vessel was located approximately 80 cm from the surface of the unit but was not associated with any cache material. The partial vessel did, however, sit atop what seemed to be a burned plaster floor. This was located approximately 4.5 m below the summit of Structure 3 and could possible coincide with Floor 2 found in Unit 2. This was the extent of the excavation in Unit 3.

Summary and Conclusions

The 2013 excavations of Structure 3 at Pacbitun indicate that the terminal building, Structure 3-1\textsuperscript{st}, was built in a single construction phase around the Late Classic period (ca. AD 700-900). It was also found that an earlier structure, Structure 3-2\textsuperscript{nd}, lay just below the terminal building. Structure 3-1\textsuperscript{st} consisted of a central stair which was likely flanked by two or three terraces, leading up to a flat summit with no evidence of a superstructure. The remains of an individual was found with 5 Late Classic vessels, four jade beads, two marine shell beads, and the skulls of two other individuals; one of which was modified.

The excavations also indicated that prior to the construction of the Late Classic building, the northern portion of Plaza A may have remained open space for much of the Classic period. During the Late Preclassic, there was likely a much smaller structure (Structure 3-2nd) in this area based on the recovery of several cut stones overlying and adjacent to Floor 2, which is dated to the Late Preclassic based on preliminary ceramic seriation. It is unclear what the function of this earlier structure was given the limited test excavations conducted. But it appears that the primary focus of Plaza A activities for much of the Classic period was related to the E Group complex (i.e., Structures 1, 2, 4, and 5), established by the Late Preclassic. It seems that following the abandonment of the use of the earlier Late Preclassic structure and prior to the erection of Structure 3, the northern portion of Plaza A remained open plaza area. It is unclear at this time if the construction of Structure 3 is related to any changing function of the E Group complex during the Late Classic period. Additional investigations within Plaza A immediately to the south of Structure 3 will hopefully clarify the function of the Late Preclassic structure in relation to the newly discovered Middle Preclassic structure named El Quemado. The recovered
information from Structure 3 can now be compared to other northern structures in Belize Valley E Group plazas as well as in the surround Lowland area to indicate whether or not northern structures were always a Classic period addition to E Group plaza plans.
Acknowledgements

First and foremost the authors owe a debt of gratitude to the PRAP director, Terry Powis, for the opportunity to work and learn at the site of Pacbitun. The senior author is eternally grateful for the confidence entrusted by said director. Furthermore, we would like to thank Drs. Jaime Awe and John Morris, as well as the rest of the staff at the Institute of Archaeology for their continuous support. Another special thanks is owed to our fieldworkers for their strenuous work and the people of San Antonio for their support of the Pacbitun project. Finally, we would both like to thank the Alphawood Foundation for their generous contribution to the project. The senior author would like to personally thank the Chicago Blackhawks for winning the Stanley Cup during the 2013 field season making work at the site that much more enjoyable. Take it away Chelsea Dagger.
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Geophysical and Geological Explorations at Pacbitun, Belize

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The use of geophysical techniques in Maya archaeology in Belize is expanding, but is still in the very early stages of adoption. However, with limited excavation time every summer, the authors decided to attempt to identify Middle Preclassic features that likely exist, based on known features found in previous excavations to be near the bedrock level, in Plazas A and B (Powis et al. 2009). By targeting areas likely to have archaeological bedrock features, it was hoped that this would be the best chance of making new discoveries over the summer season which related to the previous research. In addition, the senior author examined ground stone tools excavated at and around Pacbitun (Ward and Micheletti 2012) to determine the type of rock and probable sources of this material. To this end, granite and sediment samples were collected from the local region around the site.

This report will outline the extent of geophysical survey in the Pacbitun site core during December 2012, and the reasoning behind selection of the excavation units chosen in Plaza A during the summer of 2013. We will provide a listing of all potentially interesting anomalies identified in Plaza A and B which might be excavated in future seasons, and also discuss the individual survey lines between Plaza A and B and in Plaza D. In the conclusion, we will make suggestions for further geophysical work at Pacbitun. Finally, we will also document the granite and sediment samples which were collected around Pacbitun and sent off for geological analysis.

Background

*Ground Penetrating Radar (GPR)*

The geophysical technique called ground penetrating radar (GPR) sends microwave radar wave pulses into the ground, and records the total time from transmission of the wave to return of the reflected wave pulse from objects in the ground. A portion of the microwaves reflect back towards the antenna when encountering surfaces in the ground with differing electrical properties, while the rest of the wave continues deeper into the ground (Conyers and Goodman 1997; Weymouth 1986). Detection of archaeological features is possible when there is a significant difference in the electrical properties (called the dielectric) between materials in the feature and the surrounding soil layers. However, in soils containing large amounts of gravel layers, water, or clay, these substances tend to cause dispersion of the wave energy in all directions, and thus reduce total radar energy into and reflected from ground features (Conyers and Goodman 1997; Reynolds 1997). At Pacbitun, the presence of multiple fill layers, the density of tree roots, and general water saturation made interpretation of the radar reflections difficult. Time limitations of the survey also only allowed collection of data in one direction, and
this can cause another potential problem, since features with edges parallel to the survey
direction can be easily missed between survey lines or accidentally filtered out (Mala 2013).

**Magnetic Gradient**

Magnetic gradiometry takes precise measurements of Earth’s magnetic field using two
sensors set a fixed distance apart. By taking two slightly different readings the affects of natural
variations in Earth’s field over a few hours are reduced (Weymouth and Huggins 1985). Each
sensor records not only Earth's magnetic field, but also positive or negative variation in the
magnetic field caused by either remnant magnetism from burning of iron rich soil minerals
(Heimmer and Devore 1995), or induced magnetism from buried organic remains (Clark 1996).
Metallic objects, particularly those made of iron, will have greater affect on the magnetic
readings when compared to the remnant or induced magnetism of other archaeological features.

**Granite Geology of Mountain Pine Ridge**

The Mountain Pine Ridge is a large outcrop of intrusive igneous rock within the Santa
Rosa group, just south of Pacbitun which initially formed deep underground with enough time
for minerals to crystallize large enough to be seen with the naked eye (Figure 1). These igneous
rocks are classified as granites based on the presence of the minerals quartz, feldspar, and
muscovite and/or biotite.

![Figure 1. Location of intrusive granite outcrops in Mountain Pine Ridge in relation to the site (modified from Guerrero-Garcia and Herrero-Bervera 2012).](image-url)
Since the time of these instructions, multiple layers of sedimentary rocks have alternately been deposited and/or eroded from above the intrusion. Surrounding the intrusive granites are metamorphic rocks altered from the surrounding sedimentary sandstone and limestone rocks by the heat and pressure of the intrusions. Now that erosion has exposed the granite at various places in the Mountain Pine Ridge, granite outcrops can be found at the surface and boulders of granite found in the creeks and rivers. According to Jackson et al. (1995) there are four main mineralogical categories of granite in the Mountain Pine Ridge, namely biotite leucogranite, muscovite leucogranite, granodiorite, and tonalite. The biotite leucogranites where intruded first, followed later by the muscovite leucogranite, and finally by simultaneous intrusion of the granodiorite and tonalite. Since each occurred in a different time and tectonic environment, the levels of certain elements in the granites differ significantly from each other, and also from the next two closest granite outcrops at Hummingbird and Cockscombs plutons to the east of Mountain Pine Ridge (Jackson et al. 1995).

Survey Methods

Geophysics

During December, 2012 both GPR and the magnetic gradiometry (MAG) surveys were performed at Pacbitun in Plazas A and B (Figure 2). The equipment for the GPR survey was a Mala X3M controller with a 500 mHz or 250 mHz antenna attached to a collapsible cart (500 mHz) or pulled by hand (250 mHz). The cart had an inline survey wheel and a survey wheel was attached when pulling the 250 mHz antenna. In both cases, the GPR survey lines were started off the same starting grid line, and then the survey wheel measured total survey line length. For the GPR surveys, obstacles too large to easily get around required stopping survey lines and restarting them on the other side, which shows up as blank areas on the survey grids. In contrast, the MAG survey did not require stopping survey lines because it was able to negotiate through tighter obstructions. The equipment for the MAG survey was a GEM Systems GSM 19GW using two Overhauser sensors set 0.5 m apart. These were deployed in a horizontal gradient position about one meter above the ground surface with readings taken twice a second.

The survey lines in Plaza A were run approximately from west to east, starting in the southwest most corner. The survey lines in Plaza B were run approximately from east to west, starting in the northeast corner of each grid except on grid which was run north to south. An additional GPR survey line approximately 50 m long was run west to east using the 250 mHz antenna near the north side of Structure 8 in Plaza D with the hope of determining the bedrock depth. Three GPR survey lines were run west to east using both the 500 mHz and 250 mHz antenna where Plaza A descends steeply down to Plaza B between structures 2 and 6. These are shown as double ended arrows in Figure 2A. Except for the noted survey lines above, separation between both MAG and GPR survey lines in each grid was 0.5 m. The Plaza A grid for both MAG and GPR is 35 m by 44 m, with a total of 2066 m of total survey line length covered (Figure 2). The main section of the GPR grid for Plaza B was a 25 m by 30 m grid from the middle of Structure 8 to the eastern edge of Structure 7 (see Figure 2A), and two smaller subgrids created to capture at least some of the area lost to the large tree obstructions in the center of the plaza. A total of 2340 m of GPR survey line length was
Figure 2. Map of Pacbitun (modified from Skaggs et al. 2014 and Healy 1990:Fig. 3), which shows the total extent of coverage in Plaza A, B, and D by GPR in box A and by magnetic gradient in box B.

covered. The MAG grid of Plaza B was done in two pieces covering a total of 60 m by 45 m. The actual survey lines for the GPR Plaza A are shown in Figure 3. The actual survey lines for the GPR in the main and subgirds for Plaza B are shown in Figure 4. Both GPR and magnetic gradient data was processed using Dean Goodman’s geophysical software, GPR-Slice.
Figure 3. Survey lines for GPR in Plaza A. Software processing requirements forced the measurements to be entered as shown and flipped to the correct orientation later during processing.

Figure 4. Survey lines for GPR in Plaza B. The survey was broken into the large grid on the right and the two smaller grids at bottom and left to avoid obstacles.
Geophysical Results

Previous practitioners of geophysical techniques in Belize have noted many of the same difficulties that we encountered, such as water saturation, gravel and plaster layers and tree roots (Haley 2006). Also, since not many surveys have been done, there isn’t a clear idea of what Maya geophysical anomalies in plaza areas would look like (Aiken 2008; Haley 2006; Haley et al 2008). We tested four excavation units based on two strategies. One focused on excavation of a test trench of the area with the most varied GPR anomalies, Unit 1A in Figure 5, which had a shallow vertical anomaly, a mid-depth diagonal and horizontal anomaly, and a deep circular anomaly. The second strategy focused on both alignment and GPR anomalies. Unit 2 was excavated because a minor, shallow GPR anomaly matched the centerline of Structure 3. Units 3 and 4 were excavated due to mid-depth linear GPR anomalies and circular or linear deep GPR anomalies that aligned with the central stelae and Structures 1 and 2. Excavation results are reported elsewhere in the current report. Figure 6 shows all the depth levels separated into approximately 13 cm levels based on migration estimates of the wave speeds.

Figure 5. Shallow GPR Anomalies in Plaza A and the four units excavated over the summer.
In addition to the area excavated, there are a number of areas in Plaza A that would be worth investigating in the future. The highest probability area would be between 4 - 6 m on the X axis and 22 – 26 m on the Y axis in Figure 5 and Figure 6, since this area shows a shallow GPR anomaly and also two very strong MAG anomalies (Figure 7). These MAG anomalies were largely ignored during the analysis of where to locate summer excavation targets because they were assumed to represent modern metal trash. However, given that the burnt platform (see excavation results in this volume), is in this area, that assessment may need revision. The area around 15 m on the X axis and 20 – 25 m on the Y axis in depth layers between 40 cm to 100 cm deep layers in Figures 6 is also potentially linked to the burnt platform. Another high probability area is around 25 - 26 m on the X axis and 16 – 20 m on the Y axis in depth layers between 62 cm – 104 cm which has a corresponding MAG anomaly in Figure 7. What this might be related to is unknown.
The GPR and MAG anomalies in Plaza B were not tested due to the overwhelming amount of excavation in Plaza A. The most obvious GPR and MAG anomalies in Figures 8 and 9 are, unfortunately, due to previous excavations in the area of 30 – 40 m on the X axis and between 4 – 10 m on the Y axis. However, since this is an area of known Middle Preclassic structures (Powis et al. 2009), future excavations should focus on similar features. In terms of MAG anomalies, the one most like those noted above is between 22 – 30 m on the X axis and 12 – 18 m on the Y axis. There is a corresponding rectangular GPR anomaly in this same area. There is another area where the GPR and MAG anomalies correspond between 58 – 60 m on the X axis and between 14 – 16 m on the Y axis. A MAG anomaly from 42 – 46 m on the X axis and around 6 m on the Y axis along with a southwest trending linear GPR anomaly just 2 m further west should both be investigated. There is one final GPR anomaly of interest located from 28 – 30 m on the X axis and 30 – 32 m on the Y axis with no nearby MAG anomaly. Overall, the MAG anomalies are very strong, and could be associated with modern surface debris, but the presence of GPR anomalies at some of the same locations make these areas worth testing.
Figure 8. GPR anomalies in Plaza B.

Figure 9. MAG anomalies in Plaza B.
The GPR survey lines run down the slope between Plaza A and Plaza B where an attempt to try and determine if the slope below the surface was smooth or had a series of steps. Three channels were cut through the underbrush to connect the line between 35 - 44 m on the X axis along the western baseline of the Plaza A GPR survey with the eastern baseline of the Plaza B MAG survey around 32 – 40 m on the Y Axis. Detailed analysis of the results will require the integration with the forthcoming LiDAR models of the structures. This is because the radar beam is penetrating into the ground at a significant angle instead of straight into the ground and also at an angle compared to the grids currently modeled in GPR-Slice (Figure 10). The X axis baseline in Figure 10 is anchored on the X axis of Figures 5 and 7 with the survey lines running approximately west towards the Y axis baseline in Figure 9. Additionally, it will be interesting to render both Plaza A and Plaza B GPR results together at the true elevations, which would allow a better understanding of the true bedrock surface. Regardless, despite not lining up exactly in each channel (probably because both of the offset angles mentioned previously), the repetitive nature of the high intensity reflections in each channel does indicate that the slope probably has between 5 and 7 steps.

![Figure 10. GPR results from slope connecting Plaza A and Plaza B between Structure 2 and 6.](image)

The GPR survey in Plaza D was confined to a single survey line using the 250 mHz antenna to determine bedrock depth. The survey starts at the eastern edge of structure 8 and proceeds west. Based on the where the reflections slope downward in Figure 11, the bedrock gradually slopes until 18 m, when it drops sharply. It is only an estimate, but migration data suggests that 0.53 m of depth for each 10 nanoseconds of travel time. This means bedrock starts at 1.2 m and slopes to 1.6 m by 18 m west. It then drops sharply to 3 to 4 m deep by 26 m west. It is relatively flat until it drops sharply again to significant depth (10 m) after 38 m west.
Figure 11. GPR profile from Plaza D just on north side of Structure 8. Upper picture is zoomed in on the top 50 ns of two way travel time of waves.

**Granite Sampling**

Sampling of granite and other rock samples from the Mountain Pine Ridge batholith (see Figure 1) area were taken during the summer, with local rock outcrops accessible from the road or in riverbeds sampled for both crystalline rock and the sediment which built up over time. These will be compared to mano and metate fragments from the Tzib Group and the soils from below the fragments. These locations are listed in Table 1 and shown in Figure 12. The senior author also examined pieces of mano and metate fragments, soil from below these fragments, and unidentified granite chips and flakes.
Table 1. GPS coordinates and description of samples taken during granite survey of Mountain Pine Ridge Batholith and the area surrounding Pacbitun.

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Figure 12. Google Earth map of the locations of granite and sediment samples taken from around Pacbitun area.
The archaeologically-defined granite pieces were all identified as geologically fitting the description of deeply intruded granite. Making the assumption that the stone was not obtained from outside the country, it is probable, based on Jackson’s report (1995), that most of the pieces with pink or reddish potassium feldspar mineral are likely to have come from Mountain Pine Ridge batholith. However this will need to be confirmed through petrographic analysis currently underway by Linda Howe of HD Analytical Solutions, Inc., London, Ontario, Canada.

We will also perform electron microprobe analysis to confirm that the chemistry of the mica minerals matches between the archaeologically excavated artifacts and the field collected samples. Those samples without pink or red potassium feldspar could have come from any the three batholiths in Figure 1. A number of the fragments were noted, like sample MO50, to have a chalky or decayed looking texture (Figure 13). It is unclear if this texture was caused by later metamorphic activity in the area, or by either human processing of the stone or just natural weathering after deposition. One sample, ME002, was noted to contain a possible xenolith from when the granite intruded into country rock, which might be useful if more detail analysis is required into the origin of the magma emplacement and composition.

Preliminary analysis of the sand excavated with the mano and metate fragments suggests that the sediment is the result of crushing or pecking at a granite source rock. This is because the examined sediment contained pieces of granite (multiple granite mineral crystals in a single grain), the variety of grain sizes, and that the majority of the grains were quite angular.

Figure 13. Sample MO50 showing both the pink potassium feldspar and also the chalky texture.
Normally weathered sand should be sorted into a single grain size and have rounded grains. Further analysis by Dr. Howe of grain mounts for both the excavated and naturally occurring sediment around the Mountain Pine Ridge granites samples and from a nearby large, natural sand deposit (BG11-1) will either support or negate this theory.

Conclusions

The 2012 Geophysical Survey of Pacbitun was very successful, with numerous potentially important anomalies identified in both Plaza A and B. The first set of GPR anomalies excavated where all in Plaza A, and generated very important Middle Preclassic architecture. The results of the excavations (and previous excavations in Plaza B) have lead to a refined identification of future targets using both the GPR and MAG anomalies. It remains to be seen if the MAG anomalies are indeed real archaeological features, or the result of modern metallic trash at the site. It is suggested that for the benefit of understanding how Middle Preclassic features in plaza areas appear, that additional GPR work be performed in Plaza A, but at an angle compared to the previous survey.

The Granite Survey of Pacbitun is still in a very preliminary stage, and further sample collection and analysis will be required before any determination of the source of mano and metate granite. Even the conclusion that the sand sediment excavated from beneath the granite fragments may change with additional analysis of the sediment samples collected this season.

Both additional geophysical surveying of all the other Pacbitun plaza areas and more detailed and systematic samples of the local stone resources within the local region are suggested.
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