Shells of the freshwater gastropod Pachychilus spp. are frequently recovered from the archaeological record at ancient lowland Maya sites. Commonly called “jute” or “tutu” by the modern Maya, these fully-aquatic gastropods can be found in the streams and rivers of southern Mexico, the southern Yucatan Peninsula, Guatemala, Honduras and Belize (Halperin et al. 2003; Healy et al. 1990; Moholy-Nagy 1978). As seasonal climate variation in the Maya lowlands is principally expressed as cycles in rainfall (not air temperature) (Collar and Collar 1972; Lachniet and Patterson 2009; Setzekorn 1981; Wright and Coutts 1993), $^{18}\text{O}$ variation observed in the shell carbonate of jute shells may primarily reflect seasonal fluctuations in stream water $^{18}\text{O}$, rather than temperature variation. An investigation of the shell carbonate oxygen isotope geochemistry as well as shell structure and growth of this gastropod is needed in order to determine if specimens from Maya sites may be useful as paleoclimate proxies for rainfall variation during the various stages of ancient Maya civilization. Pachychilus, being ubiquitous at ancient Maya sites and having been deposited in these sites for nearly two millennia (e.g. Halperin 2002; Halperin et al. 2003; Healy et al. 1990; Solis 2010), may be an interesting avenue not only for paleoclimate studies of northern Central America and the impact climate may have had on ancient Maya populations, but they may also be a source of information pertaining to human subsistence behavior. From June 2009 to January 2011, fieldwork was conducted in the Cayo District of Belize by the author Kelley Rich, her husband Kendall Rich, and several local Belizean assistants: Lenney Gentle, the Britt Family, and Javier Mai. This study of modern jute and their environments was conducted in order to test the ability of this species to be used in paleoclimate and/or seasonality studies in the Maya lowlands.

Fieldwork

The Cayo District of Belize was chosen for this research because of the large quantities of jute snails that can be found there today as well as the large jute deposits found at ancient Maya sites in the area. For example, over 100,000 individual jute specimens have been recovered from Pacbitun (Powis, personal communication 2009). A total of four trips were made to Cayo (June 2009, October 2010, June 2011, and January 2012) by the author and her husband to conduct the fieldwork involved in this study of jute.

During the initial visit made to Cayo in June 2009, three stream reaches were selected for the investigation, including parts of Roaring Creek, Barton Creek, and a small tributary of the Macal River. When the author returned to Cayo in October 2010, water temperature data loggers were deployed on Roaring Creek and Barton Creek (Figures 1 and 2), as the small tributary of the Macal River had filled with silt resulting from road construction. At this time local field assistants Lenney Gentle (Roaring Creek) and the Britt Family (Barton Creek) were employed to
guard to the data loggers throughout the course of data collection. When the data loggers were deployed, initial water samples, temperature measurements and live *jute* collections were taken. The methodology surrounding the data collection and analysis will be discussed in the following section.

In June 2011, water temperature data was successfully recovered from both data loggers; however, in order to fully investigate the usefulness of the proxy, at the very least a full year’s worth of data is needed. Therefore, in June 2011 the data loggers were left in situ until a final trip to Belize was made in January of 2012 to retrieve the data loggers. In June 2011 and January 2012 additional water samples and live *jute* collections were taken from Roaring Creek and Barton Creek. The January 2012 fieldwork concluded data collection on these stream reaches.

**Figure 1.** Map of the data collection locations along Roaring Creek.
Also, in June 2011, the author and her husband explored another stream, Tutu Creek, with Javier Mai, a worker from the Pacbitun Regional Archaeological Project (PRAP). This stream is located in the Pacbitun site periphery. Tutu Creek was fairly dry in some locations, but water samples were taken along with live *jute* from several locations along the creek, while a temperature data logger was deployed in a large pool that Javier claimed would not lose its water. This data logger has not been retrieved, as it has not yet recorded a full year’s worth of temperature data.

In addition to water temperature data, stream water samples, and live *jute* collections, meteoric water samples were also taken during the June 2011 and January 2012 trips. The local field assistants who guarded the temperature data loggers along Roaring Creek and Barton Creek also collected stream water samples between the author’s return trips to Cayo. Roaring Creek was sampled with much more frequency than was Barton Creek. During the June 2011 trip, 18 water samples periodically taken between October 2010 and June 2011 by Lenney Gentle (Roaring Creek) were retrieved by the author. At this time, the Britt Family (Barton Creek)
provided the author with two samples they took in November and December 2010. In addition, the author took 12 surface water and four meteoric water samples between June 5, 2011 and June 11, 2011 from various localities in the Cayo District, including five samples along Tutu Creek. During the final field trip in January 2012, Lenney Gentle provided the author with 10 more Roaring Creek water samples collected between June 2011 and October 2011, and the author took five more surface water samples and two more meteoric water samples from various localities in Cayo between January 11, 2012 and January 14, 2012. \( \delta^{18}O \) analysis of the stream and meteoric water samples allows the author to see how closely stream water values reflect those of meteoric water. The 31 consecutive stream water samples taken from Roaring Creek between October 2010 and January 2012 have been analyzed by the author to see if there is a seasonal pattern in stream water \( \delta^{18}O \) which may reflect seasonal rainfall patterns and meteoric \( \delta^{18}O \) variation in the area.

The collection of live jute specimens recovered during each trip are currently stored in the Department of Geological Sciences Paleoclimatology Laboratory’s freezer at the University of Alabama. The snail’s flesh was removed from each shell using tweezers and hemostats before transport back to the United States, since only the shell carbonate is of interest to this study. During the January 2012 trip, several relatively large specimens were recovered from Roaring Creek. These specimens were taken from the same area in which the data logger was stationed and the sequential water samples were taken. It will be these particular shells that will be analyzed along with the Roaring Creek temperature data and sequential water samples from Roaring Creek in order to see if jute snail shell carbonate does reflect stream \( \delta^{18}O \) variation.

**Background Methodology**

If shell carbonate is deposited in isotopic equilibrium with the ambient water in a system, its oxygen isotope value (\( ^{18}O \)) will reflect two variables: the temperature of the water and the oxygen isotope value of the water (\( ^{18}O_w \)) (e.g. Grossman and Ku 1986; Kennett and Voorhies 1996; Mook and Vogel 1968). Extensive research conducted in the latter part of the twentieth century has developed isotope-paleothermometry equations that relate these three variables [the oxygen isotope value of shell carbonate (\( ^{18}O_c \)), temperature (T) and the oxygen isotope value of the water (\( ^{18}O_w \)) to one another (e.g. Böhm et al. 2000; Grossman and Ku 1986; Kim et al. 2007a; Patterson et al. 1993; Thorrold et al. 1997; White et al. 1999; Zhou and Zheng 2003). An example of one of these equations is given below:

\[
T(\degree C) = 20.6 - 4.34 (^{18}O_c - ^{18}O_w), \text{ Grossman and Ku (1986) Equation A}
\]

With detailed environmental monitoring of water temperature and \( ^{18}O_w \), equations such as this can be used to assess oxygen isotopic equilibrium of shell carbonate precipitation (Grossman and Ku 1986). These equations can also be applied to the subfossil record to assemble proxy data for an unknown variable of interest, assuming other variables are controlled or held constant. In this study, it is hoped that ancient shells can be used to estimate past stream \( ^{18}O_w \) values and in turn relate these data to precipitation in the local environment in which the jute snails, and Maya lived.
When applying an isotope-paleothermometry equation such as the one above to interpret information about the past, some assumptions must be made. The $^{18}\text{O}_c$ variable can be directly measured from the carbonate of the subfossil shell; however, one cannot go back in time to measure either the temperature or the $^{18}\text{O}_w$ value of the stream in which the organism lived. Therefore, estimates must be made for one of these variables in order to derive values for the other one.

In tropical areas, such as Central America, there is minimal seasonal variation in air temperature, with typically less than 5°C temperature seasonality (Collar and Collar 1972; Lachniet and Patterson 2009; Wright and Coutts 1993); therefore, tropical seasonal climate variation is principally expressed as cycles in rainfall, not air temperature. In effect, winter and summer occur not as end members of yearly temperature variation, but instead as seasonal extremities in rainfall, with one being the height of the rainy season (summer) and one being that for the dry season (winter) (Collar and Collar 1972; Setzekorn 1981; Wright and Coutts 1993).

$^{18}\text{O}_w$ in a water system varies as a function of evaporation, precipitation and mixing of water from different sources. Rainfall is isotopically lighter than open ocean water (~0‰). During the rainy season in this region, a surface water system would be expected to have a higher influx of light isotopes than in the dry season due to lighter meteoric $^{18}\text{O}_w$ values wet season. This should cause the $^{18}\text{O}_w$ value of the system to become more negative during the rainy season. Conversely, during the dry season, the system is not being replenished as often while $^{16}\text{O}$ is being preferentially evaporated from the system, thus one would expect $^{18}\text{O}_w$ to become less negative. In the study area it is expected that stream water $^{18}\text{O}_w$ will reflect meteoric water $^{18}\text{O}_w$, even though substantial ground and surface water mixing occurs. This is because $^{18}\text{O}_w$ of the surface and groundwater within this area have a similar range of values due to high hydraulic conductivity of the karstic aquifers in the area (Marfìa et al. 2004). A recent study by Lachniet and Patterson (2009) agrees with this expectation as their study of $^{18}\text{O}_w$ and $^{18}\text{D}$ of surface waters collected across Belize and Guatemala (from the Caribbean Sea to the Pacific Ocean) found that river waters in this region are good proxies for $^{18}\text{O}$ of precipitation.

If the shell carbonate of an aquatic mollusk species is deposited in isotopic equilibrium with the water and temperature can be held relatively constant, the $^{18}\text{O}_c$ should primarily be a reflection of $^{18}\text{O}_w$ variation. Therefore, the oxygen isotope values of the shell carbonate should reflect the intensity of $^{18}\text{O}_w$ variation of the water in which the organism lived, which itself would primarily reflect variation in seasonal rainfall.

**Field and Laboratory Methodology**

**Water Sampling**

Water temperature and salinity was measured in the filled using a YSI Model 30 hand-held meter. Measurements were recorded in units of Celsius and parts per thousand (ppt), respectively. HOBO U22 Water Temp Pro v2 data loggers were used to record water temperature data in units of Celsius over an extended period of time.
Stream and meteoric water samples were collected in 30-mL (1 oz.) Nalgene ® water bottles. The bottles were filled such that no headspace remained in the bottles once they were closed. Also, care was taken to insure that very few, if any bubbles remained in the bottles once the sample was taken and the bottle was closed. After taking the sample and closing the bottle, the space where the lid meets the bottle was covered using electrical tape to insure that the water in the bottle did not fractionate with the atmosphere during evaporation. If water molecules were allowed to escape from the bottle via evaporation, δ¹⁸O values obtained from the water samples could potentially be less negative than the true values of the water samples.

All water samples were measured in the University of Alabama’s Stable Isotope Laboratory in Tuscaloosa, AL. The water samples were measured for oxygen isotopes using the CO₂ equilibration method on a Thermo GasBench II peripheral device and a Thermo Delta Plus isotope ratio mass spectrometer (IRMS). The precision of the values (+/- 0.1 ‰) was obtained based on standards analyzed during the same run. All δ¹⁸Ow values are reported in parts per mil (‰) Vienna Standard Mean Ocean Water (VSMOW).

Shell Sampling

Prior to sampling carbonate, the shells are immersed in a 30% (w/w) H₂O₂ solution to removed residual organic material, in particular the periostracum, followed by an ultrasonic bath in de-ionized water. The methodology used for shell carbonate sampling is currently being developed by the author. Two methods have been used so far to obtain the small (70-100 µg) carbonate samples required for δ¹⁸Oc analysis. Jute shell carbonate has been sampled by the author using a hand-held slow-speed drill as well as micro-sampled using a New Wave Research/Merchantek micromill with dynamic XYZ control at a submicron scale.

There appear to be advantages and disadvantages with each method, and the author is currently working to figure out which is the most time-efficient method to use without losing resolution. One of the primary concerns with molluscan proxy establishment is the manner and timing in which the shell is deposited. If a shell has multiple layers, those layers may be deposited by the organism at different times. These shell layers, as are present in the jute shell, may be very thin, on the order of 10¹ to 10² µm, so if the shell layers are deposited at different times and two layers are sampled at once, then it is possible that the δ¹⁸Oc value for that sample is a time-average, rather than being a snapshot of the environment (if the shell layers were deposited by the organism at different times). With the hand-held slow-speed drill, it is difficult to control which layer of the shell is being sampled; however, with the micromill it is possible to control for depth. The drawback to the micromill is that, unlike bivalve shells, it is difficult to adhere a whole gastropod shell to the stage and measure along the entire ontogeny of the shell. It is possible to cut the shell in half along the axis of coiling and mount each half onto the micromill stage, but even then it is difficult to sample the areas of the shell that are curved downward. The advantage to using the hand-held slow-speed drill is that the shell can be easily rotated by hand, so sample preparation time is reduced, as the shells to not have to be sectioned. The author is currently testing to see if δ¹⁸O varies through shells layers by sampling at different depths in the shell and along visible growth lines. To date, it appears that there is likely negligible difference in δ¹⁸Oc values between shell layers, and the hand-held slow-speed drill
After drilling/micro-milling, the samples are collected using stainless steel blades, weighed, and transferred to 4.5-mL round-bottomed borosilicate vials. The carbonate powder reacts with 100% H$_3$PO$_4$ at 50°C. The resulting CO$_2$ is purified using the GasBench II peripheral device. The CO$_2$ is analyzed for $\delta^{13}$C and $\delta^{18}$O with continuous flow methods using the IRMS. All carbonate values are expressed in parts per mil (‰) relative to the Vienna Pee Dee Belemnite (VPDB) standard by use of the NBS 19 standard. The precision of the data (+/- 0.13 ‰) was determined based on NBS 19 standards analyzed in the same run. As the NBS 19 standard is composed of calcite and the author believes the modern jute shells are most likely comprised of aragonite, an aragonite correction factor of 0.34 ‰ was subtracted from each $\delta^{18}$O$_c$ value based on the temperature-dependent phosphoric acid-carbonate isotope kinetic fractionation function derived by Kim et al. (2007b) for reactions at 50°C.

**Scanning Electron Microscope and X-Ray Diffraction**

In addition to assessing the relationship of $\delta^{18}$O between shell layers, a study of jute shell microarchitecture is also currently underway in order to further assess the snail’s ability to accurately reflect seasonal rainfall variation in its shell. When sclerochronologists establish molluscan climate proxies using modern analogues of species found in archaeological sites, the understanding of shell mineral composition, isotope systematics, as well as the manner and timing in which the shell is deposited is a common concern (Caseldine and Turney 2010; Kennett and Voorhies 1996). As mentioned earlier, when sampling a molluscan shell along shell ontogeny for seasonal climate data, it is important that only discreet intervals of growth are sampled so that time-averaging is kept at a minimum. It is also important to understand if the shell is composed of aragonite, calcite or both, as the application of paleo-thermometer equations as well as fractionation resulting from the reaction of the shell carbonate ion with phosphoric acid will vary depending on mineral composition. Scanning electron microscope (SEM) images of shell layers as well as x-ray diffractometer (XRD) analyses are being used to further the author’s understanding of these parameters.

Prior to SEM imaging, shells were impregnated with epoxy and thick-sectioned using an Isomet diamond-blade saw. Thick sections were polished using a fine-grained sand paper and were acid-etched using a 10% HCL solution. Once they were acid-etched, the thick sections were sputter-coated with atomized gold and imaged using a Phillips XL-30 SEM.

No shells have been analyzed by XRD to date, however sample preparation for this method is quite simple. Several grams of shell powder have been ground from a couple of modern jute shells. A “smear” of this carbonate power will be created by mixing the powder with deionized water and filtering that solution using a vacuum filtration apparatus. The carbonate powder will then be “smeared” onto a glass filter paper. This “smear” can go directly into the XRD machine for analysis. It will also be important to use this method to analyze the mineral content of jute shells from Pacbitun in order to see if any diagensis has taken place.
Results

Analysis of the data collected in the field to assess whether or not the jute snail will be a viable paleoclimate proxy for rainfall in the Maya lowlands is currently underway, as all data has only recently been retrieved. Here, the data that has been analyzed to date will be presented along with preliminary interpretations of the data.

Temperature from in situ Data Loggers

Figure 3 shows the temperature data retrieved from the two data loggers left in Roaring Creek and Barton Creek from October 2010 to January 2012. Temperature measurements were recorded hourly but because of the extremely large dataset generated, the data points represented in Figure 3 are daily averages of the hourly temperature data collected. At Roaring Creek, the maximum daily average temperature was 28.5 °C on June 10, 2011, while the minimum daily average temperature was 20.6 °C on February 13, 2011. Therefore, there was a 7.9 °C difference between maximum and minimum daily average temperatures in Roaring Creek. At Barton Creek, the maximum daily average temperature was 25.9 °C on June 30, 2011, while the minimum daily average temperature was 20.4 °C on December 2, 2011. Therefore, there was a 5.5 °C difference between maximum and minimum daily average temperatures in Barton Creek. The minimum daily average temperatures of Roaring Creek and Barton Creek only differ by 0.2 °C, with Roaring Creek’s minimum value being only slightly warmer than Barton Creek’s. There was a greater difference in maximum daily average temperatures between Roaring Creek and Barton Creek, as their maximum values differed by 2.6 °C.
**Figure 3.** Roaring Creek and Barton Creek temperature data retrieved from temperature data loggers deployed in October, 2010 and retrieved in January, 2012.

\( \delta^{18}O_w \) from Roaring Creek

The \( \delta^{18}O_w \) date from consecutively sampled water samples from Roaring Creek are shown plotted with the data logger temperature data from Roaring Creek in Figure 4. The maximum \( \delta^{18}O_w \) value obtained was -3.5 \( \% \) on May 5, 2011, while the maximum value was -6.0 \( \% \) on November 22, 2010. There is a bit of variability in samples at the beginning of the sampling period. The reason for this variability has not been determined to date, but there does appear to be a less negative trend in the data from January 19, 2011 to May 11, 2011, corresponding to the dry season in the region and a more negative trend from June 6, 2011 to January 12, 2012, corresponding to the wet season. This seasonal signature in \( \delta^{18}O_w \) data appears to coincide with the seasonal trend in the temperature data.

Modeled \( \delta^{18}O_c \) for shell carbonate in Roaring Creek

The temperature values obtained from the Roaring Creek data logger and the consecutive \( \delta^{18}O_w \) values were plugged into nine different paleothermometer equations for aragonite (Böhm et al. 2000; Grossman and Ku 1986; Kim et al. 2007; Patterson et al. 1993; Thorrold et al. 1997; White et al. 1999; Zhou and Zheng 2003) to solve for \( \delta^{18}O_c \). The modeled values for the shell carbonate along with the \( \delta^{18}O_w \) values are shown in Figure 5. Like the \( \delta^{18}O_w \) the modeled \( \delta^{18}O_c \) values show a seasonal trend, however, data from the shells of jute that lived in Roaring Creek during the time the temperature and \( \delta^{18}O_w \) data were collected is needed in order to verify the relationship between the different variables. One jute shell collected live in June 2009 has been sampled at high resolution along shell ontogeny in order to get a preliminary look at shell
carbonate data (Figure 6). These preliminary data show a strong sinusoidal variation in $\delta^{18}O_c$, leading the author to believe that this snail may be a viable proxy. However, without comparison to contemporaneous stream temperature and $\delta^{18}O_w$ values, this result is not yet completely substantiated. What is interesting to note is that the range of values obtained from the shell collected in June 2009 match the range of values modeled using the Zhou and Zheng (2003) paleothermometer equation, an equation derived using inorganically precipitated aragonite.

**Shell Structure and intra-layer $\delta^{18}O_c$ variability**

The shells of two *jute* specimens were examined by SEM: one adult and one juvenile. The adult was recovered from Roaring Creek and the juvenile was recovered from Barton Creek, both in June 2009.

![Roaring Creek Temperature and $\delta^{18}O_w$ Data](image)

**Figure 4.** Roaring Creek temperature data and $\delta^{18}O_w$ data collected from October, 2010 to January, 2012.
Figure 5. Modeled $\delta^{18}O_c$ data using Roaring Creek temperature and $\delta^{18}O_w$ data collected from October, 2010 to January, 2012.
Figure 6. δ¹⁸O and δ¹³C curves from modern jute shell carbonate recovered from Roaring Creek in June, 2009. The dark line is the moving average using an interval of 10 data points. While the δ¹³C data are included, the cause of their variability is unknown at this point, and no assumptions have been made since no data for the δ¹³C value of dissolved inorganic carbon (DIC) in the stream system are available.

SEM examination of both adult and juvenile jute shells revealed three layers of crossed lamellar microarchitecture (Figure 7). The shell structure remained relatively consistent in number of layers throughout all areas of the shell examined.
The most commonly-found shell microarchitecture in gastropod shells are crossed lamellar layers (Chateigner et al. 2000; de Paula and Silveira 2009; Flügel, 2004; Wilmot et al. 1992), occurring in up to 90% of all gastropod species (Martin 2006). Crossed lamellar structures are almost always comprised of aragonite (Dauphin and Denis 2000; Lowenstam and Weiner 1989; Majewske 1974) and are very similar in bivalve and gastropod shells (Dauphin et al. 2003). Gastropod shells usually have one to five layers of crossed lamellar structure with different orientations (Majewske, 1974; Wilmot et al., 1992), with two to three layers being the most common occurrence (Majewske, 1974). Gastropod shells are almost always composed completely of aragonite (Flügel, 2004) and all of the freshwater gastropod shells examined by Keith et al. (1964) were comprised primarily of aragonite. Although XRD analysis has not been conducted on the modern shells yet, chances are they are comprised of aragonite. XRD analysis will be conducted on modern shells as well as on shells from Pacbitun. There is a chance that diagenesis has occurred in the archaeological shells, so XRD analysis should determine whether or not the shells retained their original mineral composition.
Conclusions

There is a difference in the summer months’ water temperature recorded in Roaring Creek and Barton Creek, but overall there is less than 10°C temperature variation in water temperature throughout the course of a year. $\delta^{18}O$ of the stream water in Roaring Creek shows seasonal variation that may be slightly more pronounced than the seasonal variation observed in water temperature. This relationship is currently under further review. Modeled $\delta^{18}O$ of shell carbonate shows seasonal variation, as does the shell carbonate of a jute snail collected live at Roaring Creek in June, 2009. Thus far, the jute snail appears to be a viable proxy for studying season of capture.

Future Analyses

Once the jute snail proxy validation of this research is complete, the author plans to use jute shells recovered from Pacbitun in a seasonality study. The author currently has 38 shells from 10 different contexts within both the site core and site periphery of Pacbitun provided by Dr. Terry Powis. Based on radiocarbon data from contemporaneous charcoal samples, the shells from the site core date to the Late Preclassic period (approximately 300 to 500 B.C.) (Terry Powis, personal communication 2011). With these shells, the author hopes to be able to determine if perhaps the ancient Maya were harvesting jute snails at a particular time of year.
Acknowledgements

The author would like to thank the Explorers Club Exploration Fund, the University of Alabama Graduate School, the University of Alabama Graduate Student Association, the University of Alabama Department of Geological Sciences Wallace C. Johnson Endowed Support Fund and Gary W. Hooks Endowed Geology Fund, and the Alabama Geological Society John G. Newton Memorial Scholarship Fund for the funding that was needed to make this project possible. The fieldwork portion of this project was also greatly aided by the support and assistance of the author’s husband Kendall A. Rich, P.G. and other family members, especially Alan and Janis Seraphine and Dale W. Whatley. The author also thanks her advisor Dr. C. Fred T. Andrus as well as her entire dissertation committee: Dr. Paul Aharon (The University of Alabama), Dr. Albeto Perez-Huerta (The University of Alabama), Dr. Lisa LeCount (The University of Alabama), and Dr. Terry Powis (Kennesaw State University). Laboratory analyses were aided by Dr. Joe Lambert and the staff of the Alabama Stable Isotope Laboratory as well as Johnny Goodwin and the staff of the University of Alabama’s Central Analytical Facility.
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They Lived Where?!: A Report on the 2011 Settlement Reconnaissance around Pacbitun, Cayo District, Belize

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This report documents the reconnaissance of ancient Maya settlements, chultuns, and springs around Pacbitun during the 2011 field season (Figure 1). The impetus for this activity was the recognition during the previous season’s cave reconnaissance (Spenard 2011) that the region surrounding Pacbitun was much more densely settled than had been previously believed. It was performed as a non-intensive side project associated with the cave reconnaissance again during the 2011 field season (see Spenard in this report for the report on the cave reconnaissance). The two projects complement each other because of the relationship between caves and settlement. The two tend to be in relatively close proximity to each other, and the settlements reported here were frequently encountered on the way to the caves. All of the sites and features reported here were brought to the project’s attention by the junior authors who have spent their lives exploring, and guiding scientists, survival camps, and local work groups through the wilderness that surrounds Pacbitun, and thus have unparalleled intimate knowledge of it. The results of the reconnaissance reported here are envisioned as a primary step in assisting in the development of future settlement pattern studies around Pacbitun. As such, it should be understood as a preliminary sample of what is out there rather than a final report of a systematic study.

The procedure used for recording each group included taking a gps point in the center of every structure, a photograph of it if possible, a sketch when appropriate, and notes of its character, alignment, artifacts, and relationships to other structures and features. With the exception of one site, no artifacts were collected. One point of note that became apparent quickly after starting this project is that our energies were better spent recording architectural concentrations. Individual mounds are frequently encountered though they were seldom recorded.

The architectural groups described here would have had various levels of interaction with Pacbitun, and in once case, Guacamayo, though what they were is indeterminable based on our current knowledge of them. This ambiguity raises larger questions relating to the nature of an
Figure 1. Google earth map showing sites and features recorded during reconnaissance and others known in the region. Triangles represent groups, blue circles are springs, and black dots are chultuns.
archaeological site. For example, was Alux a satellite settlement of Pacbitun, was it an independent political unit, or something else? Further research is necessary to determine this question for these groups surrounding Pacbitun, though we doubt that this debate in archaeology will ever be settled. Nonetheless, our intentions are to avoid taking sides on this debate, especially in regards to the names that we gave them. Therefore, we refer to a concentration as “X group,” leaving the determination of their political affiliations to later projects. The name given to a group refers to the current landowner, unless otherwise specified.

**Settlement Reconnaissance**

Viejo Sak Tunich is the first group that was recorded during reconnaissance. It is named after the Sac Tunich artisan group and resort on whose land it sits. It is the only one that was surface collected because it faces an immediate threat. Sac Tunich is in the process of clearing and leveling the terrain in order to build cabins. As a result, many of the mounds have been partially destroyed and artifact piles abound. Currently, only structure, an elevated deck, has been built.

The group consists of nine structures placed randomly over a hilltop ridge oriented 37 degrees along the ridge that is bisected by a dome that rises up approximately 15 m (Figure 2). A spring is reported to be located at the foot of the hill though it was not located. Two chultuns located 8 m apart are cut into the south face of the domes, and they are in poor shape. Artifacts including ceramics, lithics, and ground stone are ubiquitous on the ridge. This settlement seems to have been strategically located because it provides unobstructed views of Pacbitun, Sak Pol Pak, Cahal Pech, and the land around Xunantunich. The epicenter of the latter is obscured by another hill.

Chultun 1 is further up hill than Chultun 2, and has been almost completely destroyed by excavations. The feature resembles a large hole in the ground and is aligned 320 degrees. Obtaining measurements proved difficult due to its condition. Nonetheless, part of the original entrance can be made out in the bedrock exposed in the southeastern corner. Its limestone plug was uncovered in an adjacent back dirt pile, suggesting that the destruction was recent (Figure 3). The plug is 50 cm in diameter, suggesting that the entrance was the same size, and two handles can be seen carved into its sides.

Chultun 2 has two chambers, and it is roughly figure 8 shaped. The chambers are aligned approximately east/west. The entrance hole is 50cm in diameter, and located above the eastern chamber. An alluvial cone has filled in chamber 1. The floor to ceiling measures 80cm in height for chamber 1, while chamber 2, lacking any alluvial fill is 95cm deep. The chultun is very hot, probably 20°F warmer than the outside air. Most of it is filled with alluvial deposits from the ground above. There are also many bugs, huge roaches, whip scorpions, mandingas, and more. No artifacts were noted within but this lack may be due to the alluvial fill. The entrance is cut round and directly into bedrock, as is the entire feature. In total, it measures 3.5 m x 1.2 m x 70 m.
Structures 1 and 2 share the central dome with the two chultunob. Structure 1 is located to the northwest of the elevated deck. It measures 0.5 m tall, 4.50 m north-south x 470 m east-west. This is the closest structure to Chultun 1, and likely faces to the northwest. Structure 2 runs east-west and is adjacent to Structure 1. It is approximately 30 cm in height and measures 1.5 m north-south x 3 m east-west.

Structures 3, 4, and 5 are located on the northern portion of the ridge. Structure 3 measures 2 m east-west x 1 m north-south x 20 cm tall. It is positioned in a low spot between the north ridge and central dome. Structure 4 is large compared to the others in this group. It measures approximately 1 to 1.5 m tall, and a nearby rubble pile contains cut stones suggesting that this structures had stairs at one point, or alternatively, constructed with high quality cut stones. It measures 4.30 m north-south x 7.40 m east-west. Structure 5 is located approximately half-way along the north ridge, though no other constructions were seen beyond it. Nonetheless, the lack of structures beyond that point may be due to the lack of vegetation clearing. The vegetated area was unsuccessfully surveyed for additional settlement, though two metate fragments were located. Both are of rough granite and may be part of the same piece. The depths of the grinding areas are 11 and 7 cm. Structure 5 measures 8.20 m north-south x 5.80 m east-west and is approximately 1.5 meters tall. There was a large pile of sherds at this structure and a pile of rock, presumably placed there by Sak Tunich employees.

Figure 2. Overview photo of Viejo Sak Tunich’s southern ridge. The rubble piles are the result of the ongoing cleaning and leveling of the area for the construction of cabins. Structure 6 is near rubble pile in middle of image. Structures 7 and 8 are under the one next to the clearing jog. Structure 9 is to the left of the top of the cut.
Structures 6 through 8 are located on the southern section of the ridge, and Structure 9 is located on a natural elevation that runs directly south. Structure 6 is located half-way down the central dome. It measures 5.20 m north-south x 4.80 m east-west, and is approximately 2 m tall looking at it uphill. This structure is likely a terrace as it is on a slope and it has a very low density of artifacts around it. Structure 7 is a low mound upon which sits one of the modern rock piles. A high concentration of pottery surrounds this structure suggesting that it is a house mound. It measures 4.40 m north-south x 8.30 east-west. It is at the lowest point of the central hill’s slope until climbing back up to the southern ridge. Structure 8 measures 3.20 m north-south x 3.20 m east-west. It appears to be a small ancillary structure attached to Structure 7 though the sherd density is much lower. This may be a storehouse or kitchen. A bit further south of these structures is a possible terrace though it was not recorded. Structure 9 is the furthest south on the southern ridge, but it also on a natural elevation. The structure measures 3.60 m north-south x 4.00 east-west and is approximately 1 meter tall when looking up at it. A possible sling stone was noted at the foot of the hill that it sits on.

The Alux group is located just outside of San Antonio on the road to Cristo Rey, and across the street from the San Antonio Maya Spiritual Center (Figure 4). It was named after the presence of an “Alux house” next to a natural spring (See “Diego’s World” by Spenard in this report for a more in depth discussion of this feature). The site consists of a loosely dispersed group of independent structures and small hilltop plazuela group. The landowner was uncomfortable with on us being on his property and only allowed us to walk around. As a result, it was incompletely documented. GPS coordinates of most of the structures were taken, and a
few were photographed. Structure 2 is the largest among the dispersed mounds. Digging equipment was seen on top of this structure, as well as a recent looter pit, suggesting that this site is actively being destroyed (Figure 5). The other mounds in the dispersed section were similar size, approximately 3 m$^2$.

Plaza A is a series of low mounds on a hilltop along the corner of the property. From the foot of the hill, emerging from the SW corner, the plaza looks to be a group of 3 to 4 tall structures. From the top of the hill it appears to be a group of five smaller structures none of which are more than 1.5 m tall, though the area to the east was likely bulldozed opening up the possibility that more were present in the past. A large, flat area of bedrock is located approximately in the middle of the “plaza.” An active spring is located approximately 0.5 km due west and downhill of this group. This spring is known locally as Sayab Spring, meaning “Living Spring,” in reference to it flowing perennially. This spring is one of the few in the region that has been dependable especially during times of drought.

The Mena, Pot, and Pancho Groups are located between two to three kms to the southwest of Alux, while the Sak Chultun is 1.5 km to its west (Figure 6). Mena sits on the Mena brother’s land, and consists of four architectural clusters and two chultunob. Modern agricultural fields surround the ancient settlement. The first cluster consists of a 3 structure complex aligned east-west. The first structure in this cluster is the furthest east and is approximately 2.5 m tall. It has been badly looted. It measures 11 m east-west and 9.80 wide. The middle structure is a 7.5 m long platform that extends from the east side of Structure 3. A two course rock line is still visible showing the upper wall of the structure that measures 0.75 m tall. Structure 3 is a 9.5 m long x 2 m tall, stepped structure that has also been looted. Many sherds are present throughout and around this cluster.

Structures 4 and 5 are located roughly 100 m to the northwest of Structures 1 through 3, across an unexpectedly flat agricultural field, and adjacent to the modern road. Dense overgrowth covers these structures that prohibit accurate measurements, though the groups is smaller than the one on the other side of the field. Structure 4 is a range structure that extends into Structure 5. It has been partially destroyed by the road cut and possibly looted. It stands approximately one m tall. Structure 5 measures approximately three m tall, and has been trenched by looters. The trench is approximately one m deep and cuts across the summit. No artifacts were seen around these two structures, but that is likely a result of the dense vegetation on them.
Figure 4. Google earth map of Alux site and surrounding springs.
Figure 5. Alux group Structure 2. The excavation is to the left of the tree on the right.

Figure 6. Location of Mena, Pot, and Pancho groups in relation to Guacamayo.
Sacbe Chultun is adjacent to Structures 4 and 5 in a pullout on the side of the road. The feature runs beneath the road and damage is visible from traffic passing overhead in the form of roof collapse. No lid was recorded but the entrance has been clogged with rocks to prevent animals and vehicles from falling in. Its entrance is oval shaped with the long axis running approximately east-west and measures 60 cm x 50 cm. The feature has one chamber that measures 265 cm north-south x 250 cm east west with a varying ceiling height between 40 and 70 cm. Another smaller chamber may be present to the south, but a significant amount of alluvial fill and ceiling collapse due to vehicle traffic obscure anything there.

A small cluster of three possible structures is located on a hill directly across the street from Structures 4 and 5, and the Sacbe Chultun. They were not given structure designations because their nature was difficult to determine without further investigations. The presence of artifacts on the hilltop as well as a possible looter’s pit into one of the possible structures suggests that these may be structures.

The fourth component of the Mena group is located 300 m to the northeast of the others. It consists of the Mena Chultun and a nearby structure. A large quantity of ceramics and cut stone are present around the structure, which appears to be faced with pebbles. The chultun is in a small patch of jungle that is otherwise surrounded by agricultural fields that full of artifacts. A “skotch,” or trumpet tree grows out of the entrance prohibiting any access. Nonetheless, we were able to determine that the feature is approximately 1.5 m deep, that the chamber is very round and opens to the north, and that the walls are smooth and in very good condition. The entrance slopes rather than being cut directly into bedrock unlike other chultuns.

The Pot group is located 0.5 km to the north of the Mena site. It is considered separate from Mena because it is located up and over a significant ridge with poor access between the two. It consists of a chultun (Pot Chultun), and a single hilltop structure. This group is situated on the primary range of hills rising up from the Macal river. As a result, Guacamayo, Tipu, and Xunantunich can be seen clearly from there. The structure is a poorly defined mound approximately 0.75 m tall and no looting is apparent. No artifacts were seen around it or the chultun, but the area is covered in dense grass.

Pot Chultun is the most complex of these features documented during the field season. It consists of three chambers running east-west that are well preserved, except for the central chamber, which has collapsed. The eastern chamber appears to be plastered but the west chamber is untreated. Chamber 1 is the most western. It is roughly circular measuring 150 cm in diameter, and 60 cm tall. Chamber 2 was the entrance to the feature. It measures 210 cm east-west x 180 cm north-south. Chamber 3, the eastern chamber, measures 1.90 m x 120 m x 0.7m.

The Sak Chultun is located equidistant from Viejeo Sak Tunich and the Pot group. Extremely unfavorable weather conditions prohibited an in depth exploration of the area that the chultun is in, and the presence of several trees growing from its entrance made investigating the feature impossible. Nonetheless, its entrance measures 50 cm in diameter, and several presumably invisible mounds are located in the area as indicated by a low-density ceramic scatter that covers the hilltop.
Pancho’s group (Figure 7) consists of a 5 m tall hilltop temple located on the eastern side of an artificially flattened plaza (Plaza A). The structure has been superficially looted. A smaller range structure approximately 5 m long but less than 50 cm tall sits on the northern boundary of the plaza. Approximately 4 m to the west of the bottom of the temple is a karst feature with a large wasp’s nest still in it. Whether or not this feature is a chultun or natural cave is impossible to determine with the wasps present, though it appears to have been recently dug out. The area was freshly burned when we arrived suggesting that a milpa would soon be growing over it. Another possible plaza, Plaza B, is accessed via a natural step down from the western boundary of the other. No stairs were noted connecting the two, but the weather quickly deteriorated while at the site and a comprehensive survey beyond Plaza A was impossible.

The Jau, Taibo, and Yax Tunich groups were the closest to Pacbitun and most likely of all visited this season to have been active participants in the polity (Figure 8). Such groups have recently been defined as neighborhoods and districts (Smith 2010), though which they would be needs to be determined archaeologically. These groups are also the most complex because of the large number of structures associated with them.

The Jau group consists of a large terrace area, ten structures, and several disconnected terraces (Figure 9). The terraced area is made up of approximately 6 well-defined walls with one or two possible structures, collectively referred to as Terrace 1. This group has been constructed on a gentle slope of a low hill to the north of the settlement. Each terrace measures 1 to 2 m tall and run roughly east-west. Not many artifacts were noted in this area.

The structures and disconnected terraces are similarly located on a series of gently rolling hills in a field of thick grass. A plazuela group roughly aligned to the intercardinal directions is located on top of one of the hills, but no other formal arrangements of the structures are obvious. Pacbitun and Sak Pol Pak can be seen from this group, and a ramp similar to the one at Caracol is bounded by Structures 7 and 8 discussed below.

Structure 1 is located on the highest point in this small alluvial valley. The height of the structure varies in size depending on the direction that it is approached. From the south it is a few cm at most, though from the north it is 1.5 m. There are no well-defined walls, and the structure more resembles a rubble mound. Nonetheless, there are many trees there offering a possible explanation for the severe disturbance seen. Structure 2 is a low, poorly defined rubble mound less than 50 cm high. Structure 3 is similar to Structure 2 except that the rocks used to construct it are larger and artifacts were noted. Terrace 2 is located between Structures 3 and 4. It is aligned north-south and measures 20 m long. Structure 4 is 1.5 m tall structure with patios to the east and south. The larger patio is located to the south. As with the other structures in this area, tall grass has lead to poor visibility for locating any surface artifacts. The main structure measures 9.5 m east-west x 5.20 m north-south. The eastern patio is in the shape of an uneven parallelogram. Its western side measures 5.20 m long, north 3.20 m, east 3.30, and south 3.80. The southern patio begins 2.20 m west of the west wall of the structure. It extends 3.30 m south, and is 7.10 long. Structure 5 is difficult to identify. It may be two adjacent structures or possibly
Figure 7. Plan view tape and compass map of Pancho’s group.

Figure 8. Jau, Taibo, and Yax Tunich groups in relation to Pacbitun and Sak Pol Pak.
a larger one that has been partially destroyed. It measures 10 m north-south x 7.5 m east-west x 1 m tall. The constructions are similarly aligned to each other, but may also be with Structures 3 and 4. Some jute and ceramics were noted in the soil surrounding this structure. Structure 6 is a non-descript rubble mound approximately 0.75 m tall. No walls are visible and the mound measures about 3 m x 3 m. Few utilitarian sherds are present and the structure is located at the foot of a small hill.

Terrace 3 is located at the bottom of the hill of the plazuela group. It runs northwest-southeast for 6 m. Structure 7 is the northeastern construction in the plazuela group. It measures 17 m long x 5 m wide, and 1 m tall. Structure 8 is the northwest structure and may be the tallest at about 2 m high. Nonetheless, it is at the edge of the hill, a position that gives it the appearance of being much taller when viewed from below (the north). It averages roughly 15 m² though none of its walls are the same length. A looter’s pit is present in the center of the structure, though it is only 40 cm deep. No artifacts were noted on the surface. Structure 9 is the southwestern range structure. It measures 12 m x 6 m x 0.5 m tall. This height is when viewing the structure from the plaza. It backs up directly onto a heavily vegetated fenced off property line that obscures a substantial drop off of several meters, therefore, this complex likely appears to be much more imposing from below. Very few artifacts were noted but there is a lot of rock. Structure 10 is the smallest and lowest of the group. It is less than 30 cm tall but the most artifacts appear there. It measures 6 m x 6.5 m. The hilltop extends for several meters beyond this structure, and then it drops off significantly.

The Taibo group is the most complex recorded during reconnaissance this field season. It is located approximately 1.5 km to the northeast of Pacbitun, and consists of a ridge top pyramid, 8 large house mounds, many with patios, a modified spring, and a U-shaped plazuela group. A second spring was reported to be at the southern foot of the hill though time did not allow us to locate it. The entire group is currently located beneath an extensive orange grove though the trees do not appear to have caused much damage. Half of the mounds are located on the same north-south running ridge as the temple, and the others are randomly distributed to the east and north of it.

This group is dominated by the hilltop temple that can be seen from all of the other components of it (Figure 10). The pyramid stands 4 to 5 m tall, and measures 15 m north-south x 20 m east-west at its base. The top platform is uneven but measures 5 m². The structure is positioned on the northern end of a ridgeline that is also the tallest point around. This positioning affords it the ability to be seen by anyone in the surrounding settlement. The eastern side has been all but completely destroyed by a looter’s trench. The digging indicates that a burial chamber was encountered because it reached a hollowed out bedrock area. Nonetheless, the trenching may have missed the center axis.
Figure 9. Overview of Jau group. House figures represent mounds and brick blocks represent terraces, though they are not to scale.

Figure 10. Taibo group ridgetop temple.
Mounds 1 through 5 are located on the ridge top with the pyramid. Mound 1 is situated on the furthest southern point of the ridge. It is aligned 23 degrees west of north, and has a well-defined foundation stones on its north and west sides. The southern part turns to a rubble pile. It measures 6.30 m north-south x 3.30 m east-west x 0.3 m high maximum. Ceramics, chert, and some red slate are visible on its surface. A possible side patio runs along the western edge of the structure. It shares the same north-south measurement but is 1.60 m east-west. Mound 2 is much more poorly defined than 1 though it appears to be equally aligned. It measures 5.20 m north-south x 3.90 m east-west A nice wall, possibly a hill-top leveling wall is preserved on the east side of the structure that is one course tall. It measures 4 m east-west. Pottery in this flattened area. The retaining wall leads to Mound 3, another badly disturbed structure. The wall connecting these two structures suggests that they formed a single domestic unit and that the wall made a delineated open space, perhaps for the performance of daily activities. The structure itself measures approximately 5.70 m north-south x 9.10 m east-west x 50 cm tall. The disturbance is due to modern tree fall. Many sherds are present but delineating the actual structure was difficult due the presence of non-architectural rock. Mound 4 is another poorly defined mound, and it is located in the approximate mid-point of the ridge between the pyramid and Mound 1. A large quantity of gray slate and pottery litters the area around it, though no cut stones are visible. Only one orange tree has been planted in this area suggesting some sort of subterranean disturbance. The structure measures 4.00 m north-south x 8.40 m east-west and stands approximately 50 cm tall. The structure may follow the contour of the hill suggesting that it may be a terrace rather than for habitation. Its north side is much better preserved and taller than the south. Mound 5 is a low-lying, east-west-running structure immediately to the south of the temple square. It measures 6 m north-south x 7 m east west and stands 20 cm tall. It is off center of the pyramid and too large to be an altar, all of which suggests that it was settled after the temple lost its importance for the people because its presence here seems out of place when compared to other Maya sites. Its walls are relatively well-defined though two orange trees grow out of either end of the structure.

The Taibo Spring, Plaza A, and mounds 6 through 8 are located on the low-lying area to the east and north of the ridge. The spring and Plaza A are located approximately 250 m west of the hill-top temple. The spring is a natural seep that was modified in the past with a series of steps cut into the bedrock. It measures approximately 4 m east-west and 3 m north-south, and currently about 2 meters deep. Several sherds are present there. Modern trash and containers for collecting water litter the ground around the feature. As well, a small residence, presumably of a land manager is located near by. Plaza A is located 20 m north of the spring (Figure 11a). The ground that it sits on has been slightly elevated above the surrounding terrain. Three to four courses of steps lead up into the 3 structure plaza. I suspect that this architectural group may be a temple or shrine dedicated to the spring similar to Temple 19’s relationship to the Otolum stream at Palenque (Stuart 2005:90).
Mound 6 is an architectural isolate that has been severely looted. It measures 8 m north-south x 9.5 m east-west x 0.75 m tall. A possible patio abuts the structure on the east that measures 4.6 m north-south x 4.20 m east-west. Modern trash and artifacts abound including pottery, slate, a mano, and white chert flakes. Mound 7 is also an isolate standing 0.75 m tall (Figure 11b). It measures 6.3 m north-south x 11.2 m east-west, and is aligned to the cardinal directions. A substantial L-shaped patio is located to the south of the structure that is defined by a well preserved, single-course rock alignment. The larger portion of the patio measures 7.4 m north-south x 6.4 m east-west. The smaller portion measures 4.0 m north-south x 3.2 m east west. Orange trees have unfortunately broken the patio walls in parts close to the structure. Mound 8 is the smallest visited in this group, and it has been partially destroyed by a road cut. It measures 3 m north-south x 4 m east-west, and rises less than 5 cm above the ground surface. It is located at the northern foot of the ridge that the temple sits on.

Yax Tunich (Green Rock) is a hilltop group, though only one structure was noted. Dense vegetation prohibited an in depth survey of structure, let alone the hilltop, but its size suggests that other mounds should be present. The structure was identified while visiting Actun Yax Tunich and Actun Zotz (see Spenard “Defining Community Ch’een” in this report for information on these caves).

La Caoba Higo, and Cahal Higo are the last two groups that we documented during reconnaissance (Figure 12). They are located within the boundaries of the Mountain Pine ridge, close to Privassion creek. The vegetation is lowland jungle, rather than pine, and a few milpas are located in the area, all of which suggests fertile land, which in turn, suggests the likelihood of ancient settlement beyond the two sites noted here. Time did not allow for La Caobo Higo (Mahogany Fig) to be documented with anything more than the taking of a gps point in its plaza.

Cahal Higo (Fig Village) is a small plazuela group made up of 5 structures, all of which appear to be connected by platforms (Figure 13). Javier reported that groups like this one are relatively common and follow the jungle vegetation lines and creeks all the way to Sak Pol Pak. The site was named after a large fig tree that is growing out of the southern structure on the
western side of the plaza. A type of hunting blind called a gibnut barbeque is adjacent to the fig tree. Such blinds are commonly found adjacent to these types of trees because gibnuts frequently eat figs, and therefore, offer a hunting advantage.

The southern structure is the tallest in the group, measuring approximately 4 m. Its west side has been completely destroyed by two looter’s trenches. A two-stair staircase provides access to the plaza from the southwest corner. A possible altar is positioned a few meters from the foot of the southern structure along its central axis (Figure 14). Another possible set of steps is in the northeast corner of the plaza but these go up to a platform connecting the two structures there. A row of cut stones can be seen on the northern flank of the eastern building, and several mano fragments were noted throughout the area. Reconnaissance of nearby Actun Hayach Naj cave (see Spenard in this report for the report on the cave reconnaissance) also revealed an unusually high quantity of manos compared to other sites and caves in the region suggesting that their position close to the granitic bedrock that defines the Mountain Pine ridge was more accessible.

Figure 12. Google earth map showing locations of Cahal Higo and La Caoba Higo in relation to Pacbitun and Sak Pol Pak.
Figure 13. Sketch map of Cahal Higo. The numbers adjacent to the structures are paces, “M” indicates the location of a mano fragment, and solid black squares are looter pits.

Figure 14. Possible altar in front of southern structure of Cahal Higo.
Conclusions

The number of settlement groups and other features reported here demonstrate the utility of combining settlement and cave reconnaissance. It also speaks to the significance of local knowledge of the landscape and its utility. A few patterns became obvious as the season progressed. Firstly, chultuns are common in western groups, especially those within a few km of Guacamayo. This area is largely void of caves, suggesting that they may have been made to serve a similar function as seen elsewhere in the Maya world (e.g. Brady 1991; Brady and Veni 1992). Their potential role as storage places is questioned for those in the Pacbitun region because they tend to be hotter and more humid than the outside air, which creates conditions counter ideal for storage. A second pattern is the presence of sites within the Mountain Pine Ridge reserve. This area has received little archaeological attention because the soil is not conducive to agriculture and thus human occupation (Bullard 1963). Nonetheless, the presence of the Cahal Higo and La Caoba Higo groups suggest that fertile pockets in the area did sustain settlement. A predictive model that considers soil types and water sources, similar to that devised by Ford and Fedick (Fedick 1994, 1995, 1996; Ford and Fedick 1992) for the Upper Belize River Valley area, would be productive for identifying sites to the south of Pacbitun. Finally, the results presented here further attest to the high population levels in antiquity. In the end, we hope that this brief report will stimulate future research in these otherwise archaeologically unknown areas.
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Cave archaeological investigations performed in 2011 by the Pacbitun Regional Archaeological Project (PRAP) consisted of the intensive survey of Actun Lak (Pottery Cave), and the Nohooch Tunich (Great Wall) bedrock outcrop complex (NTC), and a regional karst landscape reconnaissance. The goals of this research were three-fold. The primary goal was to initiate the first large-scale systematic archaeology cave project in the Pacbitun region. The second goal was to begin to understand the ways that various communities in the Pacbitun polity used these landscape features. The final research goal was to test the extent of the ancient Maya concept of “ch’een,” which is commonly glossed as “cave” even though archaeological and ethnographic evidence suggests that the term was likely used to refer to any hole in the ground.

A team composed of individuals with varying levels of archaeological experience performed this work. Its members included a revolving set of field school students, expert and novice local labor, two experienced cave archaeologists, and myself. Due to the varying expertise of the team within cave settings, the need to rotate students to all of PRAP’s research loci, as well as other commitments, the composition of the team fluctuated throughout the season. The entire team did all excavation and formal mapping work, but reconnaissance and cave exploration was limited to experienced staff.

Background

Pacbitun has received periodic yet intensive archaeological investigations since the mid 1980s (Healy 1990a). These research programs focused primarily on the site’s epicenter and its surrounding settlement (Healy et al. 2007; Healy et al. 2004), and they have been discussed in detail elsewhere. The reader is directed there for more information on these topics (e.g. Healy 1988, 1990a 1990b, 1992; Healy et al. 1995; Healy et al. 2007; Healy et al. 2004; Powis et al. 2009). Nonetheless, a summary of the results of these projects’ findings is necessary to contextualize the present research there.

Pacbitun was settled sometime in the Middle Preclassic period around 900 B.C. and was continually inhabited into the Terminal classic period to around A.D. 900, a time span of nearly 2000 years. The earliest inhabitants lived in a relatively small egalitarian village with an economy based on shell bead production (Powis et al 2009). Monumental architecture began to be constructed around 300 B.C. suggesting a move towards institutionalized inequality, or at least an emerging elite class (Healy 1992). The area outside of the epicenter began to be settled at this time as well suggesting a population increase, or the centralization of previously scattered, and therefore, invisible populations (Healy et al. 2007). The situation at Pacbitun remained relatively static until between A.D 550 and 700 when a massive construction boom took place.
including the construction of 3 causeways, one of which runs for 3 km into the mountains, terminating at the mouth of a cave (Healy et al. 2007; Weber 2011). Estimates from this period put the population at around 7000 individuals over a 9 km sustaining area.

**Previous Cave Research at Pacbitun**

The caves in the Pacbitun region have been subjected to periodic scientific inquiry since 1994. The first study was by a team of cavers under the auspices of the England-based Mendip Caving Group, whose goals were to locate, explore, and survey caves around San Antonio village (Flavell et al. 1994; Francis et al. 1995; Hollings 1996). The result of this survey was the location of 19 caves many of which contain evidence of ancient cultural activity particularly pottery and ground stone. Several of the caves that appeared in this early report have become the focus of our investigations. This overlap is due to both projects being guided largely by the same local person. Though the English project noted the presence of archaeological materials they went unstudied due to a lack of an archaeologist on the team.

Members of the Belize Valley Preclassic Maya Project performed the first cave archaeology investigations of the land surrounding Pacbitun in 1995 (Healy et al. 1996). Their work focused on Actun Petz (now Pech) though several caves had been plotted during settlement studies in the site’s periphery in the late 1980s. The research goals for the investigations at Actun Pech were to describe the cave and any artifacts found within, to determine when and how it was used, and what connection it had to Pacbitun (Healy et al. 1996:139). The work in this cave was purely descriptive. Artifacts were left in situ and all soil remained unexcavated. The results of this brief survey included a tape-and-compass sketch map, and the recording of several whole vessels, sherds, terraces, and human remains.

Healy and colleague’s (1996) work in Actun Pech was the last until the Pacbitun Preclassic Project (PPP) returned in the late 2000s. The PPP identified or relocated 12 caves and investigated three of them, Actun Pech, Actun Merech, and Tzul’s Cave in 2009 (Powis 2010:22-23). The goals of this research were to understand what the Maya were doing in the caves, to flesh out archaeological cave data in an unknown region in order to facilitate regional comparisons, and to identify any spatial, temporal, and social differences in use patterns. Each of the three caves was mapped, and in situ ceramic analyses were performed, suggesting that the activities within were performed in the Late Classic period.

Archaeological investigations in the caves continued during the 2010 field season focusing on Actun Pech and Actun Merech (Valdez et al. 2011), and the implementation of a regional cave reconnaissance (Spenard 2011). The goals of that season were to initiate the first cave excavations in the Pacbitun region, to document ancient speleothem use, and to catalog artifact assemblages should looting occur (Valdez et al. 2011:19). Excavation units consisted of 50 cm x 50 cm test pits and one columnar sample.

One test pit and the columnar sample were placed in Actun Pech adjacent to a set of human remains that Healy’s (Healy et al. 1995) team identified in 1995. These excavations failed to uncover any artifacts and the matrix remained consistent throughout. These findings
coupled with the presence of human remains on the surface lead the research team to conclude that the current cave floor is the same as that used by the ancient Maya (Valdez et al. 2011:28).

One excavation unit each was placed at the entrance and upper rear chamber of Actun Merech. The entrance unit recovered sherds, jute, and lithic flakes. High quantities of sherds regularly appeared in the first few levels though they became increasingly scarce near sterile. The jute pattern was directly opposite of that of the ceramics. Large quantities were found just above sterile while none were noted in the first few levels (Valdez et al. 2011:27). The presence of jute directly above sterile is a recurring pattern seen elsewhere around Pacbitun as will be discussed in more detail below. The excavation unit at the rear of the cave was much less productive than the one at the entrance. Ceramics, charcoal, and a human tooth were the only artifacts recovered. Overall, these findings suggest that the majority of ritual activity likely occurred at the entrance of the cave.

The regional cave survey in 2010 was conducted over a weeklong period, the goal of which was to investigate and preliminarily document as many karst features (caves, sinkholes, rock shelters, etc.) as time allowed in order to gauge the feasibility of implementing a multi-year regional project. This initial survey resulted in the identification of 18 new features including several large caves (Spenard 2011). One of the caves, Actun Lak, identified during this reconnaissance trip, and a rock shelter complex, Nohooch Tunich, that was recognized later are the subject of the current report.

Overall, the 2011 cave excavations in the caves consisted of 1 m x 1 m units variously aligned largely dependant on local conditions. Preexisting stratigraphy was used when present. Ten cm arbitrary levels were excavated when no other stratigraphy was present. All matrix was screened using ¼” wire mesh, with the exception of Actun Lak Units 6 and 7, which were wet screened. Cut wooden stakes marked unit corners, and all units were backfilled after excavations were complete. The corner stakes, string, and flagging tape all were variously deposited in “X” patterns in the unit bottoms prior to backfilling. Wall profiles were drawn for each unit, and plan view maps of levels were produced when features such as tree roots, rock alignments, etc. were encountered. At least one plan view photograph of each level was taken, as were occasional profile views.

Several surface collections of diagnostic pottery and other artifacts were made in all of the caves throughout the field season. They were made in order to preliminarily determine the archaeological chronology of activities, and to look for patterns that may indicate use by different communities. The preliminary chronology was determined by type-variety analysis. Archaeological and ethnographic research has demonstrated that community markers are often found in ceramics (Bartlett and McAnany 2000; Reina and Hill 1979). These markers include decorations, carrying style, and vessel and base forms.

Overall, only general collections were made in caves that were subject to reconnaissance, while Actun Lak and the Nohooch Tunich complex were more heavily sampled due to more time being spent at each of those locations. Each collection was labeled to be as descriptive as possible in regards to the area it was removed from. For example, among the names given to the Actun Lak surface collections are called “Entrance Passage-North Wall,” “Chamber 2-Alter
A sherd was considered diagnostic if it had any one or combination of the following features; rim, carrying feature (handle, lug, etc.), foot, base, modified, or unusually decorated (incising, high polishing or burnishing, bi- or polychrome, etc.). Utilitarian examples, which are commonly presumed to be from storage jars, were typically left uncollected, though a few examples from each location were collected if present. This collection strategy allows each sherd to be used potentially for dating and establishing community pattern practices.

The recovered materials are awaiting laboratory analysis. As a result, the discussion presented here focuses more on the activities of the field season rather than on the artifacts and their significance. The few artifact identifications offered here should be assumed to be tentative until the analysis is complete. Nonetheless, most of the ceramics appear to date to the Classic period, with some Preclassic and Terminal classic period use.

Archaeological Investigations

Actun Lak

This cave was the focus of investigations for the first half of the field season. It was fully mapped, and 9 excavation units were placed throughout the cave (Figure 1). Unit locations were selected based on a number of factors including the presence of architecture, transition areas such as changes in ceiling or passage height, and evidence of regularly falling water (Figure 2). Finally, several looter’s pits in the rear of the cave were backfilled to preserve its visual integrity.

A few general observations about the cave and updates to previous descriptions are in order before continuing. Specifically, the length of the cave, condition of artifacts found within, some of their identifications, and date of use, need to be updated from the initial reporting on this cave (Spenard 2011). Mapping activities measured the total length of the cave to be 43 m from the rear wall to entrance. This measurement is 7 to 17 meters shorter than had been approximated previously (Spenard 2011:36). An in-field osteological analysis on what was presumed to be a disturbed burial revealed that the bones belonged to a large mammal, though not a human. More remains from this animal were recovered during the field season in looter’s back dirt on the opposite side of the chamber, and piled in a small niche on the cave floor. These newly recovered remains included several giant ground sloth claws (Figure 3). The significance of these findings will be discussed in more detail below.

The finding of the sloth bones piled in a niche along the cave wall leads to the next point of clarification. The landowner came to check on us a few days after we began digging. He informed us that he made all of the piles of pottery that we observed during our initial visits to the cave, and he has swept large quantities of rocks in the main chamber to the walls to facilitate...
people moving around in it. He further reported that he spent between 2 to 3 months moving things to where we saw them. He does this because he takes school groups and tourists into the cave and wants to protect the artifacts from being trampled. He mentioned that he does this in all of the caves and rock shelters on his land and others in the area to protect the archaeological record. Finally, I previously reported that a contemporary altar had been constructed out of cave formations (Spenard 2011:37). I dated the use based on the presence of melted plastic. Nonetheless, a closer examination of the altar revealed that no plastic is present, but rather a large quantity of charcoal covers its surface.

The cave consists of three chambers, 5 ledges, and the entrance area. The chambers are numbered 1 through 3 starting at the front of the cave. The first portion of the cave is labeled the “Entrance Area.” It defines the area beginning at the mouth of the cave and covers the sloped entrance passage that runs for approximately 10 m. A 70 cm tall dry-laid terrace (Terrace 1) of uncut stone provides the only flat space in this section (Figure 4). A 3 m stepped drop in the passage indicates the end of the Entrance Area, and beginning of Chamber 1. This chamber is the largest in the cave. It is 23 m long by 14 m wide and an average ceiling height of over 10 m. Several large, broken stalagmitic formations are found at the center of this room, including the one described previously (Spenard 2011:37) that consists of a formation and fist-sized boulders covered in a natural calcium carbonate pavement. A second terrace (Terrace 2) runs from the northeast corner of the central formation to the cave wall (Figure 5). It appears to have been constructed by infilling gaps in exposed bedrock with other cave rocks. The chamber ends at a natural doorway on top of an elevated ridge that appears to be ancient breakdown. Beyond this doorway is Chamber 2, where the speleothem altar and sloth bones were recovered. It is 11 m x
Figure 2. Map of Actun Lak showing locations of units and significant features.
13 m wide and an average ceiling height of 2 m. A natural ridge divides this chamber into two levels. The upper level holds the altar and is heavily burned (Figure 6), though little soil accumulation is present. Further, most of the cave formations including curtains and stalagmites have been broken, and a piece of the wall directly behind the altar has spalled off. This spalling is presumed to be the result of the heavy burning that took place there. The sloth bones were recovered in the lower level, and several 40-60 cm deep looter’s pits indicates a relatively deep stratigraphy. Much of the surface soil is burned as well are many of the walls and formations, though not as intensively as above. Burning was also noted outside of the doorway between Chambers 1 and 2. The presence of these burn remains suggests that the fire or fires were large and intense. The small sub-chamber where the bones were placed by the landowner is located along the northeastern wall of the lower level. Also on this level, across from the sub-chamber is a finger passage choked with back dirt from the looter’s pits. Chamber 2 ends at a 1.5 m drop across the room from the entrance doorway. This last section, Chamber 3, is small, measuring only a few meters across and largely consisting of a sloping, muddy passageway that abruptly ends after a 180 degree turn. A possibly way on can be seen at the bottom of the slope beneath a small shelf, but the mud and formations prohibit further exploration. Large quantities of sherds are mixed in with the muddy matrix, as is seen throughout the cave.
Figure 4. Actun Lak Terrace 1. Note that the darker rocks on top of the terrace are from Unit 5 excavations.

Figure 5. Actun Lak Terrace 2.
Units 1, 2, 6, and 7 are located in Chamber 2, the same where the sloth remains were recovered and the speleothem altar is located. Unit 1 abuts the bedrock slope that leads to the higher level of the chamber. The other three units are located adjacent to the altar.

Unit 1 is aligned to the magnetic cardinal directions and consists of 4 levels excavated to sterile. It was placed at that location to determine if any behavioral differences can be seen between that area and the altar, or if it was the recipient of sweeping activities from above. The presence of the looter’s pits also helped in determining the location of this unit. The northeast corner extended into the largest of the looter’s pits, allowing us to predict the stratigraphy in this area (Figure 7). Artifacts collected from the unit include ceramics, a chert nodule, a speleothem, faunal bones (likely from rodents), charcoal, and a hard, smooth, burned, and deformed lump of unknown material that may be copal or rubber. The artifacts were evenly distributed throughout the unit suggesting that little to no sweeping action from above pushed artifacts down. The presence of charcoal would be expected because of the proximity to the altar, and because the intensive burning would have caused air to swirl around the chamber during the fire.
Units 2, 6, and 7 were placed adjacent to the altar to determine the types of activities that were performed there. A major factor in placing the unit in this location is the results of the excavations of an extensive hearth area in Barton Creek cave (Mirro and Mirro 2001; Morehart 2001; Morehart et al. 2004). Among the results were the recovery of textile fragments, miniature corn cobs, and an abundance of pine charcoal, all of which suggests that cloth-bundled items were among the offerings made in the cave (Morehart 2001, 2005). Morehart (2001:157) notes that paleoethnobotanical data has rarely been collected or analyzed in cave contexts. The presence of extensive quantities of burned material around the Actun Lak altar provided a rare opportunity to add to our knowledge of ancient Maya plant utilization in caves in Western Belize.

Unit 2 is aligned 50 degrees from magnetic north and consists of two levels. The first level is a mix of soot-covered ceramic sherds, charred material, and soil. The matrix of Level 2 is orange colored soil but retains charcoal flecks throughout. Greenstone beads and large quantities of sherds began appearing almost immediately upon beginning excavations. Most of the sherds and beads are severely burned, and several of the former are covered in copal residue. Other artifacts recovered from the unit include limestone beads, rodent bones, burned wood and a cohune nut (Attalea cohune), two reconstructable pieces of a thin-walled greenstone ear spool, and slate. Soil and charcoal samples were taken for flotation and C14 dating. The burned piece of wood was the only sample dated from the caves this year. Beta Analytic processed the sample. They found a 2 sigma range of Cal AD 770 to 900 and Cal AD 920 to 940 for the wood, meaning that there is a 66% chance that it dates between AD 770 to 940. These dates match well.
with those of the ceramics, and fit the temporal pattern of cave use seen elsewhere in the Belize Valley (e.g. Awe et al. 2005; Moyes 2006).

Units 6 and 7 are 50 cm x 50 cm extensions of the eastern wall of Unit 2. Unit 6 extends from the southeast quadrant of the unit and abuts the cave wall that separates Chambers 1 and 2. The stump of a broken formation punctuates its east wall. Unit 7 extends from the northeast quadrant of Unit 2. Its north and east walls overlap with the altar. This placement ensured the recovery of any material that may have been swept or accidentally kicked beneath the feature. The matrix of these smaller excavations is identical to that of Unit 2, with the exception of a third level in Unit 7, which is made up of a darker orange soil than that found above it. The recovery of the greenstone artifacts, and the large quantity of burned vegetal material from Unit 2 prompted the excavation of these two smaller units. The entire matrix from the smaller units was collected in levels matching those from Unit 2 and then water screened. These total collections were made to protect the archaeological materials from potential looting and to obtain samples for paleoethnobotanical analysis.

A portion of the matrix from Unit 6 was processed. The bagged material was deposited into a bucket of water, which was then poured over cheesecloth to collect the botanical remains. Our initial attempt was thwarted by the large quantities of charcoal, which prevented the water from passing through the cloth. As a result we removed handfuls of floating remains from the bucket before pouring the rest over the cheesecloth. On an interesting side note, Linda Howie, Laminai project ceramicist, accompanied us during flotation and noted that when the material from the altar was introduced to the water it instantly boiled, which was due to a quick lime effect that would only result from intensive burning over a long period of time. The quantity of material recovered suggested that such an event or events were highly likely.

Investigations in Chamber 2 also included the backfilling of the looter’s pits on the lower level. This filling was accomplished by screening the back dirt located in the eastern finger passage into the pit. The dirt covering the sloth bones suggested that it came from these looter’s pits. As a result, the goals of this activity were to search for more bones and evidence of pre-Maya use of the space, and to repair the appearance of the cave to its pre-looted condition. More megafauna bones were recovered, though pre-Maya cultural evidence remains elusive. Nonetheless, reconnaissance of Ledge 1 revealed 3 or 4 large mammal bones covered in calcium carbonate. They are smaller than megafauna, but likely belong to a deer-sized animal. The presence of these fossilized bones and the megafauna below at the rear of the cave suggests that an ancient entrance used to exist that is no longer present. An inclining muddy tube at the back of the ledge may be the remnants of this suspected entrance.

The recovery of the megafauna remains is particularly enticing because it opens up the potential to address questions related to the earliest human occupation of the Americas. Ground sloths went extinct around the end of the Pleistocene ca. 10,000 BP (Fiedel 2009), around the earliest secure time that people are known to be in the Americas. Though no cultural materials were recovered, the presence and good condition of the bones demonstrates that the cave’s environment is ideal for deep preservation of materials should any be present. The location of the sloth remains at the rear of the cave and the fossilized bones on Ledge 1 offers the possibility
that something (large cat, humans, etc.) brought the remains into the cave, if no other entrance existed during the Pleistocene.

Excavation units 3, 4, 8, and 9 were placed in Chamber 1. Unit 3 is located at the base of the elevated ridge near the natural doorway leading to Chamber 2. The unit was placed at this location for several reasons. It is at a point of drastic vertical change, all bedrock disappears below the soil there, and the passage splits in two. One branch heads up towards the natural doorway. The other leads to several small dead end chambers formed when the ceiling collapsed. Further, we noted that the afternoon sunlight strikes this portion of the cave, an occurrence of which the ancient Maya surely would have been aware.

The unit itself is aligned 30 degrees from magnetic north, and consists of three levels to a final depth of 51 cmbs. Level 1 is a mix of large quantities of small sherds and occasional charcoal flecks mixed with mottled dark brown and orange colored soil. Level 2 is purely orange though a reddish orange color was noted in the south corner of the unit. Level 3 was restricted to a 50 cm x 50 cm unit in the east corner of the unit. This level was excavated into sterile with the hopes that pre-Maya artifacts would be recovered though none were. The artifacts recovered in this unit were restricted primarily to level 1, though they did appear in the top portion of level 2. Several bags of pottery were collected from the unit, suggesting high levels of ritual activity for the area. Both modified and unmodified slate pieces were recovered as were chert flakes, and 2 beads. One of the beads was shell, and identical to those found in the Middle Preclassic period settlement in Pacbitun (c.f. Hohman and Powis 1999; Hohman, et al. 1999). The other bead was formed from a speleothem. Charcoal flecks appeared throughout the second level, though the artifacts ceased near the bottom. One slate piece was recovered in Level 3, but it likely fell from above when clearing soil out of the unit.

Unit 4 is nestled between the natural pavement at the center of the cave and its east wall in a small finger of soil that contains high concentrations of ceramic sherds. This placement caused it to be aligned 52 degrees from magnet north. Three levels were excavated down to bedrock at 24 cmbs. The matrix of this unit consists largely of sherds with some soil mixed in. In fact, each bucket of matrix dumped into the screens filled them up nearly completely with sherds (Figure 8). A few pieces of slate, a chert flake, possible shell, and speleothems were recovered from the unit. Further, a large cluster of copal residue was recovered suggesting that this material was among the offerings being made at this location.

Unit 8 was placed to the south of Unit 4 in a small alcove formed by an undercut in the cave wall. Unit 9 is 50 cm x 1 m extension of the east wall of Unit 8. Both units contain 3 levels though only Unit 9 was excavated to bedrock at 30 cmbs. The units are aligned 52 degrees from magnetic north. This smaller unit was used as a sterility test to determine whether continuing excavations in Unit 9 would be fruitful. Uncovering bedrock determined that they would not be, therefore the larger unit was terminated at the beginning of Level 3.
The surface of Units 8 and 9 was previously cleared of rocks by the landowner, and the matrix of Level 1 is mostly powdery dark brown soil with the occasional sherd mixed in. The matrices of Levels 2 and 3 were nearly identical to each other being dark reddish brown, sticky clay. The matrix along the southeast wall of both units was slightly different in character throughout the unit. It is less clayey, less compact, and contains a higher percentage of charcoal than the surrounding matrix. Several cave pearls were found in Unit 9 Level 2, but they appear to be natural formations as they are nestled in a depression in a small formation in the bedrock. This level also contained a high number of land snail shells and small rootlets, suggesting disturbance, or wash down from the Entrance Area above. Artifacts recovered from this unit include several bags of sherds, mostly from Level 1, one, possibly two shell beads, modified and unmodified slate, chert flakes, faunal (rodent and UID) bones, pieces of manganese, several pieces of possible daub or fired clay, and a two-bowl cache.
The two-bowl cache is aligned roughly east-west and was uncovered beneath the different matrix described above (Figure 9). It was placed on a series of small boulders that appear to be randomly situated. The vessels are expedient and best described as pinch pots though one is cruder than the other. The eastern vessel is the cruder of the two and it sits on the edge of the rim of the western vessel. Each pot is slightly inclined, though in different directions. The high and low points on the eastern vessel are east and west respectively. The high and low points on the western vessel are north and south respectively. The vessels and their soil contents were removed in tact with north indicated on each in order to perform more delicate excavations on them in the lab. No artifacts were recovered during the lab excavations suggesting that the vessels were the only components to the offering, or that perishable materials were included. The soil was retained for flotation and is awaiting processing.

Unit 5 was placed on the top of the flat surface created by Terrace 1 in the Entrance area. It was situated there to determine what types of activities would have been performed on it because the terraced is located in an unexpected area of the cave. The only places that it or anyone standing on it are visible is in its immediate area and from outside of the cave. Elsewhere, cave terraces are in highly visible locations within cave chambers suggesting that they are either ritual stages or bleachers for audience members (e.g., Ferguson 2001). Therefore, this terrace seemed to serve a previously unidentified function.

The unit is aligned 25 degrees from magnet north and was excavated in seven levels to approximately 200 cmbs. Overall, the matrix consists of large sherds mixed with construction ballast and soil mottled with charcoal flecks. The construction obscured a small alcove formed by a drapery formation along the cave wall that was also in filled with ballast, though it was structurally unstable. The unit was terminated due to the instability of the ballast in the unit and alcove.

Three natural stratigraphic lenses are present in the unit, which were divided into the six arbitrary levels during excavations. The first natural lens consists of a medium brown soil with high quantities of pottery and occasional rocks mixed in. The second lens is the largest in the unit and consists of an ashy gray and brown clayey soil mixed with large quantities of charcoal and ballast fill. This lens unsystematically transitions to containing less charcoal and ash and ballast, though large quantities of ceramics continue to be intermixed. It ended when a slate floor was uncovered approximately 130 cmbs (Figure 10). The matrix below the slate pavement is much different in character than those above it. It is very sandy and loose. A complete obsidian blade and shattered orange bowl were recovered from the soil below this level though they were not in direct association with each other. The blade was found a few cm higher up in the level than the bowl, but they are likely part of the same depositional event. The unit appears to be sterile below the bowl, save for a few pieces of pottery that look like dog kibble. Nonetheless, more ballast-like rocks continue to be intermixed with the soil suggesting that the whole entrance area may be modified. Other units need to be excavated in this area to test this hypothesis. The depth of the unit (200cm) is surprising due to the fact that the terrace only measures 70 cm high from the bedrock surface on which it appears to sit.
A possible explanation for the terrace is that it may be part of an elite burial. A slate workshop or storage facility was uncovered in an ancillary structure in the western corner of Pacbitun Plaza B suggesting that the site’s elite controlled its production (Healy et al. 1995:343). Further, the material frequently capped burials in the site’s epicenter (Healy et al. 1995; Healy et al. 2004:230). Though rare, elite tomb burials have been recorded in caves in the Maya area,
Figure 10. Slate floor encountered in Unit 5, Actun Lak. The face of Terrace 1 is at the right of the picture.

particularly in Naj Tunich cave in Guatemala (Brady 1989). More frequently, burials recorded in cave environments consist of numerous internments of commoners within rock shelters (Glassman and Bonor Villarejo 2005; Saul et al 2005). No human remains were recovered in Terrace 1. Expanded excavations are necessary to determine the function of this construction.

Nohooch Tunich Rock Shelter Complex

The Nohooch Tunich Rock Shelter Complex (NTC) is an approximately 1 km² bedrock outcropping located uphill and due east of Actun Lak. It is a highly irregular exposed bedrock feature that is made up of a series of boulders, chasms, cracks, grottos, rock shelters, small caves, karst windows, etc., all of which were heavily modified by the ancient Maya. Each of the features that undergoes investigations is given a name, but given their proximity to one another, and evidence of heavy utilization suggests that the complex is best understood as a unit. The majority of work in the complex focused on its namesake, the Nohooch Tunich rock shelter, and the karst features in its immediate vicinity. Nonetheless, much of the complex remains unknown though future research is scheduled to focus on these other areas. The name of the NTC comes from a translation of a hand-painted wooden sign within the main rock shelter that reads, “Great Wall.” Nohooch Tunich roughly translates to “large rock,” the closest Yucatec Mayan term to “great wall” that our workers could figure.
Archaeological investigations of the NTC were composed of surface collections of diagnostic artifacts, preliminary photo documentation of cave modifications, archaeological excavations, and preliminary detailed mapping of the entire feature. Nohooch Tunich (Great Wall) rock shelter, Actun Subuul (named after a tree), Actun Xtuyul (Termite Cave), Kajaw Tunich (Spit Rock), Actun Ha’ale (Gibnut Cave), and Actun Jcheehem (Squeaky Cave) were surface collected, and all but the latter, excavated. The mapping aspect of the investigations is incomplete, but will appear in later reports.

The Nohooch Tunich rock shelter is an approximately 55m long and 13m tall, exposed bedrock cliff face that opens to the east (Figure 11). It is roughly divided naturally into three parts based on the character of the drip line. The southern section is the largest of the three measuring nearly 20 m long and 8 m at its deepest, and we consider this to be the main activity area. Two karst elements dominate this section, an alcove, and a rock shelf that abuts the wall. The alcove is 3 m long by 1 m wide and had been completely leveled with small boulders. Unfortunately, the boulders now sit in a pile just outside of the alcove after having been looted sometime prior to our investigations there. Nonetheless, artifacts abound in the rock pile and matrix surrounding the alcove. The rock shelf is approximately 4.5 m long, 0.5 m high, and gently slopes toward the wall. This element was covered with pottery though we were informed that they were moved there from the alcove boulder pile to prevent them from being stepped on and destroyed.

**Figure 11.** Nohooch Tunich rock shelter facing south. The north section is in the foreground. The central section is in the mound left of center. The south section begins where the three individuals stand.
The central section of the shelter is defined by an alluvial mound that is an erosional product from above, an organic debris covered slope, and an alcove area that is full of logs. The geological character of the karst in this section is different than that of the south. It is flaky and soft, suggesting that it is decaying more rapidly than the other section, which is made up of a harder and more uniform limestone. No artifacts were seen in this area. Its dimensions are difficult to assess fully due to the alluvial mound and slope, though both of these are located outside of the drip line. The depth of the shelter from the drip line to wall averages 1.5 m, though the log-filled alcove is 3 m deep.

The north section of the Nohooch Tunich rock shelter is separated from the central part by a 4 m long vegetation-covered area lacking a drip line. The area of interest begins where the drip line reappears. It runs for approximately 12 m and has a maximum depth of 2.5 m. The geological character of the rock is identical to that of the central section. A rock pavement covers the entire area within the drip line, though whether it is the result of sheeting action from the wall or a cultural construction was unclear. The NTC continues after a turn to the west beyond this section, though no work was done there.

Seven units were excavated in the rock shelter making it is the most intensively excavated feature in the NTC. Units 1 through 4 and 6 measure 1 m x 1 m, and Units 5 and 7 are 50 cm x 1 m extension excavations. All units are located in the south section, except for Unit 4, which was placed in the pavement in the north.

Unit 1 is located at the southern end of the bedrock shelf, and its walls are aligned to the magnetic cardinal directions. It was placed there because a small dripstone formation is at that spot, and areas of falling water within caves have been shown to be ritually significant (Halperin et al. 2003; Thompson 1975). Six mixed levels of natural and arbitrary stratigraphy were excavated to 73 cm below ground surface. Large quantities of sherds, several jute, and chert flakes began appearing within the first few cm of excavations. This pattern of artifacts continued though new materials were encountered including an ashy lens that held charcoal and possible copal residue in Level 2 (approximately 15 cmbs). The density of jute increased as the unit deepened though other artifact classes decreased until a very rocky, seemingly sterile layer was reached at 60 cmbs. Several large rocks were removed which uncovered more jute suggesting that cultural use continued. Few artifacts were found below the removed rocks. Only a small handful (3-4 pieces) of jute, a small sherd, and a few charcoal flecks were recovered in this bottom level before the majority of the floor of the unit was exposed bedrock.

Unit 2 was placed at the transition between the southern and central sections of the rock shelter at a point directly beneath a dramatic drop-off of the upper lip of the feature and adjacent to its resultant alluvial deposition. In other words, it is at a location of multiple transitions within the feature. Four levels were excavated to bedrock at 45 cmbs in this unit aligned to the magnetic cardinal directions. The first level planed the uneven alluvial deposits. No artifacts were recovered during the first few cm of excavations, though they were present below suggesting active alluvial deposition at that spot. Disorganized clusters of rocks were seen throughout excavations suggesting that the buildup was continuous throughout the time that the rock shelter was used in antiquity. The artifacts recovered in the unit consist of ceramics and jute, similar to the assemblage from Unit 1. The character of the artifact ratios mimicked that unit as well.
Ceramics began as the most prolific artifact class but their density lessened as the unit went deeper. Jute persisted throughout the unit though they remained the only artifacts at the bottom except for one piece of slate. Level 3 (25-35cmbs) was the most diverse in the unit. Several slate fragments, a chert flake, and 2 clamshells were recovered in addition to the ceramics and jute.

Unit 3, a 1 m x 1m square, and its extension, Unit 5 (0.5 m x 1 m), were placed adjacent to the north end of the bedrock bench. They are aligned to the magnetic cardinal directions. The larger unit was placed first to determine if the bench was the focus of ritual activity, and to make a discontinuous trench excavation in front of it with Unit 1. We uncovered what appeared to be a sherd cache beneath a large rock in the wall of the unit closest to the bench (Feature 1), which prompted the opening of Unit 5. Unit 3 was excavated in 5 levels to a depth of 84 cmbs. Unit 5 was excavated in 4 levels to a depth of 63 cmbs because sterile was reached at that depth in the larger unit.

These two units uncovered a relatively complex stratigraphy for a cave setting, as well as 2 buried deposits, and a wide range of artifact material. Their location in front of the bedrock bench, and the large quantities and variety of artifacts recovered within them suggests that spot was a focus of intensive utilization. The recovered artifacts include ceramic sherds, slate, some of which had been modified, chert flakes, extra-local limestone and speleothems, a few possible pieces of daub, two fire-spalled biface fragments, quartz, jute, a possible conch shell fragment, burned wood, possible clam shells, and a coatimundi tooth. Furthermore, pockets of charcoal and ash were regularly encountered throughout the units suggesting burning events took place there.

Two features were encountered while excavating these two units. Feature 1 was the catalyst for setting up Unit 5, though it is the least likely to be one out of the two. This feature is a sherd concentration including a stack located directly beneath a stone in the northwest corner wall of Unit 3. The ceramic concentration began at 25cmbs, though the top of the stone was encountered within the first few cm of excavations. The soil surrounding the rock is a different consistency than the unit’s matrix. It is a loose pebbly mix suggesting that the sherds below were cached there, and they were the only class of artifact recovered. Nonetheless, only a slight increase in ceramic density was noted directly beneath and around the rock after opening Unit 5. A soil sample was taken for flotation though it is awaiting processing. The nature of Feature 1 remains ambiguous.

Feature 2 is a flat limestone rock alignment running northeast-southwest through Unit 3 that caps a significant jute and chert flake cache beginning at approximately 56 cmbs (Figure 12). The jute and chert were in an ashy matrix with charcoal inclusions that began appearing in a rockless pocket slightly southeast of the center of the unit and a few cm above the limestone blocks. The blocks were removed and flotation and C-14 samples were collected from the matrix directly below them. An ashy pocket was collected separately. These samples are still undergoing processing and will be reported on at a later date. The quantity of jute and chert began to lessen beginning around 66cmbs, and by 75cmbs, no other artifacts were recovered.
Nonetheless, we continued to excavate to a depth of 84 cmbs to ensure that we were in culturally sterile soil, which we were.

Unit 4 was placed at the northernmost extent of the Nohooch Tunich rock shelter on a slightly elevated ridge against the wall. It was placed there in order to determine whether the area was used, and if the visible rocks are the remnants of a human-made pavement or sheeting breakdown from the wall face. The unit is aligned to the magnetic cardinal directions and extends slightly beyond the dripline of the rock shelter. Two levels were excavated to a depth of 45 cmbs though very few artifacts were recovered when compared to other excavation units in the area. The matrix consisted largely of the same type of rocks that were seen on the surface though mixed with soil. One sherd was recovered near the surface, a possible granite mano, a few pieces of slate, and a cave crystal were the only artifacts recovered, and they all appeared in Level 1. Level 2 (34 to 45 cmbs) was completely sterile. Overall, this area of the rock shelter seems to have been used only sporadically and the surface rocks seem to be the result of sheeting from the wall. Nonetheless, the presence of the artifacts does suggest a human element though given the quantity of artifacts recovered in this unit compared to others in the rock shelter suggests that any future efforts would be better focused elsewhere.

Units 6 and 7 are located at the entrance to the looted alcove at the southern section of the Nohooch Tunich rock shelter. These units were placed in this location in order to understand what role the alcove played in the rock shelter’s ancient use. Unit 6 measures 1 m x 1 m and
Unit 7 is a 0.5 m x 1 m extension of the eastern wall of the former, and they are both aligned to the magnetic cardinal directions.

Unit 6 was excavated to bedrock in three levels at a maximum depth of 38 cmbs and minimum depth of 16 cmbs. The matrix is a loose, light brown, fine-grained sandy soil with small rocks scattered throughout. No significant change was noted in it until just above bedrock in the deepest corners of the unit. The looseness of the soil paired with the shallowness of bedrock and looting of the alcove only a few meters away suggests that the area has been disturbed at least by heavy foot traffic. Artifacts recovered from the unit include ceramics, some of which are highly polished and incised, chert flakes, jute, a possible fish scale, charcoal, a burned seed, and one piece of slate near bedrock.

Unit 7 was also excavated to bedrock in three levels to a maximum depth of 58 cmbs. This extension was placed due to the accidental uncovering of several incised sherds while excavating in Unit 6 that had unique designs, including one that we thought may contain a hieroglyph. This unit was especially productive considering its size. Several large bags of ceramics were recovered, as well as jute, slate, a large chert flake, limestone bead, and burned wood. The bead is made from a particularly hard type of limestone that is called “Yalbach” locally. Using this material was likely not an accident. Recent investigations at Sayill in the Puuc region of Mexico have demonstrated that the Classic period Maya were highly selective of the materials that they used for building and were highly knowledgeable about the properties of different types of limestone (Carmean et al. 2011). A pocket of ash and charcoal was encountered along a group of rocks near the south wall of the unit suggesting that a burning event had taken place at that spot. A soil sample was collected though it is still undergoing processing. This find also suggests that the area may not be as disturbed as originally believed. Level 1 (0–9 cmbs) ended when a soil change was encountered. The consistency remained the same but it became darker in Level 2 (9–18 cmbs). The dark soil remained in Level 3 (18–44 cmbs) until bedrock was reached. A small lens of sterile clayey orange matrix was encountered just prior to reaching bedrock. A modified ring base was surface collected just to the east of this unit. These types of ceramic objects are commonly used as jar lids at Lamanai (Linda Howie personal communication December 2011), suggesting some behavioral connection between the two centers. Overall, these two units were surprisingly productive given their relatively shallow depth, suggesting that the alcove was a focus of intensive ritual activity.

Actun Xtuyul (Termite Cave) is a small rock shelter that opens to the east and is located directly behind the upper lip of Nohooch Tunich (Figure 13). Its name comes from the extensive termites’ nests present in its northern half. It measures approximately 7.5 m east to west, reaches a maximum depth of 3 m, and is approximately 2 m tall. It is only accessible from two points in the NTC. The first is climbing up a steep hill located at the south end of Nohooch Tunich rock shelter. The other is via a natural that begins at the northern end of the Nohooch Tunich rock shelter, proceeds up a chasm, then in front of Actun Ha’ale, through Actun Ku’uk (see below for descriptions), finally reaching an open area on top of the sloping hill to the south of the larger rock shelter. Two possible rock alignments are present at the southern end of the shelter. They are single course alignments separated by about 1 meter. A large rock had been placed behind he two alignments in the past. This rock is not breakdown or collapse because the formation is
different than the rest of the shelter. A few nondiagnostic sherds were noted on the surface as was a jar rim. A groundstone mano was collected from the approximate center of the shelter.

Two 1 m x 1 m excavation units aligned to the magnetic cardinal directions were placed in this feature. Unit 1 is located against the rear wall encompassing the area where a fragment of a modified ceramic mold was recovered. The mold was biconically drilled and its edges have been reworked (Figure 14). The mold fractured along the drill holes suggesting that they were partially responsible for it breaking where it did.

The mold displays an individual squatting on a rope that wraps around their toes while resting their elbow on their bent knee. The arm of the individual is costumed with a six-piece bracelet, and a crease in the hand delineates the palm. A grooved object runs the length of the arm while two similar ones float below it. These floating objects may be feathers from a missing part of the scene. Parts of a beaded necklace are visible around the individual’s neck though the reworking of the piece has destroyed much of the detail at that part. The individual’s leg is also decorated with a six-piece anklet, and a possible loincloth can be seen just above the bent knee. A small indent at the front of the foot defines the big toe around which the rope wraps. The drill holes are located at one of the extant ends of the rope and the area behind the knee. The remaining details of the mold are difficult to identify. The rope appears to go straight down beneath the toe, below which another large object pokes out of its cords, or it is an unknown object hanging from one of the partially untwisted primary rope strands. Another grooved object floats at the bottom of the piece heading off to another missing part of the scene on the left.

Unit 1 was set up in order to find the other pieces of the mold. We were unsuccessful. Two levels were excavated to bedrock at a maximum depth of 47 cmbs, though it sloped significantly downwards towards the rear wall. The minimum depth of bedrock is 6 cmbs. The matrix in this unit is very dry and powdery. Ceramics, the mold, charcoal, and a possible chert flake are the only artifacts recovered from this unit.

Unit 2 was set up at the southeast corner of Unit 1. It was excavated in order to get a larger sample in this shelter. Three levels were excavated to bedrock at 32 cmbs. The matrix was similar to that of the first unit though it is deeper but it transitions to darker and more compact towards the east. This change in soil is likely due to the promixity of that part of the unit to the drip line, as well as a tree and its large roots that are located in the northeast corner. Very few ceramics were the only artifacts recovered during excavations and most of them appeared in Level 1 (0-10 cmbs). Excavations continued so deep due to the presence of a hole in the northwest corner of the unit. We speculated that it may be a collapsed cap of a burial or cache. Once we reached bedrock we were able to see that the hole was a natural feature rather than something cultural.

Actun Subuul is a large boulder located approximately 40 m southeast of the Nohooch Tunic rock shelter (Figure 15). Its name comes from a specific tree that grows nearby though its English name is unknown. This boulder is responsible for our initiation of investigations in the NTC. We were taken past it when being shown an easier way to get to Actun Lak. The boulder sits on the trail and we noticed several ceramic sherds behind a drip line. Because of these sherds we began probing around the area paying particular attention to the various cracks and
Figure 13. Actun Xtuyul showing locations of Units 1 and 2. Note that the tree root at upper right is in Unit 1.

Figure 14. Actun Xtuyul ceramic mold and line drawing.
crevasses that we passed by. The result was that nearly everywhere we looked throughout the complex we noted artifacts as well as ancient modifications such as terraces, walls, and other single-course rock alignments.

Actun Subuul is an oddly-shaped boulder that is approximately 10 m at its widest and longest. Nearly half of the feature consists of an undercut rock shelter that opens to the north, which is where the artifacts were noted on our initial pass-through. The undercut is a gentle slope rather than a steep cut. As a result, any water that falls gently cascades down the rear wall rather than dripping off of an upper lip. Nonetheless, a natural cave-like matrix (light brown, relatively dry soil mixed with small limestone pebbles) that is relatively free of organic debris is present. Two 1 m x 1 m excavation units aligned to the magnetic cardinal directions were placed in the undercut area. Unit 1 is located in the approximate center of the undercut. Unit 2 is located at the eastern end of the cut at a position where nearly half of it is beyond the limits of the boulder. This placement allowed us to test whether activities were restricted to the cave-like matrix or extended beyond it.

Unit 1 was excavated to sterile at a depth of 18 cm in two levels. The end was determined when decomposing limestone bedrock was encountered. Recovered artifacts include ceramics, a few pieces of slate, and jute. A thin lens of grayish ash mixed with small quantities of charcoal capped relatively dense concentration of ceramics and jute in the northern portion of the unit. Though this ashy deposit appeared to be intact, two major disturbances were noted in the unit. The first is a 12 cm diameter root that ran across the unit from the northeast corner to the southern west wall. The second is a subterranean ant or termite nest that was encountered in

**Figure 15.** Actun Subuul. Ceramics were originally noted in undercut to the left of the rear individual. That area is partially obscured by a vine.
the middle of the unit. Both of these are recent disturbances but their presence suggests the potential for more in the past.

Unit 2 in Actun Subuul was excavated to culturally sterile decomposing limestone in 4 levels to 34cmb. The matrix of the first two levels was relatively identical to each other; dry, dark, and cloddy though the southeast corner was clayey. Decomposing limestone began appearing in Level 3 (14-30 cmbs), which transitioned to reddish-orange clay intermixed with the weathering bedrock. As well, a large subterranean ant or termite nest was uncovered. Level 1 was nearly devoid of artifacts though they began appearing in higher concentrations as the excavations went deeper. This character of the location of the artifacts within the matrix suggests that some soil accumulation processes happened since the ancient Maya used the rock shelter. This artifacts recovered in this unit include badly decomposed ceramics, some burned wood, a rodent bone, jute, charcoal, slate, and a mano. Overall, this artifact assemblage is similar to what we have found in the other rock shelter contexts, signifying that the Maya made no recognizable conceptual distinctions between this boulder and other shallow karst features.

Allan Cobb a cave archaeologist who has worked and published extensively on Ancient Maya cave use throughout the Maya area reported to me having seen small, straight walled bedrock outcroppings in Quintana Roo and Campeche, Mexico that were modified to be makeshift caves where none others exist naturally. These modifications were semi-circular arrangements of stone placed in front of the walls of the outcroppings. The purpose of these stone arrangements was to create spaces in which rituals could be performed. In other words, the alignments created a chamber where cave rituals could be performed.

Kajaw Tunich (Split Rock) is a small boulder located approximately halfway between Actun Subuul and Nohooch Tunich rock shelter. The name comes from a large split running down the center of what had once been a single boulder. One 1 m x 1 m excavation unit aligned 343 degrees from magnet north was placed directly in front of the crack. This placement was chosen because it represents the most likely spot for ritual activity because of its resemblance to a cave. Only one piece of slate was recovered from the unit, which was excavated to a maximum of 25 cmbs. The location was determined to be culturally sterile.

The final excavation activity in the NTC was the screening of an alluvial deposit in Actun Jcheehem (Squeaky cave). The cave is roughly rectangular in shape and its opening faces west. Once inside the passage runs northeast to southwest. The feature itself measures approximately 2 meters at its tallest and 4.5 m north to south by 2.5 meters east to west. Three constructions are present in this cave. The first is an in filled crack at the entrance that was used to create a level step into the feature (Figure 16). The second is located in the southwestern extreme of the cave. It consists of a pile of three imported rocks stacked against a previously active formation. Several sherds were noted to the east of these piled rocks. The third construction is a two-course terrace in the northeastern extent of the cave. Sherds were intermixed with the uncut stones on the face of the terrace. A modified piece of slate was recovered to the east of this terrace.
Figure 16. Filled in crack in entrance to Actun Jcheehem. (Photo by C.L. Kieffer)

The alluvial cone that was screened dominates the central third of the cave floor. Its source is the sloped entrance chasm. The material in the cone was excavated to match the level of the floors in front of the terrace and three-stone constructions. We determined that this depth would have been the floor surface that was used by the ancient Maya. The goal was to return the cave to the condition that the Maya would likely have experienced it as close as possible. Further, we were able to see fully the constructions that had otherwise been blocked.

Investigations in the NTC documented several karst features in addition to those that were excavated that contain evidence of ancient Maya activity. These features include: Actun Ha’ale (Gibnut Cave), Actun Ku’uk (Squirrel Cave), Actun Chechem (Poisonwood Cave), and
Javier’s cave. Though these are the only features described here, we regularly passed by several more that held evidence of ancient Maya activity such as pottery or modifications that time did not allow for anything more than a cursory glance at them. These other features will be investigated in future field seasons.

Actun Ha’ale is a low ceilinged rock shelter located to the west of Nohooch Tunich, though it is part of the same bedrock outcropping (Figure 17). It is similar to Actun Xtuyul in that it is located on the upper rim of the lower rock shelter, but at its northern end and opens to the west. The ceiling is approximately 1 m high, and the feature runs north to south for 5 m. The northern portion of the shelter gives way to a cave that runs to the northeast for 2 meters. Diagnostic utilitarian sherds were surface collected. Two crude, single course rock alignments dominate the majority of space within the feature, coming together at a right angle at the southern extreme of the feature. Several bedrock fingers rise up from the ground throughout this area giving it a feel much like large cave chamber but lacking a ceiling.

Actun Ku’uk is a pass through feature that begins at the southern end of Actun Ha’ale. It runs roughly east west and there is a 1.5 m tall wall construction in the eastern side (Figure 18). Two main chambers define this feature. They were formed when a large V-shaped slab fell from the parent bedrock above. The feature would be considered a karst window or natural bridge prior to this event. The wall in the eastern side of the feature was dry-laid and constructed of uncut blocks. Another possible stone alignment runs along the southern cave wall. The feature itself is a natural depression suggesting that it floods during heavy rain. The main passage measures approximately 12 meters long, and both entrances are 4 meters tall. A series of 3 low ceilinged shelters line the eastern wall outside of the eastern entrance of the feature. The one furthest south has a small chamber in it. No artifacts were noted in this complex but due to the low-lying and sloping nature of the area, they may be found beneath deep humus deposits. Two possibilities arise for understanding this feature. The first is that the constructions were designed to passively direct traffic through the system, similar to the function of rock alignments, walls, etc. recorded in the Sibun-Manatee karst (Kenward 2005:254). The other possibility is that the

![Figure 17. Actun Ha’ale showing rock alignments. Note that they meet at a right angle on right side of photo.](image-url)
wall creates a relatively flat, definitive space within the feature that may have been used as a ritual stage.

Actun Chechem is the last substantial karst feature with cultural remains in it encountered along the trail to Actun Lak. It is actually a series of 3 small, interconnected rock shelters that we consider to be one geologic unit. It sits on a natural ledge just above the crest of a steep slope that heads down towards Actun Lak. The ledge runs northeast to southwest for 10.5 m. We nicknamed this feature “Invisible Cave” because we passed it nearly everyday but failed to notice it until near the end of the season. Its name comes from the presence of several Chechem trees growing in front of it. The feature displays surprising complexity given its size. It has two northwest facing entrances that provide access to three chambers, and a tubular ledge that connects the three. The northern most entrance is the more narrow of the two measuring approximately 2 meters wide though it provides access to two large chambers. The southern entrance measures 3 meters wide and opens to a small chamber that reduces rapidly to a 0.5 m wide passage. The tubular passage is most easily accessible from this larger entrance though it is too small for a person to enter. It splits from the floor rising up until it reaches the rim above the northern entrance. Slate and ceramics were the only artifacts noted in this feature though they were present in the northern two shelters.

Javier’s cave is located to the northwest of the northern section of Nohooch Tunich. This feature was only subjected to a preliminary reconnaissance. It is only mentioned here to note that it was visited and described by the Mendip Caving Group (Francis 1995:11; Hollings 1996). These cavers noted the presence of numerous sherds and rounded stones that are likely manos.
**Karst Reconnaissance**

This component of the project took place on the weekends and after the field school ended. Its main goal is the identification of future research locations and to supplement knowledge about caves that had already been explored. There are three main areas of focus. The first is the land to the south of Pacbitun beyond the first ridge of hills. The second area extends south and west of San Antonio Village to near the Macal River. The third area is further south and extends into the Mountain Pine Ridge reserve. None of these surveys was exhaustive of any of the regions, rather they were based on local information.

Actun Xux (Wasp Nest cave; Skeleton cave) was relocated in December 2010 (Spenard 2011). Our lack of vertical gear at the time prevented us from entering this cave. The Medip Caving Group originally recorded this feature naming it Skeleton Cave (Francis 1995:11). The name comes from the numerous human remains that they encountered in the lowest levels of the cave. Unfortunately, only one set of remains was relocated on our visit, and they had been badly disturbed.

The cave is entered via an 8 m drop onto an alluvial cone. Large quantities of sherds are immediately apparent upon entering, particularly large olla rims, some of which have been calcified. The calcified sherds likely used to belong to an intact olla though fresh, uncalcified breaks suggest that it was recently destroyed. Roaring Creek Red (Gifford 1976:240) and Daylight Orange (Gifford 1976:300) sherds were noted in the entrance area. Their presence dates the use of the cave to the Late Spanish Lookout (800-890) through early facet New Town (890-1150) phases. The theme of recent destruction is one that persisted throughout our visit. The cave itself is roughly ovoid in shape measuring 22 m x 14 m and consists of three vertical levels. The first level is the main entrance chamber. Numerous terraces that created paths over the alluvial cone were noted throughout the area. Level 2 is reached via a natural path that leads down to the north of the alluvial cone. Small ash-filled pits, and a badly disturbed mud staircase dominate this level. Mike Mirro reported that similar ash pits were found in nearby Barton Creek cave, and that excavations of them recovered evidence of food offerings such as corn and peppers, as well as textiles. Pottery is also present in this level. It consists primarily of large jar fragments though a few red or orange monochrome slipped pieces were noted. The presence of the jars in this spot coupled with them being in an area of active dripping suggests that the Maya were collecting water at this location. A possible charcoal anthropomorphic stick figure was noted on a rock above a small hole in the cave floor at the western most point of Level 2. Level 3 is reached via a tunnel beneath a formation to the west of the ash pits near the suspected charcoal figure. Burned wood and recently broken pots were noted throughout the level.

My impression of the cave is that it was highly modified and extensively used by the ancient Maya, but the archaeological context has been severely compromised since the mid 1990s. Overall, this is a very complex cave that needs individual attention by a highly experienced group of cavers and archaeologists to study properly.

Permission to enter Skeleton cave was facilitated by the proprietors of near by Moonracer Farms (MrF) who were watching over the property for the new landowner who was out of the country when we visited. The MrF people and landowner expressed concern about the cave and
the archaeological materials within though none of them had been inside. Nonetheless, plans were in motion when we arrived for a gate to be placed across its entrance to protect what was inside. As part of an agreement made for me to access the cave, I provided the landowner a brief report on what we saw. The report stressed the substantial damage that we noted and need for a gate to prevent anything further from happening.

Actun Merech was revisited in order to explore the two chutes at the rear of the cave. The Mendip Caving (Francis 1995:18) group explored these features though they made no note of the presence or absence of artifacts in them. The chutes begin as a single hole that drops 5.5 m below the cave floor after which a column-like ledge divides it in to eastern and western halves (Figure 19). The eastern half continues down for an additional 17.5 meters to an oval-shaped room that is roughly 4 m north-south x 2 m wide. Two cultural blockages were recorded in this chamber. The first consists of 3 rocks partially concealing an alcove that is 60 cm wide by 30 cm high. The second completely conceals the small passage behind it using up to 6 rocks in a space that measures 40 cm high by 60 cm wide.

The western chute drops for an additional 12 m below the split to a narrow room that measures 4.5 m north-south x 1.5 m east-west. The floor slopes downwards to the south into a dome-shaped niche 1 m wide x 30 cm tall. Sherds were noted and surface collected, and a rock placed under a ledge was recorded. A ledge splits to the east 4 meters above the bottom of the pit, and continues for an additional 3.5 m. No artifacts were recorded in the ledge.

Actun Kitam (Spenard 2011) was relocated and explored. The entrance is a 3.5 m long, south facing passage that is less than 1 m in diameter. The cave opens up to a 2 m tall x 9 m long chamber after the restricted entrance passage. The floor slopes gently down to the north-northeast further into the cave. Limestone shelves line the eastern and western walls near the rear of the cave giving the passage a “T” shape. Ceramics were noted but not collected.

Actun Caapel Tam Hol (Very Deep Hole Cave) is a vertical karst feature that we discovered by accident while looking for another cave. It is located 1 km due east of Sak Pol Pak and 0.7 km southwest of Crystal Palace cave on the south side of the ridge on which the latter sits. The feature is a double pit cave with a maximum depth of 23 m. The openings sit a few meters apart on the surface but come together approximately 9 m below surface. Both openings measure approximately 2 m in diameter. This feature was discovered after an unexpectedly long day and we were improperly equipped to explore it. Some form of rack descender rather than a figure 8 for rappelling is necessary to enter this cave. This cave will be explored in coming seasons.
Actun Yax Tunich (Green Rock Cave) is located on the northeastern side of a steep hilltop just over 1 km southwest of Pacbitun. Its name comes from the green colored algae that cover the rocks at the entrance. The cave itself consists of a 7 m stepped drop that opens into two chambers that run roughly north-south. The entrance chamber, “Chamber 1,” measures 2.5 m x 1.5 m, and is divided nearly in half by an east-west running terrace. Chamber 2 is roughly circular measuring 1.5 m in diameter, and it contains 2 complete small ollas. The first vessel was already partially exposed when we entered the cave. The Maya likely left it on the ancient surface of the cave but a substantial buildup of decomposed termite nest has partially buried it. We began clearing the nest to verify if the vessel was complete, which led us to uncovering the second vessel below. The first sits on its side, while the second appears to be standing up. Due to my exploring caves in the countryside, I decided that it was best to completely bury the vessels until I can return for a proper excavation. I suspect that this chamber may be full of vessels. These two were more or less stacked on top of each other. That neither was placed upside down suggests that recovering evidence of their contents may be possible. The pots are positioned beneath a small natural shelf that cuts across the southeast corner.

Several palm branches and other jungle brush was cut down and placed over the entrance in an effort to hide the cave from any passers by. Given its location on top of a steep hill and that it is adjacent to a cow field makes for any human traffic highly unlikely. Nonetheless, the crew did not believe that the artifacts would be in much danger of being looted regardless of whether or not we covered the entrance because gibnut hunters tend to be responsible for taking
things out of the caves. Gibnuts avoid vertical caves like this one meaning that almost no hunter would bother entering therefore preserving the integrity of the archaeological record inside.

Actun Zotz (Bat Cave) is on the same hill as Actun Yax Tunich though it is on the west side of the hill, opening in the same direction. Both of these caves are associated with structure on the crest of the hill that I have called the Yax Tunich group (See Spenard reconnaissance report). Actun Zotz is a relatively small but complex cave. There are several chambers and branching passages. One immediately obvious aspect of the cave is the high occurrence of modifications in it. Walls and blocked passages were noted throughout as were termite nests. Pottery is ubiquitous. A passage filled with branches and other cut brush runs into the hill for 25 m then ends in a small chamber 2 m in diameter. Four sherds were surface collected from the chamber. Another cave is believed to run directly below this one though it was never located.

Five karst features located on the other side of Crab cave’s arroyo from Actun Lak were recorded though only three of them contained obvious evidence of ancient Maya activity (See Francis 1995 and Spenard 2011 for discussion of Crab cave). The features are named Empty Cave 001, Actun Koxol, Stone Cache, Tunnel System 001, and Actun Kaalan. Koxol, the stone cache, and Kaalan are the features that displayed obvious evidence of ancient activity.

Actun Koxol (Mosquito cave) is a small rock shelter located on the corner of a bedrock outcropping. It is approximately 4 m long by 1 m at its tallest. It is very similar to Actun X'tuyul in the NTC. Large quantities of pottery are present, as well as the distinctive rock shelter/cave soil described above for Actun Subuul. A small rock with a pool of drip water on its top sits in the middle of the feature. The water comes from rain draining down from the outcropping above. Behind this formation up against the wall is a concentration of pottery that has been calcified. A small surface collection was made though excavations would be beneficial.

The Stone Cache is a small rock shelter that opens to the north. It is located on a shallow slope that opens down hill, and the walls are smooth. A natural shelf 0.75 m tall is located in the rear of the feature. Several fist-sized limestone rocks have been placed on the shelf. The smooth wall and nested position of the shelf suggests that the rocks on it are not native to this formation and could not have occurred there naturally. Another unusual characteristic of this feature is that pottery appears to be nonexistent within it. Overall, this is a unique feature worthy of further investigation.

Actun Kaalan (Blocked cave) is a small niche in an area of exposed bedrock. It is completely filled in with rocks and mud, and termites have since built around them. Several sherds can be seen sticking out of the mud suggesting that the infilling was a product of ancient Maya behavior. Whether there is a cave behind the blockage is indeterminable. I suspect that if there is it will be small, but this is a very interesting spot overall as it is a large bedrock outcropping similar to the Nohooch Tunich complex.

The other two features in this area, Empty Cave 001, and the Tunnel System will be briefly discussed. Empty Cave is located on a property cut and is a small limestone outcropping with a cave-like entrance less than 1 m in diameter. The entrance area was briefly investigated though no evidence of ancient use was seen. The tunnel system is a series of interconnected 1 m
tall crawls. The entire system leads to a chute that is 7-8 m deep. We lacked proper gear for investigating the drop but no chambers or other sections appear to be present, though a slight bend in the feature’s wall prohibits viewing it in its entirety. Oddly enough, no artifacts were noted anywhere in the area save for the Stone Cache about 15 m east of this system. A small cave is present but a large tree prohibits exploration. A cursory look around the tree revealed no artifacts.

Our investigations moved to the west of San Antonio village after finishing up with the karst features to the west of Actun Lak. Five caves were visited in this area, Actun Sinan (Scorpion Cave), Actun Kacha Shana (Broken Shoe cave) Actun Chak Sinik (Red Ant cave), Actun Box Tunich (Black Rock cave), and Actun Kix Och (Porcupine cave).

Actun Sinan was discovered when Javier Mai was hunting in 2008. The animal ran into a nearby cave and Javier went looking for other exits so that the animal could not escape. He encountered a huge termite’s nest that he began stripping away to be sure that any entrance was blocked should the caves connect. Many scorpions were living in the nest, giving the cave its name. A huge olla was seen sitting in the cave’s entrance after the termite nest was removed (Figure 20). The vessel stands about 80 cm tall and 2 m in circumference.

The cave itself is approximately 10 m deep, and the entrance is 80 cm wide by 90 cm tall currently, but there is some build up suggesting that it is actually larger. It runs due south for 4 meters then turns to the southwest for another two. Beyond this turn, it opens up to a chamber that is measures 2 m east-west x 1.5 m north-south. Many bats live in this chamber and several sherds were noted. Three diagnostics sherds (an undecorated tecomate, and 2 jar rims) were surface collected. A broken piece of the rim of the large olla at the entrance was also collected. I took the smallest piece to facilitate describing the vessel. Further, some residue inside of the pot was collected for floatation. I do not have high expectations that this will result in anything more than termite waste. To protect the olla we covered the cave entrance with sticks and other brush as well as replaced the termite nests.

Actun Kacha Shana was given its name after Javier broke his shoe while on reconnaissance there. The name translates to “Broken Shoe.” The cave is located approximately 3 to 4 meters from Actun Sinan. Classifying this as a cave is difficult because it is more an elevated karst sheet over the bedrock. Two entrances separated 80 cm apart penetrate the sheet though they are too small for a person to enter. Entrance 1 measures 40 cm in diameter. Entrance 2 is a bit larger but is oddly shaped and has a tree growing out of it. The interior floor of the feature is 50 cm below the surface from Entrance 1. Within arm’s reach of the entrance are stacks of small olla sherds. These vessels are not as large as the one from Actun Sinan. This feature may in fact be a storage area for the settlement below, though the climb seems a bit steep for such a utilitarian function. All told, the cave is about 2.5-3 m$^2$ and consists largely of one chamber.

Actun Chak Sinik is a small cave that measures approximately 10 m deep. The entrance faces northeast and continues to the southwest for 4 meters before it branches off to the east and continues beyond a natural split. This entire area is referred to as Chamber 1. Chamber 2 begins behind the split. Most of the pottery in the cave appears in this rear chamber though it is mostly
Figure 20. Actun Sinan entrance and large olla. The tape measure is at 80cm.

undecorated body sherds. Chamber 2 measures 2 m x 4 m. The branching passage to the east is approximately 2 m tall but very narrow.

Actun Box Tunich is a 71 m long cave located in the eastern side of a north-south running natural drainage. Its name comes from that of the local area, Black Rock. It immediately opens up to a large chamber that is nearly perfectly flat and paved with pebbles averaging 4 cm. The ceiling is very smooth suggesting that this pavement may not be a natural occurrence. Sherds are mixed in with the surface pebbles. A formation opposite of the entrance from a passage penetrating deeper into the cave has been harvested or broken. Between the passage and broken formation is another large flowstone or speleothem formation. Several rocks are present behind the formation and adjacent to the passage suggesting that it may have been blocked off in the past. The chamber is 7.30 m deep x 8.40 m wide x 3 m tall. The entrance is 3.20 m wide. It is partially naturally blocked off and possibly artificially blocked.

The cave continues beyond the entrance area and there are a few deep drops within. The cave becomes very muddy after the drops and few artifacts are seen. However, there are quite a few chutes and ledges that need to be investigated further with climbing gear. Several rocks and sherds were placed at the very rear of the cave in a small chamber that measures approximately 2 m wide x 3 m long. A piece of a large, orange-brown columnar formation was harvested approximately 4 m above the cave floor. Harvesting this piece would have been very difficult, as it would have required climbing the formation.
A drop near the front of the cave measures 6 m deep, and several blocked passages and tight crawls were noted throughout the cave. An elevated passage next to a formation was noted and explored. It lead to another drop off ~6 m deep with a possible passage leading west. Rope would be necessary to explore this area further, but it may be worth it because several sherds were found near the drop, many of which were surface collected. Just before that passage is a stone-lined sink in the cave. This feature likely represents part of a ritual pathway. The entrance area does appear to be built up with smaller and medium-sized rocks, as well as a possible elevated terrace. This cave is definitely worth returning to for further investigations.

Actun Kix Och is the last cave visited in the area west of San Antonio village. It is a large cave that contains four main chambers and many of bats. The cave houses many areas of construction, formation breakage, and ancient pathways. Ceramics can be found in large quantities throughout the cave up to a series of travertine pools approximately ¾ of the way in, after which the density plummets to nearly naught. The cave is more than 100 m deep and there is substantial evidence that at least 70% of it was heavily used.

Each of the four areas is closed off from the other via a belly crawl through a low blockage each of which are heavily choked off with many rocks. The entrance area is terraced and consists of the first passage. The passage constricts after approximately 20 m to the first belly crawl. Beyond this first crawl is Javi’s walkway named so because he continually expressed his interest in it when telling me about the cave. The feature is a naturally elevated limestone pathway that is 1.5 m wide. The entrance to the walkway is full of liquid bat sewage. A small chamber is beyond the walkway before reaching the next choke. The area behind this choke is very muddy and has several niches and alcoves. This area ends at the group of travertine pools after which no artifacts were noted. Nonetheless, heavy formation harvesting can be seen behind the pools. The cave continues and the ground becomes very muddy. Several modern footprints were noted throughout this area, as well as arrows carved on the walls. Javier said that school children are brought here, which explains the footprints. Overall, this is a very interesting cave worthy of coming back to for further investigation and documentation. A surface collection was made in the entrance area.

Two caves, Actun Hayach Naj (Small House cave), and Actun Sukunoob (Brother’s cave) were explored in the Mountain Pine Ridge on the last day of work for the season. Several other karst features were noted while hiking to and from these caves though time did not allow for any exploration of them but gps points were taken of their locations so that they can be revisited.

Actun Hayach Naj is situated at the end of a nice trail and enters into a bedrock outcropping. Blancaneaux lodge presumably maintains the trail because they regularly bring tourists there. Two large, broke olla fragments sit on a ledge on the exterior of the cave. As well, a calcite-covered bottle is near the entrance suggesting that modern water collecting activities were taking place inside, though it may be chiclero trash. The cave is comprised mostly of one large chamber that circles a columnar formation in its approximate center. The chamber is roughly 20 m deep and ovular shaped with small ledges and crawls extending away from the center. A cluster of several large sherds is near the rear of the cave. A line of flagging tape outlines the cluster to prevent them from being stepped on. Though ceramics are the most
obvious artifact in the cave, a surprising number of mano fragments litter the surface of the entire cave but seem to clustered around the central formation. A rough count places their number at about 50 on just the surface throughout the cave. They range in sizes from very small to grapefruit sized in diameter. A miniature tripod plate with one foot knocked off and part of the rim was found leaning up against the central formation. It was surface collected. The broken foot is on the opposite side of the vessel as a broken wall. The plate had been placed against an active formation as indicated by the cotton like calcite growth on it. I removed some of the flagging that surrounds the large ceramics and pulled up some of the rocks where the plate was found. Several chert flakes were seen throughout the area. The crew remarked that another vessel should be present because two are always encountered signifying male and femaleness. I placed the pink flagging below and placed the rocks back above it to mark exactly where the vessel came from when we eventually return to map the cave. As well, I took several photos of the spot marked with orange webbing.

The gendering of the finds is an interesting observation that should be highlighted. This belief may explain the pairs of vessels found in the Actun Lak vessel cache, and those found in Actun Yax Tunich. Caves are gendered spaces. For example, they are frequently described as wombs, and they gave birth to the ancestors who emerged from them (Brady 1988; Nielsen and Brady 2006; Taube et al. 2010). Further, they are the sources of rain and agricultural fertility (Brady and Prufer 2005:369). Finally, ethnographic accounts of the landscape describe mountains as male and the earth as female. The confluence of these two forces is seen when stalagmites and stalactites come together within them (Garza 2003).

Actun Sukunoob is the final cave visited during the 2011 field season, and likely the largest that we visited this season. Time did not allow for proper documentation or even a full exploration, but it is very large and consists of several rolling chambers, stalagmitic forests, travertine areas, muddy, sandy, and at times, bedrock floors. Access to the cave is reached via a 2.5 m drop down a sheer face. No modifications are seen in the entrance face. Nonetheless, a terraced platform is immediately reached. This platform incorporates the natural character of the cave to extend 6 to 7 m. Broken formations were seen sporadically throughout the chamber. The height of the chamber varies between 6 to 8 m, and it is likely higher in some places. Pottery is ubiquitous but there are no heavy concentrations in any place in particular. Sherds were noted in areas of active dripping, but these tend to be clear of matrix or naturally excavated areas so the sherd density may be similar in nondrip areas if excavated. This is a special use cave for the Maya living in the area today. Particular individuals who make ritual offerings of copal, prayers, hymns, etc. use it to access the spirit of the forest to send thanks and petition for more food, fruit, rain, etc.
List of Caves and other Karst Features around Pacbitun

This section is to gather the names of all 57 currently known karst features surrounding Pacbitun for ease of reference. There are two lists. The first is caves identified or relocated by PRAP members, and references to their initial descriptions. “Mendip” refers to Francis 1995, and not described means that only GPS coordinates of a feature were taken and is awaiting further study. The second list is those features identified by the Mendip Cave Group that have yet to be relocated by PRAP. They are listed here because many of them had archaeological material within. This second list contains 10 additional caves bringing the total of known karst features around Pacbitun to 67.

PRAP caves
Actun Balam (Spenard 2011)
Actun Bosh Tunich (This report)
Actun Bosh Tunich chico (Not Described)
Actun Caanshan (Not Described)
Actun Caapel Tam Hol (This report)
Actun Chaan Hol (Valdez and Lee this volume)
Actun Chak Sinik (This report)
Actun Chechem (This report)
Crab Cave (Mendip; Spenard 2011)
Crevasse (Not described)
Crystal Palace (Weber 2011)
Actun Dzonot (Spenard 2011)
Empty cave 001 (This report)
Actun Guacamayo (Spenard 2011)
Actun Ha (Spenard 2011)
Actun Ha'ale (This report)
Actun Hayach Naj (This report)
Hole in the Ground (Spenard 2011)
Javier’s Cave (Mendip; This Report)
Actun Jcheehem (This report)
Actun Kaalan (This report)
Actun Kacha Shana (This report)
Actun Kajaw Tunich (This report)
Actun Kitam (Spenard 2011; This report)
Actun Kix Och (This report)
Actun Koxol (This report)
Actun Ku'uk (This report)
Actun Lak (Mendip; Spenard 2011)
Actun Mai (Mendip, Spenard 2011)
Actun Merech (Mendip; Powis 2010, This report)
Museum Cave (Not described)
Actun Nohooch Tunich (This report)
Actun Pech (Healy et al. 1996; Powis 2010)
Actun Pe’ech (Not described)
Modern Threats to Caves and Their Archaeological Materials around Pacbitun

One of the most disconcerting facts of doing archaeology in the Maya area is the heavy looting that often occurs long before we have a chance to document sites. In some instances, caves are protected from these activities, though other times they are not. Often, when investigating a cave I have been told stories of the handful of beautiful vessels that used to sit on a ledge somewhere within. The opportunity to validate these statements by finding the in situ
has yet to present itself to me. Regardless, the removal of artifacts tends to be restricted to what
is on the surface, though some digging is regularly seen. The caves around Pacbitun have been
subjected to the same factors. They are not particularly unique in their overall level of
preservation or disturbance. Nonetheless, what is particularly striking is the dramatic increase
seen in their disturbance during the 15 years since interested scientists have begun visiting them.
These disturbances are particularly alarming in the area around the Nohooch Tunich complex
and Actun Xux. In the latter, numerous skeletons are missing, presumably intact vessels
cemented into the cave floor have been smashed and their remains are nowhere to be found.
Though seemingly innocuous, the shuffling of surface artifacts off of the cave floor and onto
ledges, and into nooks and crannies severely disrupts their context. Protecting the artifacts in
this manner is an alarmingly explicit mission of a local landowner. Though his desires are noble,
they are misguided from an archaeological perspective. Gates over the entrances of caves have
been shown to be effective in preserving the integrity of the archaeological record within (Powis
2009:30). The desire of the landowner of Actun Xux to gate the entrance is applauded.
Nonetheless, such protections can be prohibitively expensive, particularly in an area where
regular wage work is nonexistent. Further, gates can only protect caves. Rock shelters remain
vulnerable. The only way to truly protect these features is to study them more intensively before
they become a focus of looting. What my research demonstrates is that they were significant
features in the ancient Maya landscape and were interacted with on more than a passive level.
Constructions, rock alignments, and other modifications suggest significant amounts of time
were invested in making these features special places and therefore, should receive the
archaeological attention that they deserve to not only enhance our knowledge about them but to
also protect their contents from destruction.

Conclusions

Overall, this field season is considered a great success though much work remains to be
done. Our first goal of initiating a large-scale regional cave project was more successful than we
had hoped, as indicated by the number new caves identified as well as the work performed in
them. Our second goal is an ongoing process that only began this field season. Whether we can
identify if and which local communities were using the caves will pan out when intensive lab
work will begin in 2012. Our results far exceeded even our most ambitious expectations for
meeting our third goal. The multi-component Nohooch Tunich complex, the stone cache, Actun
Koxol, and Actun Kacha Shana all demonstrate that the concept of “che’en” is more far reaching
than referring to only caves and rock shelters. Our experiences with Kajaw Tunich, and the
empty caves and rock shelters suggest that there were some selective forces for using one of
these features ritually. More research is necessary to determine what these forces were. Our
continuing efforts planned for the coming field seasons will continue to address and refine these
questions.
Acknowledgements

This project would not have been possible without the help of many individuals and institutions. I would first like to extend my thanks to Drs. Jaime Awe and John Morris and the Institute of Archaeology for granting our project permission to work around Pacbitun. I would like to extend that thanks to PRAP project director Terry Powis for offering me the opportunity to head up this cave project. The cave archaeology skills of Mike Mirro and C.L. Kieffer were invaluable in getting as much work done as we did. Together we entered (almost) the deepest pit that we found, the explored the smallest hole, and everyone was able to make it out when doing so. Further their field notes contributed to several of the descriptions found in this report. Arianne Bouleau’s energy and willingness to help out with whatever, where ever, whenever she could is greatly appreciated. Oscar Mai and Javier Mai provided excellent help and companionship throughout the season, but particularly so during the cave reconnaissance. Their intimate knowledge of the landscape is responsible for my “discovery” all of the caves reported here. Finally, I’d like to thank the field school students for their enthusiasm and hard work. Financial assistance was provided directly to me by the University of California Humanities Graduate Student Research Grant, and indirectly through PRAP by the Alphawood Foundation and Dumbarton Oaks. Petzl provided many of the helmets and lights that are vital to any work underground.
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Pacbitun is a medium-sized ancient Maya site dating from 800 BCE to 900 CE (Healy et al. 2007, Powis 2011). Located in the Cayo District of western Belize, its center is about 3 km east of the modern Maya village of San Antonio at the edge of the lowland tropical forest and upland pine ridge ecozones (Healy 1990). It is uniquely situated between the Mountain Pine Ridge and the Upper Belize River Valley (Figure 1) where the karst terrain is part of a larger belt (Figure 2) that stretches north and west of the Maya Mountains (Day 1996:139). The foothills of the Mountain Pine Ridge begin about 1 km south of Pacbitun and the geology of this area boasts an abundance of caves, rockshelters, and other karstic features (Powis 2010). Chaan Hol rockshelter is located on the side of a steep hill approximately two and half kilometers south of the Pacbitun site core.

![Figure 1](image-url). Map of the Upper Belize Valley showing the locations of Pacbitun and Chaan Hol (after Moyes 2002: Figure 1).
As part of the 2011 Pacbitun Regional Archaeological Project, excavations at Chaan Hol were conducted. Research focused on determining whether there were any subsurface cultural deposits as well as understanding the temporal extent of utilization within the rockshelter. Surface deposits had been noted the previous year, but there was no excavation until this field season. We hypothesized that this location could have been a Preclassic habitation site based on its physical characteristics and similarities to other early habitation sites found nearby, such as at Actun Halal (Lohse et al. 2007).

Chaan Hol rockshelter (Figure 3) runs north to south with entrances at each end and a 3 m wide by 1 m long opening in the center of the southwest wall (Figures 4 and 5). This opening is somewhat restricted, with stacked stones along the bottom that appear to have been placed to modify its shape (Figure 6). At its widest point, the rockshelter reaches three meters across.
directly in front of the window, below the most covered and level area. The walls are separated by a half meter gap in the ceiling, while the central area above the window is completely covered. There are ceramic sherds on several ledges northwest of the window and a terrace evident roughly three meters northwest of the window (Figure 7). The floor begins to drop to about a thirty degree angle from the terrace towards the north opening. There is a nearly level area south of the terrace that could have been artificially filled to create a space with higher elevation.

Figure 3. Plan view of Chaan Hol Rockshelter.
Figure 4. Looking in Chaan Hol from the south entrance.
Figure 5. Looking in Chaan Hol from the north entrance.
Figure 6. South Entrance and window from inside Chaan Hol.

Figure 7. Sherds on ledge near the window opening.
Methods

The area directly in front of the window opening inside the rockshelter was chosen for Unit 1 (Figure 8). This location was chosen because it is the center of the rockshelter (Figure 9); the only completely covered area, and located directly in front of the window opening. Ten centimeter arbitrary levels were used for excavating. We planned to change to five centimeter levels if Preceramic deposits were reached. All material removed from the units was sifted using $\frac{1}{4}''$ mesh screen.

Figure 8. Unit 1 area before excavation.
Results

It was only possible to excavate to 90 centimeters below the surface in Unit 1 because large rocks lined the bottom of the unit (Figure 10). A 1x1 m extension was then added to the northeast side of the original unit, facing the interior wall. After excavating the extension to the same level as Unit 1, it was possible to move some rocks and continue excavating the unit to 120 centimeters below the surface. Unit 1 extension reached 180 centimeters below surface at which point it was no longer possible to excavate due to large boulders and rocks. For approximately the first 20 cm below the surface, the soil was extremely dry and loose.
Artifacts recovered from the excavations at Chaan Hol included 121 jute, 254 ceramic sherds, 14 lithic flakes, and 1 formal lithic tool (Table 1). Most of the ceramics were eroded but there were some diagnostic sherds that await further laboratory analysis (Figures 11, 12, and 13). No Preceramic deposits were found. At around 60 cm below the surface in the extension, there was a 3 cm thick streak of orange clay and charcoal (Figure 14). Stacked limestone blocks to the east of this area suggest there may have been a hearth. Since the feature was so close to the East corner and edge of the unit, it was not possible to estimate its size or shape.

Figure 10. Excavated Unit 1 and Unit 1 extension.
Figure 11. Roller Stamp Fragment.

Figure 12. Body sherd with fillet.
Figure 13. Incised rim sherd.
Figure 14. Profile for the SE Wall of Unit 1 and Unit 1 ext.

Discussion

Ceramics were recovered up to 1.5 meters below the surface, under numerous large cave spalls indicating this area is prone to spall and rock falls. The absence of discernable stratigraphic layers within the more compacted sediment, beneath the loose dry surface layer, suggests there may have been a continuous build-up of sediment. Since Chaan Hol is located on the side of a hill, we think it is highly probable that sediment continuously washed in from above the rockshelter. This was experienced to a degree as we were excavating. We noticed small clumps of dirt falling inside the rockshelter from the openings. When it rained, we also noticed debris being carried in by the water and wind. Throughout our excavations we encountered numerous voids and large roots which showed bioturbation was prevalent. With an obvious clay/charcoal deposit on the west wall of Unit 1 extension, we do know that at least part of the stratigraphy has not been disturbed.
The freshwater gastropod Pachychilus indiorum (*jute*) uncovered at Chaan Hol have been found throughout the Maya area in midden contexts indicating its use as food by the ancient Maya (Halperin et al. 2003). They were nutritionally important as a protein source in the maize-based Maya diet and excavations at the site core of Pacbitun indicate a heavy reliance on *jute* since remains occur in assemblages from all phases at Pacbitun and have been found during excavations at its core and periphery (Healy et al. 1990).

*Jute* depend on oxygen-rich fast moving water for respiration and food intake (Healy et al. 1990). This means that *jute* are not naturally occurring fauna in dry areas, so the species must have been manually transported into the rockshelter. The presence of *jute* in rockshelter contexts can be interpreted as ritually significant. Some examples include meals associated with ritual seclusion or ritual feasting with subsequent secondary deposition (Halperin et al. 2003). Out of the 121 *jute* excavated at Chaan Hol, 117 were spire-opped. A spire-opped *jute* has had the distal end of its shell removed to allow access to the organism for consumption (Healy et al. 1990, Halperin et al. 2003). A good marker of human agency is the presence of spire-opped *jute* since experiments have shown spires cannot be removed by animals (Halperin et al. 2003).

Since rockshelters are generally well lit and accessible, they are usually associated with public ritual (Prufer 2005). Research has shown that the ancient Maya perceived rockshelters as caves even though rockshelters were more open and accessible sacred places of ritual significance (Rissolo 2005). Prufer (2005) suggests that cave ceremony type could be determined by physical setting and likely by the type of ritual protagonist. He identifies two types of activity associated with cave ceremonies: “public political/religious and private socio-medical/religious” (Prufer 2005). So, to some degree, physical form may have a role in determining if a cave or rockshelter was used for public or private ceremony. Our preliminary conclusion is that this rockshelter was probably utilized by non-elite Maya. Chaan Hol could have been a sacred place where public ceremonial activities were conducted because of its well lit accessibility in comparison to dark zones within caves.
Table 1. Artifact Counts for Chaan Hol.

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| TOTAL | 4     | 117            | 254         | 14     | 1       | 4       | 4 | 25 | 4 | 2 |

Table 1. Artifact Counts for Chaan Hol.
Acknowledgements

We would like to thank the Institute of Archaeology in Belize, Jenny Weber, Jon Spenard, Joe Tzul, Jose Bacab, Mike Mirro, C.L. Kieffer, Oscar Mai, and Antonio Farias. We would also like to give thanks to Dr. Terry Powis for giving us the opportunity to do this research as well as for his continued support and assistance.
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Rissolo, Dominique
Preclassic Maya Use of Plaza Space in the Upper Belize River Valley: A View from Cahal Pech and Pacbitun

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Introduction

How many archaeologists does it take to excavate a plaza? One! It just takes one to be interested in studying the early Maya. How many archaeologists have dug into a structure at a Maya site? How many have dug into a plaza? How many have done it just to establish chronology? There are a number of Maya archaeologists who have not taken advantage of excavating this type of architecture. The perception might be that there isn’t much information other than recovering artifacts to date successive constructive phases associated with the buildings that they are investigating along the edges of the plaza. We see things differently. For each of us it happened at different times in the past, and at different valley sites. For me, it happened as a graduate student when I was backfilling a plaza unit at Cahal Pech, under the direction of our discussant for today. At some point I threw a large rock into the unit, hitting the side. The entire profile wall collapsed inward exposing a pristine Classic period building buried by at least 2-3 meters of fill. That clinched it for me in terms of where my investigation strategy would focus for the next few decades. For Paul Healy, it began with the discovery of this stela in front of Structure 2 in Plaza A at Pacbitun (Figure 1).

Over the years, we have seen the utility of this approach – one that emphasizes locating early Maya buildings, burials, and caches - beneath plaza surfaces. For example, look at what Hammand found at Cuello (Hammond 1991), Valdez and Hester at Colha (Hester et al. 1994), Houk at Chan Chich (Houk et al. 2010), the Chases at Caracol, Takeshi Inomata at Ceibal, and my own work at the Tolok Group (Powis 1996), located in the periphery of Cahal Pech (Figures 2-11). In the Belize Valley, there has been a concerted effort since the late 1980s to recover as much information as possible about the Preclassic Maya by specifically targeting plazas. It began with Jaime Awe at Cahal Pech, and continued at Pacbitun with Paul Healy and myself. Today, few archaeologists are engaged in examining the nature and extent of the earliest Maya in the Belize Valley – compare say to the number working on it in the Yucatan. Let’s face it Jenney Creek and Cunil occupations are not easily located. They are deeply buried, and take a lot of time, labor, and money to uncover a fraction of what we could do with those resources on an above-ground structure. Certainly, those of us working on the Preclassic period like Jaime Awe, Jim Garber, Kat Brown, Sherman Horn, Paul Healy, and myself approach our investigations into plazas in different ways but we are always successful in our endeavors, not only in terms of recovering well-preserved artifactual remains, but also in the recovery of portions, if not entire, Mamom and pre-Mamom communities.
Figure 1. Photograph of Stela 2 in front of Structure 2 in Plaza A at Pacbitun. Image courtesy of Paul F. Healy.

Figure 2. Photograph of deep trench in front of Structure 35 at Cuello.
Figure 3. Middle Preclassic house platforms below plaza at Cuello (after Hammond 1991:Fig 5.1).
Figure 4. Middle Preclassic burials buried beneath main plaza at Colha. Image courtesy of Fred valdez, Jr.
Figure 5. Location of Tomb 2 in Plaza A at Chan Chich. Isometric plan view courtesy of Brett Houk.
Figure 6. Photograph of Tomb 2 in Plaza A at Chan Chich. Image courtesy of Brett Houk.
Figure 7. Early Classic deposit in Structure B33, North Acropolis, Caracol, Belize. The pit was 60 cm in depth and was cut through earlier floors. It contained smashed and burnt vessels, artifacts, and bones (animal and human) – all badly burnt and all encompassed in a layer of ash and underlain by a layer of carbon. Some 18 vessels appear to have made up the assemblage as well as a host of green obsidian blades. Image courtesy of Arlen Chase.
Figure 8. Close-up of cache deposit in Structure B33 at Caracol. Image courtesy of Arlen Chase.

Figure 9. Photograph of the Central Plaza excavations at Ceibal, Guatemala. Image courtesy of Takeshi Inomata.
Figure 10. Round Structure 14 at Tolok.

Figure 11. Close-up of Structure 14 at Tolok with Jaime Awe in the center.
Why is it that we are able to locate buried communities under plazas? What does the general layout of these settlements look like? What types of architecture do we typically find – domestic or non-domestic structures? What does this information tell us about the daily social and religious lives of the earliest Maya? Indeed, there are many questions to be asked, but for this paper I am focusing on two, which appear to be interrelated. The first has to do with why the Classic period Maya elite utilized this space for more than just public events on occasion. Was there a conscious or concerted effort by the Classic elite to penetrate these plaza surfaces to bury items of importance down into earlier architectural phases? These range from human interments to stelae to cached offerings of pottery and other objects. It is significant to draw out why the Classic Maya decided to do this. Why not place their dead and cache their offerings into temples as they so often practiced? Why deviate from that pattern? What was it about what was buried beneath the plaza that made the Classic elite venerate this deeply buried space so deeply? Perhaps it was just a convenient space or the only space available with which to perform such acts. Given what we know about the Maya, of any period, nothing is done at random. Such interments, for example, are arranged and dedicatory. But dedicated to what? Or to who? Perhaps it is what was buried beneath the plaza surfaces that provide the answer.

The second question has to do with why Middle Preclassic communities, consisting of several structures, were sealed by successive plaza floors to begin with. Why bury, either in part or wholly, Mamom and pre-Mamom phase buildings, typically domestic, with successive plaza floors that are communal in nature? This shift must have been planned and required a complete reorganization of space, shifting the focus from the private to the public use of space.

To help us answer the question why Middle Preclassic communities were buried under plaza floors, we need to briefly look at the origins of temple-pyramids. A few years ago David Cheetham and I were interested in the origin of temples (Powis and Cheetham 2007). We were interested by their location within ancient communities – why spot X as opposed to spot Y. Without doubt, some of the earliest temple-building societies incorporated these structures into grand civic plans right from the outset. They were not haphazard additions - locations were precise and pre-determined. La Venta is an example, with large earthen temples forming the very heart of the respective civic-ceremonial blueprints. These buildings were often incorporated unto the unfolding civic-ceremonial plan of pre-existing communities. In the Belize Valley, permanent village life was established after 1200 BC. Sometime over the next century or two, we see the emergence of social ranking and modest temple buildings being constructed. Evidence is sketchy at present, but it appears that in some cases the focus of ritual life shifted from the households of emerging elites to modest temple platforms – on the same spot. What we have suggested in at least some instances is that Middle Preclassic temples represented the “house” of the founding lineage (Powis and Cheetham 2007:184). They remained such a “house” even though, physically and publically, a radical transformation had taken place. With one architectural alteration they went from private to public, from secular to sacred.

**Cahal Pech**

Cheetham and I used a few examples from across the lowlands to help illustrate our point but one of an elite residential-cum-public building occurs at Cahal Pech (Figure 12). A roughly 2,000 year, uninterrupted sequence of public buildings was exposed in the southeast corner of the
site’s main plaza within Structure B-4 (Awe 1992). The stratigraphic sequence of this building includes nine superimposed temples, the latest of which is Late Classic, the earliest of which is early Middle Preclassic, ca. 800 BC. Below this are a series of residential platforms dated to pre-Mamom Cunil times on the basis of architectural fill and floors which themselves are strewn with trash of a domestic type. Yet these Cunil residences – particularly the final ones – exhibit traits which clearly set them apart from contemporaneous domestic structures within the rest of the early village buried beneath Plaza B. In essence, the families residing at B-4 maintained a higher rank than their neighbors, just a stones-throw away.

Several classes of exotic items were associated with the B-4 buildings, including potsherds incised with abstract supernatural creatures and other mythic-religious concepts (Powis and Cheetham 2007:180). Such depictions are rare to absent elsewhere below Plaza B – the central and oldest part of the site. Indeed, Cunil occupants of B-4 enjoyed access to a wealth of exotics, which are rare or lacking beyond their immediate living space. Architecturally, the B-4 buildings – particularly the final Cunil examples – are more elaborate than contemporaneous structures below the plaza.
If we accept for a moment that emerging elite did indeed transform their residences into temples at this early time, what then happened to the space surrounding the new temples? What happened to the adjacent residences as a result of this new constructed sacred space? If a blueprint did exist after the construction of the first temple, then how was the site reconfigured? Did a reconfiguration actually take place? Were their neighbors told to move away? As we know, in the Middle Preclassic, communities were often compacted, situated within meters of other residential platforms on the same hilltop. What if these early elite transformed the domestic space near the temple to ritual/ceremonial space only by paving over their neighbors’ residential platforms? We are saying just that. In time, with successive temple constructions came new plaza surfaces, which continually buried deeper these early residential communities under meters of fill. Keep in mind, this is a radical transformation – the construction of a temple on top of a former residence. How would elites delineate this new space? Is it too far-fetched to assume that with the erection of these early temples that adjacent space would also not change in function/use? Wouldn’t you now need an open space for worship, for worshippers? What we are talking about here is the evolution of the concept of the “plaza” – the creation of public space where there was none before. And, it begins with the construction of the first temples. This
newly minted public space is considered or regarded as different from courtyard or patio spaces that are found around private residences.

**Pacbitun**

Another example comes from the site of Pacbitun, where I am currently directing the Pacbitun Regional Archaeological Project (PRAP). The site is situated on the southern rim of the Upper Belize River Valley at the juncture of two contrasting ecozones: the tropical rain forest and the pine ridge. The site is a compact acropolis center (Figure 13). The Core Zone is marked by five primary plazas (A-E), surrounded by a variety of masonry structures atop a modified natural limestone hilltop (Healy 1990). The largest open area of the Core Zone, Plaza D, measures about 5,000 square meters while the smallest, Plaza C, is only about 900 square meters. Plaza B contains the Classic period elite residences while Plaza A appears to be the ritual and ceremonial hub during this time. Structure 2, a major temple-pyramid, straddles both plazas. And, Plaza A, about 6 meters above Plaza B, is the highest level ground at Pacbitun. Plaza A also is the locus of most of the 20 known monuments, including a stela and altar complex situated in the center of the plaza.

![Figure 13. Map of the site core of Pacbitun.](image)
Archaeological investigations since the mid-1990s have identified at least 14 Middle Preclassic (800-300 BC) structures that were buried below Late/Terminal Preclassic and Classic deposits forming the fill of Plaza B (Healy et al. 2004) (Figure 14). All of these structures identified thus far are rectangular in shape (roughly measuring 6 x 8 m), marked by tamped marl floors with multi-course stone foundations (Figure 15). Some show traces of perishable pole- and-thatch-roofed buildings. The majority of these structures are parallel to one another with small alleys or walkways located between them. The buildings often terminate and corner in an orderly fashion. Over 25,000 Preclassic artifacts consisting primarily of ceramic, shell, and lithic remains, were recovered along with an assortment of faunal, botanical, and radiocarbon samples. Of particular interest is the sizeable collection of shell beads (6,898), shell detritus (2,942), and chert microdrills (371) found embedded in the floors and alleyways of these structures, especially Sub-Structure B2 (Figure 15). The recovery of so many of these artifacts, found in close association to one another, is indicative of a shell bead industry that lasted for nearly five hundred years, from ca. 800-300 BC (Hohmann 2002; Powis et al. 2009) (Figure 17). Ultimately, the late Middle Preclassic structures were abandoned and a midden-like deposit, up to one meter thick in places, loaded with organic remains and shell, was laid over the entire area to level the area for the construction of Plaza B. This dark midden layer has been dated to 400-300 BC, a time when major site planning and construction was begun.

**Figure 14.** Location of units in Plaza B at Pacbitun.
Figure 15. Plan view of Middle Preclassic buildings below Plaza B at Pacbitun.
**Figure 16.** Plan view of Structure B2 in Plaza B at Pacbitun.

**Figure 17.** Middle Preclassic ornaments and drills from Plaza B at Pacbitun.
In the mid-1980s, Healy placed several units in Plaza A to determine not only the chronology for the plaza but also to identify any Preclassic occupation. In a test unit placed in front of Structure 2, he encountered portions of the initial plaza surface, at a depth of 3.5 meters (Paul Healy, personal communication, 2012). Charcoal recovered below this floor dated to 770 BC+/− 170. Another unit was placed in front of Structure 4. He found the same plaza floor surface, dating to 800-775 BC. Additionally, he found one Middle Preclassic wall foundation that he thought was part of a domestic structure. Over the past two field seasons I have been pursuing Paul’s original research in Plaza A – trying to learn as much as possible about the Middle Preclassic community that may have extended out from Plaza B. We continue to dig in various parts of the plaza – on the lookout for early buildings (Powis 2011). Thus far, we have uncovered this large Late Preclassic retaining wall (Figure 18) and associated lip-to-lip cache (Figures 19 and 20). While work is ongoing, what we can say right now though is that the Pacbitun Maya had significantly altered a natural hilltop to create a taller, broader, and flattened area, and that at least four plaster surfaces had been laid down in Plaza A between the Middle Preclassic and Early Classic periods.

**Figure 18.** Photograph of Unit 1 placed beside Stela 4 in Plaza A at Pacbitun.
Figure 19. Photograph of Cache 1 in Unit 1 in Plaza A during excavation.

Figure 20. Photograph of Cache 1 in Unit 1 in Plaza A after excavation.
Discussion and Conclusions

In sum, we think that what is going on is this: sometime in the late Middle Preclassic an array of very significant social and cultural changes began in Lowland Maya society. We see this evident (physically) in the Late Preclassic architecture, and the shift to viewing Maya leaders as semi-divine and god-like rulers. The very substantial shift at this time is clearly in architecture (more, larger temple-pyramids, the first masonry palaces, the earliest lowland Maya ballcourts, maybe E-Groups too). We see the first masonry tombs and growing concentration of wealth in the hands of the few. To me, these mark something very major happening. At Pacbitun, at least, this is when we see a major transformation (on a far grander scale) of the site's layout and plan with the earlier, Middle Preclassic architecture buried (sealed) under a layer of midden-like fill and a transformative, new, grander Plaza Plan is established for the site at large. And the focus is clearly on these central areas (epicenter), especially Plazas A and B, becoming the focal point for both religion and secular authority (likely melded into the hands of one ruling family) because we find the elite residences (Str. 23, for example) arise now. The earlier, Middle Preclassic architecture (and site layout) is viewed as expendable and clearly on an unsatisfactory scale (too small, not grand enough) and the blueprint we envision takes precedence over the earlier structures. There seems to be a new vision - a grand plan - evident for Pacbitun by the close of the Middle Preclassic and the Late Preclassic developments result in a major re-working of the site layout with large, formal plazas, the E-Group, possible royal court palace groups, ballcourt, etc. The only trappings of royalty which are missing are stelae and altars which appear in the Early Classic.

To conclude, we want to come back to the first question we posed. Why did the Classic period Maya elite bury their dead and cache offerings into plazas where Middle Preclassic communities were buried centuries earlier? Two words — social memory. If one looks at the number and location of Late Preclassic, Protoclassic, and Late Classic burials and caches that were deposited inside the Middle Preclassic round structure at the Tolok Group (Figure 21), it provides strong evidence for ancestor veneration through time (Aimers et al. 1992). They were not found penetrating the first or even the second plaza surfaces, but into the round building itself. This round structure was sealed by the first plaza floor around 400-300 BC. The last burial to be placed into it dates to about AD 700-900.
Figure 21. Plan view of intrusive burial and caches in Structure 14 at Tolok.
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