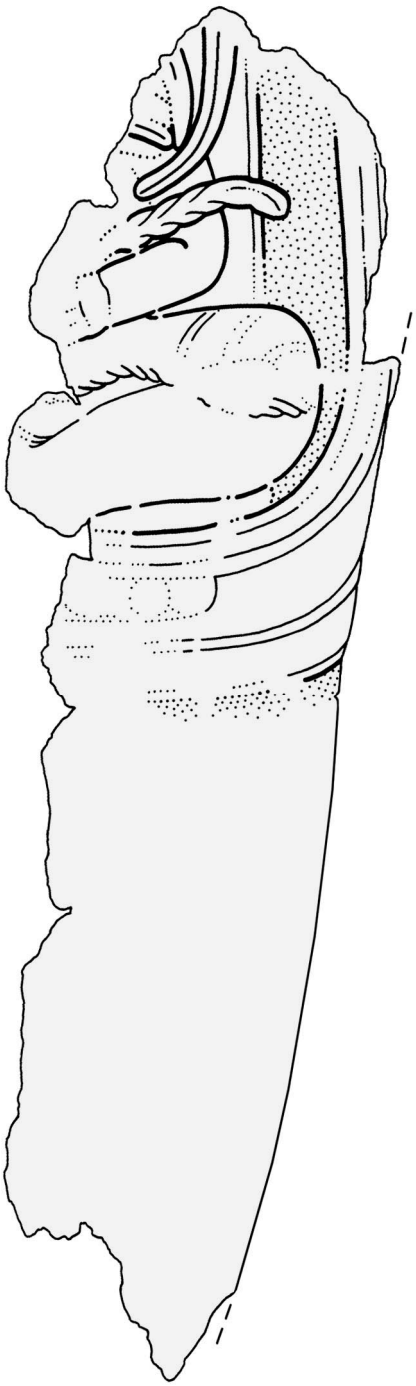
# *The Belize Valley Archaeological Reconnaissance Project:*

## *A Report of the 2005 Field Season*



EDITED BY
CHRISTOPHE G.B. HELMKE
AND JAIME J. AWE

Institute of Archaeology
Belmopan, Belize, C.A.

**2006**

**Cover:** Carved bone plaque, Bu. 1A-1, SU 313, Str. 1A, Pook's Hill, Belize (Scale 1:1).
The iconography represents a male figure, holding what may be a feather-tipped blood-letter, seated cross-legged, within an apparent lunar ancestor cartouche. Drawing by C. Helmke (2006).

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# THE 2005 SEASON OF INVESTIGATIONS

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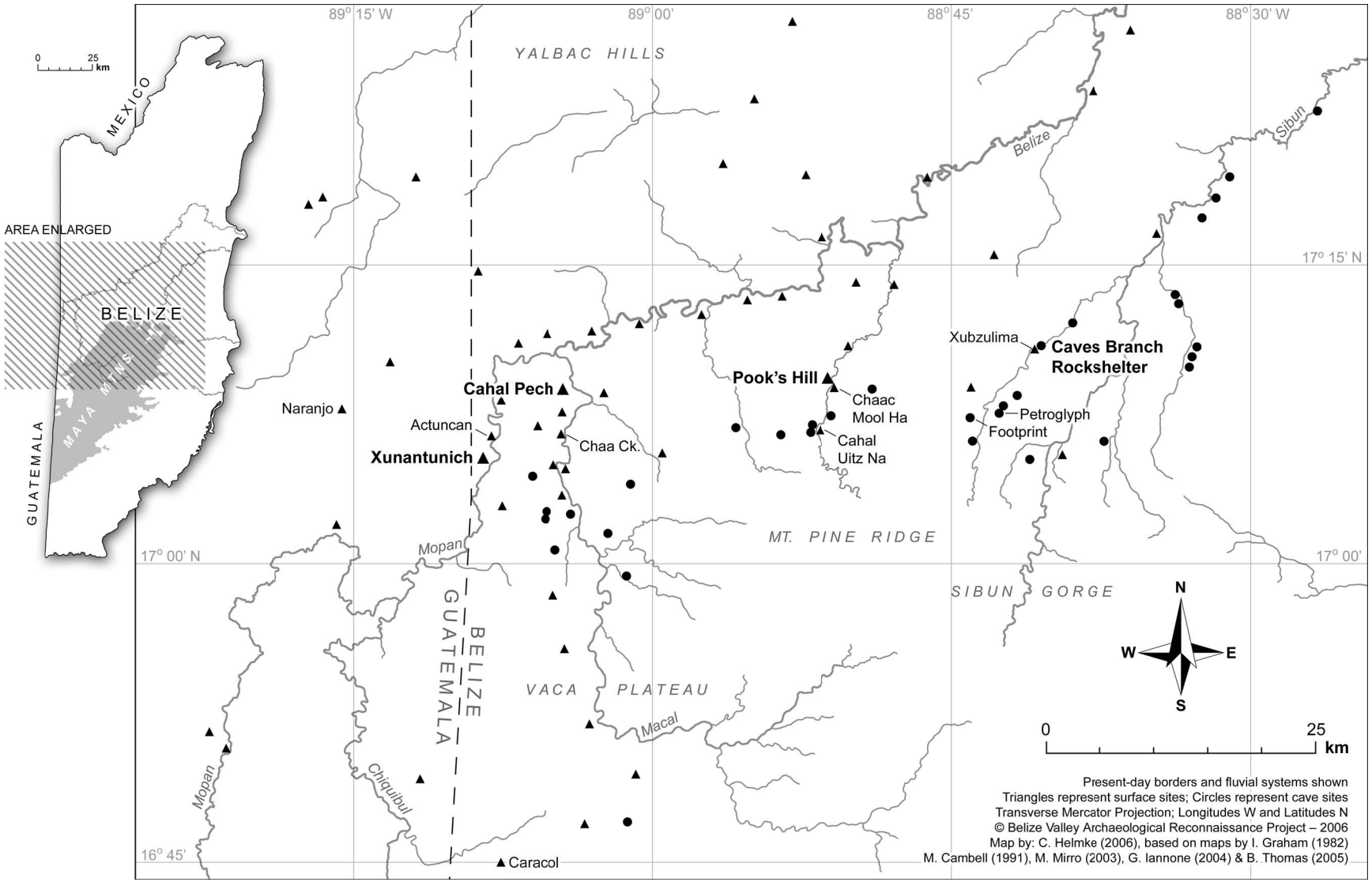
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Mopan
Macal
Chiquibul
Naranjo
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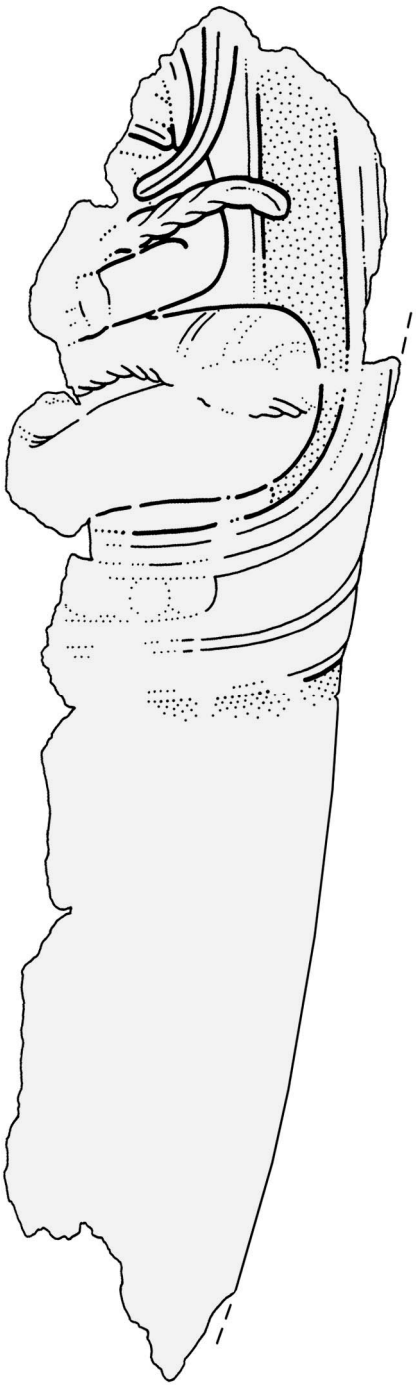

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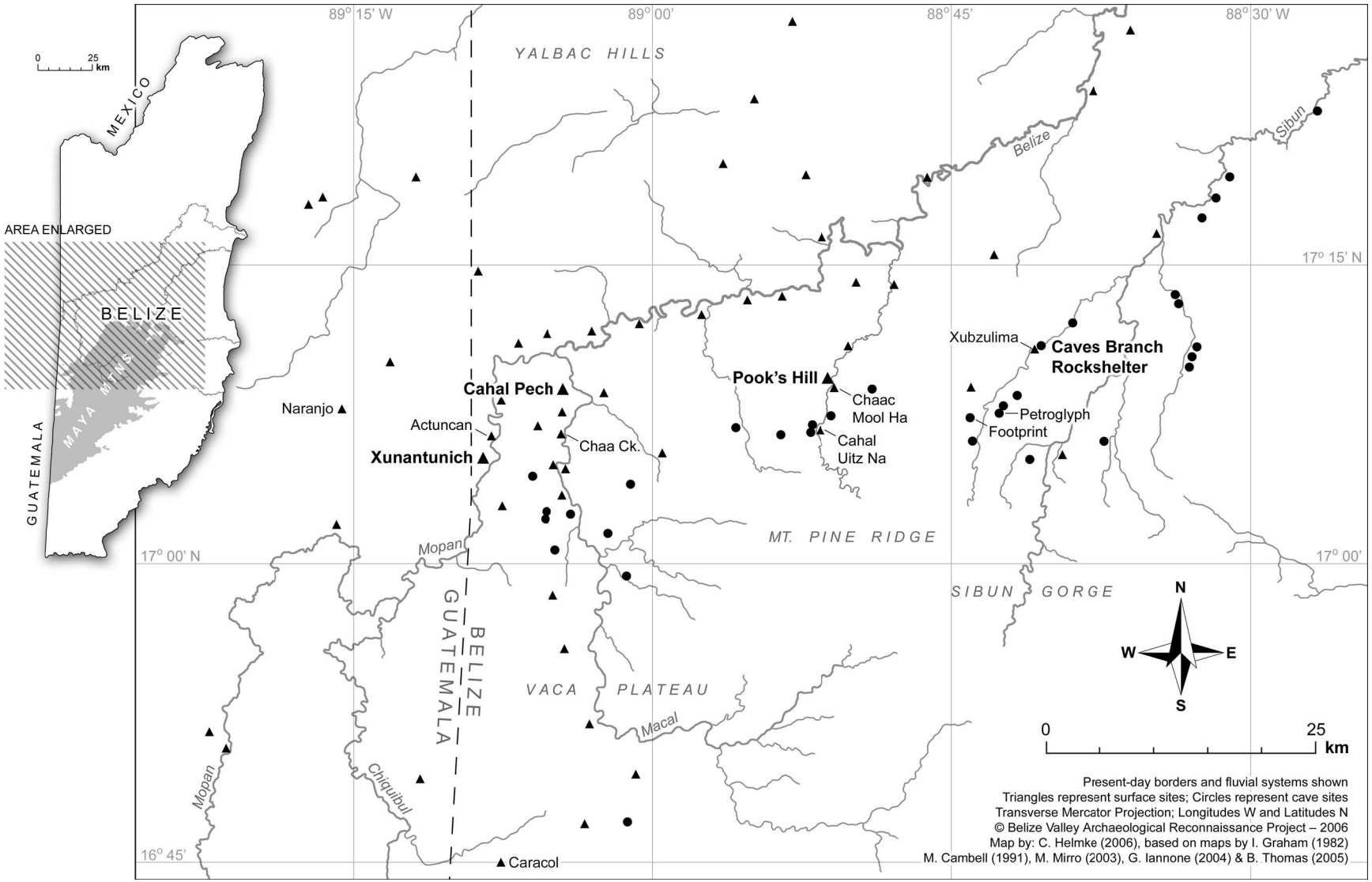
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# REVISITING CAVES BRANCH ROCKSHELTER: RESULTS OF THE 2005 EXCAVATIONS

**Gabriel D. Wrobel**
University of Mississippi

**James C. Tyler**
University of Arkansas

## INTRODUCTION

The site of Caves Branch Rockshelter (CBR) is located in the Caves Branch River Valley, Belize (Figure 1), which is known for a number of important cave sites including Petroglyph Cave (Reents 1980, 1981; Reents-Budet & MacLeod 1986), and Footprint Cave (Graham et al. 1980). Juan Luis Bonor, in collaboration with the then Department of Archaeology and the Belize Valley Archaeological Reconnaissance Project under the direction of Jaime Awe, carried out preliminary excavations of CBR during the 1994 and 1995 field seasons and surveyed other sites in the surrounding area. Using a previously developed cave typology (Bonor 1989:19-26), Bonor interpreted the data from these excavations and surveys, hypothesizing that different caves within a small geographic area served specialized functions in the various rituals carried out by a single Maya community. Bonor's primary goal during the excavations at the rockshelter was to collect data from the site, which evidenced looting. He placed eight excavation units in different sections of the rockshelter, exposing a total of 31 burials. Based on the concentration of the interments relative to the size of the rockshelter, he characterized the site as a 'cemetery' estimated to contain approximately 150 burials including individuals of all ages and sexes (Bonor & Glassman 1999).

Building upon Bonor's preliminary investigations at the site, and following Awe's (1998) research agenda for the Western Belize Regional Cave Project, the goals of the 2005 field season were:

1. to test Bonor's hypothesis that ritual activity at the site was limited to a single function: that of a domestic cemetery.

2. to determine the time span of ritual use of the Caves Branch Rockshelter.

3. to more accurately estimate the size and demographic distribution of the skeletal population.

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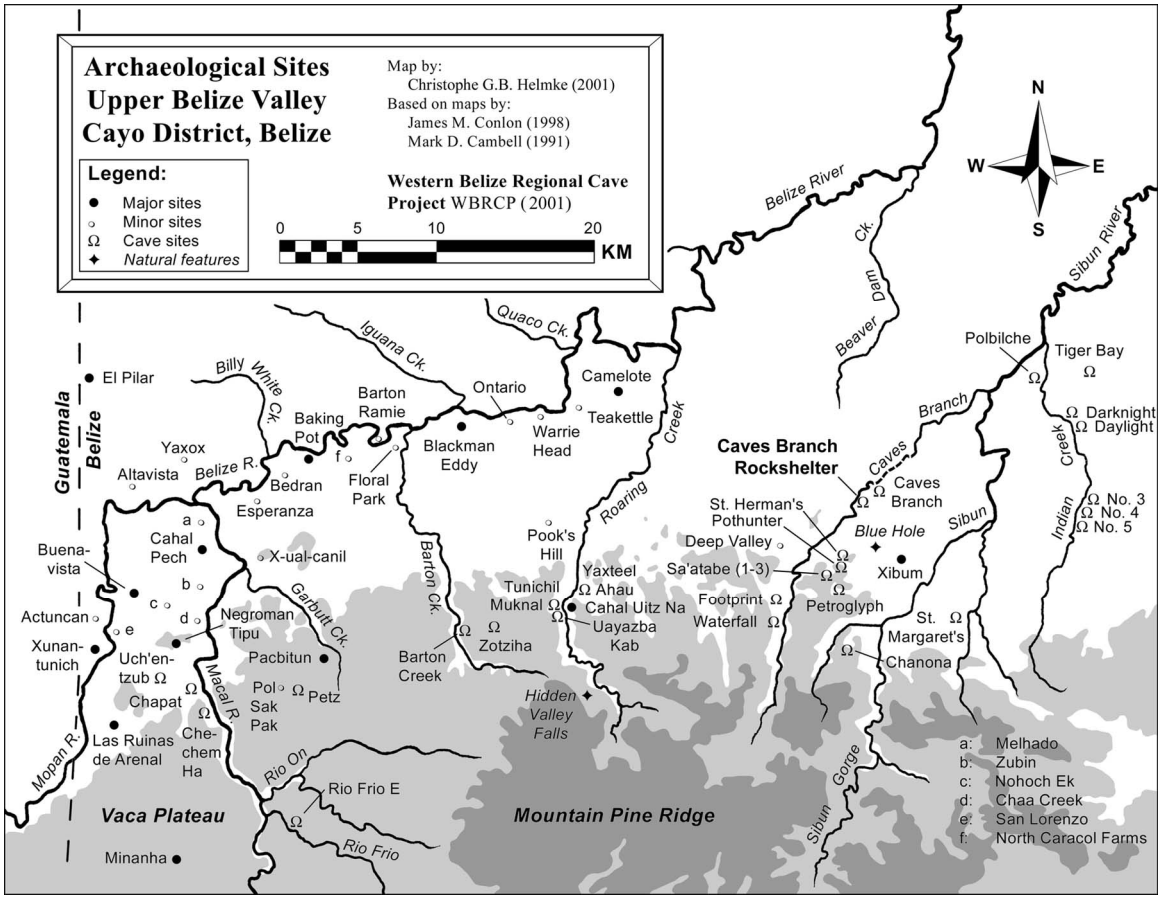


**Figure 1:** Map of the Upper Belize Valley showing the location of the Caves Branch Rockshelter relative to other ancient Maya archaeological sites. Light gray areas show elevations above 200 m and dark gray areas are elevations above 600 m in relation to mean sea level.

## EXCAVATION RESULTS

Based on an initial survey using a standard total station, the site was divided into a grid of 1 x 1 m units (Figure 2). Three excavation units were placed within the dripline, each beginning as 2 x 2 m operations that were expanded as burials were found that extended into adjoining units. The placement of the northern (Op. 1A) and southern (Op. 1C) excavation units was intended to test the horizontal extent of burials within the rockshelter, while the middle excavation unit (Op. 1B) was placed in front of a small cave-like recess in the area that Bonor reported as having the densest concentration of burials.

In general, the soils within each of the operations did not show clear or discrete stratigraphy. Cultural material consisting mostly of fragmentary human bone and freshwater *jute* shells were found in varying concentrations in almost all contexts, suggesting that the soil matrices have been consistently mixed by bioturbation and by human agency. Unfortunately, the result of these pervasive disturbances was that during excavation grave fill was indistinguishable from surrounding contexts, probably because

the site was used so extensively for burial that little of the original natural stratigraphy is still intact. In other words, the matrices have been extensively churned up by the frequent and repeated deposition of interments; thus for all intents and purposes the matrices can be broadly deemed as 'burial fill' throughout the rockshelter. The following section contains a description of each operation and the burial features found within them. Late in the season, as many of the burials were being exposed, a looter systematically dug around in each of the operations, focusing attention on the burials, presumably in the hopes that they held valuable grave goods.

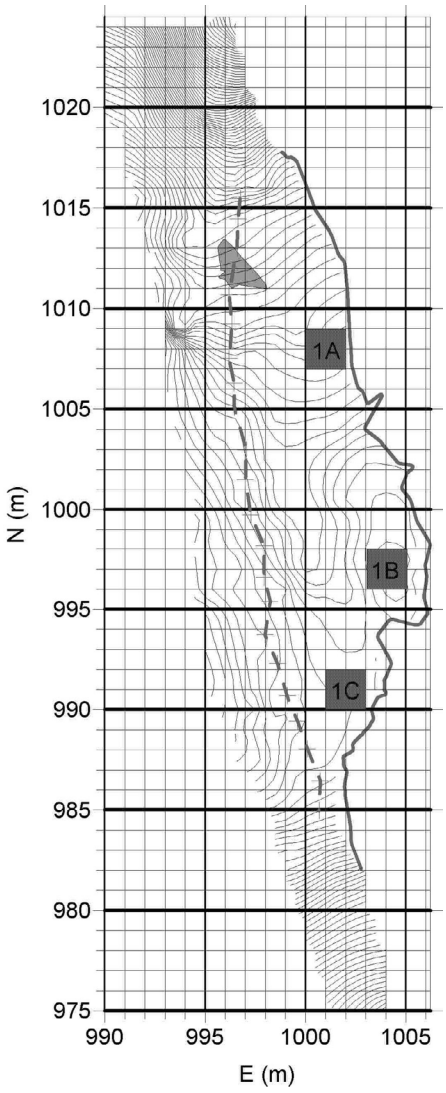


**Figure 2**: Map of Caves Branch Rockshelter excavation units in the 2005 season. Dotted line indicates dripline. Map by Bryan Haley (2005).

### Operation 1A

The surface in this northern area of the rockshelter sloped, likely as a result of erosion from the hillside north of the rockshelter's limits. The typically gray silty limestone soil matrix of the rockshelter had a slightly red tint in this northern portion –further evidence that soil washed in from another area. In addition, the upper levels of soil contained scattered pieces of human bone, which were believed to have been washed in with the soils originating north of Operation 1A, suggesting the presence of burials there. For this reason, it was hoped that the extra sediments would have protected cultural contexts in deeper levels.

Burial 35 (Level 3, Lot 50) was a pile of completely disarticulated bones, composed of several individuals, including (but not necessarily limited to) an infant and at least two adults, a young –middle aged female and an old adult. The sex of the younger adult was based on humerus size/robusticity, and the second adult is edentulous, suggesting old age. The formation processes responsible for this bone cluster involved erosion, though may have also involved stacking of the displaced bone and subsequent refilling of the washed out portion. This interpretation is based on the general scatter of bone in the area, thus it is obviously not a discrete secondary bundle reburial. However, the central cluster of bone does appear to be stacked and includes a complete vessel (Vessel #1). The washed out bones were perhaps collected and stacked with the vessel before the washed out area was refilled.

Burials 36a and 36b (Level 3, Lot 51) included both articulated and scattered bones. The general area around Excavation Unit 12F had scattered bone (Burial 36b) that

was likely associated with Burial 35, based on their proximity to one another. They are separated by an area in which there are very few bone fragments, though there is no clear break between the clusters. Among the scatter of Burial 36b is the articulated skeleton of a child (Burial 36a), whose age-at-death was approximately 5 years. Burial 36a was flexed on the left side heading south, and was associated with Vessel 2, which was found by the feet. A third ceramic container (Vessel 3) was also found associated with Burial 36b. These were wedged beneath a large rock in the north baulk of Excavation Unit 12F, and were broken and incomplete. It appears that Burial 36a was placed in an eroded area among the washed out bones of nearby disturbed burials, and then the area was refilled. Slightly east of Burial 36a, an articulated skull and mandible, and humerii of a child had been partially excavated at the time of the looting disturbance. This individual was being treated as part of Burial 36b but was likely a primary burial heading north. Following the disturbance, elements of this burial were collected along with other displaced skeletal elements from the operation as a separate 'salvage lot'.

Burial 38 (Level 4, Lot 76) was also disturbed by the looting prior to its full exposure, so there is no way of knowing how well-preserved or complete the burial was. It appeared to be a small adult heading west with the skull located beneath Burial 35. Burial 38 was partially disturbed, so it is possible that some of its elements were mixed with Burial 35. The burial also appears to have been associated with a partial vessel (Vessel #5).

Burial 42 (Level 4, Lot 79) was a well-preserved articulated foot found in Excavation Unit 13G on the last day of excavation while cleaning up around Burial 38. The body appears to be heading north, though its position is unknown. Future excavations will target this individual.

**Operation 1B**

The central area of the rockshelter, which is where Bonor focused the majority of his efforts, is associated with a small cave-like recess and is also the deepest portion of the rockshelter as measured from the dripline. Unfortunately, minor looting activity and subsequent erosion made the limits of the previous excavations impossible to determine, so much of our efforts were spent trying to distinguish *in situ* contexts from backfill, which also contained artifacts and bone.

Burials 15a and 15b (Lot 40, Level 3) were partially excavated by Bonor and were found beneath sheets of aluminum foil (that mark the end of Bonor's excavations). Burial 15a was reported by him as a 25-50 year old female. The rest of Burial 15a was uncovered and excavated. The individual was flexed on the left side and heading north. Burial 15b was headed south, with burial position unknown. Though not touched during the looting incident, the remains were very disturbed previously, so that only the vertebrae, ribs, and the base of the skull were present. An age estimate of 1-2 years was derived through the visual inspection of non-union of the neurocentral junction of the recovered vertebral neural arch fragment. Burials 15a and 15b do not seem to be contemporaneous. Both heads are missing as a result of disturbances from successive burials in the same area.

Burial 32 (Lot 25, Level 3) was found in the south baulk of Excavation Unit 24J, and the unit was expanded enough to uncover the entire individual. Burial 32 is another

infant (approximately 1 year) found beneath a sheet of aluminum foil, though Bonor's report makes no mention of this individual. The placement of the bones suggests that the individual was placed in a conical pit, since parts of the skull had slid towards the center of the body, which was lower than the legs and *in situ* skull. In addition, the legs had been disturbed and most elements were not found.

Burial 34 (Lot 45, Level 3) was also discovered by Bonor, though not mentioned in the field report. The well-preserved arm of this adult was covered with aluminum foil. The operation was expanded west into Excavation Unit 24H to recover the rest of the individual. When excavating through Excavation Unit 24H, numerous scattered bones were discovered in the first level to exhibit possible looting disturbance or commingling brought about by successive interment of individuals in this area. Beneath this was Burial 37, described below. The arm of the individual was eventually disturbed during the looting incident, and is likely among the bones recovered from the salvage lot recovered after the looting. It is unknown how much of the rest of the individual was disturbed.

Burial 37 (Lot 75, Level 3) consisted of a skull and includes Vessel 4. These appeared slightly higher than the level of Burial 34, so was considered to be a separate individual. Excavation had uncovered two skulls and Vessel 4, all of which were removed and scattered during the looting event, so their relationship to one another and to any other bones in the unit are unknown. The skeletal elements were likely collected as part of the salvage lot.

Burial 39 (Lot 43, Level 3) was a very poorly preserved adult individual. Articulated elements included cervical and thoracic vertebrae and ribs. Displaced long bone and cranial fragments that likely belonged to B39 were associated with the articulated bones. Unfortunately, Burial 39 was completely displaced during the looting incident. Many of the elements were still recognizable, however, and were collected as "Burial 39," though much of this burial was likely collected in the general salvage lot.

Burial 40 (Lot 54, Level 3) was assigned to a collection of scattered bone fragments around the partial skull of a subadult. There appeared to be at least two or three different individuals represented, so it is likely that this was not a primary interment, but instead a disturbed context. This was another context that was displaced during the looting incident before it was excavated enough to be interpreted.

Burial 43 (Lot 82, Level 3) was a partially articulated infant, which appears to have been disturbed by Burial 44. No teeth were recovered, but size of the long bones suggests that the individual was approximately the same age as the other infants in nearby contexts, approximately 1 year.

Burial 44 (Lot 53, Level 3) consisted of an area of articulated ribs and vertebrae, as well as some associated scattered elements. The size of the bones and the relative lack of attrition on several teeth suggest that the individual was a fairly young adult.

### Operation 1C

The southernmost excavation, Operation 1C, was placed on a flat surface within the dripline. Despite its relative proximity to the central burial focus around Operation 1B, there was relatively little cultural material, and only two burials were exposed. The soil in this area was very silty, and exhibited layers of gravel.

Burial 33 (Level 3, Lot 41) was small collection of disarticulated bone fragments associated with a few ceramic sherds. This burial was relatively shallow and was hard to define since the contexts around it were also dense with scattered bone, suggesting there may have been primary interments in this area that were disturbed.

Burial 41 (Level 6, Lot 780) was an adult discovered in the southeastern corner of Excavation Unit 30H, and only the right leg was visible, while the rest of the body was outside the limits of the excavation. The right leg was well-preserved and appears to be articulated, with the knee tightly flexed, suggesting a prone body position. The leg was left *in situ* for future excavation of the entire individual.

**Material Culture**

Material culture recovered from the excavations was consistent with Bonor's interpretation that a small rural farming community used the site. The several ceramic vessels found with burials were styled simply and the scattered sherds from disturbed contexts also were from plain, utilitarian vessels. No polychrome sherds were found, that otherwise may be indicative of more affluent social segments. The vessels found associated with the burials were all identified as Soccutz Striated (Christophe Helmke, pers. comm. 2005), designated by Gifford (1976) as belonging to the Hermitage Complex (i.e. the Early Classic, dated to c. AD 300-600). These types of vessels are commonly found in central Belize, including from nearby Petroglyph Cave (Reents & MacLeod 1986). They are always small, heavily-striated, thick and coarse, and may have served as cooking pots. Other artifacts from the general matrix of Caves Branch Rockshelter included a small Postclassic arrow point (Figure 3a), modeled and carved ceramic netsinkers (also known as 'netweights'; Figure 3b), and a carved faunal bone *adorno* or inlay (Figure 3c). Faunal remains included a variety of common local animals, such as

**Figure 3a**: Arrow point found in Operation 1B.

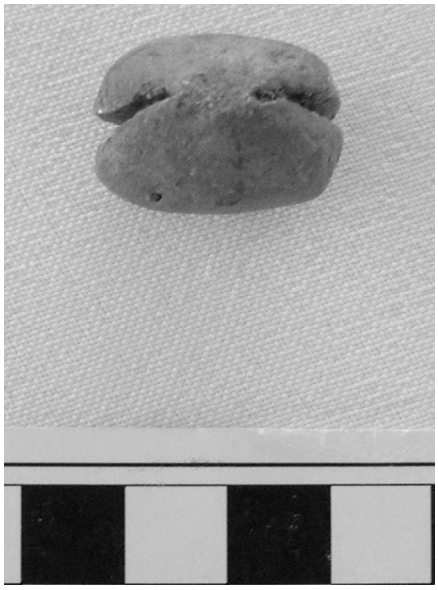

**Figure 3b**: Molded netsinker found in Operation 1B.

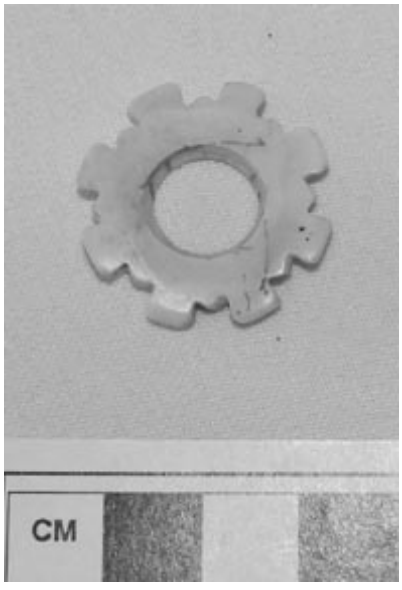


**Figure 3c**: Carved bone bead found in Operation 1B.

peccary, armadillo, and deer (Norbert Stanchly, pers. comm. 2005). There is no evidence of the types of exotic animals, such as felines, or ones imported from the coast or other inland areas, that are often associated with ritual urban contexts.

## DISCUSSION AND CONCLUSIONS

The excavations at CBR during the 2005 field season were relatively brief, and the extensive disturbances by the looters further curtailed the extent of the excavations and the analysis of the recovered data. However, a clearer picture of the site has emerged as a result of the expansion of previous excavations.

First, the data seem to support Bonor's assessment of the site as a domestic cemetery. Material culture from the site is all utilitarian, including even the grave furnishings that were limited to the occasional inclusion of a small cooking vessel, which might have contained food at the time of interment (Christophe Helmke, pers. comm. 2006). Bonor (2002) reported the presence of polychrome ceramic sherds, though none were recovered during the 2005 excavations. In addition, Glassman and Bonor (2005) reported Burial 11 as having hematite inlays in anterior maxillary teeth, a trait often assumed to be an indication of high status. In a recent study, however, Tiesler (2001) found that burials with dental decoration were not consistently associated with other indicators of social status.

Second, the analysis of ceramic material from previous excavations of the rockshelter dated the site's use from the Middle Preclassic through the Early Postclassic period (Glassman & Bonor 2005). However, the site's use as a cemetery appears to be more limited. The ceramic material from the 2005 excavations seems to be restricted primarily to undiagnostic utilitarian wares, though also includes the five cooking vessels found with burials, all of which were dated to the Early Classic. Bonor (2002) reports one burial (Burial 26) that contained a Late Preclassic Red Sierra dish with a black cross on its bottom, belonging to the Barton Creek complex (350 BC-AD 300). Burials at CBR show extensive overlap in which later graves disturbed earlier ones. This suggests that the burial sequence at CBR occurred over at least a few generations, i.e., long enough for individuals to completely decompose and then their location to be forgotten. However, even when considering only the diagnostic grave goods found *in situ*, there is evidence that the cemetery was in use during parts of two consecutive ceramic complexes spanning 1000 years. While the taphonomic influences on the disturbed bone is complicated by these and other disturbances, such as flooding, animal burrowing, and recent looting, the fairly consistent state of preservation of the remains also supports the hypothesis that the burials do not occur throughout the entire period of the site's ceramic sequence. The presence of an arrowhead, which only appears in this region beginning in the Early Postclassic, suggests that in the site's later phases it may have been used as a temporary hunting camp (Christophe Helmke pers. comm. 2006). The time depth of the cemetery is important to determine for the analysis and interpretation of the skeletal population found there.

Finally, the 2005 excavations located 14 burials, many with multiple individuals represented, as well as scattered bones from dozens of other individuals. Unfortunately, a single disturbance by looters late in the season occurred while many of these were in the

process of being excavated, thus limiting the data collected and the types of possible lab analyses. However, these data clearly support Bonor and Glassman's assessment that the cemetery contained individuals of both sexes and all ages. The new burial data from CBR also shows that burial treatment was more diverse than found by Bonor. More individuals were found to have grave goods, and both the positions and headings of the bodies also varied.

A central research objective of the CBR project involves the collection and analysis of the relatively large skeletal population interred there. From a bioanthropological perspective, the Caves Branch Rockshelter skeletal population is unique because of its relatively large size and its early date, as well as the possibility that it is an actual mortality sample from a discrete population. This final point is important because it will aid in addressing major methodological problems in Maya bioarchaeology. While many Maya urban centers were occupied by tens of thousands of people for over a millennium, biological descriptions of their populations are based on a small number of skeletons, i.e., less than 300 (see for example Robin 1989; White 1988, 1999; Whittington 1991; Whittington & Reed 1997). In addition, to the problem of small sample sizes, some have argued that analyses based on these skeletons are misleading since these individuals simply are not representative of the general population (Wrobel 2004; Wrobel et al. 2002). Archaeological investigation tends to focus on large architecture, since this is visible and is likely to reveal more impressive material culture. For this reason, Maya archaeology has been criticized as urban- and elite-focused (Pyburn 1997), limiting mortuary samples to the urban elite and upper middle classes. Furthermore, the demographics of these skeletal samples show that access to these burial locations was often restricted by age and sex biases, making them even less representative of the general populace. Providing bioanthropological data based on demographically complete skeletal populations (see Wood et al. 1992), rather than just on culturally-biased mortuary samples, will help expand Maya bioanthropology from a field that often is necessarily limited to analyses based on individuals (Saul & Saul 1989) to one that can accommodate studies designed to evaluate the health, diet and population structure of ancient groups (Storey & Hirth 1997; Wright & Chew 1999; Wright & Yoder 2003). Unfortunately, research on these types of sites is almost non-existent because of the dearth of material culture and the lack of input from bioanthropologists in determining archaeological research designs (Webster 1997). Future work at CBR will focus on these issues.

**References Cited:**


Awe, Jaime J.
1998 "Western Belize Regional Cave Project: Objectives, Context, and Problem Orientation." *The Western Belize Regional Cave Project, A Report of the 1997 Field Season*, edited by Jaime J. Awe, pp. 1-22. Department of Anthropology, Occasional Paper No.1, University of New Hampshire, Durham.

Bonor, Juan Luis
1989 "Caves Branch Caves: Archaeological Field Report." Research Report submitted to the Foundation for the Advancement of Mesoamerican Studies, Crystal River.

Bonor Villarejo, Juan Luis, and David M. Glassman
1999 La arqueología y el estudio de los restos humanos en Caves Branch Rock Shelter,

Distrito de El Cayo, Belice. *Mayab*, No. 12: 18-30.

Gifford, James C.
1976 *Prehistoric Pottery analysis and the Ceramics of Baron Ramie in the Belize Valley*. Memoirs of the Peabody Museum of Archaeology and Ethnology, Vol. 18. Harvard University, Cambridge.

Glassman, David M. and Juan Luis Bonor Villarejo
2005 Mortuary Practices of the Prehistoric Maya from Caves Branch Rock Shelter, Belize. *Stone Houses and Earth Lords: Maya Religion in the Cave Context*, edited by Keith M. Prufer and James E. Brady, pp. 285-296. University Press of Colorado, Boulder.

Graham, Elizabeth, Logan McNatt, and Mark A. Gutchen
1980 Excavations at Footprint Cave, Caves Branch, Belize. *Journal of Field Archaeology*, Vol. 7(2): 153-172.

Pyburn, K. Anne
1997 The Archaeological Signature of Complexity in the Maya Lowlands. *The Archaeology of City-States: Cross Cultural Approaches*, edited by Deborah L. Nichols and Thomas H. Charleton, pp. 155-168. Smithsonian Institution Press, Washington, DC.

Reents, Dorie J.
1981 "The 1978 Caves Branch Cave Archaeological Project: Ceramic Analysis." Report on file at the Institute of Archaeology, Belmopan.
1980 The Prehistoric Pottery from Petroglyph Cave, Caves Branch Valley, El Cayo District, Belize, Central America. Unpublished MA thesis, Department of Anthropology, University of Texas, Austin.

Reents-Budet, Dorie and Barbara MacLeod
1986 "The Archaeology of Petroglyph Cave, Belize." Report on file at the Institute of Archaeology, Belmopan.

Robin, Cynthia
1989 *Preclassic Burials at Cuello, Belize*. BAR International Series 480. British Archaeological Reports, Oxford.

Saul, Frank P. and Julie M. Saul
1989 Osteobiography: A Maya Example. *Reconstruction of Life from the Skeleton*, edited by Mehmet Y. Iscan and Kenneth A.R. Kennedy, pp. 287-302. Alan R. Liss, New York.

Storey, Rebecca and Kenneth Hirth
1997 Archaeological and Paleodemographic Analyses of the El Cajón Skeletal Population. *Integrating Archaeological Demography: Multidisciplinary Approaches to Prehistoric Population*, edited by Richard R. Paine, pp. 131-149. Center for Archaeological Investigations, Carbondale.

Tiesler Blos, Vera
2001 *Decoraciones dentales entre los Antiguos Mayas*. Ediciones Euroamericanas, INAH, México, DF.

White, Christine D.
1988 The Ancient Maya from Lamanai, Belize: Diet and Health Over 2,000 Years. *Canadian Review of Physical Anthropology*, Vol. 6(2): 1-21.

White, Christine D. (ed.)
1999 *Reconstructing Ancient Maya Diet*. University of Utah Press, Salt Lake City.

Whittington, Stephen L.
1991 Detection of Significant Demographic Differences between Subpopulations of Prehispanic Maya from Copan, Honduras, by Survival Analysis. *American Journal of Physical Anthropology*, Vol. 85: 167-184.

Whittington, Stephen L. and David M. Reed (eds.)
1997 *Bones of the Maya: Studies of Ancient Skeletons*. Smithsonian Institution Press, Washington, DC.

Wood, James W., George R. Milner, Henry C. Harpending, and Kenneth M. Weiss
1992 The Osteological Paradox: Problems of Inferring Prehistoric Health from Skeletal Samples. *Current Anthropology*, Vol. 33(4): 343-370.

Webster, David
1997 Studying Maya Burials. *Bones of the Maya: Studies of Ancient Skeletons*, edited

by Stephen L. Whittington and David M. Reed, pp. 3-12. Smithsonian Institution Press, Washington, DC.

Wright, Lori E. and Francisco Chew
1999 Porotic Hyperostosis and Palaeo-epidemiology: A Forensic Perspective on Anaemia among Ancient Maya. *American Anthropologist*, Vol. 100(4): 924-939.

Wright, Lori E. and Cassidy J. Yoder
2003 Recent Progress in Bioarchaeology: Approaches to the Osteological Paradox, *Journal of Archaeological Research*, Vol. 11(1): 43-70.

Wrobel, Gabriel D.
2004 *Metric and Nonmetric Dental Variation among the Ancient Maya of Northern Belize*. Unpublished PhD dissertation, Department of Anthropology, Indiana University, Bloomington.

Wrobel, Gabriel D., Marie E. Danforth, and Carl Armstrong
2002 Estimating Sex of Maya Skeletons by Discriminant Function Analysis of Long Bone Measurements from the Protohistoric Maya Site of Tipu, Belize. *Ancient Mesoamerica*, Vol. 13(2): 255-263.

# AN ASSESSMENT OF GEOPHYSICAL TECHNIQUES AT THREE SITES IN CENTRAL BELIZE

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## INTRODUCTION

A series of geophysical surveys were conducted at several Maya sites in Central Belize in the summer of 2005 to evaluate the utility of these geophysical techniques on a variety of targets and archaeological contexts in the region. Although geophysical techniques have become a regular component of archaeological research in many regions, their application in Mesoamerica is less frequent, especially given the richness of the archaeological resources there. The goal of the research was to provide comparative data that would further the understanding of geophysical techniques in specific geological, environmental, and archaeological settings, resulting in a more complete integration of the techniques into archaeological research designs in the Maya region. Three of the most common geophysical methods used in archaeological research, electrical resistance, magnetic gradiometry, and ground penetrating radar (GPR), were employed at the Caves Branch Rockshelter, the *plazuela* of Xubzulima, and the *plazuela* of Pook's Hill. Preliminary results reveal that the stratigraphic complexity caused by repeated, long-term use of the sites and the presence of shallow bedrock make the interpretation stage for the collected geophysical data difficult. However, several anomalies of possible ancient cultural origin were delineated in the surveys. Additional excavation must be performed to fully understand these anomalies and their relationship to the geophysical data.

## THEORETICAL INTRODUCTION

### Electrical Resistance

Electrical resistance instruments measure how readily current flows through the soil. The goal of a resistance survey is to map the distribution of subsurface differences in resistivity by taking readings from the surface (Loke 2000:1). Generally the resistance distribution is closely related to the amount of moisture contained in the subsurface material (Clark 1996:27; Weymouth 1986:319). Clayey soils will usually have lower resistivity values than coarser-grained soils because they retain more moisture after precipitation. Rocks will usually have even higher resistance values than sands because they are more moisture-resistant than most soils, although this depends on the porosity of the rock (Clark 1996:27). Relative salinity also affects electrical current flow by lowering the resistance of the soil or material (Loke 2000:4).

*The Belize Valley Archaeological Reconnaissance Project: A Report of the 2005 Field Season.* Edited by Christophe G.B. Helmke and Jaime J. Awe, pp. 11-38. Belize Institute of Archaeology, National Institute of Culture and History, Belmopan. 

Electrical resistance instruments operate by introducing a known quantity of current (I) into the soil through an electrode. The resultant voltage (V) is measured at potential electrodes (Loke 2000:1). Using Ohm's Law, or $\mathbf{V = I \times R}$, the resistance (R) can be easily calculated in Ohms. From the measured resistance values (R), an estimate of the electrical resistivity ($\rho_a$) can be calculated if needed by $\rho_a = \mathbf{k} \times \mathbf{R}$, where **k** is a geometric factor related to probe geometry (Loke 2000:1). Conversion to resistivity allows the values to be compared to other surveys. Resistivity ranges from 5 for wet clays to 10,000 for some sandy or gravely soils (Bevan 1998:8).

One characteristic of the resistance technique that is beneficial for archaeological survey is the depth of the anomaly can be determined by the electrode configuration (Weymouth 1986:326). In simple terms, the separation of the electrodes is directly proportional to the depth of maximum sensitivity. Electrical profiling, or constant separation traversing (CST), surveys measure the resistance value using a fixed probe separation along the horizontal plane of the ground (Reynolds 1997:446). Therefore, a plan map is created that represents resistance anomalies at a single, fixed ground depth. Because targets can be visible as anomalies in plan view resistance imagery, it is not essential to convert the readings to resistivity.

A typical resistance system is composed of electrodes, a battery, a meter, and a data logger. Although, in theory, all that is necessary to measure the ground resistance is a current and a potential electrode, a two electrode arrangement is impossible due to the contact resistance that is found around current electrodes (Aitken 1961:61; Bevan 1998:12). Therefore, electrical resistance instruments use a minimum of four electrodes that are designed to penetrate the ground enough to allow the current to propagate from the current probes and be sampled by potential probes. The four electrodes may be arranged in many different configurations in order to perform a geophysical survey.

The most commonly used setup in archaeological applications is the Twin array, which is particularly-suited for revealing narrow features and has good depth penetration (Clark 1996:44). For the Twin arrangement, one set of current and potential electrodes are mobile, while another set is fixed, separated by a small distance, and is placed a considerable distance from the mobile electrodes.

Electrical resistance surveys can be easier to perform and give acceptable results in a wider range of sites than many other geophysical survey techniques (Bevan 1998:7). Although extended periods of rain or drought may adversely affect resistance surveys, the instrument is not subject to interference by metal targets such as fences, overhead power lines, and cars. Archaeological features that may be detectable with resistivity survey include ditches, buried walls, foundations, tombs, voids, compacted floors, humus zones, daub concentrations, mound stratigraphy, and shell deposits (Aitken 1961:71; Geoscan Research 1996:6-8; Thompson et al. 2002; Weymouth 1986:321).

Interpretation of resistance imagery begins with the identification of high and low amplitude anomalies, which alone can yield information about the ground target. For example, a low resistance anomaly, if the shape is appropriate, may be a pit, which typically trap moisture and create a low amplitude anomaly. Conversely, a stone wall or foundation would usually produce a high amplitude anomaly. As with any geophysical survey technique, archaeological targets may only be detected if they contrast with background readings. The size and shape of resistance anomalies are relatively accurate for archaeological targets.

A Geoscan Research RM-15 instrument with a MPX-15 multiplexor was used in this research. The RM-15 is a British instrument designed specifically for archaeological research. The multiplexor is a data control unit that allows up to six readings at each station using differing electrode separations, differing array types, or increased reading density using the same electrode separation. For this research, a probe separation of 0.5 m was used.

**Magnetic Gradient**

Magnetometers are passive instruments that measure the magnetic field strength at a specific location on the surface of the Earth. The most common unit of measure is the nanoTesla (nT). The Earth's magnetic field varies depending on location relative to the earth's equator, ranging from 25,000 nT to 75,000 nT and can be visualized as a large bar magnet that is tilted 11 degrees from the axis of rotation (Heimmer & Devore 1995:12). Over a small area and in homogeneous soils, the magnetic field is expected to be uniform (Weymouth 1986:341). An archaeological target can be detected with magnetic survey as a deviation from this background field reading. The resultant anomaly often has a dipolar form aligned with the dip and direction of the Earth's field.

The magnetic signal of a target is composed of two parameters: induced and remnant magnetism (Reynolds 1997:122). Magnetometers measure the remnant magnetism of a target, which is permanent and may be caused by the presence of highly magnetic rock compounds or thermal alterations to soils which have high iron content (Heimmer & Devore 1995:12). Magnetization caused by thermal alteration is called thermoremanence and it occurs at maximum expression at temperatures above 675 degrees Celsius, but there is some effect at any elevated temperature (Aitken 1961:19). Electrons are demagnetized when temperatures are elevated and become aligned to the Earth's field as the temperature lowers (Clark 1996:64-65).

Induced magnetism is only visible in the presence of magnetizing field. However, the Earth serves as a constant magnetizing agent and, as a result, it can be sensed by a magnetometer. The induced magnetism is generally referred to as magnetic susceptibility. Magnetic susceptibility is greater in the topsoil and soils that are organically rich, but often produces relatively subtle anomalies (Clark 1996:65-66). Therefore, human activities that rearrange the topsoil are sometimes evident in magnetic surveys.

Magnetic anomalies produced by archaeological targets are often much weaker than signals produced by many other sources and are usually between 1 nT and 100 nT (Aitken 1961:2). Archaeological objects that may produce magnetic anomalies include fireplaces, furnaces, burnt clay floors, hearths, kilns, daub, bricks, and walls composed of magnetically-anomalous rocks such as basalt (Aitken 1961:3; Hasek 1999:7). Pits and ditches may be also visible if materials of differing magnetic susceptibility are contained in the fill (Aitken 1961:28). Other magnetically-visible targets are materials containing ferrous or iron oxides (Aitken 1961:35). Archaeological targets such as historic nails can sometimes be mapped using magnetometers. However, more recent ferrous objects, such as metal datum markers, power lines, cars, buried pipes, and surface trash, can easily obscure archaeological targets (Heimmer & DeVore 1995:12).

There are several types of magnetometers in use and each has advantages and disadvantages. One type of magnetometer commonly used in archaeological research is the fluxgate. These instruments are composed of two parallel cores made of materials with strong magnetic properties, primary coils wound in opposing directions, and opposing secondary coils (Reynolds 1997:142). The magnetic field is measured by determining the difference between the primary and secondary coils (Reynolds 1997:142). Some advantages to the use of fluxgate instruments are their relative insensitivity to steep magnetic gradients and their speed of acquisition is better (Reynolds 1997:142). Fluxgate instruments have become the workhorse for archaeological geophysical survey in Britain and the United States (Clark 1996:68).

The other major issue related to instrumentation is the number of sensor heads used. Gradiometers use two vertically-aligned sensor heads that can measure either the vertical and horizontal components of the magnetic field (Hasek 1999:8). The primary advantage of a gradiometer system is that no correction for diurnal drift is necessary (Bevan 1998:19; Reynolds 1997:148). In addition, they are much less affected by nearby objects with steep magnetic gradients, such as large masses iron (Bevan 1998:19). Also, gradiometers tend to emphasize shallow anomalies, a benefit for archaeological survey. One disadvantage is that the accuracy is dependent on a consistent orientation of the sensors (Bevan 1998:19; Hasek 1999:8).

Interpretation of magnetic imagery begins by identifying anomalies, which may have strong high or low amplitude values (Bevan 1998:23). Next, metal objects can be identified from the shape and amplitude. Anomalies with strong, narrowly-spaced dipoles or strong monopoles are usually produced by ferrous metal objects. If targets are relatively large, the shape may be approximated in the magnetic imagery (Bevan 1998:26). For example, the shape and location of pre-European houses can often be accurately ascertained. Little information about the depth of a target is obtained with magnetic survey. There is, however, a practical limit to the depth that can be sensed with magnetic instruments because the signal falls with $1/D^3$ for a dipolar target or $1/D^2$ for a monopolar target (Breinner 1973:20).

A Geoscan Research FM-36 fluxgate gradiometer was used in this research. The FM-36 is a British instrument designed specifically for use in archaeological applications. Readings are acquired automatically with a metronome controlled sample trigger at a fixed time interval.

### Ground-Penetrating Radar

Ground-penetrating radar (GPR) operates by sending out an electromagnetic wave pulse into the ground that reflects off materials with contrasting electrical properties (Conyers & Goodman 1997:23; Weymouth 1986:371). This is related primarily to the electrical conductivity and magnetic permeability of the materials (Conyers & Goodman 1997:32). Relative dielectric permittivity (RDP), the ability of a material to store and pass a magnetic field, is the accepted property used to describe the materials. RDP (**K**) ranges from 1 for air to 81 for water and is expressed by $\mathbf{K = c^2 / V^2}$, where **c** is the speed of light and **V** is the velocity of the wave (Conyers & Goodman 1997:33; Reynolds 1997:689). For soils, the RDP ranges from 3 for the driest sand to 40 for saturated clay. The strength of the reflection is proportional to the difference in RDP of the two materials

and relies on an abrupt change between the materials (Conyers & Goodman 1997:34; Geophysical Survey Systems Inc. 1999:36). A contrast in RDP as small as 1 can cause a reflection in some cases (Geophysical Survey Systems Inc. 1999:31).

The travel time of the radar reflection is recorded in GPR surveys and this can be related to the depth of the target. When a radar wave is bounced off a subsurface reflector, the total travel time is recorded in nanoseconds (ns). This time is directly proportional to the depth of that target. Therefore, if the RDP is known for the medium, the depth can be found. RDP is difficult to determine accurately in the field, but can be estimated by several methods (Conyers & Goodman 1997:32; Geophysical Survey Systems Inc. 1999:79). One commonly-used technique is geometric scaling in which a curve is fit to the properties of hyperbolic reflections in the data generated by strong reflectors. Because of the geometry of reflectance as the antenna passes over a target, the reflection will be expressed as a hyperbola and the width of that hyperbola is determined by the RDP of the soil (Geophysical Survey Systems Inc. 1999:83).

An interface is visible if the electrical properties of two substances contrast enough to produce a reflection. The magnitude of the reflection depends on the amount of contrast in the RDP of the materials at an interface. This characteristic of GPR can contribute substantially to the study of stratigraphy. For example, a sand layer overlying a packed clay floor, a buried stone wall, or an air-filled cavity will be likely produce a measurable reflection.

GPR antennas are available in various center frequencies, usually between 100 MHz and 1500 MHz, which are related to the optimum depth of propagation and the resolution of the signal (Geophysical Survey Systems Inc. 1999:51). In general, lower frequency antennas propagate energy to greater depths. However, the vertical resolution also decreases (Geophysical Survey Systems Inc. 1999:56). For example, low frequency antennas can penetrate as far as 50 meters in ideal circumstances. In contrast, a 1000 MHz antenna may only penetrate to 50 centimeters, but can resolve features to a thickness of a centimeter (Geophysical Survey Systems Inc. 1999:52). A 400 MHz antenna is often used in archaeological applications because of the intermediate depth abilities. For all frequencies of antennae, a cone of energy is sent out that is roughly 90 degrees from front to back and 60 degrees from side to side (Geophysical Survey Systems Inc. 1999:45).

Limitations in GPR are related to the mechanics of sending electromagnetic energy through materials with high RDP values, such as clayey soil (Reynolds 1997:688). Such soils cause the electromagnetic energy to attenuate at shallower depths as a result of the dispersion of the energy (Conyers & Goodman 1997:55). Attenuation causes the resultant data to be blurry when viewed and returns from even strong reflectors can be obscured. Wetter soils, often including clays, and high salinity materials are therefore not ideal conditions for GPR survey. Dry sand, however, can often produce dramatic results.

GPR has been used to detect a number of archaeological features including pits, trenches, hearths, stone foundations, kilns, buried living surfaces, metal objects, voids, burials, tombs, and tunnels (Conyers & Goodman 1997:23, 197-200). Archaeological features that are unlikely to be detected using GPR include very thin stratigraphic layers, features within a rock-lined burial, small clay or stone artifacts, and any feature below a wet clay layer (Conyers & Goodman 1997:197-200).

The data processing that is necessary in order that GPR data be used to its maximum potential by archaeologists is more involved than any of the other geophysical methods. Analysis begins by locating targets in the radar profiles, estimating the average RDP, and estimating the depth to targets. In the radar profiles, the amplitude of a reflection is positive if a high RDP medium is encountered below a lower RDP medium and negative when the reverse occurs. A strong narrow reflector will often produce an anomaly alternating between signs in a hyperbolic shape. Further processing is somewhat complex and includes creating plannimetric amplitude slice maps and three dimensional data cubes. Usually, the amplitudes are squared so that strong positive or negative anomalies appear the same.

A Geophysical Survey Systems Inc. (GSSI) SIR2000 with a 400 MHz antenna was used in this research. Although designed for a broad range of applications, GSSI radar systems are regularly used in archaeological research in North America and elsewhere. The SIR2000 system includes a control unit built from a laptop computer, with 2.1 GB of storage, and a battery pack that are worn on a harness (Geophysical Survey Systems Inc. 1999:5). Vertical profiles are displayed in real time on the screen. Distance marks are inserted using a trigger located on the handle of the antenna.

## RESULTS

### Caves Branch Rockshelter

Caves Branch Rockshelter (CBR) contains a Maya burial ground that, according to previous research, was in use from the Middle Preclassic to Postclassic periods (Glassman & Bonor Villarejo 2005:4). The site was the primary focus of the 2005 bioarchaeology field school under the direction of Gabriel Wrobel of the University of Mississippi as part of the Belize Valley Archaeological Reconnaissance (BVAR) project headed by Jaime Awe. The site was surveyed with electrical resistance, ground-penetrating radar, and magnetic gradient techniques. The goal of the survey was to determine if geophysical methods could be used to delineate burials in the cemetery.

Although no examples of geophysical survey on Maya cemetery targets was found in the literature, Bruce Bevan (1991) presented the seminal work on the performance of various geophysical techniques on burial targets in North America, examining a variety of cemeteries in North America with GPR, electrical conductivity (the theoretical reciprocal of electrical resistivity), and magnetic gradient methods. Although some burials in this study contained substantial burial structures such as metal caskets, Bevan also produced some positive results on older, low-contrast burials where metal caskets were not present. An essential ingredient for the success in this setting is a significant contrast between the shaft fill and the surrounding soil matrix. One hazard that Bevan encountered, especially with GPR, was the difficulty in differentiating burials from natural phenomena, such as stones. Because of this, results were sometimes inconsistent; known burials were missed while others located nearby were successfully detected.

The University of Mississippi Center for Archaeological Research has performed comparative geophysical surveys on various types of cemeteries since 2001 (Johnson &

Haley 2005). The findings confirm that one of the most important factors in the performance of geophysical techniques is the type of burial, which may vary greatly in their physical properties. Earthen burials are the most challenging target to detect with geophysical methods since they are typically low contrast features. Nevertheless, these techniques were able to delineate Civil War era graves at the University of Mississippi Confederate Cemetery (Haley et al. 2002; Johnson & Haley 2005) and at the Strawberry Plains African American Cemetery (Johnson & Haley 2004, 2005). In the former case, magnetic gradient, electrical resistance, and GPR all produced data that contained discernible and distinct anomalies resulting from several hundred unmarked burials in the cemetery. In the latter case, only magnetic gradient survey produced discernible burial anomalies.

In preparation for the CBR geophysical survey, a Leica TCR307 total station was used to set up an arbitrary grid in meters to be used for both the geophysical survey and excavations (Figure 1a). The grid orientation was chosen to best parallel the layout of the rockshelter. The survey area is bounded on the east by the rock face and, in some cases, small passages that continue into the rock face. Reference markers were placed on the rock face so that the grid could be reestablished. In addition, topographic information was recorded so that the impact of elevation changes on the geophysical data could be considered.

Several physical characteristics of CBR make it difficult for the successful application of geophysical survey techniques. Besides the typical low-contrast nature of prehistoric burials, the burials at are "fragmentary, disarticulated, and commingled", probably resulting from the disturbance of later burials at the site (Glassman & Bonor Villarejo 2005:4). Unlike most previous successful applications, the conjoined nature of these burials may reduce the contrast between feature and surrounding soil matrix. In addition, even if such targets maintain discernible boundaries, the complexity caused by multiple levels of superimposed targets would greatly inhibit interpretation of the results. Also, the rockshelter setting of the site does not allow for A horizon soil development. The admixture of A horizon soils into pits and shafts is a key ingredient that allows for their delineation in geophysical data. Finally, the buried limestone bedrock topography yields a much higher contrast target than the burials themselves. Subtle anomalies can therefore be easily obscured by nearby anomalies with great strengths.

Figure 1b shows the results of the resistance survey and Figure 2 identifies anomalies, their strengths, and assigns them identification numbers. In some cases, the variation appears to be related to topographic change since the drop off to west of the drip line and the low area at the eastern edge of the survey produce low readings. However, the strongest of the resistance anomalies do not precisely correspond to the high elevations. A likely cause for these anomalies is the underlying limestone bedrock. A total of five such anomalies were identified in the data. The changes in strength may also reflect the depth of these structures, while the draping of soil on top provides a secondary influence. No information about burials in the rockshelter appears to be contained in the data.

Based on previous research, the development of an A horizon is necessary for the delineating earthen burials with magnetic techniques (Johnson 2006:309). A low magnetic signature would typically result. The lack of this soil formation in CBR

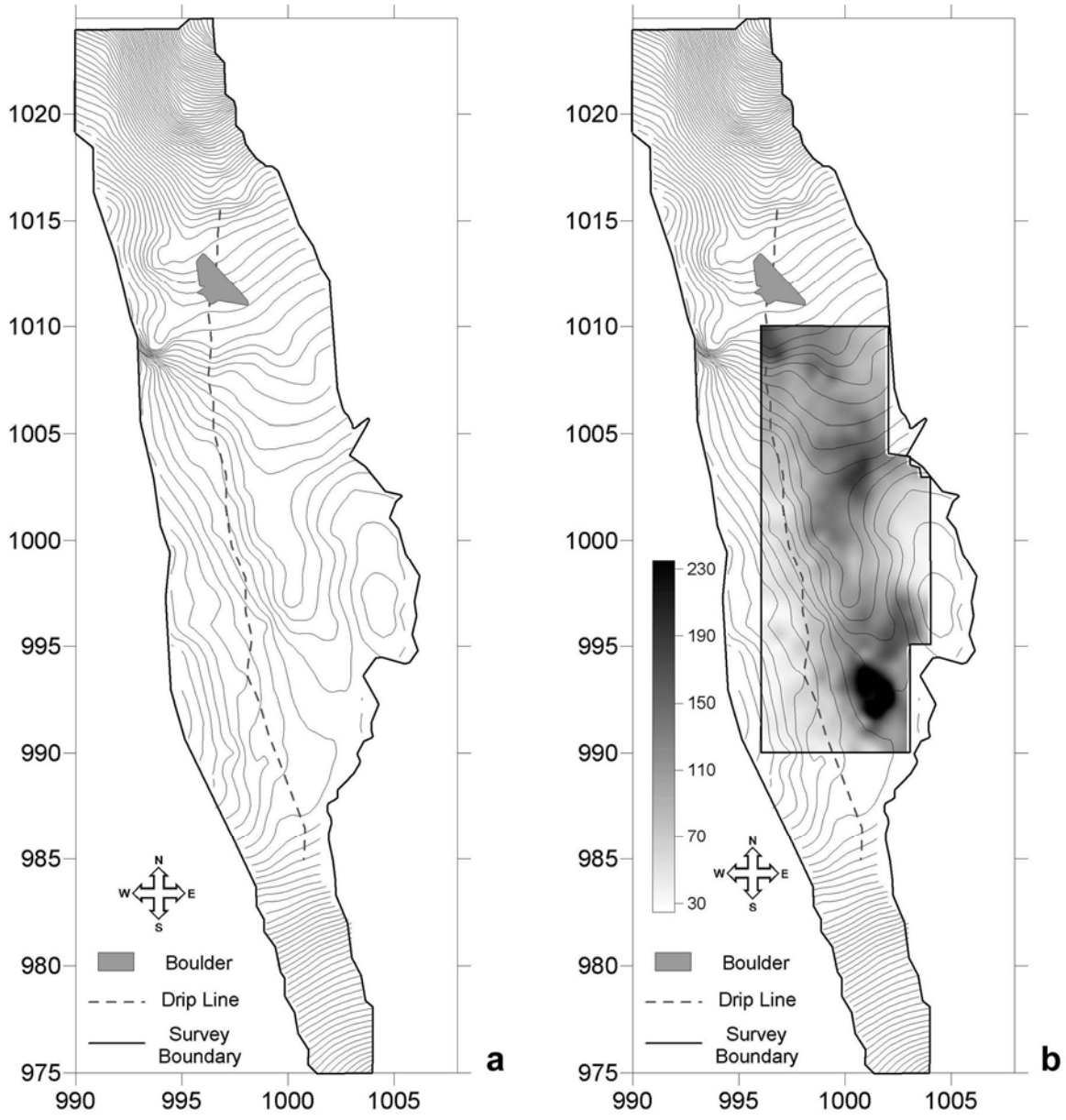


**Figure 1:** Plan of the Caves Branch Rockshelter. **a**) Topographic plan of the rockshelter at the start of investigations prominent geologic features and 10 cm contour intervals indicated. Grid is arbitrary and in meter increments; **b**) extent of the resistance survey and its results. All survey and plans by B. Haley (2005-2006) unless otherwise indicated.

therefore created low expectations for the magnetic survey. Nonetheless, numerous anomalies are present in the magnetic gradient results, which are shown in Figure 3. In Figure 4, a total of 34 high and low signature anomalies have been identified, although the last of these is related to a rebar excavation datum. The cause of the other anomalies is unknown. Burials excavated previously at CBR have been flexed and placed in a north-south orientation (Glassman & Bonor Villarejo 2005:5), although the magnetic anomalies are inconsistent with respect to size and orientation. However, it is impossible

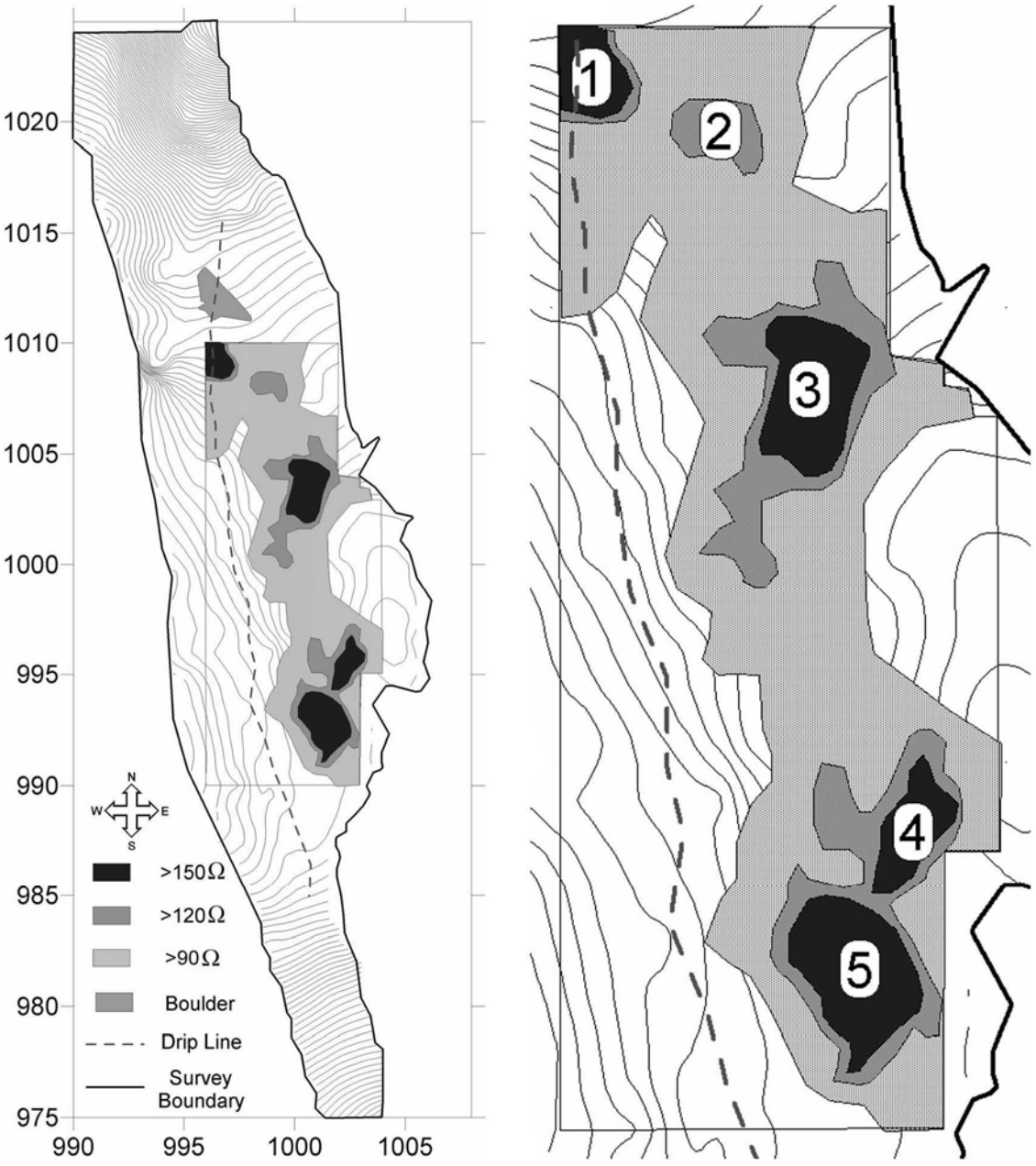


**Figure 2:** Significant electrical resistance anomalies marked with polygons (left) and numbered for identification (right).

to predict the impact of the complex arrangement of the burials on the appearance of the magnetic data. A careful comparison of these results with future excavations will be necessary to determine their cause.

During GPR data collection, several strong reflections probably caused by the buried limestone were apparent. A fainter series of reflections that appears deeper may have been the result of attenuation of the radar wave on the return from the limestone.

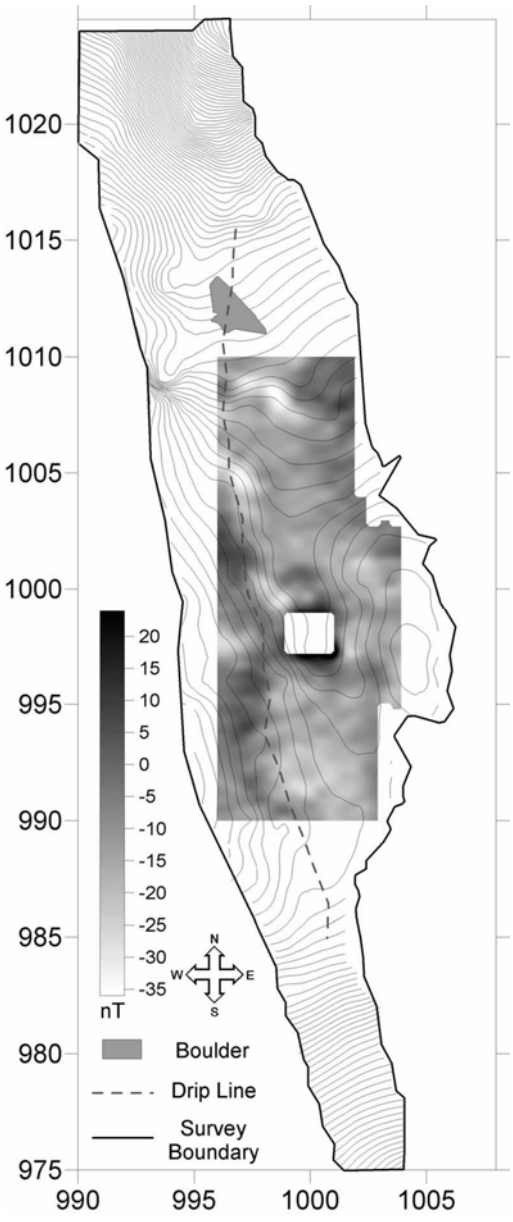


**Figure 3:** Extent of the magnetic gradient survey and its results.

Time slicing was performed on the data to produce plan view maps of the radar reflections at various depths, which are approximated using an estimate of the average velocity of the medium. The plan view reflection maps (Figure 5), as with the resistance data, probably responded to the shallow, buried, limestone topography of the rockshelter beginning at between 30 cm and 94 cm. Four of these anomalies are identified in Figure 6. GPR penetration appears to be limited so that only the shallow buried peaks are visible in the GPR data. Once again, no information about the burials in the cemetery is apparent.

A table summarizing the interpretation and the research potential of each anomaly mentioned above is presented in tabular form in Appendix A.

**Xubzulima**

The Xubzulima *plazuela*, a small, architectural group located near CBR, was surveyed with electrical resistance and magnetic gradient techniques. Ground-penetrating radar was not used in the survey since it was determined that the low brush covering the site would cause coupling problems with the GPR antenna. The site was a secondary target for the bioarchaeology field school conducted at CBR. The goal of the survey was to determine if features within the *plazuela* could be located with geophysical survey methods.

Previous resistance results of a small portion of the Great Plaza at Chichen Itza (Desmond et al. 1996) produced ambiguous results. The authors had difficulty disambiguating anomalies as natural or cultural features. Sweely (2005) used the electromagnetic conductivity at several areas with no visible architecture at Chau Hiix with better success. A number of plaster, non-platform features were located in the geophysical data and tested during the project.

A topographic survey was performed at Xubzulima prior to the geophysical survey using the Leica TCR308 total station. The results as well as the location of the structures are presented in Figure 7. An arbitrary grid in meters was set up during the

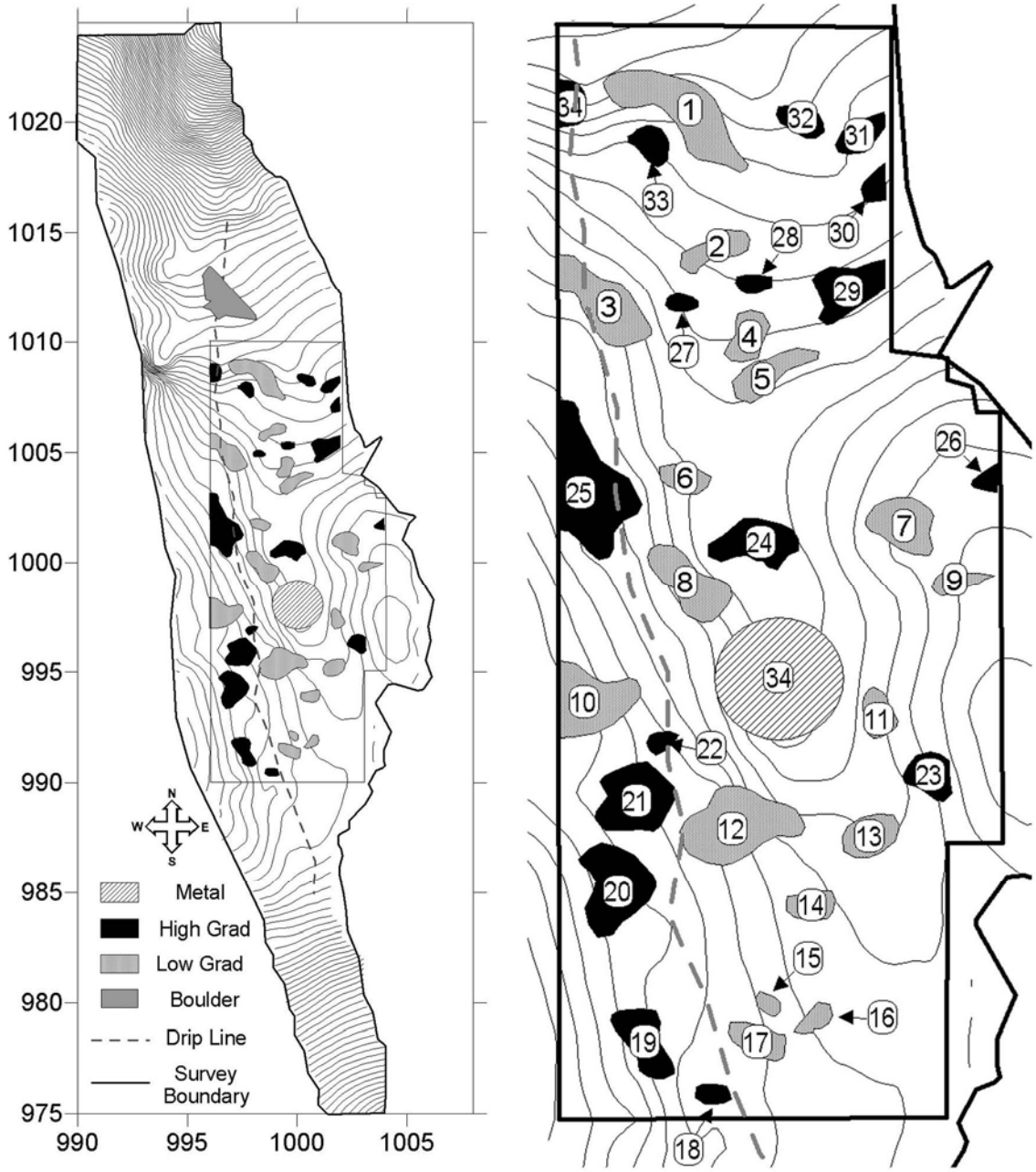


**Figure 4:** Significant electrical magnetic gradient anomalies marked with polygons (left) and numbered for identification (right).

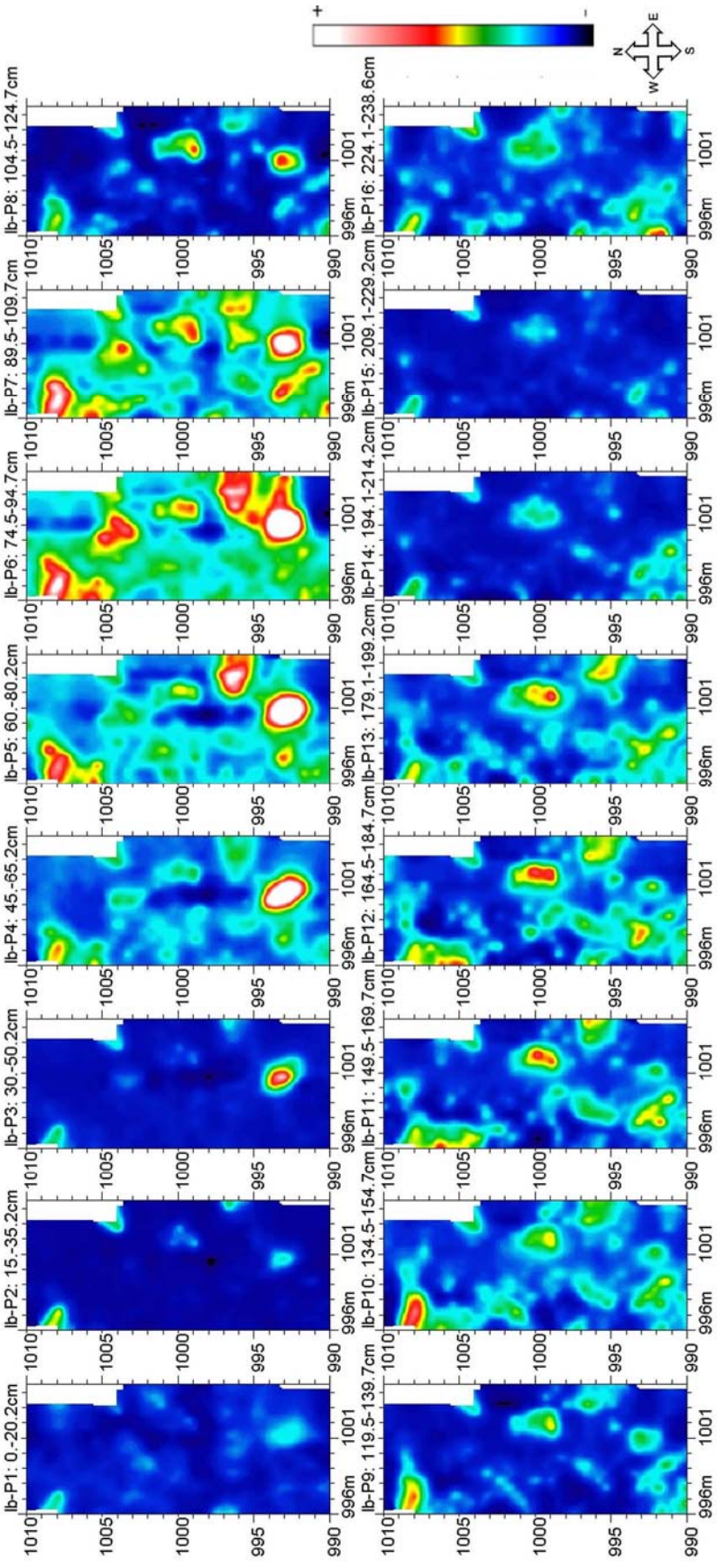


**Figure 5:** Time slice results from GPR survey. Estimated depth is indicated above each image.

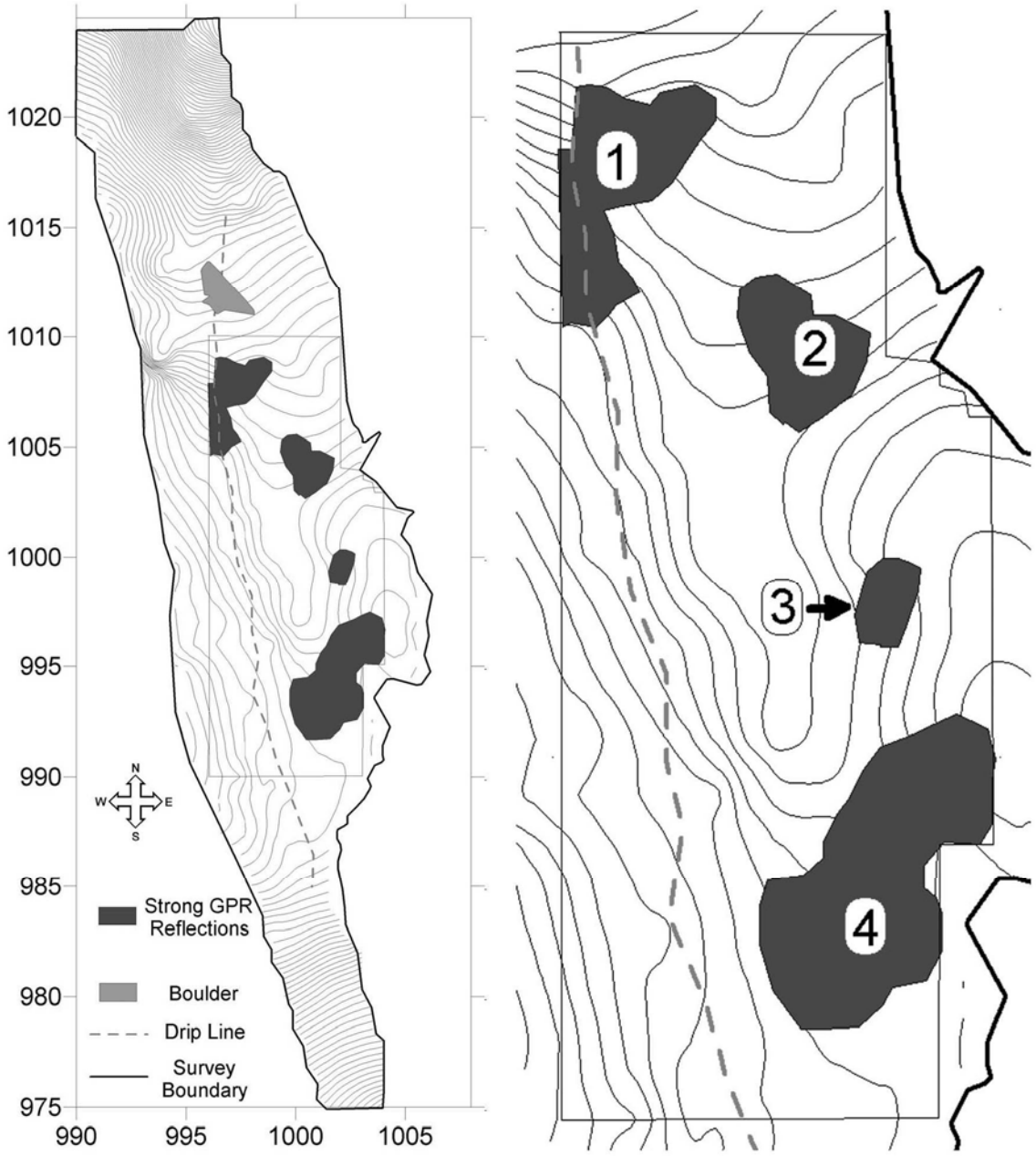


**Figure 6:** Significant GPR anomalies marked with polygons (left) and numbered for identification (right).

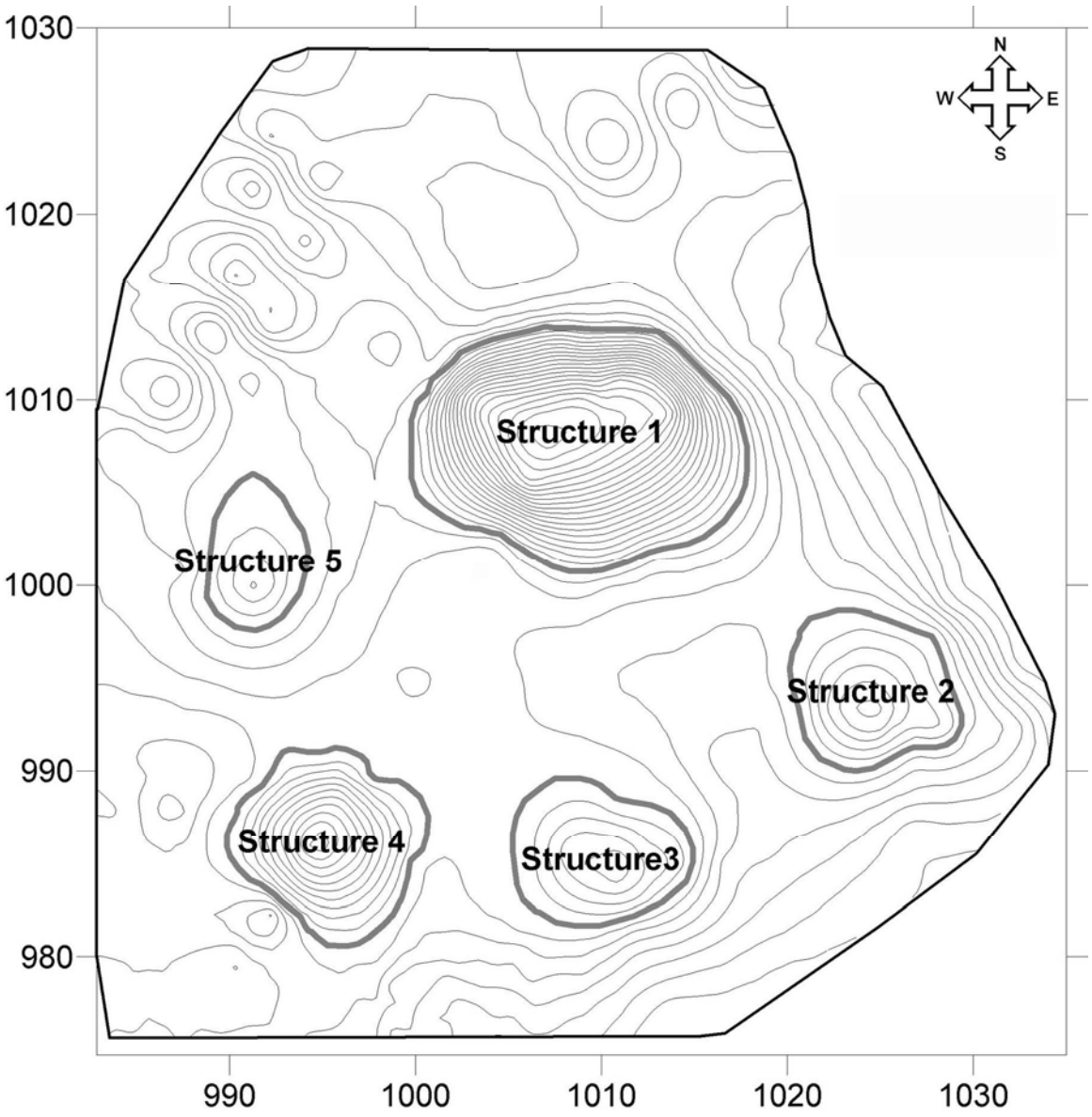


**Figure 7:** Topographic plan of the Xubzulima *plazuela*, with mounded structures and 10 cm contour intervals indicated. Grid is arbitrary and expressed in meter increments.

survey that was used to position the geophysical survey transects. Marker stakes were left in place to facilitate later relocation of the grid.

Electrical resistance results are shown in Figure 8 with anomalies identified in Figure 9. Comparison to the topographic contours suggests the low resistance anomalies (numbers 9-12) appear to be elevation-related and probably due to its influence on water runoff. High resistance anomalies within and near the structural remnants, however, do not precisely follow the topography. One explanation for these anomalies is that they are caused by the intact stone architectural material, which is covered by soil accumulation and no longer visible on the surface.

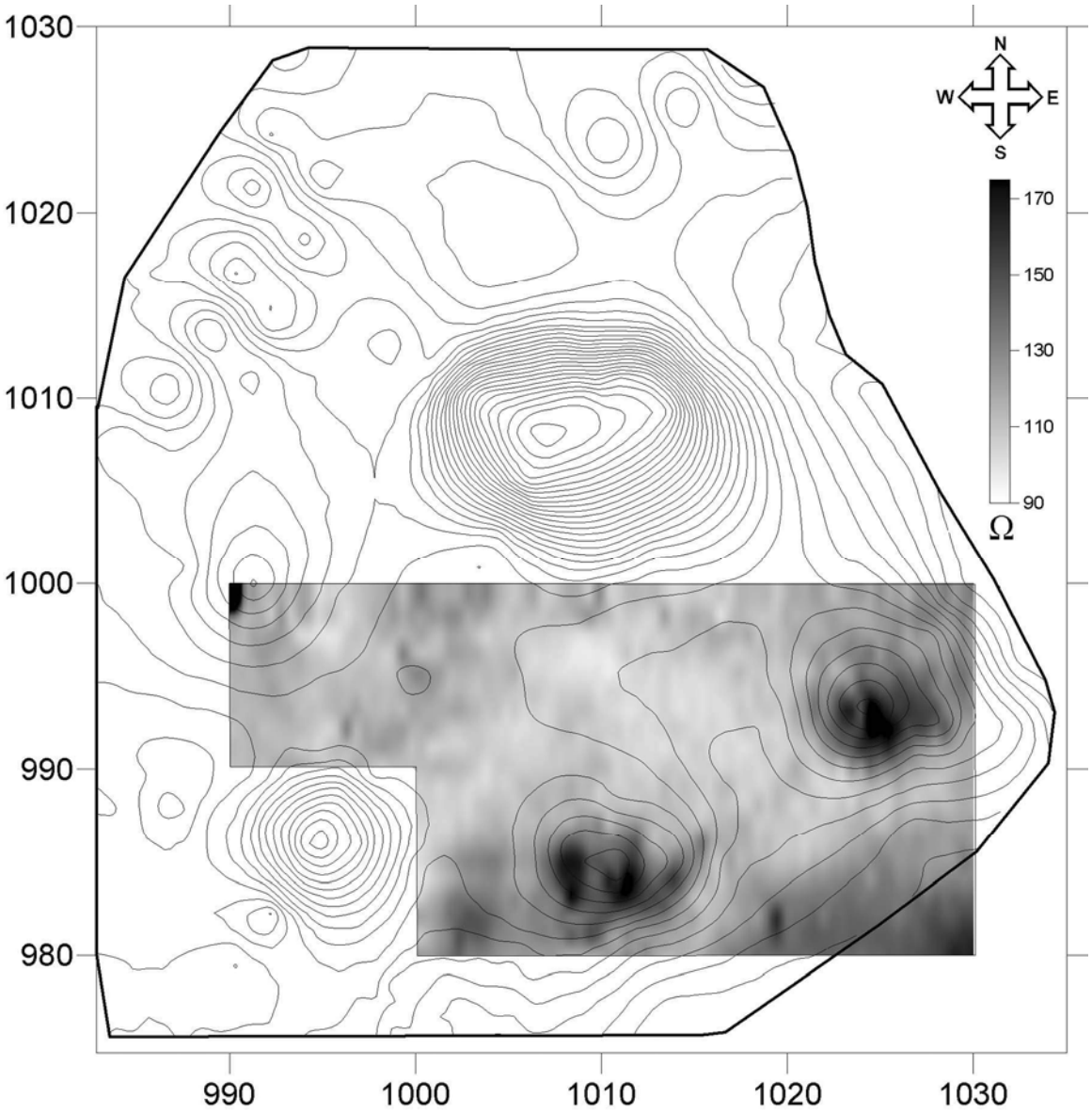


**Figure 8:** Plan of Xubzulima showing the extent of the electrical resistance survey and its results.

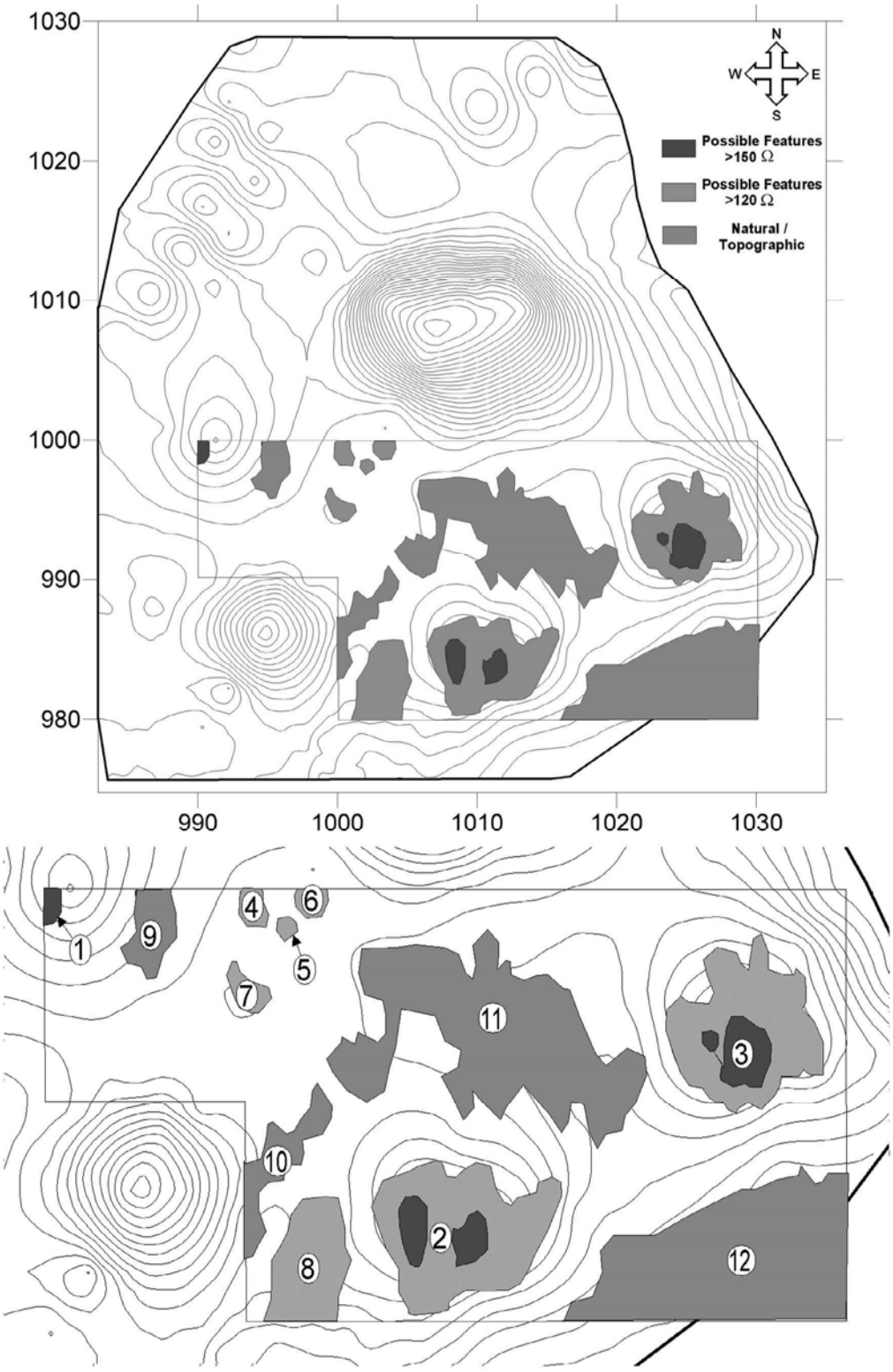


**Figure 9:** Significant anomalies from resistance survey identified (top) and numbered for identification (bottom).

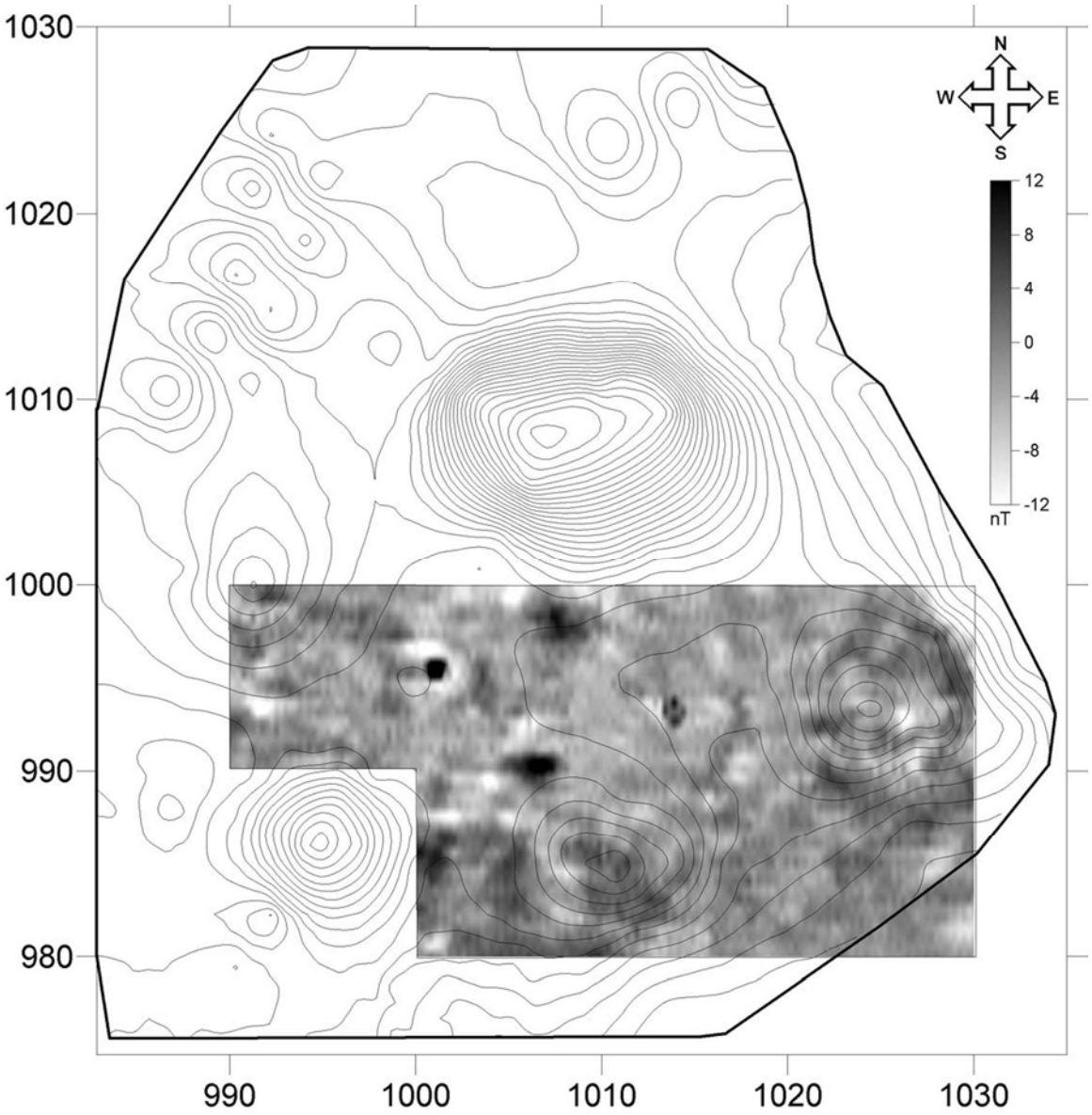


**Figure 10:** Plan of Xubzulima showing the extent of the magnetic gradient survey and its results.

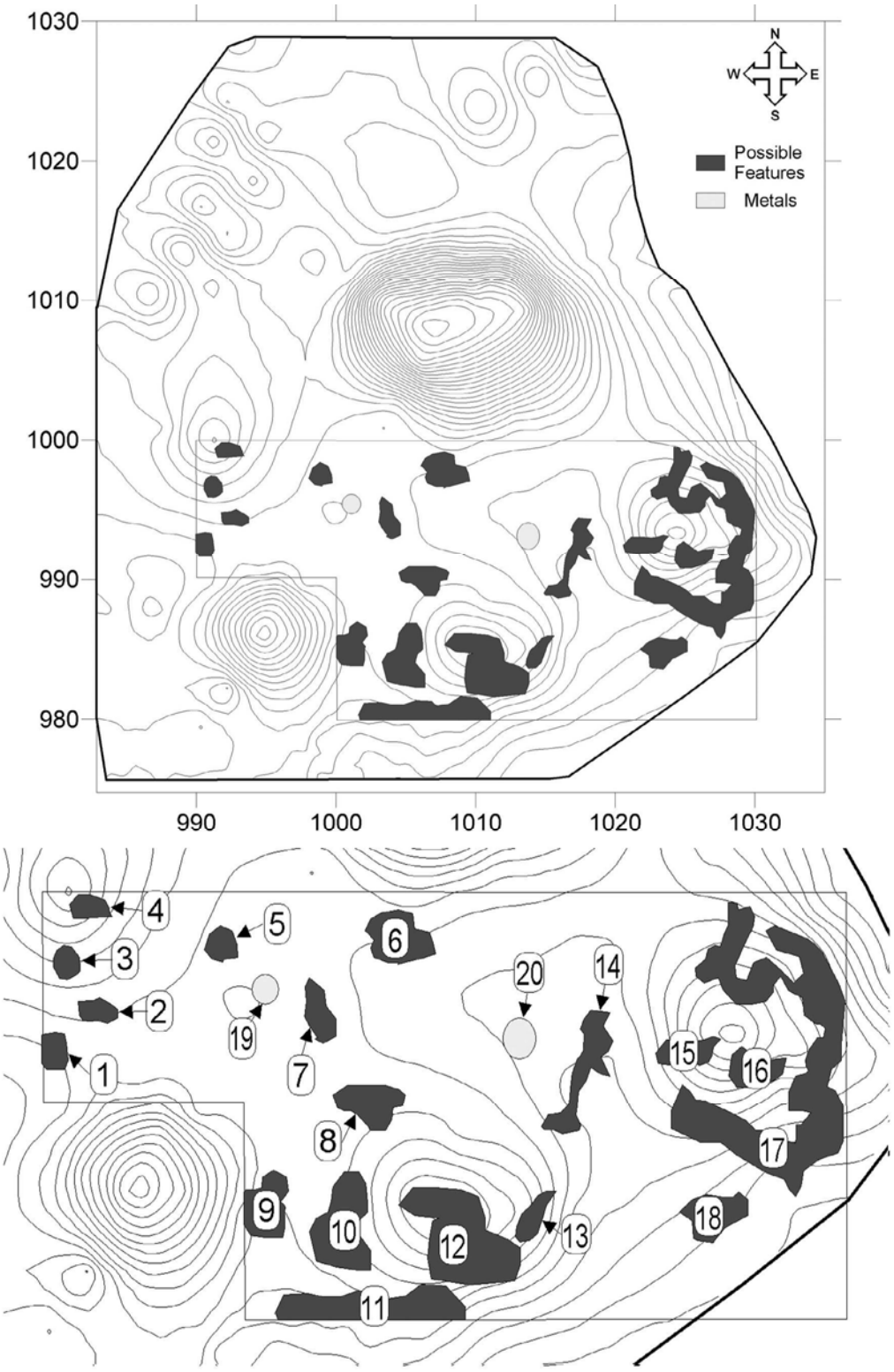


**Figure 11:** Significant anomalies from magnetic gradient survey identified (top) and numbered for identification (bottom).

Magnetic gradient results are shown in Figure 10. In addition to two ferrous metal signatures, the results contain a number of rather weak magnetic anomalies, identified in Figure 11, which might be related to the site's occupation. Two groups of these anomalies (number 10, 12, 13, 15, 16, and 17) are situated around Structures 2 and 3 and could be the result of burning related to construction or other activities. The remaining magnetic anomalies are located at a distance from the structures in the *plazuela*. Two of these (number 6 and 8) are several meters across and located at the foot of the northern and southeastern structures. Subsurface testing is strongly recommended for these anomalies.

A summary of the interpretation and future research potential of each anomaly mentioned above is presented in tabular form in Appendix A.

**Pook's Hill**

Pook's Hill is an architectural complex located southwest of Belmopan that has been the subject of excavation and consolidation under the direction of Christophe Helmke as part the BVAR project headed by Jaime Awe. A plan map (Figure 12a) created by Helmke demonstrates the architectural layout of the group (see also Helmke 2003:120). Electrical resistance and GPR methods were used at the site, but magnetic gradient survey was not conducted because of the rebar used as datums and excavation unit stakes at the site. The goal of the survey was to delineate cultural features within the *plazuela*, especially those not visible on the surface.

A few similar projects have been conducted elsewhere in the Maya region. A GPR survey was successful at mapping the buried limestone bedrock below the Great Plaza at Chichen Itza (Desmond et al. 1996; Sauck et al. 1998). However, floors were sometimes missed with the survey, however, although this may be partially due to the limitations of the low frequency (100 MHz) antenna employed in the work (Desmond et al. 1996:273). In addition, power lines running through the plaza and areas of high conductivity soil were problematic in some cases at Chichen Itza (Sauck et al. 1998:102-103). Resistance survey in the work produced ambiguous results and the authors had difficulty interpreting anomalies as natural or cultural features. Sweely (2005) presents a successful application of electromagnetic conductivity at several areas with no visible surface architecture at Chau Hiix. A number of plastered non-platform features were located in the geophysical data and tested during the project.

Electrical resistance data is presented in Figure 12b. A number of high resistance anomalies are visible in the data and they are identified in Figure 13. Based on their locations, anomalies 1 and 2 can be positively related to backfilled excavation units at the foot of the western structure (part of Op. 6). Noteworthy is the fact that the high signatures of anomalies 1 and 2 are brought about backfilled excavations that were carried to bedrock. Anomalies 3 and 4, however, were not segmented by previous excavations and these are located in the plaza area near the foot of architecture. It is therefore possible that these anomalies are related to the occupation of the site. Anomaly 5 is located in the same are as a previously completed and backfilled excavation are, but also extends beyond its limits. Nevertheless, due to the irregular shapes of anomalies 3, 4 and 5 it is strongly suspected that these are related to the natural undulating, buried, limestone bedrock beneath the plaza. In fact test excavations at the base of Structure 2A,

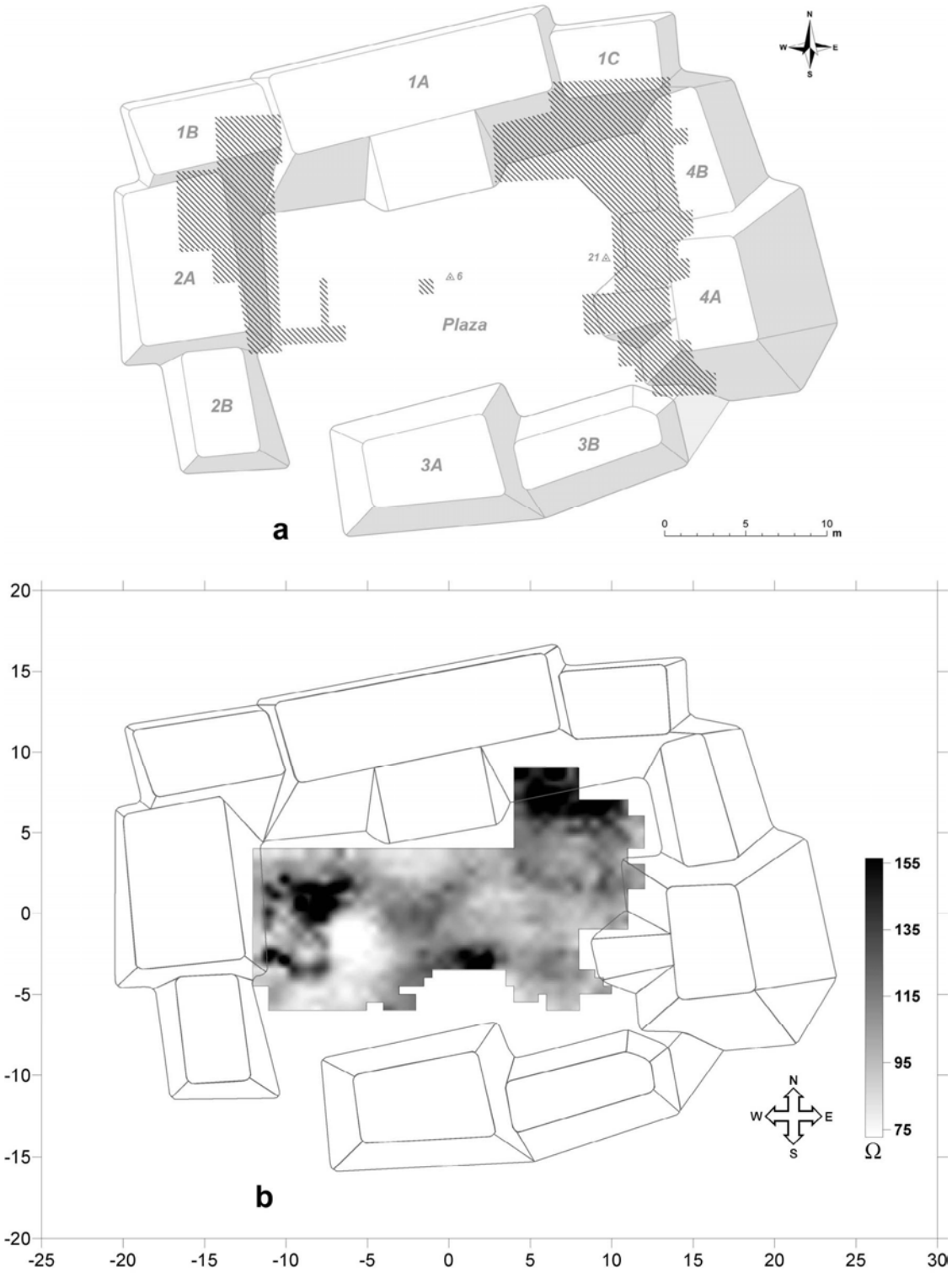


**Figure 12:** Plan of the Pook's Hill *plazuela*. **a**) Structures rendered as mounds according to a modified Maler convention. Hatched areas represent excavations completed or underway at the time of the Geophysical survey. Plan aligned to true north. Survey and plan by C. Helmke (1999-2005). **b**) Plan of Pook's Hill showing the extent of the electrical resistance survey and its results. Grid is arbitrary and in meters. Plan aligned to Geophysical survey grid. Plan by B. Haley and C. Helmke (2006).

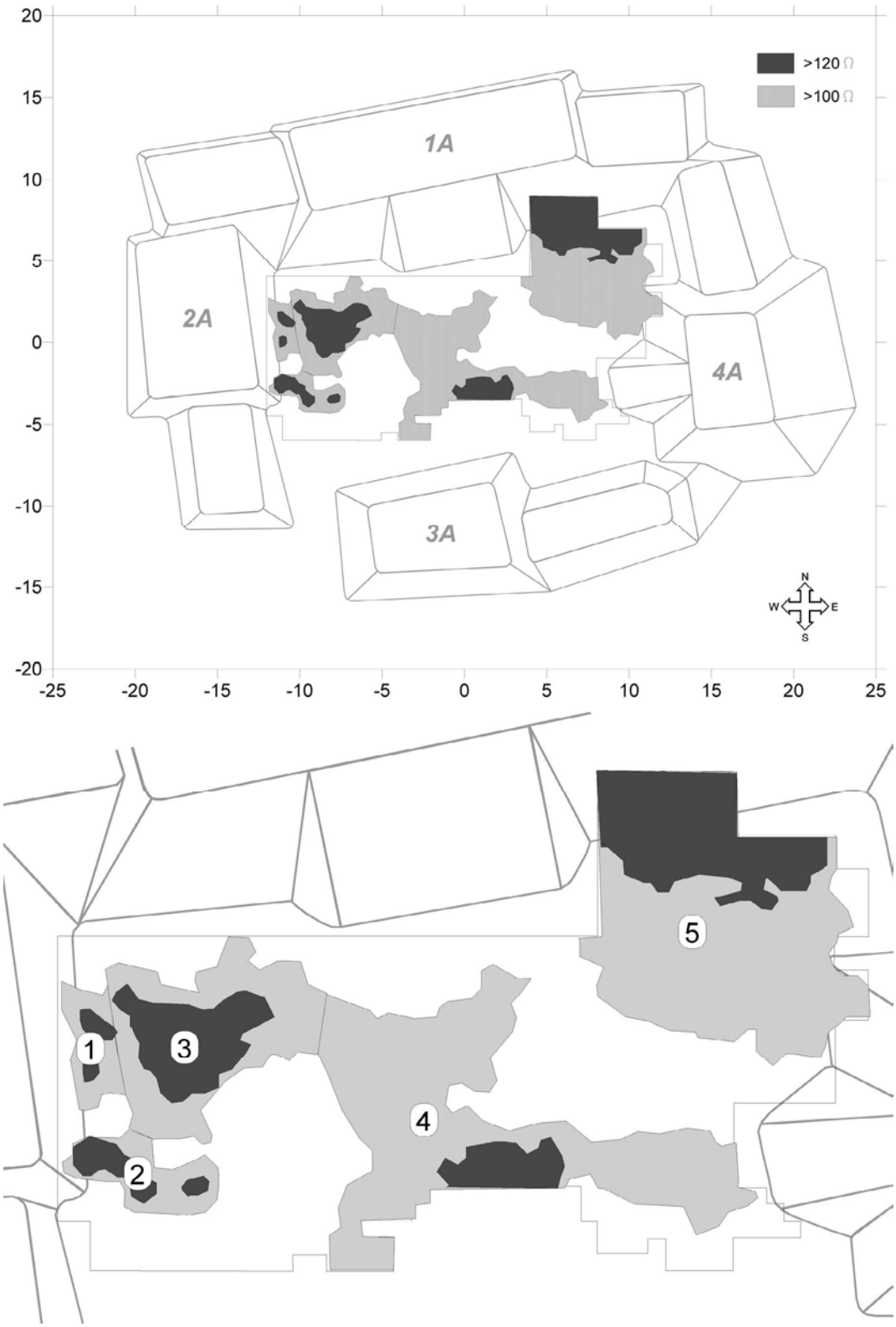


**Figure 13:** Significant anomalies from electrical resistance survey identified (top) and numbered for identification (bottom).

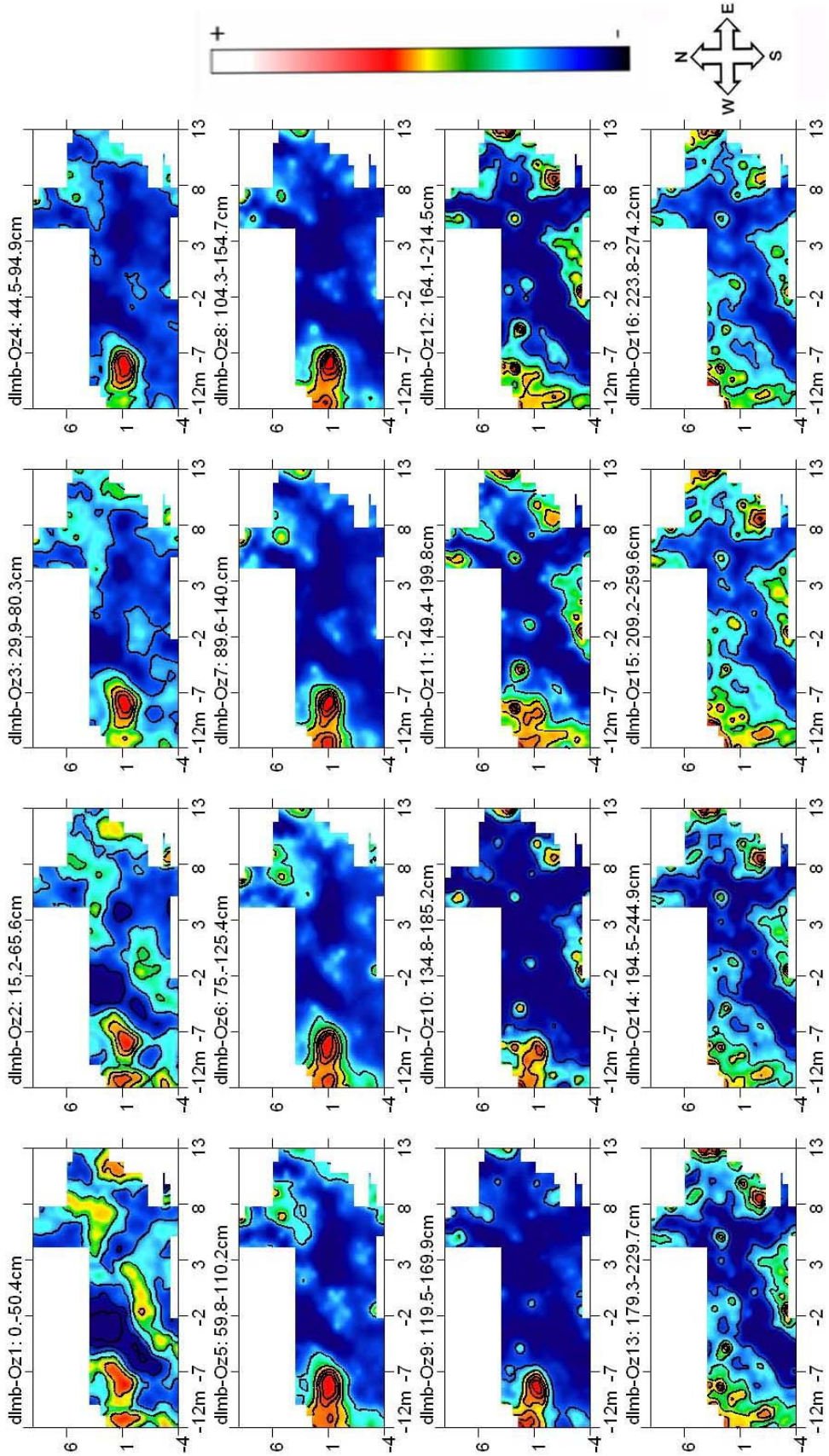


**Figure 14:** Time slice results from GPR survey. Estimated depth is indicated above each image.

1A and in the middle of the plaza have found that bedrock is shallow in the areas broadly encompassed by anomalies 4 and 5. Consequently, at least anomalies 4 and 5 may signal small peaks in bedrock topography and thus shallow overlying plaza floor cores. Nonetheless, additional work is recommended to completely reject a cultural explanation. Although it is a not cultural feature itself, the mapping of bedrock may provide supplementary information about the formation of the *plazuela*. In sum, setting anomalies 1 and 2 aside, the electrical resistance survey may have produced a detailed topographic plan of underlying limestone bedrock (and perhaps some associated cultural features), a hypothesis that could be aptly tested by minor future test excavations.

GPR survey results are shown in Figure 14 as contoured depth slices. The most important anomalies in the various slices are identified in Figure 15. Anomalies 1, 4, 7, 9, 10, and 12 are probably related to previous excavations at the site. GPR anomaly 2 matches well with resistance anomaly 3, which may have a cultural origin or may have been caused by bedrock topography but requires of further examination. The cause of the remaining anomalies (3, 5, 6, 8, and 11) may also be cultural or natural. Although the positions of several of these are correlated with anomalies in the resistance data, their shapes are much different and they may thus be related to a different class of subsurface feature. Further investigation in the form of subsurface testing is suggested for anomalies 2, 3, 5, 6, 8, and 11 to conclusively determine their origin.

A summary of the interpretation and future research potential of each anomaly mentioned above is presented in tabular form in Appendix A.

## DISCUSSION

The results presented in this paper indicate some advantages as well as some hazards for applying geophysical survey techniques in Central Belize. First, the limestone bedrock produces anomalies that are very strong and easily mapped, if this is a research objective, with resistance and GPR techniques. In addition, Sweely (2005:200-201) has noted that, in some cases, these high amplitude plaza anomalies might relate to shallow limestone features produced as part of bedrock mining. Further subsurface examination would be necessary to confirm if this is the case at Xubzulima and Pook's Hill.

More subtle features, however, such as non-platform architecture, may be obscured by the strength of the bedrock anomalies. Nonetheless, an anomaly present in both resistivity and GPR data sets at Cahal Pech was found to be an early platform surface upon excavation (Haley & Wrobel 2006).

Magnetic gradient survey may hold promise on sites with shallow bedrock since it is unaffected by limestone, which is magnetically neutral. Additional excavation at Xubzulima and CBR will help determine the source of the magnetic anomalies. In areas where modern surface metal is not abundant, additional magnetic gradient survey is recommended.

Another challenge for using geophysics in Central Belize is determining the criteria for identifying cultural features in the geophysical imagery. With respect to certain regions, cultural complexes, and archaeological feature types, identification is based largely on pattern recognition. For example, burned houses found on Mississippian

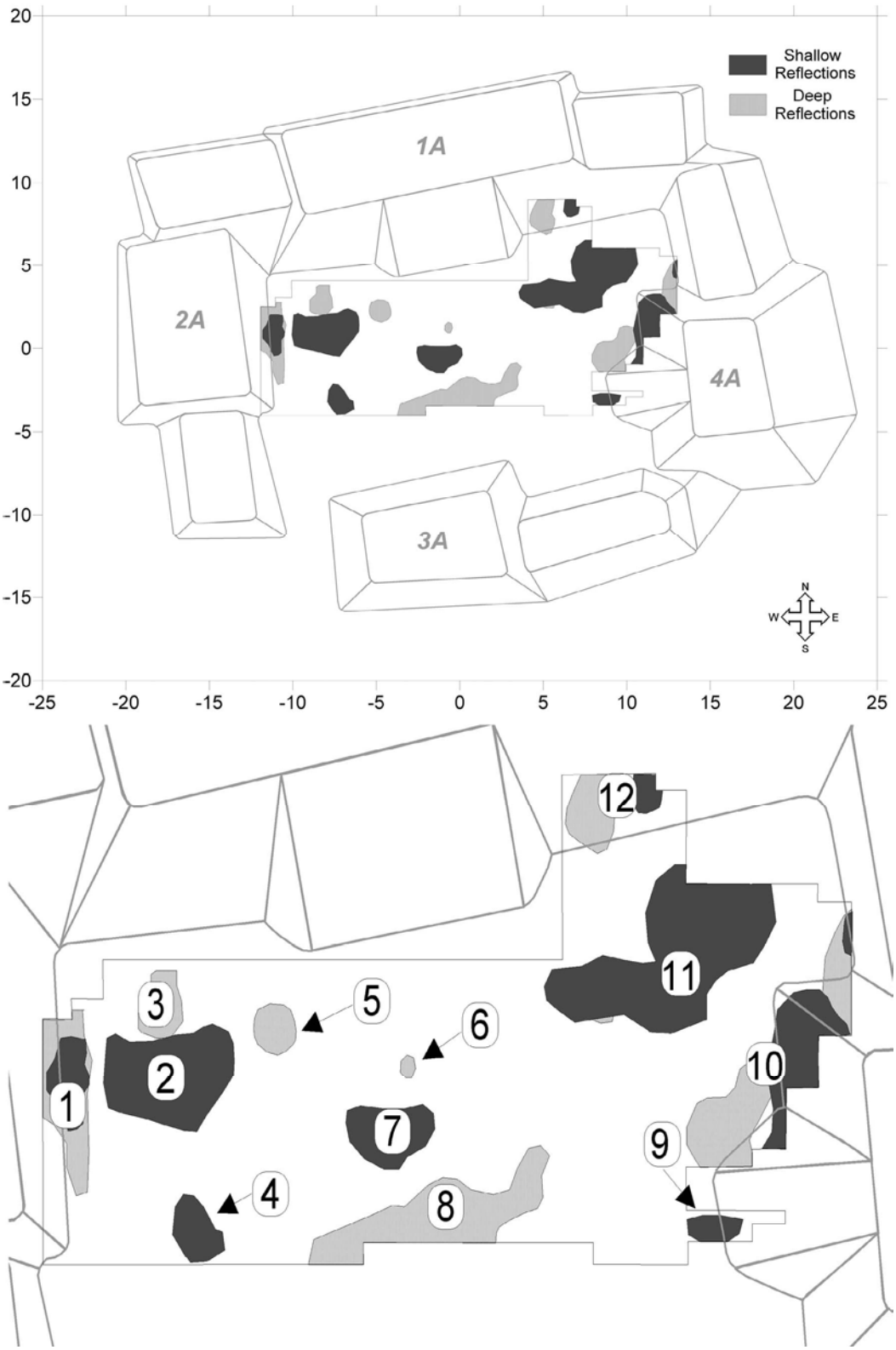


**Figure 15:** Significant anomalies from GPR survey identified (top) and numbered for identification (bottom).

sites in the southeastern United States typically produce obvious, distinct, square patterns unlike anything caused by natural phenomena (Johnson et al. 2000, 2002). Since this type of patterning is not apparent in the research presented in this paper, another interpretation approach must be used.

In the absence of obvious cultural patterning in geophysical imagery, ground truth excavation is essential to understand of the relationship of archaeological features and the geophysical data. Potential excavation targets have been identified in this report and, where possible, a tentative interpretation of the sources of the anomalies. Comparison between these anomalies and future excavation data will be necessary to improve the understanding of the operation of geophysical surveys in the context of Central Belize.

## Appendix A: Summary of Geophysical Surveys (2005 Field Season)

| Data Set | Anomaly No. | Signature | Origin | Research Interest |
|---|---|---|---|---|
| Resistance | 1-5 | High | Natural | Low |
| Magnetic | 1-17 | Low | Unknown | Medium |
| Magnetic | 18-34 | High | Unknown | Medium |
| Magnetic | 34 | Very High | Modern | None |
| GPR | 1-4 | High | Natural | Low |

**Table 1:** Summary of geophysical anomalies from the Caves Branch Rockshelter survey.

| Data Set | Anomaly No. | Signature | Origin | Research Interest |
|---|---|---|---|---|
| Magnetic | 1-5, 7, 9, 11, 14, 18 | Medium-High | Unknown | Medium |
| Magnetic | 6, 8 | High | Maya? | High |
| Magnetic | 10, 12, 13, 15-17 | Medium-High | Maya | Medium |
| Magnetic | 19, 20 | Very High | Modern | None |
| Resistance | 1-3 | High | Maya | Medium |
| Resistance | 4-8 | Medium-High | Unknown | Medium |
| Resistance | 9-12 | Low | Natural | Low |

**Table 2:** Summary of geophysical anomalies from the Xubzulima survey.

| Data Set | Anomaly No. | Signature | Origin | Research Interest |
|---|---|---|---|---|
| Resistance | 1, 2 | High | Modern | None |
| Resistance | 3 | High | Maya? | High |
| Resistance | 4, 5 | High | Natural / Maya? | Medium |
| GPR | 1, 4, 7, 9, 10, 12 | High | Modern | None |
| GPR | 2 | High | Natural / Maya? | High |
| GPR | 3, 5, 6, 8, 11 | Medium-High | Unknown | Medium |

**Table 3:** Summary of geophysical anomalies from the Pook's Hill survey.

## Acknowledgements

The author would like to thank Jaime Awe, Jennifer Cochran, James Garber, Cameron Griffith, Christophe Helmke, Jay Johnson, Gabriel Wrobel, the Belize Institute of Archaeology, the University Of Mississippi Office of Research and Sponsored Programs, and the University of Mississippi Department of Sociology and Anthropology for their support on this project.

## References Cited:

Aitken, Martin J.
1961 *Physics and Archaeology*. Interscience Publishers Inc., New York.

Bevan, Bruce W.
1991 "The Search for Graves." *Geophysics*, Vol. 56(9): 1310-1319.
1998 *Geophysical Exploration for Archaeology: An Introduction to Geophysical Exploration*. Midwest Archaeological Center, Special Report No. 1, National Park Service, Lincoln.

Breiner, Sheldon
1973 *Applications Manual for Portable Magnetometers*. GeoMetrics Inc., San Jose.

Clark, Anthony
1996 *Seeing Beneath the Soil, Prospecting Methods in Archaeology*. Second edition. B.T. Batsford Ltd., London.

Conyers, Lawrence B. and Dean Goodman
1997 *Ground-Penetrating Radar: An Introduction for Archaeologists*. Altamira Press, Walnut Creek.

Desmond, Lawrence G., William A. Sauck, James M. Callaghan, John Muehlhausen, and Kristen Zschomler
1996 "Geophysical survey of the Great Plaza and Great Ball Court at Chichen Itza, Yucatan, Mexico." *Eighth Palenque Round Table, 1993*, edited by Martha J. Macri and Jan McHargue, pp. 271-280. Pre-Columbian Art Research Institute, San Francisco.

Geophysical Survey Systems, Inc.
1999 *SIR System 2000 Training Notes*. Geophysical Survey Systems Inc., North Salem.

Geoscan Research
1996 *RM-15 Resistance Meter: Instruction Manual*. Geoscan Research, Bradford.

Glassman, David M. and Juan Luis Bonor Villarejo
2005 "Mortuary Practices of the Prehistoric Maya from Caves Branch Rock Shelter, Belize." *Stone Houses and Earth Lords: Maya Religion in the Cave Context*, edited Keith M. Prufer and James E. Brady, pp. 285-296. University Press of Colorado, Boulder.

Haley, Bryan and Gabriel Wrobel
2006 "Archaeological Geophysics in Central Belize." Poster presented at the 71st Annual Meeting of the Society for American Archaeology, San Juan.

Haley, Bryan, Allan Lemmon, John Peukert, and Matthew Reynolds
2002 "Geophysical Survey at a Confederate Cemetery." Paper presented at 2002 meeting of the Society for Historical Archaeology, Mobile.

Hasek, Vladamir
1999 *Methodology of Geophysical Research in Archaeology*. BAR International Series 769. ArchaeoPress, Oxford.

Heimmer, Don H. and Steven DeVore
1995 *Near-Surface, High Resolution Geophysical Methods for Cultural Resource Management and Archaeological Investigations*. National Park Service, Denver.

Helmke, Christophe G.B.
2003 "The 2002 Season Investigations at Pook's Hill, Belize." *Papers from the Institute of Archaeology*, Vol. 14: 119-128.

Johnson, Jay K. (ed.)
2006 *Remote Sensing in Archaeology: An Explicitly North American Perspective.* Alabama Press, Tuscaloosa.

Johnson, Jay K., and Bryan S. Haley
2005 "Methods of Geophysical Exploration as Applied to Civil War Era Cemeteries in the Southeastern United States." Poster presented at the 2005 Meeting of the Society for Historical Archaeology, York.
2004 "Geophysical Survey of Historic Sites Located at Strawberry Plains Audubon Center, Holly Springs, Mississippi." Report submitted to Strawberry Plains Audubon Center. Center for Archaeological Research, University.

Johnson, Jay K., Matthew Reynolds, and Bryan S. Haley
2002 "Doing Time at Parchman." Paper presented at the 2002 Southeastern Archaeological Conference, Biloxi.

Johnson, Jay K., Richard Stallings, Nancy Ross-Stallings, R. Berle Clay, and V. Stephen Jones
2000 "Remote Sensing and Ground Truth at the Hollywood Mounds Site in Tunica County, Mississippi." Center for Archaeological Research. Submitted to the Mississippi Department of Archives and History, House Bill 1502 Grant Project GS#501-074. Report on file at University of Mississippi Center for Archaeological Research, University.

Loke, Meng H.
2000 "Electrical imaging surveys for environmental and engineering studies: a practical guide to 2D and 3D surveys." Unpublished short training course lecture notes, Universiti Sains Malaysia, Penang.

Reynolds, John M.
1997 *An Introduction to Applied and Environmental Geophysics*. John Wiley and Sons, Ltd. New York.

Sauck, William A., Lawrence G. Desmond, and Rene E. Chavez
1998 "Preliminary GPR results from four Maya sites, Yucatan, Mexico." *Proceedings, Seventh International Conference on Ground-Penetrating Radar (GPR '98)*, Volume 1, 101-113. University of Kansas, Lawrence.

Sweely, Tracy L.
2005 "Detecting 'Invisible' Dwellings in the Maya Lowlands Using Electromagnetic Induction: Significant Findings of a Pilot Study at Chau Hiix, Belize." *Latin American Antiquity*, Vol. 16(2) 193-208.

Thompson, Victor, Matthew Reynolds, Bryan Haley, Richard Jefferies, Jay Johnson, and Cat Humphries
2002 "The Sapelo Shell Rings Site: Remote Sensing on a Georgia Sea Island." Paper presented at the 59th Annual Meeting of the Southeastern Archaeological Conference, Biloxi.

Weymouth, John W.
1986 "Geophysical Methods of Archaeological Site Surveying." *Advances in Archaeological Method and Theory*, Vol. 9: 293-357.

# A REPORT OF THE 2005 SEASON OF ARCHAEOLOGICAL INVESTIGATIONS AT POOK'S HILL, CAYO DISTRICT, BELIZE

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## INTRODUCTION

Archaeological investigations at Pook's Hill, Belize, have been carried out as a sub-program of the Belize Valley Archaeological Reconnaissance Project under the direction of Dr. Jaime Awe and led by Christophe Helmke (1999-2005). The investigations at Pook's Hill that were resumed in 2005, proved to be the most ambitious and expansive season to date. Our two principal objectives for the 2005 season were: (1) to continue research excavations focused on identifying and documenting ancient domestic and ritual activities at an intermediate-sized household group and (2) to complete restoration works on five structures that were scheduled for consolidation (to ready the site for tourism purposes). Summaries of the excavation process and the architecture exposed are provided in this report in reference to each structure investigated. In addition, the sole special deposit encountered in 2005 (i.e. Burial 1A-1) is described in detail as it proved to be one of the most important finds made at the site. The report follows the designations of the operations, starting with Operation 4 and ending with Operation 9, thus: Structure 4A (Op. 4E), Plaza Platform (Ops. 5B through 5D), Structure 2B (Op. 6E), Structure 1C (Op. 9C), Structure 1B (Op. 9D), and Structure 1A (Ops. 9A, 9E, 9F, & 9G) (cf. Table 1). Associated artifactual materials and their frequencies are not provided herein, but will be reported in detail elsewhere (Helmke & Stanchly, in prep.). In that report each major contextual grouping is presented in terms of artifact frequency and/or volumetric assessments, and where relevant some preliminary analyses and interpretations are provided.

During the 2005 season, the plaza area of the Pook's Hill *plazuela* was also prospected for buried features by means of a geophysical survey conducted with Ground-Penetrating Radar and Resistivity instrumentation, which provided promising results (Haley, this volume). The assemblage of faunal vertebrate remains and marine shell specimens recovered at Pook's between 1999 and 2005 was also subjected to comprehensive analyses (Stanchly, this volume). The human dental assemblage was examined as well for the incidence of enamel hypoplasias that affected the ancient inhabitants of Pook's Hill (Scopa, this volume). Following the completion of the field season several artifact classes and samples were exported and submitted for analyses focusing on technological aspects and sourcing of raw materials, including chipped stone specimens (to W. James Stemp, Keene State College), obsidian artifacts (to Geoffrey Braswell, University of California, San Diego), as well as plaster and limestone samples (to Isabel Villaseñor, University College London) and carbon samples (to Christopher Morehart, Northwestern University). Though several of these studies are still on-going,

*The Belize Valley Archaeological Reconnaissance Project: A Report of the 2005 Field Season.* Edited by Christophe G.B. Helmke and Jaime J. Awe, pp. 39-92. Belize Institute of Archaeology, National Institute of Culture and History, Belmopan. 

these analyses greatly contribute to our understanding of the ancient life ways at Pook's Hill and are a welcome addition to the ongoing research.

| Operation | Sub. | Description | Seasons |
|---|---|---|---|
| **Operation 1** | – | **Survey of the Pook's Hill 1 *plazuela*** | |
| | A: | Survey of entire site for production of base map | 1999 |
| | B: | Survey of elevations and artifact provenance during excavations | 1999, 2000, 2001, 2002, 2005 |
| | C: | GPS survey of site, integration into UTM grid, and topography | 2001, 2002 |
| | D: | Geophysical survey of the site to search for buried features | 2005 |
| **Operation 4** | – | **Excavations focusing on Structure 4** | |
| | A: | Clearing and testing the outset Stair 1 of Str. 4A-1st | 2000, 2001, 2002 |
| | B: | Clearing the SW corner and W face of Str. 4A | 2001 |
| | C: | Clearing the NW corner and W face of Str. 4A | 2002 |
| | D: | Clearing the inset Stair 2 of Str. 4A-2nd | 2002 |
| | E: | Clearing the W face of Str. 4B<br>and testing of Architectural Units 4 and 8 of Str. 4B | 2002, 2005 |
| **Operation 5** | – | **Excavations focusing on the Plaza Platform** | |
| | A: | Testing the center of the plaza platform | 2000, 2001 |
| | B: | Clearing and testing Architectural Unit 1 of the plaza platform | 2002, 2005 |
| | C: | Clearing the NE portion of the plaza platform | 2002, 2005 |
| | D: | Clearing the SW portion of the plaza platform | 2005 |
| **Operation 6** | – | **Excavations focusing on Structure 2** | |
| | A: | Clearing the NE face of Str. 2A | 2000, 2001 |
| | B: | Clearing the NE corner and E face of Str. 2A,<br>clearing the S face of Str. 1B<br>and testing of the outset Stairs A and B of Str. 1B | 2001 |
| | C: | Clearing the SE corner and E face of Str. 2A | 2001 |
| | D: | Clearing and testing the outset Stair 1 of Str. 2A-1st | 2001 |
| | E: | Clearing the E and S face of Str. 2B<br>and testing of the outset Stair 1 of Str. 2B-1st | 2005 |
| **Operation 9** | – | **Excavations focusing on Structure 1** | |
| | A: | Clearing the perimeter of the outset Stair 1 of Str. 1A | 2001, 2005 |
| | B: | Clearing the SE corner and S face of Str. 1A | 2002 |
| | C: | Clearing the S face of Str. 1C<br>and testing of the outset Stair 1 of Str. 1C-1st | 2005 |
| | D: | Clearing and testing the vaulted room of Str. 1B | 2005 |
| | E: | Clearing the SW corner and S face of Str. 1A<br>and testing outset Stair C of Str. 1B | 2005 |
| | F: | Clearing and testing the outset Stair 1 of Str. 1A | 2005 |
| | G: | Clearing the E face of Str. 1A | 2005 |

**Table 1:** The 2005 sub-operations and their principal objectives (i.e. Ops. 1B, 1D, 4E, 5B-5D, 6E, 9A, & 9C-9G), in relation to the overall operations of which they are a part (i.e. Op. 1, 4, 5, 6 & 9). Operations 2 (salvage of looters spoil), 3 (salvage of looters trench), 7 (geological prospection), and 8 (salvage of Str. PKH-M1) are not tabulated above as these were inactive in 2005.

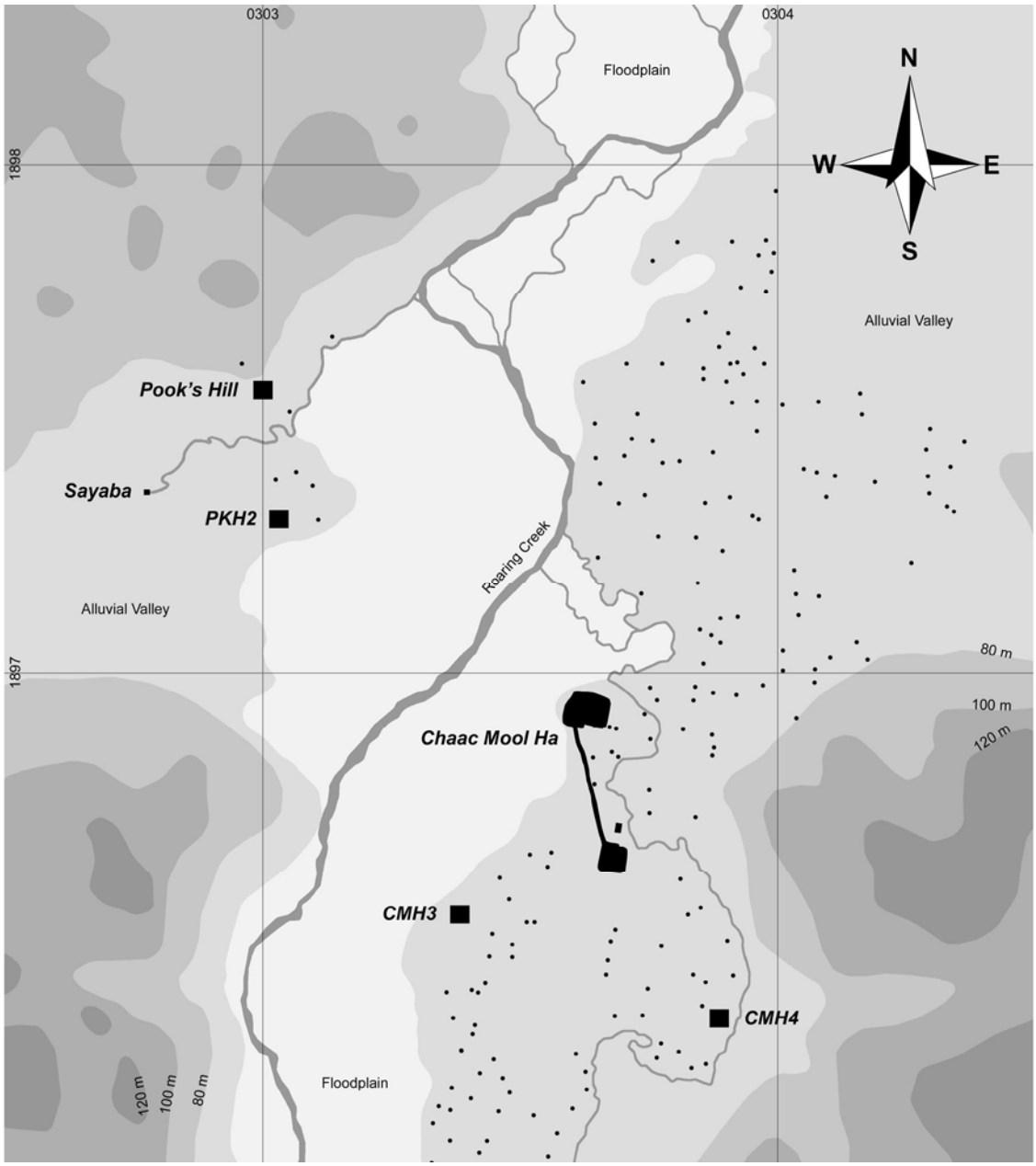



**Figure 1:** Detail of the upper Roaring Creek Valley and the environs of Pook's Hill. The two groups and the causeway of the minor center of Chaac Mool Ha are rendered to scale, while *plazuelas* (squares) and housemounds (dots) are conventionalized. The map does not present the totality of ancient sites in the area, solely the ones surveyed to date (Jan. 2006). The Roaring Creek, which courses from south to north, is rendered to scale, while the smaller tributary creeks are conventionalized. Topography is approximate and derived from 1:50,000 sheets maps of the British Overseas Ordenance Survey (Sheet 24). Contour intervals represent 20-m increments above mean sea level. Note that the entirety of the alluvial valley in this area is below 80 m in elevation. The edge of the floodplain delineates the maximum area that is susceptible to flooding during the rainy season, which in turn explains the complete absence of ancient Maya sites within that area. The grid corresponds to UTM coordinates in relation to the WGS84 datum, aligned to grid north, expressed in kilometer increments. Map based on GPS ground survey and an Othorectified Radar Image (tile 17w88b7), acquired by Intermap Technologies, used under academic license. **Survey by:** C. Helmke (1997-2006), R. Guerra (2000-2006), W. Poe (2000-2002), D. Weinberg (2001-2002), and A. Bevan (2002-2003). **Map by:** C. Helmke & A. Bevan (2006).

## SITE DESCRIPTION & LOCATION

The principal site of Pook's Hill is a *plazuela* (Ashmore 1981: 49-54) that has been termed "Pook's Hill Group 1" or PKH1 (30.189.002). On the whole, the mounded architecture of the group occupies an area of approximately 1106 $m^2$, of which about a third is occupied by the plaza platform.[1] When work was initiated in 1999 the *plazuela* appeared to consist of the collapsed and mounded remains of seven structures. Since then an additional two structures have been identified during clearing excavations, bringing the total to nine (Figure 2). Each side of the plaza is delimited by two building platforms, save the three defining the northern perimeter. The central northern Structure 1A is the largest of the group and measures 16.5 m long (E-W) and is 2.9 m high (above the modern ground surface of the plaza). The smallest building platform of the group is Structure 2B, which measures 7.1 m long (E-W) and is under 0.8 m high. Most structures are rectangular in plan based on mounded surface features as well as exposed terminal architecture, and can be broadly categorised as 'range structures' (apparently topped by perishable superstructures in the absence of clear evidence for vaulting or vault stones). The western northern Structure 1B (in the NW portion of the *plazuela*) was cleared extensively in 2005, thereby exposing an ovoid vaulted room that was once topped by a rectangular summit platform. Based on the architectural features discovered, this vaulted room has been identified as a sweatbath (reported on in detail, below). At the start of investigations in 1999, the squarish mound of the principal eastern Structure 4A was seen as a special function 'shrine', as is common at many Lowland Maya sites, notably at Caracol (Chase & Chase 1994), Tikal (Becker 1999) and other sites in the greater Belize Valley. Consequently, at the start of the excavations it was surmised that the *plazuela* conformed to what Marshall Becker (1971, 1999:139-147) has referred to as a 'Plaza Plan 2' configuration. This point has since been corroborated and all architectural details exposed and documented during subsequent seasons have served to refine our understanding of the 'building blocks' involved in the 'grammar of structural and ritual ideas exhibited by Plaza Plan 2 configurations' (Becker 1999:146).

The PKH1 *plazuela* group is located in the Roaring Creek Valley, in the Cayo District of Belize (see map on page vi at the start of this volume). The site lies approximately 13.5 km southwest of Belmopan and 8 km south of Teakettle village. The site is situated less 5 km north of a group of caves that were intensively investigated by the Western Belize Regional Cave Project between 1996 and 2000. In relation to ancient sites, the *plazuela* lies 4.7 km north of the major center known as Cahal Uitz Na (Awe & Helmke 1998; Conlon & Erhet 1999; Erhet & Conlon 1999; Ferguson 1999) and 1 km northwest of the minor center of Chaac Mool Ha (Figure 1). The latter appears to have been the principal northern satellite to Cahal Uitz Na, possibly serving analogous functions to other satellites seen in the greater Belize Valley (e.g. Xualcanil, Esperanza, Floral Park, and Ontario) (see Iannone 2004; Driver & Garber 2004). As such the ancient inhabitants of Pook's Hill were likely subservient to those of Chaac Mool Ha, possibly through tributary relations. The PKH1 site is located in the karstic foothills forming the western perimeter of the Roaring Creek Valley at an approximate elevation of 78 m

[1] These figures are based on the surface areas occupied by the mounded remains of structures. At the close of the 2005 most of the plaza area was cleared of collapse debris and has thus been considerably expanded. In fact, in the terminal phase the plaza may have occupied as much as 431.5 $m^2$.

above mean sea level, overlooking the fertile alluvial valley below. The Roaring Creek River courses to the east of the *plazuela* at distances between 370 and 680-m away.

A small cold creek, fed by an artesian spring (and several small arroyos in the wet season), runs less than 100 m south of the *plazuela* and merges with the Roaring Creek further to the northeast. The artesian spring in question (located approximately 300 m southwest of the Pook's Hill *plazuela*) was architecturally-modified in antiquity by three broad steps or terraces on three sides to facilitate access and water procurement for the neighboring households. Though it has not been investigated in detail the spring site has been named Sayaba (lit. "Spring-place" in Yukatek Maya). Since Sayaba falls under the 'catchment area' of PKH1 it is likely that the *plazuela*'s ancient inhabitants collected their daily water supply from this spring (located 4 to 5 minutes-walk away). The remainder of the creek itself was undoubtedly harvested for *jute* shells as the modern stream is rich in both small *Pachychilus indiorum* and large *P. glaphorus* shells.

## STRUCTURE 4B (OP. 4E)

### Excavations

Clearing excavations of Str. 4B were initiated in 2002, resulting in the exposure of the southern half of the frontal (western) face of Str. 4B-1$^{st}$ and the point of abutment between Strs. 4A and 4B (see Helmke 2003). Excavations focused on the exposure of the northern half of the frontal face of Str. 4B-1$^{st}$ were resumed and completed in 2005. The southern portion of Str. 4B was exposed in 2002 by means of four contiguous 1 x 2 m EUs (oriented lengthwise E-W) designated as EUs 56, 57, 58 and 64 (from S to N) conjointly forming Op. 4E (Figure 3). Set along the same alignments as the 2002 excavations, three additional EUs were established in 2005. Of these, the southern two measured as 1 x 2 m (again oriented lengthwise E-W) while the northernmost was established as a 2 x 2 m EU (as it encompassed the point of juncture between Strs. 4B and 1C). These EUs were designated as 67, 68 and 69 (from S to N) also forming part of Op. 4E (Figures 2b & 3). In addition a small 1 x 1 m eastward extension to EU 67 was established as EU 76 at the juncture between 2002 and 2005 excavations to asses the architectural alignment of Terrace 1 of Str. 4B. In the process a plaster flooring of the platform summit was encountered predating the terminal phase architecture.

The two principal stratigraphic contexts encountered during these excavations were the humic layer (SUs 259, 260, 261, 270) and the stratum of collapse debris (SUs 265, 267, 269, 273), which were successively stripped off the underlying architectural remains. As part of consolidation efforts all architectural components of Str. 4B were excavated as four discrete and architecturally-defined contexts (SUs 292, 294, 303, 305) and consolidated thereafter.

### Architecture

By the end of the 2005 season, the entire frontal face of Str. 4B has been exposed and consolidated. The architectural components exposed as part of these and foregoing


**Figure 2:** Plan of the PKH1 *plazuela*. **a**) structures rendered as mounds according to a modified Maler convention. **b**) same plan showing the sub-operations active during the 2005 season of investigations. Operation 4 pertains to the eastern structures, Op. 5 to the plaza platform, Op. 6 to the western structures, and Op. 9 to the northern structures. Note that only research excavations are rendered (no backcuts). Plans aligned to true north. **Plan by:** C. Helmke (2006). **Survey by:** C. Helmke (1999-2005), R. Guerra (2000-2005), W. Poe (2000-2002), and B. Haley (2005).

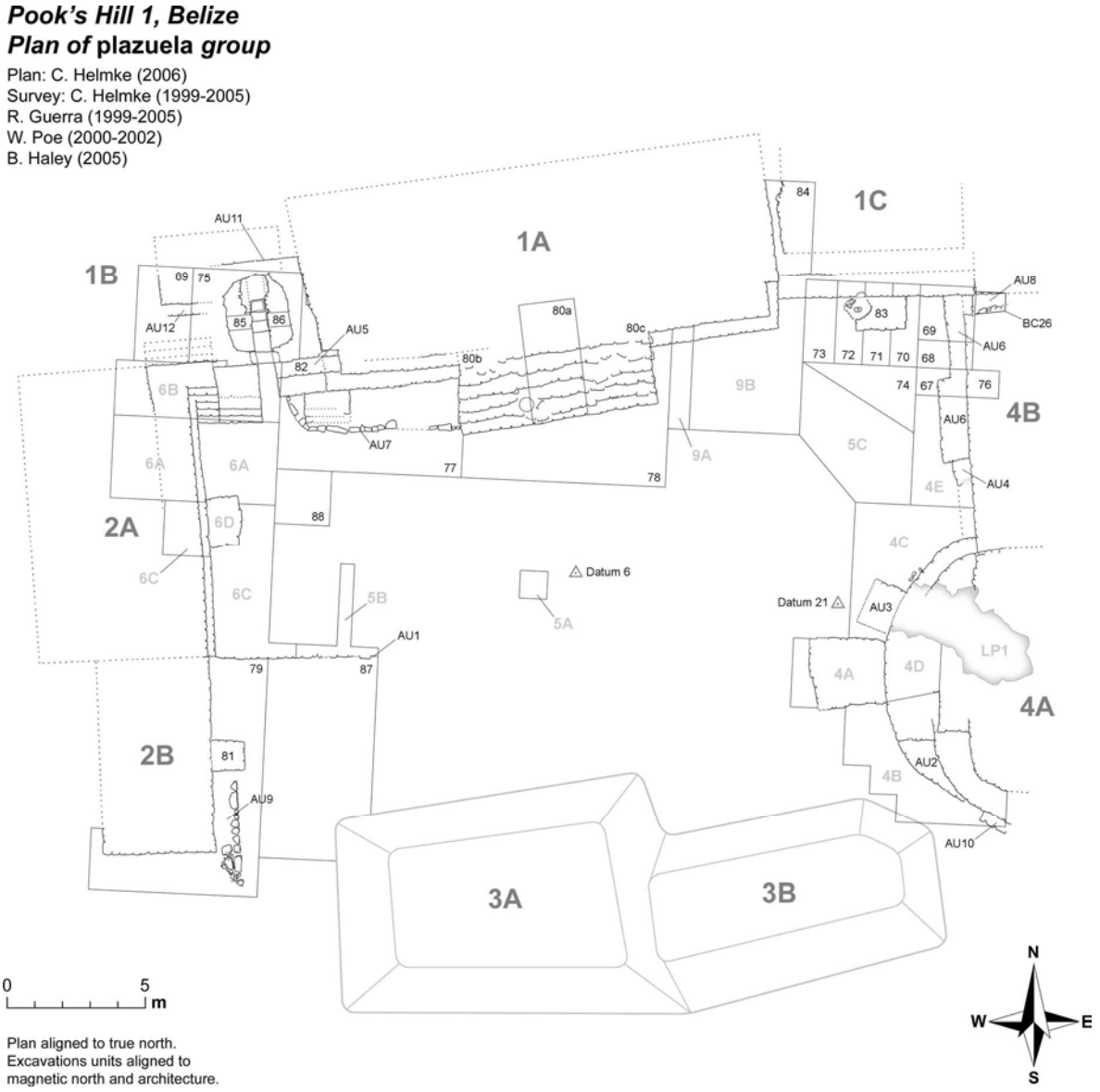



**Figure 3:** Plan of the Pook's Hill *plazuela* by the end of the 2005 season of investigations. All terminal architecture exposed to date is rendered to scale. Where the plan of structures could be securely reconstructed, these are rendered as dotted lines. Structures 3A and 3B, which remain completely untested, are rendered as mounds. All the excavation units of the 2005 season are marked off (with black numbers), while inactive sub-operations of previous seasons are also rendered (light gray designations). All Architectural Units documented to date are indicated by the prefix AU-. No backcuts are rendered, with the exception of Backcut 26, which tested Architectural Unit 8. Architecturally-defined excavation units are as follows: EU 80 corresponds to Stair 1 of Str. 1A-1$^{st}$; EU 81 to Stair 1 of Str. 2B-1$^{st}$; EU 83 to Stair 1 of Str. 1C-1$^{st}$; EU 85 to AU 5. Note the intrusive pit that undermined the western side of Stair 1 of Str. 1C-1$^{st}$. Datums 6 and 21 are two permanent survey markers that have been tied into UTM coordinates by a high-precision D-GPS survey conducted by W. Poe (2000-2002).

(2002) clearing excavations revealed a structure platform of rectangular form (8.80 m N-S and > 3.40 m E-W; Figure 4) the plastered summit of which rose 0.98 m above plaza floor (at its highest well-preserved section as found in EU 65). The entire platform appears to have been graded downwards to the south (following the c. 3.6 % gradient of Str. 4A; based on elevations of the structure's summit and the terminal plaza floor at the foot of Terrace 1) to facilitate runoff of precipitation. The facing stones composing Terrace 1 as documented in elevation drawings can be characterized as follows: ferric oxide-tinted limestone (1.0 %), grey marl (3.1 %), porous marl (13.4 %), and dolomitic limestone (82.5 %). The core of the penultimate platform of Str. 4B was composed of core-faced construction pens, as is suggested by the exposure and testing of one such component (AU 8, SU 305) documented during excavations aimed at clarifying the abutment of Strs. 4B and 1C.

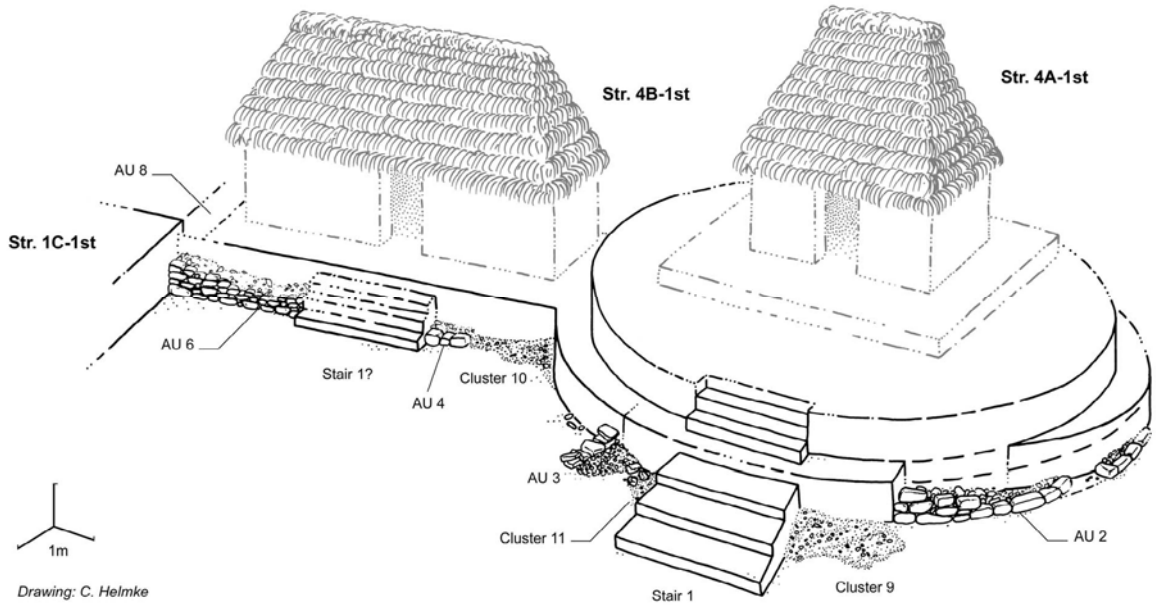



**Figure 4:** Isometric reconstruction of the terminal phase of construction of the eastern structures of the *plazuela*. Architectural Units are rendered as they were discovered, in their apparently unfinished or partly robbed state. Note how AU 4 is cut short by the terminal occupation debris Cluster 10. The possible outset Stair 1 of Str. 4B-1st forms an integral part of AU 6 and no evidence for the second and third steps were in fact discovered. Note the abutment made by Str. 4B with Str. 1C-1st. Architectural Unit 8 (a construction pen) may represent a northern expansion made to the platform of Str. 4B after Str. 1C had been expanded to the east. Cluster 11 is partly obstructed by Stair 1 of Str. 1A-1st in this northeasterly view. Perishable superstructures of thatch and adobe are conjectural.

Excavations also revealed a rectangular architectural unit (AU 6) (measuring 2.95 m N-S by 1.00 m E-W and built almost entirely of dolostone facings) that was added to the foot of the central portion of Terrace 1 (see Stair 1? in Figure 4, above). The basal course of this component was well-preserved, but the overlying second and/or third courses exhibited pervasive and extensive slumping. This component may mark the outline of the structure's principal axial outset stair and form part of the lowest step (since

the component measures between 24 and 32 cm high), though no evidence was discovered to conclusively identify it as such (hence its designation and the manner in which it was consolidated; cf. Loten & Pendergast 1984:15). The absence of a clear plaster 'flooring' across the top of AU 6 (that would otherwise mark it as a bench), further supports the identification of this component as a possible outset stair. The narrow lateral extensions to this component that run along the foot of Terrace 1 to the north and the south (i.e. SU 292 and 257, respectively; see AU 6 and AU 4 in Figure 4) are interpreted as refurbishments made to the front of Str. 4B that would have given it a double terrace configuration (which would be in keeping with all other structures exposed at the site) (cf. Figure 4). However, AUs 4 and 6 were discovered in such an incomplete state that these refurbishments were either left unfinished by the time of the site's abandonment or were extensively robbed of facing stones during a latter phase following completion of construction (for use elsewhere as part of another structure's refurbishment).[2] This interpretation is prompted by the lack of facing stones for what would have been the second and third steps of the putative outset stair (see Stair 1? in Figure 4), as well as the southernmost extent to AU 4 that –if symmetry is applicable here– would have extended to abut with the foot of Terrace 1 of Str. 4A. Instead, AU 4 as discovered, ends abruptly without exhibiting a proper southern face, as if unfinished or truncated and replaced by the deposit of "terminal occupation debris" (TOD)[3] that was found in the corner formed by Terrace 1 of Strs. 4A and 4B (Cluster 10, SUs 214, 234; Figure 4).

Due to the competing interpretations of the architectural units across the foot of Str. 4B's platform (i.e. robbed architecture vs. unfinished construction efforts) designations of these components as part of Str. 4B-1$^{st}$ and 4B-2$^{nd}$, remain tenuous at present.[4] Nonetheless, it is hoped that complete analyses of the temporally-sensitive

[2] Unfinished buildings in the Maya area are surprisingly few (or at least their identification as such). In a recent paper Inomata and colleagues (2003) summarize most of the extant examples of possible unfinished structures in the Maya Lowlands, citing examples from the sites of Tikal, Piedras Negras, Caracol, La Milpa, Lamanai, and Aguateca (Inomata et al. 2003:799-800), to which should also be added Palenque (Larios Villalta n.d.). The difficulty rests in identifying unfinished structures vs. those that have been or were in the process of being robbed of facing stones. The same problem arises in the case of Str. 4B at Pook's Hill, where the incompleteness of the architecture suggests robbing or cessation of construction. Conversely, in the cases of Structures 4A (Helmke 2003) and 1A (see below), it seems clear that the terminal architectural components in question (AU 2 and AU 7, respectively) were never completed as they exhibit only one or two courses of facing stones set partly into the terminal plaza floor without any associated masonry or core.

[3] "Terminal Occupation Debris" otherwise abbreviated as TOD is the term employed in the Pook's Hill investigations for artifact-rich deposits that in many ways appear as diminutive 'middens' or refuse heaps, frequently found swept in the corners of buildings, tucked away from view and pedestrian traffic. The definition of these types of deposits is given in more detail elsewhere (Helmke in press). As there is some disagreement as to whether these deposits are the result of domestic or ritual activities or a combination of both, we have chosen to use the present designation to underscore the fact that these deposits formed during the terminal phases of the site's occupation.

[4] Note here that AU 8, the construction pen associated with the terminal phase refurbishments made to Str. 4B, abuts the completed Terrace 1 face of Str. 1C-1$^{st}$. Consequently, Str. 4B-1$^{st}$ postdates Str. 1C-1$^{st}$, and since the latter already postdates Str. 1A-1$^{st}$, this singles out Str. 4B-1$^{st}$ as one of the latest construction efforts documented at Pook's Hill (see Appendix B). The lateness of the terminal phase construction of Str. 4B supports the hypothesis that the building remained unfinished at the time of the site's abandonment, as the alternate scenario would require the building to be standing in completed form before being susceptible to dismantlement.

materials recovered from the cores of these individual components may eventually clarify the details of the architectural history of Str. 4B.

## PLAZA PLATFORM (OPS. 5B, 5C, 5D)

### Excavations

Excavations in the plaza area of the site were conducted as three discrete excavations in 2005. These investigations encompassed areas of the plaza that are disassociated from a particular structure or were located away from collapse debris taluses of structures. Due to shallow excavations represented by the Op. 5 investigations and the degree of stratigraphic mixing it was difficult to properly segregated humus from underlying deteriorated architecture and consequently, all were excavated in a single stratum of mixed humus and collapse debris.

Operation 5B was resumed and greatly expanded in 2005 with the establishment of EU 87 (4.0 x 7.5 m, maximum dimensions) to clarify the layout and configuration of AU 1, an architectural feature of the plaza platform (Figures 3 & 5). In addition, clearing of the plaza floor of mixed humus and collapse debris (SU 321) in this area was conducted to facilitate drainage out of the plaza as part of site management and consolidation efforts. Architectural Unit 1 was followed for three meters in 2001 (as part of EUs 23a and 23b of Op. 6C), and for another two meters in 2002 at which point it ended abruptly (as part of EU 53 of Op. 5B). An extension was set (EU 63) to assess if this feature cornered to the north, but no such evidence was uncovered. Consequently, by the end of the 2002 excavations it remained unclear if the feature continued east, or cornered south. In 2005 we did not find evidence that AU 1 continued eastward, nor did we uncover conclusive evidence of the feature cornering south. Nonetheless, the portions of AU 1 that had been initially discovered in 2002 were consolidated at the end of season.

In the NE area of the plaza the southernmost extent of the mixed talus of collapse debris –stemming from both Strs. 4B and 1C– was partly cleared in 2002 as part of an irregularly-shaped excavation (EU 66 of Op. 5C) (Figures 2b & 3). This excavation was conducted as part of consolidation efforts to level the ground for drainage purposes. The terminal floor was not exposed in this area, but collapse debris was excavated down to the elevations of the adjacent, humic, modern ground surface. Upon completion of the adjoining Ops. 4E and 9C excavations in 2005, a triangular section of mixed humus and collapse debris remained (SU 306), which was designated as EU 74 (Figure 3). Similarly to EU 66, EU 74 was excavated down to the level of the surrounding modern ground surface, leaving the surface of the terminal plaza floor unexposed throughout Op. 5C.

The last plaza excavation of 2005 consisted of the 2 x 2 m EU 88, designated as part of Op. 5D. This EU was set in the NW portion of the plaza, with the juncture between the previously excavated Ops. 6A and 9E forming the NW corner of EU 88 (Figures 2b & 3). This EU encompassed the remainder of mixed collapse debris from Strs. 1A, 1B and 2A (SU 322) and was carried to the elevation of the surrounding modern ground surface, without reaching the surface of the terminal plaza floor.

## Architecture

As noted above, most Op. 5 excavations were conducted for site management and consolidation purposes and consequently most were not designed to expose architecture. Only Op. 5B was specifically aimed at exposing the terminal plaza floor surface and the associated AU 1 and thus it is only here that relevant comments can be made. The majority of AU 1 was constructed of two superimposed courses of dolostone facings that span from the SW corner of Str. 2A-1st and reach eastwards across the plaza towards the primary axis of Str. 4A-1st (Helmke et al. in press) (Figures 3 & 5). The basal course was well-preserved and *in situ*, while all the facings of the second course had slumped forward. The facings of AU 1 face south and serve as a step bridging two different levels of plaza flooring (average height between the lower plaza floor to the S and the higher floor to the N is 22 cm). As such this component forms part of a feature delimiting the only formal entrance to the *plazuela* (i.e. the gap between Strs. 2B and 3A in the SW portion of the plaza). A similar coeval feature in much the same type of location and serving a comparable function was discovered in the NW corner of the *plazuela* known as the 'House of the Bacabs' (Grp. 9N-8) at Copan (Webster & Abrams 1983:286, Fig. 2), which has been dated to around AD 780-800, during the reign of the king Yax Pahsaj (Martin & Grube 2000:211). The plastered plaza floor associated with AU 1 was poorly preserved for the most part, save along the feet of Strs. 2A and 2B where thick layers of collapse debris preserved the polished floor in patches. The two floors were found to be noticeably graded to the south to facilitate drainage. The floor associated with Str. 2A (to the north of AU 1) are graded southward by a gradient of c. 3 % (Helmke et al. in press), while that at the base of Str. 2B (to the south of AU 1) has a variable southward gradient averaging at 7 %.

**Figure 5:** Exposure of Architectural Unit 1 in 2002 (as part of the 1 x 3 m EU 53 of Op. 5B). Shot was taken from the summit of Str. 3A looking NW. Note the portion of AU 1 in the western portion (consolidated in 2001) and joining with the SE corner of Str. 2A-1st. Photo by C. Helmke (2002).

## STRUCTURE 2B (OP. 6E)

### Excavations

The point of juncture between Strs. 2A and 2B was first exposed in 2001 in EUs 20 and 23a as part of Op. 6C (Figure 3) (Helmke et al. in press). In 2005 the large EU 79 was defined to clear humus and collapse (SU 276) off the entirety of the eastern (frontal) and southern faces of the structure, the whole defined as Op. 6E (Figures 2b & 3). The excavations proceeded around the perimeter of the structure from the north clockwise, to its well-preserved SW corner at which point the excavations were halted. Terminal plaza floor was exposed along the foot of the frontal (eastern) face until the SE corner at which point the floor petered off and gradually graded into the ancient, humic ground surface. The ancient plaza floor surface was left exposed here to promote better drainage of the plaza and cleared extensively to the east as part of Op. 5B (EU 87, see above).

The architecture of Structure 2B was variably-preserved ranging from good to poor in parts. Consequently, as part of consolidation efforts the core of Terrace 1 (SU 319) had to be extensively backcut (BC 28) and consolidated to maintain the structural integrity of the building. The structure's small outset Stair 1, once completely exposed and documented, was designated as the architecturally-defined EU 81 (Figure 3). The core of Stair 1 (SU 320) was then excavated down to the well-preserved underlying plaza floor in search for axial special deposits, though none were encountered. Stair 1, though moderately-preserved, was completely dismantled thereafter and reset with replacement blocks, as necessary.

### Architecture

The excavations revealed that the platform of Str. 2B-1$^{st}$ was rectangular in plan (7.11 m N-S by 4.12 m E-W) with the summit of the platform running along the verge of Terrace 1, between 0.5 and 0.8 m above the variable surface of the terminal plaza floor. Similarly to the adjacent Str. 2A, Terrace 1 of Str. 2B was found to be evenly graded downwards to the south, along a comparable 3 % gradient. Terrace 1 facings in the medial section of the frontal face were well-preserved (though exhibiting minor slumping) while the southern aspect of Terrace 1 had collapsed away nearly completely. Access to the summit platform of Str. 2B-1$^{st}$ was gained by the diminutive axial outset Stair 1 (measuring 1.15 m N-S by 1.20 m E-W), of two broad steps. Abutting the southern side of Stair 1 and running along the foot of Terrace 1 is AU 9, a low, one- to two-course-high component (measuring 2.98 m N-S by 0.87 m E-W) (Figure 3). At some later time, a minor addition was made to southern end of AU 9. The function of AU 9 remains undetermined at present, though it may have been designed in part to keep the foundations of the structure from silting and being affected from runoff during the rainy season. The architecture of Str. 2B was composed predominantly of dolostone facings with low frequencies of marl stone facings being employed (specific frequencies were not available at the time of writing).

## STRUCTURE 1C (OP. 9C)

### Excavations

Evidence for the existence of Str. 1C was first discovered in 2002 when the westernmost edge of Terrace 1 of that structure was found abutting the eastern face of Str. 1A (in EU 62b). What is now known to have been the uppermost slumped course of Str. 1C's Terrace 1 was recorded during the mapping of the site in 1999. At the time these were thought to form part of an architectural feature forming part of a putative NE entrance to the site (Helmke 2000:289-292, Fig. 2), an interpretation that with the discovery of Str. 1C has since been abandoned. In order to assist in the exposure of the southern (frontal) face of Str. 1C in 2005, the excavations that focused on Str. 4B (Op. 4E) were carried north until the face of Str. 1C's Terrace 1 was encountered in EU 69. With the orientation of architecture found in EUs 62b and 69 the entire frontal face of Str. 1C could be extrapolated. A series of four 1 x 3 m EUs was established (oriented lengthwise N-S) across the remaining unexcavated areas of the structure and designated as Op. 9C. These were designated as EUs 70, 71, 72 and 73 (from E-W) (Figures 2b & 3). Exposure of Str. 1C entailed removal of two distinct strata: a humus layer (SUs 262, 266, 271, 272) and a stratum of collapse debris (SUs 278, 279, 280, 281, 284) concealing and deposited directly atop terminal phase architecture. During the clearing of Terrace 1 a small artifactual concentration was encountered at the foot of Terrace 1 in EU 73. This deposit was identified as 'terminal occupation debris' Cluster 13 and recovered as a separate context (SU 286). After defining the outline of the principal axial outset stair of Str. 1C-1$^{st}$ (Stair 1) it was designated as the architecturally-defined EU 83. First the overlying collapse debris (SU 284) was cleared and subsequent to documentation the core of that stair (SU 289) was excavated down to the well-preserved underlying terminal plaza floor surface. As the outline of Stair 1 was exposed it became clear that part of the western face of the stair-side and the adjoining portion of Terrace 1 had been undermined by a pit-like intrusive cut (SU 295; Figure 6). After clarifying stratigraphic details of the intrusive cut and its associated fill (SU 296), two excavations of the plaza platform core were conducted in EU 71 to test for the incidence of axial special deposits (as none were encountered in the core of Stair 1). The southern of the two excavations spanned from the riser of Step 1 of Stair 1 to the southern baulk of EU 71 (SU 297). The northern excavation was defined by the foot of Terrace 1 at the north and the butt of the facings of Step 1 at the south (SU 298) and as such conformed to the central portion of EU 83. Both excavations were carried to the underlying bedrock, without encountering any special deposits. As part of consolidation efforts the core of Terrace 1 (SU 290) was dismantled and extensively backcut down to the lowest well-preserved course (BC 22). In order to clarify the juncture between Strs. 1C and 4B, as well as to find the SE corner of Str. 1C, BC 26 was initiated as part of Op. 4E (discussed above). As consolidation efforts were unfolding the adjoining EU 84 (of Op. 9G) was initiated to clear the eastern face of Str. 1A. In the process the excavations revealed the western face of the moderately-preserved summit platform of Str. 1C (Figure 3). In addition, Terrace 2 of Str. 1C was discovered, abutting the eastern face of Str. 1A. At this juncture the western half of Terrace 2 was exposed, documented, and consolidated (Figure 7).

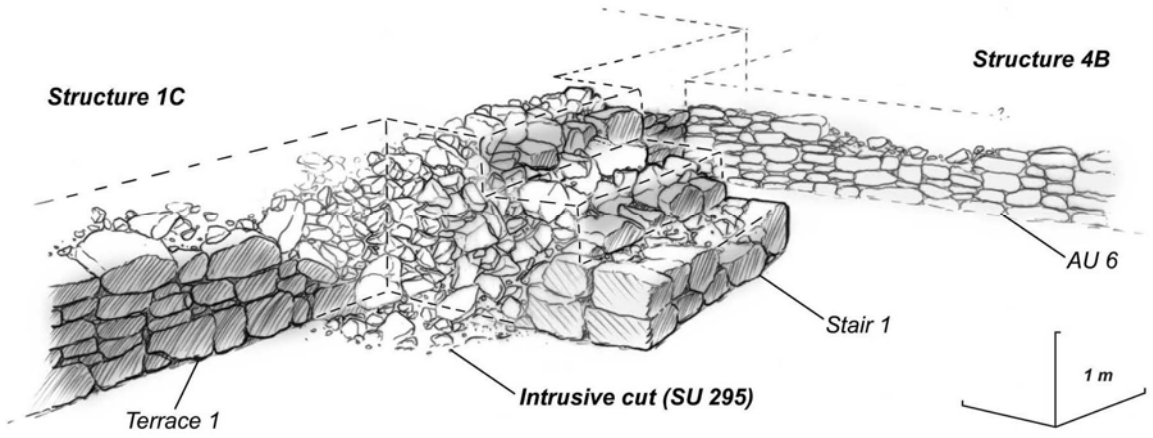



**Figure 6:** Schematic rendition of the southern face of Str. 1C-1st as exposed in 2005. Note how the intrusive cut has damaged the facings of Terrace 1, the facings of the western stair side, and pentrated into the core of the terminal plaza floor. Only Terrace 1 of Str. 1C-1st is represented, Terrace 2 is omitted. Scale varies in this perspective. The scale bar is based on averages of architectural elements in the foreground. Drawing by C. Helmke (2006), based on photographs by C. Helmke, a scaled plan by G. Billing & C. Helmke, as well as a scaled section by C. Helmke & B. Scopa.

## Architecture

Structure 1C-1st was found to have a typical rectangular plan (measuring 7.13 m E-W and > 4.35 m N-S) with a double terrace configuration embellishing its frontal (southern) face (Figure 7). Terrace 2 was well-preserved at its point of abutment with Str. 1A where it had a height of 1.12 m above the terminal plaza floor surface, and recessed 0.86 m from the face of Terrace 1. The verge of Terrace 1 was poorly preserved throughout, but enough of it remained in its central section to suggest that its original height was 0.92 m (above the height of the terminal plaza floor). During backcutting and testing of the plaza platform it was determined that the basal course of Terrace 1 was set directly atop bedrock, thereby providing the structure with solid foundations. Though only the western edge of the summit platform of Str. 1C-1st was exposed (cf. Figure 3), based on projections off other architectural features, it can be estimated to have measured approximately 6.56 m (E-W) by c. 3.80 m (N-S). The axial outset Stair 1 of Str. 1C-1st of three steps was variably preserved. Its basal outline, Step 1, and Step 3 were moderately-preserved, but most of Step 2 had eroded away completely (see Figure 6). Nonetheless, we were able to determine the average riser and tread dimensions as 31 and 36 cm, respectively. Based on documented features, the steps of Stair 1, as well as the verges of both Terraces 1 and 2 can be said to have been built level from E-W, while the corresponding treads and surfaces were only slightly graded from N-S. Stair 1 was built abutting the face of Terrace 1 and directly atop the graded terminal plaza floor (southward by a 5 % gradient), which lips up to Terrace 1.

The intrusive cut (SU 295) that undermined the western stair side and part of the adjoining Terrace 1 penetrated through the strata of collapse debris, terminal architecture, and partly down into underlying bedrock (therefore necessarily postdating each of these).

The fill of that cut (SU 296) contained few artifacts, but many small, partly or completely burnt gray marl stones, especially towards its lower reaches as well as several large facings stones stemming from Terrace 1 that equally exhibited signs of burning and charring. What prompted the digging of this cut remains unknown at present, though it is clear that the pit was the locus of an episode of burning (of unknown duration). Based on its stratigraphic position, the cut and its associated fill must date to a late period of the site's history, subsequent to the formation of the collapse debris talus of Str. 1C.

**Figure 7:** Structure 1C-1st as consolidated at the end of the 2005 season. Note the double terrace configuration of the platform and the outset stair undermined by the intrusive cut. Structure 1C-1st abutted against Str. 1A-1st to the west (on the left) and was abutted upon by Str. 4B to the south (on the right, foreground). The partly exposed summit platform of Str. 1C-1st was left *in situ* and backfilled. Detail of composite photo mosaic by C. Helmke (2006).

## STRUCTURE 1B (OP. 9D)

### Excavations

At the start of investigations at Pook's Hill in 1999, no distinction was drawn between what are now known as Strs. 1A and 1B. All that could be seen, was one large northern structure (originally designated simply as Str. 1). Evidence for the existence of Str. 1B first came in 2001 when the southern (frontal) facade of that structure was

extensively cleared as part of Op. 6B excavations (Helmke et al. in press). It was at that time that the well-preserved low doorway into the vaulted room of Str. 1B was discovered (ibid.). The doorway, the architectural features framing it and their overall dimensions were found to compare favorably to contemporary sweatbathing structures documented at the sites of Piedras Negras and Tikal, Guatemala (Helmke in press). In order to test this hypothesis, the vaulted room of Str. 1B was completely excavated and documented in 2005. Based on the many features consistent with sweatbaths uncovered during the 2005 excavations (small room, low doorway, 'sunken passageway', interior and exterior benches, as well as the presence of a 'hearth' and 'sunken firebox') it can now be conclusively stated that the vaulted room functioned primarily as a sweatbath (Helmke & Awe 2005).

As the vault appeared to be collapsed for the most part (based on visible surface features) (Figure 8), it was deemed prudent to approach the excavation of the room from the top and to proceed downwards (for both safety and research reasons). After clearing

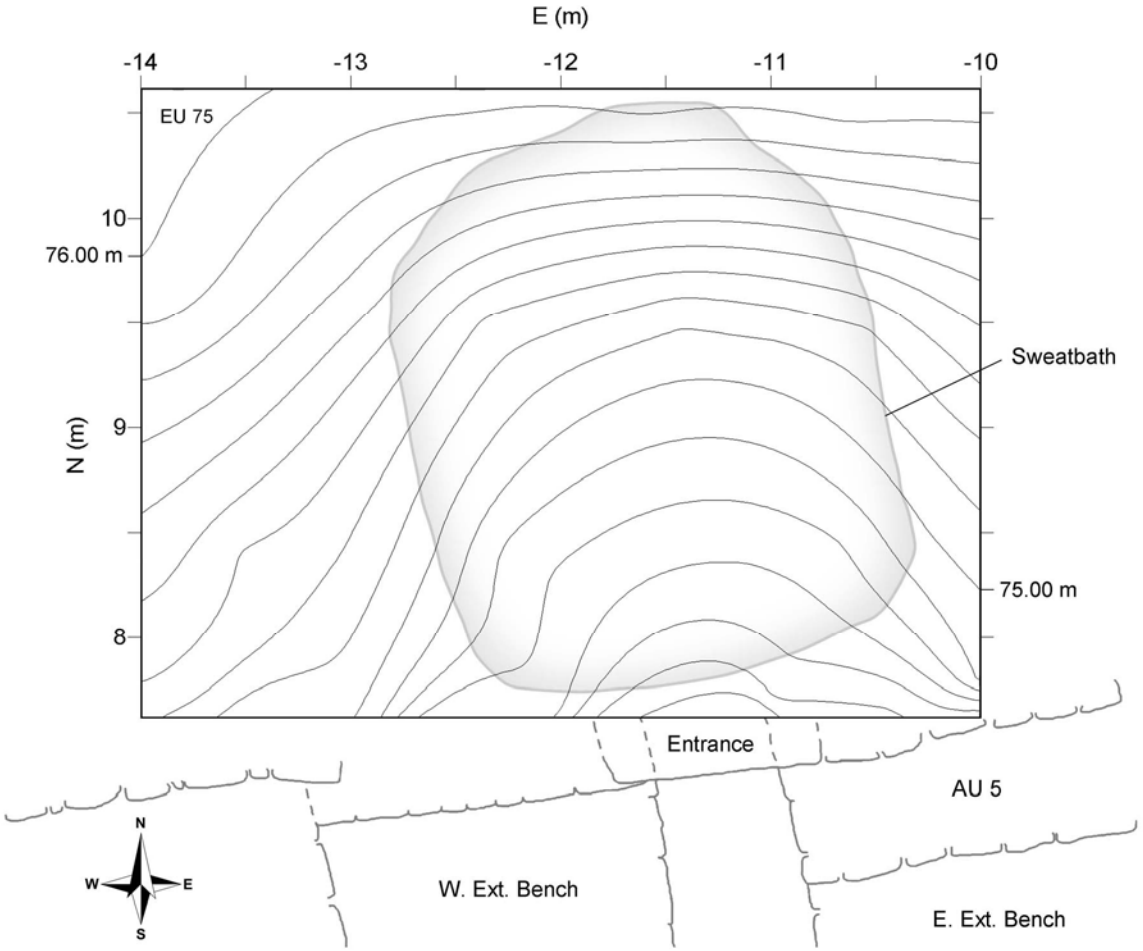



**Figure 8:** Plan of EU 75 at the start of excavations. Microtopography represented is that of the modern humic ground surface once cleared of vegetation. Contour lines are in 10-cm intervals ranging between 74.40 and 76.00 m HAE. Plan aligned to UTM grid north. Coordinates of the perimeter of EU 75 are in meters and in relation to permanent datum 6. Plan and surveys by B. Haley and C. Helmke (2005-2006).

the vegetation that shrouded Str. 1B the 3 x 4 m EU 75 was set to encompass the entirety of the vault and parts of the remaining superstructures (Figures 3 & 8). The excavations were initiated with the removal of the humic layer (SU 263) down to the partly collapsed architecture of adjoining structures (Figure 9). A small deposit of artifacts, identified as terminal occupation debris and designated Cluster 12 (SU 264) was found at that time, deposited upon the flooring surface of Terrace 2, within the SE corner of EU 75. Removal of the humic layer (Level 1a) made the outline of the vaulted room more readily discernable and from that point onwards the excavations proceeded within the confines of the room. A pervasive very dark brown stratum of organic soil was found to fill the room and on account of the thickness of the stratum was subdivided into two arbitrary levels (Levels 2 and 3, SUs 268a and 268b, respectively; see Figure 9). The end of the humic stratum was marked by a layer of collapsed vault stones that spanned across the entirety of the room (Figures 9 & 10), representing the principal phase of the vault's collapse. After exposure, documentation and cataloging of the vault stones (for research purposes and eventual use in consolidation), the room was bisected into approximate

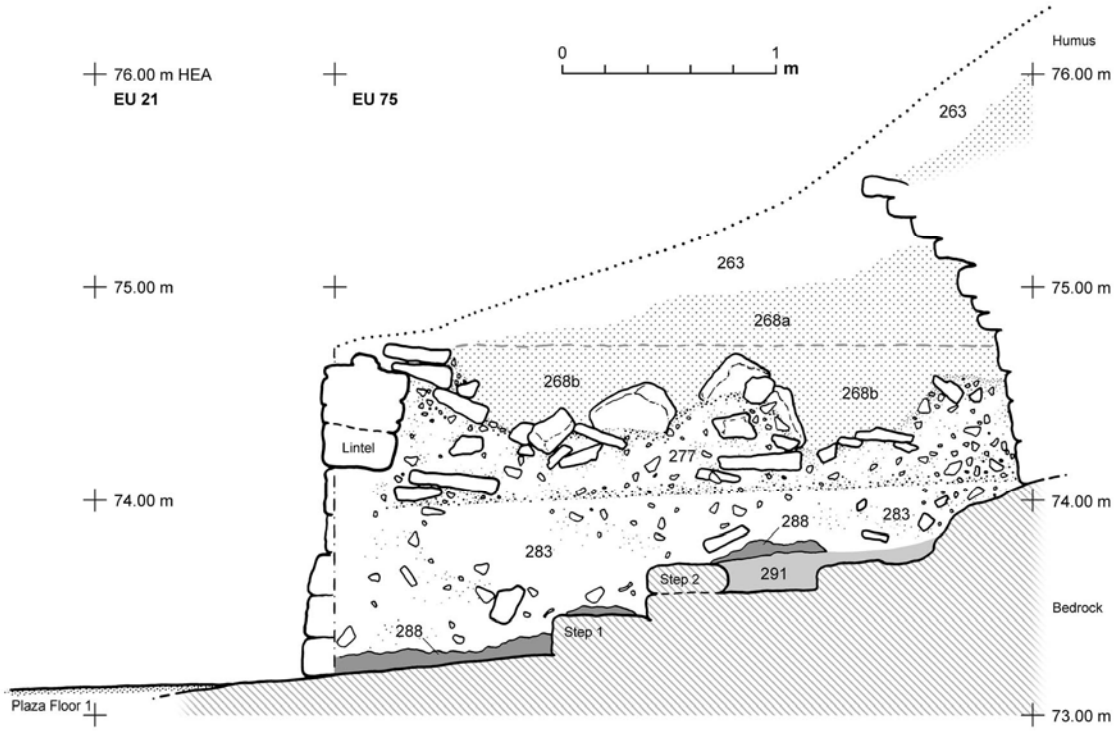



**Figure 9:** Stratigraphic section exposed in the excavations of the vaulted sweatbathing room of Str. 1B-1st (looking due magnetic west; north is to the right and south to the left). Section represents all contexts encountered in 2005; those completed in previous seasons are omitted (i.e. EU 21 of 2001). The modern ground surface of the humic stratum (SU 263) is marked by the dotted line. Note the arbitrary sub-division of the thick organic stratum (SU 268). The collapse stratum (SU 277 and 283) was divided vertically along the plastered bench surfaces (marked by the stippled interstice). Dark gray lenses represent the deposits of terminal occupation debris (SU 288) forming part of Cluster 4. The compact limestone powder filling the hearth and 'firebox' (SU 291) of the sweatbath (carved out of bedrock) is rendered in light gray. Section by C. Helmke (2006), survey by C. Helmke, B. Haley, and R. Guerra.

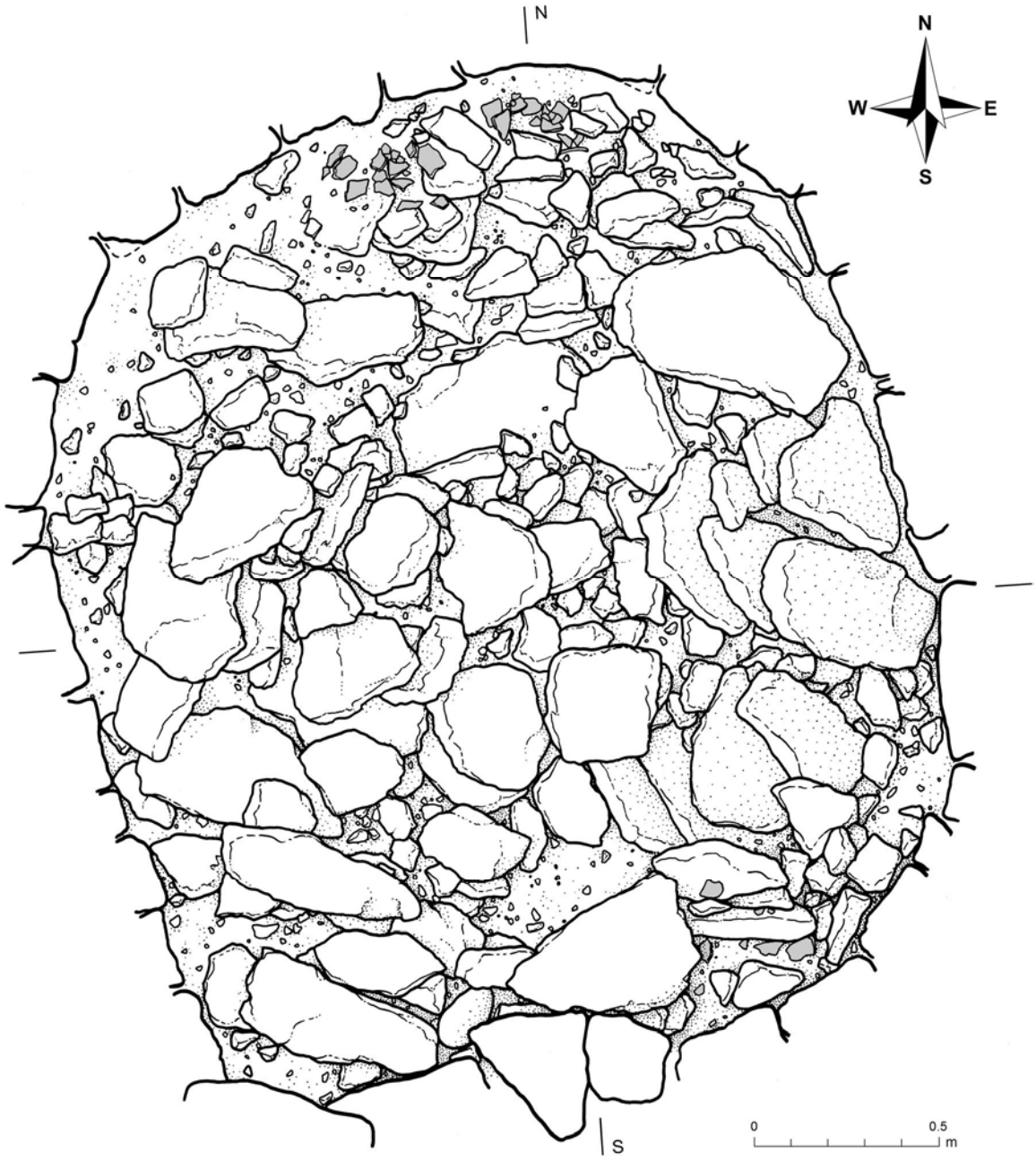



**Figure 10:** Plan of the of the collapsed vault stratum (top of SU 277) as exposed under the organic-rich stratum (bottom of SU 268). Note the partly articulated courses of flat vault stones, particularly along the eastern and western walls. Better preservation of the northern section of the vault also accounts for the relative paucity of vault stones in that section of the room. Note too the two discrete clusters of ceramic sherds (marked off in gray) in the northern and southern ends of the room. Graticules refer to the baselines established in the field for quadrant subdivision and sectioning. Plan aligned to UTM grid north. Plan by C. Helmke (2006) based on field sketches, a plan by M. Nanetti and a scaled composite digital photo mosaic by C. Helmke (2005).

eastern and western halves. In order to record the stratigraphic profile, the eastern half (SU 277a) was cleared first down to a well-preserved and graded plaster surface that eventually turned out to be the surface of the eastern interior bench. Following documentation of the stratigraphic profile, the remaining collapsed vault stones occupying the western half of the room (SU 277b) were cleared down to the analogous western bench surface. The collapsed vault stratum, however, still filled all areas of the room recessed below the elevation of the bench surfaces (i.e. the 'sunken passage' and the 'hearth'). A new context was designated to encompass the lowest reaches of the remaining collapse debris stratum (SU 283), which when cleared revealed the underlying terminal phase architecture as well as clusters of terminal occupation debris (Figures 9 & 11). The deposits of terminal occupation debris (SU 288) were found to rest directly atop terminal phase architecture save those in the northern reaches of the room that were deposited atop a layer of light-gray, dense, burnt and hard-packed limestone powder (Figure 9). This stratum (SU 291), termed 'terminal infill' in the field, filled most of the recessed 'hearth' and 'sunken firebox' that had been hollowed out of bedrock (see additional comments on SU 291 in Helmke & Stanchly in prep.). With the extraction of SU 291, exposure of terminal phase architecture and bedrock was completed throughout (a good portion of the room having been cut into bedrock). The last research-based

**Figure 11:** The terminal phase architecture of the sweatbath room with all deposits of terminal occupation debris exposed (SU 288). Note how the terminal occupation debris chokes the sunken passage leading into the room, litters the steps and covers the hearth. Photo sighted from the summit of Str. 1B, looking due magnetic south (cf. baselines set to magnetic cardinal directions). Photo by C. Helmke (2005).

excavations in the vaulted room consisted of two 50-cm wide EUs set into the center of the benches to test for the incidence of special deposits (EUs 85 and 86, SUs 316 and 317, respectively) (Figure 3). Bedrock was reached in both tests without encountering any special deposits.

Concurrent to the excavations clearing the interior of the sweatbathing chamber, the exterior facade of Str. 1B was also exposed in 2005. All of these excavations were subsumed (due to proximity) under the adjoining EU 77 of Op. 9E, though many of the architectural components uncovered are clearly related to Str. 1B. In particular a matching bench was found to the east of the sweatbath's doorway to the one discovered to the west in 2001 (Helmke in press; see Figure 3). A refurbishment made to Terrace 2 of Str. 1B had been constructed upon that bench (designated as AU 5, SU 282), which though supporting Terrace 2 from the mass of the vault, nearly reduced the surface of the bench by half (Figure 12). In exposing the well-preserved plastered surface of the eastern exterior bench a small concentration of terminal occupation debris was found atop that bench in its NE corner (designated Cluster 15, SU 301). Lastly, a small stair of three steps was exposed (Stair C, SU 300), which was built to conceal and reinforce the seam formed by the SW corner of Str. 1A and the abutting eastern exterior bench of Str. 1B. Stair C was undermined by the construction of AU 7, a terminal refurbishment to Str. 1A that remained unfinished at the time of the site's abandonment. As such its steps had been partly dismantled in antiquity. Nonetheless, Stair C is clearly analogous to Stair B that was discovered in 2001, which was built abutting the southern face of the western exterior bench of Str. 1B (Helmke in press). Both of these stairs appear to have been designed to facilitate access to the high bench surfaces to which they are appended.

The consolidation efforts focusing on the sweatbath were extensive and required significant backcutting for the sake of structural stability. The remains of the vault and the walls of the room (SU 318) had to be backcut and dismantled down to the lowest well-preserved course which was a laborious undertaking. In the process the western face of Str. 1A was exposed over a breadth of four meters until another terrace feature (AU 11) was discovered to the north of the sweatbath (Figure 3). It was deemed sound to follow and partly clear both of these architectural alignments to clarify the construction history of Str. 1B, as well as to provide good foundations for the vault mass that would be restituted. In backcutting the western wall of the sweatbath two superimposed plaster floors were discovered in the exposed section, which pertain to the summit of Str. 1B (Figures 9 & 13). In clearing westward, the lower of these floors (Floor 2, SU 324) was found to run continuously to AU 11 at the north of the sweatbath. The latter Floor 1 (SU 323) that superimposes Floor 2, serves as the summit surface atop of which the well-preserved superstructure of Str. 1B was constructed. In addition, Floor 1 and the associated superstructure seem to have spanned across the top of the vault and may represent parts of the same construction efforts. The frontal (southern) face of the superstructure was eventually refurbished and raised slightly (AU 12), representing one of the last construction efforts documented for Str. 1B. Once all the backcutting was completed the vault mass and its associated southern facade was restored to the highest documented elevation in some areas, or raised by two to three courses in others (to ensure that water would drain around, rather than into the room). All the other sections of the room were sufficiently well-preserved to warrant only repointing and re-plastering of the bench surfaces.

**Architecture**

Structure 1B exhibits the most detailed construction sequence and architectural features documented to date at Pook's Hill. In large measure this is due to the fact that the structural platform encompasses the vaulted sweatbath, which is equipped with several masonry features that relate to its specialized primary function.

Structure 1B faces south and conforms to the double terrace configuration of most other buildings at Pook's Hill. In the terminal phase the summit of Str. 1B (i.e. the flooring of Terrace 2) rose approximately 2.70 m above the terminal plaza floor (Figure 13). The small rectangular summit platform of Str. 1B-1$^{st}$-A was built atop the flooring of Terrace 2 (originally measuring perhaps c. 4.54 m wide E-W by 2.50 m long N-S, and c. 12 cm high, above the flooring of Terrace 2), while another subsequent phase of construction (either Str. 1B-1$^{st}$-B or Str. 1B-1$^{st}$-C) entailed refurbishment to the frontal face (AU 12, thereby extending the summit platform by 40 cm to the south and raising it to a total height of c. 22 cm). Access to the summit of Str. 1B was gained by the narrow, non-axial, Stair A (SU 177) of six steps (Table 2), which was built abutting the faces of Terrace 1 and 1' of Str. 2A (Figures 12 & 13). From the landing atop Terrace 1 another lateral stair (possibly of three steps, cf. Table 2) was inset into the core of Terrace 2 to gain access to the southeastern portion of Str. 1B's summit. A perishable superstructure of wattle and daub walls may have been built atop the summit platform, which originally spanned across the vaulted sweatbath (on account of the pieces of briquette recovered in the upper reaches of the vault collapse SU 277b).

The sweatbath room was built into the southeastern portion of the Str. 1B platform where the terrace faces are combined to into a single facade that rises in plumb from what elsewhere is the foot of Terrace 1 straight up to the verge of Terrace 2. The sweatbath is accessed by a small doorway (Table 3) that punctures the middle this facade, which appears recessed in relation to the adjoining Strs. 1A and 2A (Figures 12 & 13). The doorway in turn is flanked on either side by two high benches that occupy the recessed area and line up with the frontal face of Str. 1A's Terrace 1. These are referred to as the western exterior bench (SU 170) and the eastern exterior bench (SUs 174, 302) (Table 3). Access to the plastered surfaces of these benches was gained by means of two small stairs of three steps each, the western bench being associated with Stair B (SU 163) and eastern bench with Stair C (SU 300). When these stairs were constructed, the surfaces of the benches were raised slightly (by 19 cm on average) in order to conform to the tread of Step 3. Interestingly, Stair B was constructed almost entirely of dolostone facings, while Stair C was built exclusively of marl facings, but both were built abutting the southern faces of the benches directly atop the terminal plaza floor, indicating that these are discrete, later additions. This point is supported by the fact that Stair B was built abutting the previously completed Stair A (SU 177) and therefore Stair B represents –for all practical purposes– an eastward extension to Stair A.[5] Another late element in

[5] The dislodged bannerstone that was found in collapse debris (SU 165) near the SE corner of the western exterior bench, may originally have been placed higher up, on the flooring of Terrace 1, presumably near the northeastern corner of Stair A (Helmke et al. in press). As far as I am aware this is the only case in which a bannerstone or 'standard-bearer' is associated to a sweatbathing structure. It has interesting implications when one considers the connotations of banners or 'standards' in the Classic period, when these were known as *lakam* (see Miller 1986; Fash et al. 1992:426, Fig. 11; Freidel et al. 1993: 236-238, 294-295, 298-304, 325, 351-334; Stuart 1998:374; Le Fort 1998:15-16, 20-21, Fig. 9).

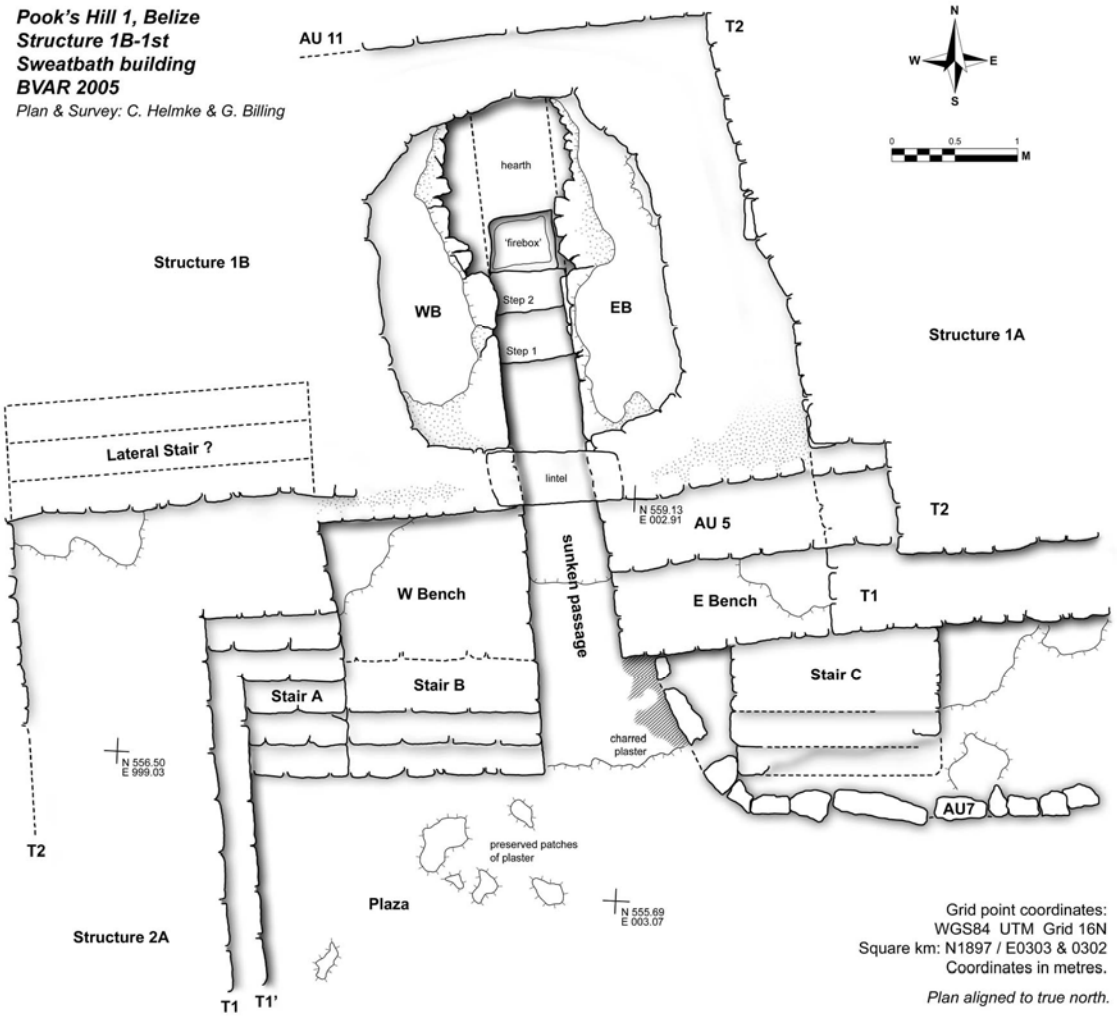



**Figure 12:** Plan of the sweatbath of Str. 1B-1st and adjacent terminal phase architectural features of the adjoining Strs. 1A and 2A. Note the interior benches of the sweatbath that are heavily worn and cracked along the hearth, brought about by repeated and prolonged contact with heat. The section of charred plaster abutting the foot of AU 7 in the sunken passage represents the eastern extent of terminal occupation debris Cluster 4 in this area. Dashed lines represent architectural elements that are concealed by later refurbishments.

the construction sequence is Architectural Unit 5 (SU 282), which is a terrace-like block of masonry that was built atop the (previously-raised) surface of the eastern exterior bench and apparently designed as a type of retaining component to Terrace 2 and the associated heavy vault mass. Whatever the original function of AU 5, it reduced the overall surface area of the eastern exterior bench to nearly half, and partially cut through Terrace 1 of Str. 1A so as to align with the face of Terrace 2 of the same building. Complete dismantling of AU 5 during consolidation efforts, however, showed no signs of Terrace 2 being breached or cracked, which otherwise could have motivated the construction of AU 5. The dismantling also demonstrated that Terrace 1 of Str. 1B

abutted Terrace 1 of Str. 1A; thereby indicating that Str. 1A-1st was already completed by the time the Str. 1B-1st sweatbath was built.

| | maximum length | maximum width | maximum height | mean riser height | mean tread width |
|---|---|---|---|---|---|
| Lateral Stair (3*) | 0.88* | 2.42* | 0.74 | 0.25 | 0.30 |
| Stair A (6) | 1.30 | 1.06 | 1.60 | 0.27 | 0.26 |
| Stair B (3) | 0.93 | 1.56 | 0.82 | 0.27 | 0.25 |
| Stair C (3*) | 1.17 | 1.66 | 0.80* | 0.26 | 0.25 |
| Interior Stair (2) | 0.76 | 0.58 | 0.42 | 0.21 | 0.40 |

**Table 2:** Physical characteristics and metrics of the stairs associated with the Str. 1B. All measurements are rendered in meters and represent maxima, except the tread and riser figures that are means. The numbers in parentheses besides stair designations refer to the total number of steps. Asterisks mark all reconstructed values.

The exterior benches and associated stairs form a narrow corridor to the doorway, a feature that has been referred to as a 'sunken passage' or *desagüe* (lit. "drainage"; see Figure 12) for the sweatbaths at Piedras Negras (Satterthwaite 1952:11-12, 18, 34, 53; Child 1997:141-142, Figs. 62 & 63; Houston et al. 1998:43-46). Benches outside of the sweatbath room proper have also been noted for several structures at Piedras Negras (i.e. Strs. N-1, P-7, and possibly Str. J-17; Satterthwaite 1952:20, 21, 38, 75), where bathers may have disrobed prior to, and rinsed off subsequent to bathing (see Cresson 1938:99; Houston 1996:138; Helmke & Awe 2005:25). That the sunken passage was designed for drainage is confirmed by the terminal plaza floor that has an even c. 3 % southward gradient, to promote runoff out of the *plazuela* via its southeastern entrance (Figure 13). In addition, the continuation of the sunken passage into the sweatbathing chamber is also graded southward, though on a sharper 9.5 % gradient (Figure 13). From around the threshold of the door inwards, the floor of the sunken passage was carved out of bedrock (Figure 13). The bedrock floor is smooth and was worn-down by repeated and continued entries, which indicates usage of the sweatbath over an extended period of time.

The interior of the small sweatbath is dominated by two high benches (Table 3, Figures 12 & 13), which were built abutting the eastern and western walls as well as partly atop bedrock in some areas and cut out thereof in others. These benches span the length of the room and thus frame the northern continuation of the sunken passage. Though not explicitly referred to as 'benches' at the sites of Piedras Negras or Los Cimientos, the sunken passages there do bisect the interior of sweatbathing rooms, thereby leaving two raised areas on either side that duplicate the interior benches seen at Pook's Hill (see Satterthwaite 1952:11-12, 34, 53; Ichon 1977; Alcina Franch et al. 1982). The disposition of the benches within the sweatbath thereby replicates that of the exterior benches and as such these are referred to as the eastern interior bench (SU 317), and the western interior bench (SU 316) (Table 3). In addition, the interior and exterior bench surfaces are also in fact continuously graded to the south in keeping with the plaza floor (c. 4 % gradient) to facilitate drainage of excess water used during bathing (Figure 13). The facings forming the verge of the southern portion of the western interior bench

also exhibit wear-polish, which again indicate extensive use of the sweatbath over a prolonged period. Similarly, the eastern interior bench exhibits two superimposed plaster surfaces that indicate re-plastering and thus maintenance (and lengthy use) of the sweatbath. Access to the interior benches was gained by two small steps (termed the interior stair) in the middle of the room, the lower one (Step 1) being carved out of bedrock and the second one (Step 2) being formed by a single dolomitic limestone block. Due to the low ceiling and the high temperatures that could be reached inside a sweatbath (Houston et al. 1998:45-46) is seems that bathers were intended to sit cross-legged or lie supine atop the interior benches (ALMG 2003a:90).

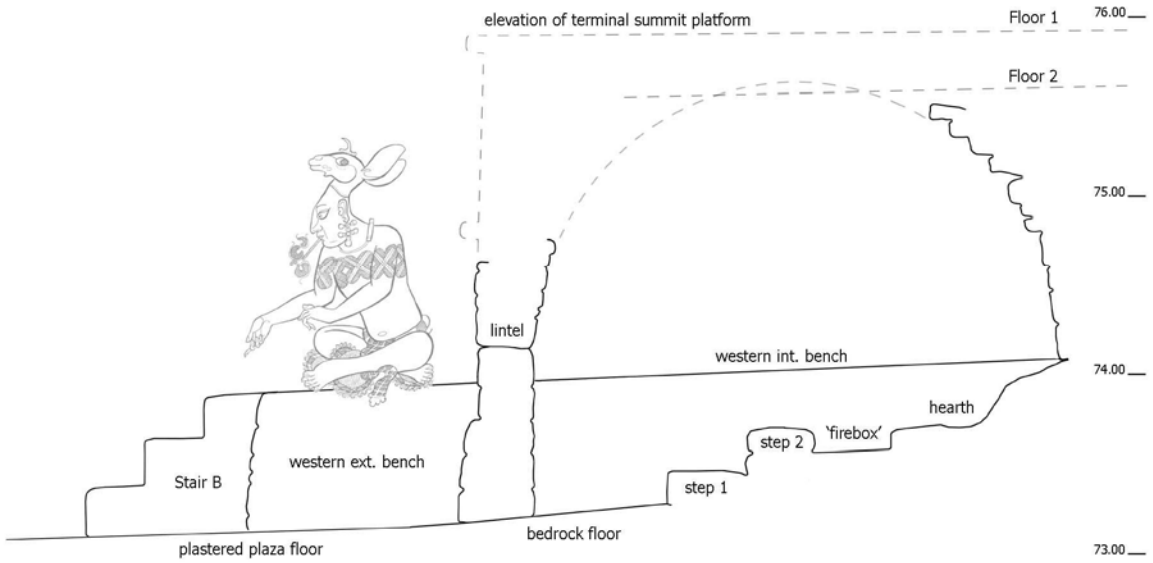



**Figure 13:** Hypothetical reconstruction section through the sweatbath of Str. 1B-1st. Solid lines represent documented architecture, dashed lines hypothetical reconstructions. The noticeably graded bench and floor surfaces are to promote runoff of water used during bathing and rinsing. Note Floor 2 that is associated with AU 11, which must predate the construction of the sweatbath's vault, while Floor 1 undoubtedly represents the summit flooring of the vaulted sweatbath. Scale is indicated by the elevation graticules expressed in meter increments (HAE). Section by C. Helmke (2006). Seated male figure based on a drawing by Linda Schele and scaled to mean male stature of the Terminal Classic (data based on Tikal).

The northernmost portion of the central passage exhibits what would have been a rectangular portion of exposed bedrock, which is delineated by the foot of the northern wall, the bench faces, and Step 2, and recessed vertically in relation to these architectural elements (Figure 12). This section of exposed bedrock served as the 'hearth' of the sweatbath, in the southernmost extent of which a small rectangular depression was hewn out of the bedrock. This rectangular depression has been termed the 'sunken firebox' (Figures 12 & 13) in keeping with the terminology employed for the Piedras Negras sweatbaths (see Satterthwaite 1952:13, 18, 33, 77), though the inadequacy of this term in reference to the Mesoamerican context is conceded (see Houston et al. 1998:44-45). In

addition, Step 2 of the interior stair doubles as a 'sill' to the 'sunken firebox', which is another feature documented in the sweatbaths of Piedras Negras (Satterthwaite 1952:18, 33, 55, 77). Together the 'hearth' and the 'sunken firebox' served as the primary heating facilities of the sweatbathing room.[6] Though it was originally held that fuel was actually ignited in 'fireboxes' within sweatbaths to heat the rooms and the associated 'hearthstones' (Satterthwaite 1952:13-14, 18), recent experimentation suggest that the 'hearthstones' were heated outside the sweatbath and subsequently hauled in (Houston et al. 1998:45-46).[7] Whichever was the case at Pook's Hill, it is clear that the 'hearth' was the focus of high temperatures, on account of the calcined and weathered condition of the benches bordering on the 'hearth' and the pervasive cracking that affects Step 2 (Figure 14). The heat-induced cracking and spalling of the facings of the benches indicate that the stones were rapidly cooled, as if by contact with water to produce steam (see Cresson 1938:98-99, 101; Satterthwaite 1952:12-13, 18). Continued usage of the sweatbath is also suggested by the hard and dense mass of fine burnt gray limestone powder –which contained charcoal inclusions and a partial ceramic *olla*– that had accumulated in the 'hearth' and the 'sunken firebox' (SU 291). This stratum of 'terminal infill' represents the accretion of the calcined facing stones of the adjacent benches. Based on the context of SU 291 and its composition (in terms of matrix and artifactual content, type and frequencies), this deposit represents the primary phase of the sweatbath's usage (see Helmke & Stanchly, in prep.). Nonetheless, based on available evidence it remains

[6] These features together were apparently referred to in the Classic period as *pib'* (based on the glyphic inscriptions at Palenque and Tortuguero), which refers to a type of 'underground oven' as seen in Yukatek reflexes (Stuart 1987:38, 39, Fig. 50b; Barrera Vásquez 1990:651; Houston 1996:136), an 'horno' in Lakantun (Bruce 1968:75). The same root *pib'*- was used to refer to sweatbaths as *pib'naah* or *pib'b'ahal* (see Houston 1996; Barrera Vásquez 1990:651) and has been retained in the Yucatec delicacy *conchinita pibil* (lit. "oven's piglet") as well as *pollo pibil* (lit. "oven's chicken"). Additional terms for the 'hearth' of sweatbaths are seen in several other Mayan languages, such as *porob'al* in Achi (AMLG 2000a:59), *ch'ujb'en* in Ch'orti' (ALMG 2000a:106), *imu'ch* or *amu'ch* (for 'hornilla de temascal') in K'iche' (ALMG 2004:43), *pan ika'* (for 'horno de temascal') in Popti' (ALMG 2001a:73) and *ch'en ika* (for 'horno del temascal') in Q'anjob'al (AMLG 2003b:74). The Maya terms can be aptly compared to the Finnish sauna 'stoves' known as *kiuas*. At Pook's Hill, the small depression provisionally designated as a 'sunken firebox' that was cut out of bedrock is reminiscent of the grate-covered 'ash drawers' seen in modern European-style fireplaces. It is possible that the 'sunken fireboxes' seen at Pook's Hill and Piedras Negras functioned similarly to collect ashes and cinders, for eventual removal?

[7] The 'hearthstones' employed in sweatbaths are known as *yoquejt* in Ch'ol (Aulie & Aulie 1978:10), *sim tun* or *sin tun* in Yukatek (Barrera Vásquez 1990:729, 730), *amutx* in Popti' (ALMG 2001:175) and Q'anjob'al (ALMG 2003b:17), *q'aaq' nb'en sqe'j* in Awakateko (ALMG 2001:31) and *tezontle* (a type of porous volcanic stone and scoria) in the Mexican Highlands (Cresson 1938:98). Many of these entries and are clearly analogous to the Finnish term *kiuaskivet* for 'stove-stones' used in saunas. The preferred *kiuaskivet* in Finland are olivine-rich stones (magnesium-iron silicate), which occurs in mafic igneous rocks (such as forsterite, fayalite, peridotite, dolerite, and to varying degrees basalt), and as a primary mineral in some metamorphic rocks (e.g. granite). If the preferred 'hearthstones' among the ancient Maya exhibited the same physical properties (as one would surmise), then the ancient inhabitants of the majority of the Lowlands would have had to obtain these by means of trade as the local geology is limestone-based and thus devoid of deposits of igneous stones. As such the closest sources for good-quality 'hearthstones' for sweatbaths are the Highlands of Guatemala and the Maya Mountains of Belize. At this juncture it should be noted that granite fragments were recovered as part of the stratum of terminal occupation debris within the sweatbath (SU 288), more specifically, three *metate* fragments in the area of the 'hearth' (i.e. SU 288a).

unclear at present, whether hearthstones were heated outside or within the Pook's Hill sweatbath, without experimentation with the particular case at hand.[8]

| | maximum length | maximum width | maximum height |
|---|---|---|---|
| Doorway | 0.43 | 0.58 | 0.98 |
| W exterior bench | 1.51 | 1.15 | 0.64 |
| E exterior bench | 1.68 | 1.31 | 0.51 |
| W interior bench | 2.67 | 0.92 | 0.82 |
| E interior bench | 2.74 | 0.82 | 0.80 |
| Vaulted room | 2.85 | 2.25 | 2.35* |
| Sunken passage | 3.14 | 0.68 | 0.82 |
| 'Hearth' | 1.32 | 0.61 | 0.36 |
| 'Sunken firebox' | 0.45 | 0.60 | 0.13 |

**Table 3:** Physical characteristics and metrics of the architectural features associated with the sweatbath. All measurements are rendered in meters and represent maxima. For the doorway, the length measurement refers to the maximum depth from front to the back of the lintel. For benches, length represents the breadth from side to side along the verge, while width refers to the distance from front to back. All measurements provided for exterior benches are for their original dimensions when first built, not their terminal phases when these were raised to the height of Step 3 (tread) of Stair B. For the interior benches mean heights above bedrock flooring are rendered. The length of the sunken passage spans from the SE corner of the 'sunken firebox' to the SW corner of the eastern exterior bench. For the 'hearth' and 'sunken firebox' the length measure is a mean, while "height" is in fact the maximum depth. An asterisk marks each reconstructed value.

The vaulted sweatbath room is roughly ovoid in plan and measures approximately 2.85 m long (N-S) by 2.25 m wide (E-W), encompassing c. 5.33 $m^2$ (Figure 12 & Table 4). The smallness of the room is obviously designed for heat-retention, another diagnostic attribute of sweatbaths (see Table 4; Satterthwaite 1952; Houston 1996). The walls of the ovoid room had solid foundations, being built directly atop cleared bedrock (Figures 9 & 13), with large dolostone slabs (here hard marl and dolostone were employed at a ratio of 1:16, respectively). The vault spring aligns to the verge of Terrace 1 (at a height of c. 1.58 m above the exterior threshold of the doorway), with the portion corresponding to Terrace 2 encompassing the vault mass proper. The best-preserved portion of the wall-to-vault juncture (in the NW portion of the room) exhibited eleven courses in all, above the western interior bench surface (of which the topmost four were part of the vault proper). The documented section demonstrates that the walls and vault were continuously corbelled, so that the room would have had a dome-like appearance

[8] Though evidence for external or internal heating of hearthstones has not been forthcoming for the Pook's Hill example, an anomaly (measuring c. Ø 4 m) was discovered during the geophysical survey of the plaza with ground-penetrating radar, whose center lies approximately 7.5 m to the SE of the door to the sweatbath (Haley, this volume). Could this anomaly have been formed by the compaction of the plastered plaza floor in this area, brought about by fires lit for the purpose of heating the sweatbath's 'hearthstones'? We hope that future excavations aimed at this particular anomaly may address this issue further.

(Figure 13), though the walls below the vault spring exhibit a lesser curvature than the vault. As such the walls can be said to have a 'negative batter' (i.e. battered-forward; see Loten & Pendergast 1984:4) of 26 cm up to the vault spring (at a height of 95 cm above the bench surfaces) at which point the vault is corbelled by c. 10 cm increments. Based on these observations and the documented summit elevations of Str. 1B-1st-A, the maximum vault height, in the center of the sweatbath may have been 2.35 m high (at the foot of Step 1; see Figure 13). During excavations we expected to find a large circular capstone that would have served to top off the whole vault, but none was found (either complete or fragmentary) amidst the collapse debris cleared out of the room (SUs 277, 283). Though conjectural, the absence of such a putative capstone may signal that the vault exhibited a central, circular orifice. Similar features have been documented as part of modern sweatbaths in Mexico and Guatemala, serving as a flue or chimney-throat through which smoke and heat are dissipated, though many examples do not incorporate such a feature (Cresson 1938:90-97 *passim*; Satterthwaite 1952:12, 14; Rojas Alba 2005). The orifice would have been located along the foot of the summit platform of Str. 1B, near its southeastern corner, and may have had a circular cover[9] that could be moved to damper and adjust the smoke and heat within the sweatbath.


**Figure 14:** Close-up of Step 2 within the sweatbath, exhibiting pervasive cracking, induced by high temperatures and rapid cooling. Note also the extensive breakage of the benches bordering on the hearth, again apparently brought about by repeated and prolonged exposure to heat. Photo and graphics: C. Helmke (2005).

[9] Note the Mam Maya terms *tlamel chuj* or *tjepel chuj* for such a 'tapadera de temascal' (ALMG 2003a:100). In these entries the material out of which these covers are made is not specified, though conceivably they could have been made of wood, ceramic, or stone (perhaps slate).

| | | max. length (m) | max. width (m) | max. height (m) | total area ($m^2$) | total volume ($m^3$) |
|---|---|---|---|---|---|---|
| **Lowland Sweatbaths** | | | | | | |
| Cuello, Str. 342 | C | 2.50 | 2.50 | --- | 4.91 | --- |
| Ceren, Str. 9 | C | 2.60 | 2.60 | --- | 5.31 | --- |
| Piedras Negras, Str. N1 | S | 4.80 | 3.25 | 2.00* | 15.60 | 23.40 |
| Piedras Negras, Str. S19 | S | 4.25* | 2.80 | 2.50 | 11.90 | 22.31 |
| Piedras Negras, Str. J17 | S | 4.00 | 2.90 | 2.30* | 11.84 | 20.31 |
| Piedras Negras, Str. O4 | S | 4.50 | 2.80 | 2.60 | 12.60 | 24.57 |
| Piedras Negras, Str. S2 | S | 4.50 | 3.00 | 2.50 | 13.50 | 25.31 |
| Piedras Negras, Str. S4 | S | 4.50 | 3.20 | 2.60 | 14.40 | 28.08 |
| Piedras Negras, Str. R13 | S | 4.60 | 2.50 | 2.70 | 11.50 | 23.29 |
| Piedras Negras, Str. P7 | S | 3.30 | 2.20 | 2.70 | 7.26 | 14.70 |
| Piedras Negras, Str. BS27 | S | 1.90 | 1.40 | --- | 2.66 | --- |
| Altun Ha, Str. C17-A (?) | C | 4.20 | 4.20 | --- | 13.85 | --- |
| Cahal Pech, Str. B5-sub (?) | S | 3.60 | 3.06 | --- | 11.02 | --- |
| Copan, Str. 10L-223, Rm. 2 | S | 4.76 | 4.47* | --- | 21.26 | --- |
| Palenque, Str. TC$^+$ | S | 3.31 | 1.77 | 2.83 | 5.86 | 14.21 |
| Palenque, Str. TFC$^+$ | S | 2.88 | 1.56 | 2.34 | 4.49 | 9.32 |
| Palenque, Str. TS$^+$ | S | 2.78 | 1.30 | 2.59 | 3.61 | 8.10 |
| Copan, Str. 9N-81, Rm. 2 (?) | S | 2.36 | 2.36 | --- | 5.56 | --- |
| Calakmul, Str. 2B, Rm. 7 | S | 5.90* | 1.00 | --- | 5.84 | --- |
| Tikal, Str. 5E-22 | S | 5.14 | 2.75 | 2.40* | 14.14 | 25.44 |
| Pook's Hill, Str. 1B | C | 2.85 | 2.25 | 2.35* | 5.33 | 9.56 |
| Chichen Itza, Str. 3C15 | S | 5.00 | 2.75 | >2.00 | 13.75 | 20.63 |
| Chichen Itza, Str. 3E3 | S | 5.50 | 3.00 | 1.97 | 16.50 | 24.38 |
| **Highland Sweatbaths** | | | | | | |
| San Antonio, Str. n.d. | S | 10.00 | 3.00 | 1.60 | 30.00 | 36.00 |
| Agua Tibia, Str. 2B | S | 4.50 | 2.25 | --- | 10.13 | --- |
| El Paraíso, Str. n.d. | C | 5.50 | 5.50 | >2.00 | 23.76 | >25.85 |
| Los Cimientos, Str. B12 | S | 6.30 | 1.40 | --- | 8.82 | --- |
| Tepoztlan | S | 1.60 | 1.80 | 1.10 | 2.88 | 3.17 |
| Chichicastenango 1 | S | 1.75 | 1.75 | 1.50 | 3.06 | 4.59 |
| Milpa Alta 1 | S | 1.95 | 1.85 | 1.10 | 3.61 | 3.97 |
| Milpa Alta 2 | C | 2.13 | 2.13 | 1.25 | 3.56 | 4.08 |
| Tepoztlan | S | 1.42 | 1.75 | 1.13 | 2.49 | 2.81 |
| Aguacatan | S | 2.35 | 2.10 | 1.24 | 4.93 | 6.12 |

**Table 4:** Volumetric and areal comparisons of a sample of sweatbath chambers in the Maya region, ordered in rough chronological order from earliest to latest, with Lowlands and Highland examples presented separately. Rectangular or square-shaped sweatbaths are marked by "S", while circular and domed ones are noted as "C". The cross sign (+) refers to temple sanctuaries that serve as 'symbolic', non-functional sweatbath chambers (see Houston 1996). Asterisks (*) denote reconstructed measurements. Surface area and volumetric calculations by the author, based on data presented by Cresson (1938), Satterthwaite (1952), Pendergast (1982:223-224), Alcina Franch et al. (1982), Webster & Abrams (1983:292-293), Barnhart (2001), Houston (1996), Jones (1996:75-77), Hammond & Bauer (2001), as well as Cheek (2003:134-135, Fig. 3), David Webster (pers. comm. 2006), and Gabriel Wrobel (pers. comm. 2006).

*Comparisons to other Sweatbaths in the Maya Area*

The Pook's Hill sweatbath shows many points of commonality with the well-documented Piedras Negras examples and some modern (or colonial examples), but also some disparities. One salient point of disparity is that the Pook's Hill example exhibits an internal 'hearth' at the back of the chamber rather than a separate and annexed 'fire chamber', the latter being commonplace in modern and colonial examples, with archaeological examples known from Cuello, Ceren, and Chichen Itza among others (Cresson 1938:102; Hammond & Bauer 2001). In addition, the sweatbath at Pook's Hill is roughly circular in plan, which obviously runs counter to the square or rectangular examples seen in the Classic-period at Piedras Negras, Palenque, Tikal, Copan, Cahal Pech, and Chichen Itza (Ruppert 1935: 270, Figs. 349 & 350; Cresson 1938:89, 96; Satterthwaite 1952; Jones 1996:75-77, Fig. 62, 63b; Robertson 1985:79-80, Table 4; Jaime Awe pers. comm. 2001; Cheek 2003:134-135, Fig. 3; David Webster pers. comm. 2006). Nonetheless, examples of dome-shaped or circular sweatbaths have been found at Ceren (Sheets 1992:97-102), Cuello (Hammond & Bauer 2001), and possible examples may be seen at Altun Ha, (Pendergast 1982:223-225, Fig. 110, Plates 51 & 52), Tikal (Becker 2001:437), and a site in the Yalbac (Jason Yaeger pers. comm. 2005). The circular shape is thus seen in the earliest dome-shaped examples (Hammond & Bauer 2001) as well as in modern examples from Oaxaca (Rojas Alba 2005), and it should be noted that most dome-shaped examples are comparatively small to the larger and at times monumental examples seen at major centers (Table 4). The pattern that emerges (though tentative and provisional) is one of two competing sweatbathing traditions, an elite one that is associated with rectangular sweatbaths, which is temporally and spatially-restricted versus a vernacular tradition of great longevity and geographic breadth, more frequently associated with domed sweatbaths. As such, the Classic-period examples of domed sweatbaths, such as the one at Pook's Hill, may be seen as direct precursors the non-regal, dome-shaped examples that are typical in the Mesoamerican cultural region today.

*Construction Sequence and Dating*

The architecture of Str. 1B and its articulation with neighboring buildings provides key elements to understanding its place in the construction history of Pook's Hill. Its clearest point of articulation is with Str. 1A, where Terrace 1 of Str. 1B was found to abut Terrace 2 and partly cover Terrace 1 of the former. Consequently, it is clear that Str. 1A-1$^{st}$ was already completed by the time the sweatbath chamber of Str. 1B was built (see Appendix B). In backcutting the vault, AU 11 was found, which undoubtedly is a terrace-like component to Str. 1B-2$^{nd}$ (which matches up with Floor 2 of the summit platform) and that already appeared to abut Terrace 2 of Str. 1A-1$^{st}$. The articulation of Str. 1B with Str. 2A remains to be clarified and excavations conducted in 2001 and 2005 along the point of juncture between the two proved inconclusive (though Str. 1B-1$^{st}$ is undoubtedly later than Str. 2A-1$^{st}$). What is clear is that originally a gap existed between Str. 1B-2$^{nd}$ and Str. 1A-1$^{st}$, which was later filled by the custom-sized sweatbath room of Str. 1B-1$^{st}$ (Helmke & Awe 2005:25). As such the sweatbath of Str. 1B-1$^{st}$ appears to be the latest completed structure in the construction history of Pook's

Hill, followed only by unfinished architectural components associated with Strs. 4A, 4B, and 1A.[10]

On the whole the sweatbath exhibits three principal phases of construction. The first entailed the construction of the walls, interior architectural components, and vault mass (which matches Floor 1 of the summit platform) that together form Str. 1B-1st-A. Subsequently, the exterior benches were added, though it remains possible that these represent solely sub-divisions of the same construction effort. Another later phase of the sweatbath's construction is represented by the addition of Stairs B and C (atop the surface of plaza Floor 1), to facilitate access to the high exterior benches and the simultaneous raising of these benches to conform to the uppermost treads of the stairs (Str. 1B-1st-B). These refurbishments signal continued usage of the sweatbath and remain in keeping with the structure's primary function. It is perhaps at this time that the interior bench surfaces were re-plastered. The final phase of construction documented with the Str. 1B sweatbath is the addition of AU 5 that was built atop the raised surface of the eastern exterior bench (Str. 1B-1st-C). At present we have not been able to determine the relationship between the refurbishments made to the summit platform (AU 12) with the B or C phases of construction in evidence with the sweatbath (though on account of the size and type of facing stones used, AU 12 may well be coeval to Str. 1B-1st-B).

Of interest is the lateness of the Str. 1B sweatbath in relation to the functional repertoire represented by other buildings at the site. Despite its tardiness, Str. 1B witnessed considerable use, as is attested by the wear-polish that formed on the bedrock floor of the sunken passage and the verge of the interior benches. Continued and extensive usage is also indicated by the formation of the 'terminal infill' deposit in the hearth as well as re-plastering of the interior benches. The cessation of the sweatbath's usage in contrast is marked by the deposition of terminal occupation debris Cluster 4, which was cast within the sweatbath (SU 288a-288c, 288g), partly choked the entrance, the sunken corridor (SU 288d-f, 100), and draped the lowest steps of Stairs A and B (SU 36, 120, 121). This expansive deposit of terminal occupation debris represents a rather late episode in the site's history considering the attested longevity of Str. 1B's usage. As such, analyses of the artifactual materials forming this deposit will be insightful with regards to domestic and ritual activities conducted late in the site's history.

[10] Note here that Str. 4B may have been completed before the site's abandonment and that its 'unfinished' appearance stems from extensive stone-robbing, as was discussed under that structure heading, above. Nonetheless, AU 2 (Str. 4A) and AU 7 (Str. 1A) were clearly left unfinished at the time of abandonment, and both therefore appear to postdate the sweatbath. Importantly, the construction of AU 7 partly undermined Stair C of Str. 1B and therefore clearly postdates the sweatbath. Temporal correlation of the sweatbath to AU 2 could not be ascertained on the basis of stratigraphic evidence (and will have to rely on dating of ceramic materials) and thus it remains possible that the construction of the sweatbath is roughly contemporaneous to the terminal phase construction efforts of Str. 4A (which transformed that building into a circular shrine; see Helmke 2003). The circular shape of the terminal shrine has been cited as evidence of central Mexican influence (Helmke 2003) and its possible contemporaneity to the sweatbath in turn suggests that it too may have been constructed with a circular plan under similar foreign cultural influences.

## STRUCTURE 1A (OPS. 9A, 9E, 9F, 9G)

### Excavations

Clearing excavations of Str. 1A were initiated in 2001 by a 1-m wide test trench exposing Terraces 1 and 2 (EU 41) (Saunders et al in press). In 2002 most of the SE portion of the structure was cleared as part of Op. 9B. The 2005 excavations of Str. 1A started by clearing the SW portion of the structure as part as one broad excavation, designated EU 77 and encompassing the entirety of Op. 9E (Figures 2b & 3). Exposure of the terminal architecture consisted of excavating humus and collapse debris conjointly (SU 274), though the collapsed remains of Terrace 1 were so distinct that these were segregated stratigraphically and excavated as a separate context (SU 293). In the process, several architectural features were exposed, some pertaining to Str. 1A and others to Str. 1B; these are thus discussed as part of each respective structure. Of these architectural components the one discovered in EU 77 that clearly relates to Str. 1A is AU 7 (SUs 308, 309). In exposing AU 7 an artifactual deposit was found at the foot of this component that represents a concentration of terminal occupation debris (designated as Cluster 14, SU 233) that clearly postdates AU 7. The eastern baulk of EU 77 was defined in turn by the W stair-side and the SW corner of the principal axial outset Stair 1 of Str. 1A-1$^{st}$. EU 78 was then established to clear the perimeter of Stair 1 of humus and collapse debris (275), an excavation that was subsumed under Op. 9A. The northern baulk of EU 78 consisted of the outline of Stair 1 and continued east until it merged with the previously excavated EU 41 of Op. 9A (Figures 2b & 3). The entirety of the outset Stair 1 was then designated as the architecturally-defined EU 80, encompassing the totality of Op. 9F, aimed at clearing and testing the stair. Once all the well-preserved steps of Stair 1 had been cleared of humus (SU 285) and documented (EU 80), a 2.0 x 4.3 m test trench (EU 80a) was architecturally-aligned to the stair's primary axis to document the construction history of the stair and to test for the incidence of axial special deposits (Figure 3). The test trench was carried to underlying bedrock throughout and resulted in the discovery of Stair 2 and Bu. 1A-1 (SU 313). Conjointly to the Op. 9F excavations the eastern face of Str. 1A was cleared of humus and collapse debris (SU 307) in EU 84 (designated as Op. 9G) (Figures 2b & 3), thereby revealing the edge of the well-preserved summit platform of Str. 1A (as well as the moderately-preserved summit platform of Str. 1C).

With the close of the research excavations, all the architectural components of Str. 1A exposed in 2005 were partly backcut or completely dismantled as necessary and consolidated thereafter. Terrace 1 (SU 287, 299) was slumped to such an extent and built entirely of rotted marl facings that it had to be completely dismantled (EU 78 & BC 24). In the process of dismantling the western portion of Terrace 1, a polychrome sherd was found in its core, near its midpoint (Figure 15). The sherd is unusual for its placement and on account of the paucity of polychrome sherds that have been recovered at the site as a whole. In addition, the core of Terrace 1 of Str. 1A exhibited one of the lowest artifact frequencies documented at Pook's Hill to date (see Helmke & Stanchly in prep.). Consequently, the inclusion of such an unusual and remarkable sherd is interpreted as an expedient dedicatory act.[11] The highly-diagnostic rim sherd is that of a flat-bottomed

[11] This interpretation is shared by foreman José Puc, who independently referred to it as a "regalo" (pers. comm. 2005)

tripod serving dish, attributable to the Zacatel Cream-polychrome type (Culbert 1993:4, 11, 15), which at Tikal has been assigned to the Imix and Eznab complexes (dated respectively c. AD 700-850 and AD 850-950). The closest comparable examples of such serving vessels have been found in several interments at Tikal, including Bu. 116 (Culbert 1993: Figs. 65b, 66, 67), Bu. 191 (Culbert 1993: Fig. 82a1), and Bu. 196 (ibid.: Figs. 92h, 92i, 93, 94, 95). Burial 116 has been conclusively identified as the tomb of the celebrated Tikal king Jasaw Chan K'awiil I who appears to have been buried between AD 733 and 734 (Harrison 1999:142-145; Martin & Grube 2000:47). Burial 196, which shows many parallels to Bu. 116 in terms of artifactual content also included a glyphic reference to the successor, Yik'in Chan K'awiil, and the date AD 754, thereby firmly placing the dating of the tomb, though the identity of its occupant remains debated (Harrison 1999: 162-164; Martin & Grube 2000:50). Based on these data it would appear that these particular ceramic specimens date to the early facet Imix complex at Tikal, perhaps more specifically to the first half of the eighth century AD. The lower end of this dating range (i.e. AD 700) thus serves as an apt *terminus post quem* date for the construction of Terrace 1 (and therefore for most of the Str. 1A-1$^{st}$ the construction efforts).

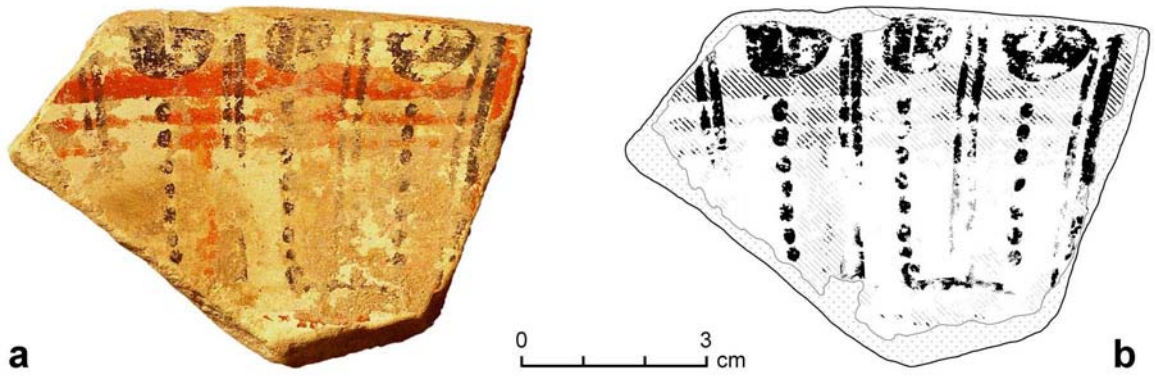



**Figure 15:** Internal view of a polychrome sherd recovered in an axial position with the core of the western half of Terrace 1 of Str. 1A-1$^{st}$. The rim sherd is that of a flat-bottomed tripod serving dish identified as a specimen of the Zacatel Cream-polychrome type. The specimen may have been deposited as part of an expedient dedicatory act during the construction of the architectural component. The painted design along the interior rim of the sherd represents a so-called "dress shirt" design (Coggings 1975), that more recently has been identified as the stylized rendition of a mythical *muwaan* bird tail feather (see Miller & Taube 1993:121; Barrera Vásquez 1990:531-532). Photograph and drawing by C. Helmke (2005).

The poorly-constructed and unfinished AU 7 was also completely dismantled (SU 309) and re-set though none of its facings had to be replaced. Terrace 2 in contrast was found to be in such a good state of preservation that it required only repointing. The steps of Stair 1, though articulated and relatively well-preserved, had to be dismantled (SUs 304, 314, 315) as these had slumped and were adversely affected by extensive tree growth, leaving the stair sides to be repointed. Thereafter all the constituent facing stones were reset to form the consolidated Stair 1 visible at the site today (Figure 16).

**Figure 16:** Structure 1A as consolidated at the close of the 2005 season. This northwesterly shot was taken from the summit of Str. 4A. Note the prominent outset Stair 1 as well as Terraces 1 and 2 of Str. 1A-1st. In the foreground the abutment of Str. 1C can be seen, while Strs. 1B and 2A are partly visible in the background. Detail of composite photo mosaic by C. Helmke (2006).

### Architecture

The largest structure of the Pook's Hill *plazuela* is Str. 1A. By the end of the 2005 season the entirety of the structure's frontal face had been cleared and consolidated as were parts of the eastern and western faces. The platform of Str. 1A-1st was rectangular in plan (measuring 16.5 m E-W and in excess of 5.4 m N-S) with its mounded summit rising as much as 2.9 m above the height of the terminal plaza floor. In comparison, the eastern edge of the well-preserved summit platform exposed in EU 84 was found to be 2.5 m above the elevation of the terminal plaza floor. On account of its height (relative to all the other structures), Str. 1A had a triple terrace configuration of which only traces of Terrace 3 remain today (to the west of Stair 1). Terrace 2, which is the best-built architectural component documented at the site, was constructed directly atop bedrock and almost exclusively of large dolomitic limestone facings with a strong mechanical bond, rising to a height of 1.8 m above the terminal plaza surface. Terrace 2 and the stair sides of Stair 1, were built as a single continuous construction effort. This is at odds with all the other terminal stairs documented at the site, which were built abutting the previously completed terraces faces. Nonetheless, Stair 1 like all the other terminal stairs of the site was built atop the terminal plaza Floor 1. Terrace 1 rose to a height of between 1.2 and 1.4 m (above the terminal plaza surface) and abutted the face of Terrace 2. In contrast to Terrace 2, Terrace 1 was built almost entirely of porous, friable, and

rotted marl facings which apparently relied on a now-dissolved chemical bond. Terrace 1 while built in part atop Floor 1, appears in some areas (like Terrace 2) to have been constructed atop cleared bedrock. This in turn suggests that minor parts of Floor 1 may have been cut to set the foundations of Terrace 1 or that the construction of Floor 1 and the terminal architectural components were consecutive and separated by little time.

As exposed, the moderately well-preserved terminal Stair 1 of Str. 1A-1st was found to have six steps and to be 1.8 m high (above the surface of the terminal plaza floor) (Figure 17). The risers of these steps were determined to have been 30 cm high on average, and built primarily of two superimposed courses of large slab facing stones, with a 1:20 ratio of marl to dolostone facings. Stair 1 is the largest documented at Pook's Hill, measuring 7.16 m wide (E-W) and outset by 2.58 m (N-S) from the foot of Terrace 2.

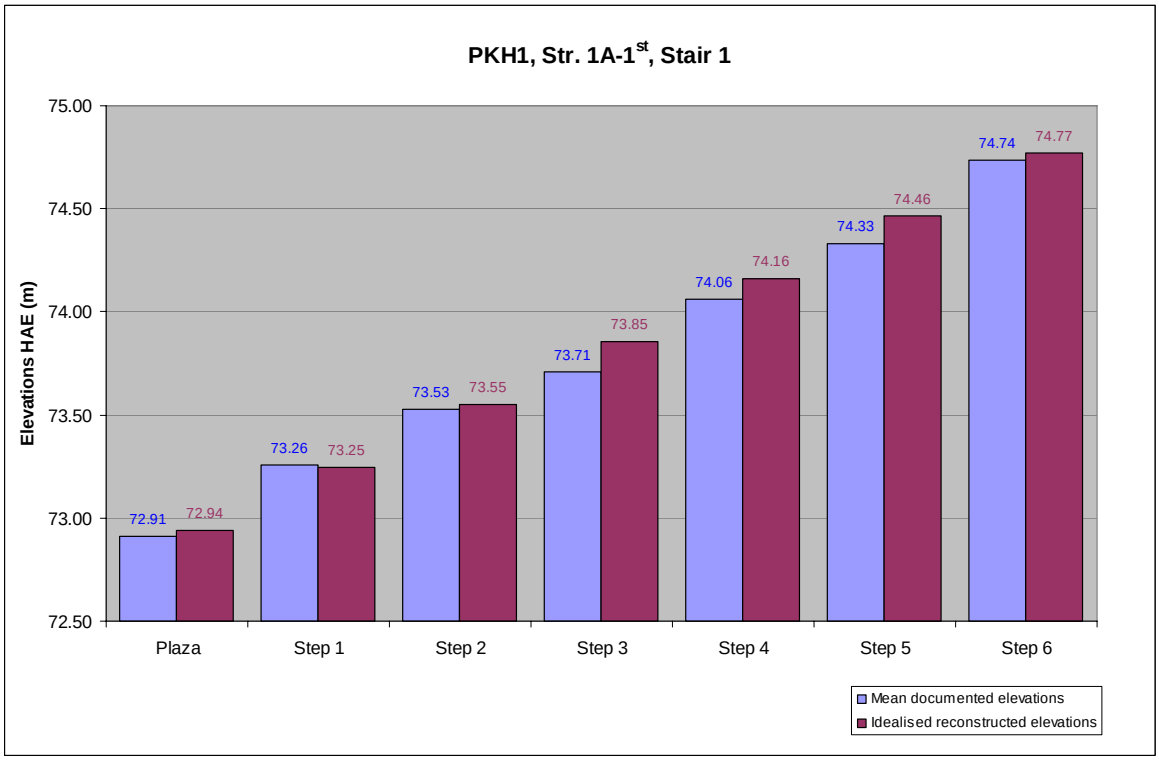



**Figure 17:** Mean documented vs. reconstructed elevations of the step treads of Stair 1 of Str. 1A-1st. Means are based on 4 to 5 shots secured for each step. It is on the basis of these metrics that Stair 1 was consolidated at the close of the 2005 season.

Trench excavations of Stair 1 revealed that it engulfed another earlier Stair 2 (Figure 18). The constituent core of Stair 2 (SUs 312a, 312b) differed sufficiently from that of Stair 1 (SUs 304, 314, 315) to distinguish these and excavate each as stratigraphically-distinct contexts (Figure 18). The base of Stair 2 is marked by its lowest step, which was built of two to three courses of large dolostone facings, rising to a height of 40 cm above the terminal plaza floor. The basal step exhibited the poorly preserved remains of a plastered tread (designated Floor 4) that is between 30 and 72 cm wide (N-

S). The remains of additional steps are suggested by three faint plaster lenses (designated as Floors 1 through 3) encountered during the excavations, though none exhibit risers of dressed facing stones. If such steps were present and the riser heights consistent, then Stair 2 would originally have had five steps and been approximately 2 m high. The original width of Stair 2 was not determined and at present it remains unclear whether it represents a 'construction stair' to the construction efforts of Str. 1A-1st, or a penultimate stair associated with Str. 1A-2nd. If the latter scenario proves correct, it must be assumed that the facings of Stair 2 were reutilized in the construction of the terminal Stair 1 and that the plaster lenses represent the remains of treads of the ancient steps. If Stair 2 proves to be a construction stair, then the lenses may mark the boundaries between discrete episodes of core loading. The issue will hopefully be resolved with the dating of temporally-sensitive materials contained in the cores of the respective Stairs 1 and 2, and will hinge in large part on the dating of Bu. 1A-1. This interment was found within the core of Stair 2, directly atop bedrock; a stratigraphic position which indicates that it is non-intrusive and forms an integral part of the Stair 2 construction efforts. Dating of Bu. 1A-1 is discussed further below (see "Special Deposit"). Nonetheless it should be noted that the core of Stair 2 atop the capstones of Bu. 1A-1 shows what may be signs of disturbance as recorded in the stratigraphic profile (see Figure 18), perhaps brought about during the terminal refurbishments.

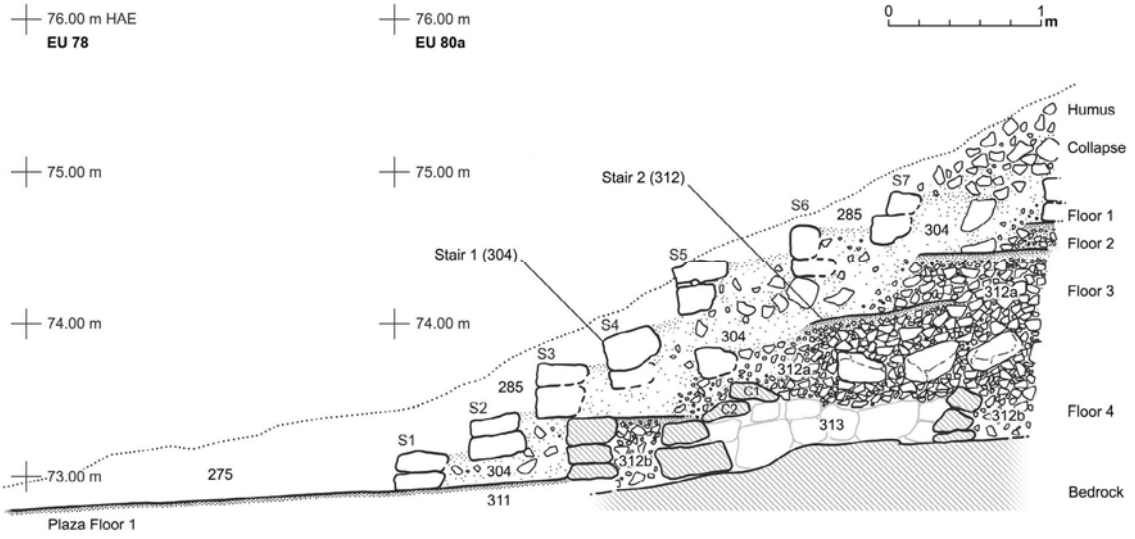



**Figure 18:** Stratigraphic section exposed in the excavations of Stair 1 of Str. 1A-1st (representing the western baulk of EU 80a; looking due magnetic west; north is to the right and south to the left). The modern ground surface of the humic stratum (SU 263) is marked by the dotted line. Note the clear distinction between the cores of Stair 1 and Stair 2 respectively, and the presence of lenses of plaster flooring associated with the core of Stair 2. Items represented in section (rather than in profile) such as the two capstones of Bu. 1A-1 are represented with hatching (i.e. poché). Section and survey by C. Helmke & J. Puc (2005-2006).

The last documented construction effort associated with Str. 1A is AU 7 (SUs 308, 309) (Figures 3 & 12). The component appears to have remained unfinished at the time of site's abandonment and essentially represents the basal course of dolomitic and marl facings to what could have been designed as a broad southern expansion to the SW portion of Terrace 1. No evidence for a symmetrical refurbishment was found during clearing of the SE portion of Str. 1A (Op. 9B), which further evokes the fleetingness of the AU 7 construction effort. In fact consolidation of this component required its dismantling and re-mortaring, an effort which took us a mere few hours. Of interest are the relations of this component to adjacent stratigraphic episodes. In sequential order, AU 7 partially cut into the terminal plaza Floor 1 (SU 308), was abutted on the west and south by two discrete deposits of terminal occupation debris (Clusters 4 and 14, respectively), and finally plaza Floor 1 exhibited a burnt patch that spans from Cluster 4 eastwards and ends at the face of AU 7 (Figure 12). Consequently, the construction of AU 7 –though late in site's architectural history– predates the latest phases of the site's usage as represented by the artifactual deposits that abut it. Also the construction of AU 7 must have remained idle for sufficiently long to allow the artifactual deposits and the burning activity to form and leave their mark. In addition, were AU 7 completed, it would have provided a rounded shape to the refurbished terrace. The practice of rounding off previously rectangular buildings has been documented elsewhere in the Pook's Hill *plazuela* (Helmke 2003:123-124, Fig. 4) and this trend has been observed for both benches and buildings in contemporary Terminal Classic contexts at Caracol to the south (Jaime Awe, pers. comm. 2005). The other examples at Pook's Hill are the terminal refurbishments made to the eastern shrine Structure 4A. The refurbishment in question provided a circular platform (Str. 4A-1$^{st}$) to a building that previously had a roughly square plan with rounded corners, and stair-side outsets (Str. 4A-2$^{nd}$) (Helmke 2003:123; Ek & Helmke in press). Of note is the fact that the refurbishments made to the north of the axial stair of Str. 4A had been completed, while those to the south remained unfinished by the time of the site's abandonment (ibid.). If the cessation of construction efforts at both structures is concurrent, then the construction of AU 7 can be said to have been broadly contemporaneous to the likewise unfinished SW flank of Str. 4A-1$^{st}$.

## SPECIAL DEPOSIT

Only one special deposit was encountered during the 2005 season, namely Bu. 1A-1. It was found late in the season during trenching of Str. 1A's primary axial outset stair. This interment has proved to be one of the most important finds made at Pook's Hill to date and is presented below in some detail. Identifications of the faunal and shell specimens recovered in the burial were made by Norbert Stanchly (this volume).

### Burial 1A-1 (SU 313)

*Provenience:* Entirety of deposit recovered in EU 80a, Level 4. Maximum elevation of the top of Capstone 1: 73.58 HAE. Mean elevation of the top of cist stones: 73.40 m HAE. Mean elevation of top of

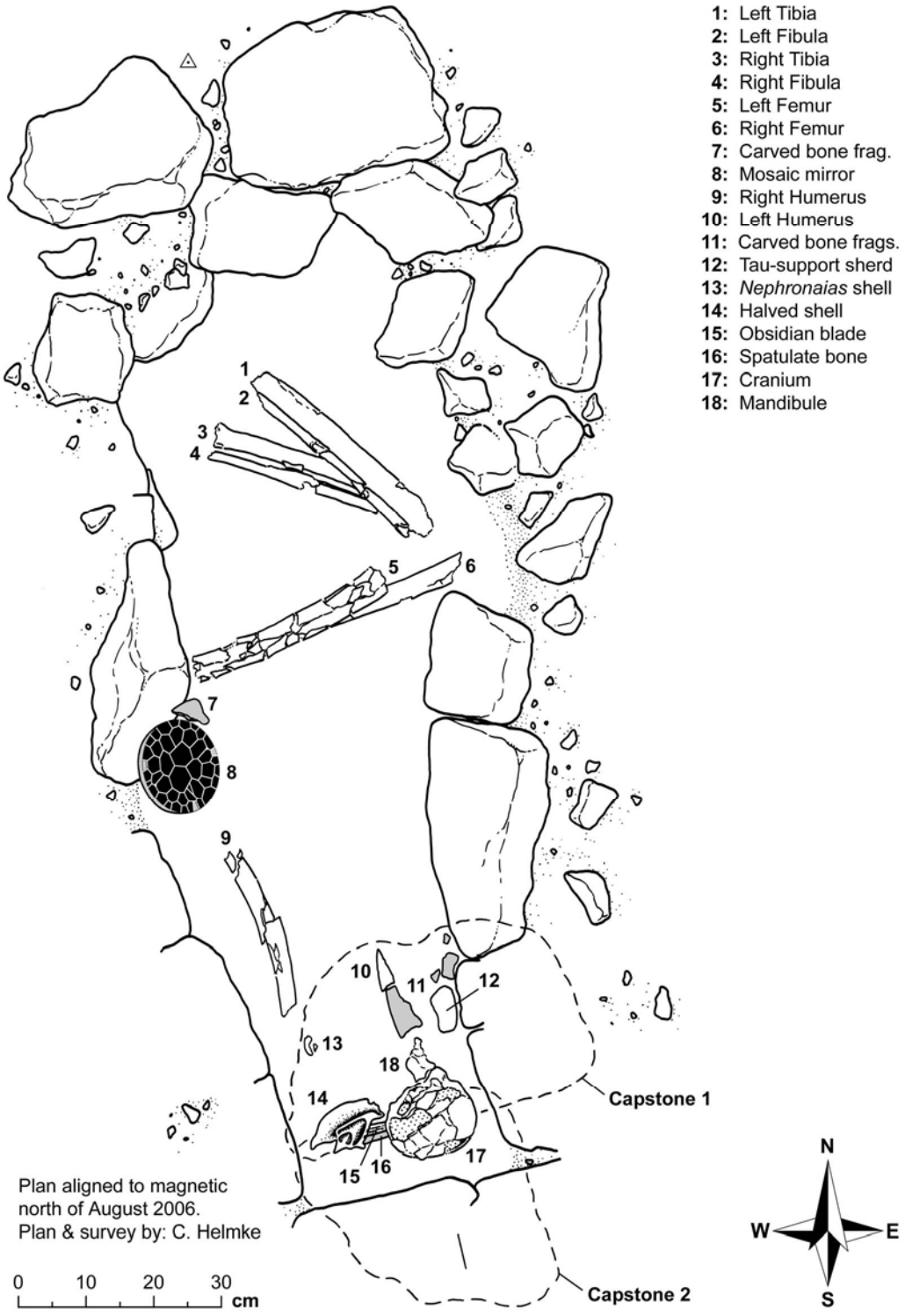



**Figure 19:** Plan of Burial 1A-1 (SU 313), as found in the core of Stair 2 of Str. 1A, directly atop bedrock.

skeletal remains: 73.25 m HAE. Elevation of bedrock base in burial cist varies between 72.99 and 73.21 m HAE (Figures 18 & 19).

*Grave type:* Perimeter of the grave is completely delineated by marl and dolostone facings (ratio of 1:5 respectively), with the cranial area covered by two large marl capstones. The southern extremity of the cist is rectangular, built of two neatly-stacked courses of facing stones. The entirety of the cist is built directly atop unmodified and sloping limestone bedrock. Covered in its entirety by the core of Stair 2.

*Grave dimensions:* Grave (internal dimensions): Total length: approx. 150 cm (measured between faces of upright cist stones); Mean width: 42 cm (ranging between 29 cm at the head and 55 cm at the hips, measured between the faces of cist stones) (Figure 19); Mean depth: 32 cm (ranging between 24 and 41 cm, measured from bedrock to top of stone cist or bottom of the capstones as applicable) (Figure 18).
Skeleton: Maximum length: 118 cm; Maximum width: 42 cm.

*Burial Type:* Primary.

*Orientation:* Head to the south, facing east and down.

*Position:* Partly flexed, prone. Left and right arms apparently extended along side of the body. Legs flexed, with left leg atop the right.

*Condition:* The skeleton is poorly preserved and highly fragmentary in all respects. Deterioration affected both cranial and postcranial axial skeleton as well as the hands and feet in particular, which have completely disintegrated, or nearly so. The cranium, though fragmentary appears better-preserved than other portions of the skeleton (possibly on account of the capstones).

*Individual:* **Field determination:** Possible male based on preliminary field assessment of stature and overall robusticity of the bones. Due to extreme fragmentation of the skeleton this assessment is deemed tentative and provisional (CGBH).
**Laboratory determination:** n.d.

*Cultural Modification:* n.d.

*Skeletal Material:* The individual appears to be edentulous based on the total absence of teeth in the burial, and thus may be of advanced age. No additional data are available at present as the skeletal remains have not yet been subjected to lab analyses.

*Associated Material:* **313/1** [23, 24] Complete mosaic mirror and backing (30.189.002:003) (Figures 19.8, 20h, 20i). Mean diameter: 13.4 cm. Mirror is composed of a solid stone backing and 45 tesserae (of which 37 were found still adhering to the backing and 5 more were found in the burial fill around the mirror). Three tesserae were not recovered and appear to have been lost during original

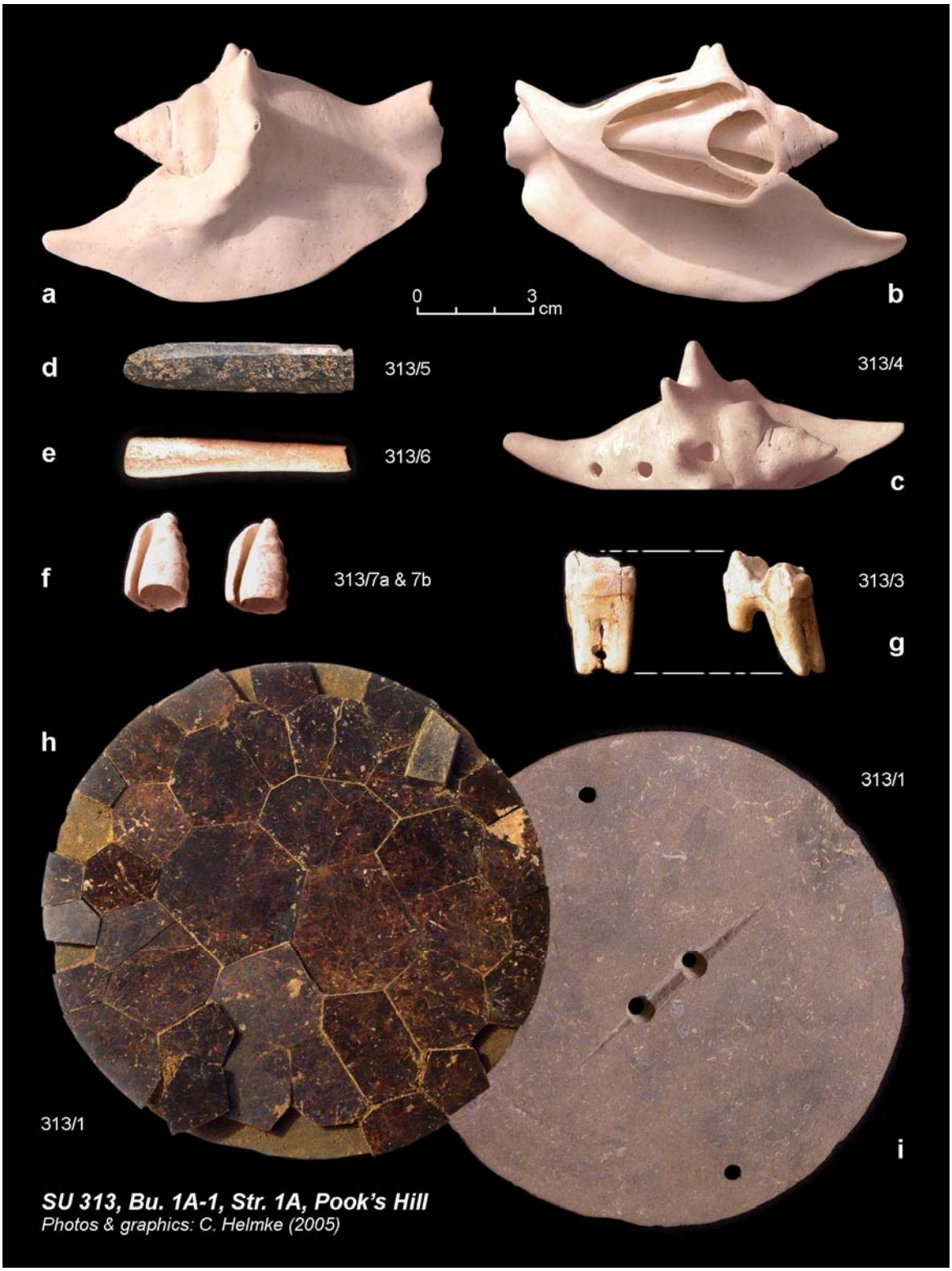



**Figure 20:** Artifacts found within Bu. 1A-1. **a**) exterior view of the shell inkpot, note the completely smoothed surfaces (313/4); **b**) interior view of the inkpot; **c**) lateral view of the inkpot showing the three perforations; **d**) complete prismatic obsidian blade (313/5); **e**) fragmentary spatulate bone implement or hair pin (313/6); **f**) pair of shell tinklers (313/7a & 7b); **g**) two views of the perforated tapir molar pendant, note the partial and complete perforations in the root (313/3); **h**) recto of the pyrite mosaic mirror as recovered and oriented as found (313/1) (i.e. bottom was resting on bedrock); **i**) same view and orientation of the slate mirror backing with the tesserae removed during curation. Note the position of the lateral conical and central biconical perforations as well as the biconvex groove. All artifacts are rendered to scale.

usage. The complete baking is neatly polished on the verso, but only roughly so on the recto (side to which tesserae were adhered). The verso edge of the backing is extensively chipped on one side and partly so on the opposite side. The stone backing has four perforations, two smaller biconically-drilled holes near the middle and two larger conically-drilled ones near the rim. Material: tesserae are made of iron pyrite; backing is made of gray slate with micaceous inclusions. Found near the small of the back of the skeleton resting against the nearby cist stone.

**313/2** [9-4, 11, 12, 14] Fragmented carved bone plaque (30.189.002:004) (Figures 19.7, 19.11 & 21). Maximum length: 17.7 cm; max. width: 4.9 cm. Recovered as 15 fragments, below the skeleton, and directly atop bedrock. The edge of the plaque was sharpened by grinding and polishing. Material: unidentified large mammal (possibly human). The largest concentration of pieces was found below the left shoulder area, with all the other pieces scattered throughout the southern portion of the burial.

This distribution as well as the fact that less than half of the original plaque is represented suggests that it was deliberately broken before interment and forcefully smashed into the cist, apparently as part of a termination event. The missing portion of the plaque was never included in the burial, indicating that it had already been broken into at least two large pieces before the presumed termination event.

**313/3** [18] Fragmentary perforated tooth (Figure 20g). Maximum length: 3.0 cm. Fragmentary molar tooth with one complete and one partial biconically-drilled suspension hole in the root. Material: Tapir (*Tapirus bairdii*), upper molar 3 (unsided at present). Found atop bedrock, below the cranium.

**313/4** [19] Complete 'inkpot' pendant (Figures 19.14 & 20a-20c). Maximum length (from crest to base of outer lip): 10.9 cm; max. width (from dorsal process to outer lip): 6.7 cm. Gastropod shell with extensively polished exterior and three aligned suspension holes; 'halved' appearance brought about by grinding. The base of the whorl was chipped before interment. Material: Rooster-tail conch (*Strombus gallus*). Found behind the cranium, resting partly atop 313/5 and 313/6.

**313/5** [20] Complete prismatic blade (Figures 19.15 & 20d). Maximum length: 6.1 cm; max. width: 1.3 cm. Material: obsidian. Found directly atop bedrock, parallel to 313/6, partly below 313/4 and the cranium.

**313/6** [21] Fragmentary spatulate implement (Figures 19.16 & 20e). Maximum length: 5.8 cm; max. width: 1.1 cm. Highly polished, spatulate-shaped implement (possible hair pin or weaving-needle). Material: possibly deer (Family Cervidae),

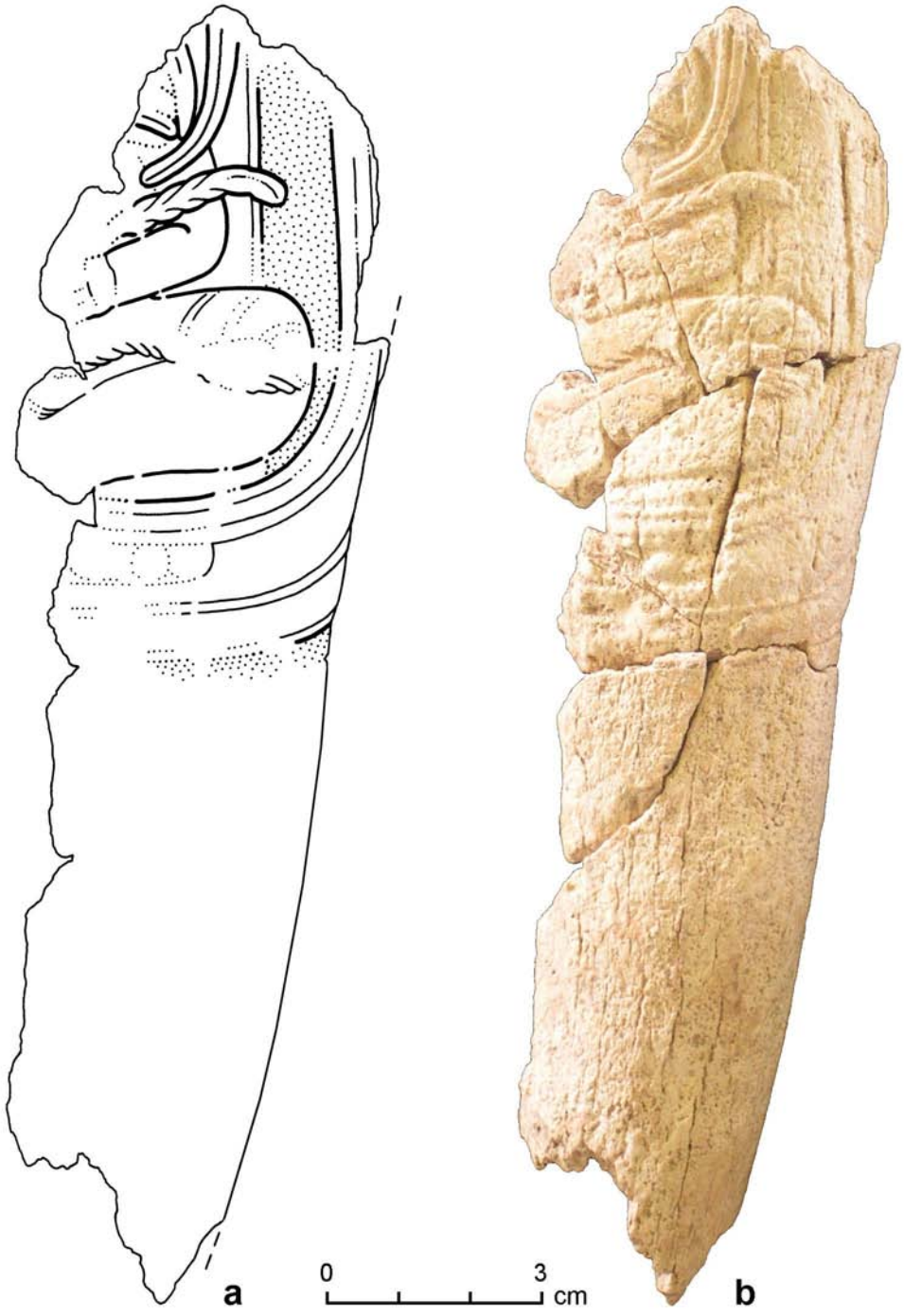



**Figure 21:** Carved bone plaque recovered from Burial 1A-1 (Scale 1:1). The iconography may represent a male figure, holding what appears to be a feather-tipped blood-letter, seated cross-legged, within an apparent lunar ancestor cartouche. Drawing and photograph by C. Helmke (2006).

metapod or ulna. Found resting parallel to 313/5, partly below 313/4 and the cranium, directly atop bedrock.

**313/7a** & **7b** [22] Pair of complete tinklers (Figure 20f). Mean maximum length: 2.6 cm; mean max. width: 1.5 cm. Spire-lopped gastropod shell tinklers, with one major incision near the base serving as a suspension hole. Material: possibly related to Warty cone shell (*Conus jaspideus verrucosus*). Found below the cranium, near the mandible.

**313/8** [8] Fragmentary shell valve (Figure 19.13). Unmodified. Material: River clam (*Nephronaias sp.*), right valve. Found in the burial fill above the left shoulder. Possible secondary inclusion.

In addition to the above, the burial fill also contained 114 ceramic sherds, 20 freshwater *jute* shells (*Pachychilus* spp.), 2 canine teeth, possibly from a possum (see Stanchly, this volume), and what appears to be a fragment of a partially polished animal tooth. Most of these artifactual materials appear to be incidental inclusions and may not have been deposited into the burial deliberately, save the possum teeth as one was found below the cranium. The identified diagnostic ceramic sherds represent several type-varieties, including: Aguila Orange (Gifford 1976:182-183; Culbert 1993:13), Minanha Red (Gifford 1976:156-159), Mountain Pine Red (ibid.:193-195), and Sotero Red-brown (ibid.:315). In addition, a crenellated and incised Tau-shaped support to a Late Classic 3 (c. AD 830–950) flat-bottomed serving dish (Figure 19.12; possibly related to Platon Punctated-incised; see Gifford 1976:257, 259) was also found near the cranium, below the capstone (Figure 19.12). This latter specimen may be a secondary inclusion.

*Relationship to Adjacent Stratigraphy:* The burial fill differs notably from that of the surrounding core as the ceramic sherd and freshwater shell content per cubic meter is at least five times higher than analogous indices for the core of Stair 2. Similarly, the faunal, limestone, and slate artifacts are all notable for their respective presence and absence in each context. Based on these attributes it is clear that the burial fill and the core of Stair 2 represent two distinct contexts.

The grave was built directly atop bedrock and was completely sealed by the core of Stair 2 (SU 312a, 312b). As such it is clear that Bu. 1A-1 inclusive in the construction of Stair 2 and only separated by a short temporal interval. In fact it is possible that the passing of the individual in Bu. 1A-1 incited the construction of Stair 2. As analyses are still on-going, dating of Bu. 1A-1 remains tentative at present; a point underscored by diagnostic sherds that provide an inconclusive range that spans the entirety of the Classic period (c. AD 250-950). The style of the

iconography on the carved bone plaque, appears to be squarely Late Classic 2, and the dating of Str. 1A's Terrace 1 to equal or later than c. AD 700 (based on artifactual inclusions, see Figure 15) do narrow the temporal placement for Bu. 1A-1, somewhat. Consequently, it remains unclear if reliance should be placed on the crenellated Tau-shaped support sherd as a secure anchor for Bu. 1A-1, which otherwise would mark it as being Terminal Classic. Could that sherd be intrusive and contemporaneous to the construction of Stair 1? If so, the burial and Stair 2 may date to the Late Classic 2 phase, while Stair 1 dates to the Late Classic 3. We hope to resolve this issue with continued analyses in future seasons.

## SUMMARY & CONCLUSIONS

The 2005 season of investigations have allowed us to greatly clarify the construction history of the site and the temporal placement of seven of the *plazuela*'s structures (i.e. c. 78 %). In particular, the temporal placement of the terminal phase architecture of structures relative to each other has been defined, by means of expansive stripping excavations. In so doing, three sub-phases of terminal construction have been identified, labeled A, B, and C (from earliest to latest, see Appendix B), that span over an approximate century-long period. The horizon of the earliest terminal refurbishments is Plaza Floor 1 (Terminal A), which is the first plastered floor to span the entirety of the *plazuela*. Of the structures investigated in 2005 Str. 1A-1$^{st}$ appears as the first to be remodeled into its terminal guise after the completion of Plaza Floor 1. Based on diagnostic sherd material included in the core of Str. 1A-1$^{st}$ and datable material in Bu. 1A-1$^{st}$ (which may belong to Str. 1A-2$^{nd}$), this phase of construction can be dated to after c. AD 700. The deposits of terminal occupation debris recovered in association with Strs. 1A-1$^{st}$, 1B-1$^{st}$, and 1C-1$^{st}$ (Clusters 4, 12, 13, 14, 15) all included ceramic materials that can be securely dated to after c. AD 830 based on the inclusion of molded-carved vase specimens (see Helmke 2005) and other diagnostic materials of the Terminal Classic. As these deposits were in stratigraphic positions that postdate terminal architecture it is clear that the latest terminal sub-phase (Terminal C) was completed by some time around c. AD 830. Based on these parameters, we can see that construction remained constant throughout the terminal phase of the site's occupation, and may have continued unabated until the site's abandonment. It is also noteworthy that the principal structures (the largest structures of each side of the *plazuela*'s perimeter) all have at least one or two more antecedent phases of construction, with the tardy addition of as many as half of the structures being restricted to the terminal phase.

Based on this assessment of the site's historical development it is interesting to note the function of the structures that were added in the terminal phase to the overall functional repertoire of the penultimate *plazuela*. In this regard Str. 1B-1$^{st}$ emerges as a significant addition, as all remodeled other structures apparently maintained their original functions, based on consistency in architectural form and configuration. Though a tardy addition to the site, the sweatbath appears to have witnessed prolonged usage based on

the amount of wear observed on the floor and benches, as well the re-plastering of bench surfaces and the many architectural additions made. What motivated the addition of a sweatbath so late in the site's developmental history remains to be elucidated, particularly since no evidence exists that such a building was represented at the site before. Based on the symbolic associations of sweatbaths with childbirth and the curing of diseases (see Orellana 1987; Stuart 1987: 38, 39; Gingerich 1988:225; Barrera Vásquez 1990:651; Houston 1996:135-136, 138, 139, 140; Katz 1996, 1997; Bassie 2002; Goldman & Glei 2003; Groark 2005), should the sweatbath be seen to be functionally tied to the eastern shrine, as complementary parts of a whole (birth vs. death)? If so, is the position of the sweatbath within the *plazuela* significant in relation to that of the standard eastern position of shrines? We hope that additional comparisons to other known cases of sweatbaths within *plazuelas* (at Piedras Negras, Quirigua, Tikal, Palenque, Cahal Pech, Altun Ha, Copan, and Yookop) may help to shed light on this point.

In turn, knowing that some buildings were full-time or part-time special function buildings, how does this bode for reconstructions of the ancient demographics of Pook's Hill? Of the seven buildings investigated two have been securely determined as non-residential, special function structures (Str. 4A and 1B), while Str. 4B may well be a tardy ancillary shrine, though functionally analogous to the earlier Str. 4A. Structure 1A as the residence of the lineage head and Str. 2A as a possible 'reception hall' or 'young men's house' stand as residential structures that served as part-time locations of administrative and festive activities (see Helmke 2005). This leaves Strs. 2B and 1C (and possibly the summit platform of Str. 1B) as the only purely domestic buildings at the site. As such the investigated structures of the site may have been the residence of between four and five nuclear families, bringing the population estimate of the *plazuela* group to anywhere around 20 individuals and up (based on the 5.5 individuals per structure figure, cf. Culbert & Rice 1990), in its terminal phase of occupation. As approximately one in three buildings at the site served special, non-residential functions, this pattern will be of great utility in generating further population estimates for settlement in the Roaring Creek Valley.

The final phase of occupation, as evidenced by the deposits of terminal occupation debris, does hint at disjunction in structure function, cessation of building works and structure maintenance. The latter point is underscored by the lenses of terminal occupation debris that we found between discrete strata of collapse debris, discovered along the base of Str. 2A and 1A in the 2001 and 2002 season (see Helmke in press). If these lenses represent continued occupation of the site, however sparse, then it is clear that cessation of building works does not correspond to site abandonment, as may be initially surmised. Instead it would signal continued occupation of the site despite partial collapse of some structures and as such would mimic 'squatter occupations' seen at other contemporary sites (e.g. Yaxha, Dos Pilas, Tikal, see Palka 1997; Harrison 1999). This is another point that we hope to elucidate with continued analyses of the artefactual remains.

## Appendix A:

## Pook's Hill 1, Index of Stratigraphic Units (2005 Field Season)

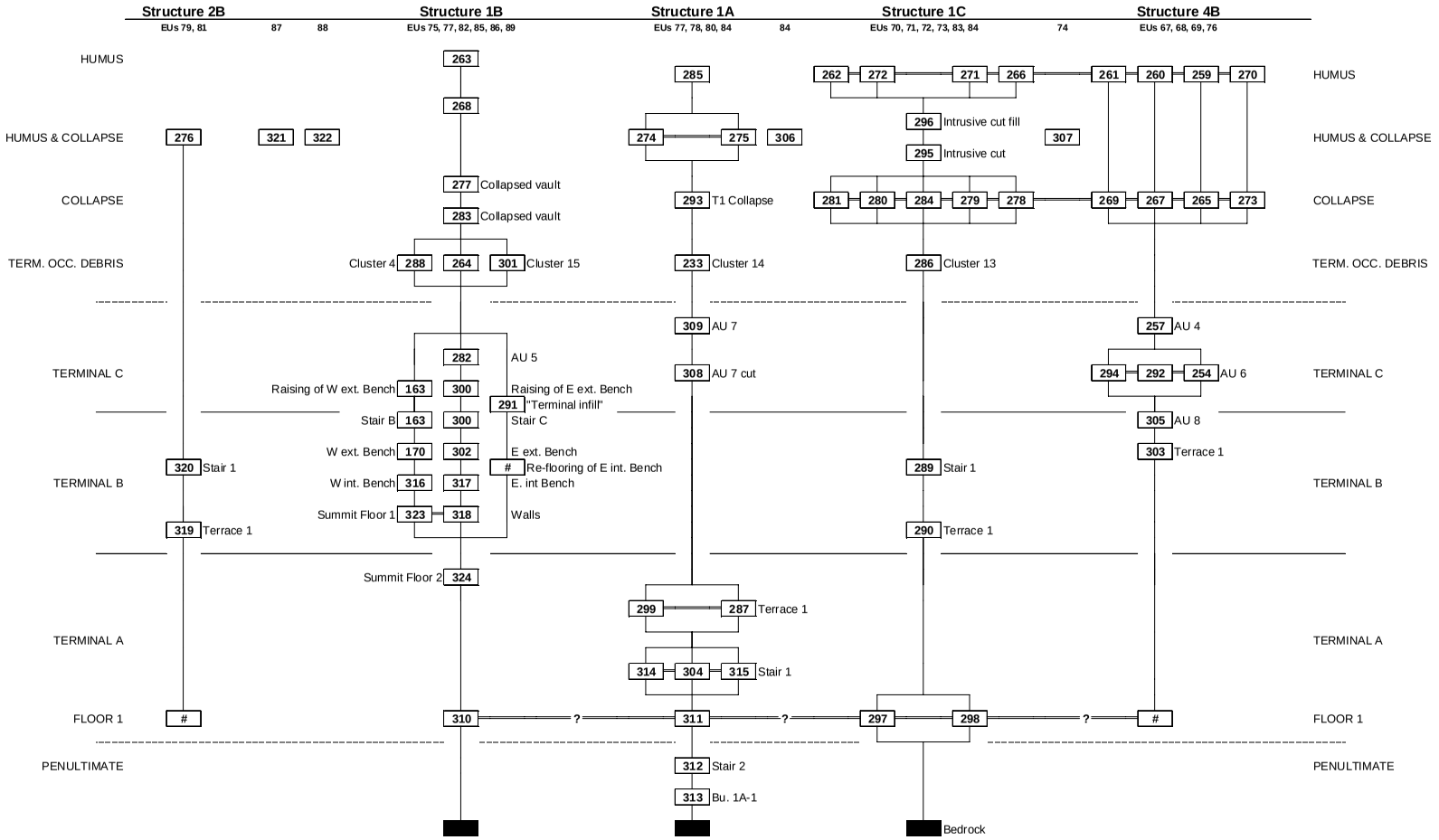
| SU | Op. | Str. / Area | EU | Lvl. | Description |
|---|---|---|---|---|---|
| 233 | 9C | 1A / 1B / Plaza | 77 | 1c | Terminal occupation debris Cluster 14. Found abutting the foot of Architectural Unit 7 and resting atop the terminal plaza Floor 1. |
| 259 | 4E | 4B / Plaza | 67 | 1a | Humus stratum overlying collapse debris. |
| 260 | 4E | 4B / Plaza | 68 | 1a | Humus stratum overlying collapse debris. |
| 261 | 4E | 4B / Plaza | 69 | 1a | Humus stratum overlying collapse debris. |
| 262 | 9C | 1C / Plaza | 73 | 1a | Humus stratum overlying collapse debris. |
| 263 | 9D | 1B | 75 | 1a | Humus stratum overlying the partly collapsed remains of adjoining structures and the thick deposit of black soil filling the vaulted room. |
| 264 | 9D | 1B | 75 | 1c | Terminal occupation debris Cluster 12. Found atop the surface of Terrace 2 of Str. 1A-1$^{st}$, within the SE corner of EU 75. |
| 265 | 4E | 4B / Plaza | 67 | 1b | Collapse debris atop remains of terminal phase architecture. |
| 266 | 9C | 1C / Plaza | 70 | 1a | Humus stratum overlying collapse debris. |
| 267 | 4E | 4B / Plaza | 68 | 1b | Collapse debris atop remains of terminal phase architecture. |
| 268a | 9D | 1B | 75 | 2 | Black humic soil filling the vaulted room from the MGS down to arbitrary vertical sub-division. |
| 268b | 9D | 1B | 75 | 3 | Black humic soil filling the vaulted room from arbitrary vertical sub-division to top of stratum of collapsed vault stones. |
| 269 | 4E | 1C / 4B /Plaza | 69 | 1b | Collapse debris atop remains of terminal phase architecture. |
| 270 | 4E | 4B | 76 | 1a | Humus stratum overlying collapse debris. |
| 271 | 9C | 1C / Plaza | 71 | 1a | Humus stratum overlying collapse debris. |
| 272 | 9C | 1C / Plaza | 72 | 1a | Humus stratum overlying collapse debris. |
| 273 | 4E | 4B | 76 | 1b | Collapse debris atop remains of terminal phase architecture. |
| 274 | 9E | 1A / 1B / Plaza | 77 | 1a-1b | Humus & collapse debris atop remains of terminal phase architecture. |
| 275 | 9A | 1A / Plaza | 78 | 1a-1b | Humus & collapse debris atop remains of terminal phase architecture. |
| 276 | 6E | 2B / Plaza | 79 | 1a-1b | Humus & collapse debris atop remains of terminal phase architecture. |
| 277a | 9D | 1B | 75 | 4a | Collapse debris overlying remains of terminal phase architecture. Specifically collapsed vault stratum, eastern sub-division. |
| 277b | 9D | 1B | 75 | 4a | Collapse debris overlying remains of terminal phase architecture. Specifically collapsed vault stratum, western sub-division. |
| 278 | 9C | 1C / Plaza | 70 | 1b | Collapse debris atop remains of terminal phase architecture. |
| 279 | 9C | 1C / Plaza | 71 | 1b | Collapse debris atop remains of terminal phase architecture. |
| 280 | 9C | 1C / Plaza | 72 | 1b | Collapse debris atop remains of terminal phase architecture. |

| SU | Op. | Str. / Area | EU | Lvl. | Description |
|---|---|---|---|---|---|
| 281 | 9C | 1C / Plaza | 73 | 1b | Collapse debris atop remains of terminal phase architecture. |
| 282 | 9E | 1B | 82 | 2 | Core of AU 5 of Str. 1B atop eastern exterior bench. |
| 283 | 9D | 1B | 75 | 4b | Collapse debris within sunken corridor, between benches and in the 'hearth' of the vaulted room. |
| 284 | 9C | 1C | 83 | 1b | Collapse debris overlying the remains of Stair 1 of Str. 1C-1st. EU is architecturally-defined by the outline of the stair. |
| 285 | 9F | 1A | 80 | 1a | Humus stratum overlying the remains of Stair 1 of Str. 1A-1st. EU is architecturally-defined by the outline of the stair. |
| 286 | 9C | 1C / Plaza | 73 | 1c | Terminal occupation debris Cluster 13. Found at the foot of Terrace 1 of Str. 1C-1st atop terminal plaza floor. |
| 287 | 9A | 1A | 78 | 2 | Core of E portion of Terrace 1. Context encompasses the westernmost extent of Terrace 1 to its point of abutment with the eastern stair side of Stair of Str. 1A-1st. |
| 288 | 9D | 1B | 75 | 5 | Terminal occupation debris Cluster 4. Found directly atop the plastered bench surfaces, within the 'hearth' and partly filling the sunken corridor leading into the vaulted room. |
| 289 | 9C | 1C | 83 | 2 | Core of Stair 1 of Str. 1C-1st down to the surface of the terminal plaza Floor 1. |
| 290 | 9C | 1C | BC 22 | 2 | Core of Terrace 1 of Str. 1C-1st down to lowest well-preserved course. Spans EUs 69 through 73. |
| 291 | 9D | 1B | 75 | 6 | 'Terminal Infill.' Dense, hard-packed, light-gray limestone powder accumulated within the 'hearth' and 'sunken firebox' of the vaulted room, down to bedrock. |
| 292 | 4E | 4B / Plaza | BC 23 | 2 | Core of Architectural Unit 6, built atop terminal plaza Floor 1 and spanning along the foot of Terrace 1. |
| 293 | 9E | 1A / Plaza | 77 | 1b | Collapse debris of Terrace 1 of Str. 1A-1st resting directly atop terminal plaza Floor 1. |
| 294 | 4E | 4B / Plaza | 67 | 2 | Core of the northernmost portion of the 'stair-like' component of AU 6, within the confines of EU 67. |
| 295 | 9C | 1C / Plaza | 71-72 | 3 | Ancient cut made through the western stair side of Stair 1 of Str. 1C-1st and parts of the adjoining Terrace 1. |
| 296 | 9C | 1C / Plaza | 71-72 | 3 | Fill of ancient cut, SU 295. |
| 297 | 9C | 1C / Plaza | 71 | 2 | Core of Floor 1, down to bedrock. Stair 1 at the N and S baulk of EU 71 at the S. |
| 298 | 9C | 1C / Plaza | 71 | 2 | Core of Floor 1, down to bedrock. Terrace 1 at the N and Step 1 of Stair 1 at the S. |
| 299 | 9E | 1A / Plaza | BC 24 | 2 | Core of W half of Terrace 1 down to terminal plaza Floor 1. |
| 300 | 9E | 1A / 1B / Plaza | 77 | 2 | Core of Stair C, down to terminal plaza Floor 1. |
| 301 | 9E | 1B | 77 | 1c | Terminal occupation debris Cluster 15. Found atop the plastered surface of the eastern exterior bench in its NE corner. |
| 302 | 9E | 1B | 77 | 2 | Core of eastern exterior bench, down to best-preserved course. |
| 303 | 4E | 4B | BC 25 | 2 | Core of Terrace 1 of Str. 4B-1st, down to best-preserved course. Spans EUs 67 through 69. |
| 304 | 9F | 1A | 80a | 2 | Core of Stair 1 of Str. 1A-1st down to the top of Stair 2. |

| SU | Op. | Str. / Area | EU | Lvl. | Description |
|---|---|---|---|---|---|
| 305 | 4E | 1C / 4B | BC 26 | 2 | Core of AU 8, the construction pen of Str. 4B, abutting Str. 1C. |
| 306 | 5C | Plaza | 74 | 1a-1b | Humus and collapse debris down to the level of surrounding MGS and Floor 1 surface as exposed in Ops. 4E and 9C. |
| 307 | 9G | 1A / 1C | 84 | 1a-1b | Humus and collapse debris atop the remains of terminal phase architecture. |
| 308 | 9E | 1A / Plaza | 77 | 2 | Intrusive cut made into terminal plaza Floor 1, to accommodate the construction of Architectural Unit 7. |
| 309 | 9E | 1A / Plaza | 77 | 2 | Architectural Unit 7. |
| 310 | 9E | Plaza | 77 | 2 | Ballast and core of Floor 1, below Stair C of Str. 1B-1st. |
| 311 | 9F | 1A / Plaza | 80a | 4 | Ballast and core of Floor 1, below Stair 1 of Str. 1A-1st. |
| 312a | 9F | 1A | 80a | 3a | Core of Stair 2 of Str. 1A, above Burial 1A-1. |
| 312b | 9F | 1A | 80a | 3c | Core of Stair 2 of Str. 1A, below Burial 1A-1, down to bedrock. |
| 313 | 9F | 1A | 80a | 3b | Burial 1A-1. Human remains and associated artifacts. |
| 314 | 9F | 1A | 80b | 2 | Core of Stair 1 of Str. 1A-1st. EU 80b is located west of EU 80a. |
| 315 | 9F | 1A | 80c | 2 | Core of Stair 1 of Str. 1A-1st. EU 80c is located east of EU 80a. |
| 316 | 9D | 1B | 85 | 2 | Core of W Bench within the sweatbath chamber, down to bedrock. |
| 317 | 9D | 1B | 86 | 2 | Core of E Bench within the sweatbath chamber, down to bedrock. |
| 318 | 9D | 1B | BC 27 | 2 | Core of the walls and remaining vault mass of the vaulted room, down to best-preserved course. |
| 319 | 6E | 2B | BC 28 | 2 | Core of Terrace of Str. 2B-1st, down to the best-preserved course. |
| 320 | 6E | 2B | 81 | 2 | Core of Stair 1 of Str. 2B-1st, down to the surface of terminal plaza Floor 1. |
| 321 | 5B | Plaza | 87 | 1a-1b | Humus and collapse debris atop the surface of terminal plaza Floor 1, S of AU 1. |
| 322 | 5D | Plaza | 88 | 1a-1b | Humus and collapse debris down to the level of surrounding MGS and Floor 1 surface as exposed in Ops. 6A and 9E. |
| 323 | 9D | 1B | 89 | 2 | Core of summit Floor 1 of Str. 1B-1st, down to the surface of summit Floor 2. |
| 324 | 9D | 1B | 89 | 3 | Core of summit Floor 2 of Str. 1B-2nd, down to the lowest extent of the adjoining BC 27. |

Only the SUs documented in 2005 are presented above.

# Appendix B: Pook's Hill 1, Preliminary Harris Matrix of Stratigraphic Units (2005 Field Season)



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## References Cited:

Academia de las Lenguas Mayas de Guatemala

2004 *K'iche' Choltzij, Vocabulario K'iche', K'iche'-Kaxla'n Tzij, Kaxla'n Tzij-K'iche'*. Academia de Lenguas Mayas de Guatemala, Guatemala City.

2003a *Pujb'il Yol Mam, Vocabulario Mam: Mam-Tyol Mos, Tyol Mos-Mam*. Academia de Lenguas Mayas de Guatemala, Guatemala City.

2003b *Jit'il Q'anej Yet Q'anjob'al, Vocabulario Q'anjob'al, Q'anjob'al-Español, Español-Q'anjob'al*. Academia de Lenguas Mayas de Guatemala, Guatemala City.

2001a *Ak' B'oj Payat Tzoti' Yul Ab'xub'al Popti', Actualización Lexical Idioma Maya Jakalteko (Popti')*. Academia de Lenguas Mayas de Guatemala, Guatemala City.

2001b *Tqan Qayool, Vocabulario Awakateko, Awakateko-Español, Español-Awakateko*. Academia de Lenguas Mayas de Guatemala, Guatemala City.

2003a *Pujb'il Yol Mam, Vocabulario Mam: Mam-Tyol Mos, Tyol Mos-Mam*. Academia de Lenguas Mayas de Guatemala, Guatemala City.

2000b *Oj ronerob' Ch'orti', Vocabulario Ch'orti', Ch'orti'-Español, Español-Ch'orti'*. Academia de Lenguas Mayas de Guatemala, Guatemala City.

Alcina Franch, José, Andrés Cuidad Ruiz, and Josefa Iglesias Ponce de León
1982 "El '*temazcal*' en Mesoamérica: evolución, forma y función." *Revista Española de Antropología Americana*, Vol. 10: 93-132.

Ashmore, Wendy
1981 "Some Issues of Method and Theory in Lowland Maya Settlement Archaeology." *Lowland Maya Settlement Patterns*, edited by Wendy Ashmore, pp. 37-69. University of New Mexico Press, Albuquerque.

Aulie, H. Wilbur, and Evelyn W. Aulie
1978 *Diccionario ch'ol-español, español-ch'ol*. Serie de Vocabularios y Diccionarios Indígenas, Mariano Silva y Aceves no. 21. Instituto Lingüístico de Verano, México, DF.

Awe, Jaime J. and Christophe G.B. Helmke
1998 "Preliminary Report on the Reconnaissance of Cahal Uitz Na, Roaring Creek Valley, Cayo District, Belize." *The Western Belize Regional Cave Project: A Report of the 1997 Field Season*, edited by Jaime J. Awe, pp. 200-215. Department of Anthropology, Occasional Paper No.1, University of New Hampshire, Durham.

Barnhart, Edwin L.
2001 "The Palenque Mapping Project, 1998 - 2000 Final Report." Report submitted to the Foundation for the Advancement of Mesoamerican Cultures, inc., Crystal River.

Barrera Vásquez, Alfredo
1990 *Diccionario Maya Cordemex: Maya-Español, Español-Maya*. Ediciones Cordemex, Mérida.

Bassie, Karen
2002 "Maya Creator Gods." *Mesoweb*: <www.mesoweb.com/features/bassie/CreatorGods/CreatorGods.pdf>.

Becker, Marshall J.
2001 "Houselots at Tikal, Guatemala: It's what's out Back that Counts." *Reconstruyendo la Cuidad Maya: el urbanismo en las sociedades antiguas*, edited by Andrés Ciudad Ruiz, Maria Josefa Ponce de León and Maria del Carmen Martínez Martínez, pp. 427-460. Publicaciones de la SEEM, no. 6, Sociedad Española de Estudios Mayas, Madrid.
1999 *Excavations in Residential Areas of Tikal: Groups with Shrines*. Tikal Report 21, University Museum Monograph 104, University of Pennsylvania, Philadelphia.
1971 The Identification of a Second Plaza Plan at Tikal, Guatemala, and its Implications for Ancient Maya Social Complexity. Unpublished PhD dissertation. Department of Anthropology, University of Pennsylvania, Philadelphia.

Bruce, Roberto D.
1968 *Gramática del Lacandón*. Publicaciones 21. Departemento de Investigaciones Antropológicas, Instituto Nacional de Antropología e Historia, México, DF.

Chase, Arlen F. and Diane Z. Chase
1994 "Maya Veneration of the Dead at Caracol, Belize." *Seventh Palenque Round Table 1989*, edited by M. Greene-Robertson and V. M. Fields, pp. 55-62. Pre-Columbian Art Research Institute, San Francisco.

Cheek, Charles D.
2003 "Maya Community Buildings: Two Late Classic *popol nahs* at Copan, Honduras." *Ancient Mesoamerica*, Vol. 14: 131-138.

Child, Mark B.
1997 "PN 18: Excavaciones en el baño de vapor R-13." *Proyecto Arqueológico Piedras Negras, Informe Preliminar No. 1, Primera Temporada 1997*, edited by Héctor L. Escobedo and Stephen D. Houston, pp. 141-152. Copy on file at the Instituto de Antropología e Historia, Guatemala City.

Coggins, Clemency C.
1975 Painting and Drawing Styles at Tikal: An Historical and Iconographic Reconstruction. Unpublished PhD

dissertation, Department of Fine Arts, Harvard University, Cambridge.

Conlon, James M. and Jennifer J. Erhet
1999 "Initial Investigations at the Recently Discovered Major Center of Cahal Uitz Na, Cayo District, Belize." Paper presented at the 64th Annual Meeting of the Society for American Archaeology, Chicago.

Cresson, Frank M.
1938 "Maya and Mexican Sweat Houses." *American Anthropologist*, Vol. 40(1): 88-104.

Culbert, T. Patrick
1993 *The Ceramics of Tikal: Vessels from the Burials, Caches, and Problematical Deposits*. Tikal Report No. 25A. University Museum Monograph 81, University of Pennsylvania, Philadelphia.

Culbert, T. Patrick and Don S. Rice (eds.)
1990 *Precolumbian Population History in the Maya Lowlands*. Albuquerque, University of New Mexico Press.

Driver, W. David and James F. Garber
2004 "The Emergence of Minor Centers in the Zones between Seats of Power." *The Ancient Maya of the Belize Valley: Half a Century of Archaeological Research*, edited by James F. Garber, pp. 287-304. University of Florida Press, Gainesville.

Erhet, Jennifer J. and James M. Conlon
1999 "Plaza Excavations at Cahal Uitz Na, Cayo District, Belize: Preliminary Ceramic Analysis." *The Western Belize Regional Cave Project: A Report of the 1998 Field Season*, edited by Jaime Awe, pp 53-68. Department of Anthropology, Occasional Paper No. 2, University of New Hampshire, Durham.

Ek, Jerald D. and Christophe G.B. Helmke
in press "Pook's Hill 1, Operation 4B: Architectural Excavations of the Eastern Shrine, Structure 4A, Roaring Creek Valley, Cayo District, Belize." *The Belize Valley Archaeological Reconnaissance Project: A Report of the 2001 Field Season - Volume 2*, edited by Christophe G.B. Helmke and Jaime J. Awe. Institute of Archaeology, National Institute of Culture and History, Belmopan.

Fash, Barbara, William Fash, Sheree Lane, Rudy Larios, Linda Schele, Jeffrey Stomper, and David Stuart
1992 "Investigations of a Classic Maya Council House at Copán, Honduras." *Journal of Field Archaeology*, Vol. 19(4): 419-442.

Ferguson, Josalyn M.
1999 "Salvage Excavations of the Ballcourt at Cahal Uitz Na." *The Western Belize Regional Cave Project: A Report of the 1998 Field Season*, edited by Jaime J. Awe, pp. 45-52. Department of Anthropology, Occasional Paper No. 2, University of New Hampshire, Durham.

Freidel, David, Linda Schele, and Joy Parker
1993 *Maya Cosmos: Three Thousand Years on the Shaman's Path*. William Morrow and Company, Inc., New York.

Gifford, James C.
1976 *Prehistoric Pottery Analysis and the Ceramics of Barton Ramie in the Belize Valley*. Memoirs of the Peabody Museum of Archaeology and Ethnology Vol.18, Harvard University, Cambridge.

Gingerich, Willard
1988 "Three Nahuatl Hymns on the Mother Archetype: an interpretative commentary." *Estudios Mexicanos*, Vol. 4(2): 191-244.

Goldman, Noreen and Dana A. Glei
2003 "Evaluation of midwifery care: results from a survey in rural Guatemala." *Social Science and Medicine*, Vol. 56(4): 685-700.

Groark, Kevin P.
2005 "Vital warmth and well-being: steambathing as household therapy among the Tzeltal and Tzotzil Maya of highland Chiapas, Mexico." *Social Science and Medicine*, Vol. 61(4): 785–795.

Hammond, Norman and Jeremy R. Bauer
2001 "A Preclassic Maya Sweatbath at Cuello, Belize." *Antiquity*, Vol. 75(290): 683-684.

Harrison, Peter D.
1999 *The Lords of Tikal: Rulers of an Ancient Maya City*. Thames & Hudson: London and New York.

Helmke, Christophe G.B.
in press "A Summary of the 1999–2002 Seasons of Archaeological Investigations at Pook's Hill, Cayo District, Belize." *Research Reports in Belizean Archaeology*, Vol. 3.
2005 "The Terminal Classic Molded-carved Ceramic Tradition of the Eastern Maya Lowlands." Paper presented at the *Fine Paste Relief Wares of Ancient Mesoamerica* Symposium, 70th Annual Meeting of the Society for American Archaeology, Salt Lake City.
2003 "The 2002 Season Investigations at Pook's Hill, Belize." *Papers from the Institute of Archaeology*, Vol. 14: 119-128.
2000 "Pook's Hill 1, Operations 1 through 3: Salvage Excavations of Structure 4A, Roaring Creek Valley, Cayo District, Belize." *The Western Belize Regional Cave Project: A Report of the 1999 Field Season*, edited by Cameron S. Griffith, Reiko Ishihara, and Jaime J. Awe, pp. 243-287. Department of Anthropology, Occasional Paper No. 3, University of New Hampshire, Durham.

Helmke, Christophe and Jaime Awe
2005 "The Ancient Maya Sweatbath at Pook's Hill." *Belize Today*, Vol. 5(1): 24-26.

Helmke, Christophe G.B., Megan L. Bassendale, and Sally M. Graver
in press "Pook's Hill 1, Operations 6A-6D: Architectural Excavations of Structures 2A, 2B, and 1B, Roaring Creek Valley, Cayo District, Belize." *The Belize Valley Archaeological Reconnaissance Project: A Report of the 2001 Field Season - Volume 2*, edited by Christophe G.B. Helmke and Jaime J. Awe. Institute of Archaeology, National Institute of Culture and History, Belmopan.

Helmke, Christophe G.B. and Norbert Stanchly
in preparation "Preliminary Contextual and Volumetric Analyses of Artifacts from Pook's Hill, Belize." Typescript in preparation, copy in possession of the authors.

Houston, Stephen D.
1996 "Symbolic Sweatbaths of the Maya: Architectural Meaning in the Cross Group at Palenque, Mexico." *Latin American Antiquity*, Vol. 7(2): 132-151.

Houston, Stephen, Héctor Escobedo, Mark Child, Charles Golden, René Muñoz, and Monica Urquizú
1998 "Monumental Architecture at Piedras Negras, Guatemala: Time, History, and Meaning." *Mayab*, No. 11: 40-56.

Iannone, Gyles
2004 "Problems in the Definition and Interpretation of 'Minor Centers' in Maya Archaeology with Reference to the Upper Belize Valley." *The Ancient Maya of the Belize Valley: Half a Century of Archaeological Research*, edited by James F. Garber, pp. 273-286. University of Florida Press, Gainesville.

Ichon, Alain
1977 "A Late Postclassic Sweathouse in the Highlands of Guatemala." *American Antiquity*, Vol. 42(2): 203-209.

Inomata, Takeshi, Erick Ponciano, Oswaldo Chinchilla, Otto Román, Véronique Breuil-Martínez, and Oscar Santos
2003 "An unfinished temple at the Classic Maya centre of Aguateca, Guatemala." *Antiquity*, Vol. 78(302): 798-811.

Jones, Christopher
1996 *Excavations in the East Plaza of Tikal*. Tikal Report 16, University Museum Monograph 92, University of Pennsylvania, Philadelphia.

Katz, Esther
1997 "Baños terapéuticos y posparto entre los indígenas de la Mixteca Alta (México)." *Parodiana*, Vol. 10(1-2): 153-164.
1996 "Recovering after Childbirth in the Mixtec Highlands." *Médicaments et Aliments: l'approche Ethno-pharmacologique*, edited by Ekkehard Schröder, Guy Balansard, Pierre Cabalion, Jacques Fleurentin, and Guy Mazars, pp. 99-111. Actes du 2ème Colloque Européen d'Ethnopharmacologie et de la 11ème

Conférence internationale d'Ethno-médicine, Heidelberg.

Larios Villalta, C. Rudy
n.d. "Palenque's Temple XX: A Very Special Puzzle." *Mesoweb Feature*. http://www.mesoweb.com/palenque/features/larios/TXX.html

Le Fort, Geneviève
1998 "Gods of War: Of War Protectors, Effigy Idols and Battle Banners among the Classic Maya." *Mayab*, No. 11: 12-22.

Loten, Stanley H. and David M. Pendergast
1984 *A Lexicon for Maya Architecture*. Archaeology Monograph, No. 8, Royal Ontario Museum, Toronto.

Martin, Simon and Nikolai Grube
2000 *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya.* Thames & Hudson, London.

Miller, Mary E.
1986 *The Murals of Bonampak*. Princeton University Press, Princeton.

Miller, Mary and Karl Taube
1993 *An Illustrated Dictionary of the Gods and Symbols of Ancient Mexico and the Maya*. Thames & Hudson, London and New York.

Orellana, Sandra L.
1987 *Indian Medicine in Highland Guatemala: The Pre-Hispanic and Colonial Periods.* University of New Mexico Press, Albuquerque.

Palka, Joel W.
1997 "Reconstructing Maya Social Inequality and the Collapse at Dos Pilas, Peten, Guatemala." *Ancient Mesoamerica*, Vol. 8(2): 293-306.

Pendergast, David M.
1982 *Excavations at Altun Ha, Belize, 1964-1970, Volume 2*. Royal Ontario Museum, Toronto.

Robertson, Merle Greene
1985 *The Sculpture of Palenque, Volume III, The Late Buildings of the Palace*. Princeton University Press, Princeton.

Rojas Alba, Horacio
2005 "Temazcal: The Traditional Mexican Sweat Bath." *Oaxaca Newsletter*, Spring.

Ruppert, Karl
1935 *The Caracol at Chichen Itza, Yucatan, Mexico*. Carnegie Institution of Washington, Publication 454. Carnegie Institution of Washington, Washington DC.

Satterthwaite, Linton Jr.
1952 *Piedras Negras Architecture, Part V, Sweathouses*. University Museum, University of Pennsylvania, Philadelphia.

Saunders, C. Mathew, Christophe G.B. Helmke, and Rafael A. Guerra
in press "Pook's Hill 1, Operation 9A: Test Excavations of Structure 1A, Roaring Creek Valley, Cayo District, Belize." *The Belize Valley Archaeological Reconnaissance Project: A Report of the 2001 Field Season - Volume 2*, edited by Christophe G.B. Helmke and Jaime J. Awe. Institute of Archaeology, National Institute of Culture and History, Belmopan.

Sheets, Payson D.
1992 *The Cerén Site: A prehistoric Village Buried by Volcanic Ash in Central America*. Harcourt Brace Jovanovich, Fort Worth.

Stuart, David
1998 "'The Fire Enters His House': Architecture and Ritual in Classic Maya Texts." *Function and Meaning in Classic Maya Architecture*, edited by Stephen D. Houston, pp. 373-425. Dumbarton Oaks Research Library and Collection, Washington DC.
1987 "Ten Phonetic Syllables." *Research Reports on Ancient Maya Writing*, No. 14. Center for Maya Research, Washington DC.

Webster, David and Elliot M. Abrams
1983 “An Elite Compound at Copan, Honduras.” *Journal of Field Archaeology*, Vol. 10(3): 285-296.

# A PRELIMINARY ANALYSIS OF THE POOK'S HILL VERTEBRATE FAUNAL ASSEMBLAGE

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## INTRODUCTION

The entire faunal assemblage recovered during excavation of the Pook's Hill 1 *plazuela* between 1999 and 2005 is in excess of 4,000 specimens and includes a large number of invertebrates. The majority of these are freshwater river snails (*Pachychilus* spp.) and several modified and unmodified marine shells are also present. Since the analysis of this material is incomplete, only the results of the preliminary analysis of the vertebrate fauna recovered from Pook's Hill 1 is presented.

It is clear from this preliminary analysis that quality cuts of meat were consumed on site and bone was also readily available as a raw material source in the production of bone artifacts. The identified taxa were procured both locally and from more distant sources such as the Caribbean Sea.

White-tailed deer remains account for the majority of those bones identified to species. The distribution of body portions, indicate that quality cuts of deer haunches were readily available. Other taxa consumed include peccary, rabbit, agouti, paca, armadillo, turtle, and turkey. It is assumed that these species were procured locally. Parrotfish are also identified in fairly high frequencies and, indeed, are the only identified fish taxa to date. Parrotfish were procured from the reefs of Caribbean Sea (situated over 85 km to the east), either directly or through trade.

## METHODS

The analysis of the Pook's Hill 1 vertebrate assemblage was conducted in Belize during the summer of 2001 and 2005 with the aid of published keys and a limited modern skeletal reference collection in the possession of the author. Published keys utilized include, for mammals, Gilbert (1980) and Olsen (1964), for birds Gilbert et al. (1981), for reptiles Olsen (1968). Many of the unidentified specimens should be identifiable with comparison to a more complete skeletal reference collection. All listings of unidentified fauna below are to be considered tentative and provisional, until analyses have been conducted with the aid of more comprehensive skeletal reference collections.

All of the material was initially sorted into two categories: zoological class or class unknown. For those specimens identified to a zoological class the following observations were noted when possible: (1) lowest zoological taxon (e.g. class, order, family, genus and/or species); (2) body portion (e.g. cranial, axial, forelimb, pectoral, pelvic, hindlimb, or appendage), skeletal element, and portion thereof (e.g. complete,

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partial, or fragment; proximal or distal); (3) element side (left or right); (4) skeletal age (e.g. juvenile, immature, subadult, adult, or indeterminate); (5) and modification (cultural and/or non-cultural).

Taxonomic nomenclature is based on the following references: for mammals, Emmons and Feer (1990) and Reid (1997), turtles follow Ernst and Barbour (1989) as well as Lee (2000), while snakes and lizards follow Lee (2000) as well as Villa et al. (1988). Marine fish nomenclature follows Böhlke and Chaplin (1968). Bone nomenclature (e.g. specimen, element) follows Lyman (1994).

All taxa are listed as number of identified specimens (NISP). A preliminary listing of minimum number of individuals (MNI) is provided for the site as a whole (Table 3). The MNI values are given for all taxa identified to genus and/or species that are considered to be food refuse or possible food refuse. The MNI values presented should be considered absolute minimums and were derived via techniques well established by others (see Grayson 1984:27-29 for a discussion of MNI derivation). It was decided to calculate MNI values at the site level so as to not inflate the true representation of species utilization due to aggregation effects associated with subdividing faunal assemblages into more contextually-discrete "analytic units" (for example, excavation unit or level) (Grayson 1984:29).

Taphonomic analyses of the vertebrate assemblage are ongoing and as such a detailed discussion of the subject is not provided. However, the preliminary results of this analysis suggest that bone survivorship rates are generally good. Preservation of the majority of the bone specimens is considered excellent. Very little evidence of post-depositional fracturing is noted. This suggests that much of the assemblage was likely protected by overburden such as collapse debris. Moreover, the minimal amount of taphonomic signatures associated bone weathering (e.g. exfoliation, longitudinal cracking) noted on the bone suggests that the material was sealed fairly quickly by overburden and not left exposed to the elements for protracted periods.

## THE VERTEBRATE FAUNAL ASSEMBLAGE

A total of 1,517 vertebrate specimens were presented for analysis and are reported on below. Of these, 1,457 specimens, or 96 % of the sample, could be assigned to zoological class (Table 1). Sixty bone fragments (4 %) could not be assigned to zoological class.

| Zoological Class | NISP | % of Vertebrates |
|---|---|---|
| Class Aves | 52 | 3.6% |
| Class Mammalia | 1,185 | 81.3% |
| Class Osteichthyes | 202 | 13.9% |
| Class Reptilia | 18 | 1.2% |
| **Total** | **1,457** | **100.0%** |

**Table 1:** Distribution of Pook's Hill 1 vertebrate fauna by zoological class.

The majority of the sample is mammal bone, accounting for approximately 81 % of all of the specimens identified to zoological class. Bony fish accounts for approximately 14 % of the sample, while bird and reptile bones account for the remaining 5 % of the sample.

At least 21 taxa are represented in the assemblage (Table 2). The 1,461 specimens identified to zoological class were found to include 269 representatives of 14 mammalian, avian, and reptilian species. Mammalian species identified include nine-banded armadillo (*Dasypus novemcinctus*), domestic dog (*Canis familiaris*), jaguar (*Panthera onca*), tapir (*Tapirus bairdii*), white-lipped peccary (*Tayassu tajacu*), white-tailed (*Odocoileus virginianus*) and red brocket (*Mazama americana*) deer, pocket gopher (*Orthogeomys hispidus*), agouti (*Dasyprocta punctatus*), paca (*Agouti paca*), and domestic cow (*Bos taurus*). The identified bird species is ocellated turkey (*Meleagris ocellata*). Identified reptilian species include two turtles, the Central American river turtle (*Dermatemys mawii*), or *hickatee*, and the Mexican Giant musk turtle (*Staurotypus triporcatus*).

The remaining 1,188 specimens were grouped into larger taxa including genus, family, order, and class. Parrotfish (Family Scaridae) bones account for 132 specimens and are the only identified fish taxon. Mammalian taxa identified to genus include seven rabbit (*Sylvilagus* sp.) specimens and two opossum (*Didelphis* sp.) bones. Three opossum bones are identified only as Family Didelphidae. One unidentified rat and/or mouse bone (Family Cricetidae) is noted in the sample.

**Account of Mammals (Class Mammalia)**

The 1,185 mammal bones include 381 specimens identified to 21 taxa (Table 3). These include small, medium, and large game. Small game animals include rabbit, agouti, paca, opossum, armadillo, and pocket gopher. Medium-sized game taxa include the unidentified carnivores, dog and peccary. Large game animals include tapir, red brocket deer, and white-tailed deer. Some of the taxa listed in Table 3 are not considered to be representative of food refuse. This includes the two specimens of a modern domestic cow, a jaguar canine tooth, and a mouse and/or rat partial femur. Both the cow and small rodent bones are clearly modern intrusive elements. The jaguar canine is ornamental and is the single representative of this taxon indicating its importance as a status symbol or ornament. No direct evidence for consumption of jaguar is noted to date.

A total of 804 mammal bone specimens have not been identified to a lower taxon. Although many of these are considered too fragmented to identify to a lower taxon, it is likely that some of the bones can be identified to a more specific taxon with the aid of additional reference material. An attempt was made to sort each unidentified mammal bone as to the size of animal represented. For example, the specimens were sorted as belonging to a small-, medium-, or large-sized animal.

*Opossum* (Family Didelphidae and *Didelphis* sp.) – A total of 5 specimens belong to one of the many opossum species present in Belize. Two opossum bones are identified only to genus (*Didelphis*) and are representative of either the Virginia opossum or the common

| Scientific Name | Common Name |
|---|---|
| **Vertebrates** | |
| **Class Osteichthyes** | **Bony Fishes** |
| Family Scaridae | Parrotfish |
| **Class Reptilia** | **Reptiles** |
| Order Testudines | Turtles |
| Family Dermatemydidae | Central American River Turtle |
| *Dermatemys mawii* | Central American River Turtle (Hickatee) |
| Family Kinosternidae | Mud and Musk Turtles |
| *Staurotypus triporcatus* | Mexican Giant Musk Turtle |
| **Class Aves** | **Birds** |
| Family Meleagrididae | Turkeys |
| *Meleagris ocellata* | Ocellated Turkey |
| **Class Mammalia** | **Mammals** |
| Family Didelphidae | Opossums |
| *Didelphis* sp. | Opossum |
| Family Dasypodidae | Armadillos |
| *Dasypus novemcinctus* | Nine-Banded Armadillo |
| Order Carnivora | Carnivores |
| Family Canidae | Dog Family |
| *Canis familiaris* | Domestic Dog |
| Family Felidae | Cats |
| *Panthera onca* | Jaguar |
| Family Tapiridae | Tapirs |
| *Tapirus bairdii* | Baird's Tapir |
| Order Artiodactyla | Even-Toed Ungulates |
| Family Bovidae | Bovids |
| *Bos taurus* | Domestic Cow |
| Family Tayassuidae | Peccaries |
| *Tayassu* sp. | Peccary |
| *Tayassu tajacu* | White-Lipped Peccary |
| Family Cervidae | Deer |
| *Odocoileus virginianus* | White-Tailed Deer |
| *Mazama americana* | Red Brocket Deer |
| Order Rodentia | Rodents |
| Family Cricetidae | Rats and Mice |
| Family Geomyidae | Gophers |
| *Orthogeomys hispidus* | Hispid Pocket Gopher |
| Family Agoutidae | Pacas |
| *Agouti paca* | Paca |
| Family Dasyproctidae | Agoutis |
| *Dasyprocta punctata* | Central American Agouti |
| Order Lagomorpha | Rabbits and Hares |
| Family Leporidae | Rabbits |
| *Sylvilagus* sp. | Rabbit |

**Table 2:** List of taxa identified in the vertebrate assemblage from Pook's Hill 1.

| Taxon | NISP | MNI |
|---|---|---|
| **Class Aves** | | |
| Unidentified bird | 50 | --- |
| *Meleagris ocellata* | 1 | 1 |
| *Meleagris* sp. | 1 | --- |
| **Class Mammalia** | | |
| *Agouti paca* | 7 | 2 |
| *Bos taurus* | 2 | 1 |
| *Canis familiaris* | 9 | 4 |
| *Dasyprocta punctata* | 12 | 3 |
| *Dasypus novemcinctus* | 67 | 1 |
| *Didelphis* sp. | 2 | 2 |
| Family Canidae | 1 | --- |
| Family Cervidae | 22 | --- |
| Family Cricetidae | 1 | 1 |
| Family Didelphidae | 3 | 1 |
| *Mazama americana* | 8 | 1 |
| *Odocoileus virginianus* | 121 | 5 |
| Order Artiodactyla | 9 | --- |
| Order Carnivora | 11 | --- |
| Order Rodentia | 54 | --- |
| *Orthogeomys hispidus* | 21 | 3 |
| *Panthera onca* | 1 | 1 |
| *Sylvilagus* sp. | 7 | 1 |
| *Tapirus bairdii* | 3 | 1 |
| *Tayassu* sp. | 16 | --- |
| *Tayassu tajacu* | 4 | 1 |
| Unidentified mammal | 804 | --- |
| **Class Osteichthyes** | | |
| Family Scaridae | 132 | 8 |
| Unidentified fish | 70 | --- |
| **Class Reptilia** | | |
| *Dermatemys mawii* | 12 | 1 |
| Order Testudines | 3 | --- |
| *Staurotypus triporcatus* | 1 | 1 |
| Unidentified reptile | 2 | --- |
| **Unidentified Vertebrate** | 60 | --- |
| **Total** | **1,517** | **39** |

**Table 3:** List of Pook's Hill 1 taxa.

opossum. Both specimens are major portions of two separate left mandibles indicating the presence of at least two opossums within the sample. These are considered problematic faunal deposits as opossums are known to occupy burrows deserted by other animals and the presence of these specimens may not be archaeological but merely intrusive elements to the sample. The fact that both specimens are mandibles may lend support to this interpretation. Another three specimens are identified only as belonging to the opossum family (Didelphidae). Two of these are also mandible fragments and indicate that at least three opossums account for all the specimens identified to date. One

of these mandible fragments is charred. A partial femur from an immature opossum is also identified.

*Paca* (*Agouti paca*) – A total of 7 specimens are identified as paca, or *gibnut* as it is commonly known in Belize today. All of the specimens of this large nocturnal rodent are forelimb or hindlimb elements and include 6 long bones and one anklebone. A minimum of two individuals is represented based on element duplication and age at death. One immature and one adult *gibnut* are present.

*Agouti* (*Dasyprocta punctata*) – The twelve specimens identified as agouti, or *bush rabbit*, include cranial, forelimb, and hind limb elements. A single molar is representative of cranial elements. All but one of the eleven post-cranial specimens consists of limb bones. All four of the forelimb specimens are humerus portions. The hind limb bones include femur, tibia, and calcaneum specimens. At least three individual agoutis are represented. At least one adult and one immature animal are present.

*Hispid Pocket Gopher* (*Orthogeomys hispidus*) – The twenty-one specimens from this fairly large rodent species were found to include primarily teeth. The remaining six specimens consist of humerus, femur, and tibia fragments. One partial humerus is from an immature animal. Charring is noted on one specimen, a partial tibia. The cranial fragments consist of nine teeth, mainly upper incisors that are easily recognized by a diagnostic vertical groove present on the anterior surface of the incisors. One molar fragment and three partial right mandibles are also present. A minimum of three individuals accounts for the identified specimens. Three of the incisors were found in association with an additional eleven incisors recovered from Burial 4A-3. It is possible that the remaining eleven incisors are also gopher, but they may be agouti and/or paca specimens as well.

*Rat or Mouse* (Family Cricetidae) – A single specimen is identified to this family. This is the major portion of a left femur from an immature individual. It is however, considered to be an intrusive element in the assemblage and not a cultural deposit.

*Unidentified Rodent* (Order Rodentia) – A total of 54 specimens are identified only as rodent bones. These include 11 specimens that are either agouti or paca. These consist of three incisors, one molar, one mandible fragment, one partial right radius, one partial right ulna, one complete left astragalus, one partial right femur from an immature animal, the distal portion of a femur from an immature animal, and a partial tibia. The remaining 43 rodent bones are likely to contain representatives of agouti, paca, and possibly pocket gopher. Cranial and post-cranial elements are present. Squirrel may also be present but further analysis is required to verify the presence of sciurid in the sample. At least six of the unidentified rodent specimens are from immature animals. It is possible that some of these rodent bones could represent intrusive elements within the faunal sample but the majority of the larger rodent bones (i.e. those that are likely gopher, agouti, or paca) are considered to represent food refuse or intentional inclusions in special deposits. This includes 11 incisors recovered from within Burial 4A-3 (SU 53). Although these were initially identified as either paca or agouti teeth (Helmke 2003:122), they could be from

pocket gophers as three incisors found in association with these teeth are positively identified as gopher. These require additional analysis. It is of course possible that all three of these rodent species are present in the burial. Only two elements are modified and include one charred long bone shaft fragment (possibly a femur) from an immature animal, and a charred distal right humerus shaft fragment.

*Nine-Banded Armadillo* (*Dasypus novemcinctus*) – The 67 armadillo specimens are representative of at least one individual animal. A total of 64 specimens are dermal plates from the animals' exoskeleton. The remaining 3 specimens include a phalanx, tibia, and unidentified limb bone. Two specimens exhibit signs of heat alteration. One, a partial tibia, is charred. The other is a slightly "browned" partial unidentified limb bone.

*Domestic Cow* (*Bos taurus*) – The two domestic cow specimens are modern specimens. One is a complete humerus from a juvenile animal. The other is a partial humerus. The complete forelimb bone was recovered during surface collections and the partial humerus is from a mixed humus and collapse debris stratum.

*Carnivore* (Order Carnivora) – Eleven specimens are identified to this zoological order. Three of these specimens are likely domestic dog elements and include one partial cervical vertebra, one incisor, and one molar fragment. One canine tooth crown fragment is charred and is likely to be representative of either dog or a small cat species. The remaining seven specimens consist of two humerii, four femora, and one charred metapodial fragment. Both of the humerii are from medium-sized carnivores. One may be from a mustelid. The other is beveled at one end and has an epicondylar foramen. This specimen may be from a tayra or perhaps a small cat. One of the femora shaft fragments is also beveled at one end and is likely representative of either dog or cat.

*Domestic Dog* (*Canis familiaris*) – A total of 9 specimens are identified. This includes eight worked molar teeth (all lower M1) recovered from within Burial 4A-7 (SU 161). These eight teeth represent 4 pairs of M1 teeth from four separate dogs. All exhibit perforated roots. The remaining dog specimen is an unmodified partial left mandible.

*Dog or Coyote* (Family Canidae) – One unmodified upper premolar from either a dog or coyote was recovered from within Burial 2A-1 (SU 162). This tooth is likely from a dog and is identified as a right upper $4^{th}$ premolar.

*Jaguar* (*Panthera onca*) – The largest carnivore known in Belize is identified by a single perforated canine tooth. This tooth is perforated through the root, indicating that the large tooth was likely worn as a pendant. The presence of this complete tooth within collapse debris may suggest that the adornment was lost rather than intentionally discarded.

*Deer* (Family Cervidae) – A total of 151 specimens are identified as deer. Of these, 22 specimens could not be identified to specific species and are identified as only as deer family. In Belize there are two species, the larger white-tailed deer and the smaller red brocket deer. The unidentified deer specimens include 12 cranial, 3 hind limb, 5

unidentified limb, and two extremity or appendage bones. The 12 cranial elements include 9 antler tine fragments of which three are modified. These are polished fragments. One of these is a charred antler tip portion. This may have been used as a punch for soft-hammer percussion during lithic tool production. Another appears to be a weaving needle fragment and is also charred. The remaining 3 cranial elements are teeth and include two partial lower molars and one indeterminate premolar or molar fragment. Identified limb bones include two left calcaneum bones and a partial metatarsal shaft. Five bone fragments are identified only as metapodia. Four of these are modified. Two fragments are charred and two are intentionally worked. Both of these specimens are polished and are likely fragments from bone awls. The remaining two bones identified as deer include one proximal and one mid phalanx.

*White-Tailed Deer* (*Odocoileus virginianus*) – A total of 121 specimens representative of at least five individual deer are identified. These account for approximately 8 % of the total vertebrate sample recovered from Pook's Hill 1. It is clear from the distribution of body portions that quality cuts of meat were consumed. Included are 13 cranial and 108 post-cranial elements or portions thereof. The cranial elements include 4 antler fragments, two complete auditory bullae, and 7 teeth. Two of the four antler fragments are part of the tine and includes one tip fragment. The teeth include two un-sided upper third molars, both of which are from the same side. Based on wear patterns, one appears to be an un-erupted molar from an immature deer. Three indeterminate upper premolars are noted and one of these also appears to be from an immature animal. The remaining tooth is identified only as a partial lower molar. The post-cranial elements include 19 forelimb, 34 hind limb, 13 indeterminate limb bones, two pectoral bones, and one indeterminate post-cranial bone fragment. The forelimb bones include 11 specimens identified as humerus. All of these are partial elements and include seven right humerii fragments, 3 left humerii, and one specimen that could not be sided. One left and one right humerus fragment are charred. One right humerus distal shaft portion has been beveled, likely to aid in the manufacture of bone beads or tubes. The remaining forelimb specimens consist of 4 metacarpal fragments, three radii fragments, and the distal portion of a left ulna. One radius shaft fragment is heat-altered. The 34 specimens identified as hind limb bones include 17 specimens from the ankle region. The astragalus and calcaneum elements are represented by 9 specimens, and 8 specimens, respectively. All of the astragalus elements are complete. Two calcaneum bones are also complete and at least two are from an immature deer. The high degree of completeness seen among these identified ankle bones is due to their bone density which in turn results in their high survivorship in the faunal assemblage. The femur is represented by seven specimens. None are complete. One is from a mature adult and one is from an immature deer. Modification is present on two specimens and in both instances the shafts have been beveled. This includes the femur identified as an immature animal. Beveled shafts ends are generally considered to be diagnostic indications of bone bead and/or tube manufacture with the remaining beveled bone representing the associated debitage resulting from this activity. Five specimens are identified as metatarsal element fragments. None of these have been sided. One if from an immature animal and two are modified. One partial shaft has been polished and grooved. Another proximal shaft portion is charred and calcined and consists of five fragmentary pieces of the same

element that fit together. Four specimens are identified as tibia and include both left and right elements. Two of these are from immature animals. One complete right patella bone is noted. Of the thirteen unidentified limb bones, seven are metapodial shaft fragments, of which two are heat altered. Two charred bone fragments are identified as the lateral portions of a left and right scapula. Finally, one unidentified long bone shaft fragment has been polished along its exterior surface at the end. This may be from a bone pin or awl. The remaining 39 specimens consist of 36 phalanges and three axial bones. The phalanges were found to include 22 complete elements consisting of four distal phalanges, 6 mid phalanges, and 12 proximal phalanges. One mid phalanx is charred and one proximal phalanx fragment is calcined. The axial bones consist of two cervical vertebrae and one rib fragment. One of the cervical vertebrae is identified as a partial axis (C1) vertebra exhibiting some mild heat alteration.

*Red Brocket Deer* (*Mazama americana*) – The eight specimens identified to this species, known locally in Belize as *antelope*, consist of cranial and limb bones. The cranial element is a lower molar. Each of the following limb elements are represented by one specimen: humerus, radius, metacarpal, femur, tibia, and calcaneum. Only the calcaneum is a complete element and this is also calcined. The partial femur shaft has a beveled end, indicating that this specimen is debitage associated with bone bead and/or tube manufacturing.

*Peccaries* (Family Tayassuidae) – Four of the twenty peccary specimens are positively identified as collared peccary (*Tayassu tajacu*). These include a partial left and right mandible, a complete lower canine, and a partial right tibia. At least one collared peccary is present. The remaining 16 peccary specimens (*Tayassu* sp.) include cranial, limb, and appendage bones. Cranial elements identified include six incisors, and five canine teeth. The three limb bones include a partial left humerus, and two charred metapodial fragments. Both of the appendage bones are proximal phalanges, one of which is complete and charred. It is possible that all of the bones may be from the collared peccary.

*Even-Toed Ungulates* (Order Artiodactyla) – A total of nine bones are identified as belonging to this zoological order. All but one of these bones is from either deer or peccary species. One specimen, a metapodial distal shaft fragment from a juvenile animal, may be from a modern domestic cow. The remaining eight specimens consist of cranial, limb, and appendage elements. One mandible fragment from a large artiodactyl is charred. Two limb bone shaft specimens appear to be intentionally polished and may be from a bone tool or ornament.

*Tapir* (*Tapirus bairdii*) – A total of three specimens are identified as tapir. Two are molars and one is a metapodial fragment. One of the molar teeth is identified as a left upper third molar (M3) and has a perforated root. This tooth was recovered as a grave good from within Burial 1A-1 (SU 313) (see Helmke, this volume).

*Rabbit* (*Sylvilagus* sp.) – The seven specimens identified as rabbit include cranial, axial, forelimb, and hind limb elements. Unfortunately it has not been possible to identify the

specific species of rabbit present within the Pook's Hill 1 assemblage. Two species are known to inhabit Belize today. These include the eastern cottontail (*Sylvilagus floridanus*) and the forest rabbit (*Sylvilagus brasiliensis*). Identification to species based on post-cranial elements is extremely difficult. At least one rabbit is present and identified elements include a left and right partial mandible, a complete cervical vertebra of an immature rabbit, a partial distal right humerus, and a partial distal left tibia.

*Unidentified Mammal Bone* (Class Mammalia) – The 804 unidentified mammal specimens likely contain additional representatives of those taxa discussed above, as well perhaps of some new taxa. Rather than speculate on what taxa may be present among this assemblage, attempts have been made to sort the unidentified specimens as to body portion or element represented, and the size of animal represented. As well, comments are offered on modifications observed. Cranial elements account for 35 specimens and include teeth and skull bones of small-, medium-, and large-sized animals. Of these, 11 are charred and/or calcined specimens. Post-cranial remains include 94 axial bones. These include 62 assorted vertebrae (cervical, thoracic, and lumbar vertebrae are present), 30 rib fragments, and 2 indeterminate axial elements. Of the 94 axial specimens, 22 are considered to be representative of large mammal, 44 of medium to large mammal, and 25 of small to medium mammal. A total of 23 axial bone specimens exhibit signs of heat alteration in the form of charred and/or calcined bone. Twelve axial specimens are from immature animals. The forelimb is represented by eighteen specimens. These include humerus, radius, and ulna fragments from mainly small- to medium-sized animals. One radius shaft fragment is from a small immature animal, possibly a rabbit or large rodent. Three bone fragments are charred and one ulna shaft from a medium to large animal is worked. This specimen is polished and appears to be a portion of a bone awl. A total of 19 specimens are identified as hind limb elements and include femur and tibia fragments. The majority of these are from medium to large mammals. Two femur shafts are worked. One is a beveled specimen from a medium to large animal and likely represents debitage from bone bead or tube manufacturing. The other is a polished fragment from a large-sized mammal. Two femur specimens are from immature animals. A total of 45 specimens are unidentified limb bone fragments from a variety of small- to large-sized animals. One specimen is from a large immature animal and another is from a large juvenile animal, possibly an artiodactyl. Heat alteration is noted on five specimens, and includes charred and calcined bone fragments. Seven specimens are worked. These include fragments of bone awls, tubes, and possibly spatulas. One specimen, a large mammal, is carved. Several of these were recovered from burial contexts and these are discussed in more detail below in the section on distribution of faunal remains. Eight specimens are from pectoral and pelvic elements and include three partial scapulae from small- to medium-sized animals and five partial innominates from small and medium to large animals. One of these is charred. Four phalanges are also present and include one from a small animal and three from medium to large animals, possibly artiodactyls. One of these is charred. One mid phalanx is a complete specimen and is from a large animal, either a tapir or perhaps a modern cow. There are 456 specimens identified simply as post-cranial bones. Of these, 405 are long bone portions and are likely to represent limb elements. The remaining 51 specimens are likely mainly axial bone fragments. Modification is noted on 75 of the 456 unidentified specimens. Five fragments show

clear signs of breakage incurred during butchering processes. One long bone shaft fragment is spirally fractured possibly resulting from butchering. Heat alteration is noted on 52 of these specimens and includes charred and calcined fragments. Seven long bone specimens exhibit signs of non-cultural modification including exfoliation and cracking associated with weathering. Three long bone shaft fragments are rodent-gnawed. A total of 10 bones are worked. Among these are one bead manufactured from the shaft of a long bone from an indeterminate-sized animal. Polishing is noted on eight specimens and these are likely fragments of bone awls, weaving (?) pins, and/or spatulate implements. One carved long bone shaft segment from a large mammal was recovered from Burial 1A-1 (SU 313). Finally, a total of 120 bone specimens are too fragmented to identify to body portion or skeletal element. The majority of these are believed to be from medium- to large-sized taxa. Ten of these fragments are charred and/or calcined. One specimen is carved and is from a large mammal. This was recovered from Burial 2A-2 (SU 179), which was originally misidentified as a turtle carapace fragment in the field (Christophe Helmke pers. comm. 2001).

**Account of Bony Fish (Class Osteichthyes)**

The 202 bones identified as bony fish consist of 132 parrotfish (Family Scaridae) cranial elements or portions thereof. All of these bones are from the jaw apparatus of the fish and include maxillae, dentaries and upper and lower grinding mill bones. Due to the lack of a comparable skeletal reference collection these bones have not been assigned to a specific genera or species. However, it is expected that further analysis of this material with reference to such a collection will allow sorting of the majority of the bones to at least the genus level, if not specific species represented. A minimum of eight individual parrotfish accounts for the identified assemblage. These fish bones were recovered from a variety of contexts but none are associated with burials. A total of seven specimens are charred and/or calcined. Parrotfish are restricted to marine reef environments and their inclusion in the faunal assemblage at Pook's Hill 1 is clearly via trade with coastal communities or through direct access of the Caribbean Sea. Their inclusion in the sample is likely as a specialty food associated with competitive feasting events at the site (see Helmke 2001).

The remaining 70 specimens consist primarily of vertebrae (n=56), unidentified cranial elements (n=13), and a single spine. It is possible that these unidentified elements may also be parrotfish, however, the possibility exists that some could be local river fish as well. This remains to be determined. Of these, 9 are charred and/or calcined fragments.

The distribution of fish body portions is somewhat interesting. The presence of a large number of cranial specimens (n=145, or 71.7 % of all fish bones), would suggest that whole fish were processed and/or consumed on site. If only fillets were being brought to the site then it would be expected to see a lack of cranial elements and the exclusive representation of post-cranial elements. However, with the presence of large numbers of cranial elements and the concomitant assumption that whole fish were being brought to the site, then one would also expect to see higher frequencies of post-cranial elements, particularly vertebrae. The lack of apparent vertebrae and spine bones in the sample is somewhat problematic. The distinct possibility exists that bone density may

affect the survivorship of these elements. Although parrotfish jaw elements are highly dense bones, the density of post-cranial relative to cranial elements remains unknown at present. Cooking practices (i.e. heating) may in turn also affect bone survivorship. At Lamanai, it has been noted during excavation that several fish bones found in situ within a collapsed vessel disintegrated upon their removal from the surrounding soil matrix (Darcy Wiewall, personal communication 2005). It has been postulated that these remains were prepared as a stew. It is clear that the biased distribution of fish elements at Pook's Hill 1 requires clarification by means of further study.

**Account of Birds (Class Aves)**

A total of 52 specimens are identified as bird bone. Of these, only two are positively identified as turkey bones. Both are likely ocellated turkey and this identification is based on the assumption that domestic turkey was not introduced to the Maya area until the Postclassic period. One of these turkey bones is a partial right coracoid element, and the other is a partial left tarsometatarsus from the leg. An additional five specimens are believed to be turkey bones as well. All of the bird bones are post-cranial elements and include several wing and leg specimens. Three specimens are from a small- to medium-sized bird species and are believed to be identifiable with comparison to modern skeletal reference collections. It is possible that all of the medium- to large-sized bird bones could be turkey. Two bone fragments are charred and one is calcined. A total of nine specimens are worked. These include five complete beads and one fragmented bead. Two of the beads are manufactured from the distal shaft portions of a left and right humerus from a large bird (possibly turkey). These were both recovered from Burial 4A-5 (SU 144). An additional two complete beads and one partial bead manufactured from indeterminate long bone shafts, were also recovered from Burial 4A-5. One tibiotarsus specimen from a large bird is beveled and likely represents debitage associated with bead manufacturing. Finally, a polished long bone distal shaft fragment from a large bird was recovered from within Burial 4A-7 (SU 161).

**Account of Reptiles (Class Reptilia)**

The eighteen specimens identified as reptilian bone were found to include 16 turtle shell fragments, one partial innominate and a partial vertebra from an unidentified small reptile taxon or taxa. The 16 turtle shell fragments include 12 pieces identified as Central American river turtle, or *hickatee*. All of these are calcined on both their exterior and interior surfaces, suggesting that they were burned following deposition. One partial costal shell element from a Mexican giant musk turtle is also noted. Three turtle shell fragments could not be identified to a lower taxon and include one charred specimen and one calcined specimen. These too exhibit post-depositional burning.

**Unidentified Bone**

The sixty unidentified bone fragments include 16 heat-altered fragments (most are charred) and one worked long bone fragment. This specimen is polished on its exterior surface.

## INTERSITE DISTRIBUTION OF THE VERTEBRATE FAUNAL ASSEMBLAGE

Animal bone was recovered from five operations (Ops. 3, 4, 5, 6 and 9) comprising twenty separate sub-operations (marked by alphabetic suffix) associated with the excavation of seven structures and the plaza platform (Table 4). The majority of the sample comes from excavations associated with Operation 6A. This operation was focused primarily on Structure 2A and the plaza area immediately to the east of its frontal face. A total of 350 vertebrate specimens were recovered from six separate excavation units within the operation. This accounts for approximately 23 % of the Pook's Hill 1 vertebrate assemblage. Other operations yielding assemblages of greater than 100 specimens include Operations 4C, 6B, 9D, and 9E. Together, these 5 operations account for 75.5 % of the bone sample.

| Provenience | Operation | NISP | % of Total |
|---|---|---|---|
| Plaza Platform | 5A, 5C | 2 | 0.1 % |
| Structure 1A | 9A, 9B, 9E, 9F, 9G | 270 | 17.8 % |
| Structure 1B | 9D | 143 | 9.4 % |
| Structure 1C | 9C | 23 | 1.5 % |
| Structure 2A | 6A, 6B, 6C, 6D | 640 | 42.2 % |
| Structure 2B | 6E | 3 | 0.2 % |
| Structure 4A | 3, 4A, 4B, 4C, 4D | 390 | 25.7 % |
| Structure 4B | 4E | 46 | 3.0 % |
| **Total** | | **1,517** | **100.0 %** |

**Table 4:** Distribution of faunal remains by provenience.

### Plaza Platform (Ops. 5A, 5C)

Excavation of the plaza platform resulted in the recovery of only two specimens. A parrotfish jaw element was recovered from the core of Floor 1, and an indeterminate long bone shaft portion from a large mammal was recovered from the overlying humus and collapse debris.

### Structure 1 (Ops. 9A, 9C, 9D, 9E, 9F, 9G)

Excavation of Structure 1A, 1B, and 1C resulted in the recovery of 436 specimens (Table 5). Bird, mammal, reptile and fish specimens account for 429 of these. A total of 7 bone specimens could not be assigned to zoological class. The analysis of those specimens identified to zoological class includes 186 representatives of 16 separate taxa. Of these, 133 are identified to nine mammalian species. These include agouti, paca, pocket gopher, armadillo, red brocket and white-tailed deer, collared peccary, jaguar, and tapir. The remaining 53 specimens could be sorted to zoological order, family, and genus. Faunal remains were recovered from a variety of contexts including burial, humus and collapse debris, terminal occupation debris (including middens), and core deposits. Terminal occupation debris, humus, and collapse debris account for the

majority of the specimens and indicate, in association with the distribution of taxa and their representative elements and body portions, that the faunal remains primarily represent food refuse.

| Zoological Taxon | NISP | % of Structure Sample |
|---|---|---|
| **Class Aves** | | |
| Unidentified bird | 21 | 4.8 % |
| **Class Mammalia** | | |
| *Agouti paca* | 5 | 1.1 % |
| *Dasyprocta punctata* | 3 | 0.7 % |
| *Dasypus novemcinctus* | 64 | 14.7 % |
| Family Cervidae | 9 | 2.1 % |
| *Mazama americana* | 5 | 1.1 % |
| *Odocoileus virginianus* | 50 | 11.5 % |
| Order Artiodactyla | 2 | 0.5 % |
| Order Rodentia | 5 | 1.1 % |
| Family Cricetidae | 1 | 0.2 % |
| *Orthogeomys hispidus* | 1 | 0.2 % |
| *Panthera onca* | 1 | 0.2 % |
| *Tapirus bairdii* | 3 | 0.7 % |
| *Tayassu tajacu* | 1 | 0.2 % |
| *Tayassu* sp. | 4 | 0.9 % |
| Unidentified Mammal | 214 | 49.1 % |
| **Class Osteichthyes** | | |
| Family Scaridae | 31 | 7.1 % |
| Unidentified Fish | 7 | 1.6 % |
| **Class Reptilia** | | |
| Order Testudines | 1 | 0.2 % |
| Unidentified Reptile | 1 | 0.2 % |
| **Unidentified Bone** | 7 | 1.6 % |
| **Total** | **436** | **100.0 %** |

**Table 5:** List of Structure 1 taxa.

Among those specimens identified to species, white-tailed deer and red brocket deer account for 55, or approximately 41 % of the sample. It is clear from the distribution of body portions and skeletal elements that good quality cuts of deer meat were consumed on site. All but two of the specimens are post-cranial elements and only three of these are axial bones. Elements of both the fore and hind limbs are present in high frequencies to indicate that haunches were the preferred meat source. All of the species identified, with the exception of jaguar, are considered to be food sources. Except for the armadillo, which at this point is identified solely on the basis of the presence of dermal plates, the distribution of body portions of the other species is similar to those of the deer indicating that quality cuts of meat were consumed.

The remaining 53 specimens identified to higher taxa than species but below the level of zoological class include deer, peccary, rodent, turtle, and parrotfish specimens. Parrotfish account for 31 specimens. Unfortunately, none of the 21 bird bone specimens

could be identified to a lower taxon, however, several of these are from a large-sized bird, possibly turkey.

**Structure 1A (Ops. 9A, 9B, 9E, 9F, 9G)**

The 270 specimens recovered from five operations associated with Structure 1A investigations include bird, mammal, and fish taxa. Identified taxa include agouti (n=1), paca (n=4), indeterminate rodent (n=2), tapir (n=3), peccary (n=4), red brocket deer (n=4), white-tailed deer (n=48), indeterminate deer (n=4), indeterminate artiodactyl (n=2), indeterminate turtle (n=1), and parrotfish (n=21). Unidentified specimens include fish (n=4), mammal (n=166) and bird (n=2). Two bone fragments could not be identified to zoological class.

Heat alteration is noted on eight white-tailed deer specimens, including 4 charred fragments. One fish vertebra is charred and another is calcined. Four parrotfish bones are completely charred on all surfaces (most likely due to post-depositional burning). Heat alteration is noted on 27 unidentified mammal bones, and includes charred and calcined fragments. One mammal long bone shaft is spirally fractured. Weathering is noted on 11 white-tailed deer specimens, all of which are from the collapse debris of Terrace 1. Surface pitting and longitudinal cracking is seen on some of these suggesting that they were exposed for a period of time to natural elements (e.g. sunlight, water) harmful to bone preservation. Charring is evident on one parrotfish bone. Charring is also noted on the root fragment of a peccary canine tooth. A turtle carapace fragment is similarly calcined.

*Burial 1A-1*

Four mammal bones were found in association with this burial. These include a perforated tapir molar (313/3), a fragmentary carved plaque made from the shaft of a large mammal long bone (313/2), a bone spatulate implement or hairpin manufactured from the limb bone of a large mammal (313/6), and an unmodified canine tooth from a medium-sized mammal (perhaps an incidental inclusion), possibly an opossum or small carnivore. For detailed descriptions of each of these specimens see Helmke (this volume).

*Worked Bone*

One unidentified long bone shaft fragment from a small- to medium-sized animal is polished on its exterior surface. One bird bone bead was recovered from the core of Architectural Unit 5 (AU 5). A red brocket femur shaft portion recovered from Cluster 15 is beveled. One perforated tapir molar was recovered from Burial 1A-1. There are four worked unidentified mammal bones: one bead from a long bone shaft recovered from humus/collapse debris; one carved long bone from Burial 1A-1; one possible bone spatula or pin from Burial 1A-1; and one probable awl fragment manufactured from a large limb bone found in the collapse debris associated with Terrace 1. One deer charred and polished antler tine fragment was recovered from the collapse debris of Terrace 1. Another white-tailed deer polished and grooved metatarsal shaft came from the collapse debris of Terrace 1.

**Structure 1B (Op. 9D)**

The 143 bone specimens from this operation were found to include bird, mammal, fish, and reptile taxa. Identified taxa include agouti (n=2), paca (n=1), armadillo (n=64), indeterminate deer (n=2), indeterminate rat or mouse (n=1), indeterminate rodent (n=2), jaguar (n=1), collared peccary (n=1), and parrotfish (n=2). Three bone fragments could not be identified to zoological class.

None of the 19 bird bone fragments could be identified below the level of zoological class. Three fish vertebrae are unidentifiable. The single unidentifiable reptile bone is likely intrusive and closely follows gecko. A total of 41 mammal bones could not be identified to a lower taxon.

The rat or mouse bone is considered intrusive to the sample. One of the indeterminate rode bones is either agouti or paca. The other is considered to be intrusive and may be from a squirrel.

Two deer metapodial fragments are charred. One indeterminate mammal rib bone is calcined. Another unidentified mammal long bone shaft fragment is charred.

*Worked Bone*

The single jaguar identification is a complete canine tooth pendant that has been perforated through its root. This artifact was recovered from collapse debris and its completeness may suggest that it represents a lost item rather than an intentionally discarded adornment. Two unidentified mammal bones are worked. This includes a beveled femur shaft fragment from a medium- to large-sized animal recovered from collapse debris, and a polished long bone shaft fragment of a large mammal recovered from midden Cluster 4.

**Structure 1C (Op. 9C)**

A total of 23 mammal and fish specimens were recovered during the excavation of Operation 9C. These were found to include red brocket deer (n=1), white-tailed deer (n=2), indeterminate deer (n=3), pocket gopher (n=1), indeterminate rodent (n=1), and parrotfish (n=8). Seven mammal bones could not be identified to a lower taxon. Two unidentifiable mammal long bone fragments are charred.

*Worked Bone*

One white-tailed deer indeterminate long bone shaft fragment recovered from the core of Stair 1 has a polished end. Two indeterminate deer antler fragments are polished and one is also charred.

**Structure 2 (Ops. 6A, 6B, 6C, 6D, 6E)**

The excavation of Structures 2A and 2B resulted in the recovery of 642 specimens (Table 6). Bird, mammal, reptile and fish specimens account for 608 of these. A total of 34 bone specimens could not be assigned to zoological class. The analysis of those specimens identified to zoological class includes 194 representatives of 21 separate taxa. Of these, 60 are identified to one avian, ten mammalian, and one reptilian species. These

include agouti, paca, pocket gopher, armadillo, red brocket and white-tailed deer, collared peccary, and domestic cow. The remaining 134 specimens could be sorted to zoological order, family, and genus. Faunal remains were recovered from a variety of contexts

| Zoological Taxon | NISP | % of Structure Sample |
|---|---|---|
| **Class Aves** | | |
| *Meleagris* sp. | 1 | 0.2 % |
| Unidentified Bird | 22 | 3.4 % |
| **Class Mammalia** | | |
| *Agouti paca* | 1 | 0.2 % |
| *Bos taurus* | 1 | 0.2 % |
| *Dasyprocta punctata* | 1 | 0.2 % |
| *Dasypus novemcinctus* | 2 | 0.3 % |
| *Didelphis* sp. | 1 | 0.2 % |
| Family Didelphidae | 1 | 0.2 % |
| Order Carnivora | 8 | 1.2 % |
| Family Canidae | 1 | 0.2 % |
| Family Cervidae | 9 | 1.4 % |
| *Mazama americana* | 1 | 0.2 % |
| *Odocoileus virginianus* | 39 | 6.1 % |
| *Tayassu* sp. | 10 | 1.6 % |
| *Tayassu tajacu* | 2 | 0.3 % |
| Order Artiodactyla | 2 | 0.3 % |
| Order Rodentia | 25 | 3.9 % |
| *Orthogeomys hispidus* | 12 | 1.9 % |
| *Sylvilagus* sp. | 1 | 0.2 % |
| Unidentified Mammal | 333 | 51.9 % |
| **Class Osteichthyes** | | |
| Family Scaridae | 74 | 11.5 % |
| Unidentified Fish | 59 | 9.2 % |
| **Class Reptilia** | | |
| *Staurotypus triporcatus* | 1 | 0.2 % |
| Order Testudines | 1 | 0.2 % |
| **Unidentified Bone** | 34 | 5.3 % |
| **Total** | **642** | **100.0 %** |

**Table 6:** Structure 2 taxa.

including burial, humus and collapse debris, terminal occupation debris (including midden), and core deposits. Deposits of terminal occupation debris, separated as discrete clusters, account for the majority of the specimens and indicate, in association with the distribution of taxa and their representative elements and body portions, that the faunal remains primarily represent food refuse. Consequently, these deposits can be aptly regarded as middens.

Among those specimens identified to species, white-tailed deer and red brocket deer account for 40 specimens, or approximately 67 % of the sample. As with the remains from Structure 1, it is clear from the distribution of body portions and skeletal elements that good quality cuts of deer meat were consumed. All but two of the specimens are post-cranial extremity elements. Elements of both the fore and hind limbs are present in high frequencies to indicate that haunches were the preferred meat source.

All of the species identified, with the exception of the modern cow bone, are considered to be food sources. The distribution of body portions of the other species is similar to those of the deer indicating that quality cuts of meat were consumed. The single identified reptile bone is a costal element of a musk turtle.

The remaining 134 specimens identified to higher taxa than species but below the level of zoological class include deer, peccary, opossum, carnivore, rodent, rabbit, turtle, turkey, and parrotfish specimens. Parrotfish account for 74 specimens. The remaining 22 bird bone specimens could not be identified to a lower taxon, however, several of these are from a large-sized bird, possibly turkey.

**Structure 2A (Ops. 6A, 6B, 6C, 6D)**

The 639 specimens recovered from four sub-operations associated with Structure 2A investigations include bird, mammal, and fish taxa. Identified taxa include turkey (n=1), paca (n=1), agouti (n=1), armadillo (n=2), opossum (n=2), indeterminate carnivore (n=8), dog or coyote (n=1), red brocket deer (n=1), white-tailed deer (n=39), indeterminate deer (n=9), collared peccary (n=2), indeterminate peccary (n=10), indeterminate artiodactyl (n=2), indeterminate rodent (n=25), pocket gopher (n=12), rabbit (n=1), parrotfish (n=74), Mexican musk turtle (n=1), and indeterminate turtle (n=1). Unidentified specimens include bird (n=22), mammal (n=329), and fish (n=59).

Several specimens are modified. These include a charred fragmented ulna from a large bird, possibly turkey. Two other bird bones are modified and include a charred and a calcined long bone. A complete red brocket calcaneum is calcined. One white-tailed deer proximal phalanx is calcined and one fragmented white-tailed deer metatarsal shaft is calcined and charred. One indeterminate artiodactyl mandible portion is charred. Three fish vertebrae are charred and/or calcined. One parrotfish premaxilla bone is charred. Two of the unidentifiable bone fragments are charred. Heat alteration is noted on 68 unidentified mammal specimens. These are both charred and calcined. One armadillo long bone fragment is heat-altered. The proximal fragment of a small carnivore, possibly a raccoon metapodial, is charred. An immature rodent long bone fragment is charred. A right humerus shaft fragment of a small rodent is charred. A gopher tibia shaft is charred. One fish vertebra and two cranial fragments are charred and/or calcined. One fish vertebra is calcined. One parrotfish bone is charred and calcined. Thirteen unidentified bone fragments are charred and/or calcined. One unidentified mammal long bone fragment from a large animal show signs of breakage associated with intentional butchering.

*Surface (Operation 6)*

One complete humerus of a juvenile domestic cow was recovered from the surface of the site.

*Burial 2A-1*

One upper fourth premolar from either a dog or coyote was associated with Burial 2A-1 (SU 162).

*Burial 2A-2*

Two specimens were recovered from this burial and include: a bone awl and a carved bone plaque, both from an unidentified mammal (SU 179).

*Worked Bone*

One bird bone bead manufactured from the shaft of a large long bone was recovered from midden Cluster 6 (SU 61). A tibiotarsus fragment from a large bird, possibly turkey is beveled. This is from a mix of collapse debris and Cluster 4. One unidentified deer metapodial shaft fragment is polished and likely is a partial tool. This was also recovered from Cluster 6. Two white-tailed deer bones are beveled. One is a distal humerus from mixed humus/collapse debris and the other is a proximal femur, also recovered from a mixed humus/collapse debris context. Three mammal long bone shaft fragments are worked: one is the distal tip portion of an awl recovered from humus/collapse; one is a polished fragment, and the other is a fragment from a bone tube. All were recovered from humus/collapse mixed contexts. One polished deer metapodial shaft fragment was recovered from the core of Terrace 1. This is probably from an awl. A beveled right femur of a white-tailed deer was recovered from the core of Stair B. Nine unidentified mammal bones are worked and include: one awl fragment from Burial 2A-2, one carved bone also from Burial 2A-2, one awl from a large mammal, possibly artiodactyl recovered from the core of Stair B, and six polished bone fragments from Cluster 4. All are probably part of bone tools.

**Structure 2B (Op. 6E)**

Only three specimens were recovered during Operation 6E excavations. These are all unidentified mammal long bone shaft fragments recovered from mixed humus and collapse debris contexts. All are from medium- to large-sized animals and one is charred. One shaft fragment is worked with a polished surface. This may be part of a bone pin.

**Structure 4 (Ops. 3, 4A, 4B, 4C, 4D, 4E)**

The excavation of Structures 4A and 4B resulted in the recovery of 436 specimens (Table 7). Bird, mammal, reptile and fish specimens account for 417 of these. A total of 19 bone specimens could not be assigned to zoological class. The analysis of those specimens identified to zoological class includes 151 representatives of 20 separate taxa. Of these, 84 are identified to one avian, ten mammalian and one reptilian species. These include ocellated turkey, agouti, paca, pocket gopher, armadillo, domestic dog, red brocket as well as white-tailed deer, collared peccary, and *hickatee* turtle. The remaining 76 specimens could be sorted to zoological order, family, and genus. Faunal remains were recovered from a variety of contexts including burial, humus and collapse debris, midden, terminal occupation debris, and core deposits.

Among those specimens identified to species, white-tailed deer and red brocket deer account for 34 specimens, or approximately 45 % of the identified species sample. As with the remains from Structure 1A and 2A, it is clear from the distribution of body portions and skeletal elements that good quality cuts of deer meat were consumed although higher frequencies of cranial elements (i.e. mostly teeth) are noted. All of the

species identified are considered to be food sources. The distribution of body portions of the other species is similar to those of the deer indicating that quality cuts of meat were consumed.

| Zoological Taxon | NISP | % of Structure Sample |
|---|---|---|
| **Class Aves** | | |
| *Meleagris ocellata* | 1 | 0.2 % |
| Unidentified Bird | 7 | 1.6 % |
| **Class Mammalia** | | |
| *Agouti paca* | 1 | 0.2 % |
| *Canis familiaris* | 9 | 2.1 % |
| *Dasyprocta punctata* | 8 | 1.8 % |
| *Dasypus novemcinctus* | 1 | 0.2 % |
| *Didelphis* sp. | 1 | 0.2 % |
| Family Didelphidae | 2 | 0.5 % |
| Family Cervidae | 4 | 0.9 % |
| *Mazama americana* | 4 | 0.9 % |
| *Odocoileus virginianus* | 30 | 6.9 % |
| Order Artiodactyla | 5 | 1.1 % |
| Order Carnivora | 3 | 0.7 % |
| Order Rodentia | 24 | 5.5 % |
| *Orthogeomys hispidus* | 8 | 1.8 % |
| *Sylvilagus* sp. | 6 | 1.4 % |
| *Tayassu* sp. | 2 | 0.5 % |
| *Tayassu tajacu* | 1 | 0.2 % |
| Unidentified Mammal | 256 | 58.7 % |
| **Class Osteichthyes** | | |
| Family Scaridae | 26 | 6.0 % |
| Unidentified Fish | 4 | 0.9 % |
| **Class Reptilia** | | |
| *Dermatemys mawii* | 12 | 2.8 % |
| Order Testudines | 1 | 0.2 % |
| Unidentified reptile | 1 | 0.2 % |
| **Unidentified Bone** | 19 | 4.4 % |
| **Total** | **436** | **100.0 %** |

**Table 7:** Structure 4 taxa.

The remaining 74 specimens identified to higher taxa than species but below the level of zoological class include opossum, deer, carnivore, peccary, rodent, rabbit, turtle, and parrotfish specimens. Parrotfish account for 26 specimens. Seven bird specimens could not be identified to a lower taxon than class, however, some of these are likely to be turkey.

### Structure 4A (Ops. 3, 4A, 4B, 4C, 4D)

The 390 vertebrate specimens recovered from five sub-operations associated with the excavation of Structure 4A included bird, mammal, fish, and reptilian taxa. Identified taxa include ocellated turkey (n=1), paca (n=1), agouti (n=8), pocket gopher (n=8) indeterminate rodent (n=23), rabbit (n=6), domestic dog (n=9), indeterminate carnivore

(n=3), armadillo (n=1), opossum (n=3), red brocket deer (n=2), white-tailed deer (n=31), indeterminate deer (n=4), indeterminate peccary (n=2), indeterminate artiodactyl (n=5), parrotfish (n=23), *hickatee* (n=11), and indeterminate turtle (n=1). Unidentified fauna include bird (n=7), mammal (n=223), fish (n=4), and reptile (n=1). Thirteen bone fragments could not be identified to zoological class.

Heat alteration is noted on a total of 23 specimens. Eleven *hickatee* shell fragments are calcined on all surfaces. This suggests post-depositional burning. Charring is noted on an armadillo tibia, an opossum mandible, a left humerus from a white-tailed deer, the canine tooth of an indeterminate medium- to large-sized carnivore, and seven unidentified mammal bone fragments.

*Burial 4A-3*

A total of 21 bone specimens were associated with this burial (SU 53). These include a total of seventeen unmodified teeth of which three are pocket gopher (*Orthogeomys hispidus*) molars, eleven are indeterminate rodent incisors (these are either from gopher, agouti, and/or paca), one is a charred fragment of a canine tooth from a medium-sized mammal (possibly peccary), one is a charred fragment from the crown of a canine tooth from a medium-sized carnivore (possibly dog or one of the small cat species), and the charred unidentified tooth fragment from a large mammal (probably a carnivore). The remaining four inclusions include a heat-altered shell fragment from a small turtle species, the heavily-charred fragment of a long bone shaft from a medium- to large-sized mammal, a partial caudal vertebra from a small mammal (possibly rodent), and the major portion of a left humerus from an immature pocket gopher.

*Burial 4A-5*

All five vertebrate specimens recovered from this burial (SU 144) are beads manufactured from bird bone. Four of the beads are complete. Two are manufactured from the shaft of an indeterminate long bone from a large bird. Another fragmented partial bead is also manufactured from an indeterminate long bone shaft from a large bird. The remaining two complete beads are manufactured from the distal shaft portion of both a left and right humerus from a large bird, possibly turkey.

*Burial 4A-7*

Ten specimens were recovered from this burial (SU 161) and include eight pendants manufacture from dog's teeth. All of the teeth are lower first molars. Four are from the left mandible and four are from the right mandible and represent a minimum of four individual dogs. Also recovered was a carved mammal long bone shaft fragment from a large animal. The remaining worked piece of bone recovered from the burial is a polished long bone from an unidentified large bird.

*Worked Bone*

There are three worked bone fragments found in addition to the 15 recovered from Burial 4A-5 and 4A-7. These include the shaft of a bone needle manufactured from a white-tailed deer metapodial that was recovered from Cluster 9, and two beveled long bone shaft fragments from unidentified carnivore species recovered from within the core of Terrace 1. One of these is the distal portion of a right humerus and the other is the

proximal portion of a left femur. Both are believed to be from a medium-sized carnivore. Both of these bones are considered to be pieces of debitage associated with the manufacture of bone artifacts.

**Structure 4B (Op. 4E)**

A total of 46 specimens were presented for analysis and found to include mammal, fish, and reptilian taxa. Mammals account for 36 specimens and include three representatives of white-tailed deer, collared peccary, and rodents. The remaining 33 mammal bone specimens could not be identified to a lower taxon. Fish account for three specimens and all are parrotfish cranial elements. The single reptilian specimen is a *hickatee* shell fragment. Six bone fragments could not be identified to zoological class.

The faunal material was recovered from a variety of contexts including: terminal occupation debris Cluster 10, humus, collapse debris, and core of Terrace 1. The majority of the material was recovered from collapse debris contexts.

The single white-tailed deer bone is a distal portion of a tibia from an immature animal. Collared peccary is identified on the basis of a single partial right tibia. One partial rodent tibia is from either an agouti or paca. The single *hickatee* shell fragment is too fragmented to differentiate between a carapace or plastron element. All of the parrotfish elements are from the jaw apparatus.

Five bone specimens show signs of modification. Four unidentified mammal long bone shaft pieces are fragmented as a result of butchering. A single *hickatee* shell fragment is completely calcined.

## SUMMARY & CONCLUSIONS

The preliminary analysis of the vertebrate faunal assemblage recovered during excavations at the Pook's Hill 1 site suggests that meat was readily available and consumed at the site. Both local and more distant taxa have been identified within the assemblage. Large game –namely deer– appears to dominate the sample in reference to meat yields. This is seen not only in frequencies and percentages of the sample represented but also by the distribution of meat cuts consumed. It is clear that haunches were eaten. Not only was local meat consumed, but the site's inhabitants also had access to non-local foods such as marine fish. The presence of reef parrotfish indicates this. Whether access was direct is questionable, and it seems more likely that the fish was obtained through indirect trade with coastal fishing communities.

Heat alteration is noted on several bone and/or tooth fragments. However, the patterning and degree of alteration seems to indicate post-depositional burning. Many of the specimens are charred and/or calcined on all surfaces. Charring associated with cooking would not leave such a pattern of alteration. Calcination would not be expected at all from cooking. The patterns of heat alteration observed indicate that the material was burned following deposition.

It is also clear that bone was used as a secondary source for raw materials based on the large numbers of worked bone. The majority of the intentional modifications to bone are cutting and surface polishing associated with the production of bone

adornments. Several bone shafts are beveled. This, in conjunction with the bone beads recovered from some of the Pook's Hill 1 burials, is a clear indication of bone bead production at the site. Beveling is associated with this process and those shafts exhibiting beveled ends represent the detritus associated with this manufacturing.

In isolation, the vertebrate faunal assemblage from Pook's Hill 1 indicates access to quality meat cuts from both local and non-local sources. When the faunal assemblage is examined in the context of its associated artifacts, it seems likely that feasting was likely a recurrent event at the site. The artifactual constituents recovered in association with the vertebrate remains (e.g. ceramic serving vessels and wind instruments) support this interpretation (cf. Helmke 2001; Forbes 2003).

**References Cited:**


Böhlke, James E., and Charles C.G. Chaplin
1968 *Fishes of the Bahamas and Adjacent Tropical Waters*. Livingston Publishing Co. Wynnewood, Pennsylvania.

Emmons, Louise H. and François Feer
1990 *Neotropical Rainforest Mammals: A Field Guide*. University of Chicago Press. Chicago.

Ernst, Carl H., and Roger W. Barbour
1989 *Turtles of the World*. Smithsonian Institution Press, Washington DC.

Forbes, Jonathan P.
2003 Ocarinas in the Maya World. Unpublished Undergraduate Dissertation, University College London, London.

Gilbert, B. Miles
1980 *Mammalian Osteology*. Modern Printing Company, Laramie.

Gilbert, B. Miles, Larry D. Martin, and Howard G. Savage
1981 *Avian Osteology*. Modern Printing Company, Laramie.

Grayson, Donald K.
1984 *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Academic Press, Orlando.

Helmke, Christophe G.B.
2003 The 2002 Season Investigations at Pook's Hill, Belize. *Papers from the Institute of Archaeology*, Vol. 14:119-128.

2001 The Last Supper: Competitive Feasting and the Terminal Classic Moulded-carved Ceramic Tradition in the Central Maya Lowlands. Unpublished MA Dissertation, University College London, London.

Lee, Julian C.
2000 *A Field Guide to the Amphibians and Reptiles of the Maya World*. Cornell University Press, Ithica.

Lyman, R. Lee
1994 *Vertebrate Taphonomy*. Cambridge University Press, Cambridge.

Olsen, Stanley J.
1964 Mammal Remains from Archaeological Sites: 1. Southeastern and Southwestern United States. *Papers of the Peabody Museum of Archaeology and Ethnology* 56(1), Harvard University, Cambridge.

Reid, Fiona A.
1997 *A Field Guide to the Mammals of Central America and Southeast Mexico*. Oxford University Press, Oxford.

Villa, Jaime, Larry D. Wilson, and Jerry D. Johnson
1988 *Middle American Herpetology: A Bibliographic Checklist*. University of Missouri Press, Columbia.

# AN ANALYSIS OF THE POOK'S HILL DENTAL ASSEMBLAGE: HYPOPLASTIC ENAMEL DEFECTS

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## INTRODUCTION

Research on dental hypoplasia can provide an overall index of prehistoric population health. Therefore, analyses of dental hypoplasia can serve as an empirical basis for testing models of the rise of Maya kingship in the Early Classic period, as well as the effects of political, social, and environmental policies during the Late and Terminal Classic period. Changes in society and environment condition the frequency and severity of nutritional and health stresses. Children who are affected by nutritional or health problems that are severe enough to cause a disruption in growth, leave a permanent record of this stress imprinted on the developing teeth in the form of enamel hypoplasia (Figure 1). Episodes of enamel hypoplasia on a tooth surface can be measured to reveal the age of the individual when the stress occurred (Goodman et al. 1980). General social trends in nutritional and health stress can be viewed by looking at the trends in enamel hypoplasias in the population. For instance, if hypoplasias recur on a regular basis –say annually– it might indicate a certain seasonal time of stress. If hypoplasias occurred at a particular time of life for the entire population it can be assumed that there is a shared developmental period of stress. In contrast, enamel hypoplasias outside these established patterns can indicate occurrences of both chronic and acute serious illnesses in individuals. The frequency of such hypoplasias thus provides a picture of the overall health of a particular population.

## ARCHAEOLOGY AND ANCIENT MAYA HEALTH

The ancient populations of both urban and rural areas of the important site of Copan, Honduras, were found to have higher frequencies of enamel hypoplasia than smaller northern coastal communities. This pattern is an indication that Copan's population was under more chronic stress than the populations of smaller non-'urban' communities during the Late and Terminal Classic period (Storey et al. 2002). A hypoplastic sample from the Pasión River region of Guatemala illustrates that children experienced no great change in the frequency or severity of stress throughout the Classic period or into the Terminal Classic period (Wright 1997). However, there is a shift in the age in which the children experienced the most stress. Children of the Terminal Classic period were affected at the earliest age, Early Classic period children were slightly older, and the children from the Late Classic period were the oldest before being affected by stresses severe enough to form an enamel hypoplasia (Wright 1997). This data does not

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support the ecological deterioration theory for the collapse of the southern lowland Maya, which would predict that childhood stresses would have increased over the Classic period culminating in the Terminal Classic due to resource restrictions. Wright's (1997) interpretation of why these data do not fit the ecological model is that perhaps the Terminal Classic children were weaned at an earlier age than they had been previously. Weaning children earlier deprives them of their mothers' IgA immunoglobulins and leaves them more prone to infection and illness at a much younger age. Another explanation for the findings could be that, during the Late Classic period, childrearing practices, including weaning, were more heterogeneous, presumably, because in highly-stratified societies elites and commoners raise their children differently (Wright 1997). In contrast, during the Terminal Classic period there was poor nutritional consistency throughout the ranks, therefore all women weaned children at an early age (Wright 1997).

**Figure 1:** Example of an anterior tooth with pronounced linear enamel hypoplastic defect (marked by the arrow), from Actuncan, Burial 7. Photograph by B. Scopa, graphics by C. Helmke.

Danforth (1997) found that individuals from Tikal and Seibal, Guatemala as well as Barton Ramie, Belize who died before the age of eighteen had significantly higher rates of enamel hypoplasia and other enamel microdefects. She determined that children were most healthy as infants (six months to two years of age), but then became increasingly susceptible to illness (Danforth 1997:131). The most common time of enamel hypoplasia formation was during the ages of three and five. Other enamel microdefects were most common between the ages of one and one half and three (Danforth 1997:131). The temporal spacing of the enamel hypoplasias does not suggest that it is related to annual food shortages (Danforth 1997). Tikal, being the largest of the three sites, had the highest frequency of enamel hypoplasias and Barton Ramie, being the smallest, had the lowest. Barton Ramie had a higher frequency of other enamel microdefects than Tikal. Because enamel hypoplasias are the results of a much more enduring stress these results may indicate that the stressors at Barton Ramie were not as severe as those at Tikal.

Dental pathologies such as caries and abscesses show that the populations of Jaina and Xcaret, Mexico had a more varied diet (Storey et al. 2002). These populations had fewer pathologies than both rural and urban Copan. However, men had vastly greater numbers of pathologies than women at these Yucatec coastal sites. This pattern could be due to the consumption of maize-based beverages during festive and ceremonial occasions, which would have provided males with a starchier overall diet than women. At Copan, rural women had a higher percentage of dental pathologies, indicating a very starchy and limited diet. Men and urban women had about the same index of dental

pathologies. These data lend evidence to suggest that maize would have been treated very differently at inland centers. Being a dietary staple, lower status individuals would have eaten more of it, and very little else (Storey et al. 2002).

Ann Magennis (1999) found that at the site of Kichpanha in northern Belize individuals had a low frequency of caries and dental calculus during the Protoclassic period, and that there was even a dip in the rate of dental pathologies during the Early Classic period. Only in the Middle Classic did the frequency start to rise, and a sharp increase occurred during the Late Classic and Terminal Classic. It can be inferred that the high starch levels in maize most likely caused the increase in caries and build-up of calculus, but it is harder to explain the rise and fall in caries frequency over time (Magennis 1999). Kichpanha has an interesting history in which it flourished from the early Middle Preclassic until the Early Classic period. At this point, there was a drop in population, at which point Kichpanha's elite apparently moved to another center. It is thought that Kichpanha remained sparsely occupied by agriculturalists and thereafter acted as a satellite to a larger regional center. One hypothesis is that the lower frequency of caries during the Protoclassic and Early Classic periods can be attributed to the fact that the elite population which would have had access to a wider variety of food resources. The higher caries and calculus frequencies from the Late Classic and Terminal Classic population would therefore solely represent the health of common agriculturalists (Magennis 1999).

## THE DENTAL SAMPLE: THE SITE OF POOK'S HILL

For a detailed description of the Pook's Hill site and its location please refer to preceding reports in this volume (Helmke; Stanchly; see also Helmke 2003, in press). Suitable comparative data for the Pook's Hill sample are represented by the sites of Actuncan, Chaa Creek, San Lorenzo, and Xunantunich (McGovern 1992, 1993, 1994; Braswell 1998; Connell 2000; Yaeger 2000, 2003; LeCount & Blitz 2001; LeCount et al. 2005) although these are all are situated in the upper Belize River Valley in the westernmost portion of the Cayo District, Belize. Actuncan is a medium-sized major center on a ridge overlooking the Mopan River, approximately two kilometers north of Xunantunich, a similarly-sized monumental center that also overlooks the western bank of the Mopan River. Chaa Creek is a group of smaller hinterland sites located on the western bank of the Macal River, approximately nine kilometers east of the urban center of Xunantunich. Like Chaa Creek, San Lorenzo is a hinterland site positioned along the eastern bank of the Mopan River roughly equidistant between Actuncan and Xunantunich. Jason Yeager (2003) estimates that over 35,000 people lived within five kilometers of Xunantunich during the later part of the Late Classic. Louis Wirth (1938) defines a city as a large number of people living in a densely-nucleated settlement with a high degree of social and economic heterogeneity.

The site of Pook's Hill is a medium-sized *plazuela*, which though far from being a population center comparable in size or influence to the sites of Xunantunich and Actuncan, nonetheless appears to have served as a minor community center for an extended family or lineage and its dependents. In terms of size and surface area the plazuela is comparable to the larger plazuelas that are encompassed in the San Lorenzo

and Chaa Creek communities. Pook's Hill differs from these other plazuelas, however, in being located approximately one kilometer west of the larger minor center of Chaac Mool Ha, in the Roaring Creek Valley. Chaac Mool Ha in turn is a satellite of the major center Cahal Uitz Na located four kilometers to the south in the same valley system (Conlon & Erhet 1999). In addition, Pook's Hill may best be described as the residential site for an affluent extended family that undoubtedly fell under the sphere of influence of Chaac Mool Ha during at least part of its history. Based on artifactual and architectural evidence the residents of Pook's Hill do not appear to have spent the majority of their time farming and were in fact part-time craft specialists (Christophe Helmke pers. comm. 2005; see also Stanchly, this volume). Therefore, for statistical purposes this site is treated as other sites grouped together under the heading of "Center Communities".

**Evaluation of Enamel Hypoplasia**

The teeth from Pook's Hill, as well as Xunantunich, San Lorenzo, and Chaa Creek, had been previously cleaned, leaving calculus intact. Macroscopic observation of the teeth was conducted aided only with the use of a simple magnifying glass. Enamel hypoplasias were measured with thin-tipped digital calipers to the tenth of a millimeter (0.1 mm) from the center of the hypoplasia to the cemento-enamel junction. This measurement was converted into a developmental age established according to the tooth developmental chronology of Swärdstedt (1966) as used by Goodman, Armelagos, and Rose (1980). The developmental age for each tooth is divided into half-year periods, beginning with birth to six months and continuing to six and half years to seven. In order to concentrate the statistical analysis of this study on the growth disruptions of individuals in a population, the frequency and time of formation of enamel hypoplasia were recorded in reference to the individual and not solely the episode as the unit of analysis (Martin et. al 1991; Goodman et al. 1980). This approach provides a better understanding of the temporal patterns of health and growth disruptions for individuals. Individuals were selected based on the presence of at least one permanent maxillary or mandibular central or lateral incisor or canine tooth. These particular teeth were used due to their increased susceptibility to developmental disruptions as compared to molars and premolars (Martin et al. 1991; Goodman et al. 1980; Saunders & Keenleyside 1999). When both the right and left teeth were present in an individual, the left tooth was used in the sample except when there were no enamel hypoplasias on the left tooth. However, if hypoplasias occurred on the right, then the right was used in the sample. If the labial surface was completely obscured by a calcitic deposit, then the tooth was excluded from the sample. Statistics for the frequency of growth disruptions have been assembled both in terms of mean number of growth disruptions per individual and percent of individuals with at least one growth disruption. For this study, a growth disruption is defined as a half-year period determined by the measurement of a hypoplasia from the cemento-enamel junction and converted using the table from Goodman, Armelagos, and Rose (1980).

The current research site of Pook's Hill yielded a dental sample of 60 permanent first and second incisors and canines (see Appendix A). The sample of dental remains from the hinterland community of Chaa Creek consists of 58 permanent first and second incisors and canines. At San Lorenzo, the sample dental remains consist of 14 permanent

central and lateral incisors and canines. The Xunantunich sample dental remains contain sixty-two 62 permanent central and lateral incisors and canines. The sample of dental remains from Actuncan includes 17 permanent central and lateral incisors as well as canines.

## RESULTS

The mean growth disruption per individual at Pook's Hill is 4.38 (Table 1). In Upper Belize Valley populations, there is a slightly higher mean of hypoplasia for individuals living within urban centers than those living in hinterland communities. The mean growth disruption per individual in centers is 1.56, whereas the mean growth disruption per individual in hinterland communities is 1.10 (Table 2) (LeCount et al. 2005). The Pook's Hill assemblage thus exhibits a high mean of growth disruption per individual when compared to the data from the other sites used in this study. Though Pook's Hill is not a center community in the same sense as Xunantunich and Actuncan, the higher incidence of hypoplasia can be said to be more in keeping with that of urban populations. Thus when Pook's Hill is combined with the previous center communities the mean growth disruptions climbs to 2.66 (Table 1).

| Pook's Hill | Actuncan | Chaa Creek | San Lorenzo | Xunantunich | Hinterland* Communities | Center* Communities |
|---|---|---|---|---|---|---|
| 4.38 | 2.00 | 1.28 | 0.00 | 1.42 | 1.10 | 2.66 |

*Note: The Hinterland Communities are considered Chaa Creek and San Lorenzo and Center Communities are considered Pook's Hill, Actuncan and Xunantunich.

**Table 1:** Mean number of growth disruptions per individual all sites combined.

| Actuncan | Chaa Creek | San Lorenzo | Xunantunich | Hinterland* Communities | Center* Communities |
|---|---|---|---|---|---|
| 2.00 | 1.28 | 0.00 | 1.42 | 1.10 | 1.56 |

*Note: Chaa Creek and San Lorenzo are considered the Hinterland Communities while Actuncan and Xunantunich are considered the Center Communities. (LeCount, Blitz, & Scopa Kelso 2005)

**Table 2:** Mean number of growth disruptions per individual in the Upper Belize River Valley.

The percentage of individuals with one or more growth disruptions at Pook's Hill is 0.81 (Table 3), bringing the percentage in center communities up to 0.78 (Table 4) from the 0.76 percent (Table 5) for the Upper Belize River Valley. In even greater contrast the percentage of individuals with one or more growth disruptions from hinterland communities is only 0.55 (Table 4 & 5) (LeCount et al. 2005). This slight trend remains when all five sites are compared (Table 3).

| | Total Number of Individuals | *Individuals with No Growth Disruptions* | % of Individuals with No Growth Disruptions | *Individuals with One or More Growth Disruptions* | % of Individuals with One or More Growth Disruptions |
|---|---|---|---|---|---|
| Pook's Hill | 16 | *3* | 0.19 | *13* | 0.81 |
| Actuncan | 6 | *1* | 0.17 | *5* | 0.83 |
| Chaa Creek | 25 | *9* | 0.36 | *16* | 0.64 |
| San Lorenzo | 4 | *4* | 1.00 | *0* | 0.00 |
| Xunantunich | 19 | *5* | 0.26 | *14* | 0.74 |

(LeCount, Blitz, & Scopa Kelso 2005)

**Table 3:** Number of individuals without growth disruptions and the number of individuals with one or more growth disruptions by community.

| | Total Number of Individuals | *Individuals with No Growth Disruptions* | % of Individuals with No Growth Disruptions | *Individuals with One or More Growth Disruptions* | % of Individuals with One or More Growth Disruptions |
|---|---|---|---|---|---|
| Hinterland Communities | 29 | 13 | 0.45 | 16 | 0.55 |
| Center Communities | 41 | 8 | 0.20 | 32 | 0.78 |

**Table 4:** Number of individuals without growth disruptions and the number of individuals with one or more growth disruptions all sites combined.

| | Total Number of Individuals | *Individuals with No Growth Disruptions* | % of Individuals with No Growth Disruptions | *Individuals with One or More Growth Disruptions* | % of Individuals with One or More Growth Disruptions |
|---|---|---|---|---|---|
| Hinterland Communities | 29 | 13 | 0.45 | 16 | 0.55 |
| Center Communities | 25 | 6 | 0.24 | 19 | 0.76 |

(LeCount, Blitz, & Scopa Kelso 2005)

**Table 5:** Number of individuals without growth disruptions and the number of individuals with one or more growth disruptions Upper Belize River Valley.

The hinterland communities have the highest frequency of hypoplasias in the half-year development period of 2.0 to 2.5 at 33% and another peak during the developmental period of 3.0 to 3.5 years at 26.0% (Table 6) (LeCount et al. 2005). The combined center communities have a wider range of high frequencies of hypoplasias, but peak during the years of 2.5 to 3.0 at 50% and again at 3.5 to 4.0 year at 60% (Table 8). The samples from Pook's Hill exhibit several peaks within starting at 1.0 to 1.5 years of age at 50%, the second peak is 2.5 to 3.5 years of age at 54%, the third peak is 3.0 to 3.5 years of age at 50%, the forth peak is 3.5 to 4.0 years of age at 83%, and the final peak is 4.0 to 4.5 years of age at 50% (Table 6).

When the frequencies of enamel hypoplasia per tooth and half-year developmental periods are compared across sites a pattern emerges. Individuals from Actuncan have a higher frequency of hypoplasia occurring during two age ranges: 2.0 to 2.5 years of age and 3.5 to 4.0 years of age (Table 9). In the Chaa Creek sample, the majority of hypoplasias also occur between 2.0 and 2.5 years of age, but slightly later, between 4.0 and 4.5 years of age (Table 10). Interestingly, the San Lorenzo sample contained no hypoplasias at all (Table 11). Within the Xunantunich sample population the majority of hypoplasias occurred later between the ages of 2.5 to 3.0 years of age and 4.5 to 5.0 years of age (Table 12) (LeCount, Blitz, and Scopa Kelso 2005). Growth disruptions within the Pook's Hill sample show evidence that a more general period of high frequencies of hypoplasia is present between 0.5 to 1.0 years of age and 5.5 to 6.0 years of age (Table 6). When the frequency of enamel hypoplasia per tooth and half-year development period by hinterland communities and centers are compared there is a slight tendency for a greater number of hypoplasias to occur at a later developmental age in urban centers (Tables 7 and 8).

At present, no temporal trends have been derived from these data, since only six burials pre-date the Late Classic period. The Actuncan burials form the bulk of the Early Classic and Protoclassic samples (n=5), and there is one early burial from Chaa Creek (190P27-B1). In contrast the burials from Pook's Hill span from the Middle Classic to the Terminal Classic and thus form a late subset of the overall population sample represented by all sites. Definitive dating of all the Pook's Hill burials has not yet been accomplished, but ceramic inclusions and other radiometric analyses are currently underway, which will eventually clarify the temporal placement of these interments (Christophe Helmke, pers. comm. 2006).

## DISCUSSION

From this study, the percentage of growth disruptions and mean number of growth disruptions per individual for Upper Belize Valley centers is higher than that of hinterland communities. There was a difference in the age at development for growth disruptions between hinterland communities and centers. The frequency of growth disruptions in the centers occurred at an older age than that of individuals living in the hinterland communities.

This has many implications for understanding the overall dynamics and health of the Lower Belize River valley. Although this is a limited study, a few hypotheses

| Age | Maxilla | | | Mandible | | |
|---|---|---|---|---|---|---|
| | I1 H/T % | I2 H/T % | C H/T % | I1 H/T % | I2 H/T % | C H/T % |
| 0.0 - 0.5 | 0/13 (0.00) | | 0/12 (0.00) | 0/7 (0.00) | 0/8 (0.00) | 2/14 (0.14) |
| 0.5 - 1.0 | 1/13 (0.08) | | 1/12 (0.08) | 1/7 (0.14) | 2/8 (0.25) | 1/14 (0.07) |
| 1.0 - 1.5 | 1/13 (0.08) | 0/6 (0.00) | 1/12 (0.08) | 1/7 (0.14) | 4/8 (0.50) | 2/14 (0.14) |
| 1.5 - 2.0 | 1/13 (0.08) | 0/6 (0.00) | 1/12 (0.08) | 3/7 (0.42) | 1/8 (0.13) | 2/14 (0.14) |
| 2.0 - 2.5 | 4/13 (0.31) | 1/6 (0.17) | 3/12 (0.25) | 2/7 (0.28) | 2/8 (0.25) | 1/14 (0.07) |
| 2.5 - 3.0 | 7/13 (0.54) | 2/6 (0.33) | 0/12 (0.00) | 1/7 (0.14) | 3/8 (0.38) | 3/14 (0.21) |
| 3.0 - 3.5 | 5/13 (0.38) | 3/6 (0.50) | 6/12 (0.50) | 1/7 (0.14) | 0/8 (0.00) | 2/14 (0.14) |
| 3.5 - 4.0 | 1/13 (0.08) | 5/6 (0.83) | 3/12 (0.25) | 0/7 (0.00) | 1/8 (0.13) | 7/14 (0.50) |
| 4.0 - 4.5 | 1/13 (0.08) | 3/6 (0.50) | 5/12 (0.42) | 0/7 (0.00) | 0/8 (0.00) | 4/14 (0.29) |
| 4.5 - 5.0 | | | 3/12 (0.25) | | | 3/14 (0.21) |
| 5.0 - 5.5 | | | 2/12 (0.17) | | | 3/14 (0.21) |
| 5.5 - 6.0 | | | 1/12 (0.08) | | | 4/14 (0.29) |
| 6.0 - 6.5 | | | | | | 0/14 (0.00) |
| 6.5 - 7.0 | | | | | | |

**Table 6:** Frequency of enamel hypoplasia per tooth for Pook's Hill.

| | Maxilla | | | Mandible | | |
|---|---|---|---|---|---|---|
| Age | I1 H/T % | I2 H/T % | C H/T % | I1 H/T % | I2 H/T % | C H/T % |
| 0.0 - 0.5 | 0/12 (0.00) | | 0/19 (0.00) | 0/11 (0.00) | 0/13 (0.00) | 0/11 (0.00) |
| 0.5 - 1.0 | 1/12 (0.08) | | 0/19 (0.00) | 0/11 (0.00) | 0/13 (0.00) | 0/11 (0.00) |
| 1.0 - 1.5 | 0/12 (0.00) | 0/6 (0.00) | 0/19 (0.00) | 0/11 (0.00) | 1/13 (0.08) | 0/11 (0.00) |
| 1.5 - 2.0 | 1/12 (0.08) | 0/6 (0.00) | 0/19 (0.00) | 0/11 (0.00) | 0/13 (0.00) | 0/11 (0.00) |
| 2.0 - 2.5 | 4/12 (0.33) | 0/6 (0.00) | 2/19 (0.11) | 1/11 (0.09) | 2/13 (0.15) | 2/11 (0.18) |
| 2.5 - 3.0 | 0/12 (0.00) | 0/6 (0.00) | 1/19 (0.05) | 0/11 (0.00) | 2/13 (0.15) | 0/11 (0.00) |
| 3.0 - 3.5 | 3/12 (0.25) | 0/6 (0.00) | 5/19 (0.26) | 0/11 (0.00) | 0/13 (0.00) | 0/11 (0.00) |
| 3.5 - 4.0 | 2/12 (0.17) | 0/6 (0.00) | 2/19 (0.11) | 0/11 (0.00) | 0/13 (0.00) | 1/11 (0.09) |
| 4.0 - 4.5 | 0/12 (0.00) | 0/6 (0.00) | 4/19 (0.21) | 0/11 (0.00) | 0/13 (0.00) | 0/11 (0.00) |
| 4.5 - 5.0 | | | 0/19 (0.00) | | | 2/11 (0.15) |
| 5.0 - 5.5 | | | 0/19 (0.00) | | | 0/11 (0.00) |
| 5.5 - 6.0 | | | 0/19 (0.00) | | | 0/11 (0.00) |
| 6.0 - 6.5 | | | | | | |
| 6.5 - 7.0 | | | | | | |

*Note: the Hinterland Communities are considered Chaa Creek and San Lorenzo

**Table 7:** Hinterland communities of enamel hypoplasia per tooth.

| | Maxilla | | | Mandible | | |
|---|---|---|---|---|---|---|
| Age | I1 H/T % | I2 H/T % | C H/T % | I1 H/T % | I2 H/T % | C H/T % |
| 0.0 - 0.5 | 0/29 (0.00) | | 0/16 (0.00) | 0/20 (0.00) | 0/20 (0.00) | 2/27 (0.07) |
| 0.5 - 1.0 | 1/29 (0.03) | | 2/16 (0.13) | 1/20 (0.05) | 2/20 (0.10) | 1/27 (0.00) |
| 1.0 - 1.5 | 1/29 (0.03) | 0/15 (0.00) | 1/16 (0.06) | 1/20 (0.05) | 5/20 (0.25) | 2/27 (0.07) |
| 1.5 - 2.0 | 1/29 (0.03) | 0/15 (0.00) | 0/16 (0.00) | 4/20 (0.20) | 1/20 (0.05) | 2/27 (0.07) |
| 2.0 - 2.5 | 5/29 (0.17) | 2/15 (0.13) | 0/16 (0.00) | 4/20 (0.20) | 4/20 (0.20) | 3/27 (0.11) |
| 2.5 - 3.0 | 8/29 (0.26) | 3/15 (0.20) | 2/16 (0.13) | 10/20 (0.50) | 7/20 (0.35) | 3/27 (0.11) |
| 3.0 - 3.5 | 8/29 (0.26) | 5/15 (0.33) | 5/16 (0.31) | 1/20 (0.05) | 1/20 (0.05) | 3/27 (0.11) |
| 3.5 - 4.0 | 6/29 (0.21) | 9/15 (0.60) | 4/16 (0.25) | 0/20 (0.00) | 2/20 (0.10) | 8/27 (0.30) |
| 4.0 - 4.5 | 1/29 (0.03) | 4/15 (0.27) | 1/16 (0.06) | 0/20 (0.00) | 0/20 (0.00) | 6/27 (0.22) |
| 4.5 - 5.0 | | | 1/16 (0.06) | | | 8/27 (0.30) |
| 5.0 - 5.5 | | | 1/16 (0.06) | | | 4/27 (0.15) |
| 5.5 - 6.0 | | | 0/16 (0.00) | | | 5/27 (0.19) |
| 6.0 - 6.5 | | | | | | 0/27 (0.00) |
| 6.5 - 7.0 | | | | | | |

*Note: the Center Communities are considered Pook's Hill, Actuncan and Xunantunich.

**Table 8:** Center communities frequency of enamel hypoplasia per tooth.

| Age | Maxilla | | | Mandible | | |
|---|---|---|---|---|---|---|
| | I1 H/T % | I2 H/T % | C H/T % | I1 H/T % | I2 H/T % | C H/T % |
| 0.0 - 0.5 | 0/5 (0.00) | | 0/2 (0.00) | 0/4 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 0.5 - 1.0 | 0/5 (0.00) | | 0/2 (0.00) | 1/4 (0.25) | 0/3 (0.00) | 0/2 (0.00) |
| 1.0 - 1.5 | 0/5 (0.00) | 0/1 (0.00) | 1/2 (0.50) | 2/4 (0.50) | 0/3 (0.00) | 0/2 (0.00) |
| 1.5 - 2.0 | 0/5 (0.00) | 0/1 (0.00) | 0/2 (0.00) | 0/4 (0.00) | 0/3 (0.00) | 1/2 (0.50) |
| 2.0 - 2.5 | 1/5 (0.20) | 1/1 (1.00) | 0/2 (0.00) | 1/4 (0.25) | 0/3 (0.00) | 0/2 (0.00) |
| 2.5 - 3.0 | 0/5 (0.00) | 0/1 (0.00) | 1/2 (0.50) | 0/4 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 3.0 - 3.5 | 2/5 (0.40) | 1/1 (1.00) | 1/2 (0.50) | 0/4 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 3.5 - 4.0 | 2/5 (0.40 | 1/1 (1.00) | 1/2 (0.50) | 0/4 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 4.0 - 4.5 | 0/5 (0.00) | 0/1 (0.00) | 0/2 (0.00) | 0/4 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 4.5 - 5.0 | | | 0/2 (0.00) | | | 0/2 (0.00) |
| 5.0 - 5.5 | | | 0/2 (0.00) | | | 0/2 (0.00) |
| 5.5 - 6.0 | | | 0/2 (0.00) | | | 0/2 (0.00) |
| 6.0 - 6.5 | | | | | | |
| 6.5 - 7.0 | | | | | | |

**Table 9:** Frequency of enamel hypoplasia per tooth for Actuncan.

| Age | Maxilla | | | Mandible | | |
|---|---|---|---|---|---|---|
| | I1 H/T % | I2 H/T % | C H/T % | I1 H/T % | I2 H/T % | C H/T % |
| 0.0 - 0.5 | 0/10 (0.00) | | 0/16 (0.00) | 0/9 (0.00) | 0/10 (0.00) | 0/9 (0.00) |
| 0.5 - 1.0 | 1/10 (0.10) | | 0/16 (0.00) | 0/9 (0.00) | 0/10 (0.00) | 0/9 (0.00) |
| 1.0 - 1.5 | 0/10 (0.00) | 0/4 (0.00) | 0/16 (0.00) | 0/9 (0.00) | 1/10 (0.10) | 0/9 (0.00) |
| 1.5 - 2.0 | 1/10 (0.10) | 0/4 (0.00) | 0/16 (0.00) | 0/9 (0.00) | 0/10 (0.00) | 0/9 (0.00) |
| 2.0 - 2.5 | 4/10 (0.40) | 0/4 (0.00) | 2/16 (0.13) | 1/9 (0.11) | 2/10 (0.20) | 2/9 (0.22) |
| 2.5 - 3.0 | 0/10 (0.00) | 0/4 (0.00) | 1/16 (0.06) | 0/9 (0.00) | 2/10 (0.20) | 0/9 (0.00) |
| 3.0 - 3.5 | 3/10 (0.30) | 0/4 (0.00) | 5/16 (0.31) | 0/9 (0.00) | 0/10 (0.00) | 0/9 (0.00) |
| 3.5 - 4.0 | 2/10 (0.20) | 0/4 (0.00) | 2/16 (0.13) | 0/9 (0.00) | 0/10 (0.00) | 1/9 (0.11) |
| 4.0 - 4.5 | 0/10 (0.00) | 0/4 (0.00) | 4/16 (0.25) | 0/9 (0.00) | 0/10 (0.00) | 0/9 (0.00) |
| 4.5 - 5.0 | | | 0/16 (0.00) | | | 2/9 (0.22) |
| 5.0 - 5.5 | | | 0/16 (0.00) | | | 0/9 (0.00) |
| 5.5 - 6.0 | | | 0/16 (0.00) | | | 0/9 (0.00) |
| 6.0 - 6.5 | | | | | | |
| 6.5 - 7.0 | | | | | | |

**Table 10:** Frequency of enamel hypoplasia per tooth for Chaa Creek.

| Age | Maxilla | | | Mandible | | |
|---|---|---|---|---|---|---|
| | I1 H/T % | I2 H/T % | C H/T % | I1 H/T % | I2 H/T % | C H/T % |
| 0.0 - 0.5 | 0/2 (0.00) | | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 0.5 - 1.0 | 0/2 (0.00) | | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 1.0 - 1.5 | 0/2 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 1.5 - 2.0 | 0/2 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 2.0 - 2.5 | 0/2 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 2.5 - 3.0 | 0/2 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 3.0 - 3.5 | 0/2 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 3.5 - 4.0 | 0/2 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 4.0 - 4.5 | 0/2 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) | 0/3 (0.00) | 0/2 (0.00) |
| 4.5 - 5.0 | | | 0/3 (0.00) | | | 0/2 (0.00) |
| 5.0 - 5.5 | | | 0/3 (0.00) | | | 0/2 (0.00) |
| 5.5 - 6.0 | | | 0/3 (0.00) | | | 0/2 (0.00) |
| 6.0 - 6.5 | | | | | | 0/2 (0.00) |
| 6.5 - 7.0 | | | | | | |

**Table 11:** Frequency of enamel hypoplasia per tooth for San Lorenzo.

| | Maxilla | | | Mandible | | |
|---|---|---|---|---|---|---|
| Age | I1 H/T % | I2 H/T % | C H/T % | I1 H/T % | I2 H/T % | C H/T % |
| 0.0 - 0.5 | 0/11 (0.00) | | 0/14 (0.00) | 0/9 (0.00) | 0/9 (0.00) | 0/11 (0.00) |
| 0.5 - 1.0 | 0/11 (0.00) | | 2/14 (0.14) | 0/9 (0.00) | 0/9 (0.00) | 0/11 (0.00) |
| 1.0 - 1.5 | 0/11 (0.00) | 0/8 (0.00) | 0/14 (0.00) | 0/9 (0.00) | 0/9 (0.00) | 0/11 (0.00) |
| 1.5 - 2.0 | 0/11 (0.00) | 0/8 (0.00) | 0/14 (0.00) | 1/9 (0.11) | 0/9 (0.00) | 0/11 (0.00) |
| 2.0 - 2.5 | 0/11 (0.00) | 0/8 (0.00) | 0/14 (0.00) | 1/9 (0.11) | 0/9 (0.00) | 0/11 (0.00) |
| 2.5 - 3.0 | 1/11 (0.09) | 1/8 (0.13) | 1/14 (0.07) | 3/9 (0.33) | 2/9 (0.22) | 0/11 (0.00) |
| 3.0 - 3.5 | 1/11 (0.09) | 1/8 (0.13) | 4/14 (0.29) | 0/9 (0.00) | 1/9 (0.11) | 1/11 (0.09) |
| 3.5 - 4.0 | 3/11 (0.27) | 3/8 (0.38) | 3/14 (0.21) | 0/9 (0.00) | 1/9 (0.11) | 0/11 (0.00) |
| 4.0 - 4.5 | 0/11 (0.00) | 1/8 (0.13) | 1/14 (0.07) | 0/9 (0.00) | 0/9 (0.00) | 2/11 (0.18) |
| 4.5 - 5.0 | | | 1/14 (0.07) | | | 3/11 (0.27) |
| 5.0 - 5.5 | | | 1/14 (0.07) | | | 1/11 (0.09) |
| 5.5 - 6.0 | | | 0/14 (0.00) | | | 1/11 (0.09) |
| 6.0 - 6.5 | | | | | | 0/11 (0.00) |
| 6.5 - 7.0 | | | | | | |

**Table 12:** Frequency of enamel hypoplasia per tooth for Xunantunich.

concerning the health of valley populations can be formulated for later testing. If hypoplasias are more common in Late Classic centers than in hinterland communities, then it can be suggested that rural populations appear to have enjoyed greater health than those who lived in centers. Why might this be so? Poor sanitation and higher population densities in urban centers might have made these sites less healthy placed to live than small villages. It is also probable that stress in urban centers arose due to social and economic factors. Since populations living in centers were more likely to be occupational specialists and not farmers, disruptions in food supply might have caused more stringent, though short-term dietary stresses. Interestingly, urban populations were more likely to be elite; therefore, generalizations about elite versus commoner health should take into concerning context, as well as social status.

If age of growth disruptions can be used as a measure to determine age of weaning, it can be inferred that families in Upper Belize Valley centers weaned their children later than those who lived at hinterland sites. Why might this be so? Again, this pattern may be due to environmental stress or cultural factors. Rural women may have been more likely to wean their children earlier because of their workloads in the fields. Urban women may have had been able to breast-feed their children even when they were at work. It is also possible that many elite women did less work or less strenuous manual labor. An alternative hypothesis to explain this data may be that elite women weaned their children later due to social practices that marked their status. All these avenues need to be explored further during future analyses, though the similarity and disparity of the results for each of the sites considered indicates that several interconnected social, economic, environmental, and cultural factors were responsible for the nutritional stress episodes documented or the lack thereof.

## References Cited:


Braswell, Jennifer B.
1998 Archaeological Investigations at Group D, Xunantunich, Belize. Unpublished Ph.D. dissertation, Department of Anthropology, Tulane University, New Orleans.

Conlon, James M. and Jennifer J. Erhet
1999 Initial Investigations at the Recently Discovered Major Center of Cahal Uitz Na, Cayo District, Belize. Paper presented at the 64th Annual Meeting of the Society for American Archaeology, Chicago.

Connell, Samuel
2000 Were They Well Connected? An Exploration of Ancient Maya Regional Integration from the Middle-Level Perspective of Chaa Creek, Belize. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.

Danforth, Marie Elaine
1997 Late Classic Maya Health Patters: Evidence from Enamel Microdefects. *Bones of the Maya: Study of Ancient Skeletons*, edited by Stephen L. Whittington and David M. Reed, pp. 127-137. Smithsonian Institution Press, Washington.

Goodman, Alan H., George J. Armelagos, and Jerome C. Rose
1980 Enamel Hypoplasia as Indicators of Stress in Three Prehistoric Populations from Illinois. *Human Biology*, Vol. 52(3):515-528.

Helmke, Christophe G.B.
in press A Summary of the 1999–2002 Seasons of Archaeological Investigations at Pook's Hill, Cayo District, Belize. *Research Reports in Belizean Archaeology*, Vol. 3.

2003 The 2002 Season Investigations at Pook's Hill, Belize. *Papers from the Institute of Archaeology*, Vol. 14: 119-128.

LeCount, Lisa and John Blitz
2001 Actuncan Early Classic Maya Project: Report of the First Season. Copy on file at the Institute of Archaeology, Belmopan.

LeCount, Lisa, John Blitz, and Rebecca Scopa Kelso
2005 Actuncan Early Classic Maya Project: Report of the Second Season. Copy on file at the Institute of Archaeology, Belmopan.

Magennis, Ann L.
1998 Dietary Changes at the Lowland Maya Site of Kichpanha, Belize. *Reconstructing Ancient Maya Diet*, edited by Christine D. White, pp. 133-150. The University of Utah Press, Salt Lake City.

Martin, Debra L., Alan H. Goodman, George J. Armelagos, and Ann L. Magennis
1991 *Black Mesa Anasazi Health: Reconstructing Life from Patterns of Death and Disease*. Center for Archaeological Investigations Occasional Papers, no. 14. Southern Illinois University at Carbondale.

McGovern, James
1994 Actuncan, Belize: The 1994 Excavation Season. *Xunantunich Archaeological Project: 1994 Field Season*, edited by R. M. Leventhal, pp108-122. University of California, Los Angeles. Copy on file at the Institute of Archaeology, Belmopan.
1993 Survey and Excavation at Actuncan. *Xunantunich Archaeological Project: 1993 Field Season*, edited by R. M. Leventhal, pp. 100-127. University of California, Los Angeles. Copy on file at the Institute of Archaeology, Belmopan.
1992 1992 Study of Actuncan (Cahal Xux). *Xunantunich Archaeological Project: 1992 Field Season*, edited by R. M. Leventhal, pp. 74-83. University of California, Los Angeles. Copy on file at the Institute of Archaeology, Belmopan.

Storey, Rebecca, Lourdes Marquez Morfin, and Vernon Smith
2002 Social Disruption and the Maya Civilization of Mesoamerica: A Study of Health and Economy of the Last Thousand Years. *The Backbone of History: Health and Nutrition in the Western Hemisphere*, edited by Richard H. Steckel and Jerome C. Rose, pp. 283-306. Cambridge University Press, Cambridge.

Wirth, Louis
1938 Urbanism as a Way of Life. *American Journal of Sociology*, Vol. 44:1-24.

Wright, Lori
1997 Intertooth Patterns of Hypoplasia Expression: Implications for Childhood Health in the Classic Maya Collapse. *American Journal of Physical Anthropology*, Vol. 102:233-247.

Yaeger, Jason
2003 Untangling the Ties that Bind. *The Social Construction of Ancient Cities*, edited by M. Smith, pp.121-155. Smithsonian Books, Washington and London.
2000 Changing Patterns of Social Organization: The Late and Terminal Classic Communities at San Lorenzo, Cayo District, Belize. Unpublished PhD dissertation, Department of Anthropology, University of Pennsylvania, Philadelphia.

**Appendix A:** Tabulation of Linear Enamel Hypoplastic Defects in the Skeletal Population of Pook's Hill.

| Pook's Hill Individuals | Age of Growth Disruption | | | | | | | | | | | | Sex & Age Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.0-0.5 | 0.5-1.0 | 1.0-1.5 | 1.5-2.0 | 2.0-2.5 | 2.5-3.0 | 3.0-3.5 | 3.5-4.0 | 4.0-4.5 | 4.5-5.0 | 4.5-5.0 | 5.5-6.0 | |
| Bu. 1A-1 | n.a. | | | | | | | | | | | | possible male elderly adult |
| Bu. 2A-1 Indv. A | | | | | | 2.5-3.0 | | 3.5-4.0 | 4.0-4.5 | 4.5-5.0 | | | probable male adult |
| Bu. 2A-1 Indv. B* | 0.0-0.5 | 0.5-1.0 | | | 2.0-2.5 | 2.5-3.0 | 3.0-3.5 | | | | | | possible female young adult |
| Bu. 2A-3 | | | | | 2.0-2.5 | 2.5-3.0 | 3.0-3.5 | | | | | | elderly adult female |
| Bu. 4A-1 | | | | | | 2.5-3.0 | 3.0-3.5 | 3.5-4.0 | | | | | probable adult male |
| Bu. 4A-2 | n.a. | | | | | | | | | | | | young adult |
| Bu. 4A-3 Indv. A | | | | 1.5-2.0 | | | | 3.5-4.0 | | 4.5-5.0 | | 5.5-6.0 | probable male adult |
| Bu. 4A-3 Indv. B | | | | 1.5-2.0 | | | | 3.5-4.0 | | 4.5-5.0 | | 5.5-6.0 | probable female |
| Bu. 4A-3 Indv. C | | 0.5-1.0 | 1.0-1.5 | | | | | | 4.0-4.5 | | 4.5-5.0 | | probable male |
| Bu. 4A-3 Indv. D | | | | | 2.0-2.5 | 2.5-3.0 | 3.0-3.5 | 3.5-4.0 | | | | | probable male adult |
| Bu. 4A-3 Indv. E | none | | | | | | | | | | | | adult male |
| Bu. 4A-3 Indv. F | | 0.5-1.0 | | | 2.0-2.5 | 2.5-3.0 | 3.0-3.5 | 3.5-4.0 | 4.0-4.5 | 4.5-5.0 | | 5.5-6.0 | sub-adult |
| Bu. 4A-3 Indv. G | | | | 1.5-2.0 | | | | 3.5-4.0 | | 4.5-5.0 | | | probable male adult |
| Bu. 4A-3 Indv. H+ | | 0.5-1.0 | 1.0-1.5 | 1.5-2.0 | 2.0-2.5 | 2.5-3.0 | 3.0-3.5 | 3.5-4.0 | 4.0-4.5 | | | | young adult |
| Bu. 4A-5 | 0.0-0.5 | | 1.0-1.5 | 1.5-2.0 | 2.0-2.5 | 2.5-3.0 | | 3.5-4.0 | 4.0-4.5 | 4.5-5.0 | | 5.5-6.0 | probable adult male |
| Bu. 4A-6 | 0.0-0.5 | 0.5-1.0 | | | | 2.5-3.0 | 3.0-3.5 | 3.5-4.0 | 4.0-4.5 | | 5.0-5.5 | | probable young adult |
| Bu. 4A-7 | | | | 1.5-2.0 | 2.0-2.5 | 2.5-3.0 | | 3.5-4.0 | | | 5.0-5.5 | 5.5-6.0 | probable adult male |
| Bu. 4A-8 | n.a. | | | | | | | | | | | | n.d. |
| Crypt (SU 18) | none | | | | | | | | | | | | n.d. |

**Notes:**

n.a. = sample contains only molars or premolars, which are not used in this study.
none = no dental hypoplasia occurred in the sample.
* = originally designated in the field as Bu. 2A-2.
+ = originally designated in the field as Bu. 4A-4.

# PRELIMINARY INVESTIGATION OF STRUCTURE C2 CAHAL PECH, BELIZE

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## INTRODUCTION

In January 2006 we conducted several test excavations on Structure C2 at Cahal Pech, as part of the 2005 field season of the Belize Valley Archaeological Reconnaissance Project. Our reasons for conducting this work were based on the fact that previous investigations at the site had never tested C2, thus we had limited evidence for determining the construction history, or function, of the structure. Another goal of our investigation was to record architectural data on the mound for possible future conservation efforts at Cahal Pech. Together, these investigations would also add information for the preparation of an updated guide book for the site. This paper describes our preliminary excavations of Structure C2, and provides information on the results of our investigations.

## SITE DESCRIPTION

Structure C2 is a long, low-lying mound on the eastern perimeter of Plaza C in the Cahal Pech site core (see Figure 1). The mound is approximately 30 m long, 12 m wide and 1.8 m high. To the southeast C2 abuts Str. C1, a roughly conical mound that likely served non-domestic, ritual, purposes. The scar of an old looter's trench is still visible along the east-west axis of C1. To the north C2 abuts C3, another low-lying mound that defines the northern perimeter of Plaza C and likely served as the platform for perishable superstructures. Other structures in Plaza C include the East Ballcourt (Strs. C4 and C5), and another large platform that defines the southern end of the plaza, designated as C6. The latter structures are all located to the southwest of C2.

## EXCAVATIONS

Our preliminary testing program excavated a total of four excavation units into Structure C2. Two of these units (Excavation Units 1 and 2) formed an east-west trench with the purpose of exposing the terminal phase architecture of the mound. The other two units (Excavation Units 3 and 4) were placed within the trench in order to penetrate

*The Belize Valley Archaeological Reconnaissance Project: A Report of the 2005 Field Season*. Edited by Christophe G.B. Helmke and Jaime J. Awe, pp. 135-142. Belize Institute of Archaeology, National Institute of Culture and History, Belmopan. 

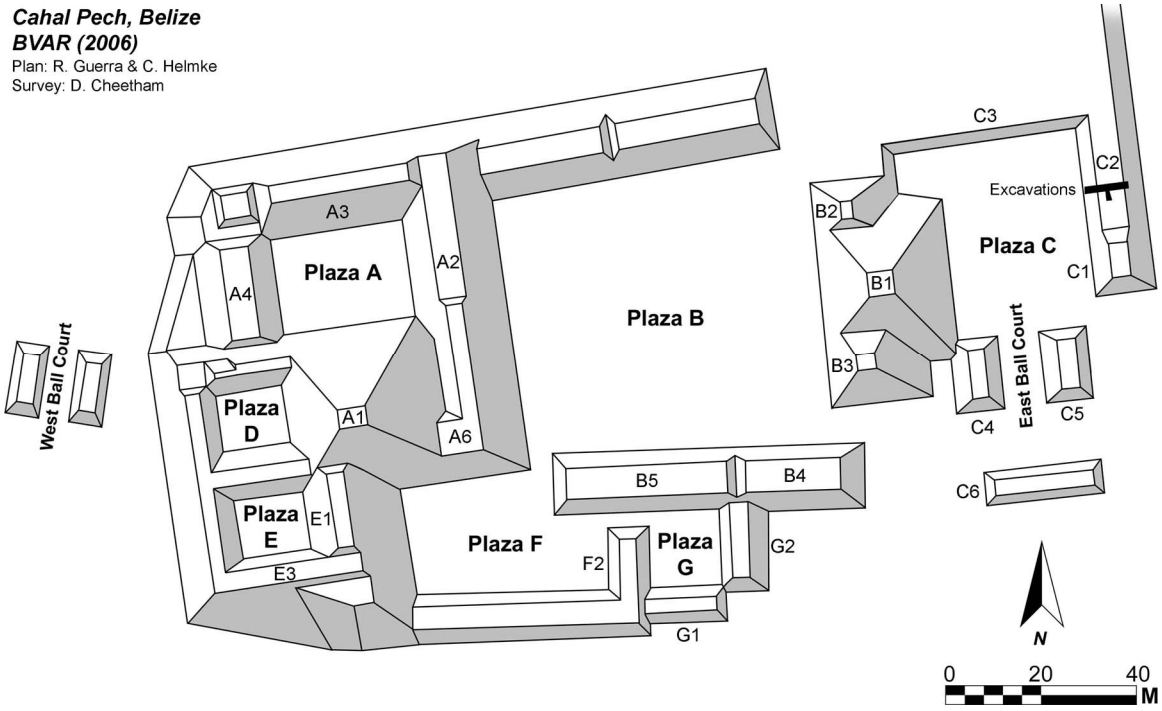


**Figure 1:** Map of the site core of Cahal Pech. Note the distribution of structures around Plaza C, as referred to in the text and the axial test excavations of Structure C2 reported herein, rendered to scale.

the mound and test for earlier phases of construction. The trench was placed in a location where cut stones of the terminal phase architecture were visible at the surface. The excavations were also placed near the southern end of the mound, where the architectural relationship between C2 and C1 remains unclear. Subsequent analyses of the materials recovered in the excavation units were used to determine the function of the structure, and the chronological sequence of the architecture and plaza through time.

### Excavation Unit 1

Excavation Unit 1 (1.5 x 6.1 meters) consisted of the entire west portion of the trench and extended from plaza level to the summit of the mound. Excavation into Level 1 recorded mostly humus, ballast, decomposed lime plaster, and other collapsed debris of the terminal phase architecture. At the western base of the mound the excavation exposed the terminal phase plaza floor and the partially collapsed west face of a cut-stone wall (Figure 2). The latter apparently served as the retaining wall (or terrace) of a structural platform. The wall was six courses high but may have originally stood 10 courses in height. Clearing of the humus about 50 cm east of the wall exposed 2-3 courses of what appeared to be another wall with cut stones facing eastward. While it appears that these cut stones may be the other side (or east face) of the retaining wall, it is interesting to note that the stones used for this section of the wall are slightly smaller than those used on the west face of the wall. This type of construction is not very typical for retaining walls at most sites in the Belize Valley where they generally tend to only have dressed stones on the outer face of the wall. And although this pattern of dressed stones

on both faces is not uncommon at Cahal Pech, the feature is certainly worthy of further investigation. It may be possible, for example, that the wall was part of an earlier building that was modified to serve as a retaining wall for a platform during subsequent architectural modifications of C2.

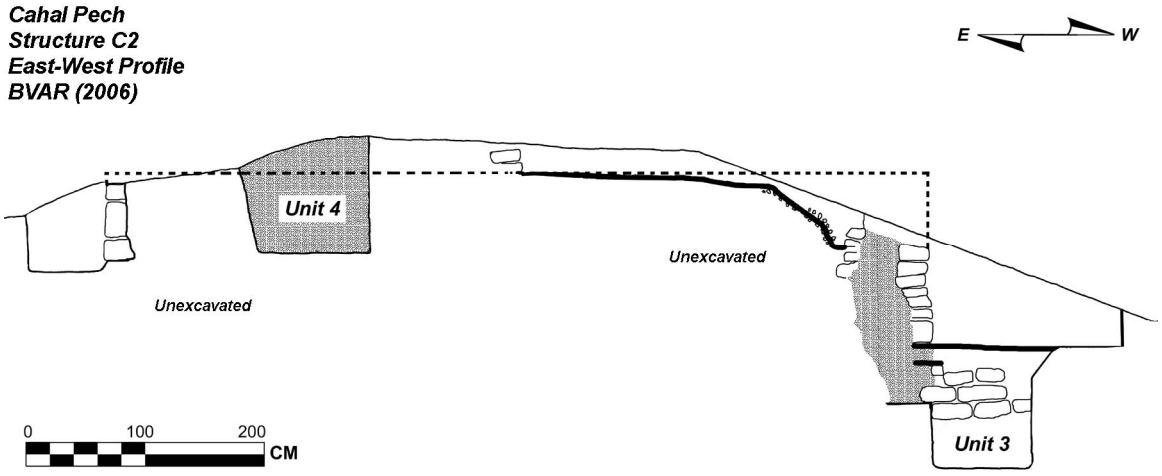


**Figure 2:** Profile of Structure C2, showing architecture and contexts exposed and tested as part of excavations. Note to plastered plaza floor surfaces to the right and the reconstructed summit platform (rendered in dashed lines). Profile by R. Guerra. Survey by J. Puc & M. Schwanke.

To the east of the retaining wall was a poorly preserved floor that extended to another low wall, two to three courses high, near the summit of the mound. This second wall either functioned as the building platform for a perishable superstructure or as a low bench within the building. The floor in front of the summit platform was littered with what appears to be Terminal Classic occupation debris or a post-abandonment deposit. The latter included large potsherds, obsidian blade fragments, chert flakes and a single faunal long bone fragment. The pottery consisted of Terminal Classic (Spanish Lookout) types such as Belize Red, Platon Punctated-Incised, McRae Impressed, Benque Viejo Polychrome, Cayo Unslipped, Alexander's Unslipped and a single piece of Mount Maloney Black. This deposit extended (north-south) across our excavation unit and approximately 1.2 m west of the summit platform. In an effort to acquire a larger sample of this deposit, and to gain a better understanding of the nature of the deposit, we decided to extend the excavation unit 2-m to the south along the base of the summit platform (see Figure 3).

At the western base of the unit the excavation exposed a small area of the associated plaza floor near the base of the retaining wall. Because of the floor's relatively poor preservation it was difficult to tell how often it had been re-plastered following the construction of the terminal phase structure. Future excavations along the base of the wall should, however, provide more information on this feature.

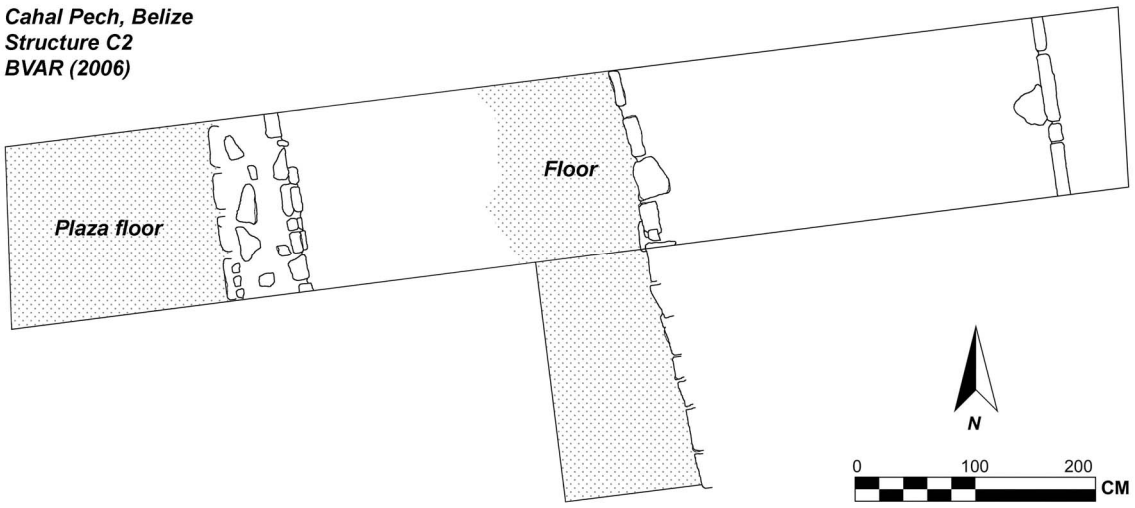


**Figure 3:** Plan of the Structure C2 test excavations. Note the architectural alignments and walls exposed. Plan aligned to magnetic north, while excavations were oriented to architecture. Plan by R. Guerra & C. Helmke. Survey by: J. Puc & M. Schwanke.

### Excavation Unit 2

Excavation Unit 2 consisted of the eastern portion of the trench, and covered an area with an east-facing line of cut stones at surface level. The purpose of this excavation unit was to determine whether this line of stones formed the back or east side of the summit or building platform. The clearing of the first level exposed a layer of ballast-like gravel on the summit platform surface, west of the line of cut stones. Excavation along the line of cut stones revealed that they were indeed part of a wall with mostly large cut stones. Just below surface we recovered a number of artifacts, including ceramics, lithics, and obsidian blade fragments. A fragment of a hollow "Jaina Type" figurine was also recovered from this level (see Figure 4).

East of the wall, at approximately 25 centimeters, the matrix changed (Level 3) to a more compact dark-colored soil that contained significantly fewer artifacts than the previous level. While the 3-6 courses of facing stones continued through Levels 2 and 3, they abruptly ended in the north side of the excavation unit with no evidence of a floor beneath. It was unclear within the 1.5 meter-wide trench whether the stones continued down in the south portion of the unit, and time constraints prevented us from exploring this further.

### Excavation Unit 3

Excavation Unit 3 (1.5 x 1.0 m) was placed within the plaza at the base of the retaining wall exposed in Excavation Unit 1. In Level 1 we recorded two floors (Floors 1 and 2), which represented consecutive re-plastering of the plaza surface. Twelve centimeters below Floor 2 we exposed a third floor (Floor 3). This floor, while very soft and not very thick, was preserved throughout the area exposed in the excavation unit.

Below Floor 3 (Level 2), in the northern part of the excavation unit, the matrix consisted of limestone pebbles mixed with a compact clayey soil. In the southern section of the excavation unit, the top of a building platform was exposed. The summit floor of the platform was finished with flat, fist-sized, limestone cobbles. The wall of the platform had an east-west orientation and extended eastward beneath the terminal phase of Structure C2, and westward beyond the limits of our excavation unit. Time constraints prevented us from exposing more of this early architecture but we do plan to investigate it in the 2006 season. Ceramic artifacts in Level 2 included remains of both Early Classic (Minanha Red basal-flanged dishes) and Late Preclassic types (Sierra Red, Laguna Verde Incised).

Level 3 included the material collected from the surface of a Preclassic platform. All the ceramics in this level were Preclassic in date and included types of both the Middle and Late Formative.

In an effort not to destroy the Preclassic platform we decided to limit the size of the excavation unit and to only continue exposing the area north of the platform. There were no cobbles in this area, only the compact clayey soil with limestone pebbles noted earlier. The entire north side of the excavation unit (including the cobble fill matrix) was eventually cleared to a compact or tamped surface that the cobbles were resting on. This level most likely corresponded to a construction surface since the facing stones of the Preclassic platform continued below this level.

Level 5 continued below the tamped construction surface and ended at the base of the Preclassic platform. This revealed that the wall of the platform had three courses of cut stone and was 46 cm in height. There was no evidence of a plaster floor at the base of the platform so it is likely that the patio floor associated with the platform was constructed on a tamped or natural surface.

Level 6 began below the level of the Preclassic platform in the northern part of the excavation unit, and consisted of a very compact matrix with small limestone inclusions. This matrix likely represented the material that formed the surface of the plaza corresponding to the Preclassic platform.

Level 7 consisted of the matrix below Level 6. It included a dirt fill abutting a core of angular cobbles that tapered from north to south. Within this matrix, and approximately 40 cm below the Preclassic platform to the south, we uncovered a cache (Cache 1) containing the remains of a partial vessel and a single jute shell. The former consisted of a red-slipped dish that shares characteristics with both Middle Preclassic Sampopero Red and Late Preclassic Sierra Red dishes (see Gifford 1976:86, Fig. 34h & 34s). Diagnostic potsherds in the core above the vessel were also Middle Preclassic in date, suggesting that the platform could date to the Terminal


Figure 4: "Jaina Type" figurine recovered from Excavation Unit 2, Levels 1-2. Photograph by M. Schwanke (2006).

Middle Formative period. Due to time constraints, bedrock was not reached and Excavation Unit 3 was closed at the base of Cache 1 and Level 7.

### Excavation Unit 4

Excavation Unit 4 (1.5 x 1.0 m) was placed in the summit platform of Structure C2, between the east-facing platform wall exposed in Excavation Unit 2 and the west face of the two-course summit platform. The purpose was to determine the construction sequences of the summit platform and the supporting substructure.

Level 1 included the area from the surface of the summit platform to the level of the structural platform (approximately 36 cm high). Included in this material was the ballast of the platform surface, as well as construction core in the form of small cobbles. Due to the close proximity to the modern surface, the matrix of this level continued to contain a significant amount of humic material.

Level 2 continued into the core of the substructure, and was arbitrarily assigned since there was no evidence of a plaster floor at the level of the structural platform. The reason for the absence of a plaster floor at this level could be due to the fact that there was heavy root disturbance in the section of the structure. Of course, it is also possible that the plaster floor that was found to the west of the summit platform did not continue beneath it but rather abutted it. The presence of ballast-like material at this level nevertheless supports the first possibility, but this again should be determined by future investigations.

The matrix below the ballast-like level changed to large boulders mixed with a loose fill of cobble-sized stones. This material is representative of Classic period architectural core at Cahal Pech and was likely associated with the construction of the platform. Along the northern section of the excavation unit we also exposed the south face of an east-west running wall made from large, uncut, boulders. This feature most likely represents part of a construction pen. These pens, or construction walls, are commonly found in the architecture of Cahal Pech and were used from at least Middle Preclassic time into the Classic period (Lee & Awe 1995; Lee 1996). Time constraints prevented us from extending the excavation or continuing vertically to determine the extent of the possible construction pen, or whether there was evidence of an earlier structure encased by the terminal Structure C2.

## CONCLUSION

Results of our preliminary excavations on Structure C2 indicate that there are possibly three phases of constructions associated with the mound. The earliest phase is a small building platform that possibly dates to the latter part of the Middle Preclassic, or to a transitional phase between the Middle and Late Preclassic periods (see Appendix A). This structure was later completely encased by Structure C2-2$^{nd}$, represented by the retaining wall exposed in Excavation Unit 1. Ceramic material associated with this phase suggests an Early Classic date of construction for this penultimate phase of architecture. The final construction phase of C2 incorporated the wall of the C2-2$^{nd}$ building as the retaining wall for a large structural platform. At the summit of this structure the builders

constructed a low building platform or bench that was covered by a perishable superstructure. This last construction phase was likely realized in the early part of the Late Classic period. Sometime after the construction of C2-3rd (or last construction phase), and possibly even after the site is abandoned, it appears that there is renewed human activity in and around the building. This is suggested by the concentration of Terminal Classic period materials that are strewn across the surface of the mound. These remains are either associated with ephemeral occupation of the site at this time, or with rituals deposits left behind by people returning to a site once considered an important part of the sacred landscape of the upper Belize River valley.

**References Cited:**


Gifford, James C.
1976 *Prehistoric Pottery Analysis and the Ceramics of Barton Ramie in the Belize Valley*. Harvard University, Peabody Museum of Archaeology and Ethnology, Memoir No. 18. Harvard University, Cambridge.

Lee, David and Jaime J. Awe
1995 "Middle Formative Architecture, Burials, and Craft Specialization: Report on the Investigations at the Cas Pek Group, Cahal Pech, Belize." *Belize Valley Preclassic Maya Project: Report on the 1994 Season*, edited by Paul Healy and Jaime Awe, pp. 95-115. Trent University Occasional Papers in Anthropology, No. 10. Trent University, Peterborough.

Lee, David F.
1996 "Nohoch Na (The Big House): The 1995 Excavations of the Cas Pek Group, Cahal Pech, Belize." *Belize Valley Preclassic Maya Project: Report on the 1994 Season*, edited by Paul Healy and Jaime Awe, pp. 77-97. Trent University Occasional Papers in Anthropology, No. 12. Trent University, Peterborough.

**Appendix A:** Diagnostic Ceramic Types Identified in Structure C2 Excavations.

| | EU 1, Level 1 | EU 2, Levels 1-2* | EU 3, Level 1 | EU 3, Level 2 | EU 3, Level 3 | EU 3, Level 4 | EU 3, Level 5 | EU 3, Level 6 | EU 3, Level 7 | EU 3, Level 7, Cache 1 | EU 4, Levels 1-2** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| "Jaina Type" figurine | | X | | | | | | | | | |
| Three-pronged unslipped censer | | X | | | | | | | | | |
| Alexander's Unslipped | X | X | | | | | | | | | |
| Cayo Unslipped | X | X | | | | | | | | | |
| Tutu Camp Striated | X | X | | | | | | | | | |
| Dolphin Head Red | X | | | | | | | | | | X |
| Benque Viejo Polychrome | X | | | | | | | | | | |
| Platon Punctated-incised | X | X | | | | | | | | | |
| Belize Red | X | X | | | | | | | | | |
| Mount Maloney Black | X | X | | | | | | | | | |
| Minanha Red | | | X | X | | | | | | | X |
| Sierra Red | | | X | X | X | X | X | | | | X |
| Transitional Sampopero to Sierra | | | | | | | | | | X | |
| Chan Pond Unslipped | | | X | | ? | | | | | | |
| Laguna Verde Incised | | | | X | | | | | | | X |
| Paila Unslipped | | | | X | | X | | ? | | | X |
| Savana Orange | | | | | X | | X | | | | |
| Sapote Striated | | | | | | X | | | ? | | |
| Polvero Black | | | | | | | X | | | | |
| San Felipe Brown | | | | | | | X | | | | |
| Jocote Orange-brown | | | | | | | | X | X | | |
| Reforma Incised | | | | | | | | | X | | |
| Cu Orange (Cunil) or Joventud Red. | | | | | | | | X | | | |

* This level is similar to terminal deposits on west side of trench.

** No Terminal Classic ceramics were identified in these levels. Conspicuous absence of ash-tempered pottery.

# A COMPREHENSIVE REVIEW OF THE CARVED MONUMENTS AND HIEROGLYPHIC INSCRIPTIONS OF XUNANTUNICH, BELIZE [*]

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## INTRODUCTION

The prominence of Xunantunich during the Terminal Classic period has long been attested by its three carved monuments commemorating the period endings spanning 9.19.10.0.0 (AD 820) to 10.1.0.0.0 (AD 849). This late florescence is further supported by extensive and intensive programs of archaeological research that were conducted by the Xunantunich Archaeological Project (1992-1997) and the Tourism Development Project (2000-2004). The recent discovery of two new monuments extends the longevity of the sculptural tradition earlier in the foregoing Late Classic period. The content of the inscriptions testify to an established dynastic seat at the end of the preceding Late Classic and enhances our understanding of the geopolitical fabric of Belize Valley polities. The relations that Xunantunich maintained with its neighbours are hinted at in the inscriptions, but until now have remained opaque and debated. In a re-examination of the site's known inscriptions, analysis of the recently discovered monuments and comparison with the glyphic texts from other nearby sites, this paper provides the framework for a better understanding of the place of Xunantunich within the socio-political landscape of the region during the latter portion of the Classic period.

The first recorded mention of Xunantunich (Figure 1) has been attributed to Sir Alfred Malony, during his tenure as Governor of then British Honduras in 1891 (Morley 1938:204) –then alternately known as Benque Viejo or Mount Maloney. Shortly thereafter the site's carved Stela 1 and Altar 1 received the attention of some of Maya archaeology's well-known pioneers including Thomas Gann (1894-1895, 1925), Teobert Maler (1908) and Sylvanus Morley (1937-1938). Controlled excavations of the site were initiated by Sir J. Eric S. Thompson in 1938 (Thompson 1942), at which point he examined Stela 1 and produced a field drawing of that monument. It was not until two decades later that two more monuments (Stelae 8 and 9) were brought to light by successive Archaeological Commissioners Peter Schmidt and Joseph Palacio (Graham 1978:2:118). Since then the inscriptions of Xunantunich have been properly published in

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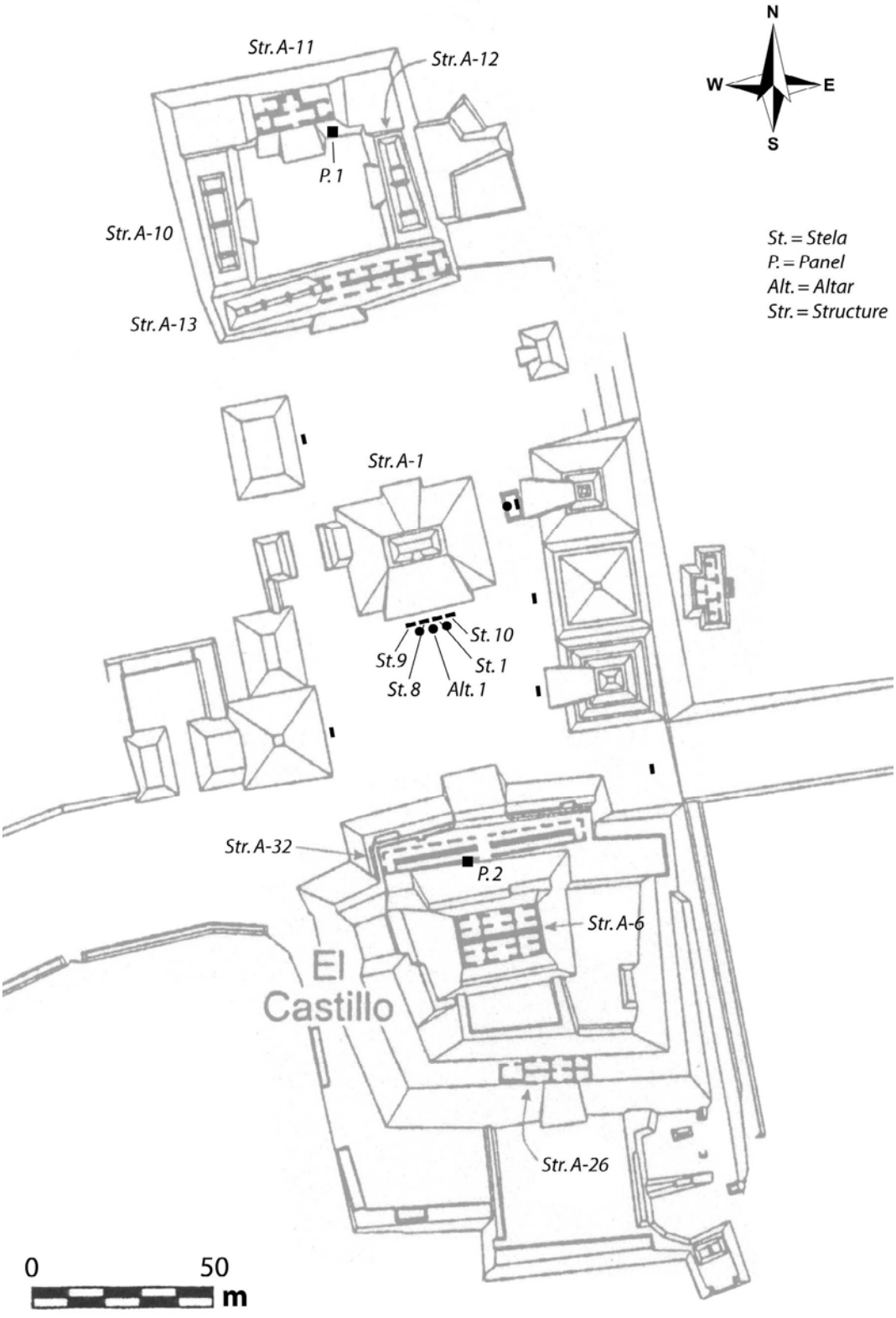



**Figure 1:** Map of the monumental epicentre of Xunantunich showing the location of structures and carved monuments mentioned in the text. Note the concentration of monuments at the southern base of Str. A-1. Map adapted by C. Helmke (2005) from a map by Angela Keller & Jason Yaeger (2002).

the Corpus of Maya Hieroglyphic Inscriptions as part of efforts by Ian Graham and Eric von Euw (Graham 1978:2:117-2:127). While the status of Xunantunich as the most important locus of archaeological excavations in the Belize Valley cannot be negated, the site's glyphic inscriptions have received only peripheral mention in the published literature to date (Ashmore 1998:170, 173; Martin & Grube 2000:83; LeCount et al. 2002:55). With the recent discovery of well-preserved monument fragments (Panels 1 and 2 and a fragment of Altar 1) as part of investigations conducted by the Xunantunich Archaeological Project (1992-1997) and the Tourism Development Project (2000-2004), it has been deemed timely to finally provide a comprehensive review of the site's inscriptions.

Of the sixteen monuments discovered at Xunantunich six were carved. Ten monuments are represented by stelae of which only three are carved (Stelae 1, 8 and 9). The remainder is represented by four altars (the carved Altar 1, two plain altars and a masonry altar), as well as the glyphic Panels 1 and 2 (Figure 1). Our discussion will focus exclusively on the carved monuments and specifically on the epigraphic analysis of the glyphic texts. Nonetheless, the associated iconography is described and the archaeological context in which these monuments were found is summarized. All the carved monuments were examined by the authors in the field with the aid of artificial lighting in January and July 2004. The results of these analyses were weighted against previously published drawings and amendments or complete re-drawings were executed as necessary. The corpus is presented in its presumed chronological order, from earliest to latest, beginning with Panel 1 and ending with the Stela 1 and Altar 1 pair (Figure 2).

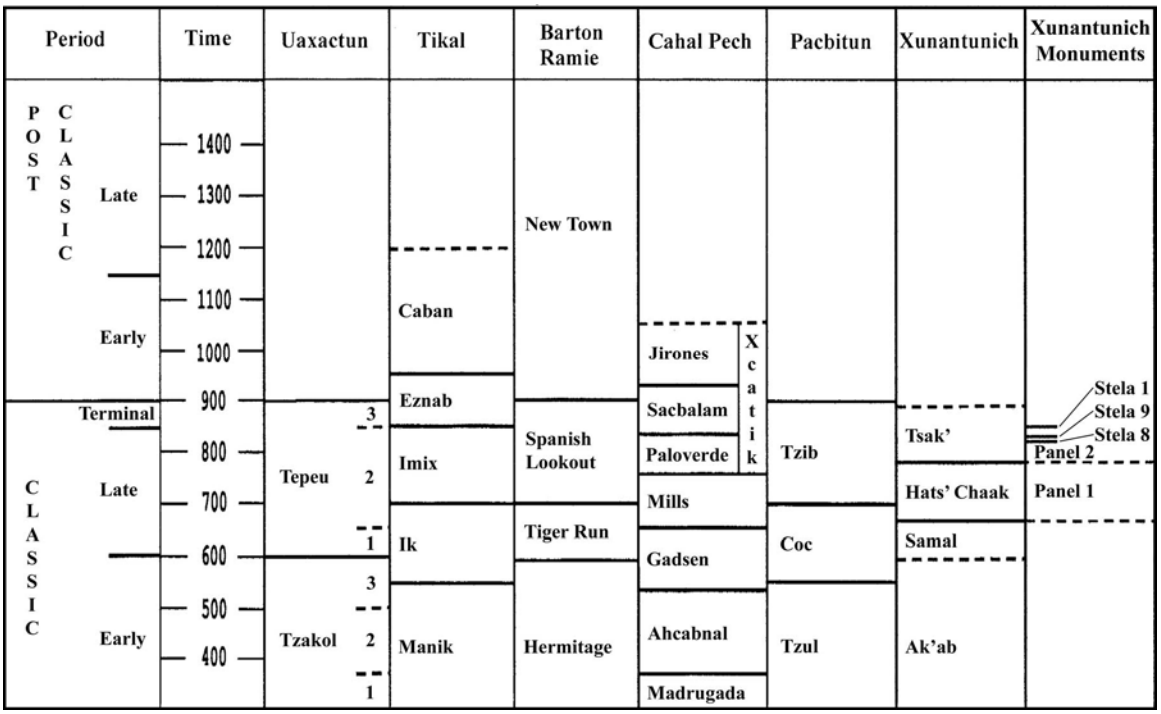



**Figure 2:** Ceramic complexes of the eastern Maya Lowlands and central Belize and the chronological placement of the carved monuments of Xunantunich. Note that Panels 1 and 2 are dated stylistically, while the other have been dated on the basis of calendrical data present in the inscriptions (adapted by C. Helmke from LeCount et al. 2002:45, Fig. 3).

**PANEL 1 (ca. AD 670-780)**

The monument designated as Panel 1 (Figure 3) was discovered in 1997 as part of the Xunantunich Archaeological Project (XAP) excavations of the northernmost Plaza A-3 complex (Yaeger 1997:25-42). This complex forms a *plazuela* or 'court' group and is composed of multi-room, vaulted range structures (Structures A-10 through A-13), including a pyramidal, two-story 'palace' (Str. A-11) and a nine-doorway '*audiencia*' building (Str. A-13) (Arnauld 2001; Gann 1925:80-81; Harrison 1996; MacKie 1961, 1985:42-44; Yaeger 1997). The layout, configuration and function of the A-3 complex is in keeping with multi-functional palace groups present elsewhere in the Lowlands and the Belize Valley (see Awe 1992; Ball & Taschek 1991, 2001; Bill 1982; Inomata & Houston 2001a, 2001b), a point that has been generally corroborated by XAP investigations (Harrison 1996; LeCount 1996:83, 86, 93-98; LeCount et al. 2002:43; Yaeger 1997). The complex is thus seen primarily as the residential seat of the Late Classic royal family and secondarily as an administrative node that is complementary in function to the larger *Castillo* palace complex to the south (described below). In particular, a case has been made for the identification of Structure A-11 as the residence of the royal family (LeCount et al. 2002:43; Yaeger 1997:32-35).

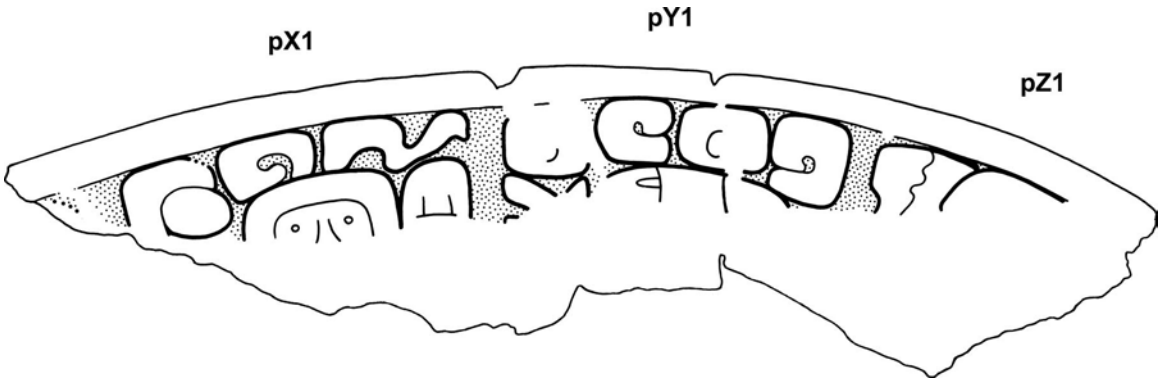



**Figure 3:** Panel 1 (c. AD 670-780). Maximum preserved width: 0.27 m. Drawing of conjoining fragments by Christophe Helmke (2004) based on a photograph by Jason Yaeger.

The three conjoining fragments that together represent the remains of Panel 1 were found in a secondary context in association with the lower building of Structure A-11 (Yaeger 1997:35). More specifically, the fragments were found as a cluster sealed under a stratum of collapse debris, slightly east of the lower building's eastern doorway, just a few centimetres above the floor surface of the basal terrace (Yaeger 1997:35). The stratigrahic context of these fragments suggests that their breakage and displacement took place in antiquity prior to the collapse of Structure A-11. The thinness of the monument has been taken as an indication that it once served as a wall panel (Yaeger 1997:35; cf. Houston 1993:77, Table 3-4, Fig. 3-13). The fragmentary state of the panel and its disassociation from the once larger –now missing– monument are signs of wilful destruction (Jason Yaeger pers. comm. 2003).

The three fragments of Panel 1 represent parts of a glyphic rim band to a circular monument. Based on extant curvature, the monument may have had an original, maximum diameter ranging between 64 and 65 cm. Assuming that the size and spacing of glyph blocks was consistent, the complete text would have been composed of 22 glyph blocks, indicating that less than 10 % of the original text remains. Considering the surface area represented by the fragments less than 6 % of the original monument may be represented. The central circular section of the panel framed by the glyph band may have exhibited an iconographic program (perhaps accompanied by a caption) or an oversized Ajaw period-ending date based on examples found at other Lowland sites, such as Caracol, Tikal and Tonina (Beetz & Satterthwaite 1981; Grube 1994:90-91, 100-101; Jones & Satterthwaite 1982; Mathews 1983:6:48; Graham & Mathews 1996:6:81; Graham & Mathews 1999:6:142-147, 6:162-165, 6:168-169; Martin & Grube 2000:89).

The little that remains of this monument is nonetheless fully-legible, relatively well-preserved and does shed some light on the ancient dynasts of Xunantunich. Palaeographic style dating of the glyphic collocations indicate that the panel is coeval to the Late Classic 2, Hats' Chaak phase (AD 670-780) construction date of Structure A-11 (Yaeger 1997; Alfonso Lacadena pers. comm. 2004). Contemporaneity of this monument to Structure A-11's primary phase of construction further supports the idea that its destruction may have taken place during secondary architectural refurbishments dated to a latter part of the Hats' Chaak phase (Yaeger 1997:36). Despite signs of extensive architectural modification, cessation of the complex's function and its abandonment are in evidence by the start of the ensuing Tsak' phase (AD 780-890) (Yaeger 1997:35-36; LeCount et al. 2002:42).

What remains of the text is initiated by a so-called "flaming ajaw" collocation (pX1) marked by the possessive prefix <u>[1]. While the reading of this collocation has been much-debated[2] it clearly serves as a relationship glyph tying the name of an offspring to that *of* its father as part of a "child of (male)" expression (Coe & Van Stone 2001:87; Jones 1977; Kettunen & Helmke 2005:32, 76; Schele & Grube 2002:65). Based on the syntax of comparable clauses the name of the father follows the 'flaming ajaw' expression while that of the offspring (typically the protagonist of a text) precedes it.

[1] For details on the conventions used in this paper see end note no. 1 at the end of this paper.

[2] The main sign of this relationship expression is a capped *ajaw* sign surmounted by fire scrolls, which is clearly from the *ajaw* sign outside of its cartouche. Originally Nikolai Grube and Werner Nahm offered the value of **NIK** to the main sign, supported by phonetic complementation in **ki** (Freidel et al. 1993:440). The reading offered fulfils the semantic requirements of the relationship expression based on cognates in Tzotzil and Tzeltal that include the root *nich* or "flower" in expressions such as *nich'ón*, *nich'onil*, and *nichan* all meaning "son or daughter of a man" (Kaufman 1972; Laughlin 1975). In this context the reference is part of a metaphorical expression in which the offspring is likened to a "flower". Since then, the value of the main sign as **NIK** has been debated, though that reading still provides several productive glosses in a variety of other contexts. The debate may in fact be stirred by the graphic overlap of the simple *ajaw* sign outside the cartouche with the "flaming capped *ajaw*" sign, which in many texts, especially those of the Usumacinta region occur side by side (note for example the unprovenanced panel in the Meagli collection). Recently, Stephen Houston has suggested that two discrete variants of the "flaming ajaw" may indeed exist with the latter complemented phonetically by **mi** in initial and **ni** or **na** in final position. Comparison to known relationship expressions suggests **MIHIN** or **MIJIN** as the logographic value, related to its cognates *mejen* and *mehen* in Yukatekan languages (Yukatek, Itzaj, Mopan and Lakantun), variously meaning or forming the root for "small, baby, child, son, father's son" and "hijo de varón" (Barrera Vásquez 1980:516; Bastarrachea et al. 2003), *miín* in Ch'olti' (Morán 1695:161), and *mi'in* as a word for 'father's offspring' in two languages of the Q'anjob'alan stock, namely Q'anjob'al and Chuj (Dienhart 1997).

Here, unfortunately, nothing remains of the name or titles of the protagonist. However, portions of the first two nominal collocations of the father are represented. The nominal string is initiated by a collocation (pY1) that can be transcribed as **u-yu-#**, followed by another (pZ1) that is tentatively identified as the leaf-nose of the bat logogram **SUTZ'**. A search for comparable or analogous nominal strings in contemporary texts of other Lowland sites produced no matches suggesting that the name cited on the panel is that of an as yet unidentified (apparently local) royal figure.

The presence of a 'flaming ajaw' collocation indicates that the panel made reference to a parentage statement of the probable protagonist and patron of this monument. Such statements were employed by rulers to support their pedigree and to legitimize their right to the throne (e.g. Trigger 2003:74-78). This parentage statement would thus seem to mark the presence of a local ruler making a concerted effort to legitimize his/her pedigree. Panel 1 and the completion of the Plaza A-3 complex in the Hats' Chaak phase together suggest the presence of an established, local, regal dynasty by at least the latter half of the seventh century AD. Nonetheless, the budding dynasty appears somehow unsettled by the eighth century with the abandonment and subsequent decay of the Plaza A-3 complex.

**PANEL 2 (ca. AD 780-820)**

The most recent addition to the corpus of Xunantunich is Panel 2 (Figure 4), found amidst the site's most prominent landmark, originally known as '*El Castillo de dos Épocas*' (Maler 1908:77). Known today simply as '*El Castillo*', it is in fact a multi-functional palace complex of several vaulted masonry structures (i.e. Structures A-5, A-6, A-20, A-26 and A-32) built upon an imposing, terraced and pyramidal basal platform, rising to a total height of 39 m above the terminal plaza. The *Castillo* aroused the interest of early explorers (Maler 1908:77-78; Gann 1925:57-58; Morley 1938:206-207) and was the subject of documented excavations as early as 1950 (Satterthwaite 1950). Since then the XAP excavations undertaken in the 1990s have provided a clearer picture of the complex (Clancey 1997; Fields 1994, 2004; Hays 1997; Larios & Penados 1994; Miller 1995, 1996; Neff 1995; Robin 1994; Sanchez 1993; Yaeger 1997). Most recently, the *Castillo* has been the focus of an extensive and intensive program of architectural curation assumed by the Tourism Development Project (TDP) as a joint venture between the Inter-American Development Bank (IDB) and Belize's National Institute of Culture and History (NICH). It is as part of these latter efforts that Panel 2 was brought to light in 2003.

Previous investigations indicate that the *Castillo* rose from humble beginnings in the Early Classic Ak'ab phase (AD 300-600) as a small one-meter-high platform (LeCount 1996:89; LeCount et al. 2002:43; Miller 1995, 1996). The much-expanded, monumental and penultimate version of the *Castillo* has been dated to the Late Classic 2 Hats' Chaak phase (AD 670-780), the site's pre-eminent period of architectural expansion. Consequently, the penultimate *Castillo* is broadly contemporaneous to the Plaza A-3 complex (described above) and Structure A-1 (discussed below) (LeCount 1996:91-92; LeCount et al. 2002:43). The penultimate phase *Castillo* was dominated by the large vaulted Structure A-6-2$^{nd}$ set in a double-tandem configuration of three rooms

(with twelve rooms in total), with triple doorways facing all four cardinal directions. The upper zone or façade of this building was embellished by a stucco frieze on all four faces, though only portions of the eastern and western faces are preserved today (Fields 1994, 2004; Satterthwaite 1950; Yaeger 1996). These fragments represent diminutive cosmograms, in which the earthly realm is dominated by zoomorphic depictions of supernatural *witz* or "mountains" (Stuart 1986: 17-20, 23, Figs. 28-32, 48 n. 4; cf. Fields 1994), of which there were undoubtedly twelve in all originally, perhaps in compliance to the number of rooms. The earflares of these creatures are flanked by maize sprouts, which in keeping with epigraphic conventions denote *–nal*, a type of "maize"; serving also as a common locative suffix for toponyms (Schele et al. 1990; Stuart and Houston 1994: 20, 21, Fig. 22). Thus, the penultimate Castillo was clearly marked as a *witznal* or "mountainous place" in accordance with Maya notions of pyramidal structures as artificial mountains (Stuart 1986, 1997; Vogt and Stuart n.d.).

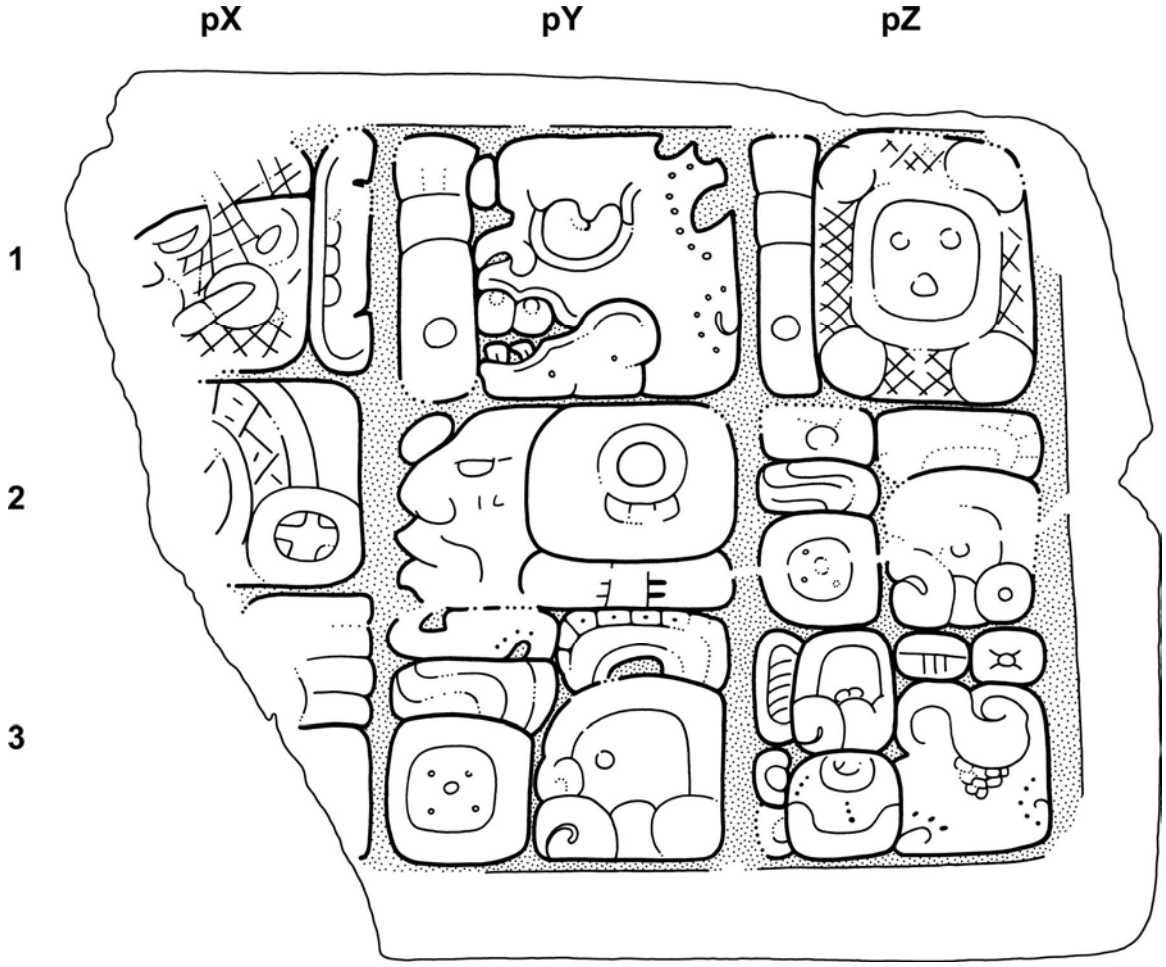



**Figure 4:** Panel 2 (c. AD 780-820). Maximum preserved width: 0.40 m. Drawing of conjoining fragments by C. Helmke (2004) based on photographs, field drawings and inspection of the original monument by C. Helmke.

During the Hats' Chaak construction surge, the Castillo was elaborated by tandem-layout *audiencia* range structures (see Category 2 in Harrison 1970) on both its northern (Structure A-32) and southern (Structure A-26) flanks. Panel 2, was found in association with Structure A-32, the northern *audiencia* of the *Castillo*. Specifically, the panel was recovered from the alleyway formed by the southern face of Structure A-32[3] and the northern face of the terraced platform of Structure A-6. It was situated at the foot of said terraces in alignment to the doorway immediately west of the central transversal corridor of the *audiencia* (Figure 1). Much like Panel 1, Panel 2 was found fragmented, but articulated as two conjoining pieces, sealed under a layer of collapse debris, resting almost directly atop the terminal plastered surface of the medial terrace upon which Structure 32 was constructed. As the palaeographic style dating of the panel (i.e. c. AD 780-820; Alfonso Lacadena pers. comm. 2004) corresponds to the first half of the Tsak' phase (AD 780-890), it is clear that the monument was found in a secondary context as it postdates the architectural setting in which it was found (Jason Yaeger pers. comm. 2005). Furthermore, Panel 2 may have originally served as a veneer facing to a stair riser, based on overall dimensions and the broadness of the lowest portion of the plain band that frames the panel (a feature consistent with riser panels of hieroglyphic stairs). The secondary context, in which the remaining panel fragments were found, as well as their fragmentation and disassociation from the remaining monument all suggest intentional destruction.

The text of Panel 2 is the best-preserved written record of dynastic activity discovered to date at Xunantunich (and possibly within the entire Belize Valley). Though the monument now exhibits maybe only a third of the original length, all preserved portions are nearly pristine, clearly-written and fully-legible, suffering only from negligible spalling. The first unbroken collocation (pY1) forms part of a common couplet known as the 'flint and shield' expression generally written by means of logograms, syllabograms or by a combination thereof as *took' pakal* (Houston 1983; Schele & Miller 1986:210, 221; Lacadena & Wichmann 2004:156; Martin 2001:178-179). The sequence of this couplet (pY1 to pZ1) within the overall text implies that the reading order follows the standard double column format (top to bottom, left to right and in paired columns). Within other texts, elsewhere in the Lowlands, the syntactic context of this glyphic pair is the object of clauses. Based on this feature the couplet would have been preceded by a verb and followed by the clauses' subject, usually the "owner" of the 'flint and shield'.

Typically, in ancient Maya written narratives, sentences are ended and new ones begun by a Calendar Round (hereafter CR) or other date expression, which take the position of an adverbial phrase. Consequently, in this instance it also seems probable that a CR date preceded the verb (pX3). Significantly, a fragmentary collocation that exhibits an infixed **K'AN** sign is represented (pX2) in a position preceding the putative verb

[3] Structure A-32, the northern thirteen-doorway *audiencia*, is notable for being intimately comparable (in terms of size, location, and configuration) to contemporaneous structures of Cahal Pech's acropolis and Caracol's *Caana* (Awe 1992 [Str. A-2]; Ball & Taschek 2001 [Str. A-1]; Chase & Chase 2001 [Str. B-14 and B-15]). Consequently, based on overall architectural configuration and probable function in antiquity, the *Castillo* complex as a whole can be compared to Caracol's commanding *Caana* complex (Martin & Grube 2000:93; Chase & Chase 2001:110-116).

(pX3). Few logograms in the Maya script include a **K'AN** infix[4] and it is noteworthy that a diagnostic attribute of the Haab sign Pop is the infixed *k'an* sign. Unfortunately, far too little remains of this possible CR (pW2) to even consider anchoring it in the Long Count (hereafter LC).

Based on the reconstructed position of the calendrical expression it seems that most of the last clause of the narrative presented on Panel 2 is preserved. In turn, the fragmentary glyph block at pX1 would represent the last collocation of the preceding sentence, which can be transcribed as **#-pa-na**. Based on an extensive review it is probable that this collocation recorded the toponym *monpan* or *monpaan* that is documented in the texts of Najtunich, Guatemala (Figure 5), an important cave site located 90 km to the south (MacLeod & Stone 1995). The incidence of a toponym at the end of a sentence is also syntactically congruent for clauses specifying the locality of events (i.e. sentences conforming to the "place name formula"; see Stuart & Houston 1994:7-18). The preceding sentence may have thus have recorded a now lost event that "happened at Monpan". Six examples of the little-known, but important toponym

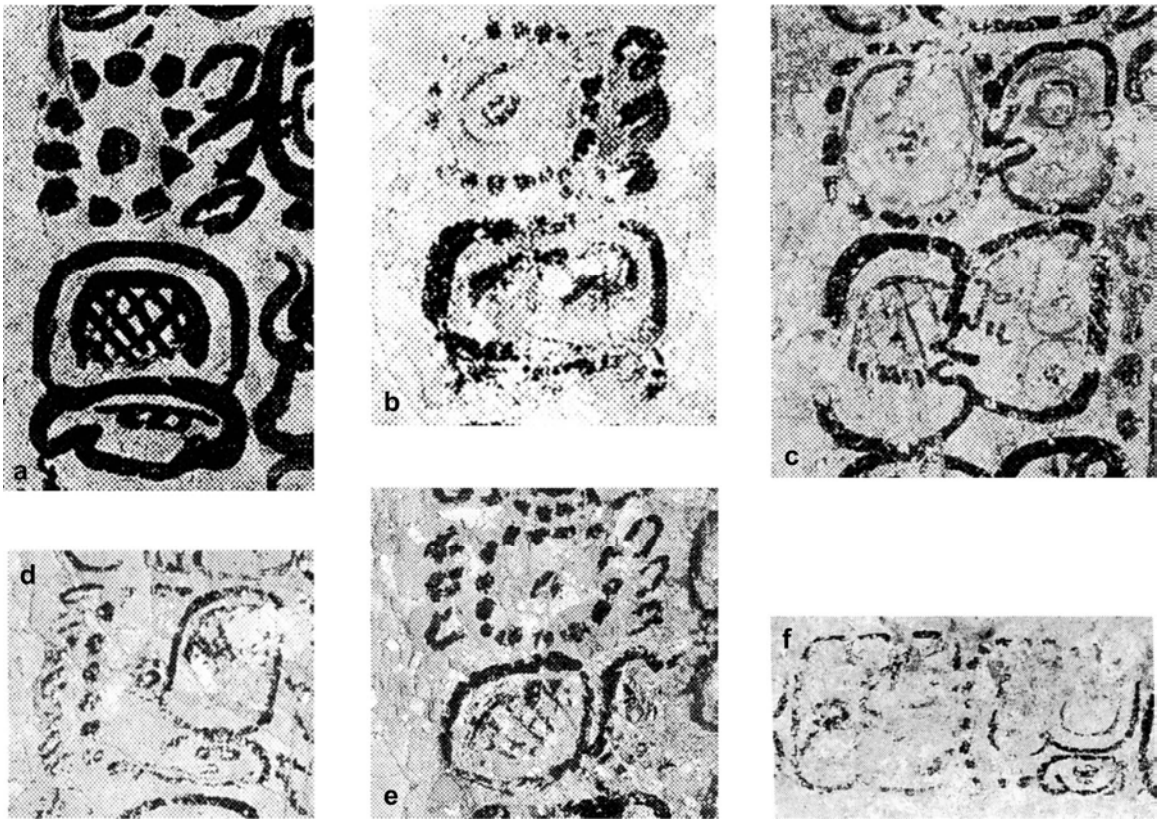



**Figure 5:** Examples of the *Monpa(a)n* toponym as recorded in the glyphic texts of Najtunich, Guatemala. **a**) Drawing 23; **b**) Drawing 24; **c**) Drawing 25; **d**) Drawing 28; **e**) Drawing 29; **f**) Drawing 66. Details of photos by Chip and Jennifer Clark in Stone (1995).

[4] Examples of glyphs that include an infixed **K'AN** logogram (T281) include: **B'AH** (T757), "POP" (T551), and **[K'AN]a-si-ya** (T[281]743:57.126).

*Monpan* or *Monpaan*[5] are known from the texts of Najtunich (Stone 1983: 92-93, Fig. 3; Stuart & Houston 1994: 56, Fig. 66b; MacLeod & Stone 1995: 165, 169). The ancient toponym has been connected to the term Mopan that serves to designate the language and ethnonym of the southernmost group of Yukatek Maya (MacLeod & Stone 1995:169). The Mopan settlement documented in the Colonial records has been placed at modern day San Luís, south of Poptun, Guatemala and is located less than 20 km southwest of Najtunich (MacLeod & Stone 1995:169; Thompson 1977:5). Mopan also serves as the name of the western branch of the Belize River, which has its source in the Chiquibul valley approximately 20 km north of Najtunich. This is the same river that courses along the eastern base of the hill that Xunantunich is situated upon. The colonial distribution of the name Mopan in the vicinity of Najtunich therefore suggests that it is of great antiquity being descendant of the **monpan* toponym cited in the glyphic inscriptions. Based on this line of evidence, the river now known as the Mopan may have been the principal physiographic feature of an area known as Monpan in antiquity. The possible reference to Monpan on Panel 2 would therefore suggest that it relates an event that took place along the course of the Mopan River in relative proximity to Xunantunich.

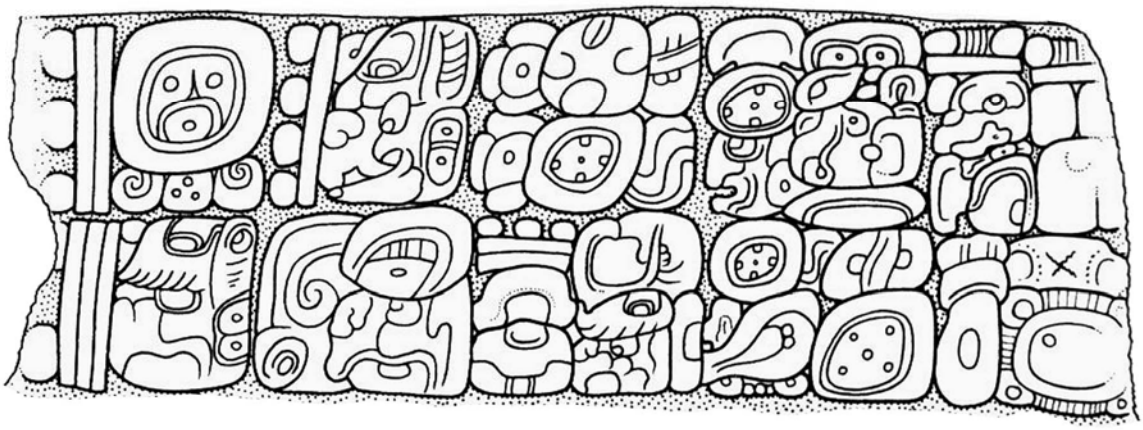
The verb of the final clause would have occupied the entirety of two glyph blocks (pW3-pX3) of which little now remains (based on the reconstructed position of the possible CR date). It is regrettable that the verb has not been preserved on the extant fragments as 'flint and shield' expressions can be preceded by one of several different verbs.[6] In addition, the *took' pakal* couplet can be marked by a variety of possessive prefixes that link these to the subject of the clauses. Due to these variables several significantly different sentences could have been written, though each, in one measure or another makes reference to martial actions or at the very least stand as symbolic referents thereof (Genet [1934]2001:285-290; Martin 2001:178, 179). Despite said variability, the clause on Panel 2, is only paralleled by four other examples (Yaxchilan HS3, Step 3: C4b; Dos Caobas Stela 1: C2-D2, a fragmentary stela at Chinkultic: E2; and the text of vessel K5022: B3; Figure 6) in its use of the preposition *ti* ("to, at, from, by, with") as *ti took' ti pakal* (lit. "with flint, with shield" or possibly "by the flint, by the shield") (see Grube 2003:37-38). This prefix marks the couplet as the indirect or dative objects of the clause. Since neither the flint nor the shield is marked by the possessive pronoun, the syntactic relation of the names that follow remains indefinite, though it seems probable that it is the subjects cited that were "with flint and with shield".

[5] The toponymic collocation Monpan and its variant Monpaan is written as **[mo]no-pa-na** or **mo-no-pa-na** and **[mo]no-pa-ni**, respectively. At the time MacLeod and Stone put forth their arguments, the second glyphic sign of the collocation was understood to have the vocalic value **o**. Consequently the toponym was originally transliterated as *mo'pan*. Since then David Stuart has demonstrated that the sign in question has the syllabic value **no**, hence the transliteration presented here. Despite these changes we believe that the conclusions reached by MacLeod and Stone remain valid, particularly considering the relative weakness of <n> when it is the first phoneme in consonant clusters as well as in word final position. Apparently, the <n> phoneme has been lost in the course of phonological shifts over the course of more than seven centuries: *monpaan* > *monpan* > *mopan* (Marc Zender pers. comm. 2003).

[6] Examples of verbs that precede the 'flint and shield' expression include: *jub'*- ("topple"), *tz'ak*- ("order"), *wi'*- ("eat"), *k'a*- ("wilt"), *ete'*- ("deed"?), and the undeciphered "star war" verb.

a

b



c

**Figure 6:** Other examples of the couplet *ti took' ti pakal* as seen on **a)** unprovenienced vessel K5022 at B3 (adapted from a photograph © Justin Kerr); b) Dos Caobas Stela 1 at C2-D2 (detail of a photograph by Joel Skidmore), and c) fragmentary stela at Chinkultic at E2 (detail of a drawing by Christian Prager).

The nominal section exhibits three discrete segments. The first two belong to a special toponymic class identified by the suffix *–n-ib'* (pZ2a and pY3a), which may simply be translated as "place"[7] (Boot 2002:61, 75, 76). The third and most important segment records a hitherto unknown Emblem Glyph (pZ3). Each is prefixed by a collocation standing for a noun or adjective serving to modify the value of each segment.

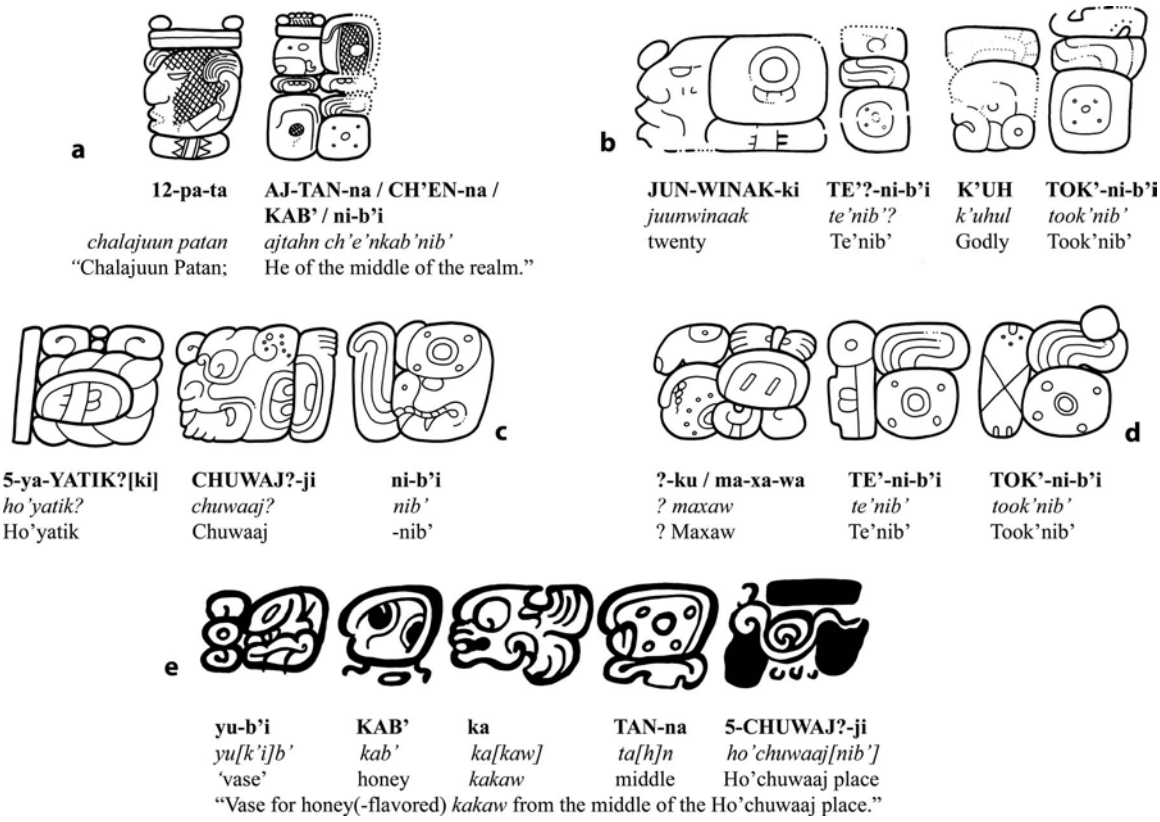



**Figure 7:** Examples of *–nib'* suffix toponyms. **a**) Yaxchilan, Hieroglyphic Stair 3, Step 4 (C6-C7); **b**) Xunantunich, Panel 2 (pY2-pY3a); **c**) Topoxte, Mirror backing (O1-Q1); **d**) Topoxte Mirror backing (R1-T1); **e**) unprovenienced bowl K0681 from the Naranjo area (A1-E1). All drawings by Christophe Helmke based on drawings by Nikolai Grube, Ian Graham, and a photo by Justin Kerr, respectively.

The first is introduced by a collocation (pY2) prefixed by the polyvalent sign representing and youthful female head in profile (variously serving as **IX(IK)**, **JUN** or **na**). The main sign of the collocation is the logogram for "twenty" with a phonetic complement as subfix (**WINAK-ki**) (Figure 7a). Based on the numerical context the whole is best read as *juun winaak* for "twenty" or "twenty-one" (lit. "one-twenty"), following the patterns observed in several Maya languages.[8] The subsequent collocation

[7] For details regarding *–nib'* suffixed toponyms, see end note no. 2 at the end of this paper.

[8] The interpretation of pY2 as **juun winaak* may also be supported by a recent re-interpretation of the T683a WINAK logogram in the Lunar Series as having a possible infixed disk for "one" as **[JUN]WINAK** (Juan Ignacio Cases Martín pers. comm. 2003). Further supporting this re-interpretation of T683a are the references made in the texts of the Temple of the Inscriptions at Palenque to various adornments of god

(pZ2a) records the first of the two *–nib'* suffixed toponyms though the logogram of that segment (i.e. the superfix) has suffered from chipping and therefore resists conclusive reading.

The second *–nib'* toponym (pY3a) (Figure 7b) is, however, fully legible as Took'nib' or "Flint Place" and is known from the inscription on a slate mirror backing discovered in Burial 49 at Topoxte (Figure 7d; Fialko 2000:144-149, Figs. 102-103), Guatemala, located 30 km west of Xunantunich. The text of that inscription is also closed by a series of three toponyms. The first (O1-Q1) is composed of three glyph blocks, with the latter (P1) having as its main sign the head variant of the so-called 'Jaguar God of the Underworld' (JGU) possibly read *chuwaaj*[9] and closed by the locative suffix *–nib'* in the third glyph block (Q1). The preceding collocation (O1) is composed of the numeral five, a florid logogram and a syllabogram superfix. Together the flower sign and its phonetic complement may be read as *yatik*,[10] which may form a rare numerical classifier or an adjectival modifier for *chuwaaj*. The whole may thus be read as *Ho'yatik Chuwaajnib'*. This particular toponym –though represented allographically– is associated with the kings of Naranjo,[11] an important site located 16 km to the west of Xunantunich. The remaining two toponyms of that inscription form part of a couplet, in which Took'nib' again occurs in second position, being preceded in that instance by Te'nib' that is "Wood Place" or "Tree Place" (Figure 7c). In light of the weathered appearance of the foregoing toponym on Panel 2 (pZ2a) the possibility that it once

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effigies in multiples of *juun winaak* (Schele & Freidel 1990:246-251; Schele & Grube 1993:2, Fig. 5). In addition, Colonial Yukatek provides us with the entry *jun k'al* for "twenty" (Barrera Vásquez 1980:367), as do Ch'ol (Aulie & Aulie 1978:22), while Itzaj has *junk'aal* and Jakaltek and Q'anjob'al have *hunk'al* (Dienhart 1997). Additionally, K'iche', Kaqchikel, Tz'utujil, Uspantek, Chuj and Achí all have *juwinaq* or *junwinaq* (Dienhart 1997), close cognates to the example at hand on Panel 2 of Xunantunich. Note also similar entries for "twenty-one" in the dictionaries.

[9] Recent research by Luis Lopes, considering pattern of phonetic complementation for this JGU logogram suggest that it may have had the value of **CHUWAJ** and read *chuwaaj*. This reading is reinforced in the case of the Topoxte mirror backing (P1) by the presence of a **ji** subfix, serving as phonetic complement, and producing a long terminal vowel. In Yukatek *chuwaj* has been understood to target "scorpion" as seen in the entry *ek' chuwaj* (Barrera Vásquez 1980:151), though Classic-period iconographic depictions of this entity are decidedly feline.

[10] The **YATIK?** value for this logogram was first suggested by Christian Prager (Boot 2003:5) based on patterns of phonetic complementation in **ya-** and **–ki** and examples of this collocation seen at Palenque. No associated gloss has been provided with this suggested reading. The collocation in question would thus be written as **5-ya-YATIK?** for *ho'yatik*.

[11] Two noteworthy examples of this *Ho' Chuwaajnib'* toponym are associated with the late Early Classic king known as *Aj Wosaaj* (Martin & Grube 2000:71-72, Grube & Martin 2004). One is found on Altar 1 (C6) as part of the nominal string of a Naranjo figure cited in a mythological event taking place in 258 BC, while another example is mentioned on an unprovenanced ceramic vessel bearing *Aj Wosaaj*'s name, titles and pedigree (K0681). The example on K0681 occurs in a syntactic context that –though significantly abbreviated– suggests that the vessel was primarily intended as the "drinking-implement for honey[-flavoured] *kakaw*" (*yu[k'i]b' kab' ka[kaw]*) originating from the "middle of the Ho' Chuwaaj place" (*ta[h]n ho' chuwa[a]j[nib']*). Here we have the same toponym as on the Topoxte mirror backing, but apparently with the possible *yatik* modifier and locative suffix suppressed, a common practice in Maya writing (Houston & Stuart 1994:14-18). Examples of the *Chuwaajnib'* toponym are also found in the titular strings of Late Classic Naranjo kings (e.g. Stela 13, Stela 21 and the verso of Altar 2; cf. Grube & Martin 2004:46-47, 129-130, 145-146). The close association between this place name and Naranjo's monarchs, both mythical and historical, implies that it may have been a toponym of great importance within, or of Naranjo itself (a point highlighted by the Jaguar God of the Underworld impersonation ceremonies represented on Naranjo monuments (e.g. Stela 30).

recorded Te'nib' cannot be readily verified though this identification seems most probable.[12] Were that the case the couplet on Panel 2 would duplicate that represented in the Topoxte text. Unlike the first toponym that is prefixed by a numeral, the second is prefixed by the logogram for **K'UH** (pZ2b). This logogram serves as an underspelling of the exalted appellative *k'uhul* ("godly" or "divine") typically reserved only for the highest-ranking monarchs, though in this instance the *ajaw* ("lord" or "king") title is not present.

The third segment is also prefixed by the appellative *k'uhul* (pY3b) though in this case it serves as the first segment of a full Emblem Glyph (hereafter EG). In addition to its prefix it also includes the superfix **AJAW** for "king" (lit. "orator" or "lord"). The main sign of the EG is the logogram **WITZ** for "mountain" and is introduced by syllabograms spelling out **ka-ta-?-tzi**.[13] The reading of the whole EG remains problematic since one syllabogram has suffered from spalling and thus eludes conclusive reading. This royal figure appears to be the most important subject in the clause, based on its incidence at the end of the text as well as associated titular components. The EG is a hitherto unknown one in the Lowland glyphic corpus. The inclusion of the term *witz*, however, prompts a connection not only of the steep-sided hill upon which the site of Xunantunich is sited, but also recalls the iconographic references made in the stucco frieze to the penultimate *Castillo* as a *witznal* or 'Mountainous Place'. The preceding term designating or modifying *witz*, however, specifies the type of mountain that is referred to by the EG and therefore will deserve further scrutiny. Taken as a whole, it seems probable that the EG cited in Panel 2 is in fact that of Xunantunich itself. The toponym included as part of the EG may thus have designated one or a combination of the following: the hill upon which Xunantunich is sited, the Castillo as a person-made emulation of a mountain, the name of the royal house seated at Xunantunich.

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[12] Nonetheless, the logogram of the first toponym (i.e. the superfix) has suffered from chipping and therefore resists conclusive reading. Its sole surviving diagnostic attribute is a central scroll, congruent with an undeciphered 'Water Scroll' logogram that is recorded in the inscriptions of the eastern Lowlands and notably at Pusilha (Stela D, C13 and E14), in southern Belize where examples are rendered with a *-nib'* suffix. Despite this possibility, Erik Boot (pers. comm. 2004) has pointed us to the pairing of "wood" (*te'*) vs. "flint" (*took'*) in the text on the unprovenienced vase K1398 that was produced in a Naranjo area workshop. There the couplet is rendered as *te'b'aah took'b'aah* (lit. "wood-head and flint-head"). The recurrent pairing of the terms *te'* and *took'* in the texts of the greater Naranjo area further suggest that *Te'nib'* was originally represented on Xunantunich Panel 2.

[13] Initially it was suggested that the whole collocation may be read as *K'uhul Katwitz Ajaw*. This interpretation seems improbable now for two reasons: first, the partly weathered syllabogram in the **ka-ta-?-tzi** sequence does not conform to the reconstructed **wi**, and second this collocation would be the only example in Maya writing in which the phonetic value of a logogram is also presented fully-syllabically as a prefix as **{wi}-tzi-WITZ**. It should be noted that the eroded syllabogram in question resembles in its remaining outlines the syllabogram **ya** or the stacked **ka** sign.

Consequently, the modifier of *witz* may originally have stood as *katkaatz* or *katyaatz*. The former reconstruction does not yield any productive translations. The latter, however, could be segmented morphologically as: kat-y-aatz. The root *kat* may stand for "clay" in Yukatek (Barrera Vásquez 1980:303), where we see in terms such as *pak' kat* for 'small jar' (Barrera Vásquez 1980:626). In the second segment we see the root *atz-* that occurs in compound expressions referring to the 'giving' and 'granting' of charity or alms as *yatz-* (Barrera Vásquez 1980:970) and as the root *atz-* in terms for 'payment' (Barrera Vásquez 1980:19). Though tentative, the whole toponymic expression *Katyaatz Witz* could thus be roughly translated literally as 'Clay-giving Mountain' and more loosely as 'Clay-bearing Mountain'.

The nominal section represented on Panel 2 is noteworthy in that no actual names are represented, only three discrete titular segments. This pattern is duplicated in the text of Pusilha's Stela D, where *–nib'* suffixed toponyms are also cited as the agents of clauses, with proper nominal segments completely suppressed. The text of Nim Li Punit's Stela 2 is also comparable in its preponderant reference to lords by titles alone. On Panel 2, the *k'uhul* prefix and its exclusive use in titular contexts make it clear that titles are indeed targeted, rather than anthroponyms. The initial *juun winaak* prefix of the first toponym is in direct substitution for the titular adjective *k'uhul* and finds no easy explanation, unless the numeral is related to the numbered titles seen elsewhere in the eastern central Lowlands, where lords are referred to variously as *28 B'aahkab'* (Machaquila), *Elk'in 28 Sak Chween* (Naranjo), *K'ale? 27 Ajaw* (Caracol), or *28 Ajawtaak* (Dos Pilas). A similar title in the set may also be represented on Nim Li Punit's Stela 2, where the 'Black Bat' title of Copan and Quirigua (Looper 1999:268; Schele & Looper 1996:125; Wanyerka 2003:36, 38, Fig. 17) appears to be prefixed by the numeral 20 (I2) without use of any nominals. Based on these patterns it seems evident that the subjects of the sentence are three unnamed agents bearing distinctive exalted titles.

In sum, the text of Panel 2 shows portions of two sentences, including most of the last sentence of the text. The first appears to have recorded a now lost event that is said to have taken place at a possibly proximate locality called *Monpan*. Following this reference, the temporal frame of the narrative shifts and culminates in a martial conflict involving a triple grouping of presumably proximate allied localities. Forming part of that alliance are *Took'nib'* and possibly *Te'nib'*. The third member of the alliance may have been the then current king of Xunantunich.

**STELA 8 (AD 820)**

Stela 8 is the first of a series of later monuments that differ in numerous respects from the forgoing panels (Figure 8). The monument was found to be part of row of four stelae and three altars erected along the southern base of Structure A-1, set symmetrically to the primary axis of thereof (Graham 1978:118, 120, 123). Part of this same grouping were the carved Stelae 1 and 9 (described below) as well as the plain Stela 10 (Figure 1). These four stelae were associated or loosely 'paired' with three altars. The carved and square Altar 1 appears to have been originally set along the primary axis of Structure A-1, between Stelae 1 and 8 (each slightly offset from the primary axis to the east and west, respectively), while a comparably-sized plain and square altar was found between Stelae 8 and 9 (Graham 1978:123, 125). Between Stelae 1 and 10 a relatively well-preserved circular masonry altar of moderate size was found. This grouping of monuments not only clusters together spatially, but also temporally dating to a short period of three decades. Notably, all these monuments postdate the panels and are all clearly public monuments, being erected in Plaza A-1, unlike the panels that were hidden from public view within palatial complexes. In addition, the monuments forming part of this latter grouping were all found in primary contexts, without noticeable signs of widespread and deliberate breakage. Consequently, the panels and the later public monuments seem to form two categorically, spatially and temporally discrete groups.

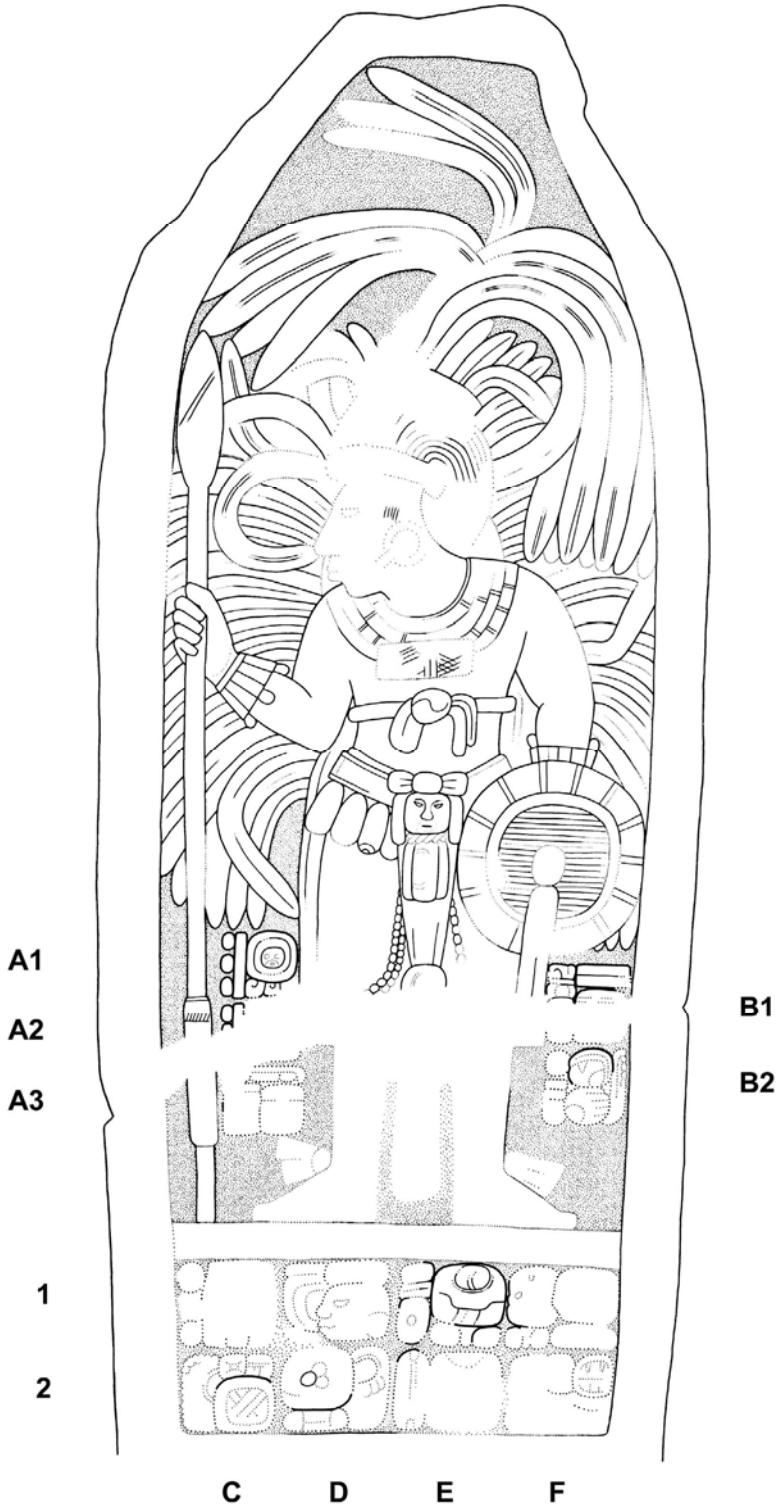


**Figure 8:** Stela 8 (AD 820). Height above lowest carving: 2.84 m. Drawing by Ian Graham (1978:2:124) with amendments made by C. Helmke (2004) based on photographs, field drawings and inspections of the original monument by C. Helmke.

The monument grouping at the southern base of Structure A-1 necessarily postdates its construction as these were erected in alignment to it. Epigraphic and archaeological evidence support this conclusion with ceramic material from the core of the structure attributed to the latter facet of the Hats' Chaak phase (AD 670-780) (Jamison & Leventhal 1997; LeCount 1996:83, 91; LeCount et al. 2002:43; Leventhal 1996:12; Yaeger 1997:46; Zeleznik 1993:54) and the dated monuments ranging between AD 820 (Stela 8) and 849 (Stela 1). Extensive stripping and deep trenching excavations revealed that the bulk of Structure A-1 was built as a single construction phase during the late Hats' Chaak with secondary additions made to the southern stair, the basal terrace and the summit platform (Zeleznik 1993). The secondary modifications may date mostly to the Tsak' phase (AD 780-890) and are contemporaneous with the principal and most intensive period of use, as is evidenced by the erection of the monuments and the high frequency of censer fragments recovered during clearing excavations (Yaeger 1997:46; Zeleznik 1993:53, 54). The monuments indicate that Structure A-1 stood as a focus of dynastic veneration or at least the setting of important dynastic ritual, although it varied from the greater Lowland Maya pattern in that it apparently did not contain the tomb of an exalted ruler (Zeleznik 1993).

Stela 8, like all Xunantunich monuments, is carved on the front only and represents a royal figure facing left, standing amidst a swirl of feathers emanating from the apparently simple headdress and the backrack that is fastened across the chest with a cloth strap. The male figure is shown holding a diminutive circular shield and a plain lance tipped by a large lanceolate chipped-stone point. Regalia embellishing the portrait include a quadruple-strand necklace, typical wristlets of tubular and spherical beads, a small central *ajaw* maskette and a row of olive shell tinklers adorning the belt assemblage. The representation of the king with his lance and shield is a direct parallel to the glyphic 'flint and shield' expression explored above as part of Panel 2. The ruler is thus shown in battle garb and glorified as a warrior for his –at least nominal– military prowess. Emphasis on increasingly military iconography is a prevalent trend in the Terminal Classic (Schele & Grube 1995), thereby offering some insight onto attitudes of the time, even though the ideal of the king as warrior finds its roots as far back as the fourth century AD.

The majority of the composition is evenly preserved on both large fragments, though the lower portion has obviously suffered more from erosion (Graham 1978:123). The upper portion is relatively well-preserved and the near complete absence of facial features therefore hints at deliberate defacement (Jason Yaeger pers. comm. 2003). This conclusion is supported by comparison to the other figurative monuments (Stelae 1 and 9) that also exhibit spalling and pecking in the facial areas. Consequently, while the stelae do not appear to have befallen the fate of the panels by being highly fragmented and scattered, they did nonetheless suffer from minor, but localized defacement, possibly as a ritual means of terminating these monuments as well as the prowess of the rulers these depicted. As it is improbable that these disfigurements took place during the reign of the figures portrayed, it seems more likely that these were executed towards the end or subsequent to the rule of these lords, late in the Tsak' phase.

Like much of Xunantunich's monuments, Stela 8 has received comparatively little attention in large part due to the eroded condition of its glyphic inscription. Nonetheless, the presence of what has been referred to as a "possible Naranjo Emblem Glyph" has

stirred debate as to the socio-political status and role of Xunantunich vis-à-vis its larger neighbour to the west (Ashmore 1998:173; Houston et al. 1992:506-507; Leventhal 1996:10; Martin & Grube 2000:83; Grube 2000:210-211; LeCount et al. 2002:43). Detailed re-examination of the monument has allowed a re-drawing of its text, which considered in light of the current state of decipherment, reveals important historic details. In particular it may be said with added confidence that the Naranjo EG is indeed represented.

The text is initiated by a CR date of which the day sign (A1) clearly exhibits a coefficient of 8, though its main sign is simplified and partly eroded. The faint traces that remain of the Tzolkin main sign are, however, entirely consistent with an **AJAW** logogram (LeCount et al. 2002:55). While nearly obliterated by a large break, the following month sign (A2) also appears to have borne a value of 8, assuming that it once was of the same size as that of the foregoing day sign. A Haab coefficient of 8 has the advantage of fulfilling the value conditioned by a foregoing Ajaw in a standard Type III year-bearer system (MacLeod & Stone 1995:158-163; Proskouriakoff & Thompson 1947; Satterthwaite 1965; Thompson 1950:124-128). Greatly assisting the placement of the CR date into its corresponding LC station is a so-called "lahuntun" collocation (B1), indicating that the date falls on a period-ending in which the "tun"[14] has a coefficient of 10 (i.e. "lahun" or **lajuun*). Review of cycle 9 'lahuntun' period-ending dates for 8 Ajaw 8 ? yields six possible matches. Of these all but one fall within the span of the sixth century AD, a range that is improbable considering the sculptural style of the monument as well as its archaeological context at the foot of the Hats' Chaak period Structure A-1 (Zeleznik 1993). Consequently, the date 8 Ajaw 8 Xul 9.19.10.0.0 (May AD 820 using the GMT correlation) emerges as the secure anchor for the CR date.

Typically between the CR date and so-called "tun-ending" collocations[15] (B1) reference is made to a period-ending verbal expression. Broadly contemporary inscriptions of Nakum (Stela C at E1) and Naranjo (Stela 19 at B2; Stela 21 at E10b) provide examples of the two verbal expressions that occur in precisely the same syntactic position, namely: *uk'altuun* (lit. "the stone-binding of") or *uchokow ch'aaj* (lit. "the scattering of drops") (Stuart 1996; Grube & Schele 1995). These expressions refer to the preferred ritual acts performed at important period-endings such as the one commemorated on Xunantunich's Stela 8. As *uk'altuun* is clearly represented in the text of Stela 8 at B2 after the **tu-10-HAB'** collocation (B1), the eroded expression at A3 must have recorded *uchokow ch'aaj*. Detailed examination of the collocation at A3 reveals that the expression was indeed prefixed by <u> with the remaining eroded outlines being reasonably consistent with the **CHOK** syllabogram of *uchokow ch'aaj* expressions (though apparently underspelled as **u-CHOK-ch'a** or rendered fully as **u-CHOK-**

[14] What is here referred to as "tun" is the term employed by early epigraphers basing their terminology on Colonial period Yukatekan documents. Recent epigraphic research has demonstrated that the Classic Maya antecedent recorded in the inscriptions was in fact **haab'* (Stuart et al. 1999), written as the logogram **HAB'** or sometimes with an infixed phonetic complement as **HAB'[b'i]**.

[15] So-called "tun-ending" collocations include "hotun" and "lahuntun" and are usually written as **tu-#-HAB'** in which the hash variously marks the value of 5, 10 or 15 (Thompson 1950:190-193, Fig. 32.36-32.55). The **HAB'** main sign is the Classic period equivalent of the sign known to early epigraphers as "tun" based on Yukatek Colonial sources. The foregoing **tu** syllabogram is the contraction of the preposition <ti> and the third person singular ergative or Set A pronoun <u> as **ti-u > tu*.

**CH'AJ**). The initial calendrical sub-clause (A1-B2) thus records that both a 'drop-scattering' and 'stone-binding' took place on the period-ending of 9.19.10.0.0.

The agent of the 'stone-binding' follows (C1-C2) and is directly linked to the verbal expression by its third person singular ergative prefix. The clearest element of this individual's nomino-titular segment is the EG of Naranjo (C2), probably read as *k'uhul saal ajaw* (Grube & MacLeod 1989; Martin & Grube 2000:69; Grube 2000). The syntax of the clause thus relates that the period-ending rituals are literally those *of* the Naranjo individual, indicating that he is the one who claims credit for officiating these in person. In the absence of a toponymic referent it seems probable that the events recorded on the monument took place locally at Xunantunich. The name of this individual (C1-D1) is considerably eroded, but bears some similarity to that of the last known ruler of the Naranjo dynasty, namely Waxaklajuun Ub'ah K'awil (Martin & Grube 2000:83). Graphic aspects that support the identification of this agent as the last Naranjo king are the two remaining disks at C1 that may have formed part of the numeral 8, while the weathered logogram at D1 appears to represent an anthropomorphic head (possibly read *b'aah* in this case) from which emanate the fire scrolls that are characteristic of the supernatural figure known as K'awil (God K). In addition, Stela 8 is contemporaneous to Naranjo's last monument, Stela 32, the sole surviving monument of Waxaklajuun Ub'ah K'awil's rule at Naranjo and it bears mentioning that the 15 km that separate Naranjo from Xunantunich could have been covered in a single day. Stela 32 was erected to commemorate the 9.19.10.0.0 period-ending of AD 820. Records for this Naranjo king span between AD 814 (his accession) and May AD 820 at which point he is said to celebrate the coincident period-ending by a 'stone binding' ritual, which now appears to have been celebrated at Xunantunich. After AD 820 Waxaklajuun Ub'ah K'awil disappears from the inscriptions.

The Naranjo EG closes the calendrical clause and another is opened at D2 by a verbal expression. The verb in question is written **AK'-ta-ja** for *ak'taj*, or "danced" (Grube 1992; Boot 2002:16, 33, 88, 115). All the major diagnostic attributes for each glyphic sign were recorded in the original drawing (Graham 1978:124), but the re-drawing reveals additional attributes that render this interpretation secure. As in other examples of this expression the preposition *ti* follows the dancing verb, usually marking the specific type of implement *with* which a ruler is said to have performed a dance (cf. Grube 1992; Figure 9). At E1 the collocation is indeed preceded by the preposition, but the fully legible glyph that follows (**OL-la** or *ohl* for "heart" see Boot 2002:63, 100, 124; Lacadena & Wichmann 2004:161) does not readily match known dancing implements documented in other Classic texts (Grube 1992; Kettunen et al. 2002).

Syntax and the number of glyph blocks remaining in the text from that point forward suggest that the nominal segment of the local individual who performed the dance closes the clause (Grube 1992).[16] Unfortunately little else remains of the second agent's name or titles save the outlines of three discrete collocations (F1-E2). In the

[16] The caption to the northwest jamb of Structure 18 at Copan, which depicts a dancing male figure (Baudez 1992:Fig. 95a), is written as: **u-B'AH / ti-AK' / ti-ka-se** perhaps yielding *ub'aah ti-ak'taj ti-kase'w* (Figure 9), which provides a basis for an interesting alternative. The function of the syllabogram **ti** in the dancing expressions typically relates the type of implement *with* which the dance was performed. Here, however, it may serve the function of a locative and mark the dance as taking place on the day known as *Kase'w*. If the same holds true for Xunantunich Stela 8, then it may relate that the dance took place on the day named *Ohl*, perhaps a referent to the day known as Kumk'u in later periods.

position where one would expect an EG (F2) all that remains is the so-called "Ben" glyphic element forming part of the common bipartite **AJAW** superfix (Lounsbury 1973; Mathews 1991). This attribute therefore indicates that an EG was indeed originally present, but on account of poor preservation it cannot be confirmed if it recorded the presumed Xunantunich EG represented on Panel 2.

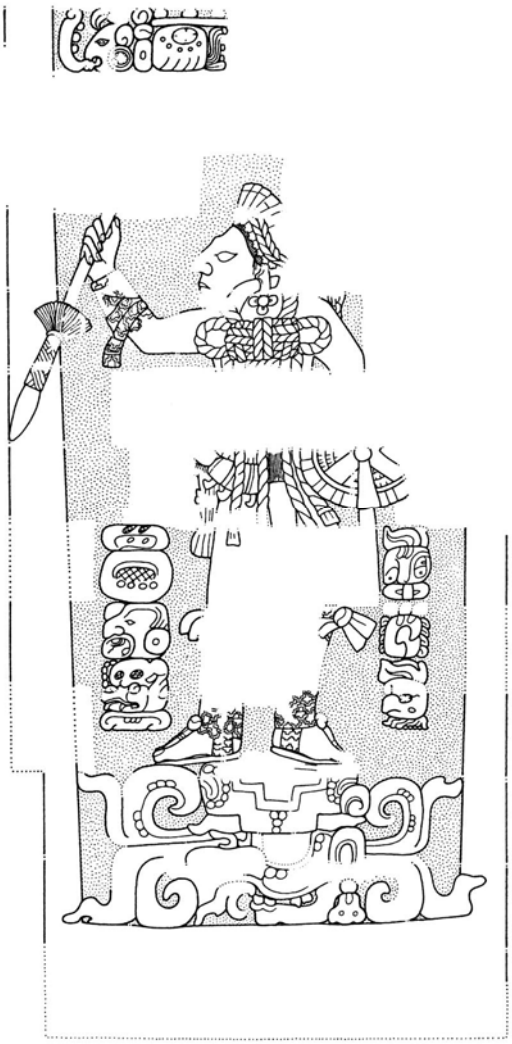

**Figure 9:** Drawing of one of piers from Str. 10L-18 at Copan, showing Yax Pahsaj performing a martial dance. Drawing by Barbara Fash in Baudez (1992: Fig.95b).

Glyphic references to particular dances are frequently accompanied by iconographic representations thereof (Grube 1992). The iconography of Stela 8 is comparable in several respects to scenes depicting Copan's king Yax Pahsaj performing some sort of martial dance (Figure 9), though unfortunately the accompanying glyphic texts there are not sufficiently preserved thereby disabling secure identification of the type of dance in question (Grube 1992; Baudez 1992: Fig.95b). Nonetheless, it seems possible that the same type of dance was originally performed at Xunantunich as part of the period-ending celebrations.

## STELA 9 (AD 830)

Like Stela 8, Stela 9 was found to be part of the grouping of monuments to the south of Structure A-1 (Figure 10). It too was found in primary context and is the least fragmented of the site's monuments, exhibiting only breakage of the two upper corners (Graham 1978:125). Nonetheless, Stela 9 also displays the defacement apparent on Stela 8, with the face of the royal figure completely pecked off. This monument shares a great deal of Stela 8's iconography and overall composition as well. The majority of the glyphic text, for example, is arranged in a similar manner to Stela 8, with the notable exception of small captions inscribed into the frame. The posture and regalia worn by the protagonist are also nearly identical, with minor exceptions, including an apparently different headdress and the substitution of a K'awil or so-called "Manikin sceptre" (Spinden 1913:50-53; Schele & Miller 1986:49; Miller &

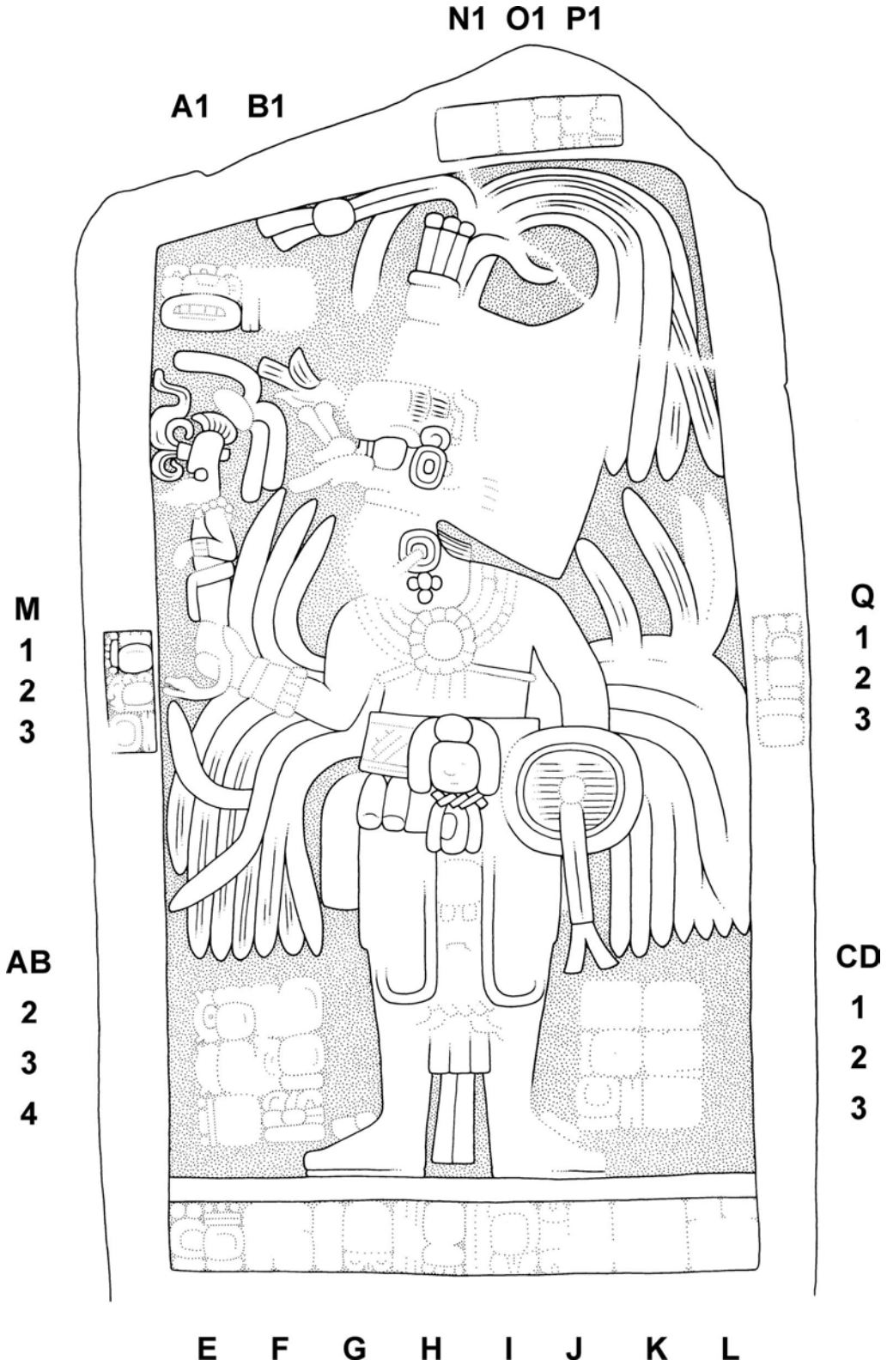


**Figure 10:** Stela 9 (AD 830). Height above lowest carving: 2.20 m. Drawing by Eric Von Euw (Graham 1978:2:125) with minor amendments by Christophe Helmke based on photographs, field drawings and inspections of the original by C. Helmke.

Taube 1993:110) for the spear or lance. The headdress of Stela 8 is all but effaced and therefore cannot be adequately compared to that of Stela 9. The latter's headdress incorporates a prognathic and jawless zoomorphic skull, topped by a bundle-like element and a sipping hummingbird at its front. These exceptions aside, the iconography, regalia portrayed and relief of the carving are so comparable as to suggest that these two monuments may not only have been produced by the same (group of) sculptor(s), but may also represent the same ruler. This conclusion may in fact be supported by the glyphic captions (a point discussed below). The representation of the ruler with the same small circular shield suggests that the iconography is still meant to convey the martial overtones that were explicit in the foregoing monument. Nonetheless, the representation of a K'awil sceptre rather than a lance suggests that added emphasis was placed on representing the royal figure as both regent and warrior.

Of Xunantunich's monuments, Stela 9 is probably the one that has suffered the most erosion. The attrition that affects the entirety of the monument is spread evenly across its surface with no section being better-preserved and thus more discernable or legible than any another. This weathering is all the more regrettable since the text of Stela 9 is the longest known inscription at Xunantunich. Despite the severity of the erosion the outlines of many glyphic elements have preserved and due to the highly formulaic structure of calendrical statements much of these sections can be reconstructed.

The text is initiated by an Initial Series Introductory Glyph (ISIG) (A1) and followed by the sole Long Count statement recorded in the corpus of Xunantunich. The Long Count (B1-B3) is clearly stated as being 10.0.0.0.0, which corresponds to the CR date of 7 Ajaw 18 Sip, or March AD 830 (using the GMT correlation).[17] The coefficient of the Day Sign is preserved (A4) though the projected accompanying **AJAW** logogram is completely effaced. The Secondary Series is initiated by a conflation of Glyphs G and F. Glyph F appears to serve as a title read *ti'hu'un* for the foregoing Glyph G or "Lords of the Night" series (Cases Martín 2001; Gronemeyer 2003; Schele et al. 1992). The expected 'Lord of the Night' is the undeciphered glyph G9, which must have been reduced to a partially darkened *k'in* sign[18] infixed into the middle of the Glyph F collocation. While most of the secondary series has weathered away (C1-D2), the end of that section is indicated by the final glyph 10A (C3). The four remaining glyph blocks of the secondary series match the expected number of intervening collocations between Glyph F and A. The projected reconstruction of this whole segment is as follows: Glyph 13D (C1), Glyph 2sC (D1), Glyph X2 (C2) and Glyph B (D2) (Juan Ignacio Cases pers. comm. 2004). The secondary series would thus have specified that on the date recorded 13 days had elapsed since the 'arrival' of the moon (Glyphs E and D), that the lunar phase was in its second semester in a count of 18 months (Glyph C), that the moon's youth name (Glyph C) was *Ux K'uh ? Witz* (Glyph X) and that the current lunation was

[17] Incidentally, this Long Count date confirms the chronological proximity of Morley's LC placement of the CR date of Stela 1. Coupled with stylistic and archaeological data this LC date provides a secure Terminal Classic Tsak' phase anchor for all the stelae of Xunantunich.

[18] Glyph G9 of the 'Lord of the Night' series is typically represented by an aged human head (comparable to God N or the head variant of number 5) wearing a headdress composed of a partially darkened **K'IN** sign infixed into a **yi** syllabogram (Thompson 1950:Fig. 34). Frequently the collocation has a possible **cha** sign as a superfix (ibid.). Occurring without a superfix the conflated sign forms part of the name of the 27th Tikal Ruler known as Ruler B, in which context the reading of *yik'in* has been suggested (Martin & Grube 2000:48).

considered to bear 29 days (Glyph A) (Juan Ignacio Cases pers. comm. 2004; cf. Cases Martín 2001). The whole secondary series would have been closed by the Month Sign 18 Sip (D3), though traces of which no longer remain.

Classic Maya syntax and ancient scribal practices prescribe that a verb should follow a date, as seen in the preceding examples, above. Such a verb marks the event that is said to take place on a foregoing date. Here, however, the text continues with two eroded collocations, one prefixed by the numeral 2 and the other by 13 (E1a and E1b). The presence of numerals accompanying two successive collocations in a calendrical context suggests that these may have formed part of a distance number expression in which at least 2 'days' and 13 'months' of twenty days elapsed between the initial LC date and an ulterior event ultimately marked by a verbal expression. Typically, distance number expressions are closed by a CR date that also marks the start of a new clause. In the continuation of the text a CR indeed seems to appear, though little but the main sign **SIHOM** (I1) of one of the colour months (i.e. Ch'en, Yax, Sak, or Kej) remains. The intervening glyphs at F1 and G1 may have recorded an additional 'year' coefficient for the distance number and a concluding verbal expression such as *uhtiiy* ("happened ago") or *uhto'm* ("will happen"), respectively (see Wald 2000). Unfortunately, the text is too eroded in this section to propose a conclusive distance number and the calendar round date to which it leads. Nonetheless, the CR date that opens the clause proper appears to be the focus of the monument's narrative as the previous portion of the text solely conveyed calendrical information establishing the temporal setting of the event. It is again unfortunate that the monument is too eroded to properly discern the verb (J1) as well as the name (K1) and title (L1) of the subject of the action.

In addition to the main text, Stela 9 also exhibits three small subsidiary glyph panels along the otherwise plain border of the monument. These small panels may have formed part of a continuous clause serving as a caption to the scene represented. If the subsidiary text did serve as a caption, it would make reference to the royal protagonist represented and may have recorded the type of event that he was commemorating. Due to their diminutive size the glyphs of the subsidiary text few legible elements remain. Nonetheless, amidst the first few glyph blocks two (P1a and P1b) appear to duplicate collocations represented on Stela 8 (F1a and F1b). While these remain illegible on account of erosion, remaining outlines of the main signs, their respective subfixes and surviving internal details are all intimately comparable, suggesting that these two segments represent parallel segments. Were the subsidiary text on Stela 9 to represent a caption –as seems probable– the text would have been initiated by *ub'aah* or "[it is] the image/self of" at N1 (Houston & Stuart 1996). The ensuing collocation at M1 is comparable in all respects to the corresponding collocation on Stela 8 (E2). Consequently it seems probable that both Stelae 8 and 9 cite the name of the same king, though the latter monument renders his name more fully or credits him with a longer titular string (based on the total number of glyph blocks). The connection between Stela 8 and 9 is made all the more likely considering the little time that separates both dedications, which remains well within the biologically possible range of a human being (Grube 2005). As on Stela 8, here we also see the outlines of an EG, thereby indicating that the local lord continues to claims the exalted divine royal title.

**STELA 1 (AD 849)**

Found erected at the base of Structure A-1 near its primary axis, Stela 1 (Figure 11) forms part of the same monument grouping to which Stelae 8 and 9 belong. It is the first monument discovered at Xunantunich, reported by Sir Alfred Malony, during his tenure as Governor of then British Honduras in 1891 (Morley 1938:204). Due to the longevity of its exposure the carved face of the monument has suffered considerably from erosion and exfoliation apparently brought about by contact with swidden fires (Gann 1925:63; Maler 1908:79; Morley 1938:209). This deterioration is all the more lamentable since the well-preserved background illustrates the fine details that the monument once exhibited. Like Stela 8 this monument was found in situ with the largest upper portion having broken off the butt, apparently during structural collapse. Along the break, the basal portion broke into a number of smaller fragments though most of which have not been recorded or recovered (Gann 1925:63; Graham 1978:121). Early excavations around the butt revealed a sub-stela cache of three or four chert eccentric lithics (Gann 1925: 66; Morley 1938:211), comparable to the dedicatory cache recovered from the core of the terminal phase summit platform of Structure A-1 (Gann 1894-1895; Morley 1938:210-211; Zeleznik 1993:31). The possible equivalence between both of these caches suggests that these may have been deposited concurrently, with the erection of Stela 1 marking the completion of a secondary refurbishment of Structure A-1's summit.

Like all foregoing stelae the absence facial features of the regal figure, suggest that these were deliberately defaced. The iconography of this monument shares several aspects of the foregoing Stela 9 including most notably the headdress, with the same sipping hummingbird at the front of the bundled element atop the zoomorphic skull described above. In fact the two headdresses are intimately comparable thereby suggesting that they are one and the same. The figure is also shown in the same posture holding a K'awil sceptre and a small circular shield. Too little remains of the shield, however, to gauge whether it is the same as that represented on Stelae 8 and 9. Early references to it relate that the outlines of a "grotesque face" remained visible at the time (Morley 1938:210) suggesting that the typical Jaguar God of the Underworld was once depicted thereupon (cf. Schele & Miller 1986:50, Fig.35).

Despite the continuities implied by repetitive iconographic elements, Stela 1 does differ from preceding monuments in several respects. First, the monument is the sole one even loosely paired with a carved altar (i.e. Altar 1) and the text on the stela itself is the shortest documented at the site. Both of these aspects may in fact be related if Altar 1 forms the continuation of the stela's text (as is sometimes observed at other sites). Second, the style of the carving and the great depth of relief are also at variance with foregoing monuments. Third, this stela breaks from earlier formats in terms of the disposition of its text and the replacement of the textual basal register with a bound and prostrate captive upon which the ruler is shown standing. While the captive and the shield alone are indicative of martial conflict with its neighbours, the text does not specifically relate such an event. The continuity in martial iconography between all stelae, however, is a typical feature of the Terminal Classic political rhetoric.

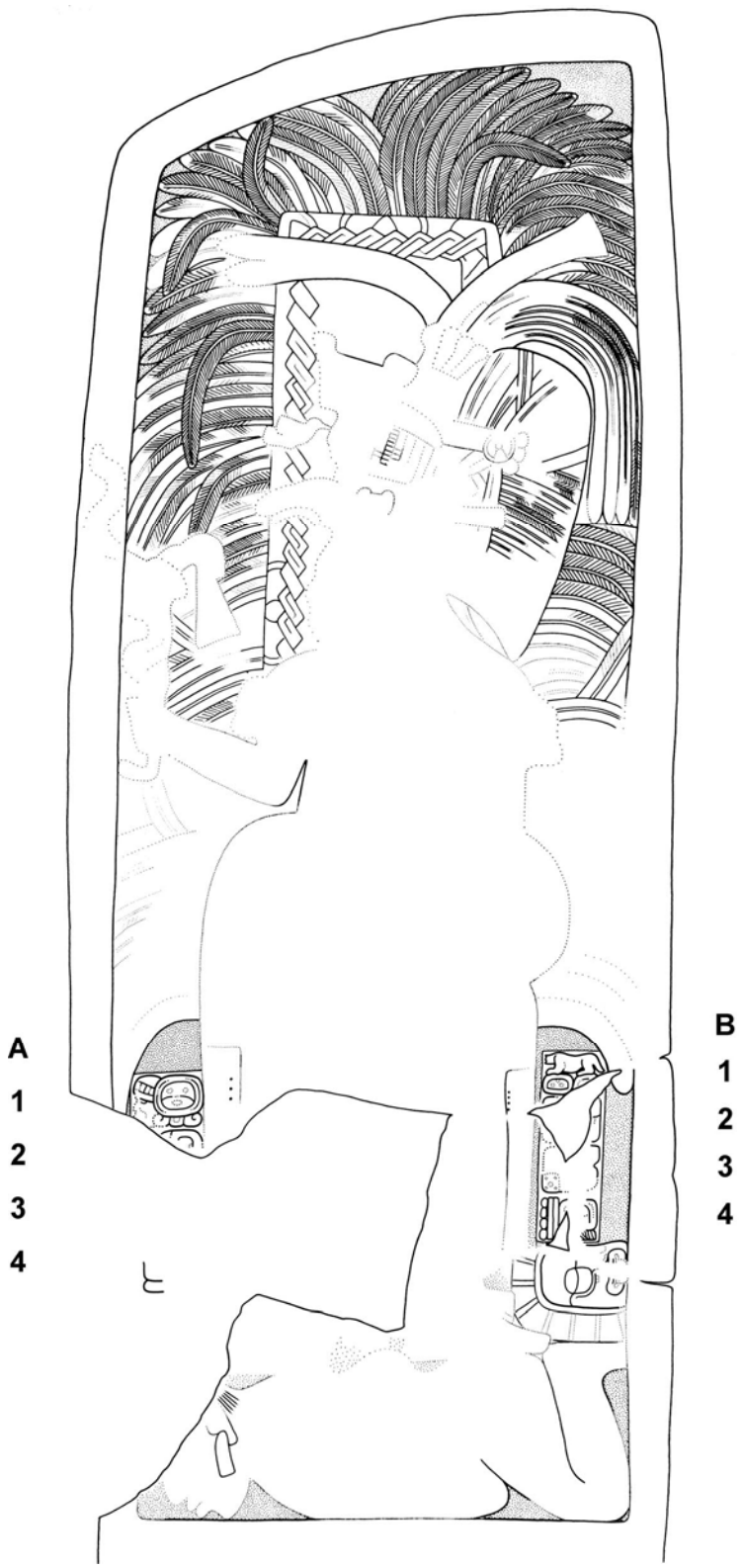


**Figure 11:** Stela 1 (AD 849). Height above lowest carving: 3.10 m. Drawing by Ian Graham (1978:2:122) with amendments by C. Helmke based on photographs, field drawings and inspection of the original by C. Helmke as well as an early sketch of the text by Morley (for glyph block A4).

The short text on this monument begins with a calendar round date in which the Tzolkin or 'day' sign is an eroded **AJAW** (A1), preceded by the head variant of the numeral **HO'** for "five". The Haab or 'month' sign (A2) has suffered from fracturing and erosion, but the preserved part represented –the **K'AN** logogram infixed into the eye of a parakeet main sign of vocalic value **a** (T743)– is consistent with the main sign for *k'anasiiy*, otherwise known by its Colonial Yukatek name K'ayab'. Based on these parameters Morley (1938:209-210) suggested that the CR represented the date 5 Ajaw 3 K'ayab', anchored into the LC at 10.1.0.0.0, or November AD 849 (using a GMT correlation). The anchor provided for the 5 Ajaw ? K'ayab' date has the advantage of being the most 'even' period ending for the entirety of Baktun 9 and 10. The event or verbal expression that took place on that date (A3) was once represented on a fragment that has not been recovered and thus remains unknown. The association of the date to a period ending, however, makes it probable that the event recorded a ritual period-ending verbal expression (as in the case of the foregoing Stela 8).

The next legible segment of the text appears at the top of the second column (B1) and has as its main sign a rare logogram representing a 'decapitated jaguar' (T832). The suffix to this main sign is composed of two somewhat eroded circular elements. Despite the rarity of the T832 in the glyphic corpus we are fortunate to have another eight examples: at Palenque (Tablet of the Temple of the Sun), Yaxchilan (Stela 18 at B2 and Lintel 47 at D3), Tikal (Stela 3 at D3), Ek Balam (Miscellaneous Text 7, from Tomb 1) and on three unprovenanced ceramic vases (K0531, K5062 and Schele 1985: Fig.3) (Figure 12). Examination of the well-preserved examples indicates that a compound of the **la** and **yu** syllabograms (written **[la]yu**) most frequently subfixes the T832 logogram. Together these phonetic complements indicate that the collocation possibly ends in *-laay* or *-la'y*. Search for matching entries yields *b'olay* (Grube & Nahm 1994:688), **b'o'lay* (Kaufman & Norman 1984:117), as well as its cognate *b'oley*. In turn, these terms find support in the fully syllabic substitutions **b'o-la-yi** (Boot 2002:20). The modern and Colonial glosses for this term refer to a class of predatory animals in which felines are named either *k'an b'o'lay* or *chak b'olay*[19] in accord with iconographic aspects of T832.[20]

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[19] Yukatek: ***b'olay***: "nombre genérico a todo animal bravo y que mata; jaguar, gato montés, bestia, fiera" (Barrera Vásquez 1980:62). ***k'an b'olay***: "yellow b'o'lay" <*c'^n bo'lay*> in Ch'ol for "yellow spotted, large jaguar" (Aulie & Aulie 1878:13, 23); also *q'an bolay* and *q'an boláy* both in Ixil for "puma" (Sapper 1907). ***k'am b'olay***: "red b'olay" <*q'am bolay*> in Ch'ol for "coyote"; note cognate *q'amboley* in Ch'ol also for "coyote" (Dienhart 1997). ***chak b'olay***: "red b'olay", <*chak bola'ay*> in Yukatek for "jaguar, tigre" (Bastarrachea et al. 2003). ***ik' b'olay***: "black b'olay", <*ic' bo'lay*> for "ocelot" in Ch'ol (Aulie & Aulie 1978:45), <*7ik' b'olay*> in Q'eqchi' of Cahabón for "viper, víbora" (Kaufman 2003:499). ***b'ole b'aalam***: "b'ole[y] jaguar" <*b'ole b'aalàm*> in Ch'ol for "ethnospecies, a kind of jaguar" (Sapper 1897; Attanasi 1973). Note also the reconstructed entry for Proto-Cholan **b'o'lay* (Kaufman & Norman 1984:117) as well as *Tabolay*: "Where the best of prey is" (Scholes & Roys 1948:389). The latter is the name of sixteenth century Chontal 'pueblo' in the Acalan area of Campeche. Based on all these entries it seems clear that *b'olay* and other reflexes (*b'oley, b'oláy, b'o'lay, b'o'la'ay*) do not refer specifically to a particular animal or ethnospecies, but to a broader class of predatory animals, which are differentiated by an assortment of modifying prefixes.

[20] Since the syllabic suffixes are consistently represented, the T832 logographic main sign probably does not include the phonetic value provided by the complements. Based on this attribute and the prefixation of a syllabic **to-** in one example (Schele 1985: Fig. 3) the value of T832 is probably **B'OL**. The whole collocation would thus be spelled **B'OL-[la]yu** yielding *b'olaay* or *b'ola'y*.

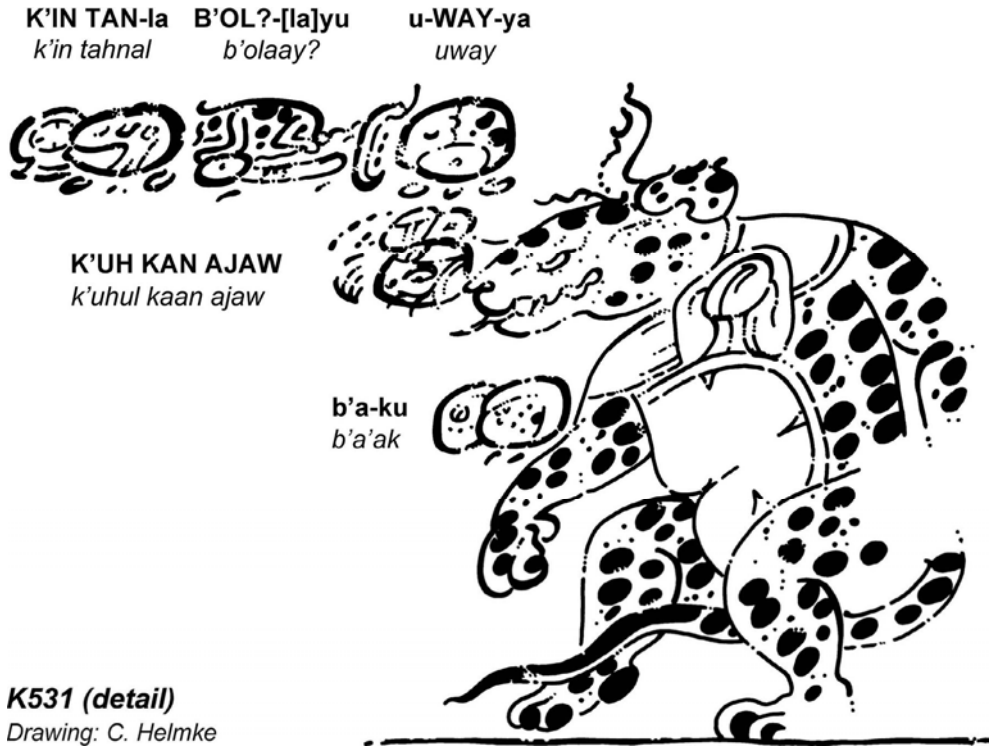


**Figure 12:** Example of K'in Tahnal B'olaay, the spirit companion to a royal 'youth' bearing the Snake Emblem Glyph associated with Calakmul. Note the *k'in* sign for "sun" on the chest of the spotted feline. Drawing based on a roll-out photograph of unprovenienced Codex-style vessel K0531 © Justin Kerr.

In addition, a collocation variously written as **K'IN-(ni)-TAN-na-(la)** and reading *k'in ta[h]nal* also frequently precedes examples of the collocation including T832, indicating that the two form integral parts of a glyphic sequence. Based on a representation on the Codex Style vessel K0531 it is clear that the glyphic sequence names a supernatural *way* figure (i.e. a spirit companion, co-essence, or *nagual*; cf. Grube & Nahm 1994:687-688; Houston & Stuart 1989; Martin & Grube 2000:81). This *way* figure is depicted as a jaguar with human gait, in a dance-like pose that has a large circular "sun" logogram (**K'IN**) embedded into its chest, in exact accordance with its name since *K'in Tahnal* may be translated as "Sun-Chested" (Grube & Nahm 1994:687).[21] References made to this supernatural figure in the glyphic inscriptions inform us that it was one of the manifestations of the Jaguar God of the Underworld, who is said to be born in 2586 BC (i.e. 1.6.14.11.2 – 1 *ik'* 10 *kase'w*). In addition, this creature was one of the spirit companions of a royal youth from Calakmul and occasionally played a part in the accession ceremonies of kings. On Stela 1 of Xunantunich the *K'in Tahnal* collocation would have occurred at A4 and it is noteworthy that an early sketch of the now lost fragment in question (Morley 1938:210) is entirely

[21] The root **tahn* for "chest" is based on the following entries: Ch'ol *tajn* 'chest, pecho' (Josserand & Hopkins 1988; Lacadena & Wichmann 2004:155), the Itzaj *taan* 'frente del cuerpo' (Hofling & Tesucún 1997:584; Lacadena & Wichmann 2002:155), the Yukatek *tan* 'pecho de hombre o mujer' (Barrera Vásquez 1980:769), and the Proto-Cholan **tahn* "chest" (Kaufman & Norman 1984:131).

consistent with the expected **K'IN-ni** glyphs. Consequently, it seems highly probable that the entire name of this supernatural *way* was also represented on Stela 1 (A3-B1).

Of the following two collocations (A2-A3) little else remains but their outlines. The penultimate collocation, nonetheless clearly includes an infixed **b'i** syllabogram, possibly serving as the instrumental suffix to the collocation of which it is a part. The main sign of the last collocation of the second column (A4), while suffering from breakage is clearly prefixed by the numeral 14 (*chanlajuun*) and based on detailed examination may have had the syllabogram **ni** as its subfix. Based on these parameters and remaining outlines, it is possible that the main sign represented a **K'IN** ("sun" or "day") logogram. A quick review of the Altar's text reveals that it is initiated by a CR date (see below). While it is tempting to view the Stela's last collocation as forming part of a distance number linking the texts of both monuments, the remains of the CR on the altar and a distance number including 14 days on the stela cannot be reconciled. Consequently an alternative, non-calendrical explanation must be sought in which the presumed *14 k'in* expression must somehow form as part of a referent to the foregoing *K'in Tahnal B'olaay* figure. Since the altar's text is initiated by an apparently unrelated CR date, the text on Stela 1 must therefore form a complete and syntactically coherent clause. Fragmentation and erosion of the Stela's latter three glyph blocks, however, renders identification of the sentence's syntax difficult.

As the text appears to relate that a new ruler was in place at Xunantunich by AD 849, the possible equivalence between the special deposit at the summit of Structure A-1 and the sub-stela cache of Stela 1 (as referred to above) may indicate that they were deposited concurrently. The apparent contemporaneity of these special deposits suggest that these are the result of construction activities initiated by a ruler who immediately sought to architecturally refurbish Structure A-1 in anticipation to the important period-ending celebrations, at which point he is shown wearing the headdress of his predecessor.

**ALTAR 1 (AD 849)**

Apparently paired with Stela 1, the Altar 1 (Figure 13) shares much the same context as the stela as well as its association with Structure A-1 and the grouping of monuments in the immediate vicinity. This altar has suffered from erosion and the destructive intervention of human agents with the unfortunate and ultimate result of its near-complete destruction. Prior to its discovery in 1905 by Maler (1908:78, 79) the upper left and lower right hand corners were already broken off suggesting that this breakage took place in antiquity. Then, in 1924, Gann had the whole altar removed and trimmed for shipment to the British Museum (Gann 1925:89-91; Graham 1978:127; Morley 1938:205, 211). In the process, the glyphic segment was completely cleaved off to facilitate shipment (Graham 1978:127). The only record of this monument's text remains the silverprint secured by Maler (1908: Plate 2; Gann 1925:p.64). The sole illustration published to date is based on that silverprint and remains conservative in the rendition of its textual details (Graham 1978:127). In 1994, however, during the course of XAP excavations the fragment of the upper left hand corner came to light in operations focused on the base of Structure A-3 (Jamison & Wolff 1994:38). The archaeological context of the fragment, amidst collapse debris 'partly up the base of the structure' further

suggests that it was partially broken and scattered in antiquity (Jason Yaeger pers. comm. 2004; Jamison & Wolff 1994:38). Discovery of this well-preserved fragment and its secure attribution to Altar 1[22] allows assessment of the amount of detail that the text of this monument originally bore, as well as clarifying the syntax and content of the text.

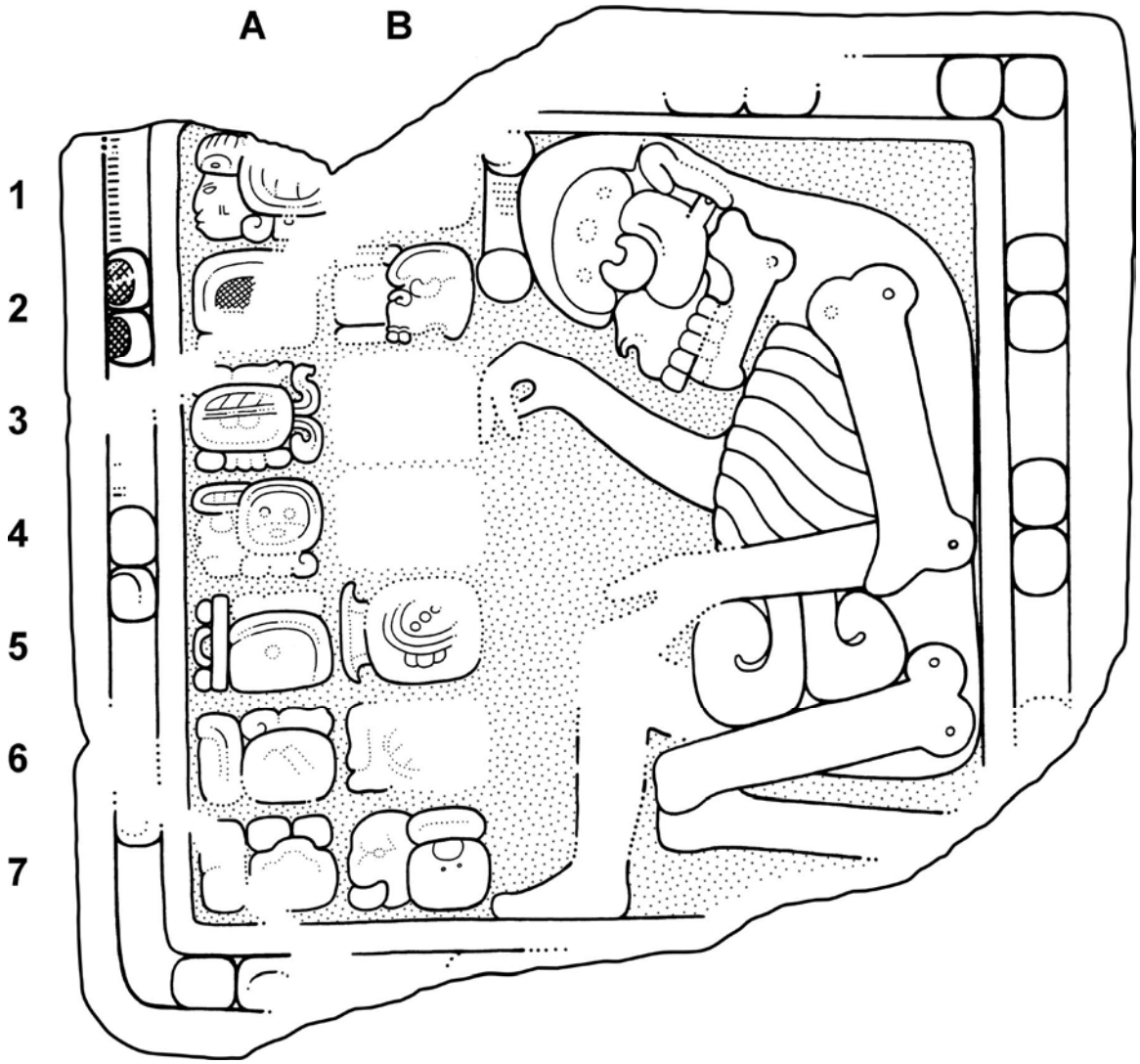


**Figure 13:** Altar 1 (AD 849). Maximum preserved width: 0.70 m. Drawing by C. Helmke based on a photograph by Teobert Maler, a drawing by Ian Graham, as well as photographs and field drawings of the upper left fragment discovered as part of XAP investigations.

Altar 1 is dominated by a crouched skeletal figure associated with a double column of glyphs arranged in seven rows. Apart from references to an "unusual" and

[22] Attribution of the fragment to Altar 1 is based on the identical composition of the decorative frame, the size (width and height) of the glyph blocks and the overall thickness of the fragment measured at 23 cm, which corresponds well to the 22 cm recorded by Graham (Graham 1978:127).

'mournful skeleton' (Maler 1908:79; Morley 1938:211) the iconography has been only superficially treated in the literature and no satisfactory explanation of its text or its image have been offered to date. The skeletal figure represented on Altar 1 exhibits all the major diagnostic attributes of the supernatural figure known from the Late Postclassic codices as God A (Schellhas 1897, 1904). The frail and de-fleshed skeleton with its grinning skull is typical of Classic and Postclassic examples of this supernatural figure (Taube 1992: 11-17; Miller & Taube 1993:146). The example on Altar 1 is depicted wearing a small headdress or ruff of "death eyes" (Beyer 1937:151-152; Coe 1973:16; Taube 1992:11-13), which in other representations is more typically shown worn as a necklace known as a "collar of death eyes". The scrolls emanating from the partly swollen and apparently putrid ribcage have been understood as "outpouring swirls of blood or rotting matter" (Taube 1992:11). With advances made in the field of iconography the figurative panel is now better described, though the tantalizing link suggested between the text and the imagery first pointed out by Morley (1938:211) still requires elucidation. Fortunately, enough of the text remains to finally provide an explanation.

The text of Altar 1 is composed of two clauses each introduced by a CR date. The text starts off with the first CR date (A1-B1) in which the Haab half is completely effaced. The Tzolkin portion represented (on the XAP fragment) has fared considerably better and clearly represents the head variant **CHA'** for "two". Though the day sign is considerably eroded it may have recoded either K'an or B'en as it conforms most closely to these Tzolkin day signs. Nonetheless, on account of the weathered remains of the CR no secure identification or temporal placement can be provided.

Following the date, the verbal expression (A2) is initiated by the syllabogram **pa** though the other glyphic elements of this collocation have spalled off completely. The patient is recorded in the following glyph block (B2) and has as its main sign the logogram **JOL** for *jool* "skull" or "head"[23] (Martin 1997:860, n. 15; Boot 2002:34; cf. Lacadena & Wichmann 2004:144). The foregoing signs of the same collocation are consistent with **u-b'a-ki** as rendered on Maler's silverprint. Taken as a whole this expression finds close analogues in the inscriptions of Naranjo's Stela 23 (F18-F19) and Tikal's Altar 5 (A26 & yA1) (Grube 2000:259, 260; Grube & Schele 1994). Based on these parallel clauses the complete expression can be read as *pahsaj ub'aak ujool*, or literally "exhumed were the bones and the skull" in which the 'bones and skull' couplet is a greater Lowland Maya trope for "skeleton" (Lacadena in press; Hull 2003). The subject of the clause follows and records the name of the individual whose skeleton was exhumed. In this case the name is written in two glyph blocks (A3-B3), of which the second has completely splintered off. What remains of the name reads *chanal k'a[h]k'* ("Celestial Fire"). Anthroponyms including the adjectival *chanal* appear to be rare in Lowland Maya texts[24], but a comparable example may be found on Naranjo's Ballcourt Sculpture 1 (pD), apparently written as **cha-CHAN-na-K'AK'** (see Graham 1980:2:187). Based on the standard structure of nomino-titular segments as well as Classic Maya onomastic practices in general the second, now missing, glyph block likely recorded the

[23] A variant of this term may be *jooloom*, based on the subfix **mi** seen in the inscriptions of Yaxchilan.

[24] Note here that another example of a name making use of *Chanal* is that occurring in the subsidiary caption of Caracol's Stela 21, naming a bound royal captive as *Chanal Chak Chapaht* (see Martin & Grube 2000:94; Boot 2002:24).

title and the remainder of Chanal K'ahk's name.[25] It is tempting to see a connection between the Chanal K'ahk' on Altar 1 and that cited as Naranjo as being the same, however, in light of the incomplete nature of the textual references and the lack of secure temporal controls, this association cannot be demonstrated.

Decipherment of the first clause thus reveals that the skeleton of an individual named in part Chanal K'ahk' was exhumed and finally provides an explanation for the iconography of the altar (in passing, it also confirms Morley's suspicion that the text somehow referred to the iconography, Morley 1938:211). The skeletal figure that dominates the altar thus serves as an iconic referent to the skeleton and its exhumation. In addition, the frame of the altar (based on the well-preserved XAP fragment) can now clearly be seen to represent a 'collar of death eyes', identical in all respects to the skeleton's diminutive headdress (Figure 13). Similar elements of mortuary iconography are also represented on Tikal's Altar 5 that depicts an exhumation event. There 'death eye collars' serve as the crest of a headdress and decorate the border of kilts, while a human skull resting atop a stack of long bones represent the exhumed skeleton (Figure 14). The reference here on Altar 1 to the exhumation of an individual's skeleton testifies to "the crucial importance of ancestral bones in the machinations of Maya power politics" (Grube & Schele 1994:6).

The second clause is opened by another CR date (A4-B4) in which the Haab again has completely weathered away. The Tzolkin though partly eroded appears to record 5 Ajaw. Following Morley (1938:211), it would therefore seem most likely to be a reiteration of the CR date of Stela 1, with which this monument was once paired. Consequently, 10.1.0.0.0 or AD 849 is the most likely anchor point for this CR date. This conclusion also supports the identification of the CR date of the first clause as preceding the date cited on Stela 1, thereby keeping the altar's narrative sequential.

After the CR date the second clause is initiated by a partly eroded collocation (A5) is written with an eroded main sign, prefixed by the numeral **HUK** for "seven" and superfixed by a partly chipped sign. Based on syntactic requirements this collocation should record a verb, though the inclusion of a foregoing "seven" is at odds and difficult to explain. Based on similarly-structured entries in other Lowland texts it is possible that the superfix was **TE'** and its main sign **ye** thereby forming part of a *ye(h)te'* expression that occasionally initiates sub-clauses and often links the names of captives with their captors (Chase et al. 1991:10; Martin 2004). This expression appears to be formed by the verbal root *ete'*-, but remains as yet inadequately understood (cf. Boot 2002:31; Martin 2004; Stuart 2003:2). If this interpretation is correct then the following glyph block would provide a verbal suffix written with the logogram for "house" (read *nah*) followed by a **ja** syllabogram that together may form the suffix for passive non-CVC transitive verbs as *–naj* (Lacadena 2004).

A more likely alternative interpretation is that the collocation records *Hukte'* in which the faint main sign is simply a complete form of a variant for the logogram **TE'** (T78:514). In this interpretation the following glyph block would be read as the noun *naj* for 'house' (written as *naah* in the foregoing Late Classic), with the two glyphs forming

[25] Based on onomastic patterns the name Chanal K'ahk' should be followed by a reference to a deity such as *K'awiil* (God K), *Chaahk* (God B), *K'inich (Ajaw)* (God G), *Itzamnaaj* (God D), *Yo(p)aat* (variant of God B) or an animalistic supernatural creature such as *Chapaht* ("centipede"), *Muwaan* ("screech owl"), *B'ahlam* ("jaguar"), *Hix* ("jaguar" / "puma"), *Ahk* ("turtle"), *Xook* ("shark"), etc.

the name of a building read *Hukte'naj* (lit. "Seven-tree-house"). A similar name occurs at Palenque where a *B'olonte'naah* (lit. "Nine-tree-house") is known as a referent to the Temple of the Inscriptions (cf. Martin 2004:113, Fig. 8). The verb of the second clause (perhaps a dedicatory verb) should thus have occurred before the mention to the putative building at glyph block B4, where it may have been compressed with the Haab portion of the CR date.

**Figure 14:** Tikal Altar 5 depicting an exhumation ceremony presided over by Tikal's king Jasaw Chan K'awiil I and a lord from Masuul (possibly modern-day Naachtun). Note the exhumation statement split between glyph blocks x26 and y1, which parallels the expression seen on Altar 1 at Xunantunich. Drawing by William R. Coe (Jones & Satterthwaite 1982: Fig. 23).

The next collocation (A6) appears to record the copula *yichnal*, meaning "with" or "in the company of" (Boot 2002:37, 38; Orejel 1996:65). Consequently, the agent of the

foregoing verbal expression appears to be absent and supplanted by another through the insertion of the copula. The text ends, by citing the mostly effaced name (B6) and titles (A7 and B7) of the agent. The first title is almost entirely eroded, but the outlines are in keeping with a complete EG. The main sign of the EG, however, is in keeping with that of the so-called 'water-scroll' EG and the local toponym of Topoxte (Stuart & Houston 1994:29, Fig. 31; David Stuart pers. comm. 2000). The second and final glyph records a common regnal title that typically follows the EG in a text, written in case as **B'AH-ka-b'a** or *b'ahkab'* literally meaning "head of the earth" (Houston & Stuart 1996), though it must be considered that something akin to 'leader of the land' may be closer to the original semantic domain (with 'head' functioning as in 'head chef' or 'headmaster'; Houston 1993: 129, Fig. 5-2b; Lacadena 2002; see Houston & Stuart 1996). The name of the individual bearing these exalted titles, though almost entirely illegible, differs from those recorded on Stelae 8 and 9. Consequently, the individual named on Altar 1 may be the new lord of Xunantunich (having supplanted the ruler referred to on Stelae 8 and 9), or may be an altogether foreign lord. The latter case seems more likely on account of the *yichnal* copula that introduces this individual to the text, while the distinct and differing 'Water Scroll' EG supports this idea further.

## CONCLUSION

This ample review of Xunantunich's small glyphic corpus allows the reconstruction of that site's dynastic history, even if only in the broadest of strokes. The first textual reference to an established royal house at Xunantunich is evidenced in the Hats' Chaak phase (AD 670-780) by the additions of *audiencia* structures on the Castillo, the construction A-3 plaza palace group and its associated Panel 1. The partially-preserved pedigree statement on that monument hints at concerns of the budding dynasty to legitimise and establish itself using the traditional rhetoric of other more ancient regal houses. At Xunantunich, the Hats' Chaak phase was a prolific period for the dynasty as signalled by greatly-expanded administrative and palatial facilities as well as the construction of Structure A-1, either under the influence of the Naranjo dynasty or as emulation thereof (Ashmore 1998; Leventhal 1996; LeCount et al. 2002). Its often tortuous relations with its neighbours are hinted at in the oblique reference to martial conflict on Panel 2, which dates to a time transitional between the Hats' Chaak and the ensuing Tsak' phase (c. AD 780-820). What the epigraphic data clearly indicate is that the Xunantunich dynasty at least nominally-claimed equal status and independence from its larger neighbour Naranjo by the use of a local Emblem Glyph on Panel 2. Establishing a secure power base for the Xunantunich dynasty must have rested in large measure on the ability to draw itself into networks of alliances with other political leaders as is exemplified by the possible triple alliance referred to on Panel 2.

The nascent dynasty, however, seems to have had to contend with greater socio-political issues that were affecting the majority of the Lowlands at the time. As a reaction to failing alliances and the growing power of non-royal elites attached to the court, systems of intra-polity power-sharing appear to have been established at a time concurrent with increased administration and bureaucracy. This is suggested by the stucco facade of the penultimate Castillo that duplicates in many details the iconography

of the principal 'council house' (or **pohpolnaah*) at Copan (cf. Fash et al. 1992). Here too we see multiple lesser lords depicted below the king on his celestial throne (Stuart 2003b), each of the lords in turn seated on what may be the graphic rendition of the toponyms that they administered (cf. Fash et al. 1992). If, as at Copan, the number of mountain signs that originally graced the penultimate Castillo correlate to the administrative subdivisions of Xunantunich's realm, then we can see that the kingdom suffered from extensive fragmentation.[26] Despite these troubled times and the power-sharing that may have effectively diminished centralized royal power, the dynasty endured and even prospered with renewed vigour in the Terminal Classic, thereby paralleling in part the coeval 'revival' seen at Caracol and some of the other sites in the area (Martin & Grube 2000:96-97).

This revival period differs, however, quite noticeably from the forgoing phase, by the erection of public monuments, such as stelae and altars, rather than focusing on diminutive panels that otherwise had only the elite and the court as audiences. Perhaps bolstered by its continued success, the royal agents appear to have abolished the institution of power-sharing with the complete or near-complete concealment of the frieze of the penultimate Castillo that once had stood to epitomize that institution. Perhaps concurrently the glyphic panels befell partial breakage and displacement. While this type of monument fragmentation and re-use is seen at many other Lowland sites it may suggest a break in the royal line of succession, or that the earlier testaments of the dynasty were somehow deemed incompatible with the return to mounting centralization residing in the monarch. That power was indeed centralized in the figure of the king is suggested in the iconography of the stelae, which feature him alone, proudly bearing the emblems of his station. At this juncture, the time was ripe for re-establishing alliances with neighbours, rather than focusing on intra-polity networks. It is perhaps as part of these efforts that the local lord and the last Naranjo king conducted joint period-ending dance celebrations. Shortly thereafter, we see last textual referents to the lords of Xunantunich, in the guise of Stela 1 and Altar 1. These monuments refer little to local lords, but offer a prominent place to period-ending celebrations and a supernatural creature that was somehow tied to refurbishments made to the summit of Structure A-1 and its concomitant re-dedication. The associated text of Altar 1 goes on further to relate the exhumation of a person's skeletal remains and what seems to be another building dedication event that transpired in the company of another foreign lord. Based on other examples of exhumation events we see these as taking place in times of great political turbulence as exemplified in the inscriptions of Naranjo and Tikal. However, as the names referred to on Altar 1 are those of otherwise unknown actors we cannot gauge if the exhumation was an act of despoilment or votive re-inhumation in amiable territory (cf. Grube & Schele 1994; Grube 2000:201). None the less the importance of ancestral bones in the machinations of royal politics is clear (Grube & Schele 1994:6).

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[26] The *pohpolnaah* at Copan was originally adorned by eight or nine toponyms (Fash et al. 1992:432-433, Figs. 12, 13), which represent the contemporaneous subdivisions of the realm. Based on surviving portions of the frieze at Xunantunich each side may have had three toponymic signs (with each including the place-name referent *witz* for "mountain"), totalling twelve in all. The kingdom of Xunantunich would undoubtedly have been relatively small (perhaps no more than 100 $km^2$) and as such twelve subdivisions would indicate that it was highly fragmented by the Hats' Chaak phase and beset by the demands of lesser lords.

Despite the valiant efforts made to maintain the orthodoxy of old, it was, here as elsewhere, short-lived (cf. Martin & Grube 2000:52-53). Indeed, we see the ascent of the Xunantunich dynasty at a time of weakening central powers, in the ebb of Naranjo's influence. Its ally Naranjo appears to be eclipsed shortly after the joint ritual on AD 820, with the royal line of Xunantunich ultimately befalling a similar fate, just decades later by the close of the Tsak' phase as suggested by the ultimate defacement of the figurative stelae. Thus, as with all Terminal Classic texts (see Schele & Grube 1995), the public monuments of Xunantunich focus on period-endings rather than on particular historical events and their associated dates. Contrary to the foregoing private texts such as Panel 2, wars are no longer mentioned explicitly, but militarism remains omnipresent in the figurative monuments where the dress of the dancing lords as well as the depiction of a captive all relate to martial themes. As such, the Xunantunich monuments represent some of the very typical features of the political rhetoric of the Terminal Classic period. In the troubled times of collapse and social upheaval, they say little of what was really taking place, but convey the image of powerful kings asserting their political independence, as devout lords dedicated to the observance of age-old ritual pageants.

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## End Notes

* This lengthy report constitutes an earlier version to a now significantly-abridged paper that has been submitted for publication in a forthcoming Xunantunich monograph edited by Jason Yaeger and Lisa LeCount. In our initial enthusiasm we produced a paper that was simply too long for conventional publication standards and consequently present it here.

1. Conventions employed in this paper for the rendition of glyphic data and lexical items of Classic Mayan follow Stuart (1983), Lacadena and Zender (2001), as well as Kettunen and Helmke (2005:12-17, 56-59). Transcriptions are represented in boldface type and are designed to represent the manner in which a text was written. In transcriptions uppercase stands for logographic values, lowercase stands for syllabic values, # marks eroded or now missing elements, and {…} are used to render probable reconstructions. Transliterations are all rendered in lowercase, in italic typeface and are designed to render the value of glyphic collocations as they would likely have been read. In transliterations […] are used to represent phonetic elements that were not written, but which comparative historical linguistic and/or script internal evidence indicate should have been present and would apparently have been provided by the ancient reader. /…/ serve to frame phonemic elements, while <…> mark graphemes. Numbers prefixed by T- (e.g. T162) are used to refer to specific glyphic graphemes as catalogued by Thompson (1962).

The orthography used in this paper follows that elaborated and endorsed by the Academía de las Lenguas Mayas (1988) with minor alterations to accommodate for phonemic distinctions apparently made by the ancient Maya and represented in the glyphic texts as currently understood by epigraphers. Thus the following phonemic sets are designed to render all the vocalic and consonantal sets of Classic Mayan: /a/, /b'/, /ch/, /ch'/, /e/, /h/, /i/, /j/, /k/, /k'/, /l/, /m/, /n/, /o/, /p/, /p'/, /s/, /t/, /t'/, /tz/, /tz'/, /u/, /w/, /x/, and /y/.

Note that the apostrophe systematically represents a glottal stop. Herein, /h/ and /j/ are used to mark the distinction between glottal aspirate and velar fricative, respectively (cf. Grube 2004). In addition, the model formulated by Stuart, Houston and Robertson (1999) and later elaborated upon by Lacadena and Wichmann (2004) to account for so-called 'disharmonic' spellings is employed throughout, with minor exceptions (in cases of disjunction between the model, its inferred spelling rules and comparative historical linguistic data). Thus in addition to the orthography presented above the following reconstructed complex vowels are also rendered: /aa/, /aa'/, /a'a/, /ee/, /ee'/, /e'e/, /ii/, /ii'/, /i'i/, /oo/, /oo'/, /o'o/, /uu/, /uu'/, /u'u/ (in which the first set represents long vowels (e.g. aa), the second set represents glottalized long vowels (e.g. aa'), and lastly the third set represents intervocalic glottalization (e.g. a'a).

2. This recently identified class of toponyms is identified by a discrete suffix read *–nib'* (written syllabically as **ni-b'i**). The suffix may represent a compound meaning "place" (Boot 2002:61), but may be morphologically segmented as *–n-ib'* in which *–ib'* serves as a common instrumental suffix. Analyzed as *-n-ib'*, the *-n-* must serve to derive verbs from nouns so that these may in turn be instrumentalized. Good examples of this type of toponyms are found in the greater Naranjo area, but also on many Codex style vases and polychrome bowl from the Uaxactun-El Zotz group of unprovenienced ceramics. A possible example is also seen at Seibal on Tablet 6 of the HS. All examples of this class of toponyms occur within the characteristic syntactic environments namely at the end of clauses, usually following nominal and titular signs. In addition, the suffix also occurs within an unambiguous toponymic context in an example from HS 3 of Structure 44 at Yaxchilan. Inscribed on the tread of Step 4, the example in question closes a nominal clause of a person named Lahcha' Patan. Its syntactic position alone it is already suggestive of its function as toponymic designator. The expression can be analyzed as follows:

| **AJ** | **TAN-na** | **CH'EN-na** | **KAB'** | **ni-b'i** |
|---|---|---|---|---|
| *aj* | *ta[h]n* | *ch'e'en* | *kab'* | *nib'* |
| M.AG | LOC | cave | earth | LOC |
| he [of] | centre | cave-earth | | place |

"He of the centre of the realm"

The expression is introduced by the male agentive clitic *aj-* (T12) that typically precedes place names or titles as part of "he [of] X" phrases (Stuart & Houston 1994:19, 20). Following this, the toponym is introduced by *tahn*, a common locative meaning "amidst, in the middle, or in the centre" (initially deciphered by Stephen Houston; Boot 2002:74). The toponym proper follows and is represented by an abbreviated form of the 'sky-earth-cave' expression referring to the 'realm' or 'universe' of particular polities (Stuart 2002). The whole is concluded by the *–nib'* suffix that marks foregoing collocations as place names. The *–nib'* suffix thus occupies precisely the same syntactic context and serves the same function as the *–nal* suffix. It is all the more noteworthy that these two suffixes are mutually exclusive in their occurrences. Literally, the entire toponymic phrase thus states that *Lahcha' Patan* hails from the "centre [of the] 'cave-earth' place." Taking the metaphorical value of the 'sky-earth-cave' expression into consideration the entire toponymic phrase specifies the agent's origin as the heart of Yaxchilan's realm.

## References Cited:


Academia de las Lenguas Mayas de Guatemala
1988 *Lenguas Mayas de Guatemala: Documento de referencia para la pronunciación de los nuevos alfabetos oficiales*. Instituto Indigenista Nacional, Guatemala City.

Arnauld, Marie-Charlotte
2001 La "casa grande": evolución de la arquitectura del poder del Clásico al Postclásico. *Reconstruyendo la ciudad maya: el urbanismo en las sociedades antiguas*, edited by Andrés Ciudad Ruiz, A. Josefa Iglesias Ponce de León and C. Martínez, pp. 363-401. Publicaciones de la SEEM No. 6. Sociedad Española de Estudios Mayas, Madrid.

Ashmore, Wendy
1998 Monumentos políticos: Sitios, asentamiento, y paisaje por Xunantunich, Belice. *Anatomía de una Civilización: Aproximaciones Interdisciplinarias a la Cultura Maya*, edited by Andrés Ciudad Ruiz, Yolanda Fernández Marquínez, José M. García Campillo, A. Josefa Iglesia Ponce de León, Alfonso L. García-Gallo, and Luís T. Sanz Castro, pp. 161-183. Publicaciones de la SEEM No. 4.

Sociedad Española de Estudios Mayas, Madrid.

Attinasi, John J.
1973 Lak T'an - A Grammar of the Chol (Mayan) Word. Unpublished PhD dissertation, Department of Anthropology. University of Chicago, Chicago.

Aulie, H. Wilbur, and Evelyn W. Aulie
1978 *Diccionario ch'ol-español, español-ch'ol*. Serie de Vocabularios y Diccionarios Indígenas, Mariano Silva y Aceves no. 21. Instituto Lingüístico de Verano, México, DF.

Awe, Jaime J.
1992 Dawn in the Land between the Rivers: Formative Occupation at Cahal Pech, Belize and its Implications for Preclassic Development in the Maya Lowlands. Unpublished PhD dissertation, Institute of Archaeology, University of London.

Ball, Joseph W. and Jennifer T. Taschek.
2001 The Buenavista-Cahal Pech Royal Court: Multi-Palace Court Mobility and Usage in a Petty Lowland Maya Kingdom. *Royal Courts of the Ancient Maya, Volume 2: Data and Case Studies*, edited by Takeshi Inomata and Stephen D. Houston, pp. 165-200. Westview Press, Boulder.
1991 Late Classic Lowland Maya Political Organization and Central Place Analysis: New Insights from the Upper Belize Valley. *Ancient Mesoamerica* 2: 149-165.

Barrera Vásquez, Alfredo (editor)
1980 *Diccionario Maya Cordemex: Maya-Español, Español-Maya*. Ediciones Cordemex, Mérida.

Bastarrachea, Juan R., Ermilo Yah Pech and Fidencio Briceño Chel
2003 *Diccionario Básico Español-Maya-Español*. Electronic version. Universidad Autónoma de Yucatán, Mérida.

Baudez, Claude-François
1994 *Maya Sculpture of Copan: The Iconography*. University of Oklahoma Press, Norman.

Beetz, Carl P. and Linton Satterthwaite
1981 *The Monuments and Inscriptions of Caracol, Belize*. University Museum Monograph 45. The University Museum, University of Pennsylvania, Philadelphia.

Beyer, Hermann
1937 *Studies on the Inscriptions of Chichen Itza*. Carnegie Institution of Washington, Publication 483, no. 21, Washington DC.

Boot, Erik
2003 Colors and Associated Cardinal Directions on an Unprovenanced Late Classic Ceramic Bowl. *Kerr Maya Vase Database*, <www.mayavase.com/bootcolors.pdf>
2002 A Preliminary Classic Maya-English/English-Classic Maya Vocabulary of Hieroglyphic Readings. *Mesoweb*, <www.mesoweb.com/resources/vocabulary/vocabulary.pdf>

Cases Martín, Juan Ignacio
2001 Análisis de las Series Lunares contenidas en las notaciones calendáricas de los textos glíficos mayas del Período Clásico. Proyecto de Fin de Carrera. Departamento de Astrofísica, Universidad de La Laguna, Tenerife.

Chase, Arlen F., Nikolai Grube, and Diane Z. Chase
1991 Three Terminal Classic Monuments from Caracol, Belize. *Research Reports on Ancient Maya Writing, Number 36*. Center for Maya Research, Washington DC.

Chase, Arlen F. and Diane Z. Chase
2001 The Royal Court of Caracol, Belize: Its Palaces and People. *Royal Courts of the Ancient Maya, Volume 2: Data and Case Studies*, edited by Takeshi Inomata and Stephen D. Houston, pp. 102-137. Boulder: Westview Press.

Clancey, Erin H.
1997 The 1997 Excavations on El Castillo at Structure A-32. *Xunantunich Archaeological Project: 1997 Field Season*, edited by Richard M. Leventhal, pp. 56-75. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Coe, Michael D.
1973 *The Maya Scribe and His World*. The Grolier Club, New York.

Coe, Michael D. and Mark Van Stone
2001 *Reading the Maya Glyphs*. Thames & Hudson, New York and London.

Dienhart, John M.
1997 *The Mayan Languages: A Comparative Vocabulary*. Electronic version. Syddansk Universitet: Odense.

Fash, Barbara, William Fash, Sheree Lane, Rudy Larios, Linda Schele, Jeffrey Stomper, and David Stuart
1992 "Investigations of a Classic Maya Council House at Copán, Honduras." *Journal of Field Archaeology*, Vol. 19(4): 419-442.

Fialko, Vilma
2000 El espejo del Entierro 49: morfología y texto jeroglífico. *El sitio maya de Topoxté: investigaciones en una isla del lago Yaxhá, Petén, Guatemala*, edited by Wolfgang W. Wurster, pp. 144-149. Verlag Phillip von Zabern, Mainz am Rhein.

Fields, Virginia M.
2004 The Royal Charter at Xunantunich. *The Ancient Maya of the Belize Valley: Half a Century of Archaeological Research*, edited by James F. Garber, pp. 180-190. University Press of Florida, Gainesville.
1994 The Royal Charter at Xunantunich. *Xunantunich Archaeological Project: 1994 Field Season*, edited by Richard M. Leventhal and Wendy Ashmore, pp. 65-74. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Freidel, David A., Linda Schele, and Joy Parker
1993 *Maya Cosmos: Three Thousand Years on the Shaman's Path*. William Morrow & Co., Inc., New York.

Gann, Thomas W. F.
1925 *Mystery Cities: Exploration and Adventure in Lubaantun.* Duckworth, London.
1894-1895 On the Exploration of two Mounds in British Honduras. *Proceedings of the Society of Antiquaries of London 15*: 430-434.

Genet, Jean
[1934] 2001 Revue des Etudes Mayas-Quichées. *The Decipherment of Ancient Maya Writing*, edited by Stephen Houston, Oswaldo Chinchilla Mazariegos and David Stuart, pp. 282-298. University of Oklahoma Press, Norman.

Graham, Ian
1980 *Corpus of Maya Hieroglyphic Inscriptions, Volume 2, Part 3: Ixkun, Ucanal, Ixtutz, Naranjo*. Peabody Museum of Archaeology and Ethnology, Cambridge.
1978 *Corpus of Maya Hieroglyphic Inscriptions, Volume 2, Part 2: Naranjo, Chunhuitz and Xunantunich*. Peabody Museum of Archaeology and Ethnology, Cambridge.

Graham, Ian and Peter Mathews
1999 *Corpus of Maya Hieroglyphic Inscriptions, Volume 6, Part 3: Tonina*. Peabody Museum of Archaeology and Ethnology, Cambridge.
1996 *Corpus of Maya Hieroglyphic Inscriptions, Volume 6, Part 2: Tonina*. Peabody Museum of Archaeology and Ethnology, Cambridge.

Gronemeyer, Sven
2003 Beobachtungen zur possessiven Morphologie von Glyphe F. *Wayeb Notes No. 1*.

Grube, Nikolai
2005 Las antiguas biografías mayas desde una perspectiva comparativa. *Janaab' Pakal de Palenque: Vida y muerte de un gobernante maya*, edited by Vera Tiesler and Andrea Cucina, pp. 223-261. Universidad Nacional Autónoma de México, Mexico DF.
2004 "The Orthographic Distinction between Velar and Glottal Spirants in Maya Hieroglyphic Writing." *The Linguistics of Maya Writing*, edited by Søren Wichmann, pp. 61-81. University of Utah Press, Salt Lake City.
2003 Introduction to Maya Hieroglyphic Writing. *Notebook for the XXVIIth Maya Hieroglyphic Forum*, edited by Nikolai Grube, pp. I.1-I.89. Maya Workshop Foundation, The University of Texas at Austin, Austin.

2000 Monumentos esculpidos e inscripciones jeroglíficas en el triángulo Yaxhá-Nakum-Naranjo. *El Sitio Maya de Topoxté: investigaciones en una isla del lago Yaxhá, Petén, Guatemala*, edited by Wolfgang W. Wurster, pp.249-268. Verlag Philipp von Zabern, Mainz am Rhein.

1994 Epigraphic Research at Caracol, Belize. *Studies in the Archaeology of Caracol, Belize*, edited by Arlen F. Chase and Diane Z. Chase, pp. 83-122. PARI Monograph 4. Pre-Columbian Art Research Institute, San Francisco.

1992 Classic Maya Dance: Evidence from Hieroglyphs and Iconography. *Ancient Mesoamerica* 3: 201-218.

Grube, Nikolai and Barbara MacLeod

1989 A Primary Standard Sequence on Copan Altar K. Copan Note 55. Copan Acropolis Project and the Instituto Hondureño de Antropología e Historia.

Grube, Nikolai and Simon Martin

2004 *The Proceedings of the Maya Hieroglyphic Workshop – Patronage, Betrayal, and Revenge: Diplomacy and Politics in the Eastern Maya Lowlands*. Transcribed by Phil Wanyerka. Cleveland State University, Cleveland.

Grube, Nikolai and Werner Nahm

1994 A census of Xibalba: a complete inventory of *way* characters on Maya ceramics. *The Maya Vase Book: Volume 4*, edited by Justin Kerr, pp. 686-715. Kerr Associates, New York.

Grube, Nikolai and Linda Schele

1994 Tikal Altar 5. Texas Notes on Precolumbian Art, Writing and Culture No. 66.

Harrison, Peter D.

1970 The Central Acropolis, Tikal, Guatemala: A Preliminary Study of the Functions of its Structural Components during the Late Classic Period. Unpublished PhD dissertation, Department of Anthropology, University of Pennsylvania, Philadelphia.

Harrison, Ellie

1996 The Ruler's Residential Plaza at Xunantunich, 1996 Excavations. *Xunantunich Archaeological Project: 1996 Field Season*, edited by Richard M. Leventhal and Wendy Ashmore, pp. 71-89. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Hays, Rebecca L.

1997 Excavations on the Southern Upper and Medial Terraces of El Castillo, Xunantunich, Belize. *Xunantunich Archaeological Project: 1997 Field Season*, edited by Richard M. Leventhal, pp. 76-95. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Hofling, Charles A. and Félix Fernando Tesucún

1997 *Itzaj Maya-Spanish-English Dictionary*. University of Utah Press, Salt Lake City.

Houston, Stephen D.

1993 *History and Hieroglyphs at Dos Pilas: Dynastic Politics of the Classic Maya*. University of Texas Press, Austin.

1983 A Reading for the Flint-Shield Glyph. *Contributions to Maya Hieroglyphic Decipherment, I*, edited by Stephen D. Houston, pp. 13-25. Human Relations Area Files Books, New Heaven.

Houston, Stephen D. and David Stuart

1996 Of Gods, Glyphs and Kings: Divinity and Rulership among the Classic Maya. *Antiquity* 70: 289-312.

1989 The Way Glyph: Evidence for Co-essences among the Classic Maya. *Research Reports on Ancient Maya Writing 30*. Center for Maya Research, Washington, DC.

Houston, Stephen D., David Stuart, and Karl A. Taube

1992 Image and Text on the "Jauncy Vase." *The Maya Vase Book: Volume 3*, edited by Justin Kerr, pp. 498-512. Kerr Associates, New York.

Hull, Kerry

2003 Verbal Art and Performance in Ch'orti' and Maya Hieroglyphic Writing. PhD dissertation, The University of Texas at Austin, Austin.

Inomata, Takeshi and Stephen D. Houston (eds.)
2001a *Royal Courts of the Ancient Maya, Volume 1: Theory, Comparison and Synthesis*. Westview Press, Boulder.
2001b *Royal Courts of the Ancient Maya, Volume 2: Data and Case Studies*. Westview Press, Boulder.

Jamison, Thomas R. and Richard M. Leventhal
1997 Creating and Holding a Political Center: Architecture and Space at Xunantunich. Paper presented at the 62nd Annual Meeting of the Society for American Archaeology, Nashville.

Jamison, Thomas R. and Gregory A. Wolff
1994 Excavations in and around Plaza A-I and Plaza A-II. *Xunantunich Archaeological Project: 1994 Field Season*, edited by Richard M. Leventhal and Wendy Ashmore, pp. 25-47. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Jones, Christopher
1977 Inauguration Dates of Three Late Classic Rulers of Tikal, Guatemala. *American Antiquity* 42: 28-60.

Jones, Christopher and Linton Satterthwaite
1982 *The Monuments and Inscriptions at Tikal: The Carved Monuments*. Tikal Report 33A. The University Museum, University of Pennsylvania, Philadelphia.

Josserand, J. Kathryn, and Nicholas Hopkins
1988 Final Performance Report. Chol (Mayan) Dictionary Database, pt. 3. Typescript in possession of the authors.

Kaufman, Terrence
2003 A Preliminary Mayan Etymological Dictionary. Electronic version. Crystal River: Foundation for the Advancement of Mesoamerican Studies, Inc. http://www.famsi.org/reports/01051/pmed.pdf
1972 *El proto-tzeltal-tzotzil: Fonología comparada y diccionario reconstruido*. Centro de Estudios Mayas, Cuaderno no. 5. Universidad Nacional Autónoma de México, México DF.

Kaufman, Terrence S., and William M. Norman
1984 An Outline of Proto-Cholan Phonology, Morphology, and Vocabulary. *Phoneticism in Mayan Hieroglyphic Writing*, edited by John J. Justeson and Lyle Campbell, pp. 77–166. Institute for Mesoamerican Studies Publication no. 9. Albany: State University of New York.

Kettunen, Harri and Christophe Helmke
2005 I*ntroduction to Maya Hieroglyphs: Workshop Handbook, 10th European Maya Conference*. Leiden: Leiden University & WAYEB.

Kettunen, Harri J., Christophe G.B. Helmke and Stanley P. Guenter
2002 *Transcriptions and Transliterations of Selected Texts from Yaxchilan, Chiapas, Mexico*. First Edition. Communications in Print plc, London.

Lacadena, Alfonso
in press Apuntes para un estudio sobre literatura Maya antigua. *Texto y contexto: Perspectivas intraculturales en el análisis de la literatura maya yucateca*, edited by Antje Gunsenheimer, Tsubasa Okoshi Harada and John F. Chuchiak. BAS, Bonn. Manuscript in possession of the authors.
2002 *El corpus glífico de Ek' Balam, Yucatán, México*. Electronic version. Foundation for the Advancement of Mesoamerican Studies, Inc., Crystal River. http://www.famsi.org/ cgi-bin/print_friendly.pl?file=01057es
2004 Passive Voice in Classic Maya Texts: CV[h]C-aj and -n-aj- Constructions. *The Linguistics of Maya Writing*, edited by Søren Wichmann, pp. 165-194. University of Utah Press, Salt Lake City.

Lacadena, Alfonso and Søren Wichmann
2004 On the Representation of the Glottal Stop and Rearticulated Vowels in Maya Writing. *The Linguistics of Maya Writing*, edited by Søren Wichmann, pp. 103-162. The University of Utah Press, Salt Lake City.

Larios, C. Rudy V. and Ruben Penados
1994 Proyecto del consolidación de A-6 Xunantunich, 1994. Report on file at the Institute of Archaeology, Belmopan.

Laughlin, Robert M.
1975 *The Great Tzotzil Dictionary of Santo Domingo Zinacantán*. Smithsonian Contributions to Anthropology, no. 19. Smithsonian Institution Press, Washington DC.

LeCount, Lisa J.
1996 Pottery and Power: Feasting, Gifting, and Displaying Wealth among the Late and Terminal Classic Lowland Maya. Unpublished PhD dissertation, Department of Anthropology, University of California, Los Angeles.

LeCount, Lisa J., Jason Yaeger, Richard M. Leventhal, and Wendy Ashmore
2002 Dating the Rise and Fall of Xunantunich, Belize. *Ancient Mesoamerica* 13: 41-63.

Leventhal, Richard M.
1996 The End at Xunantunich: The Architecture and Setting in the Terminal Classic. *Xunantunich Archaeological Project: 1996 Field Season*, edited by Richard M. Leventhal, pp. 10-16. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Looper, Mathew G.
1999 New Perspectives on the Late Classic Political History of Quirigua. *Ancient Mesoamerica* 10: 263-280.

Lounsbury, Floyd G.
1973 On the derivation of the "Ben-Ich" Prefix. *Mesoamerican Writing Systems*, edited by Elizabeth P. Boone, pp. 99-143. Dumbarton Oaks Research Library and Collection, Washington DC.

MacKie, Euan W.
1985 *Excavations at Xunantunich and Pomona, Belize, in 1959-1960*. BAR International Series 251. British Archaeological Reports, Oxford.
1961 New Light on the End of Classic Maya Culture at Benque Viejo, British Honduras. *American Antiquity* 27: 216-224.

MacLeod, Barbara and Andrea J. Stone
1995 The Hieroglyphic Inscriptions of Naj Tunich. *Images from the Underworld: Naj Tunich and the Tradition of Maya Cave Painting*, edited by Andrea J. Stone, pp. 155-184. University of Texas Press, Austin.

Maler, Teobert
1908 *Explorations in the Department of Peten, Guatemala, and Adjacent Region: Topoxte, Yaxhá, Benque Viejo, Naranjo*. Memoirs of the Peabody Museum of American Archaeology and Ethnology No. 4(2). Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

Martin, Simon
2004 Preguntas epigráficas acerca de los escalones de Dzibanché. *Los cautivos de Dzibanché*, edited by Enrique Nalda, pp. 105-115. Instituto Nacional de Antropología e Historia, México DF.
2001 Under a Deadly Star - Warfare among the Classic Maya. Maya: Divine Kings of the Rain Forest, edited by Nikolai Grube, Eva Eggebrecht and Matthias Seidel, pp. 175-185. Könemann, Cologne.
1997 The Painted King List: A Commentary on Codex-Style Dynastic Vases. *The Maya Vase Book: Volume 5*, edited by Justin Kerr, pp. 846-867. Kerr Associates, New York.

Martin, Simon and Nikolai Grube
2000 *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*. Thames and Hudson, New York and London.

Mathews, Peter
1991 Classic Maya Emblem Glyphs. *Classic Maya Political History: Hieroglyphic and Archaeological Evidence*, edited by T. Patrick Culbert, pp. 19-29. School of American Research Book. Cambridge University Press, Cambridge.
1983 *Corpus of Maya Hieroglyphic Inscriptions, Volume 6, Part 1: Tonina*. Peabody Museum of Archaeology and Ethnology, Cambridge.

Miller, Julia C.
1996 The 1996 Tunneling Excavations in El Castillo. *Xunantunich Archaeological Project: 1996 Field Season*, edited by Richard M. Leventhal and Wendy Ashmore, pp. 28-39. University of

California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

1995 Tunneling Excavations in El Castillo. *Xunantunich Archaeological Project: 1995 Field Season*, edited by Richard M. Leventhal and Wendy Ashmore, pp. 26-37. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Miller, Mary E. and Karl A. Taube

1993 *The Gods and Symbols of Ancient Mexico and the Maya*. Thames and Hudson, New York and London.

Morán, Fray Francisco de

1695 *Arte y Vocabulario de la lengua Cholti que quiere decir la Lengua de Milperos*. Manuscript Collection 497.4/M79 American Philosophical Society, Philadelphia.

Morley, Sylvanus G.

1937-1938 *The Inscriptions of the Peten*. Carnegie Institution Publication No. 437. Carnegie Institution of Washington, Washington DC.

Neff, L. S.

1995 Excavations of Structure A-20 on El Castillo, Xunantunich. *Xunantunich Archaeological Project: 1995 Field Season*, edited by Richard M. Leventhal and Wendy Ashmore, pp. 38-58. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Orejel, Jorge L.

1996 A Collocation Denoting a 'Substitute' Relationship in Classic Maya Inscriptions. *Eighth Palenque Round Table, 1993*, edited by Martha J. Macri and Jan McHargue, pp. 63-77. Pre-Columbian Art Research Institute, San Francisco.

Proskouriakoff, Tatiana and J. Eric S. Thompson

1947 Maya Calendar Round Dates such as 9 Ahau 17 Mol. *Notes on Middle American Archaeology and Ethnology 79*. Carnegie Institution of Washington, Washington DC.

Robin, Cynthia

1994 Form, Function, and Meaning: 1994 Excavations on El Castillo, Structure A-6. *Xunantunich Archaeological Project: 1994 Field Season*, edited by Richard M. Leventhal and Wendy Ashmore, pp. 48-64. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Sanchez, J.

1993 1993 Excavations on El Castillo, Xunantunich, Belize. *Xunantunich Archaeological Project: 1993 Field Season*, edited by Richard M. Leventhal, pp. 56-64. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Sapper, Carl

1907 "Choles und Chorties." *Proceedings of the Fifteenth International Congress of Americanists (1906)*, pp. 423-465. New York.

1897 *Das nördliche Mittel-Amerika nebst einem Ausflug nach dem Hochland von Anahuac*. Friedrich Vieweg und Sohn, Braunschweig.

Satterthwaite, Linton R.

1965 Calendrics of the Maya Lowlands. *Handbook of the Middle American Indian Vol. 3*, edited by Robert Wauchope, pp. 603-631. University of Texas Press, Austin.

1950 Plastic Art on a Maya Palace. *Archaeology* 3(4): 215-222.

Schele, Linda

1985 Balan-Ahau: A Possible Reading of the Tikal Emblem Glyph and a Title at Palenque. *Fourth Palenque Round Table*, 1980 (Vol. VI), edited by Elizabeth P. Benson, pp. 59-65. The Pre-Columbian Art Research Institute, San Francisco.

Schele, Linda and David Freidel

1990 *A Forest of Kings: The Untold Story of the Ancient Maya*. Quill & Morrow, New York.

Schele, Linda and Nikolai Grube

2002 Introduction to Maya Hieroglyphic Writing. *Notebook for the XXVIIth Maya Hieroglyphic Forum at Texas*, edited by Nikolai Grube, pp. 1-88. Maya Workshop Foundation, University of Texas at Austin.

1995 The Last Two Hundred Years of Classic Maya History: Transmission, Termination, Transformation. *Notebook for the XIXth Maya Hieroglyphic Workshop*, edited by Linda Schele, pp. 87-211. Department of Art and Art History, The College of Fine Arts, and the Institute of Latin American Studies, University of Texas at Austin.

1993 *Pi* as "Bundle." Texas Notes on Precolumbian Art, Writing and Culture No. 56.

Schele, Linda, Nikolai Grube and Frederico Fahsen

1992 The Lunar Series in Classic Maya Inscriptions: New Observation and Interpretations. Texas Notes on Precolumbian Art, Writing and Culture No. 29.

Schele, Linda and Mathew G. Looper

1996 The Inscriptions of Quirigua and Copan. *Notebook for the XXth Maya Hieroglyphic Workshop*, edited by Linda Schele, Part 2, pp. 1-226. Department of Art and Art History, The College of Fine Arts, and the Institute of Latin American Studies, University of Texas at Austin.

Schele, Linda, Peter Mathews and Floyd Lounsbury

1990 The Nal Suffix at Palenque and Elsewhere. *Texas Notes on Precolumbian Art, Writing, and Culture*, No. 6.

Schele, Linda and Mary E. Miller

1986 *The Blood of Kings: Dynasty and Ritual in Maya Art*. Kimbell Art Museum, Fort Worth.

Schellhas, Paul

1904 Representations of Deities of the Maya Manuscripts. *Papers of the Peabody Museum of American Archaeology and Ethnology* 4(1). Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

1897 *Die Göttergestalten der Mayahadschriften: Ein Mythologisches Kulturbild aus dem Alten Amerika*. Verlag von Richard Bertling, Dresden.

Scholes, France V. and Ralph L. Roys

1948 *The Maya Chontal Indians of Acalan-Tixchel: A Contribution to the History and Ethnography of the Yucatan Peninsula*. Carnegie Institution of Washington, Publication no. 560. Carnegie Institution, Washington DC.

Spinden, Herbert J.

1913 A Study of Maya Art: Its Subject Matter and Historical Development. *Memoirs of the Peabody Museum of American Archaeology and Ethnology* 6. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

Stone, Andrea J.

1983 Epigraphic Patterns in the Inscriptions of Naj Tunich Cave. *Contributions to Maya Hieroglyphic Decipherment I*, edited by Stephen D. Houston, pp. 88-103. Human Relations Area Files, Inc., New Haven.

Stuart, David

2003a Longer Live the King: The Questionable Demise of K'inich K'an Joy Chitam of Palenque. *The PARI Journal* 4(1): 1-4.

2003b "A Cosmological Throne at Palenque." *Mesoweb*: <www.mesoweb.com/stuart/notes/throne.pdf>

2002 "Mountains, Caverns and Waters: The Ancient Maya Underworld as Ritual Landscape." Paper presented at the 7th Annual European Maya Conference, British Museum, London.

1997 The Hills are Alive: Sacred Mountains in the Maya Cosmos. *Symbols*, Spring Issue: 13-17.

1996 Kings of Stone: A Consideration of Stelae in Maya Ritual and Representation. *RES* 29/30: 149-171.

1986 Ten Phonetic Syllables. *Research Reports on Ancient Maya Writing* 14. Center for Maya Research, Washington DC.

Stuart, David and Stephen Houston

1994 *Classic Maya Place Names*. Studies in Pre-Columbian Art and Architecture No. 33. Dumbarton Oaks Research Library and Collection, Washington, DC.

Stuart, David, Stephen Houston and John Robertson

1999 *Recovering the Past: Classic Maya Language and Classic Maya Gods.* I: *Notebook for the XXIIIrd Maya*

*Hieroglyphic Forum at Texas*. Department of Art and Art History, the College of Fine Arts, and the Institute of Latin American Studies, University of Texas at Austin.

Taube, Karl A.
1992 *The Major Gods of Ancient Yucatan*. Studies in Pre-Columbian Art and Archaeology No. 32. Dumbarton Oaks Research Library and Collection, Washington DC.

Thompson, J. Eric S.
1977 A Proposal for Constituting a Maya Subgroup, Cultural and Linguistic, in the Peten and Adjacent Regions. *Anthropology and History in Yucatan*, edited by Grant D. Jones, pp. 3-42. University of Texas Press, Austin.
1962 *A Catalogue of Maya Hieroglyphs*. The University of Oklahoma Press, Norman.
1950 *Maya Hieroglyphic Writing: An Introduction*. Carnegie Institution of Washington, Publication no. 589. Carnegie Institution, Washington DC.
1942 *Late Ceramic Horizons at Benque Viejo, British Honduras*. Contributions to American Anthropology and History, Vol. 7, No. 35. Carnegie Institution of Washington, Washington DC.

Trigger, Bruce G.
2003 *Understanding Early Civilizations: A Comparative Study*. University of Cambridge Press, Cambridge.

Vogt, Evon Z. and David Stuart
n.d. Some Notes on Ritual Caves among the Ancient and Modern Maya. Manuscript in possession of the authors.

Wald, Robert
2000 Temporal Deixis in Colonial Chontal and Maya Hieroglyphic Narrative. *Written Language and Literacy* 3(1): 123-154.

Wanyerka, Phillip J.
2003 *The Southern Belize Epigraphic Project: The Hieroglyphic Inscriptions of Southern Belize*. Department of Anthropology, Cleveland State University. Report on file at the Institute of Archaeology, Belmopan.

Yaeger, Jason
1997 The 1997 Excavations of Plaza A-III and Miscellaneous Excavation and Architectural Clearing in Group A. *Xunantunich Archaeological Project: 1997 Field Season*, edited by Richard M. Leventhal, pp. 24-55. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.

Zeleznik, Scott
1993 The 1993 Excavations and Consolidation of Structure A-1. *Xunantunich Archaeological Project: 1995 Field Season*, edited by Richard M. Leventhal, pp. 30-55. University of California, Los Angeles. Report on file at the Institute of Archaeology, Belmopan.