With two previous field seasons under our belts, we began the 2001 season with somewhat more informed ideas regarding the ancient Maya inhabitants of the Sibun Valley. The spring 2001 season (February through April) was an endeavor that combined research and training. Fourteen undergraduate students enrolled through the Division of International Programs at Boston University joined the project with the goal of learning archaeological methods. Many staff members, primarily graduate students from the Department of Archaeology, returned to the Sibun for the second or third time. Several specialists in the natural sciences joined the project as a consequence of support from the National Science Foundation (BCS-0096603), which is greatly acknowledged. For the first time, we tackled the upper valley settlement and caves (primarily the Hershey site and Actun Chanona) in addition to continuing research in the middle and lower sections of the valley. To achieve this end, the first five weeks of the field season were spent at Yam Wits, a hostelry along the Hummingbird Highway, while the final five weeks found us back at Monkey Bay Wildlife Sanctuary off the Western Highway.

The cast of contributors was large; below each member is listed along with her/his role in the project. Chapters of the report to follow present the results of their field research. Field Director, Ben Thomas, supervised survey and excavation at the surface sites. Total station mapping of the Hershey site was undertaken by Steven Morandi, Brian Norris, and several field school students. We are indebted to Dave Carlson at Carlson Software for the generous gift of SurvCADD software used to download Total Station data into a laptop computer. The Hershey site—as well as several smaller sites throughout the valley—were located by means of UTM coordinates by David Buck who manned the GPS equipment. Dan Welch operated the magnetometer that provided valuable clues to subsurface features at both Pakal Na and Hershey. Operation directors, who ran the individual excavations, included Eleanor Harrison, Steven Morandi, and Kevin Acone (who also doubled as project illustrator).

Exploration of the caves was directed by Polly Peterson who benefited from the input of experienced caver, Allan Cobb. Historical archaeologist, Daniel Finamore, conducted excavations in search of the Colonial period Spanish visita in the upper valley around the Hershey site. Soils geographer Pat Farrell continued her research on soils and the ancient landscape of the Sibun Valley and Thomas Bullard initiated a study of the fluvial geomorphology of the valley. Palynologist John Jones extracted several cores from oxbows of the Sibun River in order to collect pollen and reconstruct ancient patterns of vegetation. Botanist, Kirsten Tripplett, recorded modern flora (especially cacao) and initiated a water-flotation system for sieving archaeological sediments. Kimberly Berry directed the laboratory processing of all artifacts and samples. Project ceramicist, Sandra L. López Varela, began analysis of pottery recovered from settlements and caves, and Norbert Stanchly analyzed the faunal material.

In both the field and the lab, the following field school students provided valuable assistance in return for their training: Margaret Abercrombie, Tara Bermingham, Alleen Betzenhauser, Christa
When the season started, the site of Hershey was obscured by thick, secondary growth. The men listed below from the nearby village of St. Margaret’s did a remarkable job of clearing the bush: Alejandro Davila, Rigaberto Galdemez, Celestino Hernandez, Rolando Hernandez, Rudolfo Hernandez, Roberto Veron, and Saul Ortiz. From Monkey Bay, Elias Ortiz, Samuel Ortiz, and Ramon Placido provided strategic cutting and excavation support for our research in the middle and lower valley area. In the Gracy Rock area, Lance Usher and Gilford Hoare provided valuable guide service as well as excavation support. Our mobility and ability to survey large portions of the Sibun Valley would not have been possible without the technical expertise of our auto mechanic, Bruce Cullerton, who managed to keep an aging fleet of vehicles on the road. Thanks to Melito Bustamante, our bus driver on the trip to the Toledo District. Local land owners and managers facilitated our research in many ways. Bert Faux, manager of Hummingbird Citrus Ltd., allowed daily access to the Hershey site and Jonny Zander of nearby Sleeping Giant Farm helped to cut a trail into Actun Chanona. Jean Paul Cantareul, manager of the citrus farm on which Pakal Na is situated, graciously allowed us to return for another season of excavation at that site. The new owner of the Samuel Oshon site permitted us to continue our program of excavation in the Freetown Sibun area as did Augustine Obispo. Finally, we thank Jes Karper for introducing us to the hilltop locale that might be the site of Deep Valley.

Our local hosts provided us with all of the amenities one could ask for in a field camp and we extend our thanks to the Smith family of Yam Wits, especially to Joy and Rupert Smith, their three sons, Erol, Christopher, and Nicholas. Special thanks go Joy’s daughter, Carolyn Bellini, who fed us many a tasty Belizean meal and to Joy’s son, Tommy Longsworth, who transported our breakfast cook, Delvorine Budna, to Yam Wits in the early hours of the morning. At Monkey Bay Wildlife Sanctuary, Matthew and Marga Waals Miller and their support staff of Juan Esquivel, Hamish and Elishka Graham, Aretha Wiltshire, and Benedicta Perez provided us with rustic accommodations and delicious food.

In Belmopan, Hector Mai of the Belize herbarium kindly curated our botanical collection and the Department of Archaeology extended to us permission to conduct research in the Sibun River Valley under permit no. DOA/H/2/1/01(2). We thank acting commissioner, George Thompson and his support staff for their assistance.

Patricia A. McAnany
XARP Project Director
Boston University
January 2003
BETWEEN THE GORGE AND THE ESTUARY:

Investigations of the
2001 Season of the Xibun Archaeological Research Project

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1. Hershey Site

2. Transect 1 (Base of the Gorge)
The 2001 field season of the Xibun Archaeological Research Project (XARP) extended from February through April. The project takes its name from the colonial mission called Xibun, although today the River and surrounding karst are spelled Sibun. Field research took place in the Sibun River Valley of central Belize between the base of the Gorge and the beginning of the estuarine environment (a length of about 60 km as the crow flies). Selected locales for research included surface residential and ceremonial centers, underground caverns, and oxbows and physiographic features (such as river terraces and meander bends) pertinent to paleo-environmental research. The length of the valley was sampled via five transects that crosscut the valley, the first beginning at the base of the Sibun Gorge (Figure 1.1). During prior seasons (1997 and 1999), survey, excavation, and cave mapping/surface collection had been undertaken within Transects 3 and 5. Throughout the 2001 season, research focused on Transects 1, 3, 4, and 5.

During the month of February, the seminal research undertaken by XARP within Transect 1 was initiated. Located within a pocket of fertile farm land at the base of the Gorge, Transect 1 yielded a diversity of archaeological remains, most attributable to the Classic period. Several small sites such as Echo Valley, Sleeping Giant, Silver Creek, Finca Buenos Aires, and St. Thomas were located via GPS, reconnoitered, and mapped (see Morandi et al., Chapter 2). While most sites possessed a small grouping of Classic Maya platforms, St. Thomas did not. Rather, an Archaic period Lowe projectile point was discovered on the surface at St. Thomas (see Morandi et al., Chapter 2 and Finamore, Chapter 8). Using a Total Station, a topographic map was completed of the 0.75 km² Hershey site, the largest settlement in the valley complete with an 11 m tall pyramid (see Map Sheet 1). Three test excavations were placed at the Hershey site (see Harrison, Chapters 5 – 6 and Acone, Chapter 7). Historical archaeologist Daniel Finamore reconnoitered the area for the remains of the Colonial visita (see Finamore, Chapter 8). Although this survey yielded negative results, the search will continue in the lower part of the valley. The largest cave discovered to date in the Sibun environs—Actun Chanona—was investigated, mapped, and its surface collected (see Peterson, Chapter 3 and Cobb, Chapter 4).

For the months of March and April, the camp was moved to the lower valley so that Transects 3, 4, and 5 could be investigated. Since the eastern edge of the cave-containing karst is coincident with the eastern edge of Transect 4, no cave studies could be undertaken within Transect 5. Cave mapping and artifact collection continued in the Tiger Bay Cave District of Transect 3 (Usrey Cave) and was initiated within the caves of the Gracy Rock Cave District (Transect 4), most notably Arch Cave (see Peterson, Chapter 9). Surface reconnaissance, survey, and mapping were undertaken within Transect 4 and resulted in the recording of four settlement sites: Juana Pond, Butcher Bank, Freshwater Creek, and Cedar Bank (the final being a site already noted in the DOA site archives). Locations were determined via GPS and sites were mapped with a tape, compass, and laser range-finder (see Buck and Thomas, Chapter 13).
At the residential site of Pakal Na, a large burial pit had been encountered at the end of the 1999 season. This unit was re-opened in 2001 and the skeletal remains of one headless male, two bundle burials, and associated funerary objects were excavated (see Harrison and Acone, Chapter 10). Two additional excavation units were opened at Pakal Na: one at the locale of a subsurface anomaly detected by magnetometry (see Welch, Chapter 12) and the other at a partially bulldozed structure (see Morandi, Chapter 11). A 2 × 2 m excavation at the base of a large mound at Cedar Bank yielded early Colonial material (see Morandi, Chapter 14) while excavations conducted at the Augustine Obispo site yielded an abundance of Postclassic censors (see Morandi, Chapter 15). Finally, investigation of a small stone mound at the Samuel Oshon site yielded definitive evidence of a circular shrine structure, the second documented in the Sibun Valley (see Harrison, Chapter 16).

Figure 1.1 Sibun Valley showing transects and selected archaeological sites.
Under the direction of John Jones, three pollen cores were extracted from oxbows in the middle and lower sections of the valley. Oxbows were associated with the archaeological sites of Pechtun Ha, Pakal Na, and Samuel Oshon (see Jones, Chapter 34). Soils geographer Pat Farrell, assisted by Rhiannon Jones, collected samples from selected locales in the upper, middle, and lower parts of the valley in order to reconstruct the ancient soil mantle of the valley (see Farrell, Chapter 32 and Jones, Chapter 33). Geomorphologist Tom Bullard initiated study of the fluvial hydrology of the Sibun River (see Bullard, Chapter 31). Finally, botanist Kirsten Tripplett collected specimens of modern cacao as well as other species of the modern vegetation community (see Tripplett, Chapter 35). Tripplett, assisted by Emily Hall, initiated a water-flotation system for sieving bulk samples from excavations for retrieval of archaeo-botanical remains (see Hall, Chapter 30).

Piecing Together a Narrative of the Xibun Maya

As archaeological research in the Sibun Valley continues, a narrative of the Xibun Maya has begun to unfurl. The raw field data from each field season (1997, 1999, and 2001), when combined with subsequent analysis, either reinforce existing notions or lead our interpretations into new directions. Relevant to this iterative process are the major findings of the 2001 season of XARP that can be divided into two categories: archaeological and paleo-environmental. Since the Sibun Valley is an area that was relatively undocumented prior to XARP, the documentation of site locations and the construction of a local chronology of Maya occupation represented primary orders of business. Toward this end, we have established that there are two large anchor sites situated within the upper and lower valley, Hershey and Oshon, respectively (see Thomas, Marx, and Bermingham, Chapter 17). Hershey appears to be the only site in the valley with pyramidal architecture (Figure 1.2). Excavation at these anchor sites as well as smaller sites within the middle reaches of the valley has yielded evidence of construction techniques that incorporated local materials (see King, Chapter 18) and often constituted only one to three construction phases.

Toward the establishment of an absolute chronology, we have collected more than 100 charcoal samples for radio-carbon dating (many of which are currently undergoing analysis at the University of Arizona AMS lab). We have also made significant progress toward a relative chronology based on ongoing pottery analysis by ceramicist Sandra L. López Varela (see López Varela, Chapter 20). Xibun pottery represents a combination of extraordinarily well preserved sherds and complete vessels from caves (see Betzenhauser, Chapter 21) and marginally preserved pottery from excavations at residential sites, many of which are seasonally inundated. As anticipated, the Terminal Classic or Epiclassic period (AD 700-1000) appears to be the most vigorous period of platform construction in the valley and the timeframe of visitation to the nearby caves of the Sibun-Manatee karst as well as the Hummingbird karst. A time of great upheaval in ancient Maya society, the Epiclassic is the period during which sites in northern Yucatan—such as Chichén Itzá—rose to prominence. The link between sites of the Sibun Valley and northern sites is strengthened by the presence of northern pottery such as Chichén redwares in the Sibun Valley as well as the local construction of circular structures (now documented at the sites of Pechtun Ha and Samuel Oshon). Such shrine structures are a hallmark of the Epiclassic period throughout the Maya lowlands.

The cave of Actun Chanona. Located at the base of the Gorge and in proximity to the Hershey site, is thus far the only cave in the valley known to contain human remains (see
Hauksdottir and Morandi, Chapter 26). Since it is also the largest documented cave in the valley, the presence of skeletal material may refer to the fact that qualitatively different rituals were undertaken at this locale. The profound impact of the nearby caverns on the ritual life of the residents of the valley cannot be under-estimated and is materialized in the presence of speleothems transported to valley settlements (see Parks, Chapter 19) and, conversely, faunal offerings brought into the caves (see Leonard, Chapter 28).

![Figure 1.2 Three-dimensional contour map of the Hershey site.](image)

Preliminary analysis of pollen from cores extracted from oxbow features indicates a dearth of pollen from economic species (see Jones, Chapter 34). The premise that ancient cacao cultivation was practiced in the Sibun Valley is supported by these results since cacao itself leaves behind scant pollen but thrives as a lower-story arboreal species in a tropic forest. Successful cacao farmers of the past would not have leveled the bush in the manner that pollen analyses conducted on cores from the central Peten of Guatemala has suggested. The prevalence of large game in the midden deposits of relatively modest architecture is another indicator that high bush rain forest likely existed nearby.
during the population maximum (see Stanchly, Chapter 27). Another line of support for cacao production is provided by documentation of another possible cacao-drying platform—manifest as a highly fired clay surface—at the site of Pakal Na (see Welch, Chapter 12). The high frequency of imported goods, such as obsidian (see Lim and Thomas, Chapter 24) provides yet another indicator that the residents of the Sibun Valley brought something of value to trading transactions.

While we do not know exactly what commodity was traded out of the valley, we do have evidence that fish from the offshore coral reef were brought up river, presumably through trade, all the way to the base of the Gorge (see Stanchly, Chapter 27 and Kavountzis, Chapter 29). The daily life of Xibun Maya residents also involved acquiring suitable hard stone for chipped and groundstone tools (see Abercrombie, Chapter 22; Cesario, Chapter 23; and Haggar, Chapter 25). For Xibun Maya living close to the Caribbean (Transect 5), sources of medium-quality chert formed by marine transgressions of past geological epochs were readily available. Used as ballast in construction fill at the Augustine Obispo and Samuel Oshon sites, chert debitage is dramatically over-represented at Transect 5 sites in comparison to sites up river (see Cesario, Chapter 23).

While future field seasons undoubtedly will result in the revision and refinement of the Xibun narrative, the basic construction blocks are in place. Settlements and caves of the Sibun Valley, while peripheral to the powerful Maya cities of the Classic, Epi-classic, Postclassic, and Colonial worlds, contain vital information relevant to understanding major periods of transformation in Maya society. The crisp nature of the deposits in the Sibun Valley, in fact, can be attributed to the lack of severe “over-printing” caused by continued dense occupation or re-occupation. Strategic in the sense of being a locale where a desired prestige good such as cacao could be grown and advantageously situated relative to the Caribbean sea lanes so thoroughly traveled at the end of the Classic period, the Sibun Valley—and its severe flooding regime—posed a challenge to settlers. Perhaps this challenge was mitigated by the miles of nearby underground caverns available for ritual negotiations conducted by watchful farmers. These two facts of nature—floods and caves—shaped the lives of Xibun Maya residents and, in the case of the caves, were shaped by Xibun Maya ritualists. In this manner, culture begets landscape.
During the Xibun Archaeological Research Project (XARP) 2001 field season, approximately five weeks were dedicated to surveying and mapping natural and cultural features in the vicinity of the Hershey site. Located just below the Sibun Gorge at the edge of the Maya Mountains, the Hershey site is the largest known Maya site in the Sibun River Valley. Natural features in the area, such as rivers, terraces, and ponds, as well as some cultural features such as mounds, roads and orchards were mapped using Global Positioning System (GPS) instrumentation. The GPS system also served as an excellent reconnaissance tool that could be used to create spatially accurate sketch maps. Architectural mound features and adjacent areas were mapped at the Hershey site using a total station (a theodolite with an Electronic Distance Measurement device, or EDM). Several areas within the Hershey site were surveyed using a magnetometer to identify subsurface features for future investigation.

David Buck conducted the majority of the GPS data collection and was responsible for post-processing the GPS data. Total station mapping was accomplished by Steven Morandi, with Tara Bermingham, Christa Cesario, Daniel Leonard, and Kristen Marx. Daniel Welch was responsible for the magnetometry survey at the Hershey site. Brian Norris, of the James W. Sewall Company of Old Town, Maine, designed and set up the ground control network, coordinated procedures for the GPS ties to survey points with established horizontal and vertical control, and provided general land surveying guidance. Dave Carlson’s technical assistance was instrumental to the maintenance and management of the SurvCADD surveying software used in the field. A final contour map of the Hershey site based on both the total station and GPS field-collected data was created by Joe Beaulieu at the James W. Sewall Company. The ground control survey would not have been possible without the assistance of the several local macheteros who cleared the dense foliage on a daily basis so that we could see significant distances between control points and features to be mapped. From the local village of Saint Margaret’s, the cutters included Alejandro Davila, Rigaberto Galdemez, Celestino Hernandez, Rolando Hernandez, Rudolfo Hernandez, Saul Ortiz, and Rigaberto Veron.

Getting Started

One of the first steps taken in surveying the upper Sibun River area was to conduct research at the Government of Belize Survey Department to obtain existing control records that contained spatial coordinate data from the area of interest. Once this was accomplished, field reconnaissance was performed in an attempt to locate these published control markers. The next step was to establish a GPS base station at Hummingbird Haven. This base station was tied into recovered official Survey Department of Belize Control Points along the Hummingbird Highway. Once the coordinates and elevation of the base station were established this station was used to tie the total station mapping into the project datums (both horizontal and vertical).
Of the four published Department of Overseas Services (DOS) survey markers located between the Hummingbird Citrus Ltd. citrus and cacao farm and the village of Saint Margaret’s along the Hummingbird Highway (miles 31 - 36), two appeared to have been disturbed and moved from their original locations. The remaining two markers, DOS 96 and DOS 99, were used to confirm the location of the base station, referred to as Hummingbird Haven. DOS 96 (mile 35.2) is located at 323460.9 mE and 1890359.5 mN with an elevation of 86.4 m MSL (above mean sea level). DOS 99 (mile 31.6) is located at 329128.2 mE and 1889785.2 mN with an elevation of 105.1 m MSL.

Using these markers, it was determined that the Hummingbird Haven base station was located at 323210.93 mE and 1891042.45 mN with an elevation of 79.855 m MSL. After installing the GSR1000 base receiver, this location was confirmed by conducting field observations with the Rover unit at the known DOS 96 location. The difference between the actual DOS 96 location and the calculated DOS 96 (using GIR 1000) was .23 mE and .47 mN with a difference of 2.32 m (MSL). From this field test, it was determined that the accuracy associated with post-processing data using the Hummingbird Haven Base station was within our expectations. All GPS work within the upper valley during the XARP 2001 season was post-processed against the Hummingbird Haven base. The base station located at the Hummingbird Haven was in use from 31 January, 2001 to 2 March, 2001. The Monkey Bay base station, established during the 1999 season, was used for work in the lower reaches.

**GPS Data Collection Methodology**

GPS work during the XARP 2001 field season was accomplished using a Sokkia/ GIR 1000 Workabout system. The Sokkia system consists of two GSR1000 receivers (“base” and “rover” units) with GPS antennas, a PSION workabout handheld controller installed with FAMlog (Field Asset Management) data collection software, and interface cables which allow for data processing and communication between the controller, receiver, and PC computer used during data processing.

GIR 1000 (version 3.5) software was used for post-processing of the GPS data. Post-processing of field data, which compared rover and base unit data to achieve greater precision and accuracy, was necessary because the single rover GPS, by itself, would have been accurate to only 100 meters. With post-processing the instruments yield an expected accuracy of one to three decimeters under favorable conditions.

The rover unit was used for data collection. Point data was collected for five minutes in areas of dense vegetation and one minute in areas of no vegetation or low canopy unless otherwise noted. In order to achieve the desired decimeter resolution, a minimum of five satellites were tracked during field operations. The PDOP index was maintained at or below 4.0. In the event that the PDOP index rose above this value, the duration of the session was extended to ensure a more accurate measurement.

Post-processing of field data was completed at the end of each field day. Session files of the base and rover receiver were transferred to the computer via the interface cables and named according to the corresponding Julian calendar day on which the session occurred. Project files were created using the corresponding base and rover files.
Total Station Survey Methodology

The methodology and instrumentation associated with the total station have been described in detail in a previously published report (Morandi and Norris 2001: 5-6), and will not be reiterated here. As in previous seasons, the XARP 2001 survey project was designed to recover a maximum amount of data while providing students with training in surveying skills.

Most of the XARP 2001 total station survey was carried out in overgrown cacao orchards rather than in tropical rain forest. The orchard road network, crisscrossing the Hershey site, was heavily utilized for lines of sight and for establishment of new traverses. Surveying structures and the surrounding area was accomplished by establishing “spurs” off of an orchard road traverse loop to the tops of structures after they had been cleared of vegetation. The cacao tree canopy was relatively low and dense, making low total station and prism setups a necessity. In addition, the cacao of the previous year had not been harvested due to a poor market, and most of the trees were inundated with both new and rotted pods that hung off even the lowest branches. Still, the cacao groves proved advantageous for the survey due to open rows between trees (additionally, they provided shade and more than a few good snacks in the oppressive heat). Even very low mounds could be seen with some ease in the thin leaf litter, though few of these existed, perhaps due to preparation of the orchard rows, or past burial in alluvial sediment.

Changes in data processing were made for the XARP 2001 season. SurvCADD software (version CES) was generously supplied by David Carlson of Carlson Software in Brighton, MA, and was used along with AutoCAD 2000i for data entry and computer generated field maps. Data were entered into a computer on a nightly basis to ensure their integrity and accuracy before moving on to new survey areas the following day. First, the traverse observations (angles and distances) were entered. Next, the SurvCADD software was used to close the loop by averaging the error across all of the loop segments. The traverse and field point data were entered each night as dictated by the data collected in the field. Contour maps were created as check prints on a daily basis to check the quality of the survey as it was carried out.

Magnetometry Survey Methodology

In 2001, XARP was able, for the first time, to conduct geophysical prospection at various sites. The goal of these investigations was to locate subsurface features that could then be the focus of an excavation. As this was the first time we were using these methods we felt it was necessary to detail the methods and the process.

Background and Technical Theory

Magnetic gradiometry, commonly called gradiometry, is a specific refinement of another related geophysical technique called magnetometry. In fact, a magnetic gradiometer may be thought of as nothing more than a pair of magnetometers connected to a computer and set to record measurements over a given location at exactly the same time. A magnetometer is an instrument that measures the strength of the earth’s magnetic field at a particular area. The background magnetic field of the earth is thought to be generated by the movement of molten heavy metals in the planet’s mantle and core, and is affected by external inputs from the sun and outer space (Reynolds 1997).
Depending on the location on the globe, it has a particular strength range (expressed in nanoTeslas, nT) and angle of strike relative to ground surface (magnetic declination, or flux). The magnetic field is affected by various factors and is hugely variable both in its temporal and spacial extents. As magnetometers are moved over the ground surface, they respond to shallowly buried materials, geology, and even minute dissimilarities in soil chemistry. It is the challenge of the surveyor in archaeological geophysics to separate the anomalies caused by man-made features from natural interferences that obscure the more ephemeral archaeology. This is made easier with gradiometry because the paired magnetometers act as a high-pass filter which helps to remove the gradual low-frequency changes caused by soil chemistry and geology, leaving visible the near-surface, high-frequency anomalies (Breiner 1973).

While it is the variation over the ground surface that is most important to archaeology, it is the field’s variation over time that has most governed the development of gradiometry. The strength of the earth’s magnetic field is hugely variable throughout a given day. While no one is certain of all the affecting factors, the greatest source of interference is from the sun. The sun, and to a lesser extent outer space, constantly bombards the earth with electromagnetic energy. While the atmosphere stops most of this energy, some penetrates and causes spikes in the magnetic field. During periods of intense sunspot or solar flare activity, magnetic storms descend on the earth and cause enormous variations. Generally speaking such storms are rare, and do not often pose a great problem. The natural daily oscillation in field strength is called the diurnal effect, and it would pose significant problems to archaeological magnetic survey done without gradiometers. To give an example, the earth’s field strength can vary by as much as hundreds of nanoTeslas over the course of several hours, while archaeological features may have signal strengths of only a few nanoTeslas.

As noted earlier, a gradiometer is made up of two paired magnetometers. In archaeological exploration, one magnetometer passes as closely as possible to the ground surface, while the other passes over the same area at a greater height, typically 50-75 cm. While both magnetometers measure the diurnal effect and cosmic interference, and to some extent changes in geology, the bottom magnetometer also measures archaeological inputs. Since the weak signals generated by archaeology fall off dramatically with distance, readings from the top magnetometer are considered to be uninfluenced by archaeology. These magnetometers are set to record readings at exactly the same time. The top reading is then subtracted from the bottom reading to remove the diurnal effect and other gradual interferences. The resultant value is termed the magnetic gradient and is measured in nanoTeslas.

The equipment used in the XARP survey was a Geometrics G-858G Cesium Vapor magnetometer configured in gradient mode. The G-858G represents current state-of-the-art, high-resolution magnetics and a sensitivity increase of an order of magnitude over other more commonly used types. A detailed discussion of the Cesium magnetometer’s theory of operation can be found in Smith (1997). The equipment consists of a pair of sensors aligned one on top of the other, a control unit to record measurements and set field survey parameters, and a battery pack (Figure 2.1). The sensor setup is located on a long boom to remove the influence of the battery pack and the control unit.
Archaeological Applications

Geophysics is solely concerned with contrasts. Every geophysical technique measures the contrast in some physical property across an area. Most techniques accomplish this by sending a pulse of energy into the ground and measuring changes in its transmission velocity or strength as it passes through the subsurface. These techniques are termed ‘active’ and the most commonly used are ground-penetrating radar, electrical resistivity, and EM conductivity. In contrast, magnetometry is a passive geophysical technique that simply records already present interferences in the Earth’s natural magnetic field. These interferences can vary with the scale, depth, mass, and composition of the affecting object or area. While there are plenty of natural geological phenomena in the surficial area which cause interferences in earth’s magnetic field, human activity influences the subsurface in a number of ways which are readily detectable with magnetometry. These interferences are caused by a variety of materials including: ferrous metals, organic-rich soil, volcanic stone, kilns, and hearths (Clark 1996).

In New World prehistoric archaeology, the presence of ferrous metals can often be an excellent hallmark of disturbance, particularly in agricultural fields or in areas near to roads. Farm machinery and vehicles commonly throw off all manner of metallic parts, the signals of which are easy to separate from the dataset because there are often the strongest signals. If time and funds permit, a quick metal detector survey is the most useful method for locating and removing recent intrusive metal (Heimmer and DeVore 1995).

In most environmental zones, and especially the American tropics, the creation of topsoil through a bio-chemical process tends to imbue it with a weak magnetism. This is termed magnetic
susceptibility and is useful for identifying activities that disrupt the normal soil column (Clark 1996). Humans can alter the magnetic susceptibility of the soil with organic input from waste and middens, or by removing topsoil in the course of digging pits. The signature of such variations is ephemeral, but still detectable. Around mounds such as those at Pakal Na and elsewhere in the tropics, the washing of organic-rich materials off of the mounds to the surrounding area tends to give them a halo-like appearance.

In general, the most commonly sought targets for gradiometry are hearths and kilns. When sediments are burned so that their temperature rises above the Curie point, (different for every mineral, but around 500-700 Celsius on average), the weakly magnetic minerals are converted to oxides, including magnetite. Upon cooling, these oxides develop a fixed and permanent magnetism aligned with the earth’s field at the time of firing (Clark 1996: 64-65). This is termed thermoremanence. The principle applies to volcanic stone as well; basalts used in construction or as monuments are readily detectable.

Field Operations

Magnetic gradiometry has been used in archaeology in two ways. The first of these is known as magnetic scanning. Equipment is passed over a given area much the same way as a metal detector. There are no maps produced and anomalies are normally flagged in the field for testing. This method is extremely rapid but is usually only effective at locating isolated metallic objects or intensely burned areas such as kilns. The fact that maps are not produced makes the identification of subtle anomalies difficult.

By far the most common archaeological use for gradiometers is mapped area survey. Survey areas are defined and tied into a larger site grid system so that anomalies can be relocated for later ground-truthing. The survey proceeds over the area in a predefined pattern and every measurement is stored along with its coordinate location on the survey grid. The data are then downloaded into a computer for processing and map production. Several survey areas may be surveyed separately and then stuck together, or concatenated, into a larger area map. For the XARP survey, this second method was used to identify areas that could be tested during future seasons. All survey grids were tied to the local site grid by measuring the distance and angle from grid corners to known survey points.

Data were download each evening into a personal computer in order to check data integrity, perform field processing, and generate initial interpretations. Processing was done with Geometrics MagMap2000 and Golden Software Surfer, both running on a Windows platform. Final interpretation and map production were performed after the field season.

Results of the Upper Sibun River Valley Survey and Mapping Project

The Hershey Site: GPS Mapping

The focus of GPS work within the Hershey site and surrounding orchard was two-fold. First, the traverse network laid out by the survey team using the total station needed to be tied to a known horizontal and vertical datum. Second, features that could not be tied into the Hershey site traverse
network using the total station due to distance and/or line of sight obstructions could be quickly mapped with reasonable accuracy using the GPS rover unit. The 14 traverse stations were observed using the Rover and small tripod. Satellite data was collected for five minutes at each traverse station, pertinent information was recorded in a survey book (book 1 of 2, pp. 46-49), and post-processing with the base station was carried out in the lab. The results of this session are listed in Table 2.1.

<table>
<thead>
<tr>
<th>Structure No.</th>
<th>Easting (Precision)</th>
<th>Northing (Precision)</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>401</td>
<td>325332.17 mE (0.03 m)</td>
<td>1895508.51 mN (0.02 m)</td>
<td>65.53 m</td>
</tr>
<tr>
<td>402</td>
<td>325667.90 mE (0.03 m)</td>
<td>1895340.68 mN (0.01 m)</td>
<td>54.05 m</td>
</tr>
<tr>
<td>403</td>
<td>325488.28 mE (0.05 m)</td>
<td>1895013.03 mN (0.02 m)</td>
<td>51.99 m</td>
</tr>
<tr>
<td>404</td>
<td>325656.38 mE (0.15 m)</td>
<td>1894935.18 mN (0.06 m)</td>
<td>51.51 m</td>
</tr>
<tr>
<td>406</td>
<td>325512.32 mE (0.13 m)</td>
<td>1894658.27 mN (0.05 m)</td>
<td>54.63 m</td>
</tr>
<tr>
<td>407</td>
<td>325524.03 mE (0.18 m)</td>
<td>1894618.24 mN (0.04 m)</td>
<td>54.45 m</td>
</tr>
<tr>
<td>409</td>
<td>325456.36 mE (0.10 m)</td>
<td>1894572.72 mN (0.07 m)</td>
<td>54.82 m</td>
</tr>
<tr>
<td>411</td>
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<td>1894532.76 mN (0.05 m)</td>
<td>53.46 m</td>
</tr>
<tr>
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<td>325591.78 mE (0.15 m)</td>
<td>1894491.49 mN (0.13 m)</td>
<td>53.89 m</td>
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<tr>
<td>414</td>
<td>325566.81 mE (0.04 m)</td>
<td>1894460.79 mN (0.02 m)</td>
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<td>1894454.89 mN (0.14 m)</td>
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<tr>
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<td>1894505.66 mN (0.08 m)</td>
<td>62.76 m</td>
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<tr>
<td>418</td>
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<td>1894619.67 mN (0.02 m)</td>
<td>55.82 m</td>
</tr>
<tr>
<td>419</td>
<td>325303.55 mE (0.31 m)</td>
<td>1894658.13 mN (0.15 m)</td>
<td>55.11 m</td>
</tr>
</tbody>
</table>

Maps of the road system within the orchard were also created using the Sokkia GPS system in order to supplement the total station survey work as well as to aid in future GIS modeling. The data for the orchard roads were collected both on foot as well as with a vehicle using the line function within the FAMlog data collector software. The road system was mapped in four separate sessions and these maps are included in Map Sheet 1.

In addition to mapping the roads, reconnaissance within the orchard was carried out as part of the on-going survey work. An archaic Lowe projectile point was found within the roadcut of an orchard road N-NW of the main entrance to the Hershey Orchard. A GPS point was collected at the location (325490.84 mE, 1896356.38 mN). Additional survey within Transect 1 adjacent to the Hershey site was carried out along the southern bank of the Sibun River. Although visual confirmation was not possible during this season, local interviews suggested the possibility of additional mounds further downstream near the confluence of Dry Creek and the Sibun River. This area is considered to be in Transect 2 and will be the focus of more intense reconnaissance and survey during future seasons.

The Hershey Site: Total Station Survey

Total station mapping at the Hershey site resulted in a detailed topographic map that revealed a highly organized site center (Map Sheet 1). First, a random traverse was set in the vicinity of the Hershey site. The angles and distances of the entire traverse network were accurately measured
using the total station and tripod mounted prisms. The main traverse loop was closed around the major cultural features, and then several traverse “spurs” off the main loop were established to allow for the mapping of different mound groups at the site. The traverse loop also was connected (via a spur) to Survey Marker 420, a control point set by the Belize Department of Survey. This served as a secondary check on the spatial accuracy of the GPS ties. Most of the mounds at the Hershey site were large enough so that cacao trees were not planted on them. As a result, they were covered with dense stands of small trees and underbrush, which had to be cleared before the survey was attempted.

At the Hershey site, the Group C structures were the first to be mapped, followed by Group B, Group D, Group F and finally Group A, the largest at the site. The order of mapping was dictated by the order of clearing of the various areas, which generally proceeded from smallest to largest. A total of 32 traverse points were established at the Hershey site. Over 1500 field shots (with their coordinates in three dimensions) were recorded to create the topographic map of the site center. A total of 38 architectural mound features were identified, ranging in size from a few square meters in area and half a meter in height to the central pyramid of Group A, at roughly $25 \times 40$ m in area and over 13 m tall.

*The Hershey Site: Geophysical Prospecting*

One day of geophysical survey was conducted at the Hershey site in order to examine areas which were either partially tested by excavation or were slated for testing in future seasons. Three areas in and around the site center were selected for geophysical investigation (Figure 2.2). Arbitrary survey areas were laid out in such a way as to maximize area coverage given the uneven ground and brush. Readings were taken at an interval of 0.1 m along transects spaced 0.5 m apart. At least two corners of each survey grid were tied into the site master grid by tape-and-compass measurements to nearby survey points. No permanent markers were left in the ground.

![Figure 2.2 Hershey site center with survey area locations.](image-url)
Area 1 is a $15 \times 5$ m area partially enclosed by parallel mounds to the southeast and northwest. It was selected because the configuration of the mounds suggested that the area was a possible ballcourt. Many archaeologically known ballcourts in the Maya area contain a marker or stela in the center, and it was thought that this may be detectable by magnetic survey (P. McAnany and B. Thomas, personal communication, 2001).

Figure 2.3 Area 1 planviews with identified anomalies.

Geophysical survey yielded several strong dipole anomalies (Figure 2.3). The two dipoles toward the northern area of the grid have stronger positive components than the indicated dipole to the south. This object causing the southern anomaly may be oriented so that its longer axis is closer to horizontal with respect to the ground surface while long axes of the other two anomaly causing objects may be oriented closer to perpendicular. Based on its location within the grid and the signal strength and shape, the object causing the anomaly enclosed with a green circle (the center circle) has been identified as a possible ballcourt marker. This object is likely composed of some type of volcanic stone, as weakly or non-magnetic limestone would not have produced a signal of such strength. Figure 2.4 was produced to further characterize this feature. The possible ballcourt marker anomaly is not only the strongest signal in the area but the close proximity of another dipole feature may indicate that the object is actually fractured into two pieces.
Area 2 is a $35 \times 10$ m grid located to cover nearly all the top surface of Structure 507. This area was selected because it was trenched by Dan Finamore in an effort to locate a Colonial period church which was thought to be on the site. The location of the 0.5 m wide test trench is noted on Figure 2.5 with a solid gray rectangle.
This area presented some formidable challenges for interpretation because it is a non-natural feature. Ordinarily, geophysical survey locates objects or features because their physical properties or arrangement are significantly different from the surrounding matrix, which is assumed to be nearly homogeneous. Locating an arrangement of foundation stones on top of a mound which is composed of earth and rubble is a difficult prospect. The following list of anomalies for this area is by no means exhaustive, but simply the strongest or most geometrically regular, and thus, the most likely to be of interest. The cluster of strong anomalies indicated by a dashed circle may be caused by shallow rubble. The grid-northwest corner of this area had a great deal of cobbles on the surface which may have been tumble from the mound that adjoins it to the north (Figure 2.2). The cluster has a roughly regular shape, however, and should be investigated archaeologically. The area indicated by a long, thin rectangle oriented grid-east to grid-west at about Y=6 frames a possible linear feature based on the orientation of a series of anomalies which are somewhat more easily visible on Figure 2.6.

![Figure 2.6 Contour-wireframe overlay of Area 2.](image)

Finamore’s test trench (Operation 52) revealed a high concentration of cobbles in that area (Y=6-7); this anomaly could be caused by the ephemeral remains of a low wall (B. Thomas, personal communication, 2001). A dashed box shown on Figure 2.5 outlines the approximate size and shape of a rectangular anomaly that is most visible in Figure 2.6. This anomaly could indicate the presence of a structure and should be investigated archaeologically.

Area 3 is a 15 × 6 m grid sited in the cleared plaza to the southeast of Area 2. During survey, it was noted that the grid-northern and grid-southern areas gave generally higher readings than the central area of the grid. It is for this reason that the total field (TF) was analyzed, as well as the
As noted earlier, TF data provides a slight improvement in depth-penetration over the G-858’s approximate maximum of 2.5 m as well as a better indication of general trends, but TF data often is not adequate for identifying smaller, more ephemeral archaeological features. The 2001 excavations did identify a stone stairway leading up to a platform fronting the largest structure on the site. This stairway is located to the south of the TF grid and to the “right” of the rectangular outline drawn at the top, shown in Figure 2.2. The generally higher magnetic values noted for this area on the TF data, and to a lesser extent in the gradient data, may have been caused by a number of activities related to the presence of the stairway. These could range from a possible paving to increased foot traffic altering the properties of the sediment in the area. The contour plot of the gradient data (Figure 2.7, right image) also exhibits some interesting anomalies. The dashed oval shows the approximate size and shape of an inferred circular anomaly. The distribution of several small high positive values in a rough ring may indicate post-holes from the remains of a structure. The generally higher, more positive values between them could be caused by a higher organic content in the sediment which may have resulted from floor sweepings collecting at the base of the walls, leaving the center organically cleaner and magnetically weaker. The parallel lines show a break in the “ring” and could signify an entrance. This anomaly needs to be tested archaeologically to confirm or refute this interpretation. The single line to the north of the oval indicates a series of four magnetically low areas which were singled out because of their alignment. These should also be tested archaeologically.
Within the DOA files for the upper reaches of the Sibun River, two sites are noted approximately 1.5 km from one another. As mentioned in the above section, the XARP 2001 season located, mapped and excavated in the Hershey site (DOA #0301, site name Sibun). DOA site #0303 is shown on DOA maps to the south and east of the Hershey site, in an area today owned by the Chanona family and operated as the Finca Buenos Aires. The farm is located in the community of Saint Margaret’s, mile 31.5, Hummingbird Highway. This area was surveyed with the aim of locating DOA site #0303 (DOA site name Hershey). Although not confirmed during the 2001 season, two mounds (Strs. 700 and 701) located within Finca Buenos Aires could be associated with DOA site #0303. The long axis of Structure 700 is oriented east-west. The mound is approximately 10 x 5 m and 1 m in height. Construction material consisted entirely of limestone and the mound appears to have been looted, with a 2 m-diameter hole located approximately in its center. Structure 701, the larger of the two structures, is approximately 15 x 6 m and 2 m in height, with the long axis oriented N10E. Blocks of cut limestone were seen on the surface of the structure and uncut limestone was used as construction fill. The Finca Buenos Aires and its associated limestone hills and valleys will be the location of more intense survey during the XARP 2003 field season and the cultural nature of these mounds will be confirmed at this time.

Echo Valley and Actun Chanona: GPS Mapping

Additional reconnaissance and survey within Transect 1 was focused in and around the karst foothills and valleys of the Maya Mountains adjacent to the Sibun River. Echo Valley, as it became named due to its auditory characteristics, is located on the property of Caribbean Citrus, Ltd. The valley trends east-west and is flanked by karst hills to its north and south. The northern edge of the valley also contains an unnamed stream with an extensive river terrace draining the Maya Mountains and foothills (see Farrell, Chapter 32).

Within Echo Valley, a total of 15 archaeological structures were located. The valley was severely disturbed by agricultural development and therefore, the 15 mounds surveyed during the XARP 2001 season potentially provide only a minimum number of the structures that would have been located within Echo Valley during ancient times. The mounds are isolated structures configured in a linear arrangement along the terrace that borders the valley stream. They are flanked by the stream on the west and the karst on the east. Beyond the stream to the west is more karst. The Sokkia GPS system was used during this survey in order to secure coordinates for each mound. Satellites were tracked for one minute at the center of each mound. Additional information about the general dimensions of the structures was also obtained using the area function within the GIR 1000 Workabout. The area function provides both area and perimeter data for each structure. The extent of the river terrace was also mapped during the survey work in Echo Valley.

Transect 1 contains the largest and most significant cave site surveyed thus far by XARP, Actun Chanona. Actun Chanona is located in the Sibun National Forest which encompasses much of the headwaters of the Sibun River. The cave was extensively surveyed by Peterson and Cobb during the first half of the 2001 season (see Peterson, Chapter 3). GPS coordinates for the cave were taken from a clearing in front of the mouth of the cave. The location of the antenna was confirmed to be 321563.94 mE and 1890375.42 mN. From this location three measurements were taken to confirm the location of the cave entrance. At the base of the valley that leads to the cave we found
four ancient structures. This area has been tentatively named Sleeping Giant site after the farm owned by Johnny Zander on which some of the mounds lie.

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Smith, Kenneth
During gentle rains I sat at our camp in the foothills of the Maya Mountains and gazed at the karst hills, noting where clouds formed. This is one method of locating new caves. Cool air rushes out of cave mouths and mixes with hot tropical air, creating clouds of mist that seem to pour out of the hills. This meteorological phenomenon likely provided the basis on which Yucatec Maya of Chan Kom describe the Chaks, rain gods, as riding forth from their cave homes on cloud horses carrying their vessels filled with rain (Redfield and Villa Rojas 1934: 116).

Most of the clouds seemed to be clustered near the summits (some rising 120 m above the valley floor) of the hills known as the Hummingbird Karst (Day 1987). Actun Chanona, the largest known cave in the Sibun River Valley, is reached by an arduous climb up to the crest of a hill. Before describing this possible pilgrimage site, I will describe our methods of investigation.

**Mapping Archaeological Features of Caves**

The Xibun Archaeological Research Project (XARP) project began in 1997 with the purpose of archaeological investigation of settlement and sacred landscape in the Sibun River Valley. The cave team, led by Ilean Isaza (Isaza et al. 1999), explored and mapped nine caves in the Tiger Cave District. During 1999, I led an extensive reconnaissance of the Sibun-Manatee Karst in the central part of the valley in the Tiger, Thumb, and Glenwood Cave Districts (Peterson 2002). Eight additional caves were systematically mapped during the 1999 XARP field season. All caves, including those studied in 1997, were mapped using a combination of tape-and-compass and clinometer for the interior features and an Ashtec Global Positioning System (GPS) for plotting locations relative to nearby settlements (see Morandi et al., Chapter 2). The GPS points were taken outside of the cave mouths (sometimes on top of the karst hill directly above the primary cave opening) and were tied into the cave maps with tape-and-compass and clinometer.

Tape-and-compass maps of the cave floors were created in order to situate artifacts and features (hearth, altars, and artificial walls) in relation to natural cave formations, and to record the provenience of artifacts collected for analysis. Whenever possible, ceramics and C-14 samples were collected in order to reconstruct the chronology of cave use. Detailed in situ documentation of artifact assemblages (including photographs, drawings, and detailed descriptions) within the cave chambers was necessary since all intact vessels and artificially constructed walls were left as they were found. This strategy allows future investigators to view cave assemblages in context. However, artifacts deemed at risk of being disturbed or looted because of their location or potential commercial value were recorded and collected for analysis.

The 2001 field season posed many challenges, including an extended rainy season, a hill of mud to climb daily, and the psychological effects of light deprivation that go along with working in deep caverns. Some passages were too difficult to access without technical caving gear or too dangerous to map due to health risks imposed by disease-carrying insects or bat guano. These chambers were mapped with the aid of a laser rangefinder. The documentation of spectacular features, such as the “Great Platform” which is included in the following discussion of Actun Chanona, was well worth the challenges that we faced.
Actun Chanona

Actun Chanona is the largest known cave in the Sibun River Valley — spanning approximately 279 m in length — with a wide entrance on the east and a narrow opening on the west. The cave penetrates the top of a steep hill in the Hummingbird Karst near the opening of the Sibun Gorge. It is situated upstream from the Hershey site; both sites are located on the northwestern side of the river. It is the only known Xibun cave that contains human remains and large-scale artificial construction that must have required the efforts of a large labor force to build. The main eastern entrance is massive in size and could easily be envisioned as the gaping maw of the earth monster with its stalactite row of teeth and its deep sinkhole threshold.

Members of the Belize Department of Archaeology (DOA) have explored Actun Chanona in the past. The 1978 report states that the cave contained human remains, pottery vessels, *manos* and *metates*, and that the floor was carpeted with potsherds. During that visit, only three sherds were collected. The cave was mapped by geomorphologist Thomas Miller in 1980 (Figure 3.1). Jonny Zander, a local resident, led us to the cave in 2001.

![Figure 3.1 Map of Actun Chanona (adapted from Miller).](image)

Essentially a long, linear cave with both an eastern and a western entrance, the cave and its notable features and artifacts are described here in narrative form, beginning at the eastern entrance. The cave system is accessed by following a winding path down into a natural sink and then climbing up to a balcony where the main eastern entrance is located. At the tail end of the rainy season, in January and February, the
area just inside the entrance was filled with water so that one had to traverse the chamber by stepping on speleothems (see Parks, Chapter 19, for a discussion of these human modified features). Crabs live in this area of the cave. By the end of March, after the rains subsided, many of these gours dried up. A little farther into the chamber, a series of larger rimstone dams surround the path. At some time in the past, visitors wrote “Dios” and drew the sign of the cross on the wall above one pristine pool of water near the southern wall of the cave, attesting to the intermingling of pre-Columbian ritual practices and Spanish Catholicism in the Xibun region. Vessel 50, a small olla with a soda straw growing from it, was deposited on a slope between the northern wall of the cave and the rimstone dams.

Skeletal remains of at least five individuals were mapped and identified in Actun Chanona (see Hauksdottir & Morandi, Chapter 26). They were all deposited in wet portions of the cave, so some (Individuals 1, 2, and 5) are cemented to the floor with calcium carbonate and others have stalagmites (Individuals 3 and 4) growing on the bones (Individuals 1, 2, and 5 are indicated in Figure 3.2 and Individuals 3 and 4 in Figure 3.9). Individuals 1, 2, and 5 are located down a slope to the west of the rimstone ponds. In all cases the skeletons were incomplete and disarticulated. Judging from the excellent preservation of the bones, it is possible that they were brought to the cave in bundles for secondary deposition.

Skeletal elements were also found distributed throughout the cave in association with artifact clusters and speleothem arrangements. For example, two human ribs were discovered on the slope directly above and to the south of Individuals 1, 2, and 5. An obsidian blade, five stone net weights, and other assorted artifacts were collected from this slope for analysis (Figure 3.3). The slope leads up to a balcony with dense deposits of sherds, a red granite metate, and other artifacts found in recessed alcoves.

Actun Chanona contains the most complex artificial construction recorded by the XARP cave team — a 30 m long platform dubbed the “Great Platform” (Figure 3.4) — located approximately 100 m from the eastern entrance of the cave (see Cobb, Chapter 4, for a detailed description of the platform construction). An “altar,” composed of three large slab boulders propped up against each other, is the focal point of the eastern side of the platform. Charcoal, sherds, manos, and metates are distributed around the base of the “altar.” Vessel 45, a cream colored wide-mouthed olla with a large “kill hole” in the side, is located on the western side of the platform.

Underneath the “Great Platform” there are a series of tunnels that may have been created to facilitate mining the abundant high-quality red clay located beneath the cave floor (Figure 3.5). A speleothem “altar” surrounded by sherds and charcoal was observed in one of these subsurface tunnels. A ground slate hacha with edge-wear was found near one of the two chimney entrances to these tunnels. Large areas of speleothems situated around the base of the platform had been burned (see Parks, Chapter 19).

A fragment of a red ceramic drum (Vessel 46) was discovered to the south of the “Great Platform” in an area dubbed the “drum room” (Figure 3.4). The area is accessed either by descending the steep
Figure 3.2 Map of Individuals 1, 2, and 5.
Figure 3.3 Map of the balcony containing net weights.
Figure 3.4 Map of the “Great Platform.”
southern slope of the “Great Platform” or by crossing an area of boulder-sized breakdown. Vessel 46, the base of a “lamp-glass” type drum, is similar to those found at Barton Ramie in the neighboring Belize Valley and at Lubaantun in southern Belize (Gifford 1976: 217; Hammond 1975: 322). It is probably Late Classic Macal Orange-red type of the Macal variety (Gifford 1976: 214-215). Nearby, a crack in the floor, barely large enough for a person to enter, contained a large wooden torch, a human tibia, and a large stucco-covered sherd with a starfish relief decoration. Delicate helictites, speleothems that grow in any direction, twist from the low ceiling near the south wall in this part of the cave.

Fragments of a ball player figurine (Figure 3.6) were cached nearby in an alcove. Identical Terminal Classic clay figurines wearing hip hoops, recognizable as typical ball game equipment, were excavated in the Central Acropolis at Tikal (Jones 1985: 52, Figure 12; Christopher Jones, personal communication, 2001). The ball player is a mold-made hollow figurine, and may have functioned as an ocarina or whistle as did the ballplayer figurines found at Lubaantun (Hammond 1975: 372-373). The ultimate deposition of this artifact in Actun Chanona is particularly significant in light of the connection between the ritual ball game and the Underworld.

A Modeled-carved vase from Actun Chanona was reported by Elizabeth Graham, Logan McNatt, and Mark Gutchen (1980: 161-166) to be nearly identical to vessels from the sites of Altun Ha and Footprint Cave, the latter located in the Caves Branch region. Sherds likely from the same Terminal Classic Modeled-carved vessel were collected from a balcony above the “Great Platform” in 2001. Other artifacts in this area include two jars (Vessels 48 and 49), a human rib, six net weights, and a small jade bead. A “three-stone hearth” is located on the floor between the two complete vessels (Figure 3.7).
Figure 3.6 Fragments of a ball player figurine (Photo by Patricia A. McAnany).

Figure 3.7 Map of the balcony above the “Great Platform.”
At the back of the cave lies the western entrance, a narrow slit accessed by traversing a steep slope. Nearby, remains of Individuals 3 and 4 were discovered among and underneath stalagmite formations (Figure 3.8), evidence that the bones were deposited beneath actively dripping stalactites. Further to the east along this slope is a high ledge overlooking the “Great Platform” where Vessel 47, a cream colored wide-mouthed olla, is located.

![Figure 3.8 Map showing the location of Individuals 3 and 4.](image)

**Discussion**

Deposits of human remains (most likely secondary bundles of specific body parts) and artificial construction on a large scale attest to the importance of Actun Chanona to the Xibun Maya. Human modifications transformed this awe-inspiring natural landscape into a stage for ritual activities. The “Great Platform” was a focalpoint for ritual performance in this cave.

Yucatec Maya rain rituals include acts of sympathetic magic such as splashing water on participants and imitating thunder (Sosa 1985: 397). A fragment of a ceramic drum was discovered in Actun Chanona near the “Great Platform.” In the Yucatec Mayan language, the word pec can be used for drum and also to describe the noise that thunder makes (Thompson 1972: 94, 104). Perhaps the drum was played in the cathedral-sized chamber where it was found in order to mimic thunder, thus invoking rain.

Fire was used extensively in rituals that occurred in the dark zone around the “Great Platform.” Several large burned areas contain artifacts intermingled with charcoal and broken cave formations (Figure 3.9). Speleothems may have been burned along with pottery sherds and other artifacts in order to release the dangerous power that these objects accumulated during ritual. Thomas Gann (1971: 57) observed a Cha chaac rain ceremony in Belize in which ceremonial paraphernalia was intentionally burned at the conclusion of the ritual. To the Lacandon Maya, the burning of old incense burners in a cave symbolized the death of the vessels after which they were called ubäkel äk yum, “the bones of our Lords” (McGee 1998: 45).
Figure 3.9 Map showing the location of burned areas (redrawn by Cobb from Miller).

Large-scale modification of the cave environment, mass burning of speleothems, and a high density of artifacts, make evident the intensive use of the cave by the Xibun Maya. Further analysis will focus on the evidence for ritual pilgrimage to Actun Chanona.

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Chapter 4
Caves as Modified and Constructed Space for Ritual Practice: The Case of Actun Chanona
Allan B. Cobb

The use of caves as a part of the sacred landscape and their use as places of ritual is well established (Brady 1989; Heyden 1981; Thompson 1975). Past studies in caves have yielded evidence for substantial constructions within caverns either to enhance ritual ambience or to aid in negotiating a pathway. Most of Mesoamerica has an abundance of natural caves but in areas where caves are scarce or nonexistent, caverns were hollowed out of bedrock (Brady and Veni 1992; Manzanilla et al. 1994). Some caves were seldom visited (judging from the paucity of artifacts and built features), while others served as pilgrimage sites attracting visitors from the far corners of Mesoamerica. The features that rendered one cave more culturally salient than another may never be understood, but the relative importance of a cave may be measured by intensity of use. One method for measuring intensity of use entails the analysis of structural alterations to a cave. A cave that exhibits intense modifications or constructions, theoretically, is a cavern that was intensely utilized and likely played a very important role in ritual practice.

An important cave, one that was used over a long period of time or one that was used frequently for ritual, will justify the time and effort required to make major alterations. Some alterations, the removal of rocks that blocked a crawlway, are simple and even occurred in caves with sporadic or limited use. Other modifications, such as transporting stone into the cave and building massive walls, are labor intensive projects and likely reserved only for more important caves. In this chapter, alterations to Actun Chanona are identified and described in an effort to show the importance of this cavern to ancient Maya visitors.

Cave Modifications Versus Cave Construction

Alterations to caves fall into two broad categories: modifications and constructions. Cave modifications are alterations that require little in the way of materials that must be manufactured or transported into the cave. Cave modifications are based on altering the natural cave by hand or with tools. Materials used in modifications typically are found at the site of the modification or at a short distance away. Cave modifications can be as simple as moving rocks, using a rock to chip steps into flowstone or mud, or lining up rocks to guide direction of travel through a cave. Cave modifications are probably more ubiquitous than reported in the literature, either because they are overlooked or considered too insignificant to mention.

The other broad type of alteration to caves is cave construction. Cave constructions can include the actual construction of a cave but, in this paper, the term applies to constructed features within a natural cavern. Cave constructions are differentiated from cave modifications by the greater amount of labor involved, the transport of worked or raw materials from outside of the cave or from distant parts of the cave, and the grander scale of alterations. Often, cave constructions are easily noted by even the most casual of observers. Cave constructions include large retaining walls, constructed stairways, altars made of stacked stone, and large multi-course walls. Some cave constructions,
however, are subtle and more difficult to identify. Subtle cave constructions include leveling, pathways that smooth rough terrain, and platforms for rituals.

The separation between cave modifications and cave constructions is not hard-and-fast. Some cave constructions involve several different types of constructions and perhaps even some cave modifications. Because Maya builders were altering an existing natural feature, the physical space within the cave often constituted the driving force that controlled how the cave was modified or what constructions were undertaken.

Cave Modifications

Moved Rocks

Cave modifications are often difficult to detect or even identify; some are incredibly subtle. One of most subtle modifications takes place in the form of moved rocks. Rocks may be moved for some religious or aesthetic reason, which may never be explained. More likely, rocks are moved to make travel through a cave easier. Moving rocks to make passage through a cave easier is difficult to identify, especially in a cave which has had visitation since the time of the ancient Maya.

To a caver, the motivation behind much cave modification appears to be an effort to facilitate painless passage, often through small spaces. It is common to see crawlways with the larger rocks tossed to the side. Moved rocks also occur along the margins of flat floored cave passages to make walking easier. This type of modification is present throughout Actun Chanona. Unfortunately, Actun Chanona has been the recipient of a number of visitors since ancient Maya times, so it is difficult to identify which alterations were done by the Maya and which have subsequently been done. Moved-rock modifications have been observed in almost all caves visited by the author throughout Mesoamerica even though it is seldom reported.

Cut Steps

Cut steps are another modification designed to ease travel through a cave. Cut steps are hollowed cavities carved into either rock or mud. Steps cut into flowstone are widely noted in the Sibun River Valley but less frequently reported in other Mesoamerican caves (Rissolo 2001). Flowstone is a smooth cave formation that often exhibits a steep sloping surface. Made of calcite and formed by water flowing over a surface, flowstone, over time, forms a relatively smooth, cascading surface. Steps may be cut easily into the flowstone using a rock or hammer stone. If water still flows over the flowstone, the cut step will be smoothed by additional layers of calcite. Other times, calcite may obliterate any sign of the step. In Naj Tunich, steps were cut into limestone to aid in climbing a flowstone that led to a small chamber with a stacked-stone altar. Steps also may be cut into limestone. In Incidents of Travel in Yucatan, John L. Stephens mentions a cenote at the village of Telchaquillo that could be accessed by “irregular steps cut and worn into the rocks (1963: 70).”

Ancient Maya cavers probably cut steps in order to move up and down slippery mud slopes. This is a common practice among cavers today, making old steps cut into mud slopes or mud banks
difficult to date. Over time, steps likely would be obliterated by natural processes such as flooding or slumping. Old steps may also be destroyed by continued use.

Actun Chanona features two areas where cut steps have been noted. In the eastern entrance of the chamber, two steps were cut into flowstone along the back wall of the chamber. In this part of the cave, the flowstone is no longer active. The cut steps provide a much needed foothold for scrambling up or down the flowstone slope. The steps appear smooth from use but still retain somewhat angular edges with little or no deposition of calcite. Based on the weathered appearance of the steps, they are probably quite old.

Near the western entrance of the cave, there are two steps cut into clay. The western entrance is difficult to pass through due to the steeply sloping clay; the steps are located on the slope of clay about 30 m from the entrance. Judging from the high concentrations of artifacts in the western portion of the cave, ancient visitors most likely used this entrance. Maya builders most likely cut a pathway across the clay slope or used logs to construct a simple bridge. No evidence exists today to indicate how the slope was crossed. Recent visitors to the cave have caused considerable wear and erosion on the slope; however, two cut steps remain. The steps are preserved in hardened clay and show signs of considerable wear. Still used by modern visitors, this feature needs to be protected from continued use.

Traffic-flow Designators

Traffic-flow designators, as the name implies, direct traffic by a visitor. These do not forcibly restrict where one might walk and oftentimes consist of a simple row of rocks. Traffic-flow designators serve much the same purpose as ribbon-tape barricades found at airports, banks, and theaters. Traffic-flow designators as used in caves simply guide one through the cave. The rules of etiquette for these guided routes may have been based on religious or cultural ideas or simply on ease of travel. Traffic-flow designators may have been useful for groups of Maya moving through a cave. Visitors without torches would be more likely to follow the safe or designated route by using visual cues from traffic-flow designators that were lit by the torches of others.

Traffic-flow designators have been identified in other caves in the Sibun River Valley (Kenward 2001) and noted in Shoe Pot Cave, as well as in the Tiger Sandy Bay region of the Sibun River Valley. Traffic-flow designators also have been noted in Actun Kaua in the Yucatan. Traffic-flow designators are probably widely distributed throughout Mesoamerica, but they often go unrecognized as a cultural feature of caves.

Actun Chanona contains one clear example of a traffic-flow designator. At the eastern entrance of the cave, the passage leading into the cave is bounded by a low wall that suggests that access into the dark zone of the cave followed the right side of column (Figure 4.1). The rocks on the left side of the column are obviously placed, but consist only of a single layer. The single course wall in no way impedes access. During the 2001 season, the author observed that, without mentioning the line of rocks, modern visitors automatically moved to the right side of the column in order to enter the cave.
Figure 4.1 The eastern entrance to Actun Chanona features a low wall that forces one to enter the cave along the right side of the column.

Trail Markers

Trail markers are similar to traffic-flow designators in that they guide one through the cave. Only three trail markers have been identified by the author; none were found at Actun Chanona. The two caves containing trail markers are located near Dos Pilas in Peten, Guatemala. At the end of a large room near the western entrance of Cueva de Sangre, a cluster of stalactites was broken off and placed on a mud bank at a fork in the passage. This may have indicated the way into or out of that area of the cave. In two separate places at Kaxon Pec, also near Dos Pilas, stalagmites were placed at key intersections to indicate the direction of the main passage. No similar trail markers were identified in Actun Chanona. This may be due to the fact that there are no significant side passages in this cave.

Carved-niche Altars

Carved-niche altars are features created by modifying a natural recess in the wall of the cave. Often, the flowstone was chopped flush with opening of the niche. Such altars have been noted in Glenwood Cave in Belize and in Cueva del Las Pinturas in Guatemala. Carved-niche altars may be less than 0.5 m wide, or they may be quite large. Large carved-niche altars could have accommodated the ritual propitiations of two to three people. Some large carved-niche altars feature a modified flowstone floor.

One large carved-niche altar was located on the south wall of Actun Chanona, well within the dark zone (Figure 4.2). This altar is located approximately 100 m from the western entrance. The altar is large; fill was deposited to level the interior floor. Inside the niche altar are pottery sherds and evidence of burning.
Cave Constructions

Constructed Steps and Ladders

Constructed steps differ from cut steps in that they were built by adding materials. Generally, stacked rocks or cave formations were used to create treads and risers. The stairs may traverse steep slopes or span crevices. Constructed steps in the form of a grand staircase have been reported in Semay Cave in Alta Vera Paz, Guatemala (Gurnee 1965).

Constructed steps could also be made from wooden ladders. The famous staircase of Cenote Bolenchen was constructed of logs (as shown in Fredrick Catherwood’s 1842 drawing). It is likely that similar ladder-type stairways were made on a much smaller scale and used widely in caves. It is also likely that notched logs were used as simple ladders. Notched logs of modern origin have been found in caves throughout Mesoamerica. Local visitors use the notched logs to enter caves and negotiate short drops. Unfortunately, wood is seldom preserved in the wet, humid environment of caves. The ancient Maya probably also constructed wooden scaffolds to reach high and otherwise inaccessible places. Indirect but supporting evidence of scaffold construction is provided by the fact that artifacts were found at Naj Tunich on high ledges accessible only with an aluminum ladder.

Actun Chanona features several constructed stairs, most of which are found in breakdown areas and are constructed of rocks or cave formations. Materials probably were gathered within the cave.
The stairs cover crevices between breakdown blocks and provide an easy path for traversing the boulder-strewn slopes.

**Altars – Slab, Upright, and Stacked-Stone**

Altars are a focal point of ceremonial activity and have been widely reported in cave literature that describes religious activities of both ancient and modern Maya, as well as highland Mesoamerican peoples. Many cave altars have probably gone unnoticed, since altars may appear to be natural features, such as a cluster of stalagmites. In Cueva de Sangre at Dos Pilas, Guatemala, for instance, several areas of stalagmites were littered with pot sherds and evidence of burning. Similar areas of burning also were found in Actun Chanona, although, in some cases, they were much larger than anything previously observed by the authors (see Peterson, Chapter 3). Sometimes, altars were constructed. These types of features have been divided into three categories: slab, upright, and stacked stone.

Slab altars typically are constructed of tabular limestone or cave formations that are supported by smaller stones. Often constructed of dressed stone, slab altars may be built with materials available within the cave and with imported stone. Due to the amount of labor involved in dressing stone, it is likely that slabs were fashioned outside of a cave and then transported into the cave. In the Sibun River Valley, slab altars have been reported in Glenwood Cave and Pottery Cave (Kenward 1999) as well as in Guatemalan caves such as Cueva de Rio El Duende and Naj Tunich (Brady et al. 1992). In Actun Chanona, one dressed-limestone slab altar was recorded in a small chamber at the top of a flowstone slope, high above the main passage of the cave. The limestone slab did not come from that chamber, so it must have been brought from another location. Since the altar had been disturbed and moved, its original location and whether it was positioned on stones are unknown.

Upright altars feature a dominant vertical component rather than horizontal dimensions. Constructed of stone or cave formations, upright altars have been noted in Naj Tunich, Guatemala, and in Actun Kaua, Yucatan. Actun Chanona contains the largest example of an upright altar yet found. Two large, flat pieces of breakdown each about $1.5 \times 1 \times 0.3$ m were positioned upright and rested against each other to form an inverted “V.” Evidence of burning and pot sherds were noted around and under the upright stones.

Stacked-stone altars are a construction-intensive type of altar made by stacking stones, or in some cases, speleothems. Reported in many parts of Mesoamerica, stacked-stone altars are known from Glenwood Cave (Kenward 2001), Naj Tunich (Brady et al. 1992), and Actun Kaua. No stacked-stone altars were found in Actun Chanona, although it should be noted that stacked-stone altars may be easily overlooked because they are often built against the wall of a cave and may appear to be a pile of rocks.

**Walls – Retaining, Space-Restricting, Access-Restricting, and Passage-Sealing**

The construction of walls in caves is probably one of the most easily noticed and widely reported cultural features in caves. One of the earliest reports of walls built within a cave comes from Quen Santo, Guatemala (Seler 1901). Walls probably represent one the most labor-intensive cultural features found in caves. Typically, walls were built of rocks brought in from outside the cave. Stones and broken speleothems within a cave may be used but are seldom appropriately sized to
construct massive walls. Walls may vary in height from two or three courses (such as several observed at Dos Pilas) up to the 15 m high walls found in Naj Tunich (Brady and Stone 1986). Generally, walls were constructed close to the entrance in the twilight zone, as is the case in Naj Tunich (Brady 1989) and Cueva del Las Pinturas (Brady et al. 1997). Occasionally walls are constructed well into the dark zone as reported in Cueva de Sangre (Brady et al. 1991) and Quen Santo (Seler 1901). The purpose of constructing walls within caves is not fully understood.

Retaining walls reshape a cave chamber by holding back soil and debris, and often create walkways or platform areas. The most impressive example of a retaining wall is found in the entrance chamber of Naj Tunich, where retaining walls up to 15 m tall create a series of platforms and walkways within the entrance chamber.

In Actun Chanona, a series of retaining walls were noted on the north side of the eastern entrance chamber (Figure 4.3). These walls are designated as retaining walls because they appear to have held back soil and debris that would have washed into the cave entrance. The walls may also create a zigzag pathway leading into the entrance chamber. The actual height and extent of the retaining walls as well as details of construction methods can only be revealed with future excavation. All walls appear to be at least 4 to 5 m in length and about 1 to 1.5 m high. Several of the retaining walls connected natural breakdown or speleothems in the chamber. Excavations would probably reveal that the termini of the walls exploit these natural features as anchor points for each wall segment.

Figure 4.3 Plan and profile of the retaining walls found along the north side of the eastern entrance chamber of Actun Chanona.
Another short retaining wall was noted on the south side of the eastern entrance chamber of Actun Chanona. The wall is only about 1 m long and consists of three or four courses of stone. The retaining wall was built between two large pieces of breakdown and probably served to create an overlook of the entrance chamber.

Not all walls constructed in caves are retaining walls. Some walls appear to be constructed to restrict spaces for ritual use. Some caves have a space-restricting wall built within the entrance such as occurred at Cueva de Sangre (Brady 1997a). Actun Chanona may have a similar type of restricting wall built within the eastern entrance. The edge of the entrance area appeared in several places to have been modified by wall building, but, due to the presence of leaf litter and debris, no clear evidence of a wall could be seen.

Another type of access-restricting wall is similar to the traffic-flow markers that have been previously discussed. This type of wall may have prevented entrance into dangerous or confusing parts of the cave. Several examples of access-restricting walls have been reported in the Sibun River Valley (Kenward 2001), as well as, Actun Kaua, a very complicated maze cave in the Yucatan.

Access-restricting walls may actually be a subset of space-restricting walls. The differentiation between the two lies in the fact that access-restricting walls generally define some sort of passage way. The best examples of access restricting walls occur at Cueva de Las Pinturas in Guatemala, where two large walls measuring 14 × 3 × 2 m and 8 × 2 × 3 m restrict access between the entrance chamber and the dark zone of the cave. Each of the two walls has a narrow pass through the wall (Brady et al. 1997:92). These walls may have served to restrict access to the dark zone of the cave to a select group of persons. In the Sibun River Valley, these types of walls were also reported in Ek’Waynal (Kenward, 1999). No access-restricting walls were identified in Actun Chanona, although further investigation at both entrances may reveal the presence of such walls.

Another type of wall found in caves is the passage-sealing wall, which either completely or mostly blocks access to a cave passage or entrance. Passage-sealing walls have been reported at the entrances to Cueva de Sangre and Cueva El Duende at Dos Pilas and at Cueva de Tecolote (Brady et al. 1997). Passage-sealing walls that block passages within a cave have been reported in Cueva de Las Pinturas (Brady et al. 1997). No passage sealing walls were found in Actun Chanona.

It is unclear whether passage-sealing walls were intended to permanently seal off part of a cave or an entrance or to temporarily seal the cave so that it may be opened at certain times or for certain types of ritual. Sealed caves and cave passages represent significant resources for studying undisturbed caves.

Dams

A dam represents a specialized type of retaining wall constructed to hold back water in order to form a lake or to affect water flow. Dams have been reported in Cueva de Sangre at Dos Pilas, Naj Tunich and Santo Domingo Cave (Brady and Fahsen 1991). Identifying dams in caves may be difficult, as they can be washed out by floods or may no longer hold water. Another difficulty in identifying dams is that they may only function during the rainy season when water actively flows through many caves. Because most field research in caves is done in the dry season, dams may not
be noticed or recognized. Actun Chanona did not appear to contain any dams but a thorough search should be undertaken during the rainy season before dams are declared absent from Actun Chanona.

Pathways

Pathways are features of cave construction that facilitate travel through a cave. A wide variety of techniques often were used to construct pathways. In Cueva de Las Pinturas (Brady et al. 1997), a pathway is located inside the entrance chamber that connects two divergent passages. The sloping floor was leveled, possibly with the aid of small retaining walls. In Aktun Ak’ab, pathways were constructed by filling cracks between breakdown blocks, spanning breakdown blocks with slabs, and moving breakdown blocks (Rodas 1994). In Naj Tunich, retaining walls and fill behind them serve to form pathways. In Cueva de Sangre, walkways were created using stepping stones and paving stones to keep visitors out of the mud and water during the rainy season. Pathway-building in the form of ramps and tiling with paving stones was reported in Shoe Pot Cave (Kenward 2001).

In Actun Chanona, extensive pathway-building took place. Retaining walls were used in the eastern entrance chamber to create pathways across a steep debris slope. Along the northeast wall of the entrance chamber, several large speleothems were broken and removed to make a pathway along the wall of the chamber. Along this pathway, steps were cut into flowstone. In the main trunk passage of the cave, cracks between breakdown blocks were filled with small stones, speleothems, and soil in order to level the surface. Longer spans between breakdown blocks were filled using large speleothems and other breakdown blocks. Maya builders also moved considerable amounts of breakdown to clear pathways and to cover cracks and holes in the floor. In many places throughout the cave, large rocks or speleothems were positioned to make negotiating breakdown blocks or slopes much easier.

Walkways built up with retaining walls were also noted in the dark zone. Along the south wall of the cave, below the Great Platform, a well-defined retaining wall of three courses and 7 m in length was built next to the wall of the cave (Figure 4.4). Fill was added to create a smooth walkway (Figure 4.5). Based on the large number of artifacts in the area, this part of the cave was a focus of ritual activity. This walkway was difficult to identify because the retaining wall was almost touching the wall of the cave. The retaining wall was not visible unless one squeezed down between the wall of the cave and the retaining wall.

Figure 4.4 A retaining wall used to hold back fill to create a level surface.
Platforms

Platforms are constructed features in caves that probably are underreported. Often associated with retaining walls, platforms are raised, flattened areas that can cover a large area. Naj Tunich contains platforms that extend behind the retaining walls in the entrance chamber, and are connected by pathways. Inside Naj Tunich, there is a broad, raised platform well into the dark zone.

Actun Chanona features a number of platforms. In the entrance chamber, a low retaining wall creates a small platform or overlook built against the south wall of the entrance chamber. Another platform is located at the mouth of the main passage of the cave at the point where it opens into the eastern entrance chamber. This platform has low retaining walls that hold the soil and stone fill in place. Commanding a view of the entrance chamber, this platform was built where cool air blows out of the cave.

Actun Chanona contains a large platform that is approximately 30 m long, 15 m wide, and rises about 10 m above the cave floor. Due to its size, this platform was named the Great Platform. The Great Platform is composed mostly of large pieces of breakdown. The Maya used various modification and construction techniques to reshape this natural pile of breakdown into the Great Platform. The space between the pieces of breakdown were filled with large rocks, layers of smaller cobbles, red clay, and finally capped with white earth. Other cracks were simply filled with rock (Figure 4.6).
Once the breakdown was converted to a level surface, smaller platforms were built atop the Great Platform. These smaller platforms often butted up against each other but, through the use of retaining walls, the platforms were built at different heights. Approximately 30 smaller platforms were constructed and ranged in length from about 1 to 5 m. The surface of the Great Platform contains a large, upright altar as well as *manos*, *metates*, pot sherds, intact vessels, and hearths. For a detailed map of the surface and further descriptions of the Great Platform, see Peterson, Chapter 3.

**Floors**

Floors may be created on the tops of platforms or on pathways. Floors represent an improved surface and may have some ritual significance. Floors have been noted in a number of caves, such as Cueva de El Duende and Cueva de Rio Murcielagos at Dos Pilas (Brady et al. 1991), and in Cueva de las Pinturas (Brady et al. 1997). There are different types of floors; for example, Cueva de El Duende had a floor made of yellow clay, Cueva de Rio Murcielagos had featured floors possibly made of plaster, and Cueva de las Pinturas contained stratified red clay floors.

No excavations were performed during 2001 in Actun Chanona. One of the white floors located atop one of the small platforms of the Great Platform could be investigated, however, because the fill had collapsed into the crack it was covering and a cross section of the floor was exposed. Over the stone fill there was 5 to 8 cm of red clay topped with 3 cm of white earth (Figure 4.7). All of the surrounding platforms were surfaced with a similar white earth. In other parts of Actun Chanona, the floors on top of platforms typically were made of red clay instead of white earth.
Cave within a Cave

Since caves were a part of the sacred landscape, a cave within a cave, by extension, would have great significance. It may be argued that niche altars represent a cave within a cave because they are an enclosed space and usually have speleothems growing in them. Upright altars, such as the one on top of the Great Platform, may also represent the concept of a cave within a cave. In Aktun Ak’ab the use of flat stones over breakdown blocks may have represented a cave within a cave because of artifacts deposited within them (Rodas 1994). However, Actun Chanona holds the best example of a cave within a cave.

The Great Platform in Actun Chanona was constructed by filling cracks between massive breakdown blocks. Instead of completely filling the space between the blocks, the Maya wedged large rocks into the cracks and then leveled the surface of the wedged rocks by adding fill. In effect, this technique created a cave under the Great Platform. Some of the smaller platforms were deliberately set at the edge of openings that extended from the top of the Great Platform to the cave beneath the Great Platform. Visual examination of these openings revealed a large quantity of broken pottery. An entrance to the cave beneath the Great Platform was discovered, and the area was explored. Many of the same constructed features found on top of the Great Platform were also present in this cave within a cave. Small retaining walls had been built and fill added to create platforms. A slab altar was noted, as well as space-restricting walls. Based on the large amount of broken pottery and charcoal, this space was heavily used for ritual.

The Great Platform and the cave beneath the Great Platform are similar to a heavily modified hill at the site of Los Quetzales in Guatemala (Brady 1997). The main structure at Los Quetzales was a natural hill with a cave in the hill. The cave had three entrances. One of the entrances was a small restricted crawlspace, while the other two entrances were vertical drops. The cave had an access-
restricting wall that blocked access to a part of the cave that contained a skylight entrance. The hilltop above the skylight entrance had been leveled to form a courtyard with a temple structure at one end and the cave entrance at the other. Excavations in the debris cone below the skylight yielded numerous artifacts. The hill-cave complex at Los Quetzales is closely mirrored by the Great Platform cave-within-a-cave complex in Actun Chanona.

Entrance Shrines

Small shrine mounds have been reported at Cueva de Sangre (Brady 1997:609) and at Cueva de Sapo (Brady et al. 1997), both in Guatemala. The shrine mound at Cueva de Sangre is located just above the entrance to the cave and is surrounded by a circular wall. The shrine mound at Cueva de Sapo, measuring \(2.5 \times 1.5 \times 1\) m and trending east-west, is located in the entrance sinkhole. The remains of a temple shrine were found in the sinkhole around the eastern entrance of Actun Chanona. Located just outside the drip line of the cave and on the north side of the sinkhole, the temple shrine had been completely dug out by looters. Based on the fragmented remains, the entrance shrine probably measured about \(2 \times 1.5\) m and possibly reached 1 m height. The long axis of the shrine mound was 320 degrees.

Entrance shrines may be common features at caves but may be commonly overlooked because of the emphasis on working in the cave and not around the entrance to the cave. In addition, entrance shrine mounds generally are small and easily covered with leaf litter and other debris.

Altered Entrances

Altering the entrances to caves was a common practice. In Cueva de Sangre, cut stone was used to restrict the entrance to a small crawlway (Brady et al. 1991). At Cueva de Sapo, a long, low entrance was sealed to create a dark zone in the cave (Brady et al. 1997). At Cueva de Los Quetzales, the crawlway entrance had stones to restrict the size of the opening (Brady and Rodas 1994). At Aktun Ak’ab, a retaining wall was built at the entrance to restrict the size of the entrance (Rodas 1994). In the Sibun River Valley cave of Actun Itbach, stones were added above the entrance to give the cave the appearance of a vaulted ceiling (Kenward 2001).

Actun Chanona also showed signs of an altered entrance. A large platform was built in front of the entrance. A low, single-course wall served as a traffic-flow designator to guide one to the right side of a column, giving the appearance of a narrow doorway.

Conclusions

Actun Chanona represents a major focus of cave ritual in the upper Sibun River Valley based solely on the amount of modification and construction within the cave. No other cave in the region and few other caves in Mesoamerica have been as extensively rebuilt by the Maya. The variety of modification and construction in Actun Chanona represents a considerable investment of time, effort, and resources.
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Operation 51, the second excavation carried out at the Hershey site by the Xibun Archaeological Research Project during the 2001 field season, was positioned within Group A. The largest plaza group within the site, Group A was covered in thick overgrowth that involved intensive clearing. Located about 25-30 m east of Group D where Operation 50 was carried out (see Harrison, Chapter 5), Group A consists of a series of elongated platforms lining the sides of an inner central plaza. Structure 503, where excavations were focused, is a long platform that lines the southern side of the main plaza and abuts Structure 500, the largest pyramidal-shaped structure at Hershey (see Map Sheet 1).

Operation 51 was laid out as a 6 x 4 m unit, with the long axis oriented roughly north-south, effectively cross-cutting a portion of Structure 503. The operation was divided evenly into six squares (A-F), yet only Squares A and F were ultimately tested during the 2001 field season. Squares measured 2 x 2 m and exposed a significant portion of Structure 503. Positioned across the center and northern side of the elongated structure, Operation 51 revealed that the structure held several phases of construction and contained a large central staircase on the northern side of the structure, at least in its final phase of construction. Square F uncovered the remains of at least four plaster floors. Several terraces also were exposed on the northern edge of the structure, within Square A, along with the western side of the staircase flanking the northern side of the structure. All structures at Hershey appear to be oriented 20 degrees east of north and excavations were aligned accordingly. The shared building orientation of Groups A, B, C, and D may indicate that construction of all four groups was contemporaneous.

Group A appears to have been built primarily of stone masonry construction. The excavation of Structure 503 revealed nicely cut exterior limestone blocks with a limestone and river cobble core fill, indicative of formal platform construction. Several terraces were defined with a nicely preserved basal molding positioned along the base of a nine-course high exterior northern wall. Structure 503 was constructed primarily of limestone cobble fill with floor and wall surfaces covered in plaster. The general shape of each structure and the high density of exposed limestone blocks noted on the ground surface suggest all-stone masonry construction for every structure in Group A. Remnants of a formally prepared plaza surface were identified within Square A of Operation 51, to the north of Structure 503. Likely, this floor extended throughout the central plaza of Group A.

Excavation Techniques

Excavation of Operation 51 entailed the detailed investigation of an area along the southern side of Structure 503. As noted, only Squares A and F were excavated. Square A was located in the northwest corner of the large 4 x 6 m unit, while Square F was positioned in the far southeastern corner of the unit. Square A exposed the northern edge of the exterior terrace facing wall and the western side of a staircase leading up to the top of the elongated platform of Structure 503. Wedged in the corner, created by the outset staircase, a rich midden deposit was found heaped against the northern side of the structure and western side of the stair side wall. Square F, positioned on the top of the elongated platform, exposed a
portion of the interior of Structure 503 and revealed a series of plaster floors associated with four distinct phases of construction.

In an effort to glean a maximum level of information, one hundred percent of all soil excavated was screened through a quarter-inch screen, unless otherwise indicated. Trowels were primarily used in the excavation, with picks and shovels being used infrequently. Trowels (and dental tools when necessary) were utilized to define the surface of architecture and in situ deposits. Levels of sediment were removed in the context of defined zones within the individual squares that measured 2 x 2 m in dimension, unless otherwise specified. The following presents the details of excavation individually described for Square A, followed by Square F. Descriptions of zones are found under the associated square in which they were excavated. Squares A and F do not share any of the same zones, with the exception of Zone 1, which represents the top soil found across the surface of the excavation unit.

Overview of Operation 51: Square A

Square A, a 2 x 2 m unit in the northwest corner of Operation 51, was positioned along the northern side of Structure 503, where the mound slopes down to the north. A narrow terrace surface was exposed along the southern edge of Square A. Another tier of stones exists further to the south in Square C and appears to represent an upper terrace. This square, however, remained unexcavated during the 2001 season. A series of eleven zones were excavated in Square A of Operation 51. All zones and associated deposits are discussed below, presented sequentially as they were found.

Zone 1

Zone 1 consisted of a top soil that covered the surface of Structure 503. The top zone contained a relatively high density of roots, but less roots than Operation 50 (see Harrison, Chapter 5). A high density of limestone tumble was recorded at the base of Zone 1 in Square A, the remains of debris falling from the northern side of Structure 503. Few artifacts were recovered from this organic-rich humic layer.

Zone 2

Zone 2 is the matrix located to the north of the northern exterior wall of Structure 503 and to the west of the outset staircase wall of Structure 503. The matrix is tumble, collapsed debris fallen from both walls. Large, cut limestone blocks and smaller cobbles and gravel are abundant in the silty clay matrix. There is only a light density of artifacts present in the zone. Notably, a groundstone fragment and a possible speleothem or cave formation were noted in the fill of Zone 2.

Zone 3

Zone 3 is a mix of tumble and soil, similar to Zone 2, that was created arbitrarily after about 20-25 cm of tumble was removed. Located directly below Zone 2, Zone 3 is situated to the north and west of the two perpendicular walls that were further defined with the removal of the Zone 3 tumble in Square A. The zone featured a high density of medium to large limestone cobbles mixed with a semi-compact silt. Like Zone 2, artifact density was light, and another groundstone fragment was recovered.
Zone 4

Zone 4 is located directly below Zone 3, comprising the northwest corner of Square A with intact architectural walls forming its boundaries to the south and east. The removal of the tumble in Zone 4 worked to further define the two perpendicular walls. The 7th and 8th courses of the northern wall of Structure 503 were exposed at the base of Zone 4. The matrix of the zone contains a mix of limestone tumble from the walls and a semi-compact silt. At the bottom of the zone in the southeast corner, a mound of dark, organic-rich soil, identified as the midden heap, was found wedged in the corner where the two perpendicular walls of Structure 503 come together. A cross-section shows the midden sloping downward to the north (Figure 6.1). The artifact density in Zone 4 was heightened because the highest point of the midden heap was interfaced at the base of the zone in the southeast corner of the unit. Only a small portion of the midden was excavated in Zone 4, however, with the bulk of the deposit being removed in Zone 8. In the portion of midden that was excavated in Zone 4, a fragmentary vessel that was about 40 percent complete was recovered. It comprised a shallow bowl with a ring base that was smashed and inverted on top of the trash heap. López Varela (personal communication, August 2002) has tentatively identified the vessel as Roaring Creek Red, a type typically associated with the Late to Terminal Classic period (ca. AD 600-900). The deposit, positioned on the top of the midden, may signify the terminal period of occupation for the main site center of Hershey.

Figure 6.1 Cross-section of the midden deposit

Zone 7

Zone 7 entailed defining the surface of the midden and the extent of the deposit in Square A. Zone 7 primarily consisted of tumble from Structure 503 and its outset staircase positioned along the center of the northern side of the platform. The tumble contains a high density of limestone cobbles and gravel, some of which appear to have been worked and likely were the facing stones of the two walls exposed in the unit. Like the tumble excavated in Zones 1-4, Zone 7 contained a relatively light artifact density. The collapse
debris removed in Zone 7 covered the midden deposit and part of the plaza floor (Zones 8 and 11, respectively). The base of Zone 7 interfaces the sloping midden deposit, signified by a slightly darker soil and a significant spike in the density of cultural material. Another groundstone tool and two possible speleothems were recovered. In addition, large fragments of one or two partially reconstructable vessels were recovered on the surface of the midden, with at least one that appeared inverted. The vessel fragments were all located along the western wall, mostly in the southeast corner of the zone where the highest peak of the midden heap was defined.

**Zone 8**

Zone 8 comprised the bulk of the midden deposit heaped in the corner where the two perpendicular walls of Structure 503 came together. The midden measured roughly 20-25 cm in depth within the southeast corner, which represented the deepest section of the trash heap (Figure 6.1). The matrix was a semi-compact silty clay with a medium density of limestone gravel. The cultural deposit included pottery sherds, jute or land snail shell, debitage, and animal bones, including fish remains. Artifact density was heaviest along the western wall of the staircase. Dirt from the midden deposit was collected in several different samples. A 30-liter flotation sample was collected (FCB #’s 5047, 5051, 5052). In addition, a sediment sample (FCB # 5050) was collected, along with pollen (FCB # 5048) and phytolith (FCB # 5049) samples.

The zone ended at what appeared to be the surface of a deteriorated plaza floor, and no further courses of stone were found beyond the level of this surface. A total of nine courses of stone were preserved on the northern exterior wall of Structure 503, with the bottom course forming a basal molding that presumably lined the full extent of the exterior wall of Structure 503 (Figure 6.2). This decorative element typically adorns the outside of buildings and platforms in strictly elite architectural complexes. The basal course of stone of the northern wall rests on the plaza surface which is poorly preserved as evidenced by the small patch of preserved plaster found against the western wall of the staircase. The best preserved sections of plaster were located in the central area of the wall, along the first course of stones. Plaster was likely intact due to the midden deposit that effectively protected this section of the wall.

**Zone 11**

Zone 11 consisted of the plaza floor surface and its underlying construction fill. Only the western half of the plaza floor exposed in Square A was excavated, an area measuring roughly 130 (north-south) by 80 cm (east-west). The bulk of the fill contained a high density of river gravel and cobbles, measuring between 7 and 12 cm. The river cobbles layer measured roughly 15 cm in thickness. There was a light density of limestone used in the floor construction, which comprised only a thin surface layer. The plaza likely contained a plaster layer that has since deteriorated, leaving only a packed earthen layer with small limestone gravel inclusions. This compact surface and underlying 15 cm thick river cobbles construction appears consistent throughout the western half of Square A, except in the northwest corner where it appears disturbed. In this area, only alluvial soils with very few inclusions exist. Erosional processes appear to have cut deeply into this area of the floor, and intruded into Zone 14, a modified earthen layer that underlies the plaza floor construction. Artifact density tapers significantly in Zone 11, consisting of ceramic sherds, a C-14 (burned wood) sample and other organic material.
Zone 14

The Zone 14 matrix underlies the plaza floor construction of Zone 11 and is virtually devoid of inclusions. The change in the matrix is clearly discernible as a shift to a fine silty clay texture. The matrix contains only a very light density of limestone gravel (3 to 0.2 cm) and river gravel (6 to 0.2 cm). The zone measures approximately 30 cm in depth and the few artifacts found within this zone included small pieces ofdebitage, sherds, and baked clay material. Zone 14 appears to be a modified earthen layer that may havefunctioned as a subfloor construction that leveled the patio area prior to the construction of the plaza floor.

Zone 15

The matrix of Zone 15 is similar in texture and color to Zone 14, which lies directly above it. The deposit type seems to be a natural earthen layer that may have been modified slightly prior to the construction of Group A. Limited horizontal exposure prevents a more solid reconstruction. The zone contains only a very light density of cultural material in the form of sherds, baked clay material, debitage, and a small carbon sample that may provide a good C-14 date for this initial phase of site construction. Toward the bottom of Zone 15, the matrix becomes relatively sterile and very sandy, and the density of river gravel increases slightly.

Zone 20

Zone 20 consists of a shovel test pit, roughly 34 cm deep, positioned at the base of the excavation in the center of the western half of the unit (Figure 6.2). The matrix is sand mixed with river gravel and small cobbles. It appears to be a natural deposit that underlies the modified earthen layer defined in Zones 14
and 15. The zone is devoid of artifacts and appears to be an old river bed that predates the construction of Group A. Excavations in Square A ceased at this sterile level.

**Overview of Operation 51: Square F**

Square F, a 2 x 2 m unit in the southeast corner of Operation 51, is positioned in the central portion of Structure 503, on the top of the elongated platform. Square F is situated just north of Structure 501 which represents another platform possibly with stairs leading to an intermediate level terrace on the west side of Structure 500, the tallest pyramid-shaped structure within the Hershey site. A series of four floors associated with Structure 503 were identified during excavation, three of which contained the remains of a plaster surface (plaster floors 1-3). A fourth floor initially was unrecognizable due to its deteriorated state; it is the uppermost in the sequence and was highly weathered due to its exposure to the elements for an extended period of time. A series of twelve zones were excavated in Square F of Operation 51 (Table 6.1). All zones and associated deposits are discussed below, presented sequentially as they were found.

**Zone 1**

Similar to Square A, Zone 1 in Square F consisted of a top zone containing a relatively high density of roots. There was little to no stone visible on the surface of Square F. Large pieces of burned wood were recovered just below the ground surface. A line of stones exposed on the surface of Square C appears to represent a northern retaining wall of the uppermost platform surface of Structure 503. Based on the elevation of the top surface of this wall, the remains of the ancient living surface was just below ground surface. Therefore, it is conceivable that the carbonized wood is ancient material, but it was recovered from a modern root mass. A sample was collected for identification, but it may be contaminated by the modern debris. A few concentrations of limestone gravel were noted at the base of the zone and represent the surface of Zone 5.

**Zone 5**

Zone 5 is directly below Zone 1 in Square F and consists of a semi-compact earthen layer mixed with a medium concentration of limestone gravel. The concentrations of limestone inclusions are located mainly in the eastern half and southwest corner of the square and likely represent the disturbed remains of the final platform surface of Structure 503. Zone 5 also contains a light density of river gravel, and a few limestone cobbles measuring about 12 cm, which seemingly represent tumble debris fallen from Structure 501, rather than any in situ architecture on the surface of the platform. Some earthen deposits were noted toward the base of Zone 5, which may be run-off from the northern side of Structure 501. There is a light concentration of artifacts located mainly toward the bottom of the zone. A number of small sherds and some baked clay material were recovered, but very little diagnostic material was noted. At the base of Zone 5 there is a high density of limestone gravel that appears to be the remains of a ballast construction fill for the final floor surface of Structure 503. Presumably, a thin layer of plaster similar to floors 1-3 (see below) originally overlay the ballast fill and has since deteriorated.
Zone 6

Zone 6 is restricted to Square F and consists of the ballast construction fill of Structure 503. The density of gravel-size limestone inclusions increases toward the base of Zone 6. The fill contains mostly limestone, but some river gravel was noted. In addition, a number of flowstones, possibly travertine formations, were identified in the fill and several specimens (FCB# 5040 and 5043) were collected for further analysis. The flowstone was found in situ and appears to be an integral part of the construction fill. The formations range from gravel to cobble size and were found predominantly in the northeast corner of the unit. The ballast fill does not appear evenly distributed across the unit, but is somewhat disturbed and concentrated in the northeast, southeast, and southwest corners. There is a medium density of artifacts, including sherds and baked clay material. Notably, two obsidian blade fragments and some fish bone were recovered. At the base of the zone, a deteriorated plaster floor (Floor 1) was defined, however, it was only preserved along the eastern edge of the square (Zone 10).

Zone 9

Zone 9 is positioned directly below Zone 6 and is an area of exposed construction fill in the western half of the unit, which measured roughly 1.3 m (east-west) by 2 m (north-south). Here, the plaster of Floor 1 was not preserved. The construction fill is similar if not identical to the overlying fill in Zone 6. A strip of deteriorated plaster floor (Floor 1) comprises the remainder of the 2 x 2 m unit of Square F and was removed separately as Zone 10. The cobble-filled matrix of Zone 9 measures about 15 cm in depth and appears to be the associated fill of Floor 1. There is a light density of artifacts in the Zone 9 fill, with a few diagnostic ceramic sherds that could possibly date the fill layer. There is some evidence of burning in the form of charcoal smears on the gravel fill (one piece large enough to be sampled) and some burned, gray-colored limestone inclusions. At the base of Zone 9, another plaster floor (Floor 2) was encountered, this one much better preserved throughout the unit. A large depression, however, was found intruding into both Floors 1 and 2 in the northern end of the unit and appears to be the remains of tree fall (Figure 6.3).

Zone 10

Zone 10 comprises Floor 1, a highly eroded plaster surface with approximately 15 cm of underlying ballast construction fill. The floor appears associated with the remainder of the fill that was found in the western half of the square, which was removed as Zone 9. Extending only about 70 cm from the eastern edge of the square, the poorly preserved plaster floor is illustrated in the east wall cross-section (Figure 6.3). A plaster sample (FCB #5059) was taken from this area. Very few artifacts were found in the floor and fill of Zone 10. Like Zone 9, a beautifully preserved plaster floor (Floor 2 - Zone 13) was found beneath Zone 10. The base of Zone 10 defined the surface of the plaster floor and identified a large disturbance along the northern, eastern and southern edges of Floor 2 in Square F, most likely due to a tree fall. The disturbed area was removed separately as Zone 12. The tree disturbance caused the plaster in both Floors 1 and 2 to bulge in the northeast corner of the unit and slope up toward the north where a large root had apparently once existed.

Zone 12

Zone 12 appears as a deep depression; likely the remains of a large tree which cut through both Floors 1 and 2 (Figure 6.3). The zone is located along the northern side of the square. The matrix of the disturbed area consists of a loose, silty clay soil with a high density of limestone gravel and large limestone cobble inclusions. There are little to no river cobble inclusions in Zone 12. Uneven sections of Floor 2
(Zone 13) which surround the tree disturbance are likely the result of old roots pulling up the plaster surface. The loose, dry matrix of Zone 12 contained a very light density of artifacts. At the base of the zone, there is a high density of tightly packed, large limestone cobbles that appear to be in situ core fill (Zone 16), which underlies Floor 2 (Zone 13).

![Image of cross-section of the east wall]

**Figure 6.3 Cross-section of the east wall.**

**Zone 13**

Zone 13 represents the remains of Floor 2, a plaster surface disturbed due to tree fall along the northern edge of the square. Floor 2 is located roughly 15 cm beneath Floor 1 (Zones 9 and 10) and only the plaster was removed as Zone 13. Two samples of the plaster (FCB# 5062 and 5065) were collected from Floor 2. The plaster contains many inclusions and therefore is not smooth in cross-section but appears relatively smooth on the surface. There were no artifacts found in the plaster surface, however, a round hammerstone and a chert flake found at the base of Zone 10 may have been associated with the surface of Floor 2.

**Zone 16**

Zone 16 comprised two layers of distinct gravel and cobble fill underlying the plaster surface that was removed as Zone 13. The construction fill consisted of about 20 cm of tightly packed small gravel and cobble-sized limestones, followed by a layer of larger limestone cobbles, measuring about 25-35 cm. Only a light density of cultural material was recovered within these underlying construction fill layers, including two C-14 samples and a botanical sample. Several flowstone formations were collected from Zone 16, possibly travertine mined from across the nearby Sibun River. At the base of Zone 16, the surface of a sloping, packed earthen mound was defined, which showed signs of basketload stratigraphy (Zone 17). The surface
of the earthen mound appeared uneven where it interfaced the large cobbles (Figure 6.3). At the base of Zone 16, a slipped ceramic sherd and a large C-14 sample were found on the surface of the clay-filled matrix, positioned over a meter below ground surface.

Zone 17

Zone 17 consists of a compact, clay-filled mound directly below the layers of cobble fill identified in Zone 16. Together, Zones 16 and 17 appear to comprise the core fill of Structure 503, which formed the bulk of the platform. The artifact density in Zone 17 was slightly higher than the overlying fill layers in Zone 16, and included animal bone (possibly a small rodent), pottery sherds, unworked shell, and charcoal. Two C-14 samples, sealed inside the fill, were collected from the zone. Basket load stratigraphy is reflected in the mottled-clay construction fill of Zone 17. There were no rock inclusions in this compact clay construction fill. The zone was arbitrarily changed to Zone 18 after 20-25 cm of fill was excavated.

Zone 18

Zone 18 represents the bottom half of the earthen construction fill, with basket load stratigraphy still present. The earthen fill was extremely compact and yielded a light density of artifacts. Only the eastern portion of the square (a 1 x 2 m area) was excavated in Zone 18. At the base of the earthen fill, a level floor surface (Floor 3) was interfaced.

Zone 19

Zone 19 represents the surface and some of the underlying fill of Floor 3. The surface is very level and well preserved. Composed of a mixture of plaster and earth, the floor appears to have been tamped down, rather than formally prepared. Covered over in antiquity, it was protected and able to survive intact. The fill below it is a clayey silt with gravel-size limestone inclusions. Excavations ceased at this level.

Concluding Remarks

Square F of Operation 51, positioned on the top of the platform surface of Structure 503, revealed at least four distinct construction episodes, indicating a relatively long length of occupation in this central locale. Square A, situated along the northern side of Structure 503, confirmed that the elongated platform contained a centrally-located, outset staircase on the northern side of the structure, at least in its final phase of construction. In addition, Square A and the surface of Square C exposed the remains of at least two terraces flanking the northern side of the platform. A rich midden heap was found in Square A, wedged in a corner between the northern facing wall of Structure 503 and the western wall of the central staircase. Preliminary analysis of the diagnostic sherds found within the midden deposit indicates Late-Terminal Classic period material (S. L. López Varela, personal communication August 2002). At the base of excavations in Square A, the northern facing wall of Structure 503 was defined, with basal molding adorning the base of a nine-course high wall. Excavations confirmed that platform structures in Group A were oriented 20 degrees east of north. If all structures in the main group are comparable to Structure 503, each was constructed primarily of limestone cobble fill with floor and wall surfaces covered in plaster. The general shape of each structure and the high density of exposed limestone blocks noted on the ground surface suggest all-stone masonry construction for all of Group A. Remnants of a formally prepared plaza surface were identified.
within Square A of Operation 51, to the north of Structure 503. Likely, this floor extended throughout the central plaza of Group A.

Excavation of Squares A and F in Operation 51 yielded a considerable amount of information regarding the occupation of Group A, the largest plaza group that presumably housed the elite occupants of the Hershey site. The two squares were strategically positioned across the center and northern side of Structure 503, an elongated platform lining the south side of the plaza group. Investigations shed light on the construction techniques and architectural phases associated with Group A, possibly the founding settlement group of the Hershey site. Further testing, planned for the 2003 field season, aims to clarify the construction sequence of a wider range of structures at the Hershey site.
Chapter 6
Investigating the Main Plaza of the Hershey Site
(Operation 51)
Eleanor Harrison

Operation 51, the second excavation carried out at the Hershey site by the Xibun Archaeological Research Project during the 2001 field season, was positioned within Group A. The largest plaza group within the site, Group A was covered in thick overgrowth that involved intensive clearing. Located about 25-30 m east of Group D where Operation 50 was carried out (see Harrison, Chapter 5), Group A consists of a series of elongated platforms lining the sides of an inner central plaza. Structure 503, where excavations were focused, is a long platform that lines the southern side of the main plaza and abuts Structure 500, the largest pyramidal-shaped structure at Hershey (see Map Sheet 1).

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Group A appears to have been built primarily of stone masonry construction. The excavation of Structure 503 revealed nicely cut exterior limestone blocks with a limestone and river cobbles core fill, indicative of formal platform construction. Several terraces were defined with a nicely preserved basalt molding positioned along the base of a nine-course high exterior northern wall. Structure 503 was constructed primarily of limestone cobbles fill with floor and wall surfaces covered in plaster. The general shape of each structure and the high density of exposed limestone blocks noted on the ground surface suggest all-stone masonry construction for every structure in Group A. Remnants of a formally prepared plaza surface were identified within Square A of Operation 51, to the north of Structure 503. This floor likely extended throughout the central plaza of Group A.

Excavation Techniques

Excavation of Operation 51 entailed the detailed investigation of an area along the southern side of Structure 503. As noted, only Squares A and F were excavated. Square A was located in the northwest corner of the large 4 × 6 m unit, while Square F was positioned in the far southeastern corner of the unit. Square A exposed the northern edge of the exterior terrace facing wall and the western side of a staircase leading up to the top of the elongated platform of Structure 503. Wedged in the corner, created by the outset staircase, a rich midden deposit was found heaped against the northern side of the structure and western side of the stair side wall. Square F, positioned on the top of the elongated platform, exposed a
portion of the interior of Structure 503 and revealed a series of plaster floors associated with four distinct phases of construction.

In an effort to glean a maximum level of information, one hundred percent of all soil excavated was screened through a quarter-inch screen, unless otherwise indicated. Trowels were primarily used in the excavation, with picks and shovels being used infrequently. Trowels (and dental tools when necessary) were utilized to define the surface of architecture and in situ deposits. Levels of sediment were removed in the context of defined zones within the individual squares that measured 2 × 2 m in dimension, unless otherwise specified. The following presents the details of excavation individually described for Square A, followed by Square F. Descriptions of zones are found under the associated square in which they were excavated. Squares A and F do not share any of the same zones, with the exception of Zone 1, which represents the top soil found across the surface of the excavation unit.

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Zone 1 consisted of a top soil that covered the surface of Structure 503. The top zone contained a relatively high density of roots, but less roots than Operation 50 (see Harrison, Chapter 5). A high density of limestone tumble was recorded at the base of Zone 1 in Square A, the remains of debris falling from the northern side of Structure 503. Few artifacts were recovered from this organic-rich humic layer.

Zone 2

Zone 2 is the matrix located to the north of the northern exterior wall of Structure 503 and to the west of the outset staircase wall of Structure 503. The matrix is tumble, collapsed debris fallen from both walls. Large, cut limestone blocks and smaller cobbles and gravel are abundant in the silty clay matrix. There is only a light density of artifacts present in the zone. Notably, a groundstone fragment and a possible speleothem or cave formation were noted in the fill of Zone 2.

Zone 3

Zone 3 is a mix of tumble and soil, similar to Zone 2, that was created arbitrarily after about 20-25 cm of tumble was removed. Located directly below Zone 2, Zone 3 is situated to the north and west of the two perpendicular walls that were further defined with the removal of the Zone 3 tumble in Square A. The zone featured a high density of medium to large limestone cobbles mixed with a semi-compact silt. Like Zone 2, artifact density was light, and another groundstone fragment was recovered.
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Zone 4 is located directly below Zone 3, comprising the northwest corner of Square A with intact architectural walls forming its boundaries to the south and east. The removal of the tumble in Zone 4 worked to further define the two perpendicular walls. The 7th and 8th courses of the northern wall of Structure 503 were exposed at the base of Zone 4. The matrix of the zone contains a mix of limestone tumble from the walls and a semi-compact silt. At the bottom of the zone in the southeast corner, a mound of dark, organic-rich soil, identified as the midden heap, was found wedged in the corner where the two perpendicular walls of Structure 503 come together. A cross-section shows the midden sloping downward to the north (Figure 6.1). The artifact density in Zone 4 was heightened because the highest point of the midden heap was interfaced at the base of the zone in the southeast corner of the unit. Only a small portion of the midden was excavated in Zone 4, however, with the bulk of the deposit being removed in Zone 8. In the portion of midden that was excavated in Zone 4, a fragmentary vessel that was about 40 percent complete was recovered. It comprised a shallow bowl with a ring base that was smashed and inverted on top of the trash heap. López Varela (personal communication, August 2002) has tentatively identified the vessel as Roaring Creek Red, a type typically associated with the Late to Terminal Classic period (ca. AD 600-900). The deposit, positioned on the top of the midden, may signify the terminal period of occupation for the main site center of Hershey.

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Zone 8

Zone 8 comprised the bulk of the midden deposit heaped in the corner where the two perpendicular walls of Structure 503 came together. The midden measured roughly 20-25 cm in depth within the southeast corner, which represented the deepest section of the trash heap (Figure 6.1). The matrix was a semi-compact silty clay with a medium density of limestone gravel. The cultural deposit included pottery sherds, jute or land snail shell, debitage, and animal bones, including fish remains. Artifact density was heaviest along the western wall of the staircase. Dirt from the midden deposit was collected in several different samples. A 30-liter flotation sample was collected (FCB #’s 5047, 5051, 5052). In addition, a sediment sample (FCB # 5050) was collected, along with pollen (FCB# 5048) and phytolith (FCB# 5049) samples.

The zone ended at what appeared to be the surface of a deteriorated plaza floor, and no further courses of stone were found beyond the level of this surface. A total of nine courses of stone were preserved on the northern exterior wall of Structure 503, with the bottom course forming a basal molding that presumably lined the full extent of the exterior wall of Structure 503 (Figure 6.2). This decorative element typically adorns the outside of buildings and platforms in strictly elite architectural complexes. The basal course of stone of the northern wall rests on the plaza surface, which is poorly preserved as evidenced by the small patch of preserved plaster found against the western wall of the staircase. The best preserved sections of plaster were located in the central area of the wall, along the first course of stones. Plaster was likely intact due to the midden deposit that effectively protected this section of the wall.

Zone 11

Zone 11 consisted of the plaza floor surface and its underlying construction fill. Only the western half of the plaza floor exposed in Square A was excavated, an area measuring roughly 130 (north-south) by 80 cm (east-west). The bulk of the fill contained a high density of river gravel and cobbles, measuring between 7 and 12 cm. The river cobbles layer measured roughly 15 cm in thickness. There was a light density of limestone used in the floor construction, which comprised only a thin surface layer. The plaza likely contained a plaster layer that has since deteriorated, leaving only a packed earthen layer with small limestone gravel inclusions. This compact surface and underlying 15 cm thick river cobble construction appears consistent throughout the western half of Square A, except in the northwest corner where it appears disturbed. In this area, only alluvial soils with very few inclusions exist. Erosional processes appear to have cut deeply into this area of the floor, and intruded into Zone 14, a modified earthen layer that underlies the plaza floor construction. Artifact density tapers significantly in Zone 11, consisting of ceramic sherds, a C-14 (burned wood) sample and other organic material.
Zone 14

The Zone 14 matrix underlies the plaza floor construction of Zone 11 and is virtually devoid of inclusions. The change in the matrix is clearly discernible as a shift to a fine silty clay texture. The matrix contains only a very light density of limestone gravel (3 to 0.2 cm) and river gravel (6 to 0.2 cm). The zone measures approximately 30 cm in depth and the few artifacts found within this zone included small pieces of debitage, sherds, and baked clay material. Zone 14 appears to be a modified earthen layer that may have functioned as a subfloor construction that leveled the patio area prior to the construction of the plaza floor.

Zone 15

The matrix of Zone 15 is similar in texture and color to Zone 14, which lies directly above it. The deposit type seems to be a natural earthen layer that may have been modified slightly prior to the construction of Group A. Limited horizontal exposure prevents a more solid reconstruction. The zone contains only a very light density of cultural material in the form of sherds, baked clay material, debitage, and a small carbon sample that may provide a good C-14 date for this initial phase of site construction. Toward the bottom of Zone 15, the matrix becomes relatively sterile and very sandy, and the density of river gravel increases slightly.

Zone 20

Zone 20 consists of a shovel test pit, roughly 34 cm deep, positioned at the base of the excavation in the center of the western half of the unit (Figure 6.2). The matrix is sand mixed with river gravel and small cobbles. It appears to be a natural deposit that underlies the modified earthen layer defined in Zones 14.

Figure 6.2 Exterior wall of Structure 503.
and 15. The zone is devoid of artifacts and appears to be an old river bed that predates the construction of Group A. Excavations in Square A ceased at this sterile level.

Overview of Operation 51: Square F

Square F, a 2 × 2 m unit in the southeast corner of Operation 51, is positioned in the central portion of Structure 503, on the top of the elongated platform. Square F is situated just north of Structure 501, which represents another platform possibly with stairs leading to an intermediate level terrace on the west side of Structure 500, the tallest pyramid-shaped structure within the Hershey site. A series of four floors associated with Structure 503 were identified during excavation, three of which contained the remains of a plaster surface (plaster floors 1-3). A fourth floor initially was unrecognizable due to its deteriorated state; it is the uppermost in the sequence and was highly weathered due to its exposure to the elements for an extended period of time. A series of twelve zones were excavated in Square F of Operation 51 (Table 6.1). All zones and associated deposits are discussed below, presented sequentially as they were found.

Zone 1

Similar to Square A, Zone 1 in Square F consisted of a top zone containing a relatively high density of roots. There was little to no stone visible on the surface of Square F. Large pieces of burned wood were recovered just below the ground surface. A line of stones exposed on the surface of Square C appears to represent a northern retaining wall of the uppermost platform surface of Structure 503. Based on the elevation of the top surface of this wall, the remains of the ancient living surface was just below ground surface. Therefore, it is conceivable that the carbonized wood is ancient material, but it was recovered from a modern root mass. A sample was collected for identification, but it may be contaminated by the modern debris. A few concentrations of limestone gravel were noted at the base of the zone and represent the surface of Zone 5.

Zone 5

Zone 5 is directly below Zone 1 in Square F and consists of a semi-compact earthen layer mixed with a medium concentration of limestone gravel. The concentrations of limestone inclusions are located mainly in the eastern half and southwest corner of the square and likely represent the disturbed remains of the final platform surface of Structure 503. Zone 5 also contains a light density of river gravel, and a few limestone cobbles measuring about 12 cm, which seemingly represent tumble debris fallen from Structure 501, rather than any in situ architecture on the surface of the platform. Some earthen deposits were noted toward the base of Zone 5, which may be run-off from the northern side of Structure 501. There is a light concentration of artifacts located mainly toward the bottom of the zone. A number of small sherds and some baked clay material were recovered, but very little diagnostic material was noted. At the base of Zone 5 there is a high density of limestone gravel that appears to be the remains of a ballast construction fill for the final floor surface of Structure 503. Presumably, a thin layer of plaster similar to floors 1-3 (see below) originally overlay the ballast fill and has since deteriorated.
Zone 6

Zone 6 is restricted to Square F and consists of the ballast construction fill of Structure 503. The density of gravel-size limestone inclusions increases toward the base of Zone 6. The fill contains mostly limestone, but some river gravel was noted. In addition, a number of flowstones, possibly travertine formations, were identified in the fill, and several specimens (FCB# 5040 and 5043) were collected for further analysis. The flowstone was found in situ and appears to be an integral part of the construction fill. The formations range from gravel to cobble size and were found predominantly in the northeast corner of the unit. The ballast fill does not appear evenly distributed across the unit, but is somewhat disturbed and concentrated in the northeast, southeast, and southwest corners. There is a medium density of artifacts, including sherds and baked clay material. Notably, two obsidian blade fragments and some fish bone were recovered. At the base of the zone, a deteriorated plaster floor (Floor 1) was defined, however, it was only preserved along the eastern edge of the square (Zone 10).

Zone 9

Zone 9 is positioned directly below Zone 6 and is an area of exposed construction fill in the western half of the unit, which measured roughly 1.3 m (east-west) by 2 m (north-south). Here, the plaster of Floor 1 was not preserved. The construction fill is similar if not identical to the overlying fill in Zone 6. A strip of deteriorated plaster floor (Floor 1) comprises the remainder of the 2 × 2 m unit of Square F and was removed separately as Zone 10. The cobble-filled matrix of Zone 9 measures about 15 cm in depth and appears to be the associated fill of Floor 1. There is a light density of artifacts in the Zone 9 fill, with a few diagnostic ceramic sherds that could possibly date the fill layer. There is some evidence of burning in the form of charcoal smears on the gravel fill (one piece large enough to be sampled) and some burned, gray-colored limestone inclusions. At the base of Zone 9, another plaster floor (Floor 2) was encountered, this one much better preserved throughout the unit. A large depression, however, was found intruding into both Floors 1 and 2 in the northern end of the unit and appears to be the remains of tree fall (Figure 6.3).

Zone 10

Zone 10 comprises Floor 1, a highly eroded plaster surface with approximately 15 cm of underlying ballast construction fill. The floor appears associated with the remainder of the fill that was found in the western half of the square, which was removed as Zone 9. Extending only about 70 cm from the eastern edge of the square, the poorly preserved plaster floor is illustrated in the east wall cross-section (Figure 6.3). A plaster sample (FCB #5059) was taken from this area. Very few artifacts were found in the floor and fill of Zone 10. Like Zone 9, a beautifully preserved plaster floor (Floor 2 - Zone 13) was found beneath Zone 10. The base of Zone 10 defined the surface of the plaster floor and identified a large disturbance along the northern, eastern and southern edges of Floor 2 in Square F, most likely due to a tree fall. The disturbed area was removed separately and labeled Zone 12. The tree disturbance caused the plaster in both Floors 1 and 2 to bulge in the northeast corner of the unit and slope up toward the north, where a large root had apparently once existed.

Zone 12

Zone 12 appears as a deep depression, likely the remains of a large tree which cut through both Floors 1 and 2 (Figure 6.3). The zone is located along the northern side of the square. The matrix of the disturbed area consists of a loose, silty clay soil with a high density of limestone gravel and large limestone cobbles inclusions. There are little to no river cobbles inclusions in Zone 12. Uneven sections of Floor 2 (Zone 13) which surround the tree disturbance are likely the result of old roots pulling up the plaster surface.
The loose, dry matrix of Zone 12 contained a very light density of artifacts. At the base of the zone, there is a high density of tightly packed, large limestone cobbles that appear to be in situ core fill (Zone 16), which underlies Floor 2 (Zone 13).

**Zone 13**

Zone 13 represents the remains of Floor 2, a plaster surface disturbed due to tree fall along the northern edge of the square. Floor 2 is located roughly 15 cm beneath Floor 1 (Zones 9 and 10), and only the plaster was removed as Zone 13. Two samples of the plaster (FCB# 5062 and 5065) were collected from Floor 2. The plaster contains many inclusions and therefore is not smooth in cross-section but appears relatively smooth on the surface. There were no artifacts found in the plaster surface; however, a round hammerstone and a chert flake found at the base of Zone 10 may have been associated with the surface of Floor 2.

**Zone 16**

Zone 16 comprised two layers of distinct gravel and cobble fill underlying the plaster surface (Zone 13). The construction fill consisted of about 20 cm of tightly packed small gravel and cobble-sized limestones, followed by a layer of larger limestone cobbles measuring about 25-35 cm. Only a light density of cultural material was recovered within these underlying construction fill layers, including two C-14 samples and a botanical sample. Several flowstone formations were collected from Zone 16, possibly travertine mined from across the nearby Sibun River. At the base of Zone 16, the surface of a sloping, packed earthen mound was defined, which showed signs of basketload stratigraphy (Zone 17). The surface of the earthen mound appeared uneven where it interfaced the large cobbles (Figure 6.3). At the base of
Zone 16, a slipped ceramic sherd and a large C-14 sample were found on the surface of the clay-filled matrix, positioned over a meter below ground surface.

Zone 17

Zone 17 consists of a compact, clay-filled mound directly below the layers of cobble fill identified in Zone 16. Together, Zones 16 and 17 appear to comprise the core fill of Structure 503, which formed the bulk of the platform. The artifact density in Zone 17 was slightly higher than the overlying fill layers in Zone 16, and included animal bone (possibly a small rodent), pottery sherds, unworked shell, and charcoal. Two C-14 samples, sealed inside the fill, were collected from the zone. Basket load stratigraphy is reflected in the mottled-clay construction fill of Zone 17. There were no rock inclusions in this compact clay construction fill. The zone was arbitrarily changed to Zone 18 after 20-25 cm of fill was excavated.

Zone 18

Zone 18 represents the bottom half of the earthen construction fill, with basket load stratigraphy still present. The earthen fill was extremely compact and yielded a light density of artifacts. Only the eastern portion of the square (a 1 × 2 m area) was excavated in Zone 18. At the base of the earthen fill, a level floor surface (Floor 3) was interfaced.

Zone 19

Zone 19 represents the surface and some of the underlying fill of Floor 3. The surface is very level and well preserved. Composed of a mixture of plaster and earth, the floor appears to have been tamped down, rather than formally prepared. Covered over in antiquity, it was protected and able to survive intact. The fill below it is a clayey silt with gravel-size limestone inclusions. Excavations ceased at this level.

Concluding Remarks

Square F of Operation 51, positioned on the top of the platform surface of Structure 503, revealed at least four distinct construction episodes, indicating a relatively long length of occupation in this central locale. Square A, situated along the northern side of Structure 503, confirmed that the elongated platform contained a centrally-located, outset staircase on the northern side of the structure, at least in its final phase of construction. In addition, Square A and the surface of Square C exposed the remains of at least two terraces flanking the northern side of the platform. A rich midden heap was found in Square A, wedged in a corner between the northern facing wall of Structure 503 and the western wall of the central staircase.

Preliminary analysis of the diagnostic sherds found within the midden deposit indicates Late-Terminal Classic period material (S. L. López Varela, personal communication August 2002). At the base of excavations in Square A, the northern facing wall of Structure 503 was defined, with basal molding adorning the base of a nine-course high wall. Excavations confirmed that platform structures in Group A were oriented 20 degrees east of north. If all structures in the main group are comparable to Structure 503, each was constructed primarily of limestone cobble fill with floor and wall surfaces covered in plaster. The general shape of each structure and the high density of exposed limestone blocks noted on the ground surface suggest all-stone masonry construction for all of Group A. Remnants of a formally prepared plaza surface were identified within Square A of Operation 51, to the north of Structure 503. This floor likely extended throughout the central plaza of Group A.
Excavation of Squares A and F in Operation 51 yielded a considerable amount of information regarding the occupation of Group A, the largest plaza group that presumably housed the elite occupants of the Hershey site. The two squares were strategically positioned across the center and northern side of Structure 503, an elongated platform lining the south side of the plaza group. Investigations shed light on the construction techniques and architectural phases associated with Group A, possibly the founding settlement group of the Hershey site. Further testing, planned for the 2003 field season, aims to clarify the construction sequence of a wider range of structures at the Hershey site.
Operation 53 was a $1 \times 2$ m excavation unit located on Structure 517 in Group C of the Hershey site, spatially oriented with its long axis lying approximately 10 degrees east of north. Structure 517 is a large basal platform that supports Structures 518 and 519. The excavation unit extends from the northern edge of Structure 518 to the saddle located between Structures 518 and 519. The goal of the excavation was to expose a section of the retaining wall of Structure 518. Secondary to this goal was an attempt to ascertain the function of Group C and determine its relevance to the site when compared to larger mound groups in the area.

Zone 1, the topzone, consisted of fine silt overlaid by heavy amounts of leaf litter and organic debris. Surface collection in the immediate area yielded several poorly preserved pottery sherds. The poor preservation was most likely due to the effects of weathering at the surface of the platform. A few small pieces of debitage were also collected from the surface. On clearing away the organic material we uncovered several large limestone rocks erupting through the surface of the silty matrix in the southern section of Zone 1. These limestone rocks were exposed as a separate deposit labeled Zone 2, as they might have once been part of the retaining wall for Structure 518 or perhaps part of the construction fill behind that wall. Zone 1 was brought down approximately 10 cm until a slight color change was noted transitioning from the 10YR 3/3 dark brown of the silty matrix to a darker 7.5YR 3/3 brown of what was labeled the surface of Zone 3.

Zone 2 was comprised of the limestone rocks and underlying matrix located in the southern end of Operation 53 (Figure 7.1). As the rocks were exposed it became clear that not only had we identified what seemed to be cobble fill that had slipped down from Structure 518, but perhaps we had also uncovered what looked to be the remains of a small two or three course retaining wall. The limestone uncovered ranged from 3 to 25 cm in length, with the larger ones forming the base layer at the bottom of Zone 2 and the smaller construction fill located primarily to the south. In addition to the limestone we discovered a medium density of poorly preserved pottery sherds much like those uncovered in Zone 1, and a negligible amount of small chert debitage flakes. The presence of the pottery sherds and the debitage seems to point to them being part of the run off from Structures 518 and 519, caused by centuries of annual flooding. Zone 2 ended when it was determined through probing that only two courses of large limestone rocks were present and represented what remained of the retaining wall for Structure 518. Though the wall may have had more courses in antiquity, no evidence could be found to confirm that hypothesis. We then turned our attention to the area of the excavation unit to the north of the wall.

Zone 3 was a semi-compact layer of a silty clay matrix that ran from the retaining wall to the northern terminus of the excavation unit (Figure 7.2). A much higher density of poorly preserved pottery sherds was uncovered as we took down Zone 3 an additional 10 cm. Though most of the sherds appeared to be in the same weathered condition as those already found at higher elevations, there was one that maintained its integrity over the years and had retained its slip. Yet another pottery sherd showed signs of incising, a feature until now only exhibited by sherds found in the
larger groupings at the Hershey site. Excavation in Zone 3 also yielded 5 beautifully preserved, obsidian blade fragments of varied length, the highest density of such fragments that had been found during the season up to that point. Zone 3 ended as we came down upon a densely packed layer of river cobbles at 56 cm below datum ranging in size between 2 and 8 cm.

Zone 4 was a layer of densely packed river cobbles and limestone rocks ranging in diameter from 2 to 25 cm locked in a matrix of silty clay and gravel. This appeared to compose the construction fill for what seemed to be the overlying plaza surface that was Zone 3. This fill was similar to that held behind the retaining wall in the southern end of the excavation unit, though evidence of the utilization of river cobbles was more apparent in the case of Zone 4. Excavation yielded a medium density of poorly preserved pottery sherds, some chert debitage, and an additional two obsidian blade fragments of equal quality to those found in Zone 3. Additionally we uncovered what appeared to be a broken net weight, which might have been cast aside in antiquity and used as part of the construction fill of Zone 4. After approximately 25 cm of excavation there was a marked increase in the size and density of the limestone, which prompted us to call an end to Zone 4 and delve deeper below the surface of the initial layer of construction fill.
Zone 5 consisted of massive limestone boulders and river cobbles ranging in size from 5 cm in diameter near the surface of the zone to at least 75 cm at the maximum depth that time and safety would allow us to explore (Figure 7.3). These giant rocks must have been transported at considerable cost and expenditure of energy to provide the ballast layer on which to build structures high enough to resist annual floods. While the matrix remained consistent with that of Zone 4, the rocks were so large that air pockets existed between many of them as the soil was cleared down around them (Figure 7.4). Relatively light quantities of pottery sherds were excavated along with another single obsidian blade.

![Figure 7.3 Profile of Operation 53, west wall.](image)

![Figure 7.4 Final plan view of Operation 53, Zones 2 and 5.](image)
Unique to Zone 5 was the discovery of what appeared to be a piece of flowstone buried deeply within the limestone ballast. This would cast an interesting light on the significance of Structures 518 and 519, as flowstone brought from the sacred space of the local cave system and included in the construction material could denote an area of ritual importance. In addition to the presence of what appeared to be flowstone, a piece of unworked shell was also uncovered while excavating Zone 5. It is unclear whether the flowstone and shell were included in the fill purposely, or rather the unique environment caused by such massive rocks served as a catchment area for these artifacts. Excavation continued to a depth of 147 cm below datum, when it became physically impossible to remove any more limestone from the unit due to their sheer size and weight.
During the 2001 season of the Xibun Archaeological Research Project, a three-week field investigation was undertaken to assess the possibility of locating evidence of occupation in the Sibun Valley during the Spanish Colonial period, specifically the location of the town and Catholic visita church mentioned in several early seventeenth century Spanish sources. Although the archival evidence documents the existence of the settlement, it is insufficient to assist in locating the remains of the historical settlement within the river valley. Therefore, a survey was designed to identify and investigate appropriate geographical features in the fertile valley surrounding the Hershey site. Initiated in 2001, the survey investigated the southernmost arable reaches of the Sibun River Valley. In future seasons, investigations will work progressively north and eastward down the river.

Historical Sources

According to Grant Jones (1989: 288), documents in the Archivo General de Indias, Seville, Spain, indicate that the town of Xibun was located “somewhere upstream on the Sibun River” but that “none of the documentation provides specific clues concerning its precise location.” In 1631, several members of a party gave testimony about their experiences on a trip to Xibun during the previous year. Their testimonies state that on their arrival they found the town to be deserted. Descriptions of events also indicate that the ornaments of the church had been removed and the bells taken from the belfry by the residents as they departed (Petición de Cristóbal Sánchez, 1631, quoted in Jones 1989: 199-201). Although the residents were discovered living in a forest enclave five days’ walk away and were returned to the town, Xibun was found similarly deserted when visited again in 1638 (Jones 1989: 208). These testimonies constitute the extent of historical documentation known for the existence of a Christian church at the Spanish Colonial period town of Xibun, as well as the latest known date for a concentrated settlement of Maya population in the valley.

British occupation of the Sibun began sporadically in the eighteenth century, although they were not granted rights to settle there until the treaty of 1786. At the time of the treaty, many settlers already occupied downriver portions of the valley illegally, but very few had settled upriver of the confluence with Caves Branch and none above Dry Creek (PRO CO 700 BH no.13). British settlers did not explore the headwaters of the “River Sheboan” until August 1787, when it became an important strategic location that defined the new southwestern boundary of the region ceded by the Spanish government for logging (PRO CO 123/5).

Incidents recorded during the nineteenth century indicate that the Sibun remained a marginal area of British settlement. When a group of slaves ran away in 1823, some going up the Sibun and others up the Belize River Valley, it was decided to pursue only those in the Belize Valley, since the British military garrison was too small to pursue them in such a remote area as the Sibun (NAB; R4B pp. 77-78)
In 1869, the Colonial government sponsored a visit to the Sibun by Father Avarro “for the purpose of visiting the Indian Settlement.” There is no indication of where the settlement was located or whether these were residents of longstanding or new immigrants to the region, but even at this late date it was apparently unusual to make such a trip (NAB; R.101 p.295).

Criteria for Testing Locations

The limited extant documentation offers no immediate insights into the location of the town and church, so a survey strategy was employed based on topographical features that possess attributes similar to those that have yielded Spanish Colonial and later Historical period deposits from river valleys elsewhere in central and northern Belize (Finamore 1994: 176-177; Graham, Pendergast and Jones 1989; Pendergast, Jones and Graham 1993; West, Masson, Finamore and Rosenswig 1998). High priority localities for investigation were flat, well-drained areas with the following characteristics:

1) close proximity to the locus of a dense concentration of Postclassic period artifacts (exclusive of ceremonial cave contexts) presumed to exist in the central portion of the Hershey site;
2) elevation above the seasonally inundated plain. In cultivated areas this was defined as the zone separating low-lying cacao fields from slightly higher citrus orchards;
3) a prominent placement that is visible from the surrounding region, and within a few hundred meters of the Sibun River, either on a natural rise, or on an artificially elevated Maya mound.

Unfortunately, development is more extensive in the Sibun Valley than in many other parts of Belize, particularly where terraforming for modern citrus orchards has significantly altered the natural landscape to elevate trees and create furrows between rows of trees.

According to the historical maps referenced above, as well as others held in an array of archives, the Hershey site is situated farther up the Sibun River than any settlements of eighteenth- or early-nineteenth century British woodcutters who accessed the valley from the river mouth (Calderon Quijano 1944). The upper reaches of the Sibun were marginal to British settlement that was oriented toward the coast, probably because the upper reaches of the river were simply too shallow to float mahogany down. Spanish travelers, on the other hand, would have accessed the Sibun Valley from inland routes via the Belize River, and the upper reaches around the Hershey site would have been among the most accessible for them.

Field Testing and Results

Following surface survey within the orchards, pastures and wooded areas of the upper Sibun River Valley, a testing program was undertaken targeting the following four areas in the upper valley: Hershey site, Goodliving Camp, St. Thomas, and Branton Trail/Chanona Farm.
Hershey Site

Located along the west bank of the Sibun River, the site is situated in the center of the largest stretch of relatively flat arable land for many miles around. Currently this portion of the valley is under intensive citrus and cacao cultivation. Its position and proximity to resources within the valley are discussed at length elsewhere in this volume (see McAnany and Thomas, Chapter 1).

Plaza Group C

The central plaza within this group was tested with a grid of fifteen shovel test pits, each approximately 50 cm on a side. Every unit yielded approximately the same profile of 70 cm of alluvium over crumbled cobbles that were probably plaza fill. No identifiable Postclassic or Historical period artifacts were recovered.

Group A

The west range structure (507) of Group A is a platform of approximately 34.5 m in length, with a top that offers the largest flat elevation within the Hershey site proper. A 50 cm × 12 m test trench (Operation 52) was laid laterally across the center of the structure, perpendicular to its long axis and 16 m from its north side. Excavation of this trench yielded what appeared to be a footing wall for a building that sat atop the platform, with a courtyard facing into the plaza interior. There was no evidence of any Historical period occupation and the structure footing most likely dates to the same period as the platform construction, likely the Terminal Classic period.

Other Areas of the Site

What appeared to be a cement piling at the southeast point of Group B attracted the attention of those working in that area. Although it was of porous and eroding low-grade cement, it was determined to be of fairly recent origin. According to local informants a small water tank used to irrigate the adjacent fields once stood at this location.

The developed area near the entrance of the farm where the Hershey site is situated also contains several elevated areas that fit the above-listed criteria for further investigation, but which, according to the current manager, had been heavily disturbed by bulldozers when the farm was modernized between 1979 and 1987.

During investigations of undisturbed high ground, a brass military uniform-style button (Figure 8.1) was recovered from near the east foundation wall of the management building at the main entrance to the farm. The button was covered with a hard accretion of red silt and will require conservation prior to identification, but it appears to be embossed with two rampant lions flanking a coat of arms. It is no surprise that British military buttons would be found in a “backwoods” context such as this, given the regular surveys and patrols that were undertaken for purposes ranging from marking the legal boundaries of the settlement to the pursuit of escaped slaves.
Good Living Camp

Good Living Camp is a series of wood-framed buildings on both sides of the Hummingbird Highway, to the west of the bridge over the Sibun River. Subsurface testing was undertaken on a series of small rises located both north and south of the highway. Three 50 cm square shovel test pits were placed on a wedge-shaped promontory of high flat land approximately 100 m northwest of the structures on the north side of the highway.

Two additional test units were placed atop small knolls on the south side of the road to the west of the house near the river. The alluvial soils were much deeper here than elsewhere, but no Historical-period artifacts were recovered.

St. Thomas

Although largely low-lying, the farm to the north of the Hershey site, known as St. Thomas, was of interest because local informants indicated that was where the gravestone of Robert Gentle (d.1812) had been initially discovered (McAnany 2001: 229-31). The overgrowth that followed abandonment made survey of this region very difficult. The majority of the area was covered in dense bush and could not be adequately surveyed in the short period of time allotted.

Although no Spanish Colonial period artifacts were recovered, two discoveries of interest were made in the region. An abandoned lime kiln of traditional barrel construction, associated with the remains of a small wood-frame house that appeared to have been occupied until recent times, was discovered on the north side of a large karst hill near the river.

Of greater interest was a large projectile point (Figure 8.2) found on the surface inside a meander of a small stream flowing into the west bank of the Sibun. The large tangs, bifurcated base, and alternate beveled margins suggest that the point is coeval with the Lowe phase of the late Lithic stage in Middle America (MacNeish 1986: 104). Other surface finds of this point type have been made in Belize, notably around Sand Hill and Ladyville. Additional investigations near the location of this find may yield a rare pre-ceramic activity area or stratified deposit.
Branching off due south from the Hummingbird Highway at the farm of Tony Chanona is a small road called Branton Trail. According to local informants, this road predates construction of the Hummingbird Highway, and was probably a logging road that also once headed north roughly parallel to the Sibun. The road continues south and curves east paralleling the river, passing through citrus orchards, stopping at the southernmost extremity of arable land at the bottom of the steep and nearly inaccessible Sibun Gorge. At this southern extremity is a large flat pasture, elevated to the extent that it has the most expansive view of any point in the southern end of the Sibun Valley. This flat area of land, with its striking view, could at once be perceived as both a central location visible to much of the southern end of the valley, but also peripheral to the movement of people through that region.

A series of eight shovel test pits were aligned in a transect along the western edge of this pasture, near the slope down to the river. Another four test units were placed atop small knolls within this pasture. No Spanish Colonial period deposits were recovered, but among the Precolumbian artifacts was an undecorated drilled slate pendant (Figure 8.3). This pasture yielded evidence of off-mound Precolumbian Maya habitation, possibly warranting more extensive examination in future seasons.
Future Prospects

Intensive citrus cultivation in the southern Sibun River Valley has caused far more surface disturbance than in river valleys in the northern part of the country. Nonetheless, there is still significant prospect for locating the remains of the Colonial period town mentioned in the Spanish archives. In future seasons, investigations should continue working down river to the north, concentrating in vicinities near any documented Late Postclassic period settlements. Continued investigations will undoubtedly be labor intensive, requiring exhaustive testing to execute an essentially non text-aided survey strategy.

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Caves of the Sibun-Manatee Karst
Polly A. Peterson

The Sibun-Manatee Karst is one of eight karst regions which, taken together, cover about half of the surface area of Belize (Miller 1996: 103). It is characterized by towers (steep-sided hills of Cretaceous limestone) and cockpits (interior valleys) — a landscape that resembles an egg-carton (Miller 1996: 113). In the central portion of the Sibun River Valley, this cone karst dots the southeastern side of the river and extends roughly 20 km from east to west and 15 km from north to south. On the northern side of the river, the riparian forest gives way to flat pine savannah. The tower karst rises up to 200 m creating a dramatic contrast to the flat valley floors that sit at sea level (Miller 1996: 113). As the river meanders in wide oxbows towards the Caribbean Sea, the caves end near the village of Gracy Rock, and the land eastward is characterized by mangrove swamps.

Survey and mapping of caves in this portion of the river valley were conducted in three areas during the 2001 field season — the Gracy Rock Cave District located at the northeasternmost end of the Sibun-Manatee Karst, the Tiger Sandy Bay Cave District near the site of Balam Ha, and the Glenwood Cave District across the river from the site of Yax P’otob (Figure 1.1). The Tiger Sandy Bay Cave District was extensively explored during the 1997 and 1999 field seasons (Isaza et al. 1999; Peterson 2002). The 2001 season marked the first exploration in the Gracy Rock Cave District. Future fieldwork should be conducted in both the Gracy Rock and the Glenwood Cave Districts in order to study a larger sample of the countless caves used by the Xibun Maya. The following description of cave research carried out during the Spring of 2001 includes Arch Cave, Usrey Cave, Metate Cave, and K’in Rockshelter.

Gracy Rock Cave District

Arch Cave

Arch Cave is situated near the northernmost edge of the Sibun-Manatee Karst near a landmark called Gracy Rock, which is located in Transect 4. The main entrance is sheltered by a high, arcing limestone ceiling that gives the cave its name. Although the entrance is located in this open “breezeway” at the top of a steep hill, access to the cave has been restricted by the construction, presumably in Maya times, of an artificial wall. The wall is composed of breakdown, or limestone rubble, which partially seals off the entrance and effectively blocks all but a small stream of light from entering the first chamber. Perhaps the entrance was completely sealed at one time, but it was accessible through a narrow opening in 2000 when nearby villagers, Gilford Hoare and Lance Usher, discovered the cave. Despite considerable efforts to conceal the entrance in antiquity, the entrance floor was paved with flat speleothems that actually aid passage over what appears to have been a natural crevice. One must crawl into the opening and then side-step with hands pressed against a boulder and a flowstone shelf to navigate the entrance. This is the only known entrance to Arch Cave that is accessible to humans. Small openings, only large enough for bats and rodents to enter, allow light and air into the cave in a few places deeper within the cavern.
The artificial wall is most visible from the interior of the cave where it extends southwestward down a slope leading into the main chamber. The ceiling appears to be crumbling in this small entrance chamber. The breakdown rubble used to build the wall could have been easily collected from the entrance itself and from the talus slope leading up to the cave.

The entrance is located on the easternmost side of the cave (Figure 9.1). Once inside, the main chamber opens to the west and then curves to the north. While there are a few narrow side chambers, one upper level and one lower level chamber, and several small recessed alcoves — this wide, flat, north-south oriented chamber allows easy passage from one end of the cave to another.

![Figure 9.1 Map of the entrance to Arch Cave.](image)

Arch Cave contains over 29 complete and reconstructable vessels — Vessels 57-85 (see Betzenhauser, Chapter 21, for a discussion of these vessels). Many passages containing artifacts and whole vessels were not discovered until weeks after mapping and exploration of Arch Cave were underway. For instance, the “assassin bug chamber” — so named for the ubiquitous cone-nosed beetle *Pselliopus* spp., or assassin bug — was previously unknown to the guides and local residents of the nearby village of Gracy Rock. Once Gilford Hoare discovered the hidden room, which is reached by crawling down a narrow tunnel in the southernmost end of the cave, we found at least fifteen complete and reconstructable vessels (Vessels 71-85). The vessels are distributed more or less equal distances from each other in the central
portion of the room, which measures approximately 9 m in width and 6 m in length (Figures 9.2 and 9.3). There are a total of ten olla, six of which are inverted, and four of which are laying on their sides. All of the olla have been ritually “killed.” Many large rim sherds on the floor between the vessels are also from jars. Five bowls had also been deposited in the chamber; only one of the bowls is inverted and all five have been “killed.”

Figure 9.2 A partial view of the “assassin bug chamber” where fifteen pottery vessels were discovered in situ (photo by Patricia A. McAnany).

In this chamber, the ceiling is low (no more than 1 m above the floor), covered with small stalactites, and has many bat roosts. The floor is littered with hundreds of sherds laying on top of cave pearls and covered with bat guano. All pottery vessels were mapped and photographed in situ, but due to time constraints (and the fear of a bite from the so-called assassin bugs, known to carry Chagas’ disease in other parts of the American tropics) the vessels in the “assassin bug chamber” were not drawn or extensively recorded. The confined space, combined with the infestation of assassin bugs, made this a difficult area to document. The seemingly undisturbed contents of the chamber made the task worthwhile.

A tiny entrance is visible in the southernmost end of the chamber, letting in a small amount of light and air. Gibnuts have been using this entrance as evidenced by the presence of feces, leaves, and cohune nuts.

The “assassin bug chamber” is located at the southern end of a narrow chamber named "sherd alley" because the floor is littered with sherds and rubble (Figure 9.3). The main concentration of sherds is located at the entrance of the crawlspace leading to the "assassin chamber," where a honey-colored chert biface with a taperinghafted end was discovered. “Sherd alley” runs roughly north to south. Stalactites and stalagmites line the chamber’s low ceiling; some are presently active. A large depression, leading to a small chamber underneath the floor, contains a broken granite mano, sherds, and rubble.
A mandible of a small to medium mammal, a large rodent incisor, and other mammal bones were located in the center of the floor among sherds and rubble. At least some of the animal bones may be natural, although they are associated with artifacts. There is evidence of gibnut habitation in the form of cohune nuts, feces, small nests, and leaf litter. A tiny entrance accessible only by small animals lies at the end of the chamber letting in a noticeable stream of light and airflow. The opposite northern end of “sherd alley” opens onto a low balcony or ledge overlooking the main chamber.

There are charcoal markings on some of the stalactites and columns and near the opening of “sherd alley” onto the balcony. Sherds, an inverted red rimmed olla with a large kill hole at its base (Vessel 60), reptile vertebrae (possibly snake), and the distal fragment of a triangular prismatic obsidian blade (just over 3 cm long and 1 cm wide) were found along the balcony. The obsidian is cloudy with some darker bands
and one side shows some chipping from edge wear. The blade was found near the 24 small vertebrae which are scattered along a narrow portion of the ledge.

Back in the main chamber, an alcove located across from the balcony contained two noteworthy vessels and a possible “altar” (Figure 9.4). Vessel 58 is a huge wide-mouthed jar, over 58 cm in height, located near an “altar” composed of flat speleothems. The vessel was upright when we first saw it, but we were told that it was discovered on its side. Upon careful inspection, we could see a lack of calcification on the side of the vessel that originally laid on the ground before being moved. We returned the vessel to its original position. Vessel 58 is 51 cm in diameter and contains small mammal bones (most likely rodents). The pedestal base of a red bowl (Vessel 59) was situated on the floor in front of the altar approximately 1 m away from Vessel 58. Vessel 59 is associated with a large group of red sherds, which may be from the same vessel.

Figure 9.4 Map of the main chamber of Arch Cave including the alcove containing Vessels 58 and 59.
A similar arrangement was discovered deeper in the cave where an alcove contained another very large jar (Vessel 65) and another large red pedestal-based bowl (Vessel 67) positioned next to an “altar” (Figure 9.5 and 9.6). Vessel 65 is similar to Vessel 58, but is slightly smaller, measuring 56 cm in height with a rim diameter of 47 cm. Vessel 65 is complete, although large cracks, visible on the interior and exterior of the vessel, radiate from the base. The body of the large jar is calcified and fire-clouded, and the rim is slipped red. Vessel 67, the large bowl with pedestal base, was found to the southwest of Vessel 65 on the opposite side of the small alcove. The bowl was inverted and a kill hole was located in the center of its sagging base, inside the ring of the pedestal. Vessel 67 is covered in calcite. A large “altar” (about 0.75 m wide) made of rubble is located between the jar and the bowl. The “altar is covered with large sherds, including fragments of Vessel 66.

Vessel 66 is a partially reconstructable reddish black bowl. Large fragments of the vessel were found on a rock 5 cm away from the large jar (Vessel 65). Sherds of the same vessel were also located on the “altar” 2 m away. The bowl has a ring base (1.5 cm in diameter) and is roughly broken in half. There is a small mend hole located on the edge of the break.

Figure 9.5 Map of the main chamber of Arch Cave including the alcove containing Vessels 65 and 67.
The northern end of the cave is completely dark with a damp, relatively level floor. In the chamber adjoining the alcove containing Vessels 65-67, the ceiling is flat and smooth, but the ceiling of the alcove is covered with stalactites. The ceiling in the chamber is just high enough to stand, but in the alcove the ceiling drops a bit and one must crouch to enter.

Within the chamber adjoining the alcove containing Vessels 65 and 67 are three partial vessels (61, 63, and 64) and several piles of rubble containing sherds. It seems as though some of the rubble was placed intentionally on top of sherds as though they were tiny “altars.” A fragment of a brown banded shell was discovered in a rim stone dam on the floor near the vessels. Vessel 61 is a small reddish brown olla with fire clouding and calcification. It is inverted and the bottom is almost completely missing. Vessel 63 is located 2 m away from Vessel 61. It is a dark grey olla with a large kill hole that has removed approximately 75 percent of the body. The entire rim remains intact and inverted. The rim is slipped red with some evidence of fire clouding. Vessel 64 is located approximately 2 m from Vessel 63. It is the top portion of a red restricted-neck jar.

During the month of April (the “dry” season), the stalactites were actively dripping onto a floor of stalagmites in the northern end of the cave. The floor is almost entirely covered with rubble and cave pearls of various sizes. A cockle shell, jute (Pachychilus indiorum), terrestrial snail shells, animal bones, sherds, and a distal fragment of a banded grey chert biface were discovered among the limestone formations scattered on the floor. Some of the animal bones are from a small unidentified mammal with grooved canines. There are a series of low alcoves scooped out by water action along the western wall of the chamber. A small niche in the low ceiling on the western side of the chamber contained a wooden splint (possibly an unburned torch). Small fragments of the wood were collected for species identification and C\(^{14}\) dating.
Vessel 68 is located in a niche on a flowstone ledge above the main chamber (Figure 9.7). The ceiling is lower in this part of the cave and the ledge is accessible by climbing up a large flowstone formation that is growing upwards from the cave floor. There are many large olla sherds on the floor below this upper chamber and in nearby alcoves. Vessel 68 is a small, complete, inverted olla. It is black in overall color with reddish orange swirls and striations across the body (possibly as a result of plant growth on the surface). It is not associated with any other vessels. There is another smaller niche directly above the niche containing the vessel. A small mouse was seen in this niche and probably lives in the cave.

Vessel 70 is located in the westernmost corner of the northern end of Arch Cave (Figure 9.7). It is an inverted red bowl, with less than half of which remains intact. It is calcified to a rock, suggesting that it is in situ. Several other shattered vessel fragments litter the surrounding area. Vessel 70 is located below the area where Vessel 69 is situated, beneath an overhang that undercuts the cave wall. If one crawls under this overhang, one reemerges in "alcove peligroso," so named because this is where Kevin Acone took a 12 foot fall.

The "peligroso alcove" is formed by flowstone with a slippery coating of "moonmilk" or damp calcite. One must climb barefoot up to a balcony with a sloping floor to see Vessel 69, which sits atop a small pile of rocks (Figure 9.7). Vessel 69 is a small, black ring-based bowl. It is highly calcified, and does not have any signs of being ritually “killed.” The bowl is associated with a large sherd situated about 1.5 cm away on the sloping balcony.

There are charcoal marks on the flowstone wall beneath the "alcove peligroso." The alcove curves around to the west, where a large sherd of a red bowl (possibly of the Roaring Creek Red type) is located high up in a flowstone niche. Rubble covers the floor beneath this niche and air can be felt entering the cave at this location, suggesting a small opening to the outside, although none was found.

Continuing along the cave floor to the west, past Vessel 70, one can crawl into a small narrow chamber where there are many sherds (mostly complete olla rims), arboreal snail shells, and charcoal. The alcove at the farthest end of this chamber contains an olla rim that is almost completely buried.

Jaguar teeth were discovered in three separate contexts throughout the cave. The distribution of these canines throughout the cave, and their deposition in cultural contexts, suggests that they are not part of the natural cave fauna. One jaguar canine was discovered on the floor under a rock lining the path in front of Vessel 59. Another jaguar canine was found near the entrance to the “assassin bug chamber” among leaf litter from a g nibut-sized opening to the outside. A third jaguar canine was discovered along with seven molars and several bone fragments (including a long bone) in the main chamber near the cave entrance. These jaguar teeth and bone were deposited underneath a low ceiling that had been blackened by smoke. Small torches were discovered deeper in the cave cached in a niche in the low ceiling. Perhaps torches like these or incense were used in the ritual deposition of the jaguar teeth. Other notable faunal remains included the possible snake vertebrae from the balcony near “sherd alley.” Marine shells (including a large cockle shell) and freshwater jute (Pachychilus indiorum) were also discovered in several locations throughout the cave. Living animal residents of the cave currently include a large mouse, a porcupine, two types of bats, and g nibnuts.
Neither the complete vessels nor any of the artifacts were collected from Arch Cave in order to preserve it for others to experience. Since 2001, Discovery Expeditions has brought 12-20 people per week (during the winter months) on tours of the cave. The tourists are from cruise ships and only spend a half an hour at most in the cave. The tour guides are very conscientious and knowledgable about caves and of Maya culture and do not let anyone touch anything (they all stand outside of the alcoves and observe the vessels from afar). This is an excellent example of cultural patrimony. The villagers of Gracy Rock are guardians of the cave because looting of its contents would be less beneficial than preserving it as a cultural site for tourism. It is a win-win situation.

Figure 9.7 Map of the northern end of cave including the upper-level chamber containing Vessel 68 and the “alcove peligroso” containing Vessel 69.
Tiger Sandy Bay Cave District

Usrey Cave

Usrey Cave, formerly known as “No Man’s Reach” (Isaza et al. 1999: 56), was renamed for Steve Usrey who was able to free-climb to a ledge containing four vessels. This cave was shown to the Xibun Archaeological Research Project team in 1997, but was not mapped until the 2001 season with the aid of a laser rangefinder (Figure 9.8).

The cave has two entrances — the main one is accessed by walking and climbing up a gradual slope and the other is accessed by crawling through a small partially walled entrance into a lower chamber. The lower entrance is visible from above, where one can stand on a ledge inside the main chamber of the cave and look across a vertical drop (approximately 8 m high and 5 m across) to a ledge containing four *ollas*. Both entrances of Usrey Cave open to the north into Usrey Valley. The cave is quite dry, containing stalactites and stalagmites which are inactive, at least during the dry season. Usrey cave is shallow but fairly dark inside and home to bats.

Figure 9.8 Map of Usrey Cave.
The main entrance to the cave is accessed by climbing up a steep flowstone shelf. The cave floor slopes upward to the south and then the chamber turns east a short distance, ending in a steep-sided depression, the bottom of which is accessible by the small second entrance. A flowstone ledge on the far side of the depression has stalactites and stalagmites which frame a shelf containing four ollas (Vessels 51-54; Figure 9.9). There is a large column in the center of the shelf near the edge of what appears to be a separate column standing behind it to the north. These columns divide the shelf into two separate sections to the north and east. On the northern side of the flowstone shelf, there are two large inverted jars with red rims and striated bodies (Vessels 51-52). Neither of these ollas are complete, but both exhibit intact rims. To the east of Vessels 51 and 52, there are two more large inverted ollas, one gray (Vessel 53) and one black (Vessel 54). These jars have also been “killed,” but are more complete than Vessels 51-52. Vessel 54 has a small kill hole in the base and a broken off stalactite that lies in front of it. The ledge upon which these vessels have been deposited is visible from, but unreachable via the chamber accessed by the main entrance. Steve Usrey, and later Bruce Cullerton and Matthew Miller, free-climbed the cave wall from the bottom of the depression and entered the ledge from an opening underneath and behind the vessels. The ledge could be accessible via a very large ladder. The walls of Usrey Cave are smooth limestone with many water-sculpted pockets which make good handholds for climbers. Overall, cave features appear to have been formed by water erosion more than by dripping water, although there is flowstone in many parts of the cave. There is a rock overhang at the entrance with large stalactites.

Figure 9.9 Ledge containing Vessels 51-54 (photo by Patricia A. McAnany).

A small alcove is located on the wall directly above the main entrance to the cave. The alcove is part of a flowstone shelf that hangs over the sloping part of the main entrance approximately 8 m above the valley floor and about 3 m from the chamber floor. The ceiling of the alcove is high enough to sit beneath but not to stand. There are broken soda straws above the entrance to the alcove, but the broken ends cannot be found in the alcove and were likely removed from the cave. Inside the alcove there is a depression containing two small ollas with red-slipped rims and striated bodies (Vessels 55 and 56). Vessel
55 was found on its side, but may have been moved in recent times. A broken stalagmite (30 cm long, 13 cm thick, and 6 cm wide) lies behind Vessel 56. It appears to have been broken off a stump near Vessel 55, since they fit back together when joined. The niche containing the vessels is 1.22 m long and 0.44 m wide. Arboreal snail shells were found within the alcove. Sediment samples were collected from the interiors of these vessels for pollen and botanical analysis.

The lower entrance to Usrey Cave leads to a small room at the base of the steep-sided depression located beneath the shelf containing the four *ollas*. The entrance is merely a small crawl-space from the outside, which was probably once sealed by an artificial wall that has since fallen and is now a pile of limestone rubble. The room is dry but the walls are covered by *acteno mycites* (a fungus) and feel slightly damp. Assassin bugs inhabit this room.

There is a large boulder about 3 m from the rock face that conceals the lower entrance from the rest of the valley. Between the exterior cave wall and the boulder there are several smaller boulders embedded in the ground and stones from an artificial wall that probably once covered the small entrance. Many arboreal snail shells were found between the boulder and the rock face. Several species of freshwater and terrestrial molluscs had been deposited near the lower entrance to the cave (see Stanchly, Chapter 27, for a description of a sample of collected shells). Sherds and shells including *jute*, *Pomacea*, and *Nephronias* were also found in the alcove between the exterior cave wall and the small boulders (Figure 9.10). The western side of the lower level entrance is narrowly accessed due to the presence of a huge boulder. Dense deposits of terrestrial snail shells are located between the cave wall, the artificial wall, and the boulder.

![Figure 9.10 Freshwater and terrestrial shells from the entrance to Usrey Cave (photo by Patricia A. McAnany).](image)
Metate Cave

Metate Cave was investigated and mapped during the 1999 field season (Peterson 2002: 49-51). During 2001, Dr. John Jones conducted an analysis of pollen from the surface of a mano and metate that revealed the presence of ramon, fig, and other insect-pollinated tree species (see J. Jones, Chapter 34, for a complete list of species). This evidence comes from a pollen wash of a mano and metate discovered in a narrow upper chamber of Metate Cave. The cave was mapped in 1999, but the opportunity to analyze the pollen from a metate located in an upper alcove prompted us to return to the cave in 2001. The metate was inverted and was thus chosen for this particular analysis in order to determine what was ground on the stone before its final deposition in the cave. Further palynological analysis of sediments collected from complete vessels may reveal what they once contained.

Glenwood Cave District

K’in Rockshelter

Robin Brockett, a local primatologist, led us to a rockshelter where she had found an obsidian blade near a stone located just under the dripline (Figure 9.11). K’in Rockshelter has one narrow tunnel that extends a short distance into the interior of the limestone hill, but sunlight reaches all parts of the otherwise shallow rockshelter, hence it was given the Mayan name k’in or “sun.” Large sherds of ollas were discovered in the tunnel.

Figure 9.11 Map of K’in Rockshelter.
Artifacts were concentrated in areas on the floor delimited with pebbles. Two species of jute were found in these deposits — *Pachychilus glaphyrus* (identified by its characteristic sculpturing) and *Pachychilus indiorum*. Chert flakes were also discovered on the floor of the wide entrance.

It appears that more lithic debris is found in rockshelters and in pass-through caves — areas illuminated by natural sunlight — than in dark portions of the caves. The presence of expedient tools and obsidian blades may thus indicate a difference in activities performed in these areas (such as preparation for hunting or the use of natural overhangs as blinds, areas of temporary refuge, or possibly as areas of sacrifice or bloodletting).

**Summary**

Over the past three field seasons, XARP teams have mapped the floor surfaces of eighteen caves, identified the location of artifact clusters, point-plotted the location of eighty-five pottery vessels, and completed surface collections of over 8,000 artifacts from over 100 locations within sixteen caves. Detailed analysis of the data are to be presented as part of my forthcoming dissertation on the Xibun Maya utilization of caves. XARP is one of a few ongoing projects that combine the study of settlement patterns in a large region with an investigation of how the Maya perceived of and used their landscape.

Understanding the ideologically significant role of caves and other features of the landscape is an integral part of ancient Maya settlement studies, as recognized by Norman Hammond (1981: 176-177) over twenty years ago and now widely accepted by other scholars (Awe 1988; Brady and Ashmore 1999; Brady et al. 1997; McAnany 1998; Rissolo 2001). This proposition certainly rings true for the Xibun area where ancient Maya inhabitants deposited impressive amounts of cultural material in caves, most of which are located across the river from the settlements. Visitors to this subterranean world also brought speleothems back to their settlements and incorporated them into the construction of shrines, burials, and residences. Stalactites, stalagmites, and flowstone formations from the caves have been excavated in burials and other ritual contexts at settlements in the Xibun (see Parks, Chapter 19) as well as at other sites in the Maya region such as Tumen-Naranjal (Lorenzen 1999: 102). Ethnographically, cave formations have been recognized as symbols of fertility that are brought into Mixtec homes to promote fertility (Ravicz and Romney 1969: 394). This modern practice suggests one possible interpretation, but a contextual analysis of cave formations found at surface sites may yield alternative reasons for the secondary deposition of speleothems.

**Recommendations for Future Study**

Future research should be directed in the Gracy Rock Cave District, where preliminary reconnaissance has resulted in the location of several caves of interest. The karst around Arch Cave revealed evidence that the caves of this area have been used from ancient Maya times to the Colonial period. Colonial-period artifacts in caves of the Gracy Rock District include kaolin pipes, mold-made glass bottles, and wheel-made pottery sherds. There is great potential for continued research in this northernmost part of the Sibun-Manatee Karst.

Another interesting cave that merits future exploration was discovered by Robin Brockett in the Glenwood Cave District. It was named Actun Maax (“Howler Monkey Cave”) because it was the last
place where Robin, a primatologist, sighted her group of rehabilitated howlers. The cave contains polychrome sherds and a ceramic ear spool. A cache of small eggs, possibly from a reptile, were discovered in a small niche in the low ceiling of the cave. Time did not permit a more detailed investigation, but future fieldwork in the Gracy Rock, Chanona, and Glenwood Cave Districts promises to yield valuable information on Xibun Maya cave utilization.

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Chapter 10  
Revisiting the Mortuary Deposits of Structure 130 at Pakal Na  
(Operation 22)  
Eleanor Harrison and Kevin Acone

A dispersed settlement located in the middle reaches of the Sibun River, Pakal Na was the focus of mapping and excavation efforts during the 1999 and 2001 field seasons. The site is situated within the Belize Gravel and Mining Company (BGMC) concession and is located between the Sibun River and the Western Highway (near mile 35). Positioned on an escarpment that gently slopes upward from the nearby river, the collection of single and clustered mounds, mapped during the 1999 field season, form a linear pattern that extend over one kilometer in length along the north side of the Sibun River (Morandi and Norris 2001:7; see Map Sheets 2 and 8, also in the 2001 report for a complete map of the site).

During the 1999 field season, two plaza groups were the focus of investigation at Pakal Na. Operation 13 was situated on Structure 127, a possible shrine structure located within a small plazuela group in the southwestern part of the site (see Harrison 2001). Little artifactual material was recovered from the excavation, with the exception of a prominent pit cache that contained a deteriorated comal-like vessel, along with a large greenstone tubular bead and several nearly complete obsidian blades. Investigations also were carried out within the largest plaza group located in the northwestern part of Pakal Na. The layout of this main plaza group has been described elsewhere (see Harrison 2001; see also Map Sheet 8). Investigations entailed the partial clearing and test-pitting of select areas in and around Structure 130, the largest mound identified at Pakal Na. The excavation of Operation 16, located along the southern edge of Structure 130, was performed during the 1999 field season. The excavation exposed a rich midden deposit that offered insight into the household and ritual activities of the leading members of the Pakal Na community (see Harrison 2001). Operations 14 and 22 (Square A), positioned along the eastern side of Structure 130, revealed three phases of building modifications associated with the structure, referred to as Phases 1, 2a, and 2b (Figure 10.1). In addition, several pit features were exposed in these two operations that were suggestive of important ritual events carried out among the elite inhabitants of this large household group (Figure 10.2). Excavations defined a portion of a pit feature indicative of a ritual burning event, that had been dug into the surface of a large burial cut located along the central axis of Structure 130 (referred to below as Burial 1). Time, unfortunately, did not allow for the complete excavation of the burial during the 1999 field season and it was carefully covered over with back fill.

During the 2001 field season, the expansion of Operation 22 was prompted by the finds of Burial 1 in Square A during the 1999 season. Square B, a 2.5 m square, was laid out directly to the north of the original unit of Operation 22 (referred to below as Square A). The total excavation unit extended 5 m north-south by 2.5 m east-west (including a small 1 x 1 m area in the southeast corner which represented the western end of Operation 14; Figure 10.3). Operation 22 was positioned on the central axis of the eastern (front) side of Structure 130. Excavations during the 1999 field season ultimately revealed that Structure 130 was cardinally oriented. However, Operation 22 followed the orientation of Operation 14, laid out at 20 degrees east of north (a common building orientation found in the Sibun Valley that initially was thought to apply to Structure 130).
Figure 10.1 South wall cross-section of Operations 14 and 22 (drawing and inking by Kevin Acone and Eleanor Harrison).

Figure 10.2 North wall cross-section of Operation 14 (excavated during the 1999 field season, drawing and inking by Kevin Acone).
The three phases of construction (1, 2a, and 2b) are reviewed below, along with their associated features, with special attention given to the prominent burial pit (Burial 1) and an assemblage of grave goods that accompanied this interment. Following this overview, a description of each zone and the associated finds from Squares A and B of Operation 22 are provided, grouped by their associated architectural phase.

An Overview of Structure 130: Construction Phases and Associated Deposits

The first phase of construction (Phase 1) for Structure 130 consisted of a platform made of packed, mottled clay containing at least three distinct colors. The mottled construction fill shows signs of basket load stratigraphy and indicates the construction technique employed. Basket loads of clay material, likely mined from various clay beds originating in the nearby Sibun River, were transported to this area of the site for the initial construction of Structure 130. The substantial earthen mound may have stood over 2 m in height. The mound was then covered with a layer of river cobbles and possibly contained retaining walls built of cut stone. Excavations of Phase 1 in Operation 22 during the 2001 field season revealed a cache deposit (Zone 10), comprising several different smashed vessels. The ceramic deposit was found deep within the core fill with no signs of an intrusive pit and appear to have been interred directly into the construction fill during the building process. All sherds from the cache have a reddish-colored slip and several contain post-
firing incised designs. This type of incised design is a stylistic quality present in a number of ceramic phases and remains difficult to classify with any certainty, but appears to correlate to the Late Classic-Terminal Classic period (S. L. López Varela, personal communication, 2001).

In addition to the cache deposit, a burial (Burial 2 - Zone 21) of a single individual in an extended position was found interred within the Phase 1 construction fill. Like the cache deposit, Burial 2 was not placed within an intrusive pit, but rather was likely interred as the construction fill of the Phase 1 platform was consolidated. Burial 2, oriented with feet to the north, was cut into and partially destroyed by a later burial (Burial 1). The skull and right half of the torso, right arm bones, and right femur were missing from Burial 2. The lower legs of the individual were intact and crossed. A smashed cylindrical vessel with a waxy reddish-brown slip with black flecks has been placed where the skull would have been had it survived excavation in antiquity of the overlying intrusive burial pit. A preliminary analysis of the cylindrical vessel, which appears to be complete, suggests a Late Classic-Terminal Classic date (S. L. López Varela personal communication, 2001), coeval with the preliminary dates assigned to the Zone 10 cache. The cache deposit and disturbed burial found within the Phase 1 construction fill not only suggest the importance of ritual and ancestral worship at this central locale of Pakal Na, they serve as critical temporal markers and indicate that the initial occupation of the site began squarely within the Epi-classic period.

The later burial interment (Burial 1) is affiliated with Phase 2a, which constitutes the second construction phase of Structure 130. Phase 2a entailed building up the facade of the platform with earthen construction fill retained by large, shaped limestone blocks that may have formed as many as five terraces along the eastern (front) side of the platform. The terrace construction had collapsed considerably and therefore the front facing of the structure is difficult to reconstruct. However, it seems likely that the eastern facade may have contained a central staircase leading up to a superstructure where presumably a perishable structure once stood. The large stone-faced terraces created a façade that probably was meant to simulate the monumental stone masonry buildings of larger Maya city centers and suggest that the family living in this plaza group had gained significant status within the community by this time. The fill of the terraces consists of a thick layer of compact gray clay capped with a layer of gravel-size river cobbles and a thin surface of smaller limestone pebbles.

Although the deep pit containing Burial 1 intruded into the earlier Phase 1 clay-filled platform structure, it is clearly associated with the Phase 2a construction episode described above. The cut of the large burial pit was discernable in the surrounding gray clayey fill of the Phase 2a terrace construction, located directly on the central axis of the structure just east of the mound’s summit. The large burial pit was in-filled with the same material that it had been removed, a mixture of the construction fill of Phases 1 and 2a. A large but shallow pit feature that showed some signs of burning was dug into the surface of the burial pit fill (Figures 10.2 and 10.4). Burning is not intensive, and there is a general lack of utilitarian debris, suggesting a ceremonial function. Considering the position of this secondary pit feature directly overlying the burial cut, the fire pit may represent a burning ritual associated with the burial event. The secondary fire pit and large burial appear to have been capped with a poorly constructed cobble and pebble surface which sealed the features and created a surface flush with the surrounding Phase 2a terrace. The rough cobble and pebble surface suggest that Phase 2a continued to be used for some time, perhaps temporarily until Phase 2b was initiated. Excavations revealed that when the inhabitants of Structure 130 dug the large burial
pit, a portion of the Phase 2a terrace construction was dismantled and appears to have been rebuilt during the subsequent Phase 2b architectural modification. The Phase 2b modification rebuilt the upper terraces directly over the top of the earlier construction and mirrored its configuration. The look and feel of Structure 130 was modified only slightly, raising the overall height of the structure by less than half a meter.

**Excavation techniques**

Operation 22, which entailed the investigation of the eastern upper facade of Structure 130 at Pakal Na, utilized two datum stakes for the duration of the excavation. During the 1999 field season all elevations were measured from Datum B, which was positioned near the southwestern corner of Square A and measured 39.5 cm below ground surface. During the 2001 field season all elevations were taken from Datum C, which was positioned near the interface of Squares A and B along the western side of the excavation unit and measured 11.5 cm below ground surface. The two datum stakes, placed in the ground proximate to the edge of the unit in both cases, were used for relative measurements that offered quick and precise elevations during excavation. These elevations were computed into absolute elevations above sea level as measured by the Total Station. In an effort to glean a maximum level of information, one hundred percent of all soil excavated was screened through a quarter-inch screen, unless otherwise specified. When necessary, sediment from Burial 1 was brought into the lab and carefully screened for small finds through a finer mesh screen. Also, a series of soil samples were collected throughout the excavation for various sediment analyses. Trowels were primarily used in the excavation, with picks and shovels being used infrequently. Trowels were utilized to define the surface of architecture and *in situ* deposits, with the exception of Burials 1 and 2, where dental tools and bamboo sticks were used to define the skeletal material and associated grave goods.

**Overview of the Findings from Zones 1-21 of Operation 22**

As a whole, the unit provided the extensive vertical and horizontal exposure necessary for understanding the three construction episodes in the context of the large burial pit (see Figure 10.4), which extended over four meters in length (north-south) and over two meters in width (east-west). The following presents an overview of Zones 1-21, excavated in Squares A and B of Operation 22 over the course of two field seasons, with a description of the subsequent findings from each zone grouped according to their associated architectural phases (1, 2a, and 2b).
Phase 2b

Zone 1

In Squares A and B, Zone 1 consisted of the topzone that is comprised of a loose, dark matrix containing a high density of root mass and a light density of artifacts. At the base of Zone 1, the surface of a limestone cobble wall appeared running north-south along the western edge of the unit in Square A, approximately 25 cm below ground surface. This line of stones represents a retaining wall of an upper terrace, the surface of which is west of the excavation unit and was, therefore, less evident in Square B due to the orientation of the excavation unit, 20 degrees east of north. Only a small portion of this upper retaining wall (Wall 1) was exposed in Square B in the northwestern section of the unit. Limestone tumble located on the western side of the unit was defined at the base of the zone in Squares A and B and likely represented tumble from this upper terrace along the western edge of the unit. Both squares yielded only a light density of artifacts relative to the size and depth of the zone; therefore, only fifty percent of the sediment removed from Zone 1 was screened.
Zone 2

Zone 2 consisted of the tumble and silty clay matrix that had fallen from the east side of Structure 130. The tumble comprised a medium density of limestone cobbles and cut stones, presumably collapsed from part of the upper terrace retaining wall (Wall 1). At the base of Zone 2, Wall 1 (a two-course retaining wall) was exposed in its entirety along the western edge of the excavation unit. Wall 1 rested on a deteriorated packed surface consisting of a clay fill with a layer of small river cobbles topped with a thin surface of limestone pebbles. Wall 1 and its associated lower terrace represent the final Phase 2b modification (Figure 10.3). The Phase 2b terrace surface slopes downward somewhat and extends out to the east about a meter before it interfaces another retaining wall (Wall 2). Wall 2 is one to two courses high and sits on a lower terrace surface, which was exposed in the eastern half of Squares A and B. This lower terrace surface is associated with the Phase 2a construction and runs underneath the upper Phase 2b terrace (Figures 10.1 and 10.5). The east wall of the excavation unit cuts off a third retaining wall (Wall 3), but several larger stones in the eastern edge of the pit suggest a lower retaining wall in this location.

If the pattern holds, terraces appear to have been about 40 cm high, comprised of one to two courses of stone, and spaced about a meter apart. The low height of the terraces suggests that they also may have functioned as stairs, likely leading up to a perishable structure perched on top of the mound. If evenly spaced, there may have been as many as five terraces along the eastern façade of Structure 130 (Figure 10.3). The height of the structure and use of cut stone masonry, including a number of large limestone slabs that were noted along the lower portion of Structure 130 in Operation 14 (see Harrison 2001), give the impression of a monumental platform structure reflective of a high status household group.

There is a significant increase in artifact density in both squares of Zone 2. Artifacts include animal bone, debitage, chipped stone tools, obsidian blade fragments, sherds, and several mano fragments. Due to the increase in artifacts, one hundred percent of all soil was screened in Zone 2. The artifact assemblage suggests a residential function for Structure 130, arguably the home of the community leader of Pakal Na. Notably, a net weight was found in the cobble construction fill layer at the base of Zone 2, within the southwest corner of Square B. A number of similar net weights were recovered from the Phase 2a cobble surface in Operation 14. The repeated appearance of such artifacts is suggestive of a purposeful placement, perhaps serving as dedicatory offerings placed within the cobble fill during construction (see Harrison 2001). A complete chert biface also was found near the western side of Square B, resting on the upper Phase 2b terrace surface. The biface appears to be associated with the terminal occupation of Structure 130, rather than part of the terrace construction fill. Numerous ceramic sherds were found lying flat on both of the two terrace surfaces that were exposed at the base of Zone 2, primarily on the lower of the two terrace surfaces. Several diagnostic sherds were noted, which ultimately may provide a date for the terminal occupation of Structure 130. A soil sample (FCB # 938) of the terminal debris, which comprised a high density of charcoal and other organic material, was collected from Square B for future sediment analysis and flotation.
Zone 3

A shallow pit feature, illustrated in Figure 10.3, was defined on the surface of the Phase 2b upper terrace at the base of Zone 2. The pit did not appear to contain any discrete deposit and was excavated as part of Zone 3. The position of this pit feature, however, is potentially meaningful with regard to its location on the central axis of Structure 130, directly above a shallow fire pit feature and the cut of Burial 1 that were found associated with the Phase 2a construction. Together, the placement of two consecutive pit features in this locale may have served a ritual function in connection with the burial interment.

The upper terrace surface and an underlying associated gray clay construction fill also were removed as part of Zone 3. Excavation of Zone 3 was entirely associated with the Phase 2b construction, and entailed dismantling Wall 2, which essentially bisects the unit of excavation and runs in a north-south direction (Figure 10.3). The upper terrace surface retained by Wall 2 consisted of a thin layer of small limestone pebbles with an underlying layer of small river cobbles. The matrix of this packed surface was intermixed with a compact silty-clay soil. The underlying gray clay-filled construction material (approximately 35 cm in depth) also was removed. In contrast, the compact, gray clay construction fill
contained only a light density of inclusions. Overall, artifact density was light, consisting of domestic refuse similar to Zone 2, including another groundstone (mano) fragment.

**Phase 2a**

**Zone 4**

At the base of Zone 3, the earlier Phase 2a terrace surface was exposed and was found running underneath Zone 3 (Figure 10.4). Unlike the Phase 2b terrace construction, Phase 2a in Operation 22 revealed only a partially intact terrace wall and an inconsistent surface of river cobbles and limestone pebbles that were removed as part of Zone 4. The disturbed Phase 2a construction appears to relate to the two intrusive pit features that were dug into the Phase 2a terrace (Zones 4 and 5). The Phase 2b terrace construction appears to have capped and rebuilt the upper terraces that were dismantled as a result of the large, intrusive burial interment. The subsequent Phase 2b architectural modification affected the rebuilding of the Phase 2a terrace by adding another course to the existing upper terrace walls and heightening the top portion of the structure by less than half a meter.

Following the infilling of the large burial pit, a shallow fire pit was dug into the surface of the southern end of the large burial cut (Figure 10.5). As noted, the location of the pit and lack of utilitarian debris suggests that it may have served a ritual purpose, rather than simply a domestic function, such as a cooking hearth. This secondary pit, confined to Square A, showed evidence of burning that extended throughout the shallow intrusive feature. The pebble fill consists of a high density of fire-cracked rock and the soil that is significantly darker and more reddish in color, appearing rich in organic remains in comparison to the remnants of a surrounding gray, clayey construction fill (Zone 5) associated with the Phase 2a terrace construction. Both C-14 and sediment samples of the Zone 4 pit matrix were collected. The large burial and secondary fire pit features both appear to have been roughly capped with a cobble surface, indicating that the surface of Phase 2a may have seen continued use prior to the construction of Phase 2b. Due to the disturbance of the large burial pit feature, the remains of the Phase 2a construction were difficult to discern. However, the north wall cross-sections of Squares A and B (Figure 10.5) offer a clear illustration of the construction sequence and relative positioning of the large burial pit that is associated with the Phase 2a structure.

In addition to the shallow fire pit feature, Zone 4 included remnants of the Phase 2a terrace wall and a thin cobble surface that was exposed at the base of Zone 3. In Squares A and B, the remnant wall and cobble surface was removed with the exception of a small area in the northwest corner of Square B (measuring 145 cm north-south by 50 cm east-west). This area appears to be the eastern corner of a raised platform, possibly the superstructure positioned on the uppermost platform tier of Structure 130, where a perishable structure may have existed. This area of construction remains difficult to reconstruct due to the western limits of the excavation unit.

At the base of Zone 4, the cut of the burial pit feature was clearly definable in the compact, gray clay construction fill of Phase 2a (Figure 10.4). The gray fill was removed as part of Zone 5, along with the top portion of the burial pit fill. The cut of the burial, located approximately 75 cm below ground surface, appeared extremely large and encompassed almost the entire 2.5 × 5 m unit. Subsequent excavations revealed that the pit was much wider on the surface and gradually tapered down toward the base of the pit. Two small speleothems were found associated with the upper surface of the burial pit, located around the central area of cut in Square A. The weathered pieces fit together, and represent a stalactite cave formation. The cave deposit seems to have been purposefully placed in association with this important interment. An
additional larger speleothem was found deeper in the burial pit, at the north end of the burial in Square B in association with the skeletal remains that are reviewed below. The finds of cave formations associated with the burial of an important individual from Pakal Na suggest that the interred was likely involved in ceremonial pilgrimages to caves within the Sibun River Valley, where ancient ritual activity has been well documented (see Peterson 2001; Peterson, Chapters 3 and 9). Cave formations also have been found in association with two circular structures excavated at other settlements within the Sibun, including Pechtun Ha (see Harrison and Acone 2001) and Oshon (see Harrison, Chapter 16). The finds suggest that the inhabitants of the Sibun settlements sought to physically and spiritually link themselves with these powerful attributes of the sacred landscape.

Zone 5

Zone 5 is the top portion of fill for Burial 1 and surrounding gray clay fill associated with the Phase 2a terrace construction (Figure 10.4). The cut was defined in the gray clay fill, which contained few artifacts. The pit was found to be considerably wider at the top and to extend just beyond the east and west walls of Operation 22. Therefore, little of the Phase 2a terrace construction remained intact along the middle of the eastern and western sides of the unit, seemingly disturbed in antiquity during the excavation of the burial pit. Tree root disturbance also was noted along the northern side of Operation 22 (Figure 10.5). As excavation continued, most of the cut appeared well defined. The eastern and western edges became more clearly defined in Zones 6 and 7 as the pit tapered inward. Zone 5 further defined the cut and removed the first 25-30 cm of the interior pit fill. The zone ended arbitrarily and Zone 6 continued the removal of pit fill.

The pit fill cuts through the Phase 2a construction and intrudes into construction fill of Phase 1, which is a compact mottled clay-filled matrix. The pit fill consists of a mixture of re-deposited construction fill from both contexts. The fill is a semi-compact soil with gravel-sized limestone and river-derived inclusions. Artifact density is light, but there is a significant density of fire-cracked rock in the fill. Flecks of charcoal and some burned sherds were noted and a C-14 sample was collected. In addition to the discrete fire pit feature identified on the surface of the burial cut (Zone 4), it is possible that additional burning activity accompanied the infilling of the burial and was an important part of the ritual event. A flotation sample (FCB #960) was collected from the pit fill that was excavated in Zone 5 of Square B. A relatively high density of charcoal was noted and other organic material may be identifiable when the soil is floated.

Zone 6

At this lower level, the matrix of the burial pit fill is rich in cultural material, including sherds, debitage, animal bone, obsidian, groundstone fragments, and unworked shell. In Zone 6 of Square B a five gallon bucket of pit fill from Burial 1 was collected for flotation (FCB #966). Like the Zone 5 sample, it contains a high density of charcoal and other organic remains. An interred individual, found buried adjacent to the large burial cut (described as Burial 2 below), was associated with the Phase 1 construction. Burial 2 (Zone 11) evidently was disturbed by this later burial deposit and it is possible that some of the skeletal material from this earlier burial was re-deposited with the infilling of Burial 1. A human cranial fragment was found higher up in the fill of Zone 5 and a human tooth was found in the Zone 6 pit fill.

A large portion of a red-slipped serving platter (Vessel 1), associated with the burial deposit, was positioned at an angle in the pit fill where Squares A and B interface (Figure 10.6). The vessel, recovered in pieces, perhaps broke apart when the heavy fill buried the deposit. Large pieces of the vessel were found dispersed throughout the matrix and it is conceivable that the vessel was smashed ceremonially when it was
interred. If this was the case, the vessel was broken before or as it was being deposited into the pit fill and was perhaps purposefully placed at different levels in the pit fill. The broken vessel was removed over the course of Zones 6, 7, and 8 in Squares A and B. In Square A, portions of the platter were recovered at around 200 cm below ground surface and the bottom portion of the platter was found at around 220 cm below ground surface. When Square B was excavated in 2001, additional pieces of the large serving platter were found in the vicinity of the other sherds (approximately 204 cm below ground surface). The pieces of the large vessel, which has an incised design on its exterior, appeared for the most part in an upright position in the pit, directly over a portion of the burial referred to as Burial 1-B (refer to Figure 10.6) after at least 20 cm of fill had been deposited over the human remains. At the base of Zone 6, the pit fill continues, but the cut of the pit is increasingly restricted, tapering considerably toward the base of the pit.

Zone 7

Zone 7 comprised the burial pit fill at the base of the pit. The goal of the zone entailed defining the top of four vessels, which were initially identified at the base of Zone 6 in Square A. Vessels 2, 3, and 4 were ultimately removed as part of Zone 8. As noted above, a portion of Vessel 1 also was removed in Zone 7 of Square A. A large and heavy speleothem also was defined at the base of Zone 6, along with a large ceramic sherd. These two items, removed as part of Zone 7 in Square B, appear to have been purposefully placed as grave goods directly above Burial 1 in the vicinity of Burial 1-D. A whole vessel (Vessel 5) was defined and removed as part of Zone 7, but is described in Zone 8 below, along with four other vessels found in the same area.

Figure 10.6  Planview of Burial 1  (drawing by Steven Morandi and inking by Kevin Acone).
Phase 2a: Skeletal Remains of Burial 1 and Associated Grave Goods

Zone 8

Elevations indicated that the level of Zone 8 in both squares A and B were roughly equivalent. Zone 8 consisted of the bottom fill of the burial pit where a series of skeletal groupings were defined. In addition to the primary articulated interment (Burial 1-A), three clusters of bone were recognized at the base of Zone 8, referred to as Burials 1-B, 1-C, and 1-D. These discrete groupings of skeletal remains were entirely defined in Zone 9. Preliminary analysis indicates that the bone from the four skeletal groupings in Burial 1 represent several different individuals (see Hauksdottir and Morandi, Chapter 26). Overall, there is a very high density of burned wood coming out of the burial pit fill, including a great deal of fire-cracked rock. In addition, the fill contained a medium density of river gravel (likely the remains of Phase 2a) and a mixture of mottled clay (the remains of the Phase 1). A number of flotation samples from the Zone 8 pit fill (in Square A: FCB #973 and in Square B: FCB #981, 982, 987). Zone 8 also produced a number of notable grave goods. Four vessels were found situated in a line running north-south, positioned directly over the body of Burial 1-A, the main interment (see Figure 10.6). In addition, several fragments of incised human bone, seemingly part of a single cranium, were recovered in both Zones 8 and 9 from the vicinity of Burial 1-C (Figure 10.7). Zones 8 and 9 also yielded a number of perforated dog and jaguar canines. These finds are described below.

Figure 10.7 Photo of incised bone found in Burial 1, associated with Burial 1-C (photo taken by Patricia A. McAnany).
Vessels 2, 3 and 4 were defined, drawn and photographed at the base of Zone 7 in Square A and removed as part of Zone 8. Vessel 2 appears to be a highly eroded polychrome bowl, inverted over Burial 1-A and placed furthest to the south in the line of vessels (see Figure 10.6). A sediment sample (FCB #923) and two C-14 samples (FCB #920), found sealed underneath the inverted vessel, were collected in Zone 8. A third vessel (Vessel 3) was found just north of Vessel 2 (Figure 10.8). It is a badly burned Chichen Redware; a type found further to the north in Yucatan, Mexico (see López Varela, Chapter 20). Vessel 3 contained a pair of incised lines, one running below the rim and the other above a pedestal base. There are also a series of incised “X” markings and large, impressed dimples along the body of the vessel. Vessel 3 was placed upright over Burial 1-A. The pyriform vessel, dubbed the “Apollo Vessel” by the XARP team, suggests that it may have functioned as a drinking cup, perhaps reserved for special ritual feasting events involving *pulque* or *cacao*. The fourth vessel (Vessel 4) was found just to the north of Vessel 3 and was also placed upright over the main interment. The pedestal-based vessel appears to be another Chichen Redware type, with a similar form, and also displays a badly burned, blackened surface.

![Figure 10.8](image1.jpg)

*Figure 10.8* A burned, Chichen Redware vessel (Vessel 3) associated with the main interment, Burial 1-A (photo taken by Patricia A. McAnany).

A fifth vessel (Vessel 5) was defined north of Vessel 4 in Square B. It was located directly beneath Vessel 1 and was slightly lower in the pit than Vessels 2-4. This inverted bowl was poorly preserved. The interior red slip was almost entirely eroded with much of the slip remaining on the sediment underneath the vessel. Although the other three vessels further to the south in Square A were removed as part of Zone 8, Vessel 5 was removed as part of Zone 7 in Square B. Upon removal of Vessel 5, several sediment samples were collected from the soil trapped underneath the inverted vessel, including a pollen/phytolith sample (FCB #975) and a large botanical sample (FCB #976/977). The inverted bowl was situated roughly where the head of the main interment was thought to have existed. When Vessel 5 was removed, it was discovered that the head of the primary individual was missing. The remainder of the skeleton was articulated, indicating that the head may have been removed prior to the deterioration of the body’s soft tissue, and was perhaps the cause of this individual’s death.
A number of additional grave goods were recovered at the base of Zone 8 in Square A, including two large jaguar teeth that are perforated at the proximal ends and were likely strung as a necklace. Adjacent to the two jaguar teeth, a concentration of red, granular material that appears to be cinnabar was collected; this material, if heated, turns to mercury. The concentration of cinnabar was clearly part of the burial assemblage and was possibly placed in a basket or other perishable container. Both the jaguar teeth and cinnabar appeared to be associated with Burial 1-B, a smashed and disarticulated skull and mandible situated to the east of Burial 1-A (Figure 10.6). Four perforated dog canines also were recovered around Burial 1-C. They were found relatively dispersed within this locale. Two were found at the base of Zone 8 and the other two were identified in Zone 9. Both the jaguar and dog teeth were photographed and drawn.

An incised human cranial fragment in the form of a mat design also was found in Square A, along the northern end of the unit. The incised fragment rested on a mano fragment, just south of Vessel 1. The bone may be associated with Burial 1-B, but more likely was part of the skeletal grouping referred to as Burial 1-C where several additional incised cranial fragments were found (Figure 10.7). This discrete cluster of bones, located along the eastern side of the burial cut primarily in Square A, was further excavated in Zone 15 and is described in greater detail below.

A flotation sample (FCB #986) high in charcoal, was collected from the east side of the burial cut, in the vicinity of Burial 1-C. Three seeds were found in a small portion of sediment from inside a series of
stacked and inverted human cranial fragments that were not incised but were associated with Burial 1-C. These stacked cranial fragments were later identified by osteologist Rebecca Storey as the missing cranium of articulated Burial 1-A. Associated sediment was collected for a flotation sample (FCB #988) for future archaeobotanical analysis.

In sum, five broken but seemingly complete vessels were recovered from Burial 1, primarily in association with the main interment (Burial 1-A). Vessel 1 was found about 20 cm above the skeletal remains, hovering in the fill roughly at the interface between Squares A and B. Vessels 2, 3, 4, and 5 were located directly above the main interment, placed on a relatively level surface along the centerline of the body. The bottom elevations of Vessels 2-4 were within a centimeter of one another. The vessels were found resting directly on a thin layer of sediment, about 5-10 cm above the skeletal remains of the primary interment (Burial 1-A). It is conceivable that the body of the main interment was once wrapped, perhaps in cloth that has since deteriorated, and the vessels were then placed on top of the wrapped body. Vessel 5, the northernmost vessel, was positioned about 5 cm lower than Vessels 2-4, where the head of Burial 1-A ought to have been. Only a small amount of the pit fill was removed from below Vessels 2-5. The zone was then changed arbitrarily to Zone 9, which comprised the last 10-15 cm of fill around the skeletal material.

Zone 9

Zone 9 involved the removal of the burial pit fill surrounding the human remains found beneath the ceramic vessels and other grave goods. High densities of charcoal were noted throughout the pit fill and several C-14 (FCB #992 and 995) and botanical samples (FCB #989 and 992) were collected from Zone 9. Sediment directly above the human bone was significantly darker in color than the surrounding pit fill. A sediment sample of this dark organic-rich soil (FCB # 993) was collected from directly above Burial 1-D in Square B. A number of miscellaneous bone fragments from around Burial 1-C (FCB #989) and Burial 1-D (FCB #992, 995) were collected from Square B in Zone 9. A substantial deposit of cinnabar was found adjacent to Burial 1-B, to the north of the skull and proximate to the two large perforated jaguar teeth, and a large sample (FCB #991) was removed from Zone 9.

As previously mentioned, the burial consisted of four discrete deposits of human bone, demarcated as Burial 1-A, 1-B, 1-C, and 1-D (Figure 10.6). Each discrete grouping of skeletal material was removed as a separate zone. Zone 16 comprised the primary interment (Burial 1-A). Burial 1-B consisted of a smashed and disarticulated skull and mandible. The remains of the skull appear to have been positioned face-down. Burial 1-C consisted of an elongated cluster of bones running along the eastern edge of the burial pit, situated at the interface between Squares A and B. The skeletal material in Burial 1-C comprised mostly cranial and mandibular fragments. Burial 1-D, the northernmost cluster of bones, consisted primarily of the fragmentary remains of a torso, arm bones and a pair of long bones.

A series of large sherd fragments lined the southern end of the burial pit and ran underneath the lower legs of Burial 1-A. Several good samples of charcoal were found next to the tibia bones of Burial 1-A. The sherd-lined areas were removed separately as Zones 13 and 14. Zone 15 comprised a portion of an orange-slipped vessel that contained nubbin feet and was situated just to the west of the primary individual’s right shoulder. Zones 13-19 are described individually below.
Zone 13

Zone 13 consisted of a sherd-lined area on the eastern side of the burial pit at the southern end of the main interment (see Figure 10.6). The sherds lined an area under the lower legs of Burial 1-A and were clearly positioned prior to the placement of the primary interment. The deposit contained 10-15 cm of ash and charcoal underneath the concentration of ceramic material, mixed with a semi-compact silty clay. Little to no inclusions were found in the fill surrounding the vessel fragments. The ash and charcoal provided a good quality C-14 sample (FCB#601) and two botanical samples (FCB#602 and 615). Sherds were blackened, as if severely burned. The evidence of burning appears to be associated with a ritual event that took place just prior to the interment of the primary individual, and may be the remains of a fire ceremony like those described by Stuart (1998). He emphasizes the frequency of inscriptions involving fire-related ceremonies, pointing to its paramount role in ancient Maya ritual behavior. Stuart (1998:396-399) has deciphered one particular phrase, och-i-k’ak’t-u-muk-Il, as “the fire or smoke enters his/her tomb,” which may apply to the burning found in Burial 1. Stuart (1998:417-418) notes that the heat of fire is still equated today with strength, vitality, and soul by numerous Mesoamerican groups, including the Maya. Bringing fire and smoke into Burial 1 perhaps was seen as vivifying and imbuing the resting place of an important deceased ancestor with sacred power. Other references to smoke and fire are found in the context of the incised skull fragments recovered from the vicinity of Burial 1-C and are a point of discussion returned to in the final section of this chapter.

Zone 14

Zone 14 consists of a large grouping of sherds seemingly of the same vessel, smashed and positioned to cradle the lower legs on the west side of the primary interment (Burial 1-A). There was a rim sherd wedged between the lower legs. The soil matrix was a semi-compact silty clay with little to no inclusions. Unlike Zone 13, there was no charcoal or ash found underneath the sherds. The sherds were part of a red-rimmed \textit{olla}. The ceramic material was blackened like Zone 13, presumably through intense burning activity. The ceramic fragments from Zone 14 were significantly larger than those found in Zone 13. At this time, it is unclear whether Zones 13 and 14 comprise more than one vessel; however, they were positioned within the southern end of the burial pit at about the same time. The sherd concentrations from both Zones 13 and 14 were clearly deposited prior to the interment of the main individual for the lower leg bones overlaid the ceramic material. Only the southern portion of the pit in the vicinity of the lower legs was sherd-lined. All whole and partially reconstructable vessels, including those recovered in Zones 13 and 14, were directly associated with the main interment (Burial 1-A) and indicate the special treatment of the primary individual.

Zone 15

Zone 15 consists of a partially reconstructable vessel, placed upright in a small niche carved out of the western side of the large burial pit feature within Square A. The niche in which the vessel was placed had been dug into the compact, mottled clay fill associated with Phase 1, but appeared to be part of the Burial 1 deposit. The partially intact vessel was positioned on the same surface as the primary individual, roughly 260 cm below ground surface. The upright orange-slipped vessel contains small nubbin feet and is similar to a Terminal Classic vessel form from Lamanai in northern Belize as illustrated in Graham (1987:
Figure 2a). The small vessel was situated just to the west of the primary individual’s right shoulder and, like all other vessels in Burial 1, appears exclusively associated with the main interment. A single fragment of an obsidian blade was found to the east of the partially reconstructable vessel, in the vicinity of where the head of Burial 1-A ought to have been, and was removed as part of Zone 15.

Zone 16

Zone 16 consisted of the bones of Burial 1-A. The skeletal material of the primary interment appeared dark brown and somewhat soft and decomposed in certain areas (e.g., the ends of long bones and other areas where cortical bone is thin). Overall, the bones were extremely well preserved. All skeletal material from Burial 1 was drawn, photographed and catalogued with unique numbers that can be traced to specific locations noted on a planview drawing (not published in this report). A separate log itemized the numbers assigned to each bone or grouping of bones that were removed, which corresponds with the aforementioned planview drawing. When discernible, skeletal identifications were recorded. Preliminary osteological analysis of the pelvis indicated Burial 1-A represented a robust adult male. A pollen/phytolith sample (FCB #600) was collected from below the sacrum and a C-14 sample (FCB #612) was collected from Zone 16 for future analysis.

The individual was lying in an extended position, oriented with feet to the south. The individual’s right leg was crossed over the left leg and the right arm appeared bent across the chest. The bones of the feet were intact; however, several of the phalanges were exposed in the western end of Operation 14 and had been disturbed by vandals during the 1999 field season (see Harrison 2001). These bones were salvaged and subsequently removed during the excavation of Operation 14. The majority of the individual lay within Square A (Figure 10.6). The bones of Burial 1-A were fully articulated and mostly intact. However, the individual noticeably lacked certain anatomical parts, including the left arm and skull. The skull is entirely missing and does not seem to be the result of deterioration; rather, the head of the individual appears to have been removed prior to interment. Based on the articulation of the skeletal remains, the body contained soft tissue when it was buried. It is conceivable that the primary individual’s skull is among the three other discrete clusters of disarticulated bones within Burial 1. The alternative, however, is that the individual was never buried with his head. One possibility is that the head was cut off and kept above ground, perhaps as a form of ancestral worship not uncommon during the later Postclassic period. Another possibility is that the individual died violently through decapitation and the head could not be recovered upon burial. The missing arm lends support to the latter conclusion of a violent death, perhaps mutilation during a battle of some kind. More thorough osteological analysis of all bone material from Burial 1 may clarify this issue. In either case, the wealth of grave goods and three bundles of human bone that accompany this individual suggest that the primary interment held exceptionally high status within the community of Pakal Na.

Zone 17

Zone 17 contained Burial 1-B (Figure 10.6), a crushed and disarticulated skull situated to the east of the main interment (Burial 1-A) and to the west of Burial 1-C, discussed below. The bones are extremely fragmentary. The remains of the skull were accompanied by a mandible, which was positioned slightly to the west of the skull. Both the skull and mandible appear to have been placed in the burial pit upside down, with the back of the head oriented to the north. There were seven human teeth exposed on the surface of
the deposit, within the vicinity of the mandible, but many more were found when the bulk of the deposit was excavated and cleaned in the lab. None of the teeth appears worked.

The skull and mandible were found in the semi-compact pit fill, which contained a light density of gravel-size limestone inclusions and a few sherds that were associated with the deposit. Most notably, there were two large jaguar teeth and a significant deposit of cinnabar found in association with Burial 1-B (refer to Figure 10.6). The two jaguar teeth were placed around the cinnabar deposit, which was about 20 cm across and roughly 5-10 cm thick. A number of samples of cinnabar were collected in Zones 8 and 9 of Square A. The two jaguar teeth contain drill holes that suggest they were originally part of a necklace. Found at the interface of Zones 8 and 9, the jaguar teeth were removed as part of Zone 8.

**Zone 18**

Zone 18 consists of Burial 1-C (Figure 10.6), a cluster of skeletal remains found along the eastern edge of the large burial pit. The deposit appears to be a discrete collection of human bone, primarily skull and mandibular fragments belonging to at least two different individuals. In addition, several arm bones were identified. The skeletal material of Burial 1-C appears clustered together, as if once bundled and wrapped, perhaps in cloth. The elongated bone deposit measures about a meter in length and was oriented north-south. Although disarticulated cranial fragments found in the southern end of the deposit were inverted and stacked, they clearly represent a single skull. In addition, four perforated canine dog teeth and a core of a marine shell, possibly a West Indian Crown conch, were found associated with Burial 1-C (see Figure 10.6). The exterior portion of the conch shell, typically used for shell production, was missing, and only the interior spiral of the shell remained.

Of the numerous cranial and mandibular fragments identified in Zone 18 of Burial 1-C, several contained incised designs and a series of drill holes. A high level of scratch marks on the surface of the incised bone suggested that the soft tissue did not naturally decay, but was purposefully removed, likely with the express goal of carving the skull and mandible shortly after death. The fragments of worked human bone were clustered at the southern end of the bone deposit. Several fragments contained a mat design with a series of drillholes at the intersection of the mat weave. The mat design, located on the parietal area of the skull, was roughly square in shape and resembled lattice (Figure 10.7). One large incised bone fragment contained a k’ak’ glyph or smoke sign positioned roughly in the center of the frontal bone just above the eye sockets. Various cartouche designs, including the head of a snarling canine or feline, were found on the mandible, which was recovered in two pieces (Figure 10.9). Three drillholes were found on the mandible, perhaps in order to keep the lower jaw tied to the skull. Other fragmentary portions of the cartouche designs containing similar zoomorphic imagery line the parietal and temporal zone of the skull, around the edges of the mat design.

The fragmentary remains of the incised skull, recovered in Zones 8, 9 and 15, were found in various places within the Burial 1-C skeletal grouping. A preliminary analysis of the incised remains indicates they represent a single human skull (S. Morandi, personal communication, May 2001). Evidence of burning on several of the cranial fragments suggests that the incised skull may have functioned as an incense burner. One example of a human skull used as an incense holder comes from the Cenote of Sacrifice at Chichen Itza (Coggins and Shane 1984). Though this specimen was not incised, the parietal section of the skull was
cut and fashioned into a lid. Alternatively, osteologist Rebecca Storey suggests that the incised skull may represent a trophy of a sacrificed individual, perhaps a captive taken in warfare. She notes that this example resembles other specimens recently uncovered from a series of tombs at Copan in Honduras (R. Storey, personal communication, August 2002).

Zone 19

Zone 19 consists of another cluster of bones in Burial 1, labeled Burial 1-D. The bones consist primarily of a pair of long bones and torso that appears to represent a single individual. A preliminary analysis of the skeletal material suggests that the body was interred after the soft tissue had decayed, yet bones were roughly in their correct anatomical position. This implies that the bones were either placed in such a way as to reconstruct the original positioning of the body or they were bundled together when the body was still intact, only shifting somewhat over time as the soft tissue decayed. No grave goods were directly associated with Burial 1-D; however, a large smashed serving bowl (Vessel 1) found about 25-30 cm above Burials 1-A and 1-B could have some association with this individual.

Phase 1: A Dedicatory Offering and Burial 2

Zone 10

Zone 10 consisted of a portion of the compact clay construction fill of Phase 1, confined to the northwest corner of Square A, which contained a discrete cache deposit. The mottled matrix contains basket-load stratigraphy and is the same construction fill that was encountered in Operation 14 (see Harrison 2001). It comprises the core fill of Structure 130, which was topped with a surface layer of river cobble. The Phase 1 construction underlies the Phase 2a terraces, with which Burial 1 is associated. Zone 10 contains a very light density of inclusions and yielded a small quantity of artifacts. When a concentration of stacked sherds was encountered, it was clear that the ceramic material represented a discrete deposit. The dedicatory offering contained no intrusive pit, but was deposited directly in the fill of Phase 1 as the initial platform was under construction. The cached vessel had been smashed and was relatively localized within the compact clay construction fill. After further analysis in the lab, the ceramic material from Zone 10 appeared to represent more than one vessel, possibly two or three partially reconstructable vessels. The concentration of sherds, however, was referred to as Vessel 6 in the excavation notes. The sherds are thin-walled and contain a reddish-orange slip and several pieces exhibit post-firing incising. Notably, several of the sherds contained calcite deposits similar to ceramics recovered from cave contexts in the Sibun Valley. The ceramic material may have been purposefully moved to this location and secondarily deposited as a dedicatory cache because they were thought to have been imbued with power in a sacred context of a cave.

Zone 11

Zone 11 comprised the fragmentary remains of a single reconstructable vessel (Vessel 7) and surrounding fill in an area directly below Zone 10 in Square A. The fill consisted of compact clay with some
organic material, including charcoal and possibly seeds. Two botanical samples of the organic material were collected (FCB #962, 963). Both limestone and river gravel were lightly dispersed throughout the matrix. The vessel was smashed up against a large river cobbble, measuring approximately 27 cm (Figure 10.10). The ceramic fragments appear to be part of a fine-paste cylindrical vessel with a waxy reddish-brown slip with black flecks, presumably produced during the firing process. The vessel deposit is associated with the southern end of a second burial recovered in Operation 22 (Burial 2). A portion of a humerus protruded out of the northern wall of Square A, extending from a skeleton (Zone 21) lying further to the north in Square B underneath a thick layer of Phase 1 fill, which was excavated as Zone 12.

Figure 10.10 Planview of Burial 2, a single extended individual deposited directly in the construction fill of Phase 1 of Structure 130.
Zone 12

Zone 12 consists of a thick layer of mottled clay fill placed directly over the remains of Burial 2. The Phase 1 fill contained a light density of firecracked rock and limestone, as well as a few river gravel inclusions lightly dispersed throughout the fill. The mottled clay reflects the basket-load stratigraphy found throughout the Phase 1 construction fill. Toward the base of Zone 12, the fill immediately surrounding the skeletal remains of Burial 2 consisted of a loose brown soil with a higher concentration of limestone and river gravel inclusions. A sample (FCB #620) of this loose soil was collected for sediment analysis. In the fill directly above the skeletal remains, a tooth, possibly from an iguana, was found and appears worked; otherwise, artifact density in Zone 12 was generally light. While the fill surrounding the burial appeared slightly different in color and texture, there were no clear signs of an intrusive pit. Burial 2 appears to have been interred early in the construction of the Phase 1 earthen platform. Like the Zone 10 ceramic cache, Burial 2 perhaps served to dedicate the new construction and indicates the importance of ancestral veneration during the initial occupation of this central locale of Pakal Na.

Zone 21

Zone 21 comprised Burial 2 (Figure 10.10), which lay directly below the overlying fill of Zone 12. Excavations revealed that the individual was placed directly within the Phase 1 basket-load fill during the early stages of the building process. The feet of the extended individual were positioned to the north (the opposite orientation of Burial 1-A). An associated vessel (Zone 11) was smashed and placed in a disarticulated fashion to the south of the skeletal remains, where the head of the individual ought to have been. A drilled fish vertebra, possibly fashioned into a bead, was found in Zone 21 and is perhaps another associated grave good. Burial 2 was disturbed by the large cut of Burial 1, which deeply intruded into the Phase 1 construction and severed the right side of the skeleton. The skull and right half of the upper torso and right femur were missing. Cranial fragments and a drilled tooth with a missing inlay were found within the upper portion of the pit fill of Burial 1, and appear to be part of the skull from Burial 2 (R. Storey, personal communication, August 2002). Both of the feet and the tibia and fibula of Burial 2 were found intact and crossed. Overall, the bones of Burial 2 were less well preserved than the skeletal material found in Burial 1 and the lack of grave goods suggest a lesser status than the primary interment of Burial 1.

Zone 20

Zone 20 comprised a small portion of the Phase 1 mottled clay construction fill along the eastern side of the excavation unit in Square A, adjacent to the large cut of Burial 1. Toward the base of the zone, a dark lense of sediment was encountered containing a small bone deposit. The light density of bone consisted primarily of deteriorated human cranial fragments and several other fragments of unidentifiable bone. The sediment directly around the bone was a dark sandy matrix and a sample was collected for future analysis (FCB# 618). Zone 20 appears to be associated with the Phase 1 construction and may represent the remains of another early burial that was disturbed when the large pit of Burial 1 was excavated in antiquity. Due to the small quantity of bone, the skeletal remains were not given a burial designation. No other associated artifacts, with the exception of a few sherds, were found within Zone 20.

Zones 20 and 21 marked the final excavation activity for Operation 22 during the 2001 field season. Following completion of in situ recording, all skeletal material and associated deposits in the operation were carefully removed and documented for laboratory analysis.
Concluding Remarks

The Zone 10 cache and Burial 2 represent two important ritual deposits in the context of the earliest construction phase of Structure 130. They provide important critical temporal markers that indicate the initial occupation of the central area of the site began squarely within the Epiclassic period (ca. AD 750-900). The large pit of Burial 1 intruded deeply into the compact, mottled clay construction fill of Phase 1, but is clearly associated with the following Phase 2a construction. At this stage, Structure 130 was transformed into a multi-tiered platform structure, with at least five terraces flanking the eastern side of the structure. A central stairway likely led up to where a perishable building once stood, perched on top of the structure. Although the interior was filled with earth, rather than stone, large limestone slab retaining walls provided the look of a monumental facade, similar to large, all-stone masonry structures found in elite contexts at numerous Maya city centers. The architectural changes on Structure 130 suggest that the family living in this plaza group had gained significant status within the community by this time.

The large burial pit and wealth of grave goods accompanying the primary interment in Burial 1 lends support to the notion of a high status family housed in this locale. Burial 1-A, a single robust male individual lying in an extended position, was accompanied by a number of important grave goods, including six ceramic vessels. Vessel 1 was found somewhat higher up in the pit fill, while Vessels 2-5 were situated over the center of Burial 1-A running in a north-south line. Vessels 2 and 4 appear to be Chichen Redwares, characteristic of ceramics produced in northern Yucatan which date to the Terminal Classic period (see López Varela, Chapter 20). If ultimately comparable, the distinctive ceramic material may shed light on the time depth of occupation at Pakal Na and offer insight into what appears to be pre-established ties with powerful northern city centers during this time. All of the vessels from Burial 1 are special wares, perhaps an assemblage of pieces reserved for elite feasting rituals. Their forms suggest specific consumptive activities; for instance, Vessel 1 is clearly a large serving platter and Vessels 2 and 4 were arguably used for the consumption of beverages, such as cacao or pulque, which were staples in ancient Maya ritual ceremonies.

A smashed skull and mandible (Burial 1-B) lay directly to the east of the primary interment. Two other discrete clusters of disarticulated bones were revealed to the east and north of the primary interment (Burials 1-C and 1-D, respectively). They represent sacred bundles of venerated ancestors, sacrificial victims or war trophies. Their disarticulation suggests they were intentionally curated for an extended period of time. Also, a relatively large number of highly prized grave goods were found associated with the bundles, including two perforated jaguar canines, four perforated dog teeth, the inner spiral of a conch shell, one large speleothem, fragments of an incised human skull (or trophy head), along with a large quantity of cinnabar. Together, the data suggest that the primary individual (Burial 1-A) was clearly of elite status and the accompanying individuals were highly revered and perhaps ritually charged, transforming into prized grave goods for the interment of this important individual.

Burial 1-C presented no obvious concern with the anatomical positioning of the bones. The tight bundle of skeletal material (some possibly animal bone) appears as if it were once bundled and wrapped in cloth. The bones are mostly cranial fragments of at least two individuals, one of which represents the skull of the main interment. The four perforated dog teeth, conch shell, and incised skull fragments were associated with this skeletal grouping.
In contrast, Burial 1-A clearly represents a single individual with bone articulation that suggests the individual was interred prior to the deterioration of the body’s soft tissue. The headless state of the primary individual prompts several immediate questions. Did this individual die from decapitation or was his head removed and kept above ground as part of a venerating rite on the part of the living? Both of these scenarios are documented for the ancient Maya and are entirely possible, the latter explanation tending to be more of a Postclassic phenomenon. The individual also appears to be missing his left arm, which hints at the former explanation of a violent death. Preliminary analysis of the ceramics suggests a Terminal Classic date for the interment and, stylistically, the ceramics indicate ties with northern Yucatan during this time.
Structure 136 at Pakal Na was not originally atypical in size or shape, but almost half of the mound had been destroyed by a bulldozer about 25 years ago, according to the local landowner. It was decided to clear the slumped sediment from the bulldozer cut in order to investigate the construction sequence of the structure so that we could learn about the methods and date of construction as well as whether earlier structural phases existed beneath the final one.

Zone 1 consisted of slumped sediment along the bulldozer cut of Structure 136. This sediment was considered to have been disturbed by the bulldozer and was removed until a layer of loosely distributed limestone cobbles was encountered. Square A was established after this initial cleaning of the cut and was extended to the northeast past the intact edge of the mound by 50 cm (Figure 10.1). The final dimension of Square A was $2 \times 4.8$ m. No apparent internal differentiation of Structure 136 was seen after the bulldozer cut was cleared. No artifacts were found in this zone.

![Figure 10.1 Profile drawing of the west wall of Operation 36.](image)

Zone 2 consisted of the topzone matrix along the intact edge of the mound on the northern side of Operation 36 (Figure 10.2). This layer was a semi-compact 10YR 4/4 dark yellowish brown sandy clay containing a shallow root mass. No artifacts were recovered from this zone.
Zone 3 was located directly beneath Zone 2 in the 50-cm wide margin of Operation 36, Square A. The matrix had the same texture as Zone 2, but was lighter in color, a 10YR 4/6 dark yellowish brown, and had a few small pebble inclusions. After about 20 cm of excavation, this zone was arbitrarily ended. Zone 4 was a continuation of the same matrix as Zone 3, differentiated for stratigraphic control. At the bottom of Zone 4, on a surface of limestone cobbles of medium density, a few baked clay nodules and several artifacts were found, including sherds and the distal portion of a chert blade. The small cobbles and associated sediment of Zone 5 appeared to represent tumble from the eroded surface of Structure 136.

Beneath the limestone cobbled surface was a compact layer of mottled sandy clay (Zone 6), consisting of three colors: 10YR 6/6 brownish yellow, 2.5YR 5/8 red, and 10YR 5/4 yellowish brown. Artifacts were found in very low density in this zone. Zone 7 was a continuation of Zone 6, arbitrarily differentiated for stratigraphic control. It contained only a few ceramic sherds. Zone 8 was a continuation of Zones 6 and 7, again differentiated for stratigraphic control. It was ended after about 20 cm, and a posthole was extended into this surface. The same matrix continued for about 85 cm (Zone 15), followed by a change to a strong brown sandy clay (Zone 16).

Zone 9 is a compact sandy clay (10YR 4/6 dark yellowish brown) with a few limestone blocks in it, and may represent the same matrix as Zone 5, but was located off the slope of the bulldozer cut. Zone 10 is a compact sandy clay with several types of pebble-sized inclusions. The top course of a partially collapsed retaining wall (Zone 12) was revealed upon the removal of this matrix. South of the retaining wall, under Zone 10, there was a mixture of semi-compact gravelly sediment (10YR 4/4 dark yellowish brown) and large limestone blocks that had tumbled from the wall, denoted Zone 11. By the pattern of tumble, it was clear that at least three courses of the wall had fallen when Structure 136 began to collapse.

The retaining wall of Structure 136 exposed by the removal of Zone 10 was designated Zone 12 (Figure 10.3). The wall consisted of four intact courses of limestone blocks up to 15 \times 30 \times 50 \text{ cm} in size. The wall had a bearing of 340°, and originally was composed of at least six courses, reaching a height of at least 1 m. The blocks were cut so that the horizontal edges were parallel but the sides tapered from the front to the back of the block (toward the inner side of the wall). Unfortunately, time constraints did not allow for the extension of the operation in order to follow out the wall and delineate corner positions.
Below Zone 11 south of the retaining wall there was a continuation of the same matrix which was designated Zone 13. At the bottom of the zone were traces of decomposing limestone or possibly a very eroded prepared surface, found only in close proximity to the base of the wall. At this point, the matrix changed in color and texture to a semi-compact 7.5YR 4/6 strong brown sandy clay. A posthole driven 75 cm into this zone revealed no change in the matrix and the depth of this stratum remained unknown. This zone is the same as Zones 15 and 16 (described above), and probably is the original ground surface upon which Structure 136 was built.

Several important points became apparent through excavation of Operation 36. First, the construction of the platform likely occurred in one phase, with undifferentiated sediment surrounded by a basal retaining wall. How the upper part of structure was built remains somewhat speculative, as no well-cut blocks were recovered. Also, the majority of Structure 136 still remains buried a meter below the current ground surface. An intact retaining wall likely exists around the entire base of the structure. Furthermore, surprisingly few artifacts were recovered from the excavation of Operation 36. The timing of construction of Structure 136, therefore, may be difficult to determine unless some of the few eroded sherds can be typed.
The following section presents interpretations from the areas around two mound groupings at the site of Pakal Na. The surveyed areas in and around the site center at Hershey are discussed in Chapter 2.

**Pakal Na: Structure 130 Survey Areas**

The most intensive work of the Xibun Archaeological Research Project (XARP) geophysical survey was carried out at two mound groups at the site of Pakal Na. Both mound groups are located in an orange grove and although the trees presented some challenges to survey layout, their presence did not significantly impede the survey. The first group is a cluster of structures, the largest being Structure 130 (Figure 12.1).

![Figure 12.1 Pakal Na Structure 130 group survey areas.](image)

It is located in a mature orange grove, but the areas immediately surrounding the mound are clear. Structure 130 is a steeply sloping mound approximately 5 m in height. The steep sides of Structure 130 make it impossible to survey; however, associated Structures 131 and 132 are low relief mounds with gently sloping sides and were partially surveyed.
Prior excavations during the XARP 1999 season had located a burial in Operations 22 and 14 and a burned clay layer in Operation 16. McAnany posits that this layer might have been a surface for drying and processing cacao and that its close proximity to monumental architecture may reflect strong elite control over the production of this valuable resource (McAnany, personal communication, 2000). Magnetic survey was thus attempted to define this feature and to locate any other features around the mound group. At the time of the survey, an extensive excavation was underway at Operations 22 and 14 to uncover the burial discovered in 1999 and to further define the mound construction.

Five areas around Structure 130 and one area atop Structure 132 represent a total surveyed area of 1,315 m². Arbitrary survey grips were laid out in such a way as to maximize coverage of the clear areas, and although the orange trees were planted in straight rows, their large size made effective survey between them impossible. Survey area corners were linked together whenever possible in order to relocate them more easily; those corners were also tied into the site grid by XARP surveyors. No permanent corner markers were left in the ground. All areas were surveyed with the equipment configured in gradiometer mode with a sensor separation of 0.75 m. Readings were taken every 0.1 m along transects spaced every 0.5 m.

**Area 1**

Area 1 is a 15 × 7 m grid located near the junction of Structures 130 and 132. Operation 16 was reopened at the time of survey and its location in the survey grid can be seen as the solid enclosure in Figure 12.2. As Figure 12.2 shows, an area of very volatile readings surrounds the excavation. This area is enclosed by a dashed line. Many of these are paired positive-negative flux dipoles. The fact that the two isolated readings at coordinates 0.5, 2.5 and 3,4 are not oriented toward magnetic north

![Figure 12.2 Pakal Na Area 1 with indicated anomalies.](image-url)
shows that they likely are objects that were not magnetized *in situ*. They may indicate the presence of single objects such as cobbles of buried basalt or large fragments of a fired clay surface. The area enclosed by the dashed line shows the limits of the volatile area. Within it are some dipoles such as the one at 1.5, 7, as well as some single strong positive or negative readings. A possible explanation for this volatile area is that it is the location of the scattered remains of a large burned area or several smaller hearth areas. First of all, aside from the dipoles, the volatile area is generally more highly magnetic, as would be the case if fires increased magnetic qualities of the iron-rich, clayey sediments. Second, the extreme readings are organized into a rough ring, with a magnetic low occurring just to the south of excavation unit. Figure 12.3 more clearly shows the “ring” as well as the volatility of the area. This could be caused by scattered, highly magnetized stones at the edges of a firepit of a fired surface. Although the “ring” is some 5 m in diameter, a scattering of the stones could exaggerate the observed size of feature. Furthermore, the extreme magnetic values affect readings over a large area and thus the anomaly could give the impression that the feature is much larger than it is in reality. The fact that the center of the area is a magnetic low may indicate that the bottom of the burned lens is too deep to detect and that the material of that depth might be non-magnetic, such as ash.

**Area 2**

Area 2 was a thin 20 × 4.5 m strip oriented so as to cover the entire clear area southwest of Structure 130. It was also placed so that the grid northwest corner was the grid southwest corner of Area 1 (Figure 12.4). This area was magnetically quiet with two notable exceptions. The first is the area
enclosed by the circle. Modern burning was noted in this area during the survey, and the elevated readings paired with the lows may indicate this. However, the burning seemed to be confined to the area indicated, and this suggests that the anomaly to the west of the circle may not be the result of the burning. More testing is needed to be sure. The other significant feature is the linear anomaly noted with the line. This feature may be the result of water runoff from the mound. This area was noted as being at a lower elevation with respect to the rest of Area 2. Strong water runoff would disturb the chemical and magnetic properties of soil by stripping some of the topmost layer and would appear as a low magnetic value.

**Area 3**

At 31.5 × 20 m, Area 3 is the largest single survey grid at the Structure 130 mound group. The area was low and relatively flat, though some shallow furrows were present. In comparison to all other areas, Area 3 was magnetically quiet. Figure 12.5 shows the shaded contour map of the area with some indicated anomalies. Note that the scale runs from +12 to −11, while on the Area 1 maps, the scale runs +/- 80. The grid southwest corner was linked to a corner from Area 2 with tape and compass in order to make relocation of anomalies easier. On Area 3 figures, Structure 130 is just off the southern edge of the grid. On Figure 12.5 a dashed circle encloses a discrete low magnetic area. This anomaly may be too large to be the signature of a pit feature, but nevertheless should be investigated with excavation. The area of
diffuse elevated values shown by the lighter grays and whites along the southern edge of the grid (from X=5 to X=20) may simply be a “halo” of organic material eroded from the mound surface by sheet wash.
Intrusive metal seems to have been present in the southwestern portion of the grid and is shown most clearly in Figure 12.6 as the sharp peaks surrounded by solid enclosures. The contour-wireframe overlay map (Figure 12.6) also better highlights the low anomaly (dashed circle). Based on this survey, there seems to be very little of interest in Area 3, though there is always the possibility that magnetics did not detect some of the features.

Area 4

Area 4 is a $20 \times 10$ m area located on the northeastern edge of Structure 130 (Figure 12.7). The actual surveyed areas of this grid fall on either side of a 4.5 m swath formed by a row of orange trees. Because of the trees, this central swath was not surveyed. The southern three-quarters of the grid are located on a low, flat area that slopes gently to the top of Structure 131. This area was not so steep as to necessitate unidirectional survey, though care was taken during the survey to keep the sensors at a constant distance from the ground surface at all times.

Figure 12.7 Pakal Na Area 4 shaded contour with indicated anomaly.
While the actual surveyed area of this grid was rather small, a very interesting anomaly was noted in the grid northeast corner. This anomaly is shown on Figure 12.7 with a circular, dashed enclosure. The roughly rectangular shape is formed by extreme values and is reminiscent of a structure’s floor plan, so much that it was nicknamed the “structure feature.” Identification of discrete anomalies atop archaeological mounds is extremely difficult as there is often a great deal of background noise associated with the actual mound construction or other anomaly-causing features buried within the mound. In contrast to unmodified terrain, mounds are often not made up of a homogenous background matrix from which anomalies stand out. However, a number of contributing factors prompted the identification of this anomaly as a possible structure. First of all, it has a regular, rectangular shape. A geometric pattern is the most compelling evidence that an anomaly is archaeological, as nature does not often produce such regular shapes. Furthermore, the anomaly is located on the top of Structure 131, and it is logical to assume that the mound would have served as a platform for some sort of construction, and that construction would have been placed at the crest of the mound. Finally, the anomaly seemed to resemble the expected magnetic signature of a burned wattle and daub structure. As a wattle and daub structure is burned, the walls will become slightly fired like a crude ceramic. These collapsed walls should thus be detectable with magnetics. This anomaly was the only one to be tested by excavation.

Test Excavation: Operation 37

Operation 37 was originally a 1 × 2 m test unit sited to test the “structure feature” noted in Area 4. The unit’s southwestern corner was at 7, 17 on the Area 4 map and ran 2 m to the grid north and 1 m to the grid east (Figure 12.7). It was placed to straddle what appeared to be the collapsed wall of the structure. During the course of excavation, it was expanded 2 m to the grid north.

The excavation came down on top of a limestone retaining wall that had been built in a roughly east-west direction (Figure 12.8). The wall has five courses of cut limestone blocks with the top two courses showing signs of weathering. The wall’s location and orientation closely resemble the anomaly but the problem was that limestone is non-magnetic, and this anomaly is a magnetic high, so the wall itself did not cause the anomaly. The photograph in Figure 12.8 shows the “front” of the wall with a very smooth appearance. Excavation on the other side of the wall revealed that some of the stones were placed with their long axes perpendicular to the wall course. This was apparently done to anchor the wall and the obvious conclusion is that the side of the wall seen in Figure 12.8 was visible. The Operation was subdivided into Square A (grid south or behind the wall) and Square B (grid north or in front of the wall).

Square A contained a large amount of fire-cracked rock, charcoal, and burned sherds. A lens of charcoal with fire-reddened clays below it was found in the grid southwestern corner and is visible in the profile (Figure 12.9). The lens, combined with the scattering of fire-cracked rock, could have easily caused the elevated readings. Furthermore, the burning reddened the already iron-rich clays and concentrated the weakly magnetic minerals in them. The linear appearance of the anomaly and the fact that it seems to follow the orientation and location of the limestone results from the non-magnetic limestone wall acting as an insulator. It effectively blocked the heat of the fire from spreading into Square B. On Figure 12.7, the grid north side of the anomaly, Square B, exhibits a much more pronounced drop-off in magnetic intensity than Square A. This is due to the diffused reddened clays, fire-cracked rock, and burned clay nodules that are scattered throughout Square A. Square B seems to have been unaffected by these burning events.
Square B did contain some slightly eroded sherds and a large quantity of lithic debitage. The artifacts did not appear to be deposited through flooding as they did not show signs of rounding or any other damage from natural transport. There was no evidence of burning in this Square or of anything that would have produced a magnetic anomaly.

Interestingly, the geophysics did not directly detect the wall. If the sediments surrounding the wall were homogenous, the possibility is strong that the wall would have been noted as a lower magnetic anomaly surrounded by iron-rich clays. The burning event in Square A elevated values throughout the area and essentially overshadowed the non-magnetic limestone. The wall prevented the fire from cooking the sediments on the front side of it, thus creating a contrast which mirrored the location and direction of the wall.

Figure 12.8 Limestone wall of Operation 37.
Area 5

Area 5 measured $20 \times 4$ m and was the smallest area surveyed around the Structure 130 group (Figure 12.10). The reason this area is so narrow is that there was minimal open space between Structure 130 and the thickly planted orange trees. It is located a few meters to the southeast of Structure 130 and is flanked to the north by Structure 131 and to the south by Structure 132, but no part of either of these mounds fell within Area 5.

Despite the fact that this area was small in size, it contained several interesting anomalies. The first is the dipole noted on Figures 12.10 and 12.11 with a circular, dashed enclosure. This anomaly is likely caused by a single object, though it is impossible to tell whether it is archaeological or a broken piece of modern agricultural machinery. It is interesting to note, however, that the location of this anomaly is almost directly in front of Operations 22 and 14. This excavation contained a carefully prepared and capped burial that, based on the preparation and grave goods, seemed to be a high-status adult (see Harrison and Acone, Chapter 10). Due to the fact that this anomaly appears to be in the right location for a marker and also because it is apparently caused by a single object, it should be tested with excavation.

Figure 12.11 shows the same area with a contour-wire frame overlay and highlights the more volatile northern area of the grid. While there are no pattern features in Area 5, the fact that the readings in this grid seem to vary so much in the northern area while remaining relatively stable in the southern area is interesting and should also be tested with excavation.
Figure 12.10 Pakal Na Area 5 with indicated anomalies.

Figure 12.11 Pakal Na Area 5 wire frame map with contour overlay.
This $20 \times 10$ m grid was placed to cover some of the cleared area around and atop Structure 132. Although the slope of this structure was slightly steeper than that of Structure 131, it was not so steep as to significantly impede the survey. Figure 12.12 shows two plots of this area; one of a shaded image map, and the other of a shaded contour.

The most immediately noticeable feature of this area is the linear anomaly formed by a string of low readings that run roughly east to west. This feature follows the approximate contour of the structure, and may indicate a retaining wall made up of cobbles of non-magnetic limestone that contrast with the iron-rich clay sediments. The feature is further highlighted in Figure 12.13, along with the other interesting anomaly in this grid, the area of elevated readings at the western edge of

![Figure 12.12 Pakal Na Area 6 with indicated anomalies.](image)
the grid. As there is no corresponding magnetically low area visible, this anomaly does not appear to be a dipole. However, we do not have full coverage of the feature and it is possible that if the anomaly is a dipole, the negative portion of it was missed. Due to the aerial extent of the anomaly, the possibility that it is a dipole, and thus caused by a single object, is small. More likely, this area represents a burned feature and should be tested with excavation.

**Pakal Na: Plaza de las Naranjitas Survey Areas**

The seven 50 × 20 m grids placed in and around this mound group make up the largest continuous area surveyed with geophysics during the 2001 season (Figure 12.14). This area may have been recently leveled with bulldozers to plant orange saplings, so geophysics was done to see if any remaining features could be detected. The mounds themselves appear flattened, so much so that the small western one is difficult to spot unless one walks over it.

The survey procedures for this group were different from those used during the Structure 130 group survey. Rather than surveying a ring around the plaza group, transects were simply oriented in the same direction as the rows of orange saplings. The trees were small enough so that only one or two meter swaths were missed. Also, even though the mounds were fairly flat, some grids had a portion of their area on one of the mound slopes. These grids were surveyed with transects running in one direction only, rather than the
usual, faster zigzag pattern. This was done to ensure that the distance of the sensor to the ground surface was constant. Finally, since maximum coverage of the area was desirable, transects were surveyed every 1 m along the X-axis as opposed to every 50 cm. While this does mean that these areas were surveyed at a lower resolution than the Hershey site or the Structure 130 group, the change was an effective compromise between survey resolution and time. Along each transect, measures were recorded at 10 cm intervals. Each survey grid was processed and interpreted independently, though adjacent grids were also examined if it appeared that a feature might extend into another grid. Each grid was treated independently to ensure that peaks that may occur in one area of the dataset did not overshadow unrelated features. The seven grids made up a total surveyed area of 7000 m².

North 0 East 0

Figure 12.14 Plaza de las Naranjitas survey areas.

Figure 12.15 N0 E0 shaded contour plot.
This survey grid contained a small, low relief mound (Structure 129) that is part of the four-mound grouping which makes up the plaza area. The mound is noted with a dashed circle. There is a large area of higher readings atop this structure and that may be evidence of burning. There is a right angle noticeable within the anomaly at X=35, Y=10 (Figure 12.15). This may be the signature of a structure corner, and the generally elevated readings (whites and light grays) around the high area may be the result of greater humic input to the sediment from habitation. However, excavation is needed to be sure. The rest of this area appears magnetically quiet save for several areas near to the northern edge of the grid. These three areas do not appear to have any specific pattern to them and, given the recent disturbances of the sediments, these readings are likely the result of modern debris or physical changes to the sediments that altered their magnetic qualities through mixing.

**North 20 East 0**

This area contained the large, fairly steep Structure 126 as well as a long mound (Structure 127) along the northern edge of the grid. These mounds would have made zigzag survey problematic, so this grid and N40 E0 were surveyed with transects running in one direction only. The XARP survey team had driven a steel “rebar” survey point into the center of the mound, and its influence on the local magnetic field can be clearly seen in the shaded contour depiction (Figure 12.16). The location of the marker is shown by a solid gray dot; the extreme positive/negative values in that immediate area are caused by the rebar. It is impossible to be certain of the degree of influence the rebar had over the local area. There are no noticeable patterns on the mound, so hard interpretation of the anomalies on top of the mound is not possible. There is also a dipole feature at X=42, Y=26. This anomaly is isolated and is likely a piece of modern debris.

Figure 12.16 N20 E0 shaded contour plot.
This grid contained the rest of the mound that was partially surveyed in N20 E0, and was also surveyed in one direction only. The most interesting aspect of this survey area is the cluster of anomalies that appear just to the north of the mound (Figure 12.17). Of all of these clustered anomalies (indicated by a dashed circle), there appear to be two dipoles located at coordinates 34, 48 and 22, 52. These are likely the signatures of single objects, and it is impossible to be certain if they are the result of modern metallic agricultural debris or archaeological material. The two highly magnetic areas in the grid northwest section of the cluster (24, 52 and 25, 55) have no corresponding negative components and may be the signatures of hearths. The fact that these anomalies are clustered alongside a mound is also compelling, and this area should be explored with excavation.
This area is located just to the grid southeast of the plaza group and does not contain many strong anomalies (Figure 12.18). The several isolated high spots throughout the western portion of the grid do not appear archaeological and may simply be high areas of the linear geologic feature that seem to run grid northwest to grid southeast. This linear anomaly may have been caused by a physical alteration to the subsurface such as compaction or stripping of the sediments with bulldozers, or it may be as ephemeral as changes in soil chemistry over the area. One such anomaly is noted with a dashed line.

One area which may be archaeologically significant, however, is located at coordinate 81, 13. The two highs and an associated low are placed just to the grid northeast of a roughly circular grouping of moderate highs, which is approximately 5 m in diameter. While not an overwhelmingly definitive anomaly, this area should be tested if time is available.

Instrument error is also evident along several transects (X=65-68) and may have been the result of metallic debris around the orange saplings which caused the sensors to momentarily go haywire.

North 20 East 50

This grid contained the eastern most mound of the group, Structure 128. The mound was not so steep as to require single direction survey. Its location is noted on Figure 12.19 with a solid enclosure. A large anomaly can be seen atop the center of this mound, and unlike Structure 126, is not caused by a rebar survey marker. The anomaly does not have a clearly discernable shape, but this is understandable considering the fact that mound-tops are often locations of habitation which raise the magnetic qualities of...
soil through humic input. This area should be investigated through excavation. Another interesting area lies to the west of the structure. It is an isolated high anomaly and may be the location of a hearth or, because its influence is felt over a wide area, an intensely burned feature.

**North 40 East 50**

A portion of Structure 128 from the N20 E50 sample unit extends into the southwestern corner of this grid, though it does not appear to contain any interesting anomalies (Figure 12.20). There are several areas of lower readings enclosed with dashed circles which, while they are rather large to be pit features, should be investigated.

In the upper right section of Figure 12.20, the dashed black circle encloses a cluster of anomalies which could reflect a burned area or the remains of a burned structure. This interpretation is based on the shape of the anomaly; as the section immediately adjacent to this anomaly was not surveyed, we cannot be sure if the entire anomaly is visible. Murphy’s “Law of Geophysics” states that interesting anomalies will tend to fall on grid edges.

![Figure 12.20 N40 E50 Shaded contour plot.](image-url)
This final area surveyed around the Plaza de las Naranjitas group did not contain any mounds. Instrument error can be seen along several transects at X=18 to 19 and X=134. There is an interesting dipole anomaly at 146, 14, but aside from that, this grid is fairly quiet magnetically. This dipole may be metal, or an isolated cobble of volcanic rock. While it may represent a burned area, the absence on any other anomalies in the immediate area makes this interpretation unlikely.

Conclusions and suggestions for further research

At Pakal Na, a total of 8,315 m² were surveyed with magnetic gradiometry at a very high sample resolution. The survey provided the XARP with continuous maps of the magnetic qualities of the subsurface over several large areas. The fact that the soil in the area is rather iron rich likely hindered the identification of more ephemeral anomalies, such as those which may result from shallow pit features or concentrations of ceramics, but in general, the area proved to be well suited for magnetics. The sample units were all located on farms and plantations, which lessened the chance of interference from modern metal or power lines. The survey identified a number of signal anomalies and areas that should be tested in future seasons. While the overall effectiveness of the geophysical survey cannot be fully evaluated until more of the anomalies are tested through excavation, the survey seems to have been a success based on preliminary results.

Magnetic gradiometry worked well in the Sibun area. Other geophysical techniques which have great potential for this area include electrical resistivity and EM conductivity. While both measure the same physical property, they have some complementary aspects. As both depend on some degree of soil moisture, surveys should be undertaken as soon as possible after the end of the
rainy season. These techniques could locate areas of packed sediment and pit features which may be useful in locating off-mound structures. The other commonly used technique, ground-penetrating radar, should not be attempted in this area because the high clay amount in the soils would not allow good transmission of radar energy.
In 2001 the Xibun Archaeological Research Project (XARP) began studying ancient settlements and caves in the area demarcated as Transect 4. Efforts focused on initial reconnaissance and survey of the area within this transect. Two local residents, Lance Usher and Gilford Hoare, both from Gracy Rock, proved invaluable as our guides and field assistants. Through our efforts we ultimately were able to locate four settlements and two large cave systems. All sites were mapped, and one test excavation was conducted at Cedar Bank. One cave system was explored and mapped (see Peterson, Chapter 9). Initial exploration of Transect 4 revealed evidence of Maya settlement and use of caves that, while similar to evidence collected from Transects 1, 3, and 5, differed in very important ways as discussed below.

An invaluable tool in our mapping and locating efforts was our mapping-grade GPS system (see Morandi et al., Chapter 2, for description). The GPS enabled us to map the paths to the sites. Once on site we were able to establish UTM coordinates and map some of the cultural features. The use of GPS was especially useful in areas where access was restricted by terrain and geography.

In this chapter, the four settlements located in Transect 4 are summarized with maps provided. Also see Peterson, Chapter 9, for description of Arch Cave.

### Cedar Bank

The site of Cedar Bank is the largest known site located in Transect 4. It is located downriver, east of the community of Gracy Rock, adjacent to the Gracy Rock feeder road. The main group at the site is a quadrangular plaza group with four mounds. A smaller plaza is located to the north, and a series of smaller house mounds are scattered on both banks of the river. The large rectangular mounds of the main group form a closed quadrangle with a north-south orientation. The largest mound is positioned on the north; the southern and western mounds have been damaged by plowing. While the mounds form a plaza, there is no raised plaza platform supporting the mounds. We located a test excavation (Operation 40) on the southern side of the largest (northern) mound at the contact between the mound and the ground surface. (See Morandi, Chapter 14, for description of the early Colonial artifacts collected from this excavation.) The plow damage and the excavations lead us to conclude that the mounds were rubble and dirt-filled structures. Large dressed-limestone blocks were used as retaining walls and to construct what appears to be a staircase that led up the southern face of the northern mound. The artifacts from the excavation revealed that Maya occupation was capped by colonial materials. The mixing of colonial and Maya wares may indicate that this site was occupied during the 16th to 17th centuries.

The smaller group to the north of the main group is made up of three mounds: a large rectangular mound to the west and two low rectangular mounds to the east that form an “L” shape. The northern mound of the “L” formation has a small platform perched on its eastern end. The opening of the “L” faces away from the western mound. To the east of these groups are a number of smaller mounds that are scattered across the river terrace on both sides of the river. The remaining mounds occur as isolates; the two groups are the only plaza configurations.
GPS point location data were collected on each mound. Dimensions across the long and short axes of each structure were estimated using a Laser Range Finder and stadia rod, as well as tape-and-compass. Distances between the middle point of structures within the primary site center and the adjacent plaza were taken using the Laser Range Finder. Dimensions of mounds on the southern banks of the river were estimated by simple pace-and-compass. A rectified map of the primary site center and adjacent plaza was created from these data and is shown in Figure 13.1.

Figure 13.1 Rectified map of Cedar Bank site.

Freshwater Creek

Freshwater Creek is a small tributary that drains the karstic and coastal plain region to the south of the Sibun River. The creek ultimately drains into the Northern Lagoon. The settlement of the same name is located between the Sibun River and Freshwater Creek along an access road built by Hiwatchy, Ltd. The site sits in a broad, flat valley ringed by karst and contains five structures that form a plaza that is oriented north-south. The largest western mound and the second largest eastern mound are complemented by two small mounds in close proximity to them. The two smaller mounds appear to be connected to each other by
a wall, and the eastern mound appears to be linked to the smaller mound to its southwest. The overall impression is of a plaza group closed on the southern side by a wall that faces a northern mound. A looter’s hole on the western mound revealed inner cobble-fill construction.

Coordinates for these mounds were collected using the GPS rover antennae collecting satellite data for one minute per location. Data were obtained from no less than five satellites during each session. Distances between the center point of the five structures in the Freshwater Creek plaza were measured using the Laser Range Finder, insuring that the range finder was held along a horizontal line by using an attached bubble level. Long and short axes of these structures were measured using the range finder and a stationary target, with distances taken relative to the center point each mound. Structure height was estimated using the laser range finder and stadia rod. Figure 13.2 shows the rectified map of the site.

Butcher Burns

The Butcher Burns area is located downstream (east) of the Gracy Rock/Cedar Bank communities, positioned on the opposite bank of the river from the access road to the Butcher Burns community (mile 26, Western Highway). The site is situated on a peninsula of land bordered on three sides by an omega-shaped meander bend in the Sibun River. The site contains nine mounds that were surveyed during the 2001 season. Structures 1 through 5 are situated in a semi-linear fashion trending NE-SW along what is potentially the ancient riverbank leading to the oxbows Juana Pond and Long Juana Pond. The mounds range in height from 0.25 to 1.25 m with surficial areas ranging from 54 to 260 m². North of this group of five platforms are four structures built on top of a raised plaza. The plaza is elevated about 1 m above the current ground surface and covers an area of approximately 900 m². Although no test-pits were placed in the plaza, the construction appeared to contain river cobble and earthen fill. No limestone construction
material was visible on the surface. The four mounds situated on the raised plaza created a ringed formation with an opening facing the east. Location information as well as approximate areal coverage of these mounds was determined using the point and area functions of the Sokkia GPS unit. A rectified map of the site was not made in 2001.

**Juana Pond**

Juana Pond site is also located near the community of Butcher Burns, directly opposite the terminus of the Butcher Burns access road to the Sibun River. The site contains four large mounds situated in a ring-formation with an opening to the west. Adjacent to the site is an oval water hole or aguada with a diameter of 30 m. Possibly man-made, five steps lead down to the aguada from Juana Pond Structure 4. The largest mound in the plaza is located to the north; the eastern side of the plaza is closed by the four structures that comprise this group. The plaza which is open to the west points to the meander of the Sibun River. The overall appearance of the groups is one of being closed off to the east by structures and to the west by the river.

Coordinates of the four Juana Pond structures were established by GPS satellite data that were collected for one minute from the center of the structure. Dimensions of the structures and their spatial relationship with each other was obtained using the Laser Range Finder and stadia rod. The data for Juana Pond were used to produce the rectified map shown in Figure 13.4.

![Figure 13.3 Rectified map of Juana Pond.](image1.png)
Discussion

The exploration of Transect 4 in 2001 was extremely successful. We located four sites that appear to be the largest and probably most significant ones in the area. In addition to these larger plaza groups there are numerous house mounds scattered across the entire area. Transect 4 shows similar locational patterns as the other transects explored by XARP. Sites are set on high banks next to the Sibun or along streams that feed into the river. While Cedar Bank is the largest site in the area it does not contain any pyramidal structures or any obvious ceremonial structures. The other common trait the area shares with sites in Transects 1 and 3 is the fact that the settlements are located proximate to caves that were modified and visited by the ancient Maya. None of the sites in Transect 4 are comparable in size to the sites of Samuel Oshon, Pakal Na, or Hershey. This could indicate that the sites of Transect 4 were lower in the hierarchy of the region and may have been under the jurisdiction of the Samuel Oshon site, which is only a short distance away by canoe.
Cedar Bank is a site located in cohune forest near the village of Gracy Rock on the north side of the Sibun River. It contains some of the largest architectural features of the Maya sites investigated in the lower and central sections of the valley. Four large platforms are arranged in a plaza group in the southern part of the site center. Three other structures, including two long, narrow platforms are located just north of this group. Three other small platforms are known to exist outside the site center, though no intense ground reconnaissance has been completed to identify other possible structures. The relatively open area under the canopy of the cohune forest was used as a cattle-grazing area at the time of excavation. One of the structures at the Cedar Bank site contained small concrete foundations from an earlier apiary that, according to local villagers, was constructed there in the recent past.

Operation 40, a 2 × 2 m cardinally oriented excavation unit, was located on the southern edge of the largest mound, Structure 351, and included large cut limestone slabs that formed the lowest tiers of the structure. It was designed to investigate the final occupational phase of Structure 351, as well as to recover diagnostic artifacts that would help determine the time of use of the structure.

Upon immediate commencement of excavation at the Cedar Bank site, we were struck by the deep, rich, dark soil that had formed in the area. In fact, two local men who helped with the excavation removed some of the soil from the backdirt pile for their home gardens. If the same soil-forming conditions had operated in the past, this location would have been ideal for growing many types of foods.

The topzone of Operation 40, Zone 1, contained many cohune nut fragments, and several arboreal snail shells (Figures 14.1 and 14.2). The sediment of the zone was a 10YR 3/2 very dark grayish brown clay loam. A few limestone inclusions between 1 and 5 cm were found in this matrix. Many of the nut fragments were burned, indicating that the area had been cleared by fire at least once in the recent past. A line of cut limestone blocks, below those visible from the ground surface, was revealed by the excavation of Zone 1.

A mixture of historic period and prehistoric artifacts was found in Zone 1, including a clay pipe stem fragment and many faunal remains. Also, pottery sherds, obsidian blade fragments, chert debitage, unworked shell, and a chert tool fragment were found.

Zone 2 is a continuation of the Zone 1 matrix, separated for stratigraphic control. Again, historic and prehistoric artifacts were recovered from this zone. Speleothem fragments also were found. Zone 2 was continued until a high density of smooth limestone cobbles was encountered.
Zone 3 contained several irregular limestone cobbles and associated sediment, and represented a continuation of the pattern of mixed historic and prehistoric artifacts. An oval feature was exposed in this zone, a fragmented turtle shell. Historic period artifacts recovered in Zones 2 and 3 included a metal knife, bottle glass, two types of glazed ceramics, and unglazed wheel-made ceramic vessel sherds.

Zone 4 was a lens of very dark (10YR 2/1 black) organic-rich clay found beneath Zone 3 along the eastern wall of Operation 40. No artifacts were recovered from this zone, but a sediment sample was taken for flotation.

The removal of Zones 1, 2, and 3 exposed a large limestone block leaning against the basal tiers of Structure 351, designated Zone 5. The size of the block was approximately $9 \times 49 \times 52$ cm (Figure 14.1).

Zone 6 was comprised of four cut limestone slabs, two from the basal retaining wall and two from the retaining wall of the next ascending terrace. The dimensions of the stones were not entirely known because each was partially buried, but they were generally 10 to 30 cm wide, over 40 cm high, and up to 2 m long.

Zone 7 consisted of a 10YR 3/3 dark brown matrix with a high density of pebble and cobble-sized limestone inclusions. It was excavated only in the southern half of the excavation unit to preserve some of the existing surface near the basal limestone blocks of Structure 351. Zone 7 may have been the upper layer of plaza floor construction fill. The zone continued until a layer of very large limestone blocks was encountered, and the matrix color changed. Few artifacts were found in this zone, and all were prehistoric.
The layer of limestone blocks beneath Zone 7 was designated Zone 8. Some of the blocks were cut squarely while others displayed irregular margins. All were set closely in a dense layer along with smaller inclusions. The associated sediment was 10YR 4/3 brown. Relatively few artifacts were recovered in Zone 8, mostly pottery sherds.

Beneath the Zone 8 layer of limestone blocks was Zone 9, a semi-compact 7.5YR 4/6 strong brown silty clay with no inclusions. A light density of well-preserved sherds was recovered from this zone.

Zone 10 (Figure 14.3) was a continuation of the Zone 9 matrix, but was excavated as a posthole probe into the bottom of the excavation unit. The upper part of Zone 10 contained a light density of artifacts that tapered off quickly at greater depths. The matrix did not change even after excavation to one meter below the bottom of Zone 9.

Preliminary data analysis at Cedar Bank has revealed some interesting results that will be explored further in the 2003 field season of the Xibun Archaeological Research Project (XARP). A tape and compass map of the Cedar Bank core shows that though it is not the largest site in the Sibun Valley, it contains some of the largest structures of any of them. The facing stones of Structure 1 are the largest seen in the valley (except, perhaps, for one found at Structure 1 at Pakal Na).

Furthermore, the site may have been occupied over a longer period of time than any other in the valley. The size, shape, construction method and layout of structures in the site core indicate that it was constructed during the Classic period. Structure 1, the largest at the site, contained a homogenous sediment core faced by large cut limestone blocks. The same technique was used for the majority of the Classic period structures identified in the Sibun River Valley to date.
Analysis of artifacts recovered off the southern edge of Structure 1, however, indicate a later, Spanish colonial occupation at Cedar Bank. Several pottery sherds have been tentatively identified as Sevilla Blue on Blue or Columbia Plain types, Spanish majolicas common in the late sixteenth and early seventeenth centuries (Deagan 1987: 56-57,63-64). Additionally, a small, perforated copper alloy star like those found at other sixteenth century Spanish sites was recovered in the excavations (Deagan 2002: 84-85, 178-179). Sherds of wheel-made pottery, likely from olive jars, were found as well, indicating European contact.

The only known ethnohistoric sources that mention the Sibun area (Jones 1989) indicate that a visita, or frontier mission church, was built at the town of Xibun, probably in the late sixteenth century. That church was abandoned around 1631, when the Maya living in the town sought refuge from Spanish intrusion. According to one record, they took the church bell and ornaments with them when they left, indicating that a relatively substantial structure was present at the site. Whether Cedar Bank represents the colonial town Xibun or not remains open to speculation at present.

Occupation of the area also occurred during the British colonial period in Belize (Daniel Finamore, personal communication). Clay pipe stems recovered from Cedar Bank are the only evidence of this occupation to date. Clay pipes are rare in Spanish colonial contexts, however, and so are likely to indicate a later period. In fact, the only clay pipe fragments recovered have been from the topzone or from the Sibun River.
Several questions remain to be answered at Cedar Bank, including the following:

1) Does the Spanish colonial occupation at the site represent the town of Xibun mentioned in ethnohistoric sources?
2) Does a Late Postclassic phase of occupation exist at Cedar Bank, given the common pattern of reuse of Postclassic sites by Spanish colonial societies?
3) What is the material culture inventory of the Spanish colonial occupation at Cedar Bank, and how does it compare with that of sites such as Tipu or Lamanai?
4) What was the function of Cedar Bank during the Spanish colonial period? How did it function in relation to Spanish economic changes in the area, such as the implementation of the tribute-based encomienda system?

Such questions and others will be addressed during the XARP 2003 field season and XARP 2004 analysis season.

References Cited

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During the latter part of the Xibun Archaeological Research Project (XARP) 1999 field season, a small cluster of structures on the property of Augustine Obispo, later named the Obispo Site, was mapped. The Obispo site was one of four identified in the Hattieville area of the Sibun River Valley. Though the Obispo site was one of the smallest encountered in the Sibun River Valley, it contained two of the four known stone monuments (the other two are located at the much larger Oshon site less than 2 km away). During the XARP 2001 field season, the site was visited again with the purpose of completing two excavation units, Operations 30 and 31.

A small plaza group of four mounds, along with three outlying structures, comprise the total known architecture at the Obispo site. The four structures of the plaza group were constructed in a square arrangement. The northern mound, the largest at the site, was designated Structure 475. Two very low stone platforms on the east and south sides of the plaza (Structures 479 and 480, respectively), had stone monuments placed in front of them.

**Operation 30**

Operation 30, a $3 \times 4$ m excavation unit, was centered on a broken stone monument (Monument 1; Figure 15.1) located on the southwestern side of the main plaza group. The monument was found in several large pieces off the north side of Structure 480, a very low platform barely discernible on the current ground surface. The purpose of the operation was to determine when the monument was set in place, its purpose, and its possible relationship with Structure 480. Initially, the monument was thought to be the top portion of a toppled stela, though excavations indicated that it may have functioned as an altar.

![Figure 15.1 Plan view of Operation 30 showing the fragments of Monument 1.](image)
Zone 1, the top layer of sediment in Operation 30, was a semi-compact 10YR 4/1 dark gray silty clay. Several large, partially articulated stone fragments of Monument 1 (designated Zone 3) protruded through this surface layer. A medium density of sherds and debitage were found throughout Zone 1, including cylindrical ceramic fragments around the monument and in the southwest corner of the unit. The removal of Zone 1 revealed a line of small cut limestone blocks on the southern side of the unit (Figure 15.1).

Zone 2 also was a semi-compact silty clay. The artifact density of Zone 2 was heavy and included obsidian blade fragments and chert debitage. Among the many sherds recovered from this zone there were several with small “nubbin” feet or appliqué designs. Zone 2 ended in a dense layer of limestone and chert cobbles in the western half of the excavation unit and a yellowish-brown silty clay on the eastern side of the unit. The majority of the artifacts were recovered from the western half of the operation. An archaeobotanical sediment sample, field collection bag (FCB) #4015, was collected during the excavation of this zone.

Monument 1, the broken stone feature in the center of Operation 30, was designated Zone 3. The monument was broken into four large fragments and numerous smaller pieces. Each of the largest fragments of stone was roughly 20 cm thick, with a flat parallel top and bottom side. One edge of each fragment also had been shaped into a flat surface, and the other edges showed a rough, randomly fractured surface.

Zone 4 appeared to be a one-course wall built of cut limestone blocks. This feature ran almost parallel to the southern edge of Operation 30, and may have been the edge of a low structure south of Monument 1, barely visible from the surface.

A thin margin of sediment, Zone 5, was exposed between the south side of Zone 4 and the southern edge of Operation 30. If Zone 4 was indeed a retaining wall for a structure, Zone 5 would represent construction fill. Zone 5 was a light yellowish-brown semi-compact silty clay. The few artifacts were recovered from Zone 5 consisted of sherds and debitage.

Zone 6, a layer of limestone and chert cobbles, extended from the western edge of Zone 4 to the northern wall of Operation 30. Ceramic sherds were found in medium density in this zone, along with two medial obsidian blade fragments and a fish vertebra. Due to time constraints, only a portion of Zone 6 was removed, revealing a compact brown silty clay surface beneath.

Excavations of Operation 30 yielded important information about the nature of Monument 1. First, a complete removal of surrounding sediment indicated that Monument 1 was a nearly complete, rounded stone feature. No carving was apparent on the top surface of the monument. An attempt to move parts of Monument 1 proved impossible due to its weight, so the other side remained unobservable. The relatively high number cylindrical ceramic fragments and sherds with nubbin feet indicated that several “ladle” incense burner vessels had been used near the monument. As a result of these observations, it is possible to hypothesize that Monument 1 functioned as an altar in front of a low structure on the southern side of the main plaza group. The ladle-handled incensarios may have been used when the monument was whole, or perhaps as part of a termination ritual involving its destruction.
Operation 31

Operation 31, on the opposite side of the plaza from Operation 30, was undertaken to investigate the inset southeastern corner of Structure 475. The placement of this operation mirrors that of Operations 18 and 20, located at the inset corner of Structure 401 at the Oshon site in 1999. These “deep corners” were recognized not only for their high concentrations of midden materials, but also as areas containing well-preserved architecture. Operation 31, a 3 × 3 m square unit, was oriented cardinally on the southwest corner of Structure 475. It was placed such that it would cover both the edges of the inset corner of the structure, as roughly indicated by surface features, as well as the adjacent plaza surface.

The top stratum, Zone 1, included a thin root mass and associated sediment. It was semi-compact silty clay with a color of 10YR 4/1 dark gray (Figure 15.2). This thin zone ranged in depth from about 2 to 10 cm and had only a light density of artifacts, consisting primarily of eroded ceramic sherds. Several cut limestone blocks were revealed in the northwestern two-thirds of the unit, scattered in such a way that suggested tumbled architectural components of Structure 475. Along the northern and western margins of the unit, cut limestone blocks were arranged in a more linear fashion that delineated the edges of the inset corner.

Zone 2 consisted of a sandy clay matrix containing several types of pebble-sized inclusions. These inclusions became increasingly dense as the bottom of the zone, a very compact layer of chert and limestone cobbles, was reached. Upon retrospection, this zone was found to be the eroded surface of the plaza, more disturbed as distance from Structure 475 increased. In the best preserved portions of this zone, a plaster surface was still intact (Zone 7). From these well-preserved areas, it was possible to ascertain that Zone 2 probably consisted of an upper matrix of pebble-sized inclusions, a middle matrix of large chert flakes, and a lower matrix of limestone pebbles.

Zones 3, 4, 5, and 6 represent the remains of Structure 475 that spilled out upon the plaza surface as it eroded over time. Zone 3 included the tumbled cut limestone blocks from Structure 475 which

![Figure 15.2 Profile drawing of the west wall of Operation 31.](image)
extended down a slope from the northwest corner to the southeast corner of Operation 31. Immediately below this zone there was a semi-compact layer of 10YR 5/4 yellowish brown silty clay, called Zone 4. A few tumbled limestone blocks were found in this zone. Artifacts in this zone included ceramic sherds, several obsidian blade fragments, and a small triangular piece of carved and polished jadeite. Zone 5 was a continuation of Zone 4, differentiated for stratigraphic control. Artifacts included sherds, obsidian blade fragments, and several animal bones including many fish vertebrae.

A dense aggregation of cut limestone blocks, denoted Zone 6, was found beneath Zone 5 in the northern part of Operation 31. The location and roughly linear arrangement of the tumbled blocks indicate that they were part of a retaining wall from the inset corner of Structure 475 that had fallen as it eroded. The position and number of cut blocks suggested that the original wall consisted of several courses of cut stone, each 5 to 8 cm thick. The tumbled limestone blocks from Zones 3, 4, 5, and 6 likely made up several upper courses of this retaining wall. Several sherds and animal bones were recovered from this zone, although no obsidian was found in this context. The removal of Zone 6 revealed the remaining portion of the eroded plaza surface covered by the debris of Structure 475.

When Zone 6 was removed, however, the deepest part of the inset corner of Structure 475 yielded an unexpected, small, feature – well-preserved plaster of the plaza surface (Zone 7). A sample of the plaster was taken as FCB #4117. Zone 7 consisted of a few patches of plaster approximately 2 cm thick that overlaid the same Zone 2 matrix found in the rest of the unit.

The removal of Zones 3, 4, 5, and 6 uncovered not only the eroded plaza surface adjacent to Structure 475, but the intact lower courses of cut limestone blocks that comprised the walls of the inset corner. The blocks in the wall on the west side of the excavation unit were oriented at roughly 20°. These well-shaped stones ranged in size from approximately 10 × 10 × 5 cm to 20 × 40 × 60 cm and were laid upon each other without any apparent mortar in between. The three lowest courses of the wall were the best-preserved, but there are still some blocks displaced by erosion and tree roots.

Zone 9 represented the retaining wall on the northern section of the inset corner which faced southward (Figure 15.3). Again, only three courses of this wall remained partially intact, with most of the existing wall consisting of only one or two courses of cut limestone blocks. The lowest course continued in a row of nine consecutive blocks along the northern margin of Operation 31. The orientation of the wall is somewhat speculative due to the largely displaced courses of stone, though a rough compass reading gave a bearing of 110°. Such a reading makes sense in that the Zone 8 and Zone 9 walls would form a right angle, and the Zone 9 wall would be parallel to the front edge of Structure 475.
Interestingly, the Zone 8 limestone blocks appeared to be shaped differently from those of Zone 9. Those of Zone 8 were larger, more varied in size, and had roughly squared edges on all sides. Conversely, Zone 9 blocks were generally smaller and more uniform in size. The front faces of the stones were squared, but they tapered in the back to form a rounded edge.

Zone 10 simply may be an extension of Zone 2 beneath the Zone 9 retaining wall of Structure 475. Its composition, however, seemed slightly different, with fewer inclusions in the sediment matrix. The matrix itself seemed to be composed of pure clay, as opposed to the sandy clay of Zone 2. It was not excavated, but a chert “chunky biface” that was protruding from this zone was collected.

Beneath the eroded surface cap and topmost construction layers of the plaza (Zones 7 and 2) a substantial layer of fill (Zones 11 and 12) was found that provided a stable foundation for everything built upon it. Due to time constraints, only a 1 × 1 m area of the plaza fill was excavated in the southeastern corner of Operation 31.

The removal of Zone 2 had revealed a surface of well-shaped limestone blocks and irregular limestone and chert cobbles arranged compactly in a 10YR 4/4 dark yellowish brown silty clay. Excavations showed that the Zone 11 matrix was about 10 to 15 cm thick; several well-preserved ceramic sherds were recovered.

A stratum of semi-compact, 10YR 4/4 dark yellowish brown, silty clay with a low density of charcoal, baked clay nodules, and limestone pebbles, denoted Zone 12, existed below Zone 11 (Figure 15.4). Several types of artifacts were recovered from this zone in medium density, including ceramic sherds, stone tool fragments, and faunal remains. The density of charcoal and artifacts suggests that this layer may represent reused fill from other areas at the site. Zone 12 was approximately 20 cm thick.
Zone 13, directly below Zone 12, was composed of a 10YR 4/4 dark yellowish brown semi-compact silty clay matrix, but contained no inclusions. Additionally, only a few artifacts were found close to the top of the zone. Zone 13 appeared to be sterile with regard to artifacts; the few that were recovered from this zone may have worked their way into the top few centimeters of sediment from Zone 12 above. A posthole excavated in the center of Zone 13 revealed no changes in matrix for at least another meter in depth. Thus, Zone 13 appeared to represent an existing layer of naturally transported sediment upon which the plaza and other overlying structures were built.

Overall, the construction sequence of the plaza structures at the Obispo site was quite complex, conveying both a concern for long-term durability and access to, and control of, skilled laborers even at the smallest sites in the Sibun Valley. Plaza construction revealed in Operation 30 was much more complex than anticipated, consisting of several prepared layers of different materials, and capped by a plaster surface.

Operation 31 yielded artifacts unknown form any other part of the Sibun River Valley to date. The ladle incensarios and appliqué design pottery are diagnostic of the Postclassic period, and represent the first solid evidence of Maya activities in the Sibun River Valley during that time period.
Chapter 16
A Circular Shrine and Repostioned Stelae at the Oshon Site
(Operation 24)
Eleanor Harrison

The Oshon site is located in the Freetown District within the lower reaches of the Sibun River Valley. The site is situated south of Hattieville (at mile 18 on the Western Highway) and northwest of Freetown, a small village of about 70 people. The site is named after the previous land owner, Samuel Oshon Sr., who planted a few banana and avocado trees on and around the structures of the site. During the 2001 season, the property had recently been sold and the area around the excavation had been cleared for vegetable gardens. As the largest site within the lower and middle reaches of the Sibun, the Oshon site certainly holds the position of a main ceremonial center within this portion of the river valley. Positioned proximate to the Caribbean Sea and the outlet of the Sibun River, the Oshon site may have functioned as a gateway community for the Sibun Valley, navigating the interactions between coastal and inland trade (McAnany et al. 2002). The site was mapped during the 1999 field season (Morandi and Norris 1999), at which time the survey team identified a total of thirty-seven structures: two main plaza groups located at the center of the site and several outlying groups comprised of one to five mounds (see Map Sheet 9).

The two main plaza groups, A and B, are diagonally offset from each other, with Plaza A located northwest of Plaza B. Both are about 200 meters north of the current path of the Sibun River, and although Plaza A is situated on slightly higher ground than Plaza B, the latter group contains the largest structure (Structure 406) within the site. Both groups comprise five structures which are positioned around all four sides of two large central patios. Thus far, Plaza A has been the focus of excavation carried out during the 1999 and 2001 field seasons. The initial investigations of the site were performed in and around Structures 401 and 437 in Plaza A, two adjacent structures situated on the southern side of Plaza A. Midden debris found between these two structures produced evidence of an elite occupation in this locale dating to as late as the Terminal Classic period (Morandi and Thomas 2001). In the following 2001 field season, investigations entailed the clearing and partial excavation of Structure 402, located along the western side of Plaza A. A 5 x 5 m square unit was positioned cardinally along the northeastern quarter of the structure and excavations revealed a portion of a circular stone structure with two, still-standing plain stelae situated along the front or east side of the structure. The purpose of the excavation was to expose what appeared to be a special-purpose building that could offer insight into the ritual behavior of the ancient inhabitants, as well as provide a time depth of occupation for the Oshon site.

Reconstruction of Structure 402: An Overview of Construction Phases

The cardinally-oriented 5 x 5 m unit was divided evenly into four squares (A-D), each measuring 2.5 x 2.5 m. Figure 16.1 shows the relative positioning of all four squares. Excavations exposed the northeastern quarter of the building and revealed three construction modifications of the circular structure, referred to as Phases 1a, 1b, and 2. Two plain stelae were situated just to the east of Structure 402 and appear to be associated with or postdate the final Phase 2 construction. Stela 1 is situated roughly in the center of Square B and Stela 2 is positioned to the south, roughly in the center of Square D.

The initial construction, Phase 1a, consisted of a round building with an interior circular room (Figure 16.1). A low, 20 cm high plinth ran around the outside perimeter of the structure (Figure 16.2), breaking only where a central doorway, located along the east side of the structure, allowed one to enter the interior room of the structure. Excavations revealed the northern half of this central doorway, which faced the main plaza. Finely cut masonry was used to construct the thick walls of the Phase 1a building, which comprised an interior and exterior three course high limestone wall sandwiching a core of limestone cobble construction fill.
In all likelihood, the low wall held a wattle and daub structure that would have enclosed the interior room. A plaza floor, associated with the Phase 1a construction, also functioned as the initial flooring of the interior room, running underneath the Phase 1a construction and obviously pre-dating the building’s construction.

16.1 Planview of Structure 402 during Phase 1a.

16.2 Cross-section of northeastern side of Structure 402 in Square A during Phase 1a, showing 20 cm high plinth running along the exterior of the structure.
During the Phase 1b construction, the building was modified slightly. Approximately 20 cm of construction fill covered the original floor of the interior room and flagstones were laid down over top of the fill to produce a slightly elevated interior floor surface. The height of the new floor was roughly equivalent in elevation to the exterior plinth that was constructed during Phase 1a. The low plinth and outer wall of Phase 1a were covered over at this time with a new exterior wall. The plinth stones acted as the first course for the Phase 1b wall, with three more courses of cut stone positioned over top. This building modification added about 50 cm of thickness to the existing Phase 1a wall, however, the height of the wall appears to have remained the same (Figure 16.3). Like Phase 1a, the low wall undoubtedly held a wattle and daub structure that would have enclosed the interior room. The interior wall, constructed during Phase 1a, appears to have been maintained during Phase 1b and, with the exception of the new elevated floor surface, the interior room does not appear to have changed dramatically during this time. The same weathered floor continued to be used as the exterior plaza surface during Phase 1b, though it probably was repeatedly patched and repaired over time. The Phase 1b modifications effectively elevated the interior room from the surface of the plaza and, overall, made the building appear somewhat larger, perhaps to emphasize its growing importance as a shrine structure and place of worship within the site.

16.3 Planview of Structure 402 during Phase 2. Note the two stelae positioned to the east of the structure, tentatively associated with this final phase of construction.
The final phase of construction, Phase 2, constituted the infilling of the interior room with large, elongated limestone slabs that retained construction fill comprised of large limestone cobbles and boulders. The grandiose size of the interior fill lacks the finesse of the previous building techniques. The new emphasis seems to have been placed on the expedience of the building process. Although considerably disturbed by root action, an upper terrace surface is discernible, but appears poorly constructed. A decline in construction and overall maintenance characterizes the Phase 2 construction. The Phase 1b exterior wall was maintained during this time, however, smaller cut limestone blocks, which appear to be recycled construction materials perhaps robbed from other parts of the site, were added to the exterior construction. Phase 2 transformed the circular building into a multi-terraced circular platform structure. Presumably, the new surface of the platform structure held a perishable building, though poor preservation allows for only a speculative reconstruction (see Figure 11.3c).

It is theorized that the two uncarved stelae situated to the east of Structure 402 were scavenged from another location and repositioned in this locale during or some time after this final phase of construction (see Figure 11.5). Both are surprisingly still standing, inserted into the ground at a shockingly shallow depth of less than 15 cm. They barely intrude into the plaza surface and are mostly held upright by a surrounding 10 cm thick matrix that overlies a portion of the original plaza surface. The matrix resembles a midden, containing a considerable amount of refuse with few stone inclusions, heaped up against the eastern side of Structure 402. The decline of maintenance and construction technique evident in and around Structure 402 expresses a significant change in the political, economic and religious organization of the Oshon site during this phase of occupation. Based on the shoddiness of the stelae erection and the decline in building technique noted in the Phase 2 construction, it does not seem unreasonable to temporally link these two developments, however, it is conceivable that the stelae post-date the Phase 2 construction. Ceramic analysis from both contexts may clarify this aspect of the chronology. Clearly, the architectural style and building quality of Phases 1a and 1b, which both appear to be associated with the original plaza surface, are markedly different from the Phase 2 modifications. I predict that further analysis of the associated ceramic debris from all contexts will discern a clear chronological break between Phases 1 and 2.

Excavation techniques

Excavation of Operation 24 entailed the detailed investigation of the northeastern quadrant of Structure 402 and the plaza area to the east of the structure where the two stelae are situated. Two datum stakes were placed in the ground proximate to the unit and used for relative measurement during the excavation. Datum A, located along the west side of Operation 24 where Squares A and C interface, was measured at 36 cm above ground surface. Datum B, located around the northeast corner of Square B, measured 16 cm above ground surface. Datum B was used for the elevations of the northeast corner of Square B, while Datum A was used for all other elevations within the unit. These datum stakes offered quick and precise measurements during excavation and were later correlated with absolute elevations above sea level with the Total Station. In an effort to glean a maximum level of information, one hundred percent of all soil excavated was screened through a quarter-inch screen. Trowels primarily were used in the excavation, with picks and shovels being used infrequently. Trowels (and dental tools when necessary) were utilized to define the surface of architecture and in situ deposits.

Overview of the Findings from Operation 24

Previous investigation at the Oshon site by Morandi and Thomas (2001) suggested a substantial Terminal Classic occupation. As Graham (1987: 75) notes, “evidence for Terminal Classic or later occupation associated with small structures is usually revealed only by extensive exposure of these structures, as several centuries of use can often be represented by only thin scatters of debris.” Therefore, all four squares (A-D) were excavated during the 2001 field season, providing a broad horizontal exposure necessary for understanding the time depth of occupation, the aforementioned construction sequences and associated
monuments. The following presents an overview of Zones 1-10 excavated in Operation 24 and a description of the subsequent findings from each zone.

Zone 1

Zone 1, excavated in Squares A-D, consisted of a dark humic layer or topzone with a root-filled matrix. There is a medium density of limestone cobble and gravel inclusions in the soil. The density of inclusions increases at the base of Zone 1. The limestone tumble found on and sloping off of Structure 402 along the north and east sides of the structure was defined at the base of Zone 1 and excavated as part of Zone 2. Evidence of the exterior wall of a circular platform (Phase 2) was roughly defined in Squares A, B, and D at the base of Zone 1. The subsequent findings from each square are described below.

In Square A, the goal of Zone 1 was to define the northern side of Structure 402, whose exterior wall curves around and into the northwest corner of the unit. In Square A, a partially intact conch shell was found lying on the surface of Structure 402, likely associated with the final Phase 2 construction. The in situ findings of marine shell may indicate the original placement of others found just off the northern side of Structure 402 (see Square A, Zone 2). In addition, Zone 1 of Square A yielded a light density of ceramic sherds and lithic debris, some animal bone and a single human tooth, along with a piece of worked shell. The latter appears to be a worked shell bead, resembling a miniature earflare, and was found near the surface in the southwest corner of Square A, around an area of root disturbance caused by a large Corrozo palm on the top of the mound. Similarly shaped earflares were found in the Cenote of Sacrifice at Chichen Itza, although these were made of wood and intricately carved with depictions of ballplayers (Coggins and Shane 1980: Figure 40). While Coggins and Shane (1980: 60) note their resemblance to earflares, they admit that the purpose of these objects is not clearly understood. Seldom are they found in true pairs; “nor are objects of this shape represented as worn in Mesoamerican art, which includes abundant and detailed representations of costume” (Coggins and Shane 1980: 60). Among the oldest wooden objects found in the Cenote, they date them to the Terminal Classic (AD 800-1000). Although the earflare from Oshon appears to be associated with the final Phase 2 construction, it is conceivable that the growth of the large palm may have pushed the shell piece up from lower levels. The root depth of Corrozos, however, is quite shallow.

In Square B, Zone 1 encountered the topsoil matrix and collapse debris. The 2.5m x 2.5m unit is superimposed over only a small portion of the northeastern side of Structure 402 which was partially exposed at the base of Zone 1. A heavy density of artifacts was recovered from Zone 1 in Square B, primarily because the bulk of the unit comprises an off-mound area to the east of the structure. The bottom of Zone 1 in Square A contained tumble and terminal artifactual debris that had fallen from the northeastern side of Structure 402. This debris contacts the surface of a midden-like deposit, found packed against the side of the structure and surrounding the two stelae. In addition to ceramic sherds and debitage, notable finds from Zone 1 of Square A included six obsidian blade fragments, a high density of animal bone, namely mammal and fish bone, as well as a large metate foot and other groundstone fragments. Most importantly, however, were finds of several hollow-handled ladle censer fragments, diagnostic of Terminal Classic and Early Postclassic contexts, which may provide a temporal framework for at least the final phase of Structure 402. The latest deposits, which appear to date to the Terminal Classic or Early Postclassic, were found at a shallow depth, on both the surface and within the first 5-10 cm of the matrix. As Graham (1987: 75) notes, thin layers of Terminal Classic debris may, in fact, represent several centuries of occupation, which can only be discerned through a careful analysis of the material. The finds of ritual paraphernalia suggest that this area was an important ceremonial locale through its final phase of occupation, although utilitarian debris such as the groundstone fragments suggest elements of residential use in the terminal occupation.

In Square C the topsoil of Zone 1 is located entirely on-mound and yielded an interesting assemblage of artifacts that may shed light on the ritual behavior of its ancient inhabitants during the final phase of site occupation. A potentially diagnostic foot of a ceramic vessel was found just below ground surface around the northwest corner of Square C. In addition, sixteen pieces of unworked marine shell fragments and also
landsnail shell were found in Zone 1 of Square C. The fact that Square A also yielded an intact marine shell on the surface and that concentrations of conch were identified along the northeastern edge of the structure in Zone 2, primarily in Square A, suggest that the shell deposits held a special ritual significance in the context of the all-stone circular structure. Although only limited excavations have been performed elsewhere at Oshon (see Morandi and Thomas 2001), testpits investigating two neighboring Structures (401 and 437) in Plaza A did not yield a comparably high density of marine shell. Only scattered light densities were noted and one intact conch was identified on the surface of Structure 401. The debris, found in relative abundance on Structure 402, may point to this structure’s special function, possibly representative of caching behavior or used as a decorative element covering portions of Structure 402 in its final phase. In either circumstance, the symbolic importance of marine conch shell seems undeniable, known for its strong associations with fertility, the underworld, and the deity Quetzalcoatl—the conch shell pectoral is one of his signature traits (Nicholson 2000). The feathered-serpent is also strongly tied to circular architecture (Ringle et al. 1998)—a religious theme that is further discussed toward the end of this chapter.

In Square D, the topsoil was removed and the base of Zone 1 exposed the top portion of the eastern wall of Structure 402. This area yielded a high density of artifacts, including a number of diagnostic ceramics. Several appliqued pieces and hollow-handled ladle censers were noted and mentioned above as diagnostic of the Terminal Classic and Early Postclassic. A heavy density of lithics was recovered from Zone 1 of Square D with an assemblage that appears to represent every stage of tool production. Similar high densities of lithic material also were noted by Morandi and Thomas (2001) for Structures 401 and 437, located nearby in Plaza A. The data indicate the presence of a local chert source proximate to the site which was mined in antiquity, but the source presently is unidentified. An obsidian blade fragment and two pieces of groundstone were also collected. Notably, a piece of coral and two fragments of unworked marine shell were also found, adding to the significant marine assemblage found throughout Zones 1 and 2. A high density of animal bone, namely mammal and fish bone, were collected. Like Square B, the off-mound area to the east of the structure at the bottom of Zone 1 represents a combination of collapse debris and the surface of the midden-like material that overlies the plaza floor surface and was packed against the side of the structure and surrounding the two stelae. The latest deposits from Square D lend further support to a Terminal Classic or Early Postclassic date for the final construction phase.

Zone 2

Zone 2 comprises the collapse debris and midden-like fill found along the exterior of the structure, therefore Square C which is located entirely on-mound was not excavated as part of Zone 2. The debris underlies the Zone 1 topsoil in Squares A, B, and D and the matrix in this zone appears to represent a combination of collapse debris and a midden-rich deposit overlying the plaza floor surface. Zone 2 yielded the highest density of artifacts excavated from any zone in Operation 24. The Zone 2 debris, consisting of a light density of small stones and a high density of artifacts, was found heaped against the eastern side of Structure 402 and surrounded the two plain stelae that stand just to the east of the structure within the plaza. As noted, the midden debris may have been purposefully placed in and around the stelae in an effort to secure and support the two monuments. Due to the limits of the excavation, the north-south extent of the midden heap could not be defined, but appears localized around the perimeter of Structure 204 for the debris clearly slopes downward to the east and tapers out toward the eastern edge of the operation. The Zone 2 debris also contains a number of larger, cut stones, which suggests that at least a portion of Zone 2 represents collapse debris from Structure 402. Unlike the underlying plaza floor, the midden fill excavated in Zone 2 does not resemble any kind of formally prepared surface.

At the base of Zone 2 a well-preserved rounded facing wall was exposed in Squares A, B, and D. Most of the wall comprised a two-course high wall, but in some places three and four courses were preserved suggesting that the original height of the wall was at least that high in antiquity. It also became clear at the base of Zone 2 that the two stelae were positioned in shallow pits and small to medium sized limestone cobbles were placed around their bases, presumably to reinforce their upright position. The shallow
positioning of the monolithic stone monuments has caused the large stones to shift slightly, one forward and
the other backward (Figure 16.3). The two stelae pits cut into the plaza surface only slightly and the stones
positioned around the bases of the stelae protrude above the level of the floor. The majority of the stones
were left in position during the excavation process for the sake of stability.

The evidence suggests that the two stelae are perhaps coeval with the phase 2 architecture, but
certainly post-date the final plaza surface, indicating the monuments were a late addition to the plaza group.
Stelae erected during the Late Classic period are typically found to penetrate quite deeply under the plaza
surface so as to stabilize the monument. Symbolically, the stelae or stone trees were considered to be planted
in the earth (Freidel and Schele 1988; Stuart 1996). The lack of a prepared surface associated with the two
stelae and the shallowness of the stelae pits at the Oshon Site suggest that the monuments were brought from
somewhere else and perhaps reused and, in essence, re-dedicated within this ritual context. The lack of
formal preparation speaks of a later date, perhaps coinciding with the Early Postclassic period. The evidence
suggests that this particular locale held a ceremonial importance through the final occupation phase and
further analysis may show periodic visitations following the abandonment of the site.

Zone 2 in Square A yielded a high density of artifacts, including animal bone, ceramics and lithic
material. One chipped stone tool fragment, as well as a groundstone tool fragment and five pieces of
obsidian were recovered. As noted above, Square A also yielded a high concentration of marine shell,
mostly whole and a few fragmentary conch, primarily found along the exterior of the structure in Square A,
although some were also identified in Square B (see below). The marine shell debris was found in the
collapse and midden-rich fill that surrounded the exterior of the structure. The high density of marine shell,
brung down river from the coast, appear to have been prized goods, even among the Maya of the Oshon
site who were only slightly inland from the sea. In the context of the all-stone circular structure, the high
concentrations of conch suggest a ritual significance, possibly representative of a ceremonial offering or a
ritual feasting event. As proposed above and discussed in greater detail below, the marine shell may have
been placed on and around Structure 402 as a means of further identifying this structure’s special function
within the community, perhaps as a shrine dedicated to the deity Quetzalcoatl. As the marine shell bead
from Zone 1 attests, shell was also fashioned into personal adornment that may have signified an elite status,
if finds are found to be restricted to the site core. Another notable find from Square A was a fragment of a
limestone bark beater, adjacent to the northern edge of the circular Structure. To the extent of this author’s
knowledge, this is the first bark beater found in the Sibun Valley and may represent a limited paper-making
industry within the region that was maintained through Terminal Classic and Early Postclassic times.
However, the fragmentary state of the bark beater and its placement within the midden deposit suggests a
secondary context and dating of its actual use is problematic in this case. Nonetheless, the artifact introduces
the possibility that paper books or codices painted by literate scribes, known to be produced from Classic to
early Post-conquest times, were also produced in this region.

Like Square A, Zone 2 in Square B contains the terminal occupation debris directly below the Zone
1 humic layer and directly above the plaza floor. Throughout Operation 24, Zone 2 appears to have yielded
an even heavier density of artifacts than Zone 1, including ceramics, lithics, animal bone, eight pieces of
obsidian, and a piece of human bone. Notably, fragments of ladle censers, ceramic appliqued elements, and
marine shell were found, further suggesting this area was an important ritual locale until the site’s terminal
occupation. As noted above, the excavation of Zone 2 in Square B revealed a collection of limestone
cobbles surrounding the base of Stela 1, positioned within the plaza floor in a very shallow pit. The plaza
floor is considerably deteriorated and remnants of a plaster surface surround only the first 20-25cm of floor
surface around the perimeter of the exterior facing wall of Structure 402, where presumably collapse debris
protected the surface from erosion over the years. A soil sample was taken of the deteriorated mortar and
plaster debris that was associated with the northeastern side of Structure 402, which also was exposed at the
base of Zone 2.
In Square D, a similar combined collapse and midden-filled matrix was excavated as Zone 2. At the base of the zone, more of the exterior wall was exposed and an associated plaza floor, albeit considerably deteriorated, was defined in this area. Similar to Square B, the excavation of Zone 2 in Square D revealed a collection of limestone cobbles surrounding the base of Stela 2, positioned within the plaza floor in a very shallow pit. Like Squares A and B, a high density of ceramic sherds, animal bone, and lithics were recovered from the collapse and midden debris. Notably, at least five fragments of chipped tools were identified within the lithic assemblage. In addition, ten pieces of obsidian and more unworked marine shell were found within the zone.

Zone 3

Zone 3 comprised the tumble that covered the platform surface, the final architectural phase of Structure 402. At the base of Zone 3, lines of small cut stone blocks were noted on the surface of Structure 402. Although poor preservation limited an accurate reconstruction, traces of a platform construction containing at least two terraces could be discerned (refer to Figures 13.3 and 13.5). The general surface topography suggested that there was both an upper and lower terrace retained by remnant small, stacked cut stones that formed a two-tiered, circular platform structure. There appears to have originally been as many as four courses of stones making up the exterior circular retaining wall, however, the third and fourth courses were not well preserved. This wall (originally built during the Phase 1b construction episode) functioned as the exterior wall for the lower terrace surface, which was built up slightly with the addition of small stacked stones during Phase 2. The lower terrace interfaces another retaining wall, which steps up at least one course to an upper terrace surface. This upper retaining wall was also built of lines of small stacked stones, but both the wall and terrace surface are considerably deteriorated. At the base of Zone 3, Square A revealed the northeastern quadrant of the lower terrace, Squares B and D defined portions of the eastern side of the lower terrace, while traces of the upper terrace were strictly found in Square C (Figure 16.3).

Excavation of Zone 3 involved the removal of collapse debris in an effort to define these two deteriorated terrace surfaces that were primarily located in Square C. The poor preservation and total lack of a prepared surface, such as plaster or packed earth, made it difficult to discern the collapse from the construction fill of the platform (ultimately removed as Zone 9, see below). Therefore, while the majority of artifacts retrieved from Zone 3 represent surface remains from the terminal occupation of the platform, some of the artifacts may reflect debris included within the construction fill of the platform. Both contexts, however, yielded only a light density of artifacts (for a full description of artifacts recovered from the fill of the phase 2 platform see Zone 9). Throughout all squares, artifact density dropped off significantly in Zone 3, likely due in part to the shallowness of the zone (roughly 10cm in depth) compared with the deeper levels excavated in Zones 1 and 2. In addition, the lower artifact densities may indicate the relative paucity of on-mound debris at the time of abandonment or that post-depositional processes, such as flooding and run-off, caused debris to transmigrate to the lower areas around the perimeter of the structure.

Zone 3 in Square A entailed the clearing of collapse debris off the northeastern end of the circular platform structure to expose the lower terrace of the Phase 2 structure in this area. Only a light density of artifacts were recovered, including ceramics, lithic material, and animal bone. No obsidian or chipped stone tools were identified and heavily eroded sherds were noted, which suggest the surface of the platform structure was exposed to the elements for a considerable amount of time. Notably, a stone which may possibly be a speleothem was found during the excavation of Zone 3 in Square A, perhaps incorporated as part of the architectural construction. Cave formations were found incorporated into another circular stone structure at Pechtun Ha, a site located in the middle reaches of the Sibun River Valley that was documented during the 1999 field season (see Harrison and Acone 2001). The possible significance of speleothem use in circular architecture is discussed in a final section of this chapter (see below).

Only a small portion of the eastern edge of the exterior facing wall of Structure 402 was exposed in Square B. This small area of the lower circular platform surface (an area measuring roughly 50cm-x-50cm)
was exposed in the southwestern corner of the square and excavations yielded an extremely light density of artifacts (n=2 pieces of chert debitage). The section of wall exposed in Square D was beautifully preserved, presenting four courses of stone on its exterior facing.

The majority of the platform exposed in Operation 24 existed in Square C, therefore, Zone 3 covered the entirety of this square and artifact density was somewhat higher than Zone 3 in Squares A, B, and D. Excavations entailed clearing down the collapse debris on the surface of the lower and upper terraces exposed in Square C. The density of artifacts were still relatively light and included a small amount of ceramic sherds, lithic material, unworked shell, and animal bone, as well as one fragment of groundstone. Two fragmentary pieces of stone, possibly speleothems, were also collected for further study. Notably, excavations uncovered one piece of worked limestone. The piece of limestone is a small square block, about 8 x 8 cm, with incised horizontal and vertical lines. Initially, it was theorized that the piece was a fragment of a utilitarian object, such as a barkbeater, or part of a game board. Although the incised lines on this piece do not have the characteristic markings of either, Elizabeth Graham (1985) has found a number of *Patolli* board fragments from several sites in the adjacent Stann Creek Valley, specifically from the Mayflower group, and indicates that they date to the Terminal Classic and Early Postclassic periods. Alternatively, the piece may be part of a sculptural element. The design resembles elements of the carved limestone turtle sculptures from Postclassic Mayapan, specifically their stylized carapaces with the horizontal and vertical lines. Interpretations, however, remain speculative until further comparative analysis is performed.

In Square D, Zone 3 entailed clearing the collapse debris from the surrounding eastern edge of the lower terrace surface of Structure 402. Overall, artifact densities were light, and although animal bone was noted throughout Zones 1-3, none was recovered from Zone 3 in Square D. Excavations revealed a nicely preserved three course-high wall in this area. The wall in the southern end of Square D was the only area of the wall that appeared to be collapsed, exactly where the central axis of the platform structure was located. Further excavation in this locale revealed an earlier construction phase which included a small doorway positioned where the small section of collapse was found in Square D (see Zone 5, Square D below).

**Zone 4**

Zone 4 consists of the remains of the plaza floor to the east of Structure 402, which was only selectively excavated in Square D in order to test the construction fill of the plaza floor surrounding Stela 2. All of the plaza floor area in Square D, with the exception of a small portion of the floor in the southwest corner of Square D (see Zone 7 below) and an area around the stela (roughly 120 x 120 cm), was excavated roughly 20 cm in depth. The section of the plaza floor surrounding Stela 2 was left intact for the sake of stabilizing the large monolithic stone that was submerged beneath the ground surface by less than 15 cm. The goal of excavating through the floor construction was to gather diagnostic ceramics with the hopes of dating the initial construction of the plaza floor. Furthermore, excavations were aimed at revealing any earlier construction sequences associated with Structure 402. Excavations ultimately showed that only a single plaza floor was built within this area of the plaza group and the fill of the floor was constructed of a clay-filled matrix, presumed to be a modified natural earthen layer. The survey conducted during the 1999 field season (see Morandi and Norris 2001) noted that Plaza A was positioned at a slightly higher elevation than Group B. The 2001 field excavations revealed that this area of the site appears to be situated on a natural rise that was presumably modified somewhat with the initial construction of the site (see Zone 6 below).

Cross-section drawings show that the Zone 4 plaza floor construction is roughly 15-20 cm thick, including the minimal remains of plaster surface and thick construction fill. The fill overlays the natural clay-filled earthen layer and consists of small to medium-sized limestone inclusions that created a relatively level surface. The fill was then covered with a layer of plaster that has almost entirely deteriorated, with the exception of 20-25 cm perimeter around the exterior facing wall of Structure 402. While the fill of the plaza floor yielded a relatively high density of lithic debris and at least two obsidian blade fragments, very few sherds were recovered. Fortunately, a number of large, potentially diagnostic pieces of ceramics were found.
in a relatively localized area to the east of Structure 402 (Square D), around the central axis of the building directly in front of the doorway. It is possible that these sherds represent the remains of a dedicatory cache. Future analysis of the ceramics will determine whether they are wholly or partially reconstructable. A preliminary analysis of the pieces suggests that they are largely fragmentary, possibly representing less than half of a single vessel, although the southern limit of the excavation unit may have cut off a portion of this deposit and the remaining fragments may lie further to the south. Nevertheless, the sherds may provide a date for the initial construction of the plaza group. Additionally, a sizable charcoal sample was recovered from the modified earthen layer (Zone 6), sealed beneath the floor construction, and may help to determine a more exact date for the initial construction.

Zone 5

Zone 5 consists of the removal of the entire retaining wall and construction fill of the Phase 1b exterior wall of Structure 402 that was defined in Square A at the base of Zone 2. In addition, a roughly 1 x 1 m area in the vicinity of the Phase 1b wall was removed in the southern end of Square D as part of Zone 5. Due to the state of collapse noted in both areas, these two portions of the Phase 1b wall were chosen for probing in an effort to expose any earlier construction episode(s). The excavation of Zone 5 in both squares revealed an earlier construction phase (1a), and shed light on the building techniques employed for Phase 1b, which involved the addition of about 40 cm of interior cobble and gravel fill sealed with an outer wall of finely cut stones. The new construction episode (Phase 1b) echoed the same circular shape of the earlier building. Construction effectively expanded the exterior walls of the structure outward by about a meter in diameter, but did not alter the overall dimensions of the interior room and maintained the central doorway that was exposed at the base of Zone 5 in Square D.

Excavations of Zone 5 in Square A revealed that the Phase 1b wall was constructed of finely cut masonry stones which retained tightly packed cobble construction fill. The Phase 1b masonry wall and associated construction fill measured about 50 cm in thickness. Behind this later construction another finely built wall was defined and identified as part of the initial Phase 1a construction episode. As noted above, the later Phase 1b wall mimics the circular shape of the earlier structure, and utilizes the first course of stone offered by the low plinth that circled the perimeter of the Phase 1a structure. Zone 5 in Square A appeared to be a combination of collapsed wall debris and in situ wall construction laid down during the Phase 1b construction episode. In much of the Phase 1b wall fill, the matrix of the construction fill was densely packed with limestone cobble and gravel fill and the gravel seemed to act almost as mortar, holding the larger cobbles together. Both the earlier and later walls are relatively intact, however, a small portion of both appears partially collapsed at the same location in Square A. This gap, noted for both walls is about a meter wide and was initially thought to represent another doorway or entrance into the interior of the structure associated with both Phases 1a and 1b. Upon further excavation, however, a substantial portion of the inner construction fill and interior facing wall of the Phase 1a wall was found intact further to the south (see Zone 8 below), measuring about a meter in total width. This discovery ruled out this notion of a second entryway (Figure 16.1). Thus far, excavations at Structure 402 have revealed only one location for entering the room of Structure 402. It is located along the central axis of the structure as is defined in Zone 5 of Square D. Artifact density in Square A was relatively light and included ceramics, animal bone, and lithic material, as well as one identifiable chipped stone tool fragment, and, notably, another 14 pieces of unworked marine shell from the vicinity of the collapse where it was likely associated with the concentration found in the same area along the exterior of the structure in Square A.

Unlike Square A, Zone 5 in Square D appeared to consist entirely of collapse debris. Excavation exposed the plaza surface running through a central doorway opening into the interior room of Structure 402. The cross-section of the northern side of the doorway, exposed at the base of Zone 5 in Square D, clearly defines the initial Phase 1a construction and the later addition of the Phase 1b outer wall and flagstone flooring in the interior room of Structure 402. Zone 7, located directly below Zone 5, confirmed that no earlier construction phases for Structure 402 existed below the plaza surface. Excavations of Zone 5, a roughly 1 x
A 1 m area in Square D revealed about half of the central doorway opening, the remainder was cut off by the southern wall of the excavation unit. A relatively high density of artifacts, including ceramics, lithic material, animal bone, and unworked marine shell were found within the collapse debris, which consisted of a number of cut limestone blocks and a mixture of cobble and gravel material. Due to the position of the zone in the entranceway of the building, material probably represents artifacts from a mixture of contexts, primarily from the terminal occupation debris within the interior room and the midden-like material overlying the floor of the plaza.

The entranceway to the interior room was left open during Phases 1a and 1b and if a later wall was constructed for the building of the Phase 2 platform, no clear signs of the construction remained. Presumably, when the interior room was filled during Phase 2, a central doorway was no longer needed. It is possible that the structural integrity of this modification was weaker than the earlier construction phases, which would be commensurate with the overall declining construction technique evident at this time, and perhaps the wall covering the door gave way following the abandonment of the structure. Alternatively, perhaps an exterior Phase 2 wall covering the doorway was purposefully removed by ancient looters following the abandonment of the site. Evidence uncovered inside the interior of the room may support this hypothesis. Disturbance of the Zone 9 Phase 2 construction fill and underlying Phase 1b flagstone flooring (Zone 10) was noted during excavation of the southern end of the unit in Square C, directly in the line of the entranceway. While the lack of homogeneity in the Zone 9 fill made the disturbance difficult to discern, the large portion of the flagstone flooring right at the entranceway into the room was clearly purposefully removed. Initially, the partial dismantling of the flooring was assumed to have occurred during the Phase 2 infilling process, but the selective stone removal from the area only in the vicinity of the entranceway suggests that the missing stone masonry and disturbance in the fill may be related to an ancient post-abandonment activity. Furthermore, the presence of a high density of artifacts in the small 1 x 1 m zone in Square D, compared to the relative paucity noted for Zone 5 in Square A, lends support to the notion that the doorway was left unsealed, allowing for the terminal debris to infiltrate this area. Until further excavation is undertaken, the above theory remains purely speculative. Nonetheless, excavations of Zone 5 in both squares proved crucial for confirming the three structural modifications (Phases 1a, 1b, and 2), reviewed at the beginning of the chapter.

Zone 6

Zone 6, restricted to Square D, consists of an earthen layer of compact, clayey sediment with little to no inclusions that is likely a natural deposit underlying the plaza surface. This matrix appears to part of a natural rise that was modified somewhat to allow for the building of Plaza Group A. It lies directly below the plaza floor (Zone 4), which contains a layer of gravel-filled construction fill topped with a plaster surface. The size of Zone 6 mirrors the layout of Zone 4 in Square D, comprising the entire square with the exception of a 1.20 x 1.20 m area around Stela 2, which was left intact for the sake of stability, and a small area of the plaza floor and earthen layer in the southwest corner of the square which was excavated as Zone 7. Square D presented an area of the plaza surface that could further elucidate the association between the construction phases of Structure 402 and the surrounding plaza surface. Stela 2, positioned in Square D, was submerged about 10 cm into the plaza floor and does not appear to protrude into the Zone 6 earthen layer that lies about 20 cm below the plaza surface. The plaza floor construction and the Zone 6 earthen layer both run underneath Structure 402 and clearly pre-date the building. The light density of artifacts found embedded in this earthen surface suggests that the area was occupied for some time prior to the formal construction of a plaza surface and the building of Structure 402. No further excavation was performed below this area in Square D. Notably, a piece of obsidian and a chipped stone tool were recovered, along with a charcoal sample which may provide a more exact date regarding the initial occupation and construction of Plaza Group A at the Oshon site.

Zone 7

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Zone 7 also was restricted to Square D, and is an area measuring about 80 cm (east-west) x 100 cm (north-south). The zone consists of a small portion of the plaza construction and some of the underlying earthen layer (equivalent to Zones 4 and 6) that is directly below the Zone 5 collapse debris of the Phase 1b wall. Positioned in the southwest corner of Square D where a portion of the central doorway of Structure 402 is found, Zone 7 consists of the gravel fill of the plaza floor and some of the modified earthen layer that underlies the floor construction. Unlike Zone 4, artifact density is relatively high considering the small size of the zone. The goal of the excavation of Zone 7 was to better understand the construction sequence of the plaza and associated construction phases of Structure 402. Excavation reinforced the notion that the plaza surface ran underneath the building and acted as an initial floor surface for the interior room during Phase 1a, which was later covered over by about 20 cm of fill and capped with large flagstones during Phase 1b. The cross-section in Figure 16.3 best illustrated these two construction episodes. No earlier construction was found beneath this single floor surface and, therefore, the circular structure post-dates its construction.

Zone 8

Zone 8, excavated within Squares A and C, consists of the cobble-filled construction core within the center of the Phase 1a wall. The probe into the central core construction was restricted to the area that appeared to be partially collapsed, a one meter wide gap in the Phase 1a wall that was noted at the base of Zone 5 in Square A. The matrix of the fill was semi-compact overall and contained a high density of tightly packed limestone cobbles ranging from 10-20 cm in size. In Square A, the construction fill contained very few artifacts and consisted mostly of limestone gravel and cobbles. The fill of the wall is consistent throughout both Squares A and C in terms of texture, color and size of inclusions. At the base of Zone 8 in Square C, several large flagstones were noted underneath the fill, serving perhaps as the base of construction on which the Phase 1a wall was initially built. They are roughly the same elevation as the exterior plinth and interior flagstone flooring. Initially, the stones were thought to represent an earlier construction phase associated with the plinth, which would have comprised simply a one course 20 cm high and 1.5 m thick wall on which a perishable structure would have been placed. However, the presence of flagstones running underneath the core construction fill of the Phase 1a wall is inconsistent throughout the zone, and suggests that they functioned as part of a bin construction for the base of the wall and do not actually represent an earlier phase of construction. The Zone 8 probe stopped at the same level of the flagstone plinth that runs around the exterior of the Phase 1a building. A light density of artifacts were recovered in the fill of the wall in Square C, and only a slightly higher density were noted in Square A.

Zone 9

The infilling of the interior room of Structure 402 during the final Phase 2 construction episode was the matrix excavated as Zone 9. The fill inside the room, excavated in Squares A and C, contains a high density of root disturbance, especially in Square A due to the large Corrozo Palm that stands adjacent to the unit. In addition to roots, the matrix contains a high density of limestone gravel and cobbles that varies in size from 80 cm to 7.5 cm. The sediment surrounding the inclusions is a relatively loose silt. The artifact density in Square C is very light, only one piece of obsidian and a botanical sample (which may be associated with the modern intrusive Corrozo Palm) were collected from the fill that was removed. In Square A, artifact density increased slightly, and included at least ten animal bone fragments, a piece of groundstone, one obsidian blade fragment, eight unworked shell fragments, and three botanical samples (also likely associated with the modern intrusive Corrozo Palm).

This final phase of construction involved the positioning of large, upright limestone slabs against the interior wall of the room; large stone slabs also were stacked upright against one another. A number of these long, pointed stones were evident prior to excavation, protruding roughly 5-10 cm above the ground surface. Either no prepared surface was laid down on the upper platform terrace during the Phase 2 construction or a considerable amount of sediment that comprised the surface had washed away following the abandonment of the structure. The long stones were around 20 cm thick and a meter in length and rested directly on the disturbed remains of an elevated floor surface constructed of flagstones during the Phase 1b construction.
The Zone 9 fill is topped with several lines of stone (described earlier in Zone 3 of Square C), which may represent multiple terraces. Together, the Phase 2 construction effectively raised the overall elevation of the structure only slightly and transformed the building into a solid, multi-tiered circular platform, possibly with a perishable structure mounted on top.

The Phase 2 construction is problematic for several reasons. As noted earlier, the doorway that existed during construction Phases 1a and 1b, does not appear to have been properly filled in and walled off. Presumably, if the structure was transformed into a platform structure, a central doorway would no longer be necessary. Theories that possibly explain this lack of construction over the doorway are proposed above (see Zone 7, Square D). By the time the interior was in-filled, construction techniques appear to have changed considerably. The fill does not contain tightly packed stones of a consistent size like the fill defined in Phases 1a and 1b, rather, the construction materials are somewhat haphazardly thrown together and appear to be recycled materials perhaps robbed from another area of the site. The fill seems to be the result of an expedient in-filling process, rather than a thorough and careful construction procedure. While at least one upper terrace surface appears to have been constructed, it is extremely deteriorated, mainly due to large tree disturbance, and it is therefore difficult to reconstruct. Overall, the quality of construction seems considerably diminished in comparison to its precursors. Other evidence suggesting expedience over quality workmanship is reflected in the shallow placement of the two plain stelae to the east of Structure 402. While clearly associated with Structure 402, this dedicatory act appears to have been a late addition that has very little sense of permanence, and perhaps corresponds temporally to the final Phase 2 structural changes that considerably altered the associated architecture. Judging from this drop in construction quality, the Oshon site (or at least a portion of it) appears to have undergone some degree of collapse, perhaps a reflection of a significant weakening in the overall organization of the community and a gradual collapse in the governance of public affairs.

Zone 10

Zone 10 consists of a layer of construction fill lying below Zone 9, which was markedly different than the Phase 2 fill. The fill was associated with the flagstone floor surface that was built during the Phase 1b construction episode. Only the southern portion of the exposed interior flooring was removed, where the majority of flagstones were already missing. It is possible that the flagstones were purposefully removed during the in-filling of the building and reused either as part of the Zone 9 fill or for another secondary use. Alternatively, as noted above, the stones may have been removed during a later disturbance that occurred post-abandonment (see Zone 7 above). The flagstone flooring found intact in the northern portion of the exposed interior room were left in situ during excavation (see a drawing of their cross-section and the underlying fill of Zone 10 in Figure 16.4). About 20 cm of the associated underlying fill was excavated in Zone 10. The subfloor fill consists of mostly gravel-size limestone inclusions as opposed to the boulder-size rocks that made up the bulk of the interior room fill of Zone 9. This 20 cm-thick subfloor fill was laid directly over the remains of the plaza floor, which appears to run underneath Structure 402. The subfloor fill and flagstones cover the entire first course and portions of the second course of stones that comprise the interior facing wall of the room. The finely cut facing of these first two courses suggest that they were originally exposed in the initial construction phase of Structure 402 (Phase 1a), with the plaza floor serving as the initial floor for the interior room. Interestingly, the disturbed portion of the Zone 10 floor in the southern section of Square C contained a high density of chert ranging in size from 5-15 cm and an area of semi-compact reddish clay, possibly a burned area, which is suggestive of a possible termination event in this locale. The feature appears to extend beyond the excavation, further to the south and west of the unit. Future excavations may expand this area of excavation to reveal the full extent of the anomalous feature.
Discussion

The investigation of Operation 24 uncovered a portion of a circular structure that undoubtedly held religious significance within this ancient community perhaps for the duration of site occupation. Associated ritual deposits, such as the hollow handled ladle censors, appliqued pieces, and what appear to be spiked incensario fragments found associated with Structure 402 suggest a Terminal Classic (AD 800-1000) date for the final occupation of this structure. Circular structures similar to this type also appear to date solidly to the Terminal Classic in other parts of the Maya area. While future excavations may reveal a Late Classic component at the Oshon site, no other circular structure in the lowlands pre-dates the Terminal Classic, casting doubt on the assignment of an earlier date to even the first phase of Structure 402. Below, comparisons with other circular constructions found in different areas of the Maya lowlands are discussed in an effort to trace this pervasive Terminal Classic pattern. The chronological terminology for the Classic-Postclassic transition remains a hotly contested issue and, as Bey and his colleagues (1997) note, the use of a pan-lowland terminology may not be appropriate. Patterns of building activity and decline from the northern lowlands and the chronology attached to these changes (spanning AD 800-1100), however, may be potentially applicable to sites, such as Oshon, in the southern lowlands. A review of the chronology associated with findings in northern Yucatán (Bey et al. 1997; Ringle et al. 1998) presented below offers a chronology that is potentially useful in understanding the Terminal Classic building phases and subsequent decline at the Oshon site. Following a review of the chronology, the special significance of circular architecture and its possible links to religious themes centered on the worship of the god Quetzalcoatl are discussed. The data suggest a strong connection with northern lowland sites such as Chichén Itzá during this time.

Large temples of circular form often are interpreted as “a non-Classic Maya architectural form introduced at Chichén Itzá (e.g., the Caracol)” (Kowalski et al. 1996: 281) and the presence of this form in the southern lowlands often presumes a northern interaction. Examples of circular structures have been reported from numerous sites throughout the Maya area (Pollock 1936), including Uxmal (Kowalewski et al. 1996), Becan (Harrison 1979), and San Gervasio on Cozumel (Freidel and Sabloff 1984) in the northern lowlands and Nohmul (Chase and Chase 1982), San Juan (Guderjan 1995; Guderjan et al. 1989), and Seibal (Smith 1982; Sabloff 1973) in the southern lowlands. Recent finds from settlements in the Sibun Valley contribute to this ever-growing Terminal Classic architectural pattern. In addition to Structure 402 from the Oshon site, a two-tiered all-stone circular structure (Structure 100) was also found at Pechtun Ha (see Harrison and Acone 2001), a site located within the middle reaches of the Sibun River Valley. Another unexcavated structure at Obispo, a site located less than 5km from the Oshon site, may also represent an example of circular architecture and similar data, including ladle handle and spiked censers, recovered during excavations in the 2001 field season (see Morandi, Chapter 15) suggest an active Terminal Classic occupation at this nearby site as well. Together, the architectural data on circular structures appears to represent a broad spatial pattern occurring throughout the lowlands that functions as a solid Terminal Classic marker and may indicate a strong northern presence in the southern lowlands during this time.

Numerous comparisons can be drawn between other round structures found in the Maya lowlands and Structure 402 from the Oshon site. A circular structure from Nohmul, Structure 9, and Structure 402 are strikingly similar in form. Although significantly larger in diameter, Structure 9 (see Chase and Chase 1982: Figure 2) contains a substructure with a 40 cm high and 10 cm deep plinth surrounding the perimeter of the structure, comparable to the exterior design of Structure 402 during Phase 1a. Like Structure 402, the superstructures of both Structure 9 and a round structure from Uxmal (see Kowalski et al. 1996: Figures 1, 2, and 3) contained exterior walls constructed of squared “veneer” type facing stones that were roughly three to four courses high with a central doorway into a large circular room. All of these circular buildings appear to have been covered with a wattle and daub perishable structure. Although Structure 402 does not contain a substantial substructure or central staircase like the others, these differences are likely reflective of differential site size; Nohmul and Uxmal represent major ceremonial centers while the Oshon site represents
a minor one. The upper exterior course on the outer wall of both Structure 402 and the Uxmal circular structure may have been capped by a projecting, beveled cornice, although this remains more speculative for Structure 402 due to the limited preservation of the upper (fourth) course of stone.

The two-tiered platform of Structure 3 from San Jan (see Guderjan 1995: Figure 3), a site located on Ambergris Caye along the northern coast of Belize, is comparable to both the size and platform configuration found on Structure 402 in its final Phase 2 construction. As a two-tiered platform, the lower terrace of Structure 3 measured 9.2 m and the upper terrace measured 6.2 m, dimensions that are closely comparable to the overall size of Structure 402. The size and two-tiered terrace configuration also share a strong resemblance to the circular platform structure found at Pechtun Ha (see Harrison and Acone 2001). The Nohmul, Uxmal, and San Juan circular structures, as well as the earliest phase of the Caracol at Chichén Itzá all appear to date to the Terminal Classic. The structural similarities, combined with the diagnostic ceramic material found associated with Structure 402, strongly suggest that the round structure at the Oshon site even in its earliest Phase 1a form does not predate the Terminal Classic. The data compared with artifactual and architectural evidence from Obispo and Pechtun Ha suggest that a substantial Terminal Classic occupation may have existed at these sites as well.

In some instances, round structures are believed to have functioned as administrative buildings, specifically for the conduct of trade (Chase and Chase 1982), in other instances the circular structures are interpreted as both administrative and residential in function (Guderjan 1995), and still others suggest their emphasis was focused on ritual and that they may have served as shrine structures (Ringle et al. 1998). In all cases, however, the structures are associated with the elite sector of society. Arguably, the function of circular structures in all areas of the lowlands may not have remained static, but changed as political, economic, and religious transformations took place throughout the lowlands during the Terminal Classic and Early Postclassic periods (AD 800-1100). Bey et al. (1997: 250) argue that changes in architecture and in the use of space were the result of a variety of sociocultural transformations that took place throughout many centers during the Terminal Classic and indicate that “the canons covering the traditional use of space were breaking down” during this time. Areas of a site that were once used strictly for administrative or religious purposes were sometimes later transformed into a residential space and therefore a mixture of ritual and utilitarian deposits should be expected. The accumulation of midden debris around the outside of Structure 402, for instance, exhibits a mixture of ritual material and utilitarian debris such as groundstone tools and suggests a marked decline in the upkeep of the area. The evidence indicates that the traditional use of space was breaking down at the Oshon site by the final episode of occupation. At this time, the area seems to have been used differently, incorporating both ritual and residential activities in a space once strictly assigned to the former. Such data reflect the complexity of the decline following the Classic period and suggest that the abandonment of southern lowland sites was a gradual process of depopulation and reorganization.

The transitional boundary, typically referred to as the Classic-Postclassic transition, is poorly understood and remains debated among scholars studying different areas throughout the lowlands. Ceramic and occupational evidence from southern lowland sites such as Lamanai (Pendergast 1981, 1986), Laguna de On (Masson 1997), San Juan (Guderjan and Garber 1995), and sites in the Stann Creek Valley (Graham 1985) represent continuity across this blurred boundary and indicate the need for a clearer definition of the time period between AD 800-1100. Further investigation of the data from these sites, as well as the Oshon site and others in the Sibun Valley which span this tumultuous period of time, are slowly bringing this transitional period into greater focus.

Bey et al. (1997) present data from northern Yucatan that may be potentially applicable to the changes taking place at southern lowlands sites during this time. The authors attempt to clarify the Classic-Postclassic transition in their descriptions of building patterns at Ek Balam in Yucatan, which they argue reflect no strong transitional indicator in the ceramic spheres at the end of the Terminal Classic (the Cehpech sphere continues relatively uninterrupted from as early as AD 800 until AD 1100). They argue that the
decline in the quality of construction techniques characterizes the beginning of the Terminal Classic, which they suggest began around AD 925 and lasted until about AD 1100 in the northern lowlands. Typically, this time period is associated with the Early Postclassic in the southern lowlands (Chase and Rice 1986), along with the previous century, and the Terminal Classic is left unmentioned or undefined as a time period. While a pan-lowland terminology may not be applicable, patterns of occupational resurgence during AD 800-925 are apparent in the northern lowlands and need to be reassessed in the southern lowlands, where previous evidence of only scattered finds in this area has traditionally defined the resurgence following the Classic period collapse as a minimal occupation at best. Seibal is the best documented example of a major center that seemingly flourished during AD 800-925, but others are now coming to the surface, including Nohmul, Caracol, Xunantunich, Altar de Sacrificios, and Tikal, among others. While the scale of these sites diminishes significantly in comparison to their earlier Classic counterparts, the evidence of occupation should not go unnoticed. An accumulation of finds from smaller settlements, especially along the coast of Belize, also make up a large portion of the Terminal Classic occupation in the southern Maya lowlands. More recent finds from the Stann Creek (Graham 1985 and 1987) and Sibun Valleys are now offering more information on inland settlements within Belize during this time.

According to Bey et al. (1997), from AD 925 to 1100 many northern sites witnessed a cessation of new building projects with the only construction during this “postmonumental” phase involving reused stones from earlier structures. This pattern of decline may also apply to sites in the southern lowlands, such as Oshon where the final phase of Structure 402 appears diminished in scale and effort and may suggest a temporal relationship with the north, perhaps beginning, as they suggest, around AD 925. As noted above, the infilling of the interior room of Structure 402 appears rushed and lacks the building quality apparent in earlier stages of construction. The building materials for the exterior of the new multi-terraced platform are limited to small cut stones that appear to be recycled, similar to the patterns noted for Ek Balam and other northern sites.

While details of the chronology still need to be ironed out, preliminary evidence from the Sibun lends support to a model presented by Ringle and others (1998) that describes the introduction of a new religious organization in the Maya lowlands during the Terminal Classic period (AD 800-1000). Overall, the data from Oshon, Obispo, and Pechtun Ha strongly suggest that this new religious order, which centered on the worship of the god Quetzalcoatl, infiltrated the southern lowland area and likely spread from major centers in the north, stemming perhaps from the Terminal Classic superpower of Chichén Itzá. The introduction of circular architecture and a new assemblage of diagnostic ceremonial paraphernalia, including hollow-handled ladle censers, appliqued ceramics, and spiked incensarios, found in and around Structure 402 shed light on the changing ritual behavior taking place in the lowlands during the Terminal Classic period. These diagnostic ceramics are described by Ringle and his colleagues (1998) as signature wares of the so-called “International Style” of the Epiclassic, a span of time dating to AD 750-900 when much of Mesoamerica witnessed profound changes following the collapse of Teotihuacan, Monte Albán and many of the Classic Maya city centers. The data from Oshon suggest that this site stood strong during the Epiclassic transition, perhaps due to their active assimilation of a foreign religious ideology. While the finds from Oshon, including new forms of architecture associated with ritual deposits of speleothems, conch shell and censer fragments offer insight into new religious themes introduced during this time, the data also reflect strong continuity of cultural tradition among the Epiclassic Maya.

The use of speleothems at both Pechtun Ha and Oshon emphasized the continued importance of caves, home to the ancestors and sources of water and fertility, for the Maya. These themes of water and fertility that were played out in association with circular architecture offer insight into a religious ideology that appears to have become a focus of ritual behavior during the Terminal Classic period. Importantly, water and fertility, as well as circular architecture, are themes associated with the Feathered Serpent, briefly discussed in the beginning of this chapter. Postclassic depictions found in the Mixtec Codex Nuttall, which likely root in the Epiclassic, emphasize the importance of ancestor worship as part of cave ritual, a persistent
facet of Mesoamerican religion. The Postclassic documents also indicate the prominent role of the Feathered Serpent in the context of ancestor rituals and the deity’s direct association with circular architecture. On the bottom of page 18 of the Mixtec codex in the context of a series of placemaking events related to dynastic origin (which Ringle et al. [1998:185-186] argue show the cult expansion of Quetzalcoatl), an underwater or cave scene is presented. An important Mixtec leader, 4 Vulture, wears a feathered-serpent headdress and pays homage to the woman 3 Flint “Shell Mantle,” a venerated Mixtec ancestor who sits in the mouth of the cave wearing a “monster-maw” headdress. Also on this same page of the Codex Nuttall, an iconic representation of a crenellated circular structure represents the body of a Feathered Serpent with a serpent tongue that appears to be one-half of a ballcourt (another architectural feature prominent in Epiclassic contexts). Ringle et al. (1998:186) suggest that the image is an overt display of this deity’s connection to these architectural elements. The Postclassic documents offer insight into the potential significance of circular architecture and also shed light on the meaningful incorporation of cave formations to the round structures of Pechtun Ha and Oshon, perhaps meant to symbolize man-made caves where prayers for water and fertility were made to the ancestors. The karstic hills of the Sibun are riddled with cave systems and cave ritual is well-documented (Peterson 2001, see also Peterson, this volume) with clear evidence of Terminal Classic debris identified among the ritual deposits (Pendergast 1974). The material evidence from the caves, as well as settlements where selective use of speleothems with circular structures are found, reflects an important relationship possibly linking the ritual contexts found in caves and circular architecture of the Terminal Classic with the worship of the god Quetzalcoatl.

The concentration of whole and fragmentary conch found in and around Structure 402 also highlights the special function of this structure and may illustrate further ties to the Feathered Serpent. As previously noted, the concentrations of conch shell may represent a religious offering, or perhaps the remains of decorative elements that once covered the shrine structure in antiquity. In either circumstance, the importance of the deposit lies in what it conceptually symbolized for the Maya during this time. Similar to cave formations, marine shell has a long history in Maya religious tradition. Marine shell symbolized the watery underworld from which they came, which were interpreted as vital passageways for divine communication with the world of the living (Taube 1992). Marine shell, specifically conch, has strong associations with the Feathered Serpent and representations of the shells frequently accompany depictions of this deity. One of the best known examples comes from the Feathered Serpent Pyramid at Teotihuacan, where shells signifying the watery realm are carved along the base of the stone façade (Sugiyama 1989). The sliced conch shell pectoral “is a standard item in the insignia of Ehecatl Quetzalcoatl” (Nicholson 2000:147), which is found in some instances in the iconography at Teotihuacan, but appears more frequently in Epiclassic and Postclassic iconography, especially during Aztec times.

While a full description of Quetzalcoatl and what the god symbolized to the ancient Mesoamericans through time is beyond the scope of this report, the pronounced importance of the Feathered Serpent during the Epiclassic is apparent and manifestations of the god, seemingly incorporated into the local Sibun ideology, are found throughout broad areas of Mesoamerica during this time (Ringle et al. 1998). Evidence pieced together through a variety of artifactual and architectural data suggests that the religious ideology within the Sibun emphasized Quetzalcoatl through its own local lens that blended new and traditional belief systems. A number of scholars argue that increased trade and militarism during the Epiclassic period prompted the spread of the “cult of Quetzalcoatl” and the affiliated “International Style” (Ringle et al. 1998; López Austin and López Luján 2000). Fortunately, evidence for this distinct artifactual and architectural assemblage associated with the “International Style” is clearly identifiable in the archaeological record and seemingly present within the Sibun Valley during Terminal Classic times (AD 800-1000).
Concluding Remarks

The excavation of Operation 24 proved highly effective in reaching the initial objectives of the research design. A clearer understanding of the construction sequence and dating of Plaza Group A with regard to Structure 402 were gained though our investigations. Excavations confirmed that the heightened position of Plaza A, noted by surveyors in 1999 (see Morandi and Norris 2001), is due to a natural rise that appears to have been modified somewhat prior to the construction of the plaza surface. Artifacts found embedded in this natural earthen layer indicate that the natural surface may have been occupied for some time prior to the construction of the plaza group. Evidence of the plaza floor running underneath Structure 402 confirms that the floor pre-dates this construction and may indicate that the five structures which surround the plaza surface were not built all at once, but rather, developed in an accretional fashion over several centuries or more. Further testing, however, is necessary for a clear understanding of the chronology of these structural developments.

Excavations and the comparative analysis outlined above offered further insight into the dating of Structure 402. Preliminary data suggests that the final phase of the structure dates to the Terminal Classic or perhaps as late as the Early Postclassic and is likely coeval with the final occupation of Structures 401 and 437 (see Morandi and Thomas 2001). Investigations revealed that Structure 402 was an all-stone circular building, which appears to have undergone at least three architectural modifications during the history of its use at the Oshon site. During Phases 1a and 1b, the circular building maintained an interior room accessed through a central doorway and was constructed of finely cut stone masonry. Although slight modifications were made during the subsequent Phase 1b construction episode, it was only in its final construction phase (Phase 2) that the structure underwent significant transformation and developed into a solid, circular platform. More importantly, the Phase 2 changes are characterized by a decline in construction techniques and indicate the overall political, economic and religious changes taking place during this time.

Further investigations may illuminate a more substantial Terminal Classic occupation in the southern lowlands than was previously thought. Moreover, careful testing of southern lowland sites for architectural configurations, such as round, C-shaped, or patio-quad structures, (characteristic of Terminal Classic northern architectural styles) may bring into focus the extent of northern influence. More intensive analysis of archaeological remains and further sampling at Oshon and Obispo sites, with a close eye on the final occupation phase, is planned for a future field season in 2003. Investigations likely will clarify what appears to be a differential distribution of material remains associated with circular ceremonial architecture and certain symbolic media that appear linked with a distinct form of ritual activity tied to the worship of Quetzalcoatl. These future investigations promise to reveal information regarding the historical particularities of the political and ideological arrangement in the Sibun as compared with the broader patterns found throughout Mesoamerica.

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1 Bey et al. (1997) refer to the period from AD 925-1100 in northern Yucatan as the “Terminal Classic” and retain the term “Late Classic” for the period dating from AD 800-925 because they argue building activity continued during this time, which infers that economic and political stability was maintained. It is only after AD 925 that a decline in building activity is evident in the northern sites and therefore the use of the term “Terminal Classic” which implies a decline in fluorescence is more appropriate. These chronological trends, though potentially parallel in the southern lowlands, have not been adequately defined for this area. While there are a growing number of finds in the southern lowlands to suggest a similar resurgence in occupation and building activity during AD 800-925, it remains scattered throughout the area and may reflect more localized trends, rather than a regional period of growth like that of the north. Thus, until further data from the southern lowlands suggests otherwise, the traditional use of the term “Terminal Classic,” referring to the dates between AD 800-1000, will be used by this author.

2 Portable-size speleothems also were found in the context of the Pakal Na burial (see Harrison and Acone, this volume), relating the primary interment to cave ritual during life and indicating his status of venerated ancestor in the afterlife. Additionally, the selective use of cave formations in this burial, which also appears to date to the Terminal Classic, offers insight into the ceremonial life of this local community and their possible affiliations with northern lowland centers, such as Chichen Itza, and the cult of Quetzalcoatl.
In three seasons of fieldwork (1997, 1999, 2001), the Xibun Archaeological Research Project (XARP) located and recorded nineteen ancient Maya sites in the Sibun River Valley. These settlements range in size and complexity from single isolated mounds to collections of plaza groups. Buildings at these sites vary from small house platforms to large pyramids. The one factor common to all sites is their proximity to the Sibun River itself. Sites are located either adjacent to the river or to the many feeder streams that flow into it. Because of this connection between the settlements and the river, the Sibun River Valley can be studied as a geographically distinct archaeological region. Within this region sites stretch along the entire length of the river, with the densest concentration of settlements in the middle reaches. While most sites are located on high banks above the flood water line, the largest site, Hershey, is located directly on the flood plain.

In 2001, field research focused on sites in both the upper and lower reaches of the valley. Survey and mapping revealed that despite being part of the same region, sites differed from each other significantly in layout, architecture, and size. These differences are worth a closer examination and this paper hopes to highlight some of these variations as they relate to the two largest sites in the valley and the smaller settlements proximate to them.

The two largest sites along the Sibun River are the Hershey site in the upper reaches and the Samuel Oshon site in the lower reaches. These settlements dominate their respective regions in size and complexity. Scattered around each of these sites are smaller secondary settlements. We have termed the combination of a large site and the smaller sites associated with it an archaeological district. This paper will specifically discuss the Hershey District and the Oshon District.

The Hershey District

The Hershey District includes the following sites: Hershey, Echo Valley, Sleeping Giant, Silver Creek, Finca Buenos Aires, and a large cave system called Actun Chanona (Map Sheet 2). The district lies in an area of deep alluvial deposits at the base of the Sibun Gorge. These alluvial flats form the first pocket of flat land encountered when descending from the Maya Mountains. In this area, the early settlers established the largest site we have found in the valley. The location of the site must have been affected by these critical factors: proximity to the gorge and sources of granite, access to a transport route, proximity to deep alluvial soils that would have been fertile in the past and continue to be fertile today, and proximity to Actun Chanona, a cave that was used and modified extensively by the locals and maybe even by outsiders to the region (see Peterson, Chapter 3).

While the Sibun is the primary water source, the Hershey district is traversed by tributaries of the Sibun River. Additionally, there are other numerous water-bearing features such as sinkholes and springs in the area. Vegetation in the area includes broadleaf plants, such as cedar, cohune, breadnut, sapodilla, and ceiba (King et al. 1992: 90-91). Economic species currently cultivated in the area include citrus and cacao, the last being of special significance to our project.
The Hershey site is located in a cacao orchard. The site contains 39 structures of various sizes and is dominated by Plaza A. Plaza A is a large rectilinear plaza group with an orientation of N33°E. This orientation dominates the architectural plan of the entire site. The focus of Plaza A is an 11 m high pyramid located on the SW corner of the plaza. The plaza is closed off to the north, west, and east by long rectangular platforms (Structures 503-507); smaller structures are attached to and built on top of these larger platforms, including a ball court that is connected to the SE corner of the pyramidal structure (Figure 1.2).

At the southeastern end of the site is the second largest Plaza Group, Group B, a cluster of three structures atop a triangular platform. The buildings themselves are rather small in comparison to the structures found in Plaza A but the plaza of B is situated atop a high basal platform on the edge of the river. The height of the plaza may be directly related to the severity of the flooding regime. There is a smaller plaza between Groups A and B: Group C, a rectilinear plaza group composed of four primary mounds on the four sides of the plaza and three smaller associated structures. The nature of this group appears to be elite residential. The recovery of relatively high numbers of obsidian blades from a small excavation on the western side of the plaza (see Acone, Chapter 7) seems to confirm the idea that this was a higher status group.

Two smaller plaza groups round out the site. Group D is situated in the shadow of Group A and may have housed support staff for the larger group. Group T, about 100 m north of Group A, is a small residential group. There are a few other isolated mounds on the site but overall, the site gives the impression of having been laid out along strict architectural plans. Architectural orientation is consistent internally, as well as across groups suggesting a planned program of construction conceived and carried out within a relatively short period of time.

The Hershey site is the largest in the area and the only site in the district that had monumental architecture including a pyramid. It appears from the size and complexity of the site that it was the most prominent in the region. Sites mentioned below are clusters of mounds arranged in informal configurations with no defined plaza groups and no pyramids or buildings that would appear to have had a civic-ceremonial function.

Echo Valley is comprised of a group of structures that stretch in a linear arrangement along an unnamed stream that flows into the Sibun River. The site is distanced approximately 5 km from the Hershey site. Echo Valley is located on a high bank with the unnamed tributary to the west and the karst hills to the east. The karst separates the valley from the rest of the region and also creates a distinct auditory phenomenon by which sound is carried across the mounds with very little effort. It is this property of the valley led to its name Echo Valley. The 15 structures in the valley all appear to be house mounds. There are no formal plaza groups. A number of the mounds have been partially destroyed by land clearing activities undertaken while converting the area into a citrus orchard. There is no consistent orientation by which the structures were laid out. These casual arrangements suggest that there was no single construction plan like that exhibited at Hershey. In contrast, Echo Valley developed in a more organic manner; families expanded and settled in different parts of the valley as the need arose and geography permitted. There is no evidence for significant alterations to the terrain to fulfill some central plan. The site was dependent on the waters of the tributary for its day-to-day needs. But the fact that the stream flows into the Sibun means that they were still connected to the economy of the larger river. The location of Hershey downriver may indicate that control of the movement of goods and/or people along the river was a significant concern.

Between Echo Valley and the Sibun is a small community of about four mounds termed Sleeping Giant (named for the nearby farm owned by Johnny Zander). This area has been substantially modified for citrus cultivation, which may explain why we found only four mounds. Of the four we located two that had
been badly damaged. The mounds appear to be residential in nature but do not form any sort of formal arrangement. Situated proximate to the river, Sleeping Giant residents must have used the river as their primary source of water, taking advantage of their strategic location relative to river traffic at the base of the gorge. Both these communities are located above Hershey; river traffic would have floated down towards Hershey.

The Silver Creek group is a cluster of three mounds. They are near a tributary of the Sibun and are also close to a natural spring. The small mounds were probably residential in nature; they do not exhibit any formal arrangement. Finca Buenos Aires, a small plaza group, is a neighbor of the Silver Creek group (see Morandi et al., Chapter 2).

Echo Valley spreads across the greatest area. This dispersed settlement would be consistent with an agricultural community in which individual houses are surrounded by farms and gardens. The structures of Silver Creek also lie at a distance from each other, but the distances between the mounds is smaller than the distances between the mounds in Echo Valley. This could be an indication that the settlers of Echo Valley had the means necessary to maintain larger farms and gardens than their cohorts in Silver Creek. The mounds themselves are smaller at Silver Creek than those found in Echo Valley. This could be a further indication that the settlers of Echo Valley were not as well off as their neighbors.

While the main architectural center of Hershey covers a smaller area than Echo Valley, it is clearly the largest and most prominent site in the district. It is most likely that Hershey had a major influence on the traffic that moved along the river. The site itself appears to have had a strong central planning organization that was able to direct the building program. The largest and presumably most important buildings at the site were centralized. Also, variation among the structures at the site may indicate differences in status within the site. The Hershey site also is the only settlement in the area that has a civic-ceremonial area.

Within the sites of Echo Valley, Sleeping Giant, and Silver Creek there is less differentiation between the structures. All mounds within Echo Valley have strikingly similar dimensions. The exceptions are two double-mound structures that have a single platform supporting two structures. These may indicate slightly different access to resources or may simply be a factor of different functions. Similarly, mounds at Sleeping Giant and Silver Creek are fairly uniform within the site. Overall, the sustaining sites look fairly uniform internally and stand in stark contrast to the Hershey site. The idea of proximity to water is one worth repeating. While all sites enjoyed access to the river, Hershey is the only one that was located directly on the flood plain of the river. The other sites do not seem to have used the Sibun as their primary water source but are located along streams that feed into the Sibun. These streams all feed into the river at a point above the Hershey site. Any commerce from these sites then would have to pass by the Hershey site.

The Oshon District

The Samuel Oshon site is part of a collection of sites that make up what can be termed the Oshon district. In addition to the Oshon site, the district includes the following sites: Obispo, Sak Tzimin, and Neal’s. The sites in this district are discussed in Thomas and Secchiaroli (2002). Therefore we will not describe them again in detail but simply refer to them in the discussion that follows. Also, see Morandi,
Chapter 15, for a description of the excavations conducted at Obispo and Harrison, Chapter 16, for work at the Oshon site.

The Oshon District is located approximately 10 km from the opening of the Sibun River into the Caribbean Sea. Between the district and the sea are mangrove swamps and coastal sands. The **Oshon site** is the largest in the district with two plaza groups and several house platforms scattered around the plazas. The northern plaza features two stone monuments set in front of a circular building. It is clear from the monuments and the unusual architecture that the site had a civic-ceremonial function. The total number of structures at the Oshon site \((n=36)\) is comparable to the Hershey site.

The **Augustine Obispo site** contains stone monuments and a ritual aspect but still appears to be secondary to Oshon in both size and importance. It is essentially a small plaza group with a few outlying scattered mounds that are relatively small. The key features of the site are two stone monuments. One is broken and appears to be an altar. Scattered around this monument are fragments of ceramic **incensarios**.

**Sak Tzimin** and **Neal’s Site** are informal arrangements of small to medium-sized mounds. The platforms at Sak Tzimin are arranged in a linear fashion and not in plaza groups. Neal’s site contains one large steep sided platform and three small platforms. Once again there is no formal arrangement of the mounds and the sites are fairly small.

The Oshon site with its plaza groups and ceremonial structures appears to be the focus of the district and may have been a regional center for the sites in the district. It must be noted, however, that while secondary sites in the Hershey District are located above the Hershey site, secondary sites in the Oshon District are located downriver from the Oshon site. The Obispo site is the farthest downstream and is the only one in this area that is located on the south bank of the river.

**Comparison of the Districts**

The Hershey District and the Oshon District anchor the two ends of the Sibun River Valley. The Hershey and Oshon sites are the largest and arguably the most important sites in their respective districts. Hershey contains a greater volume of construction than the Oshon site but both feature similar numbers of structures, formal plaza groupings, and civic-ceremonial as well as residential architecture. This is where the similarities end. The civic-ceremonial center of the Hershey site appears to be Plaza A with its large pyramid and attached ball-court. The layout of this site is reminiscent of Classic period Maya sites found in the Petén and the Belize River Valley. A ceremonial focus of the Oshon site appears to be the circular structure in Plaza A. Two stone monuments had been reset in front of this structure. The Hershey site does not contain any stone monuments.

Satellite settlements are found around both sites. These satellites do not contain a civic-ceremonial component and therefore may have been subsidiary to the larger sites. Another indication of the importance of the larger sites is the great variation among structures within each site. The buildings in Plaza A of the Hershey site are much larger than buildings in the other plaza groups and larger than the platforms founds at the other sites. Similarly, the Oshon District structures at the Oshon site show a greater degree of differentiation within the site than the structures at the other sites in the district. This size differentiation may be evidence for a hierarchy within the sites with differential access to land, resources, and the means to construct buildings, or may reflect different functions. In contrast, the platforms in the smaller sites of each district show less differentiation, and for most part, the buildings appear fairly similar to one another. The
The Obispo site in the lower reaches is an exception. It is a small site but has two stone monuments. This settlement may have been a satellite site of Oshon and situated across the river.

From its location the Oshon site appears to have been the gateway to and from the Caribbean Sea. The importance of the Oshon site may have arisen from its control of access to the Caribbean Sea. The ability to control the transfer of goods upstream may have been part of the wealth that was generated in the lower reaches. Trade could have included cacao and granite.

The Hershey site located at the foot of the Maya Mountains would have been in a position to control highland resources. It is also better situated in reference to the Petén, Stann Creek, and the Belize River Valley. In fact, the upper reaches of the Sibun River may have been part of a route that led from the Petén to the Caribbean Sea. The importance of the Hershey site would have arisen from this contact with the larger and more powerful sites of the Belize River and the Petén. Also, if the soils supported the growth of cacao in the past as they do today, then the cultivation and transport of this precious commodity would have been of critical importance to several dominant powers in the region.

Movement along the river may be further examined by the location of the subsidiary sites within each district. The Hershey site is downriver from its subsidiary sites and therefore may have controlled the traffic and commerce that flowed downstream from this site. Similarly, the Oshon site may have restricted the flow of goods upriver from the sites that were between it and the coast. The Obispo site may have achieved a certain distinction as being one of the first sites encountered as travelers came up the river from the Caribbean, although it did not enjoy the same size and prominence as the Oshon site.

Differences between the two anchor sites may also be a factor of time. The Hershey site’s importance and prestige may have been tied to the Petén and may have collapsed at the same time as these sites collapsed. So the Hershey site may have been the dominant site early in the occupation of the Sibun River. Occupation at the Oshon site appears to have continued well past the Classic Period and into the Postclassic Period. This may be linked to the general shift in power from the internal sites to the coastal regions in the Postclassic. The Oshon site, with its proximity to the Caribbean, may have been positioned to benefit from the new coastal focus. It is possible then that later in the sequence of occupation along the Sibun, the Oshon site was the most important player in the valley.

This brief discussion of two regions along the Sibun River shows that while both were dependent on the Sibun River, sites varied greatly in size, complexity, and possibly political affiliations. These differences once again emphasize the incredible complexity of Maya culture and the difficulty in formulating generalizations that apply to the Maya region as a whole.
Chapter 18
Construction Materials and Techniques at Pakal Na, Hershey, and Samuel Oshon sites
Jessica L. King

The XARP 2001 research area includes sites in the upper, middle and lower reaches of the Sibun River Valley. This paper focuses on construction techniques at three of these sites: Pakal Na, the Hershey site, and the Samuel Oshon site. The site of Pakal Na is located in the middle reaches of the valley in a citrus orchard on land owned by a Belgian conglomerate called BGMC. The Hershey site is located in the upper reaches of the valley in a cacao orchard on land formerly owned by Hershey-Hummingbird Ltd. The Samuel Oshon Site is located in lower reaches of the river valley on privately owned land.

This paper focuses on architectural construction techniques and materials at the aforementioned sites. Analysis is based on excavation records and personal observation. In most cases, excavation units were established to expose surviving architecture or the interior construction of a structure. Analysis begins with a brief description of excavations at each of the three sites.

Site Descriptions

Pakal Na

Excavations began at the site of Pakal Na during the 1999 field season. Four operations were excavated focusing on structures 127 and 130. Operation 13 (2 × 4 m unit) was located on Structure 127 while Operations 14 (1 × 5 m unit) and 22 (1.5 × 1.5 m unit northern extension of Operation 14) were located on Structure 130. Operation 16 (1 × 2 m unit) was a midden deposit located along the southern side of Structure 130. The 2001 season saw the continued excavation of Operation 22, including a 2.5 × 2.5 m northern expansion of the unit. The operation thus became a 2.5 × 5 m unit broken down into two squares A (1999 and 2001 excavation) and B (2001 expansion and excavation).

Two new excavations were conducted during the 2001 field season. Operation 36 was located on Structure 136, a mound cut by a bulldozer. The excavation unit was established after the slump from the road-cut was cleared. The unit was placed in the center of the mound in order to uncover possible surviving architecture. The Operation was divided into 2 squares where only Square A (2 × 4.5 m unit) was excavated. Operation 37 (1 × 3 m unit) was located on Structure 131 after a magnetometer detected anomalous signals from the top of the structure that might indicate a baked clay surface.

Excavations at Pakal Na covered the two large plaza groups and small plazuela group at the site. Operations 14 and 22 exposed a sequence of architectural phases, and burials in the largest
structure (Structure 130) at the site. Operations 13, 36, and 37 exposed Structures 127, 136, and 131, respectively, yielding a fair sample of the structures at Pakal Na.

**Samuel Oshon Site**

Excavations began at the Samuel Oshon site in 1999. Operation 18 (1 × 2 m unit) was established to expose the architecture of Structure 401. Operation 20 (1.5 × 4 m unit), a southward extension of Operation 18, was established in order to further expose Structure 401. Operation 19 (1 × 2 m unit), laid out on the northern side of Structure 437, extended from the surface of the low platform to the plaza floor. Operations 21 (1.5 × 4 m unit) and 23 (a triangular unit) were established between Structures 437 and 401 to determine how and if the structures were related.

The 2001 season brought about the establishment of Operation 24, a 5 × 5 m unit on the northeastern side of Structure 402. The operation exposed the northeast quadrant of a round structure and the area around two uncarved stelae that are located along the eastern side of the structure. The unit was broken down into 4 squares, each 2.5 × 2.5. The purpose of the operation was to expose the architecture of Structure 402 as well as examine how each stela had been held in place.

The Oshon site consists of two plaza groups with outlying mounds and has a total of 37 structures. The units of excavation focused on Structures 400, 401, 402, and 437 within Plaza A. Plaza A consisted of five structures atop a large raised platform, Structure 400. The Plaza surface consisted of tightly packed limestone and chert cobbles. These excavations provided a great deal of information regarding the construction methods of some of the structures at the site. However, it would be interesting to have a sample from Plaza B or from an outlying structure like Structure 424, which lies in close proximity to the river.

**Hershey Site**

Excavations at the Hershey site began at the start of the 2001 season. Operation 50 (1 × 8 m unit) was located in Group D, with square A revealing Structure 530 and Squares C and D exposing Structure 531 as well as part of the floor between the two structures. Operation 51 (4 × 6 m unit) was located in Group A, on Structure 503. Square A exposed the staircase and exterior retaining wall while square F revealed the interior construction of Structure 503. Operation 53 (1 × 2 m unit) was located in Group C, and covered the alley between Structures 518 and 519, exposing part of the retaining walls of platform Structure 518.

The units of excavation completed during the 2001 field season covered structures in three of the five main groups at the Hershey site. Further investigations during the 2003 field season will undoubtedly yield a more complete sample of architectural construction at the Hershey site.

**Data Description**
Operation 18 was originally a $1 \times 1$ m unit that was expanded another meter in order to expose the corner of Structure 401. Some small hard clay nodules were discovered at the bottom of Zone 2, lying just above the cobble plaza surface, which could indicate there was once a hard clay surface over the cobble layer (Figure 18.1). The plaza floor was removed as Zone 4 and contained an evenly distributed layer of limestone cobbles with a few chert cobbles. A two-course limestone basal retaining wall representing the north side of Structure 401 was discovered and called Zone 5. The limestone blocks were well shaped and fit together nicely to create the wall. These stones ranged in size up to 50 cm in length and 10 cm in width. These stones were not set on top of the surface; instead, they were set into the plaza surface. Zone 10 consisted of thin limestone slabs that made up the retaining wall of Structure 401.

Operation 20, the extension of Operation 18, was established to reveal the western side of Structure 401. The tumbled surface of Structure 401 was represented in Zone 2 and consisted of limestone, chert and reddish sandstone cobbles. An inset corner of the western side of Structure 401 was uncovered in Zone 3, and Zone 4 further revealed the inset northwest corner of the structure. The cobble plaza surface was revealed in Zone 5 (Figure 18.1). A solid layer of cobbles was fully exposed and removed as Zone 6. The limestone retaining wall on the west edge of
Structure 401 was exposed as Zone 7 and was constructed of stones 10-25 cm in length. The interior construction of Structure 401 was revealed in Zone 13, a compact silty clay that would have been retained by the limestone wall.

Operation 19 revealed the northern side of Structure 437, a low platform, and the plaza floor. A compact earthen surface was uncovered below Zone 1 and was bound on the north by Zone 3, a retaining wall at the edge of the platform. The plaza surface, a high concentration of cobbles with a high surface, was uncovered as Zone 5 and met up with the retaining wall.

Operation 21 was an extension of Operation 19 that further revealed the plaza surface between Structures 437 and 401 and uncovered the platform (Structure 400) retaining wall. A cobble surface, labeled Zone 4, in the southeastern corner of the excavation, was uncovered below Zone 3 and indicated the edge of Structure 401. A narrow passage of silty clay mixed with cobble inclusions was discovered between Structures 401 and 437 and called Zone 6. Operation 23 served to connect the cobble surface of Structure 401 with the cobble surface of Operation 21 to give an uninterrupted view of the cobble surface found in Operations 20 to 21 (Thomas 2001: 200).

Excavations during the 2001 season focused entirely on Structure 402 and the two stelae in front of the structure. Structure 402 is a round structure that appears to be constructed exclusively of limestone at first sight. Operation 24 was set up as a 5 × 5 m unit along the northeastern edge of the structure and included the two uncarved stelae. The rounded edge of Structure 402 was first exposed in the southwestern corner of square B when Zone 1 was removed (Figure 18.2). The tumble in front of the outermost preserved wall was removed as Zone 2 and consisted of limestone gravel and cobble, with a few chert cobbles. Some of the cobbles may be tumble from the upper terrace, or may have been supports for the stelae. The stelae appear to postdate the last phase of construction and were placed in shallow cuts into the underlying cobble surface (also Zone 2) in front of Structure 402. When Zone 2 was removed, the three-course outermost wall of structure 402 was revealed; the two lower courses were inset. Below Zone 2 were the poorly preserved remains of what appeared to be a plaster floor that would have been cut into during the erection of the stelae. The floor extended 20-25 cm from the wall.

Zone 4 was restricted to square D and included the construction fill that supported Stela 1, as well as the plaza floor. The zone was found to the east of the structure and consisted of limestone gravel and cobble. The compact earthen layer below Zone 4 was excavated as Zone 6 and probably represents the interior construction fill of the platform (Structure 400). The construction fill behind the outermost wall was removed as Zone 5, along with part of the wall. The fill consisted of densely packed limestone gravel and cobble in a silty matrix. When Zone 5 was removed another wall was exposed. Zone 7, similar and adjacent to the Zone 4 plaza surface, was restricted to the area below the Zone 5 construction fill.
The construction fill between two veneer stone walls that lie behind the outermost wall was removed as Zone 8 and consisted of a semi-compact silty matrix with a high density of limestone cobbles (Figure 18.2). The interior construction fill, recorded as Zone 9, was characterized by a series of vertically pointed free standing limestone boulders (up to 80 cm long) set behind the innermost veneer stone wall (Figure 18.2). These large stones were set in such a way that they might represent an interior retaining wall, holding a loose silt matrix with limestone cobbled construction fill. The construction fill below Zone 9 was removed as Zone 10. The fill consisted of mostly limestone gravel in a silt matrix. A high concentration of small chert cobbles was also removed as the plaster surface was approached.

According to Ben Thomas, excavation of Operation 24 appears to indicate that there were two phases of construction at structure 402. Phase 1 probably consisted of a raised platform (Zone 5 - construction fill and outermost retaining wall) with a single room structure on top (Zone 8 - rubble core between the inner and outer veneer stone walls). During Phase 2, the upper courses of the Zone 8 wall were removed and the room was filled in with large boulders and cobble (Zones 9 & 10), thus creating a two-terrace structure. The stelae were probably erected at the very end of
the Phase 2 construction and may have commemorated the change in function of Structure 402 from a room to a terraced platform.

**Pakal Na**

Operation 13 was set up on Structure 127, a small structure that was possibly a shrine, on top of a basal platform that made up a plazuela group. The orange clay matrix of Zone 2 appeared to be the construction fill for the platform, while Zone 3 (primarily restricted to Square B), represented the remains of a platform surface, due to the remaining gray and white patches of a floor (Figure 18.3). Zone 5 was restricted to Square B and consisted of a mottled matrix of reddish orange compact clayey soil that would have been construction fill for the platform. Zone 6 also showed signs of a mottled matrix with a darker brown soil in Square A. There was also a light density of deteriorated limestones on the top of Zone 6 that might represent an earlier construction fill for Structure 127.

![Figure 18.3 Planview of Operations 13, Square B.](image)

Operation 14 was placed on the central axis of Structure 130 and revealed two distinct phases of construction. A large limestone stone (more than 1 m wide) was discovered in Zone 2 and appeared to be an eastern facing stone for Structure 130. A high density of root activity in Zone 2 appears to have disturbed the architecture of the structure. A cobble surface made of river pebbles and cut limestone slabs was found at the base of Zone 3 (Figure 18.4). Zone 4, a unit of construction fill consisting of river pebbles and limestone cobbles, may represent the final phase of construction for Structure 130 (Figure 18.4). An earthen layer, Zone 8, was found below Zone 4 and appears to represent an earlier phase of construction.

The large limestones removed as Zone 5 appear to be out of their original context, but may have served as a retaining wall for the upper terraces of Structure 130 or as a staircase (Harrison
Zone 6, similar to Zone 4, consists of a high density of river pebbles in Square A. In Square B, Zone 6 contains a high density of river cobbles that spilled out from the construction fill retained by the stone slab (Zone 2). This zone is below Zone 4 and appears to represent an earlier phase of construction. The river cobble of Zone 6 continues into Zone 12, which covers the limestone cobbles that comprises the plaza surface (Zone 13). A crude retaining wall of an upper terrace was uncovered as Zone 7.

Figure 18.4 Cross section of north wall of Operation 14.

Zone 8 was removed from Square A and consists of a compact silty clay soil that probably functioned as a packed clay core from an early phase of construction. Zone 11, a mottled matrix, was found directly below Zone 8 and consisted of a more compact earthen construction fill that would have made up the inner core of Structure 130. Zones 16 and 18 also represent a mottled matrix construction fill. Zones 20, 21, and 23, all consisting of a mottled matrix, represent the earliest phase of construction of Structure 130 (Harrison 2001: 182-183).

Operation 22 focused primarily on excavation of the burial pit feature; however a great deal of information regarding the construction of Structure 130 was gained in the process. At the bottom of Zone 1, a portion of the limestone retaining wall of the third terrace was uncovered along the west side of the excavation. A one-course retaining wall with a sloping surface above and below was revealed in Zone 2. This one-course wall may be associated with lower one-course retaining walls in that they might have functioned as a staircase (Harrison 2001: 184). An upper terrace surface constructed of river gravel was discovered and removed, along with its underlying fill, as Zone 3 (Figure 18.5). A two-course wall retained the construction fill and surface. Zone 4 ran...
below Zone 3 and consisted of the gravel fill that covered the lowest terrace (Figure 18.5). Zone 10 was restricted to Square A and consisted of the compact mottled clay construction fill of Structure 130 that underlies the earlier river gravel construction (Figure 18.6). Zone 20, also restricted to Square A, is predominantly a mottled clay layer that appears to be part of the Phase 1 construction. Zone 12, in Square B, consisted of a predominantly compact mottled clay fill, with a few limestone and river inclusions. Zones 10, 12, and 20 all appear to be part of the Phase 1 construction of Structure 130 (Figure 18.1).

Figure 18.5 North wall of Operation 22.

Figure 18.6 West wall of Operation 22.
Operation 37 was established on top of Structure 131 after a magnetometer survey detected evidence of a possible burned surface (see Welch, Chapter 12 for detailed descriptions of Operation 37). The unit was originally set up as a 1 × 2 m unit but was expanded when a limestone wall (Zone 2) was discovered at the bottom of Zone 1. The unit was extended one meter to the south to expose the wall from the northern and southern sides. Zones 3 and 7 consisted of the construction fill found to the north of (behind) the Zone 2 wall. The fill consisted of a clayey matrix with a few gravel-size river cobbles inclusions. A high concentration of charcoal was removed as Zone 4 (between Zones 3 & 7) and may have caused the anomalous readings from the magnetometer. Zone 6 was removed from the area south of the Zone 2 wall and consisted of a cobblesurface and a lower limestone retaining wall. Zone 9 was removed below the Zone 6 cobblesurface and consisted of a river gravel and cobbles fill. Zones 5 and 8 were removed from the area south of the wall and consisted of a semi compact construction fill with river cobbles, gravel, and few limestone inclusions.

Operation 36, located on Structure 136 and set up after the slump from a bulldozer cut was removed, exposed the southwestern side of the mound (see Morandi, Chapter 11 for detailed description of Operation 36). Square A was originally a 2 × 3 m unit that was later expanded 1.5 m to the southwest in order to expose a limestone retaining wall (Zone 12). Zones 3 and 4 exposed the undisturbed part of the mound and consisted of an earthen layer with very few gravel inclusions (see Morandi, Chapter 11). At the bottom of Zone 4 a limestone cobblesurface was uncovered and removed as Zone 5. This surface may have represented the final construction phase of Structure 136. Zones 6, 7, 8, and 15 (a posthole) continued below Zone 5 and consisted of mottled sandy clay fill that had virtually no stone or artifact inclusions. The zones were ended arbitrarily to maintain stratigraphic control, but each was a continuation of the same mottled clay construction fill that appears to constitute the core of Structure 136. Zones 2-8, and 15 all were restricted to the northern wall of the square (0.5 × 2 m area). Zone 9 was located in front of the limestone cobbles that had been uncovered from Zone 1. This zone consisted of a compact sandy clay matrix with a few tumbled limestone blocks. Excavation of Zone 10 caused the unit to be expanded to the southwest. This earthen layer had a high concentration of limestone gravel and gave way to the top course of a preserved wall (Zone 12). Zones 11 and 13 were removed from the area southwest of the wall and consisted of a coarse gravelly silt with gravel and cobbles inclusions (only in Zone 11). Some of the larger limestone cobbles were probably tumble from the wall. Zone 12 was a limestone retaining wall with four intact courses. Zones 14 and 16 are the same layers of sterile alluvium that underlie Structure 136. They each are located at the same depth and appear to have an identical semi-compact silt clay matrix.

**Hershey Site**

Operation 50 was located in Group D and was established in order to expose part of the architectural construction of Structures 530 and 531 (see Harrison, Chapter 5 for detailed description of Operation 50). Square A was set on Structure 530 and revealed very little preserved architecture. Zone 4 consisted of a high concentration of river cobbles and gravel with a silty clay soil. Only ten, roughly cut limestone cobbles, not *in situ*, were found in this zone, and they may have been part of a retaining wall that held the river cobble construction fill. There was also a possible gravel surface that was restricted to the southwestern corner of the square.
Squares C and D exposed Structure 531 and part of the surface between the structures. Zone 2 of Squares C and D consisted of a high concentration of limestone gravel that covered an apparent limestone cobble surface. This surface appears to be on top of Structure 531. Zones 3 and 5 are restricted to Square C and include the area to the west of a two-course limestone retaining wall. Zone 5 was the surface of the plaza that was constructed of a compact earthen matrix with a medium density of limestone gravel, and a light density of river gravel. At the base of Zone 5, 10 cm of plaza construction was excavated, revealing large river and limestone cobbles that would have comprised the surface between the structures. Square D exposed the western side of Structure 531. The top of Zone 6 was a limestone cobble surface (found at the base of Zone 2) that sloped down into Square C, and would have been retained by the two-course wall. The zone ended with a limestone retaining wall that ran north to south in the middle of the square. The series of four stones, combined with two other stones slightly to the east, appear to represent an earlier phase of construction. The orientation of the stones suggests that Structure 531 may have been an apsidal structure during its first phase of construction.

Operation 51 was located in Group A on Structure 503 (see Harrison, Chapter 6 for detailed description of Operation 51). Square A exposed the exterior facing, plaza surface and part of the northern staircase while Square F exposed the interior and early phases of construction. Zones 2, 3, 4, and 7, in Square A consisted of tumble from the exterior retaining wall and staircase of Structure 503. Upon reaching Zone 11, the plaza surface, a well-preserved nine-course limestone wall, was exposed along the southern wall of the square. The wall represents the exterior retaining wall of Structure 503. The surface of Zone 11 might have had plaster cover, but there is no remaining evidence of such construction. A compact earthen layer with small limestone gravel inclusions is the only evidence of the plaza surface. Underlying the surface is a layer of limestone gravel (light density) and small river cobbles (0.2 cm-6 cm), recorded as Zone 14, which would have supported the gravel/plaster surface. Zone 15 lies below Zone 14 and has a sandier matrix with a higher density of river gravel. This zone is probably a natural feature upon which the plaza and Structure 503 were constructed.

Square F, located on top of Structure 503, revealed many floors that represent different periods of construction. Zone 5 is a semi-compact earthen layer that may have been an earthen surface or possibly runoff from Structure 501. Zone 6 represents a layer of limestone gravel construction fill for Structure 503. This zone also contained a medium density of flowstone and travertine in the northeastern corner of the square, that would have been part of the construction fill. This fill continues to Zone 9, which lies directly below Zone 6, and the limestone gravel increases to include cobble size stones. Zone 10 consisted of a deteriorated plaster floor that was best preserved in the eastern half of the square. Zone 12 was an area of high root disturbance that contained construction fill for Structure 503. Approximately 15 cm below Zone 10, an earlier and better-preserved plaster floor was uncovered as Zone 13. The floor had a smooth surface despite the inclusions. The construction fill that was found in Zone 16 constituted the core of Structure 503. Directly below the second plaster floor (Zone 13) was a layer of limestone gravel, which was followed by 25-30 cm of limestone cobbles ranging from 7.5 to 50 cm in length. Below the large limestones was a mottled clay matrix consisting of three primary colors. The clay matrix continues.
into Zones 17 and 18. The bottom of Zone 18 interfaces a deteriorated surface, removed as Zone 19. This surface overlaid a clayey silt fill with gravel inclusions.

Operation 53 was located in Group C, between Structures 518 and 519 (see Acone, Chapter 7 for detailed description of Operation 53). A concentration of limestone and river cobble tumble was recorded as Zone 2 and most likely represents the remains of at least a two-course retaining wall and the construction fill of Structure 518. Zone 3 consisted of a compact earthen surface that overlaid Zone 4, a dense river cobble and gravel surface. Zone 5 represented the construction fill that supported the cobble surface (Zone 4). The fill consisted of large limestone boulders and river cobbles built approximately 50 cm above the plaza surface.

Analysis

Excavations completed in Plaza A of the Oshon site revealed that the Maya were using a variety of construction materials and techniques. The plaza surface (Structure 400) consisted of limestone, chert, and sandstone cobbles that were tightly packed together. A packed earthen or clay layer probably overlaid this cobble fill, creating a smooth plaza surface. Structures 401 and 437 appear to have consisted of compact earthen/clay cores retained by outer limestone walls. Excavation of Zone 6 in Operation 24 indicates the platform (Structure 400) was constructed of an earthen core. Operation 21 reveals that a limestone wall retained the earthen core of Structure 400. In comparison to Structures 401 and 437, Structure 402 had a high density of limestone used in construction, while it lacked a compact earthen core.

Structures at the site of Pakal Na display a consistent pattern of architectural construction, with a few variations. Excavations at the site provided a broad sample of the structures at the site. During their first phases of construction, Structures 127, 130, and 136 appear to have been built of a compact mottled clay matrix retained by limestone walls. The mottled appearance of the clay matrix suggests basket load construction of the three structures. Operations 14, 22, 36 and 37 revealed that gravel and cobble surfaces were placed above the clay construction fill in order to create platform and terrace surfaces. Zones 3, 4, and 7 of Operation 37 (Structure 131) appear to be a compact clay construction fill that lacks a mottled coloration and is held in place by the Zone 2 limestone wall. Further excavation of Structure 131 might reveal a mottled clay structural core. The excavations at Pakal Na revealed that most structures underwent at least two phases of construction, which can be seen by the fact that there are numerous gravel and cobble layers throughout the stratigraphic profiles.

Excavations at the Hershey site indicate that limestone and river cobble were the primary materials used in the construction of the structures. Operation 50 revealed that a limestone retaining wall held a cobble core. The earlier absidal wall (Zone 6) was also constructed of limestone cobbles. Operation 51 (Structure 503) revealed an exterior limestone retaining wall and northern staircase, along with numerous phases of construction. The structure may have started as a low platform with a plaster floor (Zone 19 or possibly earlier) and subsequently raised using cobble and clay fill. The mottled clay matrix in Zones 16-18 appears to indicate a basket load construction.
Operation 53 represents the saddle between Structures 518 and 519 and appears to show that Maya builders constructed a passageway, raised above the plaza floor, between the two structures.

Conclusions

The relatively high density of chert cobbles used in construction fill at the Oshon site indicates that the Maya had a local source that was easily accessible. The stelae in front of the round structure, 402, combined with the extensive use of limestone, also suggests that the structure probably held a ritual importance. Maya occupants of the Oshon site must have had a number of material resources available for construction due to the fact that limestone, chert, sandstone, and clay (probably mined from the river) were used in building the structures found in Plaza A.

The extensive use of clay construction fill at the site of Pakal Na indicates that the Maya were using their most available material source: clay from the river. The mottled matrix of most structures suggests that a basket load construction technique was utilized to build up a mound, which would be faced with limestone blocks. Unlike the Oshon site, there was not a high density of chert cobbles used in the construction, indicating that the Maya of Pakal Na probably did not have access to the source used by Oshon.

The Hershey site, like Pakal Na, appears to have been constructed using available materials such as river stones, limestones, clay and to a small extent, cave formations. Structures in Groups A, C, and D all contained limestone and river cobbles and the limestone was used primarily as exterior stones and the river stones as fill. The use of cave formations in the construction fill of Structure 503 (Zone 6) indicates that the Maya were removing speleothems from local caves to be sprinkled throughout their architectural constructions.

It seems evident that the Maya of the Sibun River Valley were utilizing the materials available to them in the construction of their structures. A pattern in the construction techniques appears to be apparent throughout all three sites described in this paper. Most structures appear to have been constructed of clay or cobble cores that were retained and faced by limestone walls. Plaza and structural surfaces vary from packed earthen layers to plaster floors but all appeared to consist partially of limestone inclusions. This pattern suggests that limestone was the best exterior material for construction along the Sibun, while clay might have been the most available substance.

References Cited

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Caves in the Maya area provide the best context for the archaeological study of Maya ritual. With minimal soil and sediment deposition in most cases and their relative protection against destructive processes of weathering and erosion, caves remain much the same as they were when in use by the Maya. Utilization of the cave is not restricted to the deposition of artifacts but in fact includes the modification of natural cave features. An initial study (Brady 1997) suggests that the breakage, movement and caching of dripwater formations, referred to here as speleothems, is widespread in the Maya area. The following field report seeks to document similar behavior found within the caves of the Sibun River Valley, Belize.

Evidence for the utilization of caves by the Maya is not restricted only to the caves themselves. Speleothems collected at settlement sites by the Xibun Archaeological Research Project (XARP) suggests a relationship between the surface and the subterranean. The symbolic association of speleothems with fertility, water and the underworld known as Xibalba, while not the primary focus of this analysis, is also addressed below.

Research Methods

While a number of caves in the Sibun-Manatee Karst were explored and surveyed during the 2001 field season, time permitted the detailed study of only three: Actun Chanona, Arch Cave and Actun Yax Tun. Of these, Actun Chanona, with its complex human alteration, dominates the subject matter. The analysis is limited to the modification of dripwater formations. Areas of speleothem modification were measured, drawn, photographed and described, depending on the type of alteration. Other types of modification including the construction of platforms, walls and altars and the mining of clay are discussed by Peterson (Chapter 3) and Cobb (Chapter 4).

In addition to the cave data, evidence of speleothem utilization was recovered from four surface sites excavated during the 1999 and 2001 seasons. A sample of 51 suspected speleothems was collected from Pakal Na, Pechtun Ha, Hershey and Cedar Bank. Note that not all speleothems found were collected and/or recorded. Excavation at Structure 503 at Hershey yielded dozens of speleothems of similar size and weight from which only a sample was collected. Other speleothems remain uncollected due to their size. Each collected speleothem was weighed and measured. Data from specimens recovered from excavation were taken to permit a distributional analysis. Some doubt existed about the identification of three specimens. They were designated “unidentifiable” and not included in the analysis.
Speleothem Modification Within the Cave

Encountering large areas of burning in caves, particularly in relation to hearth features, is a fairly common occurrence (Brady & Prufer 1999: 135). Of the caves explored in the Sibun-Manatee Karst, only one shows signs of large scale burning. Actun Chanona contains at least eight extensive areas of burning located in separate and distinct sections of the cave (Figure 19.1). Whether areas of burning are consistently associated with constructed cave features has not yet been determined. Interestingly, areas of burning occur only among zones of dense stalagmite and stalactite growth. Some of these areas are over 35 m in length. Regions with dense stalagmite growth alternate with stretches of floor with no formations. The heavy fire-blackening around clusters of stalagmites in contrast to the light dusting of charcoal found in areas lacking them suggests that the speleothems were the focus of the burning. Found in association with each area of burning are both large and small pottery sherds, many covered in charcoal indicating they had been positioned there before the burning occurred. Several sherds have small speleothem fragments adhering to them. What appear to be three stone hearths have also been observed in two of the burned areas.

Figure 19.1 Locations of burned areas in Actun Chanona.

Among several areas of densely packed stalagmites, large speleothems appear to have been intentionally removed. Broken stalagmites cleanly snapped at their base often lie nearby covered in charcoal. As the base also displays signs of fire-blackening, burning (or multiple burnings) occurred after the speleothem breakage took place. Clearly the breakage was not meant to terminate the utilization of the area.
A distinct type of stalagmite breakage was noted in a burnt area located above and to the west of the “Drum Room.” The majority of burnt stalagmites in the cave have been snapped cleanly but here it appears that the speleothems were fractured by the intensity of fire. As musical artifacts (drum and ocarina) were recovered in this area, Polly Peterson (personal communication, 2001) has suggested that the Maya may have set intense fire(s) so that the sound of the explosion accompanied the music.

Most areas of burning have soda straws growing from the ceiling and several of the areas were noted to contain fire-blackened and melted soda straws. Fire blackening on the ceiling above most of the areas (where the ceiling is under five meters high) confirms the strength of such fires. As soda straws are delicate, they may have been broken from the ceiling by the heat of the fire.

There is also an unnatural pattern of soda straw breakage in alcoves unassociated with the areas of burning at both Actun Chanona and Arch Cave. In Actun Chanona, the deliberate removal of soda straws from a restricted area is noted in the alcove around Human Remains 3 and 4. Within the areas of growth smaller sections of soda straws have been broken.

Soda straw breakage in Arch Cave is considerably different than at Actun Chanona. The stalactites here grow sparsely in patches, each approximately one meter in diameter with low vertical clearance. Only particular patches show breakage. The absence of broken formations on the cave floor below or nearby indicates that the formations must have been removed (Figure 19.2). Similar patterns of the removal of specific groups of stalactites have also been recorded in the caves of Quintana Roo (Lopez & Alberto 1995: 420-421).

![Figure 19.2 Soda straw breakage in Arch Cave.](image)
Movement and Internal Transport

Immediately east of Human Remains 2 and 5 in Actun Chanona, a series of speleothems appear to have been broken from their origin and moved several meters away. Large pieces of charcoal, several pottery sherds and a calcified human rib, presumably part of the human remains found approximately two meters to the west, are found within and around the speleothems. These artifacts, particularly the charcoal, suggest the displaced formations were used as an altar. According to Helmke and Awe (1998: 152) it is not unusual for speleothems to be used in ritual and particularly in altar-like contexts within a cave. In Actun Uayazba Kab in the Cayo District of Belize a large fallen speleothem found in alignment a specific modified cave feature shows classic signs (including charcoal and small offerings) of having served as an altar.

Displaced speleothems seemingly served other purposes as well. Formations removed from their origin contour paths throughout the cave presumably to designate roads to areas of apparent importance. The least complicated path toward the Great Platform in Actun Chanona is lined end to end with large speleothems each over a meter long. The absence of speleothems growing nearby indicate those lining the path must have been moved from elsewhere in the cave.

Near the entrance to Actun Chanona, displaced speleothems serve a different function. The most accessible entrance to the cave is blocked through most of the year by a pool of still water. Perhaps in an effort to protect the virgin water from contamination speleothems have been imported to and placed within the pool to serve as stepping-stones. Again, the lack of speleothems growing within or above the pool indicates that these speleothems, each nearly a meter long, had been brought from another location within the cave.

Walls

Constructed walls are prominent features of the Sibun-Manatee Karst caves. Some walls serve as a visual barrier to specific areas while still permitting physical passage; others serve to block chambers, alcoves or crawlsaces (Kenward 2000: 74-75). Interestingly, only three of the excavated caves at Tiger Sandy Bay, Gracy Rock and the Maya Mountains, Actun Chanona, Arch Cave and Actun Yax Tun, contain speleothems in addition to pieces of limestone breakdown within constructed walls. Each of these walls function as a physical barrier to particular features of the cave.

Actun Yax Tun at Tiger Sandy Bay is a north-south oriented cave only about 25 m long. The cave has been cut through a hill that separates two small valleys and is entirely in the light zone. Despite its lack of depth, Actun Yax Tun contains a wall composed of speleothems and breakdown that serves to block passage through the cave. For such an effort to have gone in to the construction of a wall here suggests that there may be more to cave ritual than artifacts and darkness.

Despite its large size, Actun Chanona has surprisingly few constructed walls or at least features still recognizable as such. Only one wall appears to use speleothems in addition to breakdown as building material. This wall was constructed in the alcove where human remains 3 and 4 are located and appears to block the main space from a perilous ledge. Unfortunately, in its current state of disrepair, it is nearly impossible to reconstruct its original form.
The final wall containing speleothems is located in the main entrance to Arch Cave. Surveying the entrance from inside the cave, it is clear that a partially dismantled wall constructed of both breakdown and speleothems blocked the small diagonal slit that forms the main entrance. The remains of the original wall is nearly half a meter high but significant piles of rubble located just inside suggests that the impediment was once much higher. The presence of a quantity of speleothems may indicate that the wall once reached the ceiling and served to completely close the entrance off to the surface.

**Speleothem Modification on the Surface**

**Speleothem Importation to Settlement Sites**

XARP has documented the importation of speleothems at surface sites around the Sibun-Manatee Karst. In two seasons (1999 and 2001), 59 formations were collected from four separate sites. It should be noted however that these represent only a sample of all the formations noted. At some sites, Hershey in particular, a number of unrecorded and uncollected speleothems were found at Structure 503.

The speleothems come in a variety of types and appear in a number of different contexts. Over 50% of the formations collected are pieces of flowstone 10-80 cm in length (at Hershey some uncollected formations were significantly larger). Stalactites, soda straws and one lone stalagmite make up the remaining formations (Figure 19.3). In addition, several pieces of travertine (limestone found in areas of running water, like river beds, that is formed by the same processes as cave flowstone) were collected and noted and, due to their similar appearance to flowstone, may in fact be equally as significant as the formations directly from the cave.

Surface site speleothems were recovered from six areas: construction fill, earthen layers, tumble, surfaces, midden and burial pits (Table 19.1). Artifacts of every category appear to be associated with these formations including: human bone, baked clay material (BCM), sherds, net weights, ground stone, chipped stone, obsidian, debitage, unworked shell, animal bone, charred wood and fire-cracked rock. Consequently, the possibility of linking cave formations with a specific artifact assemblage appears remote.

**Discussion**

Rain and fertility, essential elements in an agricultural society, are closely associated with caves (Brady 1997: 732); the controller of rain himself, Chac, lives within the cave. Essential in the terrestrial focus of their religion, the Cordemex Dictionary (Barrera Vasquez 1980: 123) indicates the relationship between speleothems and water. The Maya word for the Spanish estalactita (stalagmite) is ch`ak xix, a word meaning distilled water in a well or cave. As suggested by the
linguistic association, the speleothem symbolically holds water. Presumably, by striking open the rock, the water is released. Evidence from Actun Chanona and Arch Cave demonstrate the large-scale breakage of speleothems. These formations appear to have been removed by two means: physically snapping stalagmites from their base or allowing explosion by excessive heat.

Figure 19.3 Stalactites, soda straws, and one long stalagmite (illustration by author).

Burning is an integral part of modern Maya ritual. The K’iche Maya refer to ceremonies as “burnings” (Cook 1986: 139) and to traditional altars where rituals are performed as “burning places” (Bunzel 1952: 431). The frequency with which evidence of burning is reported in caves suggests that the modern pattern has ancient roots. The presence of charcoal on the floor and fire blackening of formations and ceilings is evidence that this was an activity area of greater emphasis than other areas lacking such evidence. The close association of burning with areas of speleothem growth suggests that areas of dripping water were considered more important to the ancient Maya than areas adjacent to them that lacked formations.
Ethnographic and ethnohistorical evidence suggest the concept of fertility to be of equal importance within ritual cave usage. According to an Aztec creation myth the sun, the moon and even the sky were created in the interior of the earth, metaphorically suggesting the representation of the cave as the womb (Heyden 1976: 1). The modern Tzotzil Maya use the word for cave “cen” to humorously refer to a woman’s vagina (Brady 1996: 52; Laughlin 1975: 132). As speleothems are physically grown from the body of the cave, it is likely that they too contain the cavern’s powers of fertility.

The connection between rain and fertility in an agricultural society may motivate the ritual focus on speleothems within the caves. The transportation of speleothems represents a reciprocal exchange: pottery and other offerings were deposited in the cave at the same time that speleothems were removed. The recovery of cave formations in a wide variety of contexts suggests that speleothems had a diverse range of functions. Recent ethnographic data from the Mexican state of Guerrero records the reverence of stalagmites and stalactites as deities (Heyden 1987: 129).

Archaeological investigation provides evidence for the display of speleothems in the public arena in addition to their usage within the household. Stalactite columns set in front of structures at Yaxchilan in the Usumacinta Valley indicate the significance of speleothems in relation to the society instead of to the smaller family unit (Maler 1903: 183). A large stalactite found in the façade tumble of Structure 503 at Hershey may have been an effort to not only designate the structure as religiously significant but to literally include the powers of the cave within its architecture.

Conclusion

While speleothem modification consumed the least time and effort of all construction that took place in caves (i.e., platform building), it served functions of equal importance. Revered for their powers of water and fertility, speleothems used within altars and walls may have been both functional and symbolic. The utilitarian use of speleothems as path markers and bridges would have proven particularly useful when entering the cave during rituals involving fires when the consuming smoke of would have created a dependency on those speleothems designated as geographical markers.

Caves were considered the entrance to the realm of deities and ancestral spirits (Brady & Prufer 1999: 129). Chac, the deity of rain, resided within a cave and symbols of water and fertility are often associated with those of the cave. These powers have been attributed to speleothems in ethnographic and ethnohistorical literature; growths from the body of the cave have seemingly been imbued with similar powers as the cave itself.

Evidence from surface sites lend strength to the importance of speleothems. The discovery of formations among surface excavations indicates their use at the settlement. Maya artifacts found within the caves suggest a symbolic and material reciprocity between their deposition there and the speleothems taken from the cave to the settlement.
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Endnote

1 Despite the tenuous connection between archaeological features and cave formations, evidence from the 1999 and 2001 XARP seasons indicate the possibility of a connection between structures at which speleothems have been found. Both Structure 100 located at Pechtun Ha (Harrison & Acone 1999: 147) and Structure 503 at the Hershey Site appear to have served religious purposes relative to their settlements (Str. 100 is a small, stone structure in a group of entirely earthen structures; Str. 503 is the largest pyramid among the largest group at the site). Both structures yielded an excess of cave formations both within the construction and among the exposed tumble.
Pottery making involves a series of decisions made by a potter on what resources to use and which form to produce in order to meet specific needs. There is a “pot for all reasons,” as stated in the title of an edited book by Kolb and Lackey (1988). Understanding the motivation behind pottery production rarely has been achieved through the type: variety system, a preferred method by archaeologists who study Maya pottery. Ongoing ceramic analysis from the Sibun Valley settlements and caves provides a unique opportunity to explore the motivations behind pottery making and use. Traditional research includes typological descriptions of pottery supported by archaeometric techniques. When correlated with radiometric and stratigraphic data these techniques can provide a chronological framework for the studied region. A postprocessual framework guides our research to address the rationales behind pottery production in order to reach an anthropological interpretation of the past.

Geolocation of Pottery Collections

Analysis of pottery from the Xibun Archaeological Research Project (XARP) includes ceramics from both caves and settlements located in the upper, middle, and lower reaches of the valley. Specifically, collections originate from excavations at the sites of Augustine Obispo, Pakal Na, Hershey, Pechtun Ha, Samuel Oshon and Cedar Bank, and from explorations in the underground caverns of Actun Chanona, Actun Ibach, Actun Ik, and Ek Waynal caves. The study of pottery from the caves of the Sibun Valley, in particular, provides an opportunity to explore the ritual and symbolic meaning of pottery deposition within a cave environment. The goal of this analysis is to arrive at an understanding of how pottery was produced, used, re-used, and discarded by the Xibun Maya.

Analysis presented here provides a preliminary interpretation of inter- and intra-regional Maya networks across a temporal sequence spanning the end of the Late Formative to the early Colonial occupation at Cedar Bank. Local ceramic traditions of the Belize Maya region are represented for the Late Formative through the Postclassic period. In general, the Sibun Valley pottery types and varieties demonstrate modal links to the Belize Valley, Central Petén, and the Usumacinta-Pasión regions throughout the Maya Classic period. Postclassic pottery within the region shares pottery traditions with the Yucatán Peninsula and Central Petén.

Formative to Early Classic Pottery in Caves of the Sibun Valley

Pottery from the caves of the Sibun Valley suggests intermittent visitation from the Late Formative to the Postclassic period. Pottery of Chicago Orange, Flor Cream, Hillbank Red, Monkey Falls, Unnamed Red-on-orange and Aguacate Orange was recognized at Actun Ik cave. At Ek Waynal, pottery types refer to the Late/Terminal Formative (e.g., Hillbank and Monkey Falls Brown) and to the Early Classic (e.g.,...
Minanha Red). These types are reported as part of the ceramic assemblages of the Late to Terminal Formative of a vast region extending from northern Belize to the Belize Valley (López Varela and McAnany 1998).

Thus far, Late Formative to Early Classic pottery has been recovered only from cave explorations in the Sibun-Manatee Karst; none has been excavated in the settlements. Early Classic pottery is present at Actun Ibach, Actun Ik and Ek Waynal caves. Pottery markers of the Early Classic, such as orange glossy slips and polychrome basal flange plates, are well represented at Actun Ik cave by the following type: varieties -- Aguila Orange: Aguila Variety; Pita Incised: Unspecified Variety; and Actuncan Orange Polychrome: Actuncan Variety. Fragmentary Actuncan Orange Polychrome: Actuncan Variety bowls were deposited in Actun Ik and Ek Waynal caves, while vessels of Caldero Buff Polychrome: Variety Unspecified vessels were placed only in Actun Ibach. This cave also contained fragments of Lucha Incised: Unspecified Variety lid. The cover, incised with a mat design (Figure 20.1), was probably part of a monochrome tripod cylinder vase, an innovation in the Early Classic Maya vessel repertoire. Grooves and incisions of walls had been used previously to frame a Maya polychrome scene and to decorate monochrome vessels.

![Figure 20.1 Fragments of Lucha Incised: Lucha Unspecified variety lid and bowl sherd found at Actun Ibach.](image)

In central Petén, tripod cylinder vases are said to be symptomatic of contact between Maya elite communities and those of Teotihuacan (Culbert 1993). Many of these polychrome vessels have been excavated at Tikal (Culbert 1993), Uaxactun (Smith 1955), and Copán (Sharer et al. 1999). However, not all Maya communities adopted the tripod cylinder vessel or expressed through material symbols a connection with Teotihuacan. In the Sibun Valley, Maya potters grooved and/or incised the walls and covers of monochrome tripods with Maya, rather than Teotihuacan, symbols. For instance, pottery types such as Lucha Incised, Santa Teresa Incised or Urita Gouged Incised were decorated heavily with chevrons, punctuated lines, incisions, and grooves, forming scrolls, triangles dots, or geometric weave patterns (Figure 20.1).
Late Classic Pottery of the Sibun Valley Caves and Settlements

The founding of communities in the Sibun Valley may have occurred sometime during the Early Classic, but ceramic evidence relating to this time period has not been recovered. Unambiguous evidence does exist, however, for settlement growth during the Late Classic. The late growth is comparable to that of Xunantunich, located to the north in the Belize Valley (Le Count et al. 2002). Correlation of ceramic types between the caves and the settlements is noted from the Late Classic through the Postclassic.

In general, Late Classic ceramic assemblages are formed by vessels of Cambio, Encanto, and Tinaja groups (Smith 1955; Adams 1971; Sabloff 1975; López Varela 1989; Foias 1996). The jar form, in comparison to Early Classic times, increased in size, most likely in response to the food and ritual needs of an expanding population. Communities of the Sibun Valley acquired or locally produced the domestic wares of the Late Classic. Jars of Cambio Unslipped, Encanto Striated and Tinaja Red occur in the Sibun caves and at the settlement of Samuel Oshon and Pechtun Ha. Tinaja Red also is included in the ceramic assemblage of the Hershey site. Nanzal Red vessels are present both at Samuel Oshon and Aktun Ik. The presence of the Cambio, Encanto, and Tinaja groups in the Sibun Valley supports a link to the Central Petén and beyond; this link is further demonstrated by the presence of Cubeta Incised at Pechtun Ha, a Late Classic type that also occurs at Pomoná and Yaxchilan (López Varela 1989, 1998).

The Belize region also was producing its own distinctive red wares, specifically a Pine Ridge Carbonate (classified as Roaring Creek Red: Roaring Creek Variety). The Dolphin Head and Vaca Falls ceramic groups, characteristic of the Belize Valley and sites in northern Belize, also are part of the Late Classic assemblage of the Sibun Valley. Distributional patterns vary by group, type, and form. For instance, Roaring Creek Red is found in most caves explored by the XARP project and at the Hershey and Pechtun Ha settlement sites. Bowls of Dolphin Head Red are present at Actun Ibach and Actun Ik and at Pechtun Ha. Although many types are present both in caves and settlements, the “domestic formula” changes meaning when a vessel is transported to the symbolic underworld of caves (Stone 1995).

The Late Classic is well known for the Saxche and Palmar polychrome traditions found in the Usumacinta, the Pasión, Central Petén, the Belize and Sibun Valleys, and as far south as the Alto Salama River (Ciudad Ruiz 1988) and Alta Verapaz (Arnauld 1987). Polychrome vessels found at Actun Ik Cave span the Early and Late Classic periods to include Early Classic Actuncan Orange Polychrome and Dos Arroyos Orange Polychrome and Late Classic Benque Viejo Polychrome. Vessels of Palmar Orange Polychrome: Variety Unspecified were found at both Actun Ik and Ek Waynal, as well as the settlements of Augustine Obispo, Pakal Na and Samuel Oshon. Xunantunich Black on Orange: Variety Unspecified vessels appeared at Pechtun and Samuel Oshon as well as Actun Ik. Local pottery of the Belize region also is expressed in Benque Viejo Polychrome: Variety Unspecified, Chunhuitz Orange: Variety Unspecified, and Gallinero Fluted: Gallinero Variety.
“Last Pots” of the Classic Period in the Sibun Valley

Throughout the Maya lowlands, Terminal Classic pottery expresses strong continuities with the Late Classic. The domestic formula of the Tinaja, Cambio, and Encanto groups endured through the Terminal Classic at sites such as Seibal (Sabloff 1975), Yaxchilán (López Varela 1989), the Tayasal-Paxcaman zone (Chase 1984), Macanche Island in El Petén (Rice 1984), Kichpanha (Reese and Valdez 1987), and Cerro Palenque (Joyce 1987:420).

A noticeable feature of the ceramic complexes of northern Belize and the Sibun Valley is a lightly striated, buff unslipped olla, named Red Neck Mother Striated (see Chase 1982). These jars are decorated with deep red slip on short outflaring necks. In the Terminal Classic period, however, the rims are slipped red down to the shoulder, and the bodies of the jars can be striated or plain (Graham 1987: 78). Similar ollas have been reported in Belizean caves (Pendergast 1974) at San Jose (D. Chase 1982: 138-139) and at Lamanai and Actun Polbilche (Graham 1987: 79). These vessels were also encountered during explorations by the XARP Project at Pass-Through cave (Csank 1998: Figures 6.1 and 6.5) and Pottery Cave (Csank 1998: Figure 6.10; compare with Graham 1987: Figure 2j found at Actun Polbilche). Graham (1987: 78) notes that large jars with slipped or washed rims are common in Belize from Middle Preclassic to Postclassic times; however, extension of the slip down on to the vessel shoulder appears to be a hallmark of the Terminal Classic period.

In Belize, another marker of the Terminal Classic period is a large dish with outcurved sides, basal break, a ring base or pedestal base, and a wide flared-everted rim that is flattened on the interior and beveled near a rounded or squared lip (Gifford 1976: 241). As noted by Graham (1987: 78), the form is widespread in Belize and occurs in a variety of types such as Roaring Creek Red and Daylight Orange. Distribution of this form is widespread and includes the Stan Creek District, Actun Tzimin in Caves Branch Valley, Actun Polbilche in the Sibun Valley, Altun Ha, and San Jose (Graham 1987: 78). The XARP project reported similar vessels from the following cave locations: Chrissy’s Crawl-Though (Csank 1998: Figure 6.4) and Pottery Cave, where Roaring Creek vessel forms (Csank 1998: Figure 6.7 and Figure 6.9) are almost identical to one found in a burial at Lamanai (Graham 1987: Figure 2d) and another reported by Graham (1987: Figure 2f) for Actun Tzimin. The form can be traced back to the Protoclassic-period polychrome dish with flared sides, basal break, and ring base. The basal break continued through the Late Classic in the tripod vessels of Saxche and Palmar groups. During the Terminal Classic, the form is elongated, and the ring base stretched, ending in a large volumetric form for the Postclassic. The widespread use of pedestal bases is a common trend of the Terminal Classic in Belize, Central Petén, and the Usumacinta-Pasión regions; it is best expressed in pyriform vases. A related bottle form, lacking a pedestal base, was collected from Actun Chanona. This reddish yellow (7.5YR 7/8) conical bowl with a sagging base is probably a Duck Run Incised: Duck Run Variety (Gifford 1976: Figure 148) decorated with incised half circles.

At the site of Pakal Na, a pedestal conical bowl with a small mouth is an addition to the Terminal Classic repertoire. An individual (Burial 1, Operation 22) was interred with two vessels of this form. The reconstructable vessel has a light brown (7.5YR 6/3), brown (7.5YR 4/2), to black (7.5YR 2.5/1) color (Figure 5b). The height of this vessel is 19.5 cm; the diameter is 6.5 cm. The insloping walls slant in a 40° angle. The base is very interesting, as it has a sagging belly placed on a 2.32 cm high pedestal base. The vessel is slipped and burnished on the exterior side and can be identified as Xuku incised. A series of circumferential lines encircle the vessel immediately below the rim, which terminates with a rounded lip. The vessel is decorated with three dimples that encircle the vessel. Circular depressions are not a common
decoration; Ichon and Grignon Cheesman (1983: Figure 83c) report Late Classic vessels from the Middle Chixoy Valley with circular hand-modeled depressions or domes. This so-called Rio Negro Brun Noir type was found in Late Classic Tomb 1 at Chirramos. Ichon and Grignon Cheesman (1983) consider the decoration to be an indication of the Postclassic period. In the Middle Chixoy Valley, the Late Classic ceramic assemblage shares another Belize Valley marker: vertical walled, ring-based vessels. Such vessels were found in Pottery Cave (Csank 1998:Figure 6.6), Altun Ha (Graham 1987: Figure 2g), and Seibal (Sabloff 1973: Figures 300-302). Common to the Belize and Sibun Valleys (Gifford 1976: 146; Csank 1998: Figure 6.3) are impressed dishes with elongated flaring sides classified as Kaway Impressed: Kaway Variety and found in Pottery and Actun Ik caves. The vessels follow the Tepeu trend of finger impressed jars of the Cambio and Encanto groups.

**Fine paste pottery in the Sibun Valley**

Modeled-carved vessels are exemplified in the Sibun Valley through what Helmke, Colas and Awe (1998) named Belize Valley Modeled-carved vessels. The so-called Belize Valley Modeled-carved vessels are well known from Chanona and Footprint Caves (Graham, McNatt and Gutchen 1980). Helmke, Colas and Awe (1998: 101) report the finding of these vessels at Water Fall Cave and at a number of surface sites, for example, Ucanal, Baking Pot, Xunantunich, Maintzunun, Lamanai, San Jose, Altun Ha, Pacbitun and Actun Balam. Fragments of modeled-carved vessels have been found at Hershey and Pakal Na during excavations in Sibun Valley sites. Fragments of a so-called Pabellon Modeled-carved vase recently found at Chanona cave might be part of the so-called Chanona vase reported earlier by Graham, McNatt and Gutchen (1980: Figure 20.8).

The iconographic theme of the Belize Valley Modeled-carved vessels is fairly standardized as previously noted by Graham, McNatt, and Gutchen (1980) and Helmke, Colas, and Awe (1998: 96). The latter authors characterize Belize Valley Modeled-carved vessels as composed of a band of glyphs or primary standard sequence carved just below the rim, below which a relatively standardized scene was depicted within two panels. More than decoration, the panels detail a narrative. According to Helmke, Colas and Awe (1998: 131), the glyphs of the texts were written in Yucatec Mayan, suggesting a well-defined regional tradition of PSS dedications in Yucatán. In contrast, the iconography of the Ucanal vase, according to Helmke, Colas and Awe (1998: 106) is Usumacinta/Central Mexico-based. The scene on the Ucanal vase depicts the presentation of a captive to a lord who is dressed in a warrior’s costume. The authors suggest that prior to the conflict, which resulted in the capture of the kneeling prisoner, the lord had undergone a bloodletting ceremony, indicating strong continuity of Late Classic ritual conventions. The Belize Valley Modeled-carved vessels also express confrontational scenes like those of the Usumacinta and Pasion regions.

Sherds of Fine Orange pottery are in the Sibun Valley; this fact supports arguments against the theory that foreign invaders introduced fine pastes (see Foias 1996; López Varela 1998). The making of Belize Valley Modeled-carved vessels may be a further clue to the adoption of a fine paste tradition that had been present in the Yucatán since the Late Classic. Chemical characterization and provenance studies are needed to define the locus of production of the Belize Valley Modeled-carved vessels, as have been conducted for the Pabellon Modeled-carved vessels of the Usumacinta zone. Such studies are needed before confirming that these vessels are not related to Pabellon Modeled-carved as Helmke, Colas and Awe (1998: 98) have suggested. Significantly fine paste pottery that clearly falls within the Altar Group also is present within the pottery assemblage of the Sibun.
The Postclassic Period in the Sibun Valley

The beginning of the Postclassic period in the Sibun Valley is marked by the appearance of new ceramic modes linked to the Yucatán Peninsula. These modes proliferate during the time following the Burial 1 mortuary ritual at Pakal Na (see Harrison and Acone, Chapter 10, this volume). Previous markers of the Terminal Classic, however, continue into the early part of the Postclassic, for example: pyriform jars, pedestal base cylinders, and open tripod bowls with bulbous or effigy molded supports. Communities in the Sibun Valley followed the Tayasal-Paxcaman ceramic styles, such as Maskall Unslipped: Maskall Variety (A. Chase 1984: 36). This type was identified at the Samuel Oshon site for the Early Postclassic. Comales are found in the Yalam ceramic at Colha (Valdez 1987: 252) and within the ceramic inventory of the Samuel Oshon site.

Middle Postclassic pottery in the Sibun River Valley is expressed in the Paxcaman Ceramic Group found at both Pakal Na and Samuel Oshon sites. Chase and Chase (1987: 61) suggest that the appearance of Paxcaman Red ceramics during the Middle Postclassic period is the result of local experimentation in the Tayasal-Paxcaman zone. Valdez places the Paxcaman ceramic group (1987: 253) in the Middle Postclassic Canos Complex of Colha.

The Late Postclassic in the Sibun Valley may be identified by a cylindrical support from a tripodal bowl or dish that exhibits two circular vents. The support, excavated from the Samuel Oshon site, may belong to a Payil Red vessel. Identical supports are reported for Los Renegados (Valdez and Guderjan 1988: Figure 1: 23), Mayapan (Smith 1971: Figure 41), and Watson’s Island (Graham 1994: 197). Graham (1994: 167) also reports a grater bowl from Altun Ha and Lamanai with similar supports. Graham places these dishes chronologically between the late 14th and 15th centuries A.D.

Thus far, Postclassic pottery from the Sibun Valley is concentrated at the sites of Pakal Na, Samuel Oshon, and Actun Ibach. Types of Tulum Red (Paxcaman Red), Ixpop Orange Polychrome, and Mama Red (Papacal Incised) groups have been identified within the collections together with Mayapan-style incensarios. Postclassic pottery may be considered scarce in comparison with pottery from other periods; however, identification of these essential components of the Postclassic sequence serves as basis for future studies.

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Caves are an excellent resource in the study of archaeological ceramics. They represent one of the few environments in which whole vessels can be preserved and studied. The lack of weathering and relatively constant temperature aid in the preservation of materials that would undoubtedly deteriorate in other sections of the tropics. Through the Xibun Archaeological Research Project (XARP), I have begun to study the whole vessels found in three of the caves mapped during the 2001 season; Actun Chanona, Usrey Cave, and Arch Cave. These caves are located within walking distance of the Sibun River and are relatively near to surface sites that were excavated.

Actun Chanona is located in the karstic limestone of the upper reaches of the Sibun River, near the foothills of the Maya Mountains. It is a large cave with an impressive eastern entrance. The ancient Maya modified many sections of the cave, especially an area called the Great Platform. This region consists of a large natural rock formation with cracks and crevices that were filled in with limestone breakdown, a layer of red clay, and finally, a layer of burned material and sherds. This area is an important frame of reference within Actun Chanona.

Usrey Cave is much smaller than Chanona and is located in the middle reaches of the Sibun. It is one of many caves in the Tiger Sandy Bay district. There are also examples of human modification, however on a much smaller scale than Chanona. This section of the valley can be characterized geomorphologically as cone-karst and cockpit karst. Although Usrey Cave contains an extremely difficult of access chamber with four vessels, the vessels under study here were found in an alcove above the main entrance.

The final cave is Arch Cave that is located in the lower reaches of the Sibun River. This region marks the furthest extent of the karstic limestone. The cave is relatively easy to access because the men who care for it built stairs to enable visitors to tour the cave. Evidence of ancient modification is also present. The entrance was completely blocked with limestone rubble at one point in time. A pathway of broken sherds leads to a jaguar tooth and a hidden room that contains fifteen complete vessels. This path has been termed “sherd alley” and the room is called the “assassin bug chamber” due to the large number of cone-nosed insects that live in and near the room. The main focus of this research is the distribution of whole pottery vessels found within these three caves. The size of the vessels and context in which they were encountered by the cave teams will shed some light on the purpose and significance of such vessels, especially if there is standardization of form or size.

Methods

The process of studying cave ceramics began with the selection of the caves. I sampled these three caves because they are located in three different sections of the Sibun River Valley and they contain examples of whole vessels. The next stage took places inside the caves. While in the cave, a member of each team drew a sketch of each of the fifteen vessels using measurements taken from the actual artifact. The height and wall thickness were recorded with measuring tapes and calipers where possible. If the base
was missing due to the presence of a kill hole then the actual height could not be measured. If the vessel was whole then the actual wall thickness of the neck and base could not be measured. A sketch of the surface appearance was completed in the cave along with Munsell colors. The colors are difficult to record exactly due to the poor lighting environment. The actual vessels were left inside the caves because they are believed to be safe from looting and the transport of some vessels would most likely result in fracturing. This study presents a small sample of the Sibun Valley cave vessels because all the caves in the valley have not been explored nor mapped and looting of some caves has prevented the recording of these vessels that were removed. Also, the vessels located in the assassin bug chamber could not be studied this season due to the possible health hazards associated with the insects. Possibly next season a method for removing or repelling the assassin bugs would make the study of these vessels feasible.

The next step took place in the lab. We used the sketch drawings as templates in order to produce a finished drawing of each vessel. The measurements were followed exactly and in the instances where measurements could not be recorded we estimated wall thickness. I then used the original drawings along with the cave forms to compare the vessels and their contexts. The drawings were done on a scale of 1:1 cm originally; however, to be included in the report they had to be scaled down via a photocopier to 33% of the original size and then inked.

Data Set Description

All the vessels were most likely constructed by hand using a coil method. Since the Maya did not have a pottery wheel, the vessels could not have been thrown. The jars and bowls were probably made in a fashion similar to that of the modern-day Maya of Guatemala (Reina and Hill 1978: 81-86). The Maya probably constructed the large ollas in sections in order to shape and be able to manage the clay on that scale. The rims and appendages such as pedestal and ring bases were added to the vessel form in the third stage, after the body had been shaped and smoothed. The firing of these vessels is a complicated task. A certain temperature must be reached in order to bake the clay. Also, tempers added to the clay aid in the firing process by making the vessels more durable. Multiple vessels can be fired at once in an open-air kiln which is the type of kiln the Maya most likely used. The transport of such vessels can also be seen in the modern ethnoarchaeological example of Guatemala. When bringing ceramics to market to sell, many Maya people carry the vessels in a net or *cacaste* (cargo container) attached to a tumpline that is strung across the forehead. The back of the transporter supports the weight of the vessels. A person would carry as many ceramics as they physically could in order to sell as many vessels as possible (Reina and Hill 1978:26, 208).

The following is a description of each vessel I drew during the course of the XARP 2001 field season and represents my study sample. These vessels range from massive ollas to small bowls and come from three different caves. All the information gathered here has been amassed from the cave vessel forms, the sketches, and final drawings. Figures 21.1-15 represent the scaled down drawings and profiles of these vessels. The final section of the description concerns the vessels in the Assassin Bug Chamber of Arch Cave. Since we could not draw nor take exact measurements of these vessels due to health concerns, I have compiled a table that gives a general description of each vessel (Table 21.1). Also included are views of the the Northwest, West, and Southwest sectors of the chamber in figures 21.16, 21.17, and 21.18, respectively. The information was gathered during the mapping of the assassin bug chamber and is recorded in the field notebook.
Vessel Descriptions

Table 21.1 Vessels from the Assassin Bug Chamber

<table>
<thead>
<tr>
<th>Vessel No.</th>
<th>Brief Description (Taken from Mapping Notes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>Inverted gray olla between columns</td>
</tr>
<tr>
<td>72</td>
<td>Inverted olla with kill hole on side and top</td>
</tr>
<tr>
<td>73</td>
<td>Large black, inverted olla with a kill hole near back wall surrounded by rim sherds</td>
</tr>
<tr>
<td>74</td>
<td>Large inverted olla with large kill hole (bottom missing)</td>
</tr>
<tr>
<td>75</td>
<td>Broken red bowl with mend hole (Roaring Creek Red?) in front of Vessel 74</td>
</tr>
<tr>
<td>76</td>
<td>Large, complete Roaring Creek Red bowl with kill hole in the bottom in front of chamber</td>
</tr>
<tr>
<td>77</td>
<td>Inverted olla with calcified, red rim and kill hole in the bottom, rim of vessel 78 rests on it</td>
</tr>
<tr>
<td>78</td>
<td>Inverted olla, same form as Vessel 77 but larger, huge kill hole (bottom missing), resting on Vessel 77</td>
</tr>
<tr>
<td>79</td>
<td>Small reddish olla, half missing, on its side</td>
</tr>
<tr>
<td>80</td>
<td>Inverted olla with large kill hole in bottom, behind Vessel 77</td>
</tr>
<tr>
<td>81</td>
<td>Inverted ring base bowl with large kill hole, stalagmite to the right</td>
</tr>
<tr>
<td>82</td>
<td>Small upright bowl, ring base, medial break, large pieces missing from both sides</td>
</tr>
<tr>
<td>83</td>
<td>Large tan olla broken in half lying on its side</td>
</tr>
<tr>
<td>84</td>
<td>Large cream colored olla, in half, on its side, left of the room entrance</td>
</tr>
<tr>
<td>85</td>
<td>Small bowl broken in half, similar to Vessel 82 but larger, behind Vessels 77 and 78</td>
</tr>
</tbody>
</table>

Vessel No. 45

Location: C 21 Actun Chanona
Form: Olla
Rim Type: Squared
Size: Rim Diameter = 32 cm
       Height = 37.8 cm
       Maximum Body Width = 37 cm
       Rim Thickness = 1.45 cm
       Neck Thickness = 1.15 cm
       Base Thickness = N/A
Surface: Unslipped and fire-clouded
Paste: No visible inclusions, oxidized firing environment
       Color: 10YR 5/1 Gray
Context: A mid-sized olla with a kill hole located at the western end of the Great Platform in a small outcrop.
Vessel No. 47

Location: C 21 Actun Chanona
Form: Olla
Rim Type: Beveled
Size:  
  Rim Diameter = 39 cm  
  Height = 40 cm  
  Maximum Body Width = 37 cm  
  Rim Thickness = 1.43 cm  
  Neck Thickness = N/A  
  Base Thickness = N/A  
Surface: Unslipped, mottled  
  Color: 2.5 Y 7/1 Light Gray  
Paste: No visible inclusions  
  Color: 10YR 6/1 Gray, 2.5 Y 4/1 Dark Gray  
Context: A mid-sized olla located in an upper niche along the western edge of the Great Platform. No kill hole is present, however there are large fissures emanating from the base.

Vessel No. 48

Location: C 21 Actun Chanona
Form: Olla
Rim Type: Squared
Size:  
  Rim Diameter = 28 cm  
  Height = 35 cm  
  Maximum Body Width = 34 cm  
  Rim Thickness = 0.83 cm  
  Neck Thickness = 0.72 cm  
  Base Thickness = 1.28  
Surface: Mottled  
  Color: 10YR 4/3 Brown, 7.5YR 4/3 Brown  
Paste: No visible inclusions, oxidized firing environment  
  Color: 10YR 6/3 Pale Brown  
Context: A mid-sized olla located on the western slope of the Great Platform on the approach to the Western Entrance. A 13.85 cm diameter kill hole is present in the base of the vessel with radiating fractures toward the mouth.
Vessel No. 49

Location: C 21 Actun Chanona
Form: Olla
Rim Type: Squared
Size: Rim Diameter = 23 cm
    Height = 26 cm
    Maximum Body Width = 27 cm
    Rim Thickness = 0.96 cm
    Neck Thickness = 0.78 cm
    Base Thickness = 0.94 cm
Surface: Unslipped and modeled with fire-clouding
    Color - 7.5YR 2.5/1 Black, 7.5YR 4/6 Strong Brown
Paste: No visible inclusions, reduced firing environment
    Color - 2.5Y 6/3 Light Yellowish Brown
Context: A small olla located 3 m West of Vessel 48 on route to the Western Entrance. 35% of the vessel is absent due to a massive kill hole that obliterated the base.

Vessel No. 50

Location: C 21 Actun Chanona
Form: Olla
Rim Type: Squared and flared
Size: Rim Diameter = 13 cm
    Height = 33 cm
    Maximum Body Width = 34 cm
    Rim Thickness = 0.77 cm
    Neck Thickness = 1.2 cm
    Base Thickness = 0.65 cm
Surface: Slipped and burnished, calcification and fire-clouding
    Color: 2.5YR 4/6 Red
Paste: Fine, white inclusions
    Color: 2.5YR 5/6 Red
Context: This vessel is a mid-sized olla with a very restricted neck. It was found on its side with a large sherd inside the vessel that had been removed via a kill hole. The sherd was placed inside in antiquity as evidenced by the lack of calcification on the sherd. The vessel is located in a large burned area to the right of and above the Human Remains 1,2, and 5. It was most likely moved to this position because of the existence of a small speleothem (soda straw) near the neck of the vessel.
Vessel No. 55

Location: C 17 Usrey Cave
Form: Olla
Rim Type: Squared
Size: Rim Diameter = 22 cm
    Height = 28 cm
    Maximum Body Width = 29 cm
    Rim Thickness = 0.57 cm
    Neck Thickness = N/A
    Base Thickness = N/A
Surface: Slipped, striated, calcification, and fire-clouding
    Color: 10YR 4/6 Red, 7.5YR 5/6 Strong Brown
Paste: No visible inclusions
    Color: 10YR Light Yellowish Brown
Context: A small, red-rimmed olla found on its side in front of a small depression to the south of Vessel 56. The vessel is located in a small alcove.

Vessel No. 56

Location: C 17 Usrey Cave
Form: Olla
Rim Type: Squared
Size: Rim Diameter = 22 cm
    Height = 23.5 cm
    Maximum Body Width = 24 cm
    Rim Thickness = 0.56 cm
    Neck Thickness = N/A
    Base Thickness = N/A
Surface: Slipped, fire-clouding, eroded
    Color: 10YR 4/6 Red, 10YR 5/3 Brown
Paste: Calcite inclusions
    Color: 10YR Light Yellowish Brown
Context: A small, red-rimmed olla closely associated with Vessel 55 in the small alcove above the main entrance. It is almost identical to Vessel 55 but shorter. It contains small animal bones and shells. A large, broken stalagmite from the other side of the depression was placed behind the vessel.
**Vessel No. 57**

Location: C 24 Arch Cave  
Form: Olla  
Rim Type: Beveled  
Size:  
  - Rim Diameter = 40 cm  
  - Height = 38 cm  
  - Maximum Body Width = 45 cm  
  - Rim Thickness = 1.13 cm  
  - Neck Thickness = N/A  
  - Base Thickness = 0.56 cm  
Surface: Unslipped and course  
Paste: Small, white inclusions, oxidized firing environment  
  - Color: 5YR 4/6 Yellowish Red  
Context: A mid-sized olla located in an alcove to the left of the main entrance. It is inverted and contains a large kill hole that removed about 35% of the base.

**Vessel No. 58**

Location: C 24 Arch Cave  
Form: Olla  
Rim Type: Beveled  
Size:  
  - Rim Diameter = 51 cm  
  - Height = 58.5 cm  
  - Maximum Body Width = 59 cm  
  - Rim Thickness = 2.15 cm  
  - Neck Thickness = N/A  
  - Base Thickness = N/A  
Surface: Unslipped and course, fire-clouding  
Paste: Fine inclusions  
  - Color: 5YR 5/4 Reddish Brown  
Context: The first of two huge ollas found in this cave. It is located in the first large chamber to the right of the entrance. It is closely associated with a fragmented pedestal base vessel and two stone altars. The olla was originally found on its side.
**Vessel No. 60**

Location: C 24 Arch Cave  
Form: Olla  
Rim Type: Round  
Size: Rim Diameter = 26 cm  
  Height = 28.5 cm  
  Maximum Body Width = 35 cm  
  Rim Thickness = 1.31 cm  
  Neck Thickness = N/A  
  Base Thickness = 0.61 cm  
Surface: Unslipped except for rim, course, and fire-clouded  
  Color: 2.5YR 3/2 Dusky Red  
Paste: Fine, white inclusions  
  Color: 2.5Y 4/1 Dark Gray  
Context: Vessel 60 is a small, overturned vessel with a kill hole. It is located on the large ledge along the left side of the first large chamber, which is also on the route toward sherd alley that leads to the assassin bug chamber.

**Vessel No. 61**

Location: C 24 Arch Cave  
Form: Olla  
Rim Type: Round  
Size: Rim Diameter = 23 cm  
  Height (to kill hole) = 23 cm  
  Rim Thickness = 0.95 cm  
  Neck Thickness = N/A  
  Base Thickness = 0.45 cm  
Surface: Unslipped except for rim, course, and fire-clouded  
  Color: 2.5YR 4/3 Reddish Brown  
Paste: Fine, white inclusions  
  Color: 2.5YR 5/2 Weak Red  
Context: A small, overturned olla near a complete pedestal vessel and stone altar. The base is mostly missing due to the presence of a kill hole. The rim is red with a fading brown to black body and fire clouding.
Vessel No. 65

Location: C 24 Arch Cave
Form: Olla
Rim Type: Beveled
Size:
- Rim Diameter = 47 cm
- Height = 56 cm
- Maximum Body Width = 61.5 cm
- Rim Thickness = 1.23 cm
- Neck Thickness = N/A
- Base Thickness = N/A
Surface: Unslipped and course with painted rim and fire-clouding
Color: 2.5YR 4/4 Reddish Brown, 2.5Y 4/1 Dark Gray
Paste: Fine, white inclusions
Color: 5YR 6/4 Light Reddish Brown
Context: The second massive olla found in this cave. It is closely associated with a stone altar and a complete pedestal vessel (Vessel 67). It is propped up on a small pile of rocks with a large bowl sherd behind it. The vessel does not have a kill hole but there are cracks radiating from the base. The contents of the olla include some sediment and small animal bones, possibly rodent. The rim has been painted red. The vessel is located next to the wall in a chamber with a low ceiling farther inside the cave.

Vessel No. 67

Location: C 24 Arch Cave
Form: Bowl with large pedestal base
Rim Type: Round
Size:
- Rim Diameter = 50 cm
- Height = 20 cm
- Maximum Body Width = 36 cm
- Rim Thickness = 0.9 cm
- Neck Thickness = N/A
- Base Thickness = 0.62 cm
Surface: Slipped and fire-clouded
Color: 2.5YR 4/8 Red
Paste: No visible inclusions
Color: 7.5YR 6/4 Light Brown
Context: The vessel is located 7 cm from the stone altar near Vessel 65. It is overturned and has a kill hole in the center of the base. The pedestal appendage is 1.01 cm thick. The surface treatment is only visible in patches between calcification.
Vessel No. 68

Location: C 24 Arch Cave
Form: Olla
Rim Type: Round
Size: Rim Diameter = 22 cm
            Height = 26 cm
            Maximum Body Width = 27 cm
            Rim Thickness = 0.84 cm
            Neck Thickness = N/A
            Base Thickness = N/A
Surface: Rough and modeled
            Color: 7.5YR 2.5/1 Black
Paste: No visible inclusions
            Color: 7.5YR 6/8 Reddish Yellow
Context: A small, overturned olla located above the cave floor in a niche on a ledge. It is black with reddish orange swirls and striations across the body. Nothing else is closely associated with this vessel.

Vessel No. 69

Location: C 24 Arch Cave
Form: Bowl with ring base
Rim Type: Round
Size: Rim Diameter = 21 cm
            Height = 11 cm
            Maximum Body Width = 23.5 cm
            Rim Thickness = 0.88 cm
            Neck Thickness = N/A
            Base Thickness = N/A
Surface: Slipped, modeled, and calcified
            Color: 7.5YR 2.5/1 Black
Paste: No visible inclusions
            Color: 2.5YR 3/4 Dark Reddish Brown
Context: A complete, small bowl located high on a difficult to access ledge. There is one large sherd 1.5 m away that is associated with the bowl. Caked mud and calcification are present on the surface. It is propped up on a small pile of rocks. No kill hole and no cracks are visible.

Analysis

The information amassed from these complete vessels through the research of the 2001 XARP can be utilized to compare and contrast the cave ceramics of the Sibun River Valley. The type of vessel that will be analyzed most extensively is the olla, or jar, since this form is the only one that can be found in all three caves under study and is the most prevalent in general (Table 21.2). An olla can be defined as a globular vessel with rounded walls, a small flat base, and a restricted mouth (Reina and Hill 1978: 26). The degree
of restriction can vary from slight to very narrow. These jars are still used in Guatemala today for food storage and preparation. The bowls are shorter vessels with unrestricted necks and many times include a ring or pedestal base. These ceramics are often used to serve foods (Reina and Hill 1978: 28).

Table 21.2 Pottery Forms in Chanona, Usrey, and Arch Caves

<table>
<thead>
<tr>
<th>Cave</th>
<th>Ollas</th>
<th>Bowls</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chanona</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Usrey</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Arch</td>
<td>17</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>5</td>
<td>29</td>
</tr>
</tbody>
</table>

There are a total of twenty-four complete ollas in Chanona, Usrey, and Arch Caves combined. Arch by far outnumbers the other two caves in olla and whole vessel counts with totals of seventeen and twenty-nine, respectively. These results may be skewed due to looting and/or human and natural disturbance within the caves since pre-Colombian times. Also, fragmentary examples of both types of ceramics are found in each of the caves. However, this study focused on complete vessels only. A complete vessel in this case is characterized as either a vessel with no missing fragments or with basal fragments absent as a result of a ritual killing. Maya animistic beliefs extended to pottery vessels and it is generally thought that a “kill hole” in the bottom of a vessel not only terminated the use life of a vessel but marked it as part of a ritual offering.

The ollas range in height from 23.5 to 58.5 cm. The majority of heights for these vessels tend to fall between 20 and 40 cm with only two outlying vessels (Figure 21.19). Rim diameters of all the vessels including bowls range from 13 to 51 cm. Rim wall thickness of the vessels occupy a span between 0.56 and 2.15 cm with most falling within a one centimeter bracket around 1 cm thick. Only one vessel lies outside this range, Vessel 58. The potter who made this large olla may have made the walls thicker in order to ensure the stability of the vessel. A comparison of olla height to maximum width reveals that these examples vary slightly in the category as demonstrated by the Pearson’s r value of about 0.94 (Figure 21.20). Eight of twelve vessels are within one centimeter of a 1:1 ratio. The greatest degree of variation is exhibited by Vessel 57 that has a diameter that is 7 cm wider than it is tall.
Of the fifteen complete vessels studied, thirteen were found in difficult to reach/obscured locations or in a ritual context (Table 21.3). For example, Vessel 58 is located in a section of Arch Cave that also included two stone altars (Figure 21.21). Also, Vessel 65 is associated with a stone altar and an overturned pedestal bowl with a kill hole (Figure 21.22). Only two vessels, 57 and 60, were located in the open with no immediately apparent ritual context.

Table 21.3 Location of Complete Vessels in Chanona, Usrey, and Arch Caves.

<table>
<thead>
<tr>
<th>Location</th>
<th>Vessel Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to reach/hidden</td>
<td>47, 50, 55, 56, 68, 69</td>
</tr>
<tr>
<td>Ritual/Altar context</td>
<td>45, 48, 49, 58, 61, 65, 67</td>
</tr>
<tr>
<td>Neither</td>
<td>57, 60</td>
</tr>
</tbody>
</table>

Inferences and Conclusions

Through the comparison of the data collected here I have deduced that there is some standardization of complete cave vessels within the Sibun River Valley. While at first glance the vessels may seem to be quite unique and varied in size, a closer examination of the ratio between vessel height and maximum body width of the ollas reveals that as the jars increased in height, their width increased proportionally as demonstrated in the high Pearson’s r value. There seems to have been a standardized 1:1 ratio of height to width concerning the production of ollas placed in caves in the Sibun Valley.

The rim types are varied but each of the three types is equally likely to be used. About thirty percent of the vessels had a round or beveled rim with slightly more (about forty percent) exhibiting a squared rim. These may be regional or site specific style variations on rim type.

There also seems to be uniformity in the settings in within the caves in which the vessels were found. I believe that all the vessels were originally placed in ritually significant areas. Their locations today may be slightly different from the original context and other objects that would indicate ritual significance may have
been removed from the cave. The same preservation that makes the study of cave ceramics possible also provides looters with excellently preserved examples of Maya ceramics. Also, ritual items tend to be of high quality, an attribute that looters prefer. The fact that many of the vessels somewhat hidden, are positioned in difficult to reach sections of the caves, or are directly associated with stone altars and other items of ritual significance (such as the jade bead near Vessel 49), supports this conclusion that these vessels were placed in the caves as part of a ritual.

Ceramic vessels were an important commodity for the ancient Maya. The existence of mend holes in Maya pottery illustrates that even after a vessel broke, it could still be used if held together with twine. Perhaps ceramics were curated as long as possible because the procurement of another was not always feasible economically. The production of a single large olla requires great skill and resources. Properly tempered clay and an open-air firing pit large enough to fire such a vessel demonstrates the significance of this olla. Also, the effort required to transport these vessels up the side of the karstic limestone hill, into the cave entrance, and through the darkened cave passages reveals that these vessels were left here for a purpose, most likely as a ritual offering.

The Maya believed that caves housed the gods of the underworld such as Chac, the god of rain (Bassie-Sweet 1991: 93). In times of drought or planting, the Maya would probably make offerings to Chac to ask for rain or a good agricultural season. Maya society was based on agriculture, therefore water was an extremely important resource and the appeasement of Chac was a great priority. Many of the vessels found in the caves could be used to store or carry water. Also, the burning of copal incense was an important part of ceremonies. Small vessels such as Vessel 69 may have been used as incense burners although analysis of the interior of the bowl would give a definitive answer.

As a result of this preliminary study of the cave ceramics of the Sibun River Valley, conclusions as to significance and uniformity have been drawn. Future research in the caves of this valley would most likely increase the sample size and shed more light on this aspect of Maya pottery and ritual. A study of the types of vessels and the time frames within which they were made could help in dating the used of the caves. Also, a comparison with local surface site ceramics could possibly provide a connection between specific sites and caves. This correlation would prove interesting and useful in further research in the Sibun River Valley. A complete study of sherds found in the caves would be time consuming but very helpful to this area of research.

References Cited

Bassie-Sweet, Karen

Reina, Ruben E. and Robert M. Hill, III
1978 *The Traditional Pottery of Guatemala.* University of Texas Press, Austin.
The ancient Maya produced a variety of chipped stone tools which were used to aid them in everyday chores and for ritual purposes. The Xibun Archaeological Research Project (XARP) recovered chipped stone tools from both settlements and caves. Since caves are an entirely ritual context, it can be assumed that the tools found in the caves were used for ritual purposes. If the tools found in the settlements were meant largely for everyday use and the tools found in the caves were meant primarily for ritual purposes, several questions arise. Are the tools from the settlements different from the tools found in the caves? Did the Maya use different raw materials for the tools meant for ritual purposes? Were the cave tools flaked more expertly than the settlement tools? Did the tools from both contexts show evidence of use like reworking or wear patterns? Are the same types of tools found in both contexts?

Because the tools from the caves were used in rituals theoretically meant to appease the gods, it seems reasonable that the Maya would use tools of the finest material and quality. Thus, one might expect to find that the tools from the caves are produced from raw materials of finer quality and are knapped more expertly than the tools from the settlements. One might also expect to find different types of tools in the caves than in the settlements, assuming that the cave tools were produced specifically for ritual functions. Tools made for ritual purposes might be larger both because a larger tool is more impressive, and because tools used in rituals may not have been reworked as often. Settlement tools were presumably used in everyday chores and would have needed reworking fairly frequently. If a tool was used strictly in ritual contexts it was probably not used often and did not require frequent reshaping.

Methods

This study examined all the formal chipped stone tools from the XARP 1999 and 2001 field seasons. Altogether there were 38 tools. Included in the sample were all the tools found in the excavations of settlements, shovel test pit excavations, settlement surface collection, and cave surface collection. This study did not look at debitage, flake tools, or ground stone tools. Flake tools were defined as large reworked flakes with evidence of use. Chipped tool fragments were examined as well as whole tools. One tool that was not included in the study was an archaic projectile point found on the surface of the Hershey site.

Once the sample had been collected and processed through the lab, each tool was examined individually. The “Protocol for Analyzing K’axob Lithics” developed by Polly Peterson, with the guidance of Dr. Patricia A. McAnany, was used to determine the tool types, raw material, and condition of each tool. Because the protocol was developed for lithics in a different area of Belize, there were some modifications to the protocol in the tool type category. A spreadsheet was created to record the information for each tool. Provenience was noted for each tool, as well as the type of tool, the type of raw material from which the tool was produced, and the fragment type (proximal,
distal, medial, or whole tool). Also recorded were the length, width, and thickness of each tool in centimeters, and the weight of each tool in grams. Finally, each tool was examined for use wear, evidence of reshaping, evidence of burning and patination, and the quality of workmanship in producing the tool. Use wear was determined by examining the edges of the tool for any evidence that the tool was utilized. Tools that showed heavy use tended to have edges that were crushed. A tool with many small secondary flakes taken off the edge was thought to have been reshaped. Burning of the tool was determined partially by the color of the stone. Chert tends to take on a reddish color when burned. Pot lidding and fire crazing on the surface of the tool also determined burning. The quality of workmanship was determined primarily by the size of the flakes removed from the tool. Tools that had large, uneven flakes taken off were determined to be of poorer workmanship. A tool produced with very good workmanship had very fine, even flakes removed from it.

The biggest difficulty encountered was trying to determine raw material classes. All of the tools in the data set happened to have been produced from chert. However, trying to determine what type of chert proved to be very difficult. At first it appeared that the majority of the tools were produced from a chert source in northern Belize. However, during the 2001 season a possible chert source was discovered along the Sibun River near the Augustine Obispo and Samuel Oshon sites. The chert from the Sibun source appeared very similar to the chert from the northern Belize source. Both types of chert were similar in color, both contained fossilized material, and both had similar cortex. Both types of chert also appeared to be of similar quality. Without microscopically comparing the two types of chert it was not possible to distinguish which tools were produced from the northern Belize chert and which were produced from the Sibun chert.

**Data Set Description**

Of the 38 chipped stone tools examined in this study, eight were found in the caves, two were recovered from shovel test pits, and one was discovered on the surface at the Hershey site. The other 27 tools came from settlement excavations. The most common tools in the data set were oval bifaces with a total of 21 examples. Oval bifaces are oval shaped tools with flakes removed from both the dorsal and ventral sides. These were all-purpose tools probably used for digging and chopping. Of the 21 oval bifaces found, five of them were discovered in the caves, two came from shovel test pits, and the remaining 14 were from settlement excavations. Blades and projectile points were the next most common tools with five blades and four projectile points in the data set. Blades are tools that are produced from a large flake. They generally do not have flakes taken from the surface and they have at least one very sharp edge. Blades will often have resharpening flakes removed from the edges. Projectile points generally have flakes removed from both the dorsal and ventral sides, but unlike oval bifaces, projectile points come to a sharp point on the distal end. Only one of blades was recovered from the caves. The other four blades came from the settlements. Of the seven projectile points, six were found in the settlements and one was found in the caves. Other types of tools in the data set include a hammerstone, which showed extensive evidence of battering on the distal end, a stemmed biface fragment, a reworked biface, and a reworked blade. There was also one non-diagnostic tool fragment recovered from the caves. The hammerstone, stemmed biface, reworked biface, and reworked blade all came from the settlements. The settlement sites from which tools were recovered include the Samuel Oshon site, Pakal Na, Pechtun Ha, Augustine Obispo, and Hershey. The caves that contained tools include Chrissy’s Crawl Through, Actun Ik,
Metate Cave, Shoepot Cave, K’in Rockshelter, and Arch Cave. The majority of the tools (n=18) were recovered from the Samuel Oshon site.

Of the five oval bifaces from the cave, four were whole tools and one was proximal fragment. All of the cave bifaces were produced from fine chert. All were well flaked but the tool from Metate Cave was more expertly flaked than the other tools. All of the tools showed signs of wear. The edges were crushed and there was evidence of sharpening along the edges of the tools. The four tools from Shoepot Cave and Arch Cave were well-used tools. They bore evidence of extensive reworking and were fractured from use. Also, the tools from Shoepot Cave appeared to have been shortened by reshaping during the time they were used. One of the tools from Shoepot Cave and one from Arch Cave showed evidence of hafting with polish in the area where the tools may have been affixed to a haft. All of the tools from the caves were patinated, indicating exposure to the elements, but the two tools from Shoepot Cave were each heavily patinated, although only on one side.

The oval bifaces from the settlements all were made of chert. Only one tool was produced from poor quality chert. All of the settlement bifaces show heavy use. The edges of the tools are crushed and edge refurbished flakes have been removed from all of the tools. Many of the tools exhibited a dull polish indicating use and there is evidence of hafting on some of the tools. Most of the bifaces are well flaked but some had large flakes removed from the surface and uneven edges, perhaps indicating that they were produced quickly or by someone who was not an experienced flint knapper. All of the settlement tools were either patinated, indicating exposure to the elements, or burned. The burned tools were discolored by fire, pot lidded, and often fire crazed. Only two of the settlement bifaces were whole tools. Thirteen of the tools were fragments. The bifaces were not very well distributed through the settlements. Twelve of the bifaces were found at the Oshon site, three from Obispo, and one from Pakal Na.

There was one macroblade fragment recovered from the Actun Ik (Figure 22.1). It was a proximal fragment produced from fine chert and it was well flaked. It bore evidence of use with crushing along the edges and flakes had been removed from the edges to sharpen the tool. The original bulb of percussion was intact on the dorsal side of the blade. Additionally, four fragmentary blades were excavated from the settlements. All were produced from quality chert and all were well flaked. All showed evidence of use and had fine flakes from the edges to sharpen them when they were dull. One of the fragments had polish along the edge indicating use, and one fragment was badly burned. The burned fragment was discolored with pot lidding and fire crazing.

Six projectile points were found in the settlements. Five of the points were distal fragments, while one was a complete tool. One complete projectile point was recovered from Chrissy’s Crawl Through. Of the projectile points from the settlements, three were from the Oshon site and Pakal Na, Obispo, and Hershey each yielded one (Figure 22.2). Three of the six projectile points from the settlements were badly burned. All were finely flaked and produced from quality chert. All of the points showed evidence of reworking around the tip, perhaps to sharpen the tool. Three of the tools were highly polished at the tip showing there was much use on that area of the tool. Two of the tools have crushed edges indicating wear on the edges. All of the tools may originally have been larger but then reworked to their present smaller size.
Of the six projectile points found in the settlements, two were laurel leaf spear points. One was found in a surface collection at the Hershey site imbedded in a tree, the other was from the Obispo site. The tool from the Hershey site, while broken, was complete and the tool from Obispo was a distal fragment. Both tools were made of quality chert, and both were expertly flaked. The complete tool showed evidence of reworking and was polished in the area where it had been hafted. It was also almost completely patinated from being exposed to the weather while being imbedded in the tree. The distal fragment shows no evidence of reworking. Both tools are still sharp and the edges were not crushed.

The projectile point found in Chrissy’s Crawl Through was a lanceolate spear point. It was a whole tool produced from very fine chert possibly from the chert source in northern Belize. The tool is expertly flaked with very fine, delicate flakes removed from the tool. The chert was almost translucent but there was patination beginning on the proximal end. There was no evidence of reworking and the tool was still sharp. The tool was produced from chert of very good quality and the workmanship in producing the tool was excellent.

The Oshon site yielded a bifacial tool that appeared to have been used as a hammerstone (Figure 22.3). The tool was produced from good chert but was not flaked particularly well. There were large, uneven flakes taken from the surface. The tool is thick and fairly stout. The proximal end tapers to what may have been a stem for hafting. There is polish on the stem to indicate that it may have been hafted. The edges of the tool are crushed from use and are not sharp. The distal end
of the tool is badly battered and there are large fractures at the distal end that may have been the result of battering. The proximal end also shows evidence of battering but not nearly as extensive as the evidence on the distal end. The tool appears to have been a large oval biface that was reworked into a hammerstone.

![Figure 22.3 Bifacial tool used as a hammerstone (illustration by author).](image)

Operation 22 at Pakal Na yielded what appears to be a stemmed biface fragment, possibly a stemmed spear point (Figure 22.4). Since the category for that type of tool was not on the protocol used to identify the tools, a new category was added. The fragment was from the proximal end of the tool and contained the entire stem. The tool was expertly chipped from fine chert. There was no polish on the tool to indicate use but there was evidence of the tool being sharpened. Also, though the stem did not seem to be reworked, there was evidence of edge-damage on the stem. One of the edges on the stem had been crushed. Because there is a stem on this tool and because there is crushing on the edge of the stem, the tool appears to have been hafted.

![Figure 22.4 Fragment of stemmed spear point (illustration by author).](image)

At Pechtun Ha a reworked biface was discovered. The tool appeared to have been an oval biface that was broken and reworked into a new tool (Figure 22.5). The fragment from the biface seemed to be a medial fragment and the new tool may have been some kind of scraping or wedging tool. The tool was produced from good-quality chert and was well flaked. The dorsal side of the tool retains the flake characteristics of a biface. The ventral side of the tool had two large, even flakes removed across the width of the tool. The ventral side is flat with few flake scars. The newer edge of the tool shows evidence of reworking in fine flakes removed from the edge to make it sharp. Both of the original edges of the tool remained and they show evidence of reworking and one edge was crushed.
A reworked distal blade fragment was found at the Oshon site. It was produced from coarse chert and the workmanship was poor with large, uneven flakes removed from the tool. The tool may have been produced as a blade but then later reworked bifacially. One edge of the tool was reworked to be sharp while the other edge of the tool was reworked to be flat. There was no evidence of use-wear polish or crushing on the tool. The dorsal side of the tool had large flakes removed from it and the bulb of percussion was no longer present.

![Figure 22.5 Reworked biface (illustration by author).](image)

The only non-diagnostic tool was discovered in the K’in Rockshelter. The fragment is a medial fragment, possibly of an oval biface. The tool was well flaked from good-quality chert. It had been fractured at both the distal and proximal ends and one edge of the tool was missing. There was no evidence of reworking on the edge that remained and the tool was still sharp.

All five of the blades recovered were fragments. Even though only fragments of blades were found, it appears that the blade that came from the cave was a much larger tool than any of the blades from the settlements. The tool from the cave was wider by two centimeters than the widest settlement blade. The cave blade was also about two centimeters thicker than any of the tools from the settlements, and significantly heavier.

The bifaces did not show much variability in size between the cave tools and the settlement tools. The largest biface came from Metate Cave. It was longer than any of the settlement tools but about the same width. It was, however, thinner than the tools from the settlements, albeit heavier. The other cave bifaces were similar in size and weight to the tools from the settlements. The settlements yielded many more biface fragments than the caves. The settlements yielded only two whole tools and 13 fragments, while the caves contained four whole tools and only one fragment. This means that it is difficult to characterize differences between the bifaces from the caves and those from the settlements. The tools from the caves may in fact be different from the settlements tools in size but because the majority of the settlement tools were only fragments it is difficult to get an idea of the average size of the bifaces that were used in the settlements. Also, the cave artifacts were large items that were visible on the surface while the settlement artifacts contained items that were recovered by excavation.
Analysis of Tools

Of the 38 tools included in this study, eight came from caves and thirty from settlements. There were 18 oval bifaces, five of them from caves. There were five blades in the data set with one coming from the caves. Six projectile points came from settlements and one came from a cave. The hammerstone, stemmed biface, reworked biface, and the reworked blade were all discovered in settlements. The only non-diagnostic tool came from a cave. Of the tools that came from the settlements, 18 were found at the Samuel Oshon site, five were from the Obispo site, four were from Pakal Na, two came from Pechtun Ha, and one was discovered at the Hershey site. There was one tool each found in Chrissy’s Crawl Through, Actun Ik, Metate Cave, and Actun K’Ic. Shoepot Cave and Arch Cave each contained two tools. There were nine whole tools recovered, five of them from the caves. There were 13 distal fragments, eight medial fragments and six proximal fragments examined in the study.

All of the tools were made of chert and most of them were well made. None of the tools from the caves were burned, though eight of the tools from the settlements were burned. All of the tools that had been burned were tool fragments. Though most of the tools seemed to be of good quality, none of the tools from the caves were poor quality. The tools that were not as well made, or were produced from chert of a lesser quality, came from the settlements. All of the tools from the caves were of good quality and workmanship. With the exception of three fragments, the majority of the tools from caves were whole, while the majority of the tools from the settlements were fragments.

The Oshon site not only contained the most tools, but it also yielded the most variety of tools. There were five different types of tools at the Oshon site: one hammerstone, 12 oval bifaces, one blade, three projectile points, and one reworked blade. The Oshon site yielded a higher proportion of bifacial tools than any other site. Of the 18 tools from the Oshon site, twelve of them were bifaces. Obispo was the only other site with more than one biface and it only yielded three. Pakal Na had four different types of tools but only one of each type: a blade, a biface, a stemmed biface, and a projectile point. Of the seven projectile points in the data set three of them were found at the Oshon and Pakal Na sites, while the Hershey and Obispo sites each yielded one.

Oval bifaces seem to be the most common tool but they do not seem to be common throughout the region. They are extremely common at the Oshon site and fairly common at the Obispo site but they are rather uncommon at the other sites. The Oshon and Obispo sites are situated fairly close together and the other three sites are located in the upper reaches of the Sibun River Valley. Tools in general seem to be more common at the Oshon site. Of the 30 tools that were recovered from all settlement sites, 18 of them came from the Oshon site. The other twelve tools were distributed among the other four settlements. The high percentage of cortical debris from the Oshon and Obispo sites (see Cesario, Chapter 23), suggests that tool production occurred locally. Tools did not seem to be common at the Hershey site although the excavations at the Hershey site were not as extensive as at the other sites represented in the data set. Presumably more will be found in future field seasons.

The lanceolate spear point found in Chrissy’s Crawl Through is perhaps the one tool of the best quality material and workmanship in the data set. The tool shows no signs of use and it retains
its sharp edge. It is possible that this tool was produced specifically for placement in the cave, or it may have been produced as a weapon and therefore did not see much everyday use. The fact that there are no other tools of this type in the data set indicates that this type of tool is rather rare in the region and possibly was produced only for specific purposes.

The other tools from the caves all showed evidence of use. The macroblade fragment from Actun Ik, the biface fragment from Arch Cave, and the non-diagnostic fragment from Actun K’Ic all seemed to have been placed in the caves after they had been broken. Since there were no other fragments of the broken tools found in the caves, it can be presumed that they were broken during everyday use before they were placed in the caves. The fragment from Actun K’in is still sharp, indicating that it may have broken while being produced. The complete tools from the cave all bear evidence of use except for the lanceolate spear point. The bifaces from Metate Cave, Shoepot Cave, and Arch Cave show evidence of reworking and sharpening as well as showing use wear along the edges of the tools. Since caves are ritual contexts, it seems likely that the tools were used outside the cave and then brought into the caves as offerings.

Discussion and Conclusions

The ancient Maya were using tools in their everyday chores and in their rituals. We know that some of the tools were used in ritual because they are found in caves, which are entirely ritual contexts. It would seem a likely assumption that the tools that were used for ritual purposes were different than the tools used in every day life, but this does not seem to be the case. With the exception of the lanceolate spear point, all of the tool types that were found in the caves were found in the settlements. In fact, there were some tools found in the settlements, like the laurel leaf spear points, that were not represented in the tools types from the caves. So it seems that the Maya were using the same tools in their rituals as they used for everyday work. Most of the tools from the caves showed evidence of use in the form of crushed edges and reworking, indicating that the tools were used before being brought to the caves. These tools do not appear to have been produced especially for ritual use with the possible exception of the lanceolate spear point. The lanceolate spear point shows no evidence of use or reworking, indicating that it might have been produced specifically to be placed in the cave in a ritual context. The edges of the tools are still sharp and there is no evidence of sharpening indicating that this tool was not used for everyday chores. The other tools from the caves however, show evidence of heavy use. They were reworked and sharpened many times. In fact, the two bifaces from Shoepot cave appear to have been reworked to a fraction of their original size. The biface from Metate Cave shows signs of use but seems to be about the size it was when it was produced. The blade fragment from Actun Ik shows evidence of being sharpened and possibly broke while being used. These tools all seem to have been used before they were deposited in the caves. The original purpose of these tools was to aid the Maya in their daily chores of farming, chopping, hunting and all the other things the Maya did to survive.

There is no need for tools like these in the caves except in ritual contexts. These tools may have been placed in the caves as offerings to the gods. However, they were not produced specifically for offering. Their original function was for everyday use. At some point the Maya who used these tools decided that they would be more useful as offerings to the gods and placed them in the caves. But until they were placed in the caves, these tools were used as any of the tools found in the settlements were used. The tools from the caves did not differ greatly from the tools from the
settlements because the tools for everyday use were sometimes left as cave offerings. More of the tools from the caves are whole tools than those from the settlements but that may be because of the circumstances of artifact recovery. Also, the Maya would rework broken tools into other tools so that if a tool broke it may not make it to the cave as an offering because it might be reworked into something else.

One big difference between the tools from the caves and those from the settlements are that none of the cave tools were burned. Several of the tools from the settlements showed evidence of burning. Since none of the cave tools were burned it is unlikely that the Maya were offering the tools to the gods by burning them in the caves. The settlements tools that were burned may have simply been tools that fell into a fire, or they may have been left in a settlement when a burning event took place. Of the eight burned tools, three of them were projectile points. It seems likely that the projectile points were used in hunting. Presumably a projectile point would become imbedded in the hunted animal and not be removed before cooking the animal. If the animal were cooked with the point still in the flesh the point would be burned as well.

Because the caves and the settlements were two very different contexts, one might expect the artifacts from the two contexts to be different. The caves were an entirely ritual context for the ancient Maya and the artifacts from the caves are therefore associated with ritual. The settlements were where the Maya lived and worked in everyday life, and the artifacts are associated with the activities of daily routine. Chipped stone tools do not seem to vary between the cave and settlement contexts. With a few exceptions, the same types of tools were recovered from both contexts. Also, the tools from both contexts showed evidence of similar use. So, the ancient Maya did not appear to be producing tools specifically for their rituals. Instead, they seem to have been placing tools that they had used in the settlement in the caves as offerings.
Lithic tools were used in both the utilitarian and ritualistic aspects of Maya life: agriculture, hunting, and offerings to the gods, are a few noteworthy examples. Through the study of chipped tool debitage – the flakes, debris, and shatter resulting from the production and maintenance of stone tools – we can attempt to gain further insight into certain facets of Maya society that are not directly related to stone tool usage. This study examines debitage from three sites of the Sibun River Valley: Pakal Na, Samuel Oshon, and Augustine Obispo. Pakal Na is a Late Classic to Postclassic site located in the middle Sibun River Valley, while the Oshon and Obispo sites were occupied in the Terminal to Postclassic periods in the lower Sibun River Valley. An analysis of the debitage found at these sites can inform us about Maya utilization of local raw materials for stone tool production in the vicinity of Pakal Na, Oshon, and Obispo as well as answer questions about the possible trade networks between these Sibun River Valley sites.

Research Methods

Sampling

The sample size for this analysis consisted of three hundred pieces of debitage in total, one hundred from each site. The samples were selected from the following deposits. Pakal Na, Operation 37, Zone 5, Square A, is a midden deposit located in front of a retaining wall on the northern side of Structure 130 (where all of the burials were excavated). Operation 24, Zone 4, Square D at the Oshon site is construction fill beneath and supporting Stela 1. Operation 30, Zone 1 of the Obispo site is a topzone/earthen layer located around and below fractured altar-pieces (Monument 1). While these are not true random samples, they were chosen particularly because they are areas of primary deposition. This is desirable in debitage analysis because it allows for more definitive interpretations of tool production within a specific locale at a certain site.

Protocol

As the basis for my analysis I used a protocol developed by Polly A. Peterson and Patricia A. McAnany for K’axob debitage and adapted it for use with the Sibun River Valley sites. After recording the provenience of a piece of debitage, the first step was to identify the debitage type: a quarry blank, core (nodule used for flaking), core tool (a tool later utilized as a core), flake (with bulb of percussion, platform, and smooth ventral surface), flake fragment, fire shatter (evidence of burning and cracking), angular debris (angular chunks without flake scars), Tranchet flake, or cobble (Figure 23.1). Next, the raw material of the debitage piece had to be determined. In the event that it was overly burned or patinated, the material was deemed unknown due to alteration. The remaining raw material differentiation was based on the color and texture of the sample. The options included Northern Belizean (or Colha) chert, a smooth banded rock; chalcedony, which exhibits a light frosted color and grainy texture; Lower Sibun River Valley chert, a banded rock with varying textures; other chert and other/unknown raw material. The third step in the procedure was to evaluate the condition of the flake.
Burning can be indicated by a black, dark grey, or reddish color, potlidding (round cavities in the surface), and a uniform layer of polish. Patinated pieces, those that have been chemically weathered over a long period of time, appear frosted with white speckles. Sharp chunks taken off a flake can identify modern damage, usually due to plowing or excavation.

Following that initial categorization, I examined the various attributes of debitage, cortex being the first (Figure 23.2). Cortex is the original limestone surface of a chert nodule and is useful in the analysis process because it indicates the stage of production at the time the flake was removed. The presence of a significant amount of cortex on a piece of debitage indicates that it was removed during the primary reduction phase, the more cortex the earlier in production the flake was chipped. Counting the number of dorsal scars, also referred to as flake scars, on a flake or flake fragment is a second indication of the type of reduction occurring at a site (Figure 23.1). Few dorsal scars indicate
a primary reduction phase, while several scars are a sign that the flake was removed from an intensively reduced core, or possibly from a finished tool during a period of retouch. Finally, I examined the platform characteristics of flakes and flake fragments. The platform of a flake is that portion of the original core or tool from which the flake was struck off (Figure 23.1). A flake removed from a biface during resharpening will exhibit a diagnostic two-sided peaked platform often with use wear.

Using a hand lens with 6x magnification, each artifact was analyzed for the presence of use-wear. Polish results from the repeated utilization of a stone tool. If a flake has a significant amount of polish, it was probably struck off of a whole tool during an episode of resharpening. Marginal edge-wear can be found around the flake edges farthest from the platform, and indicates that a flake was retouched and reused as a tool itself (Figure 23.1). The last step was to weigh the sample from each zone and measure the length, width, and thickness of every piece of debitage.

**Difficulties with Raw Material Identification**

As previously stated, during debitage analysis I based my raw material identification on the color and texture of each artifact. As raw material references I used a large nodule of Northern Belizean chert (also referred to as Colha chert) from the site of Altun Ha as well as several small cores of Lower Sibun River Valley chert, collected from the Obispo site. Remarkably, the two materials are amazingly similar to each other. For instance, both exhibit a rough, white/tan cortical layer and while the Northern Belizean chert is characterized by a smooth texture, the local chert displays not only the smooth quality of Colha chert but a variety of more coarser grained textures as well. In addition, the two share the same principle colors – the classic Colha honey/caramel shade, as well as tan, grey, greyish tan, and brown. The lower Sibun River Valley chert, though, has a light cream color that was not apparent in the nodule of Northern Belizean chert. Lastly, both the Northern and local samples exhibit banding – different layers of color running throughout the chert. Clearly, the Lower Sibun River Valley and Colha chert share an uncanny resemblance with each other and differentiating between the two was problematic.

Although not yet located, there is a chert source proximate to the Obispo and Oshon sites, as is evident in a geological map of the Sibun watershed (Boles 1999: Figure 23.3). In addition to the atlas, we can be certain that there is a local chert source because at the Obispo site large chert cobbles were used as flooring material. Because of the excessive amount and heavy weight of these chert cobbles, it is unlikely that large nodules of Colha chert would have been transported a great distance to the Sibun River Valley to be used as construction material. On the other hand, we have yet to find biface preforms made of lower Sibun River Valley chert. This absence is most likely due to the fact that we have not pinpointed the quarry area yet. For the sake of parsimony and because we do have a local chert source, I have chosen to assume that, when in question, a piece of chert debitage is one of the lower Sibun River Valley chert as opposed to that of Northern Belize.
Results

Debitage Types

At all three sites the major debitage types are flakes and flake fragments (Table 23.1). They comprise over ninety percent of the Pakal Na sample, seventy-four percent of the debitage at the Oshon site, and eighty percent of the sample from Obispo.

Table 23.1 Percentage of Debitage Types at Each Site

<table>
<thead>
<tr>
<th>Site</th>
<th>% Quarry Flake</th>
<th>% Core</th>
<th>% Core Flake</th>
<th>% Flake</th>
<th>% Flake Frag.</th>
<th>% Fire Shatter</th>
<th>% Angular Debris</th>
<th>% Tranchet Flake</th>
<th>% Cobble</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakal Na</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>44</td>
<td>47</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Oshon</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>39</td>
<td>35</td>
<td>22</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Obispo</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>40</td>
<td>12</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

All three sites yielded low percentages of angular debris, but whereas the Oshon and Obispo sites have a significant amount of fire shatter, Pakal Na has none. Because the Oshon debitage was taken from a zone lying below a stela and the Obispo sample from a zone around a fragmented altar, it is possible that the fire shatter is the result of some kind of ritual burning episode. In any case, the high percentage of flakes and flake fragments suggests that there was a great deal of tool production and resharpening at these sites.
Raw Materials

The Pakal Na, Oshon, and Obispo sites were predominantly utilizing the local chert of the lower Sibun River Valley; in fact seventy-two percent of all debitage was manufactured from this raw material (Table 23.2). However, a greater amount of chalcedony was found at Pakal Na than anywhere else. This could be an indication that both the Oshon and Obispo sites were utilizing only the local chert source for tool production, at that Pakal Na acquired its chalcedony from another area.

<table>
<thead>
<tr>
<th>Site</th>
<th>Unknown due to alteration</th>
<th>Colha chert</th>
<th>Chalcedony</th>
<th>Lower Sibun River Valley chert</th>
<th>Other chert</th>
<th>Other/Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakal Na</td>
<td>4</td>
<td>0</td>
<td>12</td>
<td>80</td>
<td>4</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Oshon</td>
<td>33</td>
<td>0</td>
<td>2</td>
<td>65</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Obispo</td>
<td>27</td>
<td>0</td>
<td>1</td>
<td>71</td>
<td>0</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

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Condition

Burned and patinated areas are usually undesirable traits for a stone tool and would be removed during the primary phases of tool production. Because stone tools were generally made without the presence of these damaged areas, when resharpened the resulting flakes would lack those burned and patinated qualities as well.

The Oshon and Obispo sites contained a great deal of burned and patinated debitage (Table 23.3). However, analyzing the condition of the debitage from the Oshon and Obispo sites becomes difficult due to the possibility that the damaged flakes resulted from a post depositional burning episode. As stated earlier, the Oshon and Obispo sites contained a stela and altar, respectively, and were therefore sacred areas. Because of that, it is highly likely that ritual burning events could have occurred, damaging the flakes after they had already been removed.

At Pakal Na, on the other hand, there is little altered debitage. This absence of burned and patinated debitage could suggest that it was more an area of resharpening and retouch than primary production, or this can merely just indicate that post depositional burning episodes did not occur at Pakal Na. However, because these three sites have not been exposed to the same post depositional events and/or processes that affected the condition of the debitage it is not wise to draw absolute conclusions from this information.

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Cortex

Examining the level of cortex on the debitage within a deposit is a good indicator of the stage of tool production occurring at that locale (Table 23.4, Figure 23.2). Roughly one third of the debitage at the Samuel Oshon site had cortex covering up to fifty percent of its surface and seven percent of the pieces exhibited between fifty and ninety percent cortex. However, about two thirds of the Oshon sample contained debitage pieces completely devoid of a cortical layer. A similar pattern occurred at the Obispo site, where cortex was absent on about two thirds of the debitage, but present on up to half of the dorsal surfaces in nineteen percent of the sample. Six percent of the Obispo debitage had a cortical layer covering between fifty and ninety percent of its surface and seven percent of the pieces within the sample were almost completely cortex. Because the Oshon and Obispo sites yielded have a large amount of cortex-covered debitage, we can infer that a great deal of primary reduction was occurring in those areas. The cortical layers of chert nodules were removed to create a clean core from which to flake a tool. But we also find a large amount of debitage without cortex at these two sites. The noncortical debris may indicate that tool manufacturing, as well. It appears that all levels of tool production were occurring at these lower Sibun River Valley sites.

At Pakal Na eighty-eight percent of the debitage pieces did not have any remnants of a cortical layer and of the remaining twelve percent, eight pieces had less than half of their surface covered with cortex, leaving only four pieces exhibiting cortex on fifty to ninety percent of the flake. At Pakal Na, cortex had already been removed from the cores and/or tools before they reached the site. Unlike Oshon and Obispo, it seems that Pakal Na was an area of only secondary production, maintenance, and retouch.

Dorsal Scars

When counting the number of dorsal (or flake) scars, one includes only flakes and flake fragments because no other forms have dorsal or ventral surfaces. Over half of the debitage from the Oshon and Obispo sites displayed between zero and four flake scars, a very small amount indicative of primary reduction (Table 23.5). The next range of five to eight dorsal scars was found on a substantially smaller number of flakes from the Oshon and Obispo sites, and may be evidence of secondary reduction – the

<table>
<thead>
<tr>
<th>Site</th>
<th>% Absent</th>
<th>% with less than 50% cortex</th>
<th>% with more than 50% but less than 90% cortex</th>
<th>% with more than 90% cortex</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakal Na</td>
<td>88</td>
<td>8</td>
<td>4</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Oshon</td>
<td>62</td>
<td>31</td>
<td>7</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Obispo</td>
<td>68</td>
<td>19</td>
<td>6</td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site</th>
<th>% of non-flake debitage (no dorsal/ventral surface)</th>
<th>% with 0-4 flake scars</th>
<th>% with 5-8 flake scars</th>
<th>% with 9-12 flake scars</th>
<th>% with 13-16 flake scars</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakal Na</td>
<td>7</td>
<td>32</td>
<td>38</td>
<td>17</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Oshon</td>
<td>26</td>
<td>53</td>
<td>17</td>
<td>4</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Obispo</td>
<td>20</td>
<td>53</td>
<td>22</td>
<td>5</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>
shaping of the actual tool surfaces. Only four and five percent of the flakes from these two sites respectively contained nine to twelve dorsal scars. A high number of dorsal scars when combined with a bifacial platform and use-wear indicate that a flake came from a resharpened whole tool. The low dorsal scar counts plus platform and use wear patterns presented below indicate that tool retouch was not a primary activity in the sampled excavation units of the Oshon and Obispo sites.

At Pakal Na, there is evidence of nearly equal amounts of primary and secondary reduction, thirty-two and thirty-nine percent respectively. Unlike the two lower Sibun River Valley sites, at Pakal Na flakes included twenty three percent with a complex pattern of dorsal scars, between nine and sixteen suggesting final stage tool production or retouch.

Use Wear and Platform Characteristics

<table>
<thead>
<tr>
<th>Site</th>
<th>% Polished</th>
<th>Retouched Pieces</th>
<th>Biface Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakal Na</td>
<td>43</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>Oshon</td>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Obispo</td>
<td>5</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

Forty-three percent of the debitage at Pakal Na contained use wear polish, indicating that those pieces were removed from a heavily utilized whole tool, probably to resharpen a tool edge (Table 23.6). The Oshon and Obispo sites revealed significantly fewer pieces exhibiting polish, indicating, once again, that these areas were sites of manufacture rather than maintenance.

In Zone 5 of the Pakal Na midden, fifteen pieces of debitage were found with marginal retouch; at Oshon only one; and none at Obispo. In addition, twenty-two flakes were recovered with biface platforms at Pakal Na, ten at Obispo, and one at Oshon. A platform that identifies a particular flake as having been detached from a biface, indicates that the flake is a product of late stage production or resharpening. It is clear that much more resharpening and retouch occurred at Pakal Na and once again, that the Oshon and Obispo sites were areas of primary reduction and production.

Measurements

<table>
<thead>
<tr>
<th>Site</th>
<th>Weight (g) Per Zone</th>
<th>Average Length (mm)</th>
<th>Average Thickness (mm)</th>
<th>Average Width (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakal Na</td>
<td>131.5</td>
<td>15.651</td>
<td>13.301</td>
<td>2.944</td>
</tr>
<tr>
<td>Oshon</td>
<td>481.5</td>
<td>25.901</td>
<td>21.293</td>
<td>6.574</td>
</tr>
<tr>
<td>Obispo</td>
<td>442.3</td>
<td>24.103</td>
<td>18.144</td>
<td>6.871</td>
</tr>
</tbody>
</table>
The Pakal Na, Zone 5 sample weighs three times less than either the Oshon or the Obispo samples (Table 23.7). Plus, the average size of the debitage pieces from Pakal Na are smaller than that of the two lower Sibun River Valley sites. This supports the notion that Pakal Na was an area of tool maintenance, while the Oshon and Obispo sites were in a region of primary production because cortical flakes and chunks are larger and weightier than small retouch flakes.

Large, long flakes are the result of primary reduction activity to remove any cortical, burned, or patinated areas. Smaller, shorter flakes, on the other hand, are removed during secondary reduction and maintenance, more precise work. The range of debitage lengths found within a site can help us to determine what types of lithic activity had occurred there. At Pakal Na, the range of debitage lengths is small, most pieces falling somewhere between twelve and nineteen millimeters. This small size range of the Pakal Na debitage suggests that secondary reduction and retouch were the primary tool production activities occurring there. At the Oshon and Obispo sites, though, there is a huge range of measurements. The debitage pieces are fairly equally distributed between about eight and forty millimeters in length. This large range of eight to forty millimeters suggests that primary reduction as well tool production was taking place at the Oshon and Obispo sites.

Discussion and Conclusion

Comparative analysis of debitage from Pakal Na, Oshon, and Obispo suggests that different types of lithic reduction occurred at each site. At Oshon and Obispo the presence of burned and patinated pieces, high levels of cortex, and absence of polish, retouch, and biface platforms indicates that these sites were major areas for primary reduction. The lower dorsal scar counts as well as the huge range of debitage sizes further suggest that these two lower Sibun River Valley sites were also producing tools. Combining those results with the close proximity of the Oshon and Obispo sites to a local chert source leads me to believe that these two sites did not only produce chipped tools, but also controlled the large scale preparation of chert cobbles into clean, smooth nodules perfect for the manufacture of stone tools.

On the other hand, the high number of flakes, absence of cortical, burned and patinated pieces, and small average measurements, suggest that Pakal Na was an area where secondary tool production occurred. The biface platforms, marginally retouched flakes, and polished debitage point to resharpening and retouch happening at Pakal Na as well.

How is what we now know about lithic reduction at the Pakal Na, Oshon, and Obispo sites significant to an understanding of trade along the Sibun River? The Maya at the Oshon and Obispo sites may have been exploiting local chert sources of the lower Sibun River Valley for the purpose of trade with sites further up river. The evidence suggests that they could have prepared not only stone tools but also clean, chert blanks for exchange. Pakal Na, being distant from the lower Sibun chert, would then have been acquiring pre-worked chert nodules as well as tools from the Oshon and Obispo sites, and acquiring its chalcedony from yet another trading partner elsewhere. The Oshon and Obispo sites were likely key players in a chert tool production and trade system within the Sibun River Valley.
References Cited

Obsidian has been a prominent feature of the ancient commerce in the Maya region. Imported from Central Mexico and the Maya highlands in Guatemala, obsidian was used to manufacture both utilitarian and ritual objects. Known locations for sources of obsidian include Zinapécuaro, Pachuca, and Otumba all of which are near Teotihuacan. In Guatemala, the sites of Tajumulco, San Martín Jilotepeque, El Chayal, and Ixtepeque were mined for obsidian. Other sources include the more remote sites of Zaragoza and Cerro de Las Minas in Central Mexico (Clark 1984: 242).

The Sibun River Valley in Central Belize is devoid of any obsidian sources, hence the Maya of this region only could have obtained this material through trade. It is not known, however, whether the Maya living in the Sibun River Valley imported the obsidian as a raw material or unprocessed cores and manufactured the tools on site, or simply obtained the tools prefabricated.

Excavations of the Xibun Archaeological Research Project (XARP) conducted during the 2001 season yielded 195 specimens of obsidian from eight different sites. In the tradition of preceding researchers, Kuba (1997) and Paling (1999), the XARP 2001 obsidian analysis includes the study of use wear, typology, density, and context of the specimens uncovered from excavations at five surface sites and collection from three caves.

Site Descriptions

The obsidian of XARP 2001 was collected from two distinct cultural contexts: caves and settlements. No excavations were conducted in the caves and all obsidian specimens were obtained either through surface collection or examined and studied in situ. Traditional excavation techniques were employed at the settlement sites and obsidian was either retrieved directly from in situ deposits or from the screen.

Cave sites from which obsidian was recorded and analyzed include Actun Chanona (C-21), K’in Rockshelter (C-22), and Arch Cave (C-24). Settlement sites include Hershey, Pakal Na, Obispo, Oshon, and Cedar Bank.

Actun Chanona. Located in the Hershey District, Actun Chanona is a limestone cave situated in the Hummingbird karst. Currently, the only access to this cave is via a citrus orchard and a precipitous one-hour mountain trek. The cave is oriented on an east-west axis with a large eastern entrance and a precarious fissure as a western entrance. The inner and central chamber of the cave contains a large modified area of breakdown known as the Great Platform. The ceiling of this chamber is approximately 17 m high. Obsidian artifacts were found on the Great Platform and in its vicinity. The eastern to the western entrance of the cave is approximately 485 m in length in its entirety. Actun Chanona is culturally rich in artifacts and human modifications to the cave can be witnessed throughout. There are remains of at least five individuals located near the two entrances and an abundance of ceramic artifacts, including several
whole vessels with kill holes. From the artifacts and evidence gathered, it does appear that Actun Chanona was a site of ritual significance (see Peterson, Chapter 3).

*K'in Rockshelter.* Situated in the Glenwood Cave District across the Sibun River from the Monkey Bay camp, access to the cave requires a one-hour hike from the river. Although the cave consists primarily of two tunnels, the majority of the structure is a rock shelter beneath an overhang. The entrance to the small rock shelter is veiled by a curtain of vines. Artifacts include the usual array of sherds, jute, debitage, and so forth. Human modification includes a wall that blocks the main entrance (see Peterson, Chapter 9).

*Arch Cave.* Situated in the Gracy Rock District, approximately a 15 minute drive from the village of Gracy Rock, Arch Cave is the most accessible of all the caves. Residents of the village of Gracy Rock maintain a walkway and staircase that leads into the cave. Once a week, Arch Cave becomes a tourist attraction and local villagers provide guided tours. The entrance to the cave is located at the top of the staircase and below a wide pass-through or archway from which the cave derives its name. The entrance itself is a narrow crevice along the wall of the arch, but quickly opens up into a wide passage that forks to the north and south. Arch Cave, though not as large or cathedral-like as Actun Chanona, is culturally rich. The main chamber of the cave contains as many as nine whole vessels, some almost a meter in height, and many large sherds. Many of the vessels are associated with possible altars and possess kill holes. Several sub chambers were found; one of particular interest is the assassin bug chamber, a low-ceilinged room containing some 15 whole vessels. Throughout the entire cave are rubble piles interlaced with pottery sherds. Other culturally significant artifacts of considerable quantity include jaguar teeth, animal bones, jute, and marine shell. Human modifications to Arch Cave are noticeable, predominantly at the entrance which features the remains of a collapsed wall that once sealed the cave (see Peterson, Chapter 9).

*Hershey Site.* The Hershey site, on the northern bank of the Sibun River, is situated on a flat alluvial plain. The southern bank in this area of the Sibun River has tall, steep, karst formations. The Hershey site is located on the first flat piece of land encountered when descending from the headwaters upstream in the Maya Mountains. The Sibun River is not very wide at this point and according to local reports flood waters can run high, possibly due to the close proximity of the karst across the river and the site’s location on a bend (this constriction causing the flood waters to rise onto the western banks). Currently the site is situated in a cacao plantation that was owned by Hershey-Hummingbird Ltd. in the 1960s (hence the site’s name) and is today owned by Hummingbird Citrus Ltd. Hershey is accessible from the Hummingbird Highway, about 5 km south of Blue Hole National Park. Hershey is comprised of five plaza groups identified as Plaza A, B, C, D, and T. Excavations were conducted in Plaza Groups A, C, and D, with Operations 51 and 52 at Group A, Operation 53 at Group C, and Operation 50 at Group D respectively. In general, the most remarkable feature of the site is the 11.3 m high pyramid in Group A. Plaza B is located within 100 m of the river.

*Pakal Na Site.* Located on a terrace set back from the Sibun River, Pakal Na is close to the confluence of the Sibun River and Indian Creek. The site is accessed from the Western Highway through a privately owned citrus orchard. Here the river is in its middle reaches and meander bends increase in frequency (compared to Hershey site, where the river bed is narrower and cuts a straighter course than in the middle reaches). The site encompasses a total area of about 1 km² and presently is surrounded by citrus orchards, with gravel and sand mining operations on portions of the land. In 2001, three excavations were conducted at Pakal Na; Operations 22, 36, and 37. A chief interest of the XARP 2001 field season at Pakal Na was the completion of Operation 22, an excavation at a large platform that enclosed a burial.
deposit containing several individuals. Preliminary studies reveal that perhaps as many as five individuals may have been interred at Operation 22, with at least one individual buried in a primary, articulated position while the others were placed in secondary bundles. Abundant grave goods also distinguish the burial.

**Samuel Oshon Site.** Situated in the Freetown Sibun District on a small private farmstead, the Oshon site can be entered via a roadway through the village of Hattieville, which is situated on the Western Highway. Minor crop cultivation has taken place on the site since the former owner Mr. Samuel Oshon sold the land in 1999. The Sibun River runs along the southern side of the site, within 15 m at its closest point. Here the water level of the Sibun is affected by the tidal fluctuations of the Caribbean Sea, as the Oshon site is approximately 10 km away from the mouth of the river. The site itself is placed on a high ridge, possibly above the reaches of seasonal flooding. Architecturally, the Oshon site is interesting because it is a relatively small settlement with stone monuments (i.e., two stelae) that are absent from larger sites such as the Hershey site. Oshon site has a distinctive round structure in its main plaza group. A single operation was carried out at Oshon, Operation 24.

**Augustine Obispo Site.** Located in the Freetown Sibun District, the Obispo site is another small settlement with stone monuments. It is one of the few settlement sites identified by XARP that is situated on the southern bank of the Sibun River. The site is located on a privately owned farmstead with moderate crop cultivation. Two excavations were conducted at this site, Operations 30 and 31 (see Morandi, Chapter 15). As with the Oshon site, Obispo is intriguing in terms of its stone monuments found wanting at other sites. Another interesting discovery was that significant amounts of chert were recovered from both the Oshon and Obispo sites. Chert nodules were used in construction fill for platforms. Chert debitage, flakes, and worked tools were found in excavations at both sites.

**Cedar Bank Site.** Within the confines of Gracy Rock District, Cedar Bank site can be reached through the Gracy Rock Village roadway. The site is located about five minutes west of the village. It is situated on a high bank with substantial mounds and architecture. Cedar Bank consists of two plaza groups that are surrounded by house groups. Excavations in a single small operation, Operation 40, uncovered artifacts from the Late Classic through Colonial periods.

**Methodology**

The first and foremost task of the XARP 2001 obsidian analyst, after having restricted the goals and objectives of the study to use wear, typology, density and context, was the creation of a cataloging system which would permit the analyst to identify and refer to each individual obsidian sample as and when necessary. This study adopted the identification number cataloging system utilized by Paling (1999). This season’s cataloging sequence began with the 300 series, starting with ID # 301 and running through ID # 495. The 300 series was chosen to provide a sufficient buffer, should work be conducted on the remaining unprocessed obsidian samples from both the 1997 and 1999 seasons.

With each piece of obsidian tagged by a unique identification number, the provenience information was entered into an Excel data set. Provenience information was collected as follows:
i) Field Collection Bag (FCB) Number.
ii) Operation or Cave Number.
iii) Zone or Cave Component Number.
iv) Square or Cave Unit Number (also Cave Surface Collection Unit Number).

Categorization of each obsidian sample involved both identification and measurements. These categories are introduced and defined as follows:

Identification (Figure 24.1)

i) Type – Blade, Core, or Flake. (Should a sample be identified as a Blade, it is possible to further breakdown the identification process by fragment type).
ii) Fragment – Complete, Proximal, Medial, Distal, or Unknown.
iii) Shape – Trapezoidal, or Triangular in cross-section.
iv) Use Wear – Irregular, Systematic, Absent, or N/A.

As with Paling’s (2001:204) classification, after an obsidian artifact was categorized as a blade, core, or flake, “blades could then be identified either as distal, medial, or proximal fragments or whole (complete) pieces. Indication of a bulb of percussion would denote a proximal end of a blade fragment. Distal pieces were identified by a tip or point. Medial segments exhibited no signs of a bulb of percussion or a tip. Whole (complete) have both a bulb of percussion and a tip.

Shape is identification of the cross section of obsidian specimens that tends to be either triangular or trapezoidal. Edge Damage comprised of distinguishing the edge wear on the blade fragments. Blades with distinct non-uniform damage on both edges were considered irregular in terms of edge damage. Systematic identifies only use wear on a single edge. Absent represents lack of any edge damage. Flakes generally have an N/A classification for edge damage, meaning that post-depositional processes have obscured any clear evidence of use wear.

Should a particular sample bear traits of two classifications, the leading classification took precedence. For example, a Blade/Flake sample is more plausibly in the likeness of a blade. Other combinations include (but not limited to) Medial/Distal fragments, Triangular/Trapezoidal shape, Irregular/Systematic use wear etc. Examination and identification of the samples were made with a 3x hand held magnification lens.

The measurement categorization of obsidian incorporates the following:

i) Length (mm)
ii) Width (mm)
iii) Thickness (mm)
iv) Weight (g)

Each piece of obsidian was measured at its greatest length, width, and thickness, to the tenth of a millimeter. Weight measurements were taken to the hundredth of a gram. The data were entered into an
Excel spread sheet with solver function, enabling the quantification of obsidian characteristics and distribution.

Figure 24.1 Diagram showing blade fragment types (illustration by author).
Results

A total of 195 pieces of obsidian were processed through the field laboratory of the XARP 2001 field season. The cave sites yielded a total of four pieces of obsidian, one of which was not collected but studied in situ. As expected, the settlement sites provided the bulk of the obsidian specimens with 191 pieces distributed over six sites and ten operations.

A break down of the distribution of obsidian by site would be as follows:

<table>
<thead>
<tr>
<th>Site</th>
<th>Qty</th>
<th>Site</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-21 Chanona Cave</td>
<td>2</td>
<td>C-22 Actun Kin Cave</td>
<td>1</td>
</tr>
<tr>
<td>C-24 Arch Cave</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hershey Op 50</td>
<td>2</td>
<td>Pakal Na Op 22</td>
<td>44</td>
</tr>
<tr>
<td>Op 51</td>
<td>4</td>
<td>Op 36</td>
<td>0</td>
</tr>
<tr>
<td>Op 52</td>
<td>1</td>
<td>Op 37</td>
<td>38</td>
</tr>
<tr>
<td>Op 53</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.Obispo Op 30</td>
<td>13</td>
<td>Oshon Op 24</td>
<td>36</td>
</tr>
<tr>
<td>Op 31</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cedar Bank Op 40</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pakal Na accounted for 42% of the obsidian recovered this season, followed by the Obispo site with 20%, Oshon site at 18%, Hershey site 10%, Cedar Bank 8%, and the remaining 2% coming from the three caves.

The sample produced 147 blade fragments and 48 flakes. No obsidian core was uncovered. The blade fragments have been identified as 38 proximal pieces, 57 medial pieces, 35 distal pieces, 13 medial/distal pieces, one proximal/medial piece, two distal/medial pieces, and one medial/proximal piece. A percentile division of proximal, distal and medial fragments revealed strikingly similar results as in XARP 1999 Field Season. This season yielded 27% proximal, 25% distal, and 48% medial fragments, as opposed to last season’s 25%, 27%, and 45% respectively.

Actun Chanona yielded 2 blades of obsidian, one of which is of particular interest. Obsidian ID # 302 is unique in that it appears to have been melted with sediments fused into the ventral and a portion of the dorsal surfaces. Its proximal tip is fused and misshapen. Along with evidence of large fires and burning around the Great Platform, this obsidian blade was either deliberately or more likely accidentally damaged by fire.

K’in Rockshelter provided a sole blade fragment collected by primatologist, Robin Brockett. Arch Cave too only revealed a single blade of obsidian (Figure 24.2, ID # 304).

Operation 50, in Plaza Group D of the Hershey site, was probably a residential area and yielded a blade and a flake. Operation 51, in Plaza Group A, was located on the northern front of the pyramid and exposed a total of four pieces. Operation 52, a narrow trench excavated by Dan Finamore in search of the
Spanish *visita* yielded a single blade. The largest amount of obsidian was collected from Operation 53 of Group C — a total of 12 pieces. Quite surprisingly, a large and complex site such as Hershey only disclosed a collection of 19 obsidian pieces. Operation 53, which was placed in a residential group, yielded the largest amount of obsidian. Use wear examinations indicate heavy utilization of the blades.

Pakal Na, which had three operations, provided 82 specimens of obsidian. Operation 22, with its complex burial deposit, and Operation 37 — an ancillary structure to the burial mound — disclosed 44 and 38 pieces of obsidian respectively. Operation 22 has the highest yield of obsidian for the entire season. This finding is in keeping with our identification of the mound as part of an elite residential complex. Operation 37, discovered through magnetometry survey, ranked next in terms of obsidian frequency from a single operation. This discovery is intriguing, as Operation 37 is believed to be an auxiliary structure to Operation 22. Operation 37, however, contained a midden deposit within its confines.

Excavations at the Obispo site brought to light a total of 39 pieces: 32 blade fragments and seven flakes from Operations 30 and 31. Work performed at the Oshon Site uncovered 36 pieces from Operation 24. Oshon Site has the highest number of retouched or reworked flakes or blade fragments with 10 such pieces.

Cedar Bank boasts only Operation 40 which produced 15 samples of obsidian. Most amazingly, Cedar Bank was excavated in four days and yet revealed a respectable quantity of obsidian. (Figure 24.2 shows a sample of obsidian pieces from the above-mentioned sites).

The study of edge damage shows that the highest proportion of blade fragments bear irregular damage (54%), followed by systematic damage (30%), and 16% with no visible edge damage. Probable retouched flake or blade fragments total some 16 pieces, 10 of which were found in Operation 24 at the Oshon site. Three pieces were unearthed at Obispo site, Operation 31 (none from Operation 30), two from Cedar Bank site, Operation 40, and a single specimen from Pakal Na, Operation 37. The high percentile of possible reworked flakes or blade fragments found at Samuel Oshon site leads one to speculate the economic nature of this settlement. Not only is this site interesting in terms of the presence of stone monuments, but in the large proportion of reworked obsidian (63%) in direct association with the monuments. Apart from the sole sample uncovered at Pakal Na, all other probable reworked obsidian pieces hail from the smaller sites investigated during this field season. Perhaps these smaller settlements were not only heavily utilizing the obsidian but also more cautious in their conservation of the locally unavailable commodity.

The paucity of obsidian blades recovered from cave sites possibly indicates that the obsidian collected this field season was more utilitarian in nature then of pure ritual significance.

The density and distribution of obsidian is quite remarkable in the sense that the largest site excavated this season was the Hershey site, which only yielded 10% of the total obsidian recovered. The smaller sites, Obispo and Oshon, both have a larger harvest with 20% and 18% respectively. Given the number of working days and time constraints at the Cedar Bank Site, it still accounted for a 8% of the entire sample size.

A significant amount of investigation is still needed to thoroughly understand or rather begin to comprehend the obsidian data presented here and those from the prior seasons. A question left
Figure 24.2 Samples of obsidian blades discussed in this chapter (illustration by author).
unanswered is how the obsidian arrived in the Sibun River Valley. Was it through trade or other mechanisms? How did the obsidian arrive at its journey’s end -- as an unprocessed raw material or as prefabricated tools? No evidence of core preparation or rejuvenation is contained within the sample of obsidian from the 2001 season, providing some measure of support for the latter option. It is hoped that the data collected and scrutinized here may be of some assistance to future researchers, who may undertake the challenge of examining the uses of obsidian by the Xibun Maya residents, and perhaps formulate a model that would address obsidian acquisition.

References Cited

Clark, John E. and Thomas A. Lee, Jr.

Crabtree, Don E.

Paling, Jason.
The category of “groundstone” can encompass a wide variety of artifacts. Here, it refers to the method of manufacture, and not to raw material, shape, or function. As a result, this study discusses five-kilogram granite metates, as well as jade beads weighing less than one-third of a gram. Artifacts of this inclusive definition encompass many different activities, from food preparation to ritual activities. In this paper, I present the groundstone artifacts collected from the Sibun River Valley, observe patterns within and between artifact classes as well as raw material types. Finally, observations are offered regarding the distribution and diversity of groundstone types, both within and among sites.

Most of the raw material from which groundstone is made is readily available near the sites. Granite is abundant in the Maya Mountains of southern Belize. These mountains may also be a source of basalt and other porous igneous rocks, but the area has not been well documented geologically (Coleman, personal communication, sited in Ebersole 2001: 29). The nearest known location of basalt is much farther away, in the Pacific coastal highlands of Guatemala. Limestone is easily accessible in the floodplain around the sites, and slate is found nearby to the south (Furley and Crosbie 1974: 6). Jade is the most difficult of the raw materials to acquire, the nearest source of it is the Montagua River Valley in Guatemala (Ebersole 2001: 30).

This study includes all groundstone artifacts found by the Xibun Archaeological Research Project (XARP) during the 1999 and 2001 field seasons, from both settlements and caves (Table 25.1). The settlements which yielded groundstone artifacts include Hershey site, Samuel Oshon site, Pechtun Ha, Augustine Obispo site, Cedar Bank, and Pakal Na. Caves from which groundstone was collected include Actun Ik, Actun Yax Tun, Actun Chanona, and Arch Cave.

Methods

The majority of the artifacts (93.5%) came from settlements; caves are under represented, yielding only 5 artifacts in my data set. The reason for this difference is that the percent of artifact collection in caves is very low for all artifact types, and large, heavy artifacts, such as whole metates and complete ceramic vessels, were even less likely to be collected than smaller, lighter artifacts such as pottery sherds and hachas. I include descriptions of uncollected artifacts from Actun Chanona and Metate Cave in the discussion of my data, but did not include them in my main data set because measurements and weights were not available. I will therefore not enter into a detailed discussion of cave versus settlement groundstone in this analysis, although the topic would be a fruitful one for future analysis.
Eight types of artifacts are included in my sample, including both artifacts ground in manufacture and those ground through use. Some artifacts, such as *manos* and *metates*, fit into both categories, becoming even more shaped and ground over time. The majority of the artifacts were identified, labelled and catalogued before my analysis, but I will discuss the general typology anyway. When there was any ambiguity, I tried to maintain consistency and generally followed protocols established by Justin Ebersole (2001) in his study of the groundstone of K’axob, a Maya site in northern Belize.

*Metates* are flat, often rectangular stones used as a surface for grinding, usually food products. Often only the “lip,” or edge of the *metate* is found, and surfaces exhibit varying degrees of smoothness, depending on both the raw material, and the extent to which it was used. *Manos* also comprise a large portion of my sample. These are the cylindrical tools used to grind materials against the surface of a *metate*. They are made from a variety of materials and exhibit different cross-sectional shapes, as I will discuss in the next section.

*Hachas* are also included in my sample, and show relatively little variation in shape. They are small and roughly rectangular, although one end is often rounded and was probably used for hafting. The other end is straight, with a steep edge-angle; this edge often exhibits signs of retouching and/or battering.

The “pounder” category is a little less clear-cut. As I said above, I tried be consistent with Ebersole’s typology, but for this category I feel it had some shortcomings. The artifacts encompass a wide variety of shapes and, I believe, functions, but are all classified as “pounders” consistent with Ebersole’s description (2001: 12) of them as large tools, with the lateral surface utilized, and without any evidence for hafting (this is in contrast with his category of “hammers,” which are smaller, lighter, and were hafted: called the *hacha* category in this analysis). Some of the “pounders” in my sample were hardly, if at all, shaped prior to use. Some were nearly spherical, and were battered on the edges; some had flat surfaces that were literally used for pounding, while others were shaped like large hachas or hand axes, but were more roughly made, and because of their size and the lack of evidence for hafting, they were still categorized as “pounders.”

The jadeite artifacts seem to have purely non-utilitarian functions, and were extensively shaped from the raw material. There are only three artifacts fabricated from jadeite and they are all very different. The combination of their apparent functions and the rarity of the raw material persuaded me to discuss these artifacts as a single category.

Celts were included in my analysis, even though they comprise a gray area technologically, being chipped and polished, as well as ground. There is only one complete celt in my sample, and one extremely fragmentary piece which was classified as a “celt” because of it was formed out of chert, and because it showed evidence of being ground, polished, and chipped.

The artifacts labelled as “unidentified” include fragments that have a ground or smoothed surface, but are so fragmentary that the original shape and/or function of the artifact could not be determined. Other artifacts included in this category include more complete artifacts, such as geometrically incised limestone artifact 63, which had an
enigmatic function that can only be guessed at. The three limestone artifacts are grouped together, even though they likely had very different functions. Each merits individual discussion, however.

Some objects were not included in this analysis at all. Some bagged and catalogued “artifacts” included unworked river pebbles that lacked worn or striated surfaces. In agreement with staff members, these were not included. Net weights also were not included. They comprise a distinctive class of artifacts, being smooth river pebbles with notches placed on two sides.

Seventy seven artifacts included in this study (Table 25.1). The data set includes the artifact type and the site and field season from which it was collected, and the operation number (with component number being substituted for operation for the cave artifacts). Number 71 is also from the caves, but the component number was not recorded by this author. The “surface” designation was used for artifacts collected from the surface (operation numbers were not included in these artifacts’ provenience). The length, width, height, and weight of each artifact is listed in the next four columns of Table 25.1. The length, width, and height measurements represent the longest, widest and highest points on the artifact, unless the ground surface is considerably smaller than this measurement, in which case the dimension of the ground surface is given. When the length and width or width and height measurements given in the table are identical, it is because the object is round, so both measurements are equivalent to the diameter. The majority of artifacts were measured with digital callipers, and these measurements are given to 0.1 millimeter. Measurements of objects too large to use calipers were accomplished with a metric ruler, and are precise to the millimeter. Most weights were done with a triple beam balance, and are precise to 0.05 grams. Metates 64-68 and 70 were too large to weigh using the triple beam balance and were weighed instead on a large hanging scale; these measurements are only precise to five hundred grams.

The last column in Table 25.1 contains the raw material from which the artifact was made. This information is tentative because of my limited knowledge of rock types. Fifty of the 77 artifacts in this sample (64.9%) have been identified by raw material. These identifications were accomplished without the benefits of a geologist or geology texts that would clarified the Maya area geology. Because of this limitation, known types are skewed towards those that are easily identifiable, such as granite, volcanic or igneous rocks, jadeite, and slate. Many of the pounders that have an “unidentified” rock type were probably made from a metamorphic material, but in the absence of certainty, I classified them as unidentified. In this paper, I refer to “granite,” and to “volcanic” or “igneous” rocks, even though granite is technically igneous as well. The artifacts I discuss as being “igneous” are made from an unknown gray, porous volcanic material, similar to basalt. For reasons of clarity, granite is never referred to as igneous, so as to distinguish it from the more porous volcanic rocks.

Future investigations would do well to include use-wear or residue analysis, especially of the metates and hachas. It would be interesting to test the metates manufactured from different materials to determine if they were used to process different substances, or to see if there was a difference in residue between metates found in
settlements versus those found in caves. Use-wear and possibly residue analysis may also be useful for hachas, to examine their battered edges.

Future studies should also include a thorough analysis of groundstone in caves, examining the artifacts in situ so that the quantities and types of groundstone are found in caves could be compared to settlement groundstone.

Data Description and Analysis

A total of 77 artifacts were analyzed from the XARP 1999 and 2001 field seasons. By far the most abundant artifacts were metate fragments, which made up 37.7% (29/77) of the groundstone. Of these metates, 13 were identified as granite, and 13 as either basalt or another igneous rock. Three of the metate fragments (10.3%) could not be identified as any particular rock type, and an igneous metate foot was also found. Fourteen of the metate fragments had at least one edge, numbers 4 and 8, being exemplary (Figure 25.1). Number 4 is a small granite edge fragment from the Hershey site, and number 8, a larger corner piece made of a very porous volcanic rock was excavated from the Oshon site. Most of the fragments in this analysis are small: 18 (62.1%) of the metates weigh less than 400 grams, and only 5 fragments and the metate foot weigh over 1 kilogram. All five of the large metate fragments, although not the metate foot, are surface collections from the Hershey site.

Figure 25.1 Metate fragments (illustration by author).
The granite metates tend to be smoother than those fabricated from the more porous igneous rock, both on the unused surfaces, and on the grinding surfaces themselves. The granite metates tend to be worn down to extremely slick, smooth surfaces, while the more basalt-like materials continue to be rough and porous, even after the metate has obviously been used extensively. Perhaps different materials were used to grind different substances, or one type was used for food, and another type used to grind something else; further use-wear analysis might clarify these differences.

Eight metate fragments were collected from the Hershey site in 2001 and another eight were recovered from the Oshon site. Most of the metates from Oshon, however, were recovered during the 1999 season, with only two metate fragments and one metate foot found during the 2001 season. Pechtun Ha and Pakal Na produced five metate fragments each, all recovered during the 1999 season. Two fragments were also recovered during excavation at the Obispo site. Only one metate was collected from a cave (metate 6 from Actun Ik), but many uncollected metates were noted in the caves. As an illustration of the abundance of groundstone in caves, despite its under representation in this analysis, I review the cave groundstone briefly.

Most of the descriptions of groundstone come from Actun Chanona. A granite mano and metate were built into a wall on the Great Platform. There is one white granite metate and one pink granite metate next to the altar on the Great Platform, both associated with manos of the same material. On a slope to the south of the Great Platform, near the drum room, there are two metates, one yellowish, and one green with phenocrysts, and both without associated manos. There is a granite metate to the east of the Great Platform, near a burned area, and there is another in the net weight area of the cave, and neither of these have associated manos. There is also a metate in Metate Cave, along with a mano.

The second most abundant type of artifacts the mano. Nearly a quarter (18/77, 23.4%) of the groundstone artifacts from the Xibun are manos. Most are fragmentary, and by examining cross sections, we can see a number of variations on a true cylinder (Figure 25.2). Of the six cross sections, some such as 28 and 37 do not have the entire cross section, but appear to be roughly ovals. Eighteen and 44 are flatter ovals, 18 possessing a flatter bottom than does 44 (the bottom of the manos in the drawings represent the flattest or smoothest surface, or the one most likely to have been used as the grinding surface). Mano 51 had the flattest bottom of any of the manos, and it was also unusual in that it was the only slate mano in the sample. Larger and more complete mano fragments were found compared to the metates: less than half (44.4% or 8/18) of the manos found weighed under 400 grams, but fewer manos could be identified in terms of raw material: only one-third (6/18) of the manos were made from an identifiable raw material, in contrast to nearly 90% of the metate fragments.

Only one mano in this sample is from a cave (mano 71), but see the Methods section above for a brief description of manos found in association with metates in Actun Chanona and Metate Cave. In addition to those found with metates in Chanona, there is a broken granite mano near the eastern side of the Great Platform. A pink granite mano was recorded near the entrance to Actun Chanona. I think it is interesting that complete manos and metates are usually paired in caves, but all of the metates found in settlement excavations are
extremely fragmentary, and nearly all the *manos* found in settlements are small sections of the original cylinder. Whole *metates* could be used and would therefore not be discarded in a settlement. Complete *manos* and *metates* were likely brought into caves by the Maya after they had already been used for a substantial period of time (P. Peterson, personal communication, 2001), probably because of the association between caves and rain, and its importance for ensuring future crops.

![Figure 25.2 Cross-sections of mano fragments (illustration by author).](image)

All other artifact types combined comprise only 39% of the total groundstone artifacts and each type is represented by less than ten artifacts. Six of the groundstone artifacts found in XARP excavations were placed in the “pounder” category. As discussed above, this category encompasses a range of shapes, and probably functions as well. Four of the pounders weigh between 400 and 600 grams, with one pounder below this range (pounder 41 at 283.5 grams), and one above it (pounder 34 at 878.5 grams). Five of the six pounders are made from the same unidentified, possibly metamorphic, rock discussed above, and one pounder is granite. Pounders 11 and 26 are nearly spherical, but slightly flatter in one dimension, and both bear evidence of battering along one edge. They are also approximately the same weight, and have similar dimensions, but they are from different sites (Hershey, Pakal Na, Pechtun Ha, and Oshon) and were excavated in different seasons (Table 25.1). Pounder 13 is more similar to a hand-axe: it is long and rounded on the end that was likely held in the hand, and has a straight, steep edge on the other end, which shows signs of battering. This is the only pounder whose raw material was definitely identified as granite. Artifact 24 was tentatively identified as a pounder; it is a dome-shaped stone, with one relatively flat surface. However, it is unclear whether this surface is rough due to being broken off a larger artifact, such as a larger hammerstone or even a *mano*, or due to battering from use. Pounder 27 is broad and rounded on one end, with a rounded point on the other
end. Comfort while holding suggests that the pointed end was the used end, perhaps as a chopping tool similar to pounder 13, but there was no obvious evidence of battering on this tool. The identification of artifact 34 as a pounder is also tentative. It is the largest artifact in this category and doesn’t have any obvious signs of battering. It was broken by a smooth clean fracture diagonally along one end, so that I could not tell whether the artifact was used as it was found or, if not, its precise original shape. The final pounder is artifact 41, and is also the smallest artifact in this category. It is similar to an irregular square in planview, and one surface is rounded, while the other is flat.

Half (3) of the pounders were found at the Hershey site, and none was found at Obispo, Cedar Bank, or in the caves. Pakal Na and Oshon, in contrast, yielded only one pounder each in two seasons of excavation. The total number of pounders found in the Xibun, however, is too small to say much more about their distribution.

The next most abundant artifact type found was the hacha. Five examples of this type were found, two of which were collected from caves. Hachas are small, light tools, used for chopping or cutting. They are roughly rectangular, with a steep cutting edge on one end, and a more rounded end on the other. They are similar to hand axes but smaller, generally finely finished by grinding and polishing, and are hafted. They all weigh between 30 and 200 grams (Table 25.1).

Hacha 7 was collected from Actun Chanona and is only slightly smaller than hacha 12. The slate was ground extremely smooth, except for a few natural pock marks on the surface. There is some battering on the working edge of the tool, but overall it is very well made and is in excellent condition. Hacha 12 also is made of slate and is the largest hacha recovered during the Xibun project. Hacha 12 was recovered from a settlement excavation at Oshon site. It too is well made, with a smooth surface finish, but there is more extensive battering on the working edge, and it is also broken diagonally along the hafted end. There are also striations near the cutting edge and perpendicular to it. Hacha 14 is made from greenstone and was collected from the cave Actun Yax Tun (which means “greenstone cave”). The surface is smoothed, it is is well made, has very little to no use-wear, and is the second smallest of the hachas in this sample. Unlike some of the others in this analysis, this hacha was probably ornamental and not functional, and may have been placed in the cave because of the association the Maya believed existed between its color and fertility and water (McAnany et al 2001: 47). Hacha 19 is the smallest found in the Xibun (in both length and weight), and it is also the most crudely made. Only 5.5 cm long, hacha 19 is very roughly cut, and is hardly ground or polished at all; the finished surface is rough to the touch, and the original large breaks that formed the hacha are still visible. This is in stark contrast to hacha 14, which was very well made and finished. The final example of this artifact type is hacha 74. It was recovered from Oshon site during the 1999 field season, and is slightly larger and more damaged than hacha 14, but also is made from greenstone. Unlike hacha 14, this one was most likely actually functional. Some general patterns are evident in the hachas found. Three of the five were recovered from the Oshon site during the 1999 season, and the remaining two were collected from caves. Two of the hachas found were made from slate, and two from greenstone; the remaining one (hacha 19) was made from an unidentified material. The hachas found in caves were in better condition than those found in
settlements, probably because these were more likely ritual and not functional, but the remaining three were also in very good condition.

Of the three jadeite artifacts found in the Xibun the first is artifact 1, a large, pale jadeite bead collected from the surface at Pakal Na during the 1999 season (see illustration McAnany et al 2001: 129). It is a 12.7 cm long tube with raised sections on one end, and was drilled through the entire length of the bead. In contrast to this large tubular bead, a small jadeite bead 1 mm thick and weighing one-third of a gram was collected from Actun Chanona (artifact 35). This bead was made from a much darker jade and is oval in shape (5.1 cm long and 5.9 cm wide). The third jadeite artifact was recovered from excavation at the Obispo site. It is a small fragment broken in the shape of a triangle one centimeter long on two sides, but the original shape of the object is not evident. It weighs just over a gram, and is approximately half a centimeter thick. One side is polished and smoothed, and has part of an incision of a quarter of a circle. There is also another line radiating out from the edge of the arc, but it is not clear whether this scratch was made before or after it was discarded (perhaps by my own trowel!). The other side is very rough and unfinished, which leads me to believe that it was originally inlaid. The value of jadeite in the southern lowlands can account for its relative rarity in this data set. The small, broken fragment from Obispo was found in construction fill and rubble in the corner of Operation 31. The large bead was found along with several obsidian blades in what was probably a cache that was disturbed by citrus planting at Pakal Na (McAnany et al 2001:129). The small jade bead from Chanona cave was probably deposited on the Great Platform on purpose, perhaps because of the connection between the color green and water and fertility, similar to hacha 14.

Artifacts 21 and 52 are flat stone disks, made from river cobbles. Disk 21 is from Pechtun Ha, and is larger than disk 52, which was recovered from Pakal Na. Artifact 38 is a very small version of these larger disks; it is a small rounded river pebble two centimeters in diameter, and was found this season at Hershey. Both the larger disks were found during the 1999 season, and none of the three are drilled or have any striations or other obvious use-wear, so I am at a loss to explain their function. The smallest disk does not appear to have been ground into its present shape, and may have been used as a smoothing stone for finishing pottery. The two larger disks are included in this analysis because they are both almost perfect circles, and almost perfectly flat on each side, which leads me to believe that they were ground from river cobbles into their current shape.

There are three limestone artifacts included in this sample. The first, a bark-beater, was excavated from Oshon site (Figure 25.3). It is a square block of limestone, with parallel v-shaped grooves cut into one surface. The block is roughly rectangular, and is broken on one end, and was probably originally much longer. Artifact 63 was also recovered from Oshon site during this season, but its function is less clear. It also is a large limestone block, larger than the bark-beater, and it has grooves on one surface. But this artifact surface has been scored with a checkerboard pattern, and in one direction the grooves are much deeper (Figure 25.4). All edges are eroded, so it is difficult to determine the original size or shape of the artifact. The left edge of the artifact in Figure 5 is the most likely to be an original edge, because the lines end near this edge. I am at a loss as to its purpose; all examples of bark-beaters from the area bear unidirectional striations. Checkerboard patterns have been found
incised on pottery fragments and were used as graters (P. McAnany, personal communication, 2001), but the material of this artifact is so much softer that this option seems unlikely. The third limestone artifact is number 16, and was found at Pechtun Ha during the 1999 season. It is a small cylinder, just over a centimeter in diameter and just under a centimeter long with has two shallow circular depressions, one on the top and one on the bottom, which leads me to infer that it is an unfinished bead blank. An unfinished ear spool is another possibility, although the outside is straight and not grooved or angled.

Figure 25.3 Barkbeater (illustration by author).

Figure 25.4 Grooved stone (illustration by author).
The final artifacts are made of chert and include Artifact 3, a chert celt found at the Oshon site during the 1999 season. It is dark gray and dome-shaped, and appears to have been chipped, polished, and ground. Artifact 75 is an incomplete polished chert fragment collected this season from Pakal Na, and I would not have considered it to be a celt except for the way in which it was worked: it was also highly polished, and appeared to have been chipped and ground, as well.

Conclusions

The Oshon site, Hershey site, and Pakal Na by far have yielded the most groundstone artifacts. The Oshon groundstone is pretty evenly divided between the 1999 and 2001 seasons. Pakal Na yielded almost all of its groundstone in 1999; hardly any was found there during 2001. The Hershey site yielded 16 groundstone artifacts during one season of excavation and an earlier season of reconnaissance, including the largest artifacts in this sample. The large metates were collected from the surface. The presence of these large metates at Hershey may be due to the location of the site at the base of a gorge where large granite and metamorphic stones are easily available (P. McAnany, personal communication, 2001).

Metates are by far the most abundant groundstone artifacts. Oshon and Hershey yielded the most metate fragments, followed closely by Pechtun Ha and Pakal Na. Pakal Na yielded at least twice as many mano fragments as any other site, and Hershey was the only site that yielded more than one pounder. Oshon yielded the only complete celt, the only bark-beater, as well as the only hachas recovered from the settlements. The caves, as I mentioned in the Methods section above, are under represented in this analysis. There are large numbers of complete metates in the caves, often associated with manos, but these were not collected and therefore could not be analyzed: not one mano was collected from the caves (the mano from Arch Cave was measured and sketched by this author in situ), and only one small metate fragment was collected from Chanona. Artifact collection from the caves was kept to a minimum deliberately; all four artifacts that were collected from the caves are small (three of the four are under 200 g), and were collected partly to protect them from being looted, especially in the cases of the jade bead and the hachas.

The Oshon site, Hershey, and Pakal Na are the three sites which produced the largest number of groundstone artifacts. Of the three, Oshon exhibits the greatest variety of artifacts, with at least one example of nearly every artifact class (excluding the “miscellaneous” category and jadeite). Pakal Na yielded five of the seven artifact types, lacking only an hacha and a bark beater. Hershey is the least diverse, having only three of the artifact types. Pechtun Ha and Obispo each produced only two artifact types each. The caves cannot be considered individually in this part of the analysis because no more than two groundstone artifacts were collected from any one cave, although when the caves are taken as a whole, they contain four of the seven artifact types.

The raw material of the artifacts can tell us about Maya trade patterns. Much of the raw material was mined locally, and could have been acquired either by the communities themselves, or else easily and probably cheaply traded through their neighbors to the south.
The Maya of the southern lowlands were also part of a larger trade network that reached all the way to the Maya in the Pacific Highlands of Guatemala. From these communities the Maya living in the Sibun River Valley traded for jadeite and obsidian. The distance this resource had to travel explains why there are so few jadeite artifacts found in these excavations, although obsidian is abundant (see Lim, Chapter 24). It also may imply that there is a source of volcanic rock closer than Guatemala, since nearly one quarter (18/77) of the groundstone found in the Xibun is made from this material, including a few very large igneous metate fragments. As was mentioned above, large metate fragments at the Hershey site demonstrate that the Maya were using the abundant supply of river cobbles available at this location.

We can conclude from the range of artifacts found in the XARP excavations that the Sibun River Valley was host to a variety of activities. The sites contain many functional tools, such as manos, metates, and pounders, as well as objects used for ornamental and ceremonial purposes, like the jadeite bead and inlaid jade fragment. We can also see that groundstone played a part in the ritual activities of the caves, by the presence of ceremonial and functional hachas, jade, and used manos and metates. These artifacts support the idea of caves as a place for rituals related to fertility in general, and to crops and rain in particular.

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Chapter 26
Human Remains for Ritual Internments at Pakal Na and Actun Chanona

Helga Hauksdottir and Steven Morandi

Human remains are vital for understanding past peoples. Important information such as diet, pathology, age and stature of populations can be collected by analyzing bones. In addition, archaeologists can learn more about a culture’s beliefs regarding life and death by excavating human burials. During the Xibun Archaeological Research Project 2001 field season, human remains were discovered and recorded at Actun Chanona and excavated at the site of Pakal Na. The following is a comparative analysis of the human remains found at these two sites. It should be noted that this report represents a preliminary inventory of the human skeletal remains found during the 2001 season and future changes will be made as a more complete analysis is undertaken by Dr. Rebecca Storey.

Methodology

Although most of the bones found at Actun Chanona and Pakal Na were inventoried, the methods of analysis differed between the two sites. In the case of Actun Chanona, the authors spent one day inventorying the bones that had been found up to that date. Our analysis involved leaving all the bones in situ, for most were stuck in mineral deposits. Some bones were movable but the decision was made to keep the collection intact within the cave rather than remove a sample of the bones. A few additional bones were discovered after our inventory was made, and they are not be included here. Our intent was to identify the human remains by anatomical part and side, if possible. Long bones were measured, when possible, to provide data for stature estimations. Any distinguishing characteristics of the bones, such as pathologies, also were noted. Due to excellent preservation, most of the bones in Actun Chanona were clearly identified. The calcification on many of the bones helped to retain their integrity.

The preservation of the human remains found at the site of Pakal Na was worse than that of Actun Chanona, but nonetheless relatively good for the tropics. At Operation 22, an articulated skeleton was found (Burial 1-A) along with three bundles (Burials 1-B, 1-C, and 1-D) consisting mostly of human cranial and long bone fragments (Harrison and Acone, Chapter 10, this volume, for description of burial deposits). As Burials 1-A through 1-D were under excavation, another articulated individual (Burial 2) was discovered within an earlier construction unit (Figure 10.6). Because Burial 1-A and 2 were articulated, it was easy to identify the bones in the field, and the foil packets often were marked with the anatomical part contained within. Some of the bones of Burial 1-A were quite fragile; in order to transport the bones to the laboratory intact, they were removed in a block of sediment and excavated in the laboratory under more controlled conditions. Many of the bones found in Burials 1-B, 1-C, and 1-D could not be identified in the field due to their disarticulated and fragmentary condition, so they were fully excavated and later analyzed and identified in the laboratory. Once in the laboratory, the bones were carefully washed, dried, and inventoried. Some of the bones became so fragmented that identification was not possible, though future restoration should clarify most of these cases.
Actun Chanona Human Skeletal Remains

A total of 5 individuals were found in Actun Chanona. The remains of individuals 1, 2, and 5 were found near the eastern entrance of Actun Chanona (Figure 3.2). The remains of individuals 3 and 4 were found near the western entrance (Figure 3.7). In the cases of individuals 3 and 4, whose remains were in close proximity to each other, it was only possible to state the minimum number of individuals. In the absence of detailed metric and qualitative data, one cannot positively assert that a cluster of bones belonged only to one individual.

There were a total of 20 bones associated with individual 1, including a mandible, a left scapula, cranial fragments, the sacrum, the pelvis, both tibiae and femora, a total of 5 vertebrae (2 lumbar and 3 thoracic), and 3 rib bone fragments. This individual did have both third molars, indicating an age of at least 18-24 years.

The remains of individuals 2 and 5 were found clustered together also near the eastern entrance, represented by only 6 bones. This included crushed cranium fragments of one individual, skull fragments and mandible of another individual, left pelvic fragments and two left femora. Both third molars had erupted, but were no longer in the mandible.

The remains of at least two individuals (here identified as 3 and 4) were found near the western entrance of Actun Chanona (Figure 3.7). A total of 18 bones were found near the western entrance. The inventory includes two left clavicles, 12 rib fragments (6 left, 5 right and one unknown), one femur, an atlas, a mandible, and a maxilla fragment. The mandible had a speleothem growing out of it due to dripwater. However, the second lower right premolar was absent. There was evidence of alveolar bone recession with the roots of the molars exposed, and the teeth were heavily worn down. A maxilla, found nearby, was too large to fit the mandible. This maxilla shows evidence of dental pathology. There are abscesses above the upper right and left lateral incisors. There is resorption of the alveolar bone where the upper right second molar should have been, indicating that a tooth fell out a significant time before death. There is also evidence of caries in the upper right first molar.

Pakal Na Human Skeletal Remains

In Operation 22 at the site of Pakal Na, the remains of two articulated individuals were found. Additionally, human skeletal remains that constituted three bundles associated with the primary Burial 1-A (Figure 10.6) were identified. Burial 1-A was extended and oriented cardinally with the head of the individual to the north and the feet to the south. The individual had been buried with one leg crossed over the other. The bones found with individual 1-A include both femora, patellae, tibiae, and fibulae, five left tarsal fragments (navicular, talus, calcaneus, and two possible cuneiform), two right tarsal fragments (possible calcaneus, one possible cuboid), a scapular fragment, the right humerus, three left metacarpals and four left phalanges, a minimum of ten vertebrae (one thoracic, two lumbar, remaining undetermined), seven right and three left rib fragments, and the os coxae (fragmentary). Interestingly, both radii and ulnae, as well as, the left humerus, were absent.

The bones associated with bundle 1-B, found east of 1-A, consisted primarily of cranial fragments,
including the frontal, left and right parietal, and occipital fragments. There was also a mandible fragment which included the body of the mandible, and the ascending ramus, in addition to fragments of the zygomatic arch. There were a total of eleven teeth found with this cranium (both first lower molars, all lower premolars, both lower canines, one lower left and one right lower lateral incisor, and the right lower central incisor. Two drilled jaguar canines were also found with this bundle.

Burial 1-C consisted mainly of long bones and cranial fragments. Included in the bundle were the fragments at least three mandibles, two maxillae, cranial fragments, right scapular fragments, one right humerus, two ulnae (one right, the other undetermined), 1 fibula (side undetermined), 1 thoracic vertebra, and fragments of a right radius. Additional bones accompanied Bundle 1-C, but were too fragmented to be identified. One left mandible fragment had three molars still intact in the mandible. Another left mandible fragment was found with the first and second left lower molars still intact. The third mandible had the first and second left molar. A right mandible fragment was found with the first right lower molar still intact. One right maxilla fragment was found with the canine, first premolar, and first molar present. The second premolar fell out before death since there is resorption of bone in its place. Another left maxilla fragment contained the canine and first premolar. The first upper molar and the upper left central incisor were found loose in the same packet. In addition to these intact teeth, a lower right lateral incisor was found.

There were two mandible fragments, and two frontal cranial bone fragments that had been incised. The two mandible fragments, conjoinable, contained three carved circles, two filled with birds’ profiles and one with a small mammal. The cranial fragment contained the border and part of a mat design, and appears to fit with a similar cranial fragment excavated from Operation 22 during the 1999 season. There was also a maxilla with a drilled canine, and an additional drilled loose canine that were found in Burial 1-C. This bundle had some additional non-human remains and artifacts including eight sherds, a marine shell, an animal long bone, one drilled dog tooth, and turtle shell fragments.

The remains in Burial 1-D were similar to Burial 1-C in that it contained long bones, but dissimilar due to the lack of cranial fragments. This bundle included two femora, two tibiae (sides undetermined), two humeri; radius and ulna fragments, a right clavicle, rib fragments, two metatarsal fragments and distal phalanx fragments. The lack of time and fragmentary state of many of these bones precluded further identification. The fact that there were two of each long bone found in Burial 1-D suggests that the bundle may represent a single individual. There were also many unidentifiable bones. Two burned bone fragments which have yet to be positively identified, and the long bone of a bird were found in association with Burial 1-D.

The remains found in Burial 2 were articulated, however, they were mostly bones from the left side of the skeleton, including the left femur, tibia, ulna, humerus, fibula, metatarsals of both feet, one calcaneus fragment, the fifth left metacarpal, three phalanx fragments, fragments of the right tibia and fibula, pelvic fragments, rib fragments, and cranial fragments. There were some unidentifiable fragments, possible distal long bone fragments.

**Analysis**

In addition to inventorying the bones found in Actun Chanona and at Pakal Na, we measured and recorded characteristics to facilitate determination of sex, age or stature of the individual. One measurement that can be made to estimate stature of an individual is the oblique length of a femur (Bass 1995: 219). We were able to measure the femora of individuals 1 and 2 of Actun Chanona. The approximate oblique length
of the femur of individual 1 is 44.5 cm, which yields a height of 164-170 cm. The measurement was approximate due to calcification of the bone. In addition, a trochanteric oblique length of the femur was taken in order to determine the sex of this individual. Unfortunately, this measurement, 41.5 cm, lies within the range of 40.5 cm to 45 cm that is considered to be sexually undeterminable (Bass 1995: 219). However, considering that it was not common for Mesoamerican women to exceed 165 cm in height, individual 1 was likely a male. In addition to the oblique length of the femur, the length of the tibiae can be used to estimate the height of this individual (Bass 1995: 238). This method is not as reliable, but it can support the measurement of the femur. In this case, it is especially useful since the oblique length of the femur was approximate. The length of the tibia is 36.0 cm, which yields a height range of 162-169 cm. Tibia length allows for a greater range as to possible height of the individual; however, it is evident that that in this case, it provides support for the notion that this individual was between 160 cm and 170 cm in height.

The third molars are present in this individual, so that he was at least 18 to 24 years old at the age of death.

The oblique length of the femur of individual 2 was also measured, and determined to be 40.6 cm. Using the same formula as that of individual 1, this person would have ranged between 155 and 161 cm in height. The trochanteric oblique length of the same femur was measured in order to determine this individual’s sex, and that measurement is 39.3 cm. Trochanteric femur length from 39 to 40.5 cm is indicative of a female. The epiphyses on the femur are all fused, so it is likely that individual 2 was an adult female.

A measurement to estimate the stature of individual 5 was not possible since only the proximal end of the femur remained. However, the cranium and teeth permit estimation of the individual’s age. The sutures were not obliterated on individual 5, indicating that this person was a young adult. The fact that the teeth found in association with this individual are not very worn compared to other teeth both in Actun Chanona and at Pakal Na supports the idea that individual 5 was a juvenile. There also was a hole where both the left and right third molars should have been. It is possible that these molars were forming, but had not yet erupted at the time of the juvenile’s death. In summary, the evidence suggests that individual 5 was a juvenile of undetermined sex.

For individuals 3 and 4, we were able to collect data to estimate sex and age. The shape of the mandible associated with individual 3 featured a pronounced chin, suggesting that the individual was a male. The mandible of individual 3 contained both third molars, indicating an age of at least 18-24 years at the time of death. The remaining bones found in association with individuals 3 and 4 were not informative of stature, sex, or age. Overall, Actun Chanona contained the remains of one adult female, two adult males, a young individual of undetermined sex, and an individual of undetermined sex and age.

At the site of Pakal Na, we were not able to take as many measurements of bones due to their fragmentary condition and the necessity for time consuming reconstruction prior to measurements. The only bone immediately available for measuring was the femur of Burial 1-A which bore an oblique length of 41.8 cm. Using the same height formula as that employed for individuals 1 and 2 of Actun Chanona, this person stood between 158 cm-164 cm in height. In associated Burial 1-C, one of the mandibles contained a third left molar, indicating that individual was at least 18 years old at the time of death. Unfortunately, determination of age, sex or stature of the remaining individuals cannot be estimated given the current fragmentary state of the bones. However, it can be said that Operation 22 contains two articulated individuals along with a minimum of 3 individuals assembled in bundles.
Discussion

The discoveries made at Actun Chanona and Pakal Na have yielded important preliminary information about the Maya people of the Sibun, their beliefs, and their rituals. Navigating in Actun Chanona’s dangerous depths, one wonders why humans were interred in this place. To the ancient Maya, caves were seen as the entrance to Xibalba, the underworld. They provided a link between the worlds of the living and their ancestors (McAnany 1995: 50). As a result, the Maya performed rituals in order to communicate with the people who came before them. The evidence for ritual can be seen by the bones that were found after the date of our inventory. These bones showed evidence of ritual burning and had been placed in a depression in the cave which could have served as an altar. Unfortunately, any information that we collected had to be from the bones themselves, since it is not certain that the context in which they were found was how they were originally interred. Several of the bones have been damaged and scattered by natural and human processes.

It is possible, however, that some of the bones were disarticulated before interment or placed intentionally in a certain way. An example is the mandible of individual 3 that could have been intentionally placed in such a way as to allow it to catch drip water, and that is why the speleothem is found on its left side. Perhaps Actun Chanona was an honorary burial place for respected Maya, so that important members of Maya society were interred inside. It is possible that at least some of the human remains were used as part of a ritual. I think that it is especially likely for individuals 2 and 5, an adult female and a young individual of undetermined sex. If these individuals were part of the common class, not part of an elite lineage, it is doubtful that they were placed in Actun Chanona as an honorable last resting place. Caves were associated with rain ceremonies, and in these particular rituals, children were sacrificed (McNatt 1996: 87). In addition, the burned bones and altars found in close proximity to these two individuals further supports the notion that these individuals could have been sacrificial victims. However, this does not mean that the remaining individuals were there for the same reason.

Another peculiarity about Actun Chanona was the dominance of left-side bones over right. Perhaps “left-ness” is associated with the underworld, the west, and the setting sun and these bones were placed as a symbol of the underworld (P. Peterson, personal communication, 2001). This suggests the possibility that these bones were secondary interments, allowing for decomposition at another location prior to placing selected bones in the cave.

The rich finds of Operation 22 at Pakal Na can reveal much about the human interments discovered there. No cranial fragments were found directly associated with Burial 1-A. Instead, three bundles were uncovered (Burials 1-B, 1-C, and 1-D). These bundles consisted primarily of cranial and long bone fragments. It is plausible that Bundle 1B, which includes a cranium, belonged to the articulated skeleton of Burial 1A. Burial 1A may represent a person decapitated before death, but buried with his cranium. The scenario is suggestive of a warrior who was beheaded in battle. Sandra Lopez Varela (personal communication, 2001) notes the similarity between one of the pottery vessels associated with Burial 1-A and the style of pottery shown on a mural in the Temple of the Warriors at Chichen Itza. Also, the cranium of the individual could have been removed after death as part of a mortuary ritual. The carved cranial fragments in Burial 1-C hint that the head may have been removed in order for the cranium to be carved with important symbols.
Like Burial 1-B, Burials 1-C and 1-D were also bundles of disarticulated human skeletal remains. One of the cranial fragments from Burial 1-C showed remnants of a carved and drilled mat symbol, which was a symbol of authority in Maya society (Sharer 1994: 329). Two of the mandible fragments found in Burial 1-C had been carved with animal motifs. One of the mandibles had a drill hole for suspension. At least one of the individuals in Burial 1-C was elite judging by the presence of a drilled canine. Maya elite drilled the front of their teeth to place a jade inlay in the tooth as a symbol of their status.

Individual 1A was not the only articulated skeleton found at Operation 22. Individual 2 consisted of several articulated bones, yet only the left side of the body was intact. Possibly, Burial 2 was disturbed when the burial cut for Burial 1-A was made (see Harrison and Acone, Chapter 10). Burial 2 could have been an ancestor of individual 1-A, with both buried under the same structure.

**Conclusion**

The ancient Maya had varied mortuary practices, which ranged from burying their ancestors beneath their houses to interring individuals in caves. The bones analyzed here tell us something about the age, sex, and stature of the individuals themselves. Yet, they also tell a complex story about Maya perceptions of life and death. We are afforded a glimpse of this cosmology from the human skeletal remains discovered at Actun Chanona and Pakal Na. It is yet uncertain whether the individuals in Actun Chanona were placed there as sacrificial victims, venerated ancestors, or for other reasons. The human remains at Pakal Na speak of important individuals buried with the accoutrements of power.
This report provides a brief summary of the results of a preliminary analysis of 3,022 shell and bone specimens recovered from surface site and cave reconnaissance in the Xibun Valley. Invertebrates are represented by three zoological classes, snails (Class Gastropoda), bivalves (Class Pelecypoda), and crabs (Class Crustacea) and account for 1,157 specimens or 38.3% of the total faunal assemblage (Tables 27.1 and 27.2). Vertebrates are represented by mammals (Class Mammalia), birds (Class Aves), bony fishes (Class Osteichthyes), and reptiles (Class Reptilia), and account for the remaining 1,865 or 61.7% of the faunal assemblage (Table 27.1 and 27.3).

<table>
<thead>
<tr>
<th>Zoological Class</th>
<th>No. of Specimens</th>
<th>% of Assemblage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammalia (Mammals)</td>
<td>1,321</td>
<td>43.7</td>
</tr>
<tr>
<td>Gastropoda (Snails)</td>
<td>1,133</td>
<td>37.5</td>
</tr>
<tr>
<td>Osteichthyes (Bony Fish)</td>
<td>263</td>
<td>8.7</td>
</tr>
<tr>
<td>Class Unknown</td>
<td>141</td>
<td>4.7</td>
</tr>
<tr>
<td>Reptilia (Reptiles)</td>
<td>122</td>
<td>4.0</td>
</tr>
<tr>
<td>Pelecypoda (Bivalves)</td>
<td>19</td>
<td>0.6</td>
</tr>
<tr>
<td>Aves (Birds)</td>
<td>18</td>
<td>0.6</td>
</tr>
<tr>
<td>Crustacea (Crabs)</td>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,022</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Excavations at four surface sites resulted in the recovery of both invertebrate and vertebrate faunal remains (n = 1,833) (Table 27.4). Invertebrates account for 333 (or 18.2%) specimens and vertebrates account for the remaining 1,500 (or 81.8%) specimens. Invertebrates identified include at least 7 taxa. These include representatives of jute snails (*Pachychilus* spp.), apple snail (*Pomacea flagellata*), and at least 3 species of land snails, two of which have been identified (*Euglandina* sp. and *Orthalicus* sp.). Bivalves include specimens of the freshwater pearly mussel (*Nephronaias* sp.). Marine shell is also represented by at least two taxa, both members of conch families (*Strombus* sp. and Family Melongenidae). The surface site vertebrate faunal assemblage is represented by at least 20 taxa including fish, mammal, reptile, and bird species. Identified fish include members of at least 2 marine families, the parrotfish (Family Scaridae) and jack fish (Family Carangidae). Identified mammals include rat or mouse (Family Muridae), peccary (Family Tayassuidae), white-tailed deer (*Odocoileus virginianus*), tapir (*Tapirus bairdii*), dog (*Canis familiaris*), jaguar (*Panthera onca*), and West Indian manatee (*Trichechus manatus*). Identified reptiles include the Central American river turtle or hickety (*Dermatemys mawii*), slider turtle (*Trachemys scripta*), musk turtle (*Staurotypus triporcatus*), crocodile (*Crocodylus* spp.), snake (Order Serpentes), and iguana (Family Iguanidae).
The majority of the taxa identified in the surface site faunal assemblage probably represent food species utilized by the Maya. The exception to this would be the land snails, and the rat and/or mouse bones. The jaguar identifications consist of two canine teeth included within a burial and do not represent the by-products of food use but rather ritual use of fauna. Utilization of the above taxa by the Maya is expanded below in the sections discussing each of the four surface sites.

In contrast to the surface site faunal assemblage, invertebrate remains account for the majority of the cave faunal sample with a total of 824 specimens or 69.3% of the total cave assemblage (Table 27.4). At least 9 invertebrate taxa are represented with the majority (n = 615) identified as various species of freshwater jute snails (Pachychilus spp.). Other snails identified include the apple snail (Pomacea flagellata), at least 3 types of land snail species (Orthalicus sp., Orthalicus sp., and unidentified species), and conch shell (Strombus sp.). Bivalves are represented by one freshwater clam species (Nephronaias sp.) and crabs by at least 2 species, both probably land crabs (cf. Cardiosoma spp.) but only identifiable as Order Brachyura. Vertebrate remains amount to 365 specimens (30.7%) representing at least 15 separate taxa including fish, reptile, mammal, and bird species. Identified vertebrate species include mud turtle (Kinosternon spp.), slider turtle (Trachemys scripta), armadillo (Dasypus novemcinctus), brocket deer (Mazama spp. cf. red brocket or M. americana), white-tailed deer (Odocoileus virginianus), and paca (Agouti paca). Unidentified bat, rat and/or mouse, peccary, bird, turtle, lizard, snake, and fish species are also present in small numbers.

Unlike the surface site assemblages, interpretations regarding utilization of the fauna found within the cave contexts is more difficult. Although almost all of the taxa listed above could have been used as a food source, it is possible that many of the species found within the caves could have died a natural death there or represent kills of natural predators. For example, the land crabs and land snails are unlikely to represent human food refuse. The rat and/or mouse bones too are unlikely to represent human food refuse and more likely to be natural deaths or the refuse of natural predators such as owls or perhaps cat or other mammalian carnivore species. This is discussed in greater detail in the section below on the cave fauna.
Table 27.3 List of Vertebrate Taxa.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class Mammalia</strong></td>
<td></td>
</tr>
<tr>
<td>Order Chiroptera</td>
<td>Bats</td>
</tr>
<tr>
<td>Order Rodentia</td>
<td>Rodents</td>
</tr>
<tr>
<td>Family Muridae</td>
<td>Rat and mouse</td>
</tr>
<tr>
<td>Agouti paca</td>
<td>Paca</td>
</tr>
<tr>
<td>Dasypus novemcinctus</td>
<td>Nine-banded armadillo</td>
</tr>
<tr>
<td>Order Artiodactyla</td>
<td>Even-toed ungulates</td>
</tr>
<tr>
<td>Family Cervidae</td>
<td>Deer</td>
</tr>
<tr>
<td>Odocoileus virginianus</td>
<td>White-tailed deer</td>
</tr>
<tr>
<td>Mazama sp.</td>
<td>Brocket deer</td>
</tr>
<tr>
<td>Family Tayassuidae</td>
<td>Peccaries</td>
</tr>
<tr>
<td>Tapirus bairdii</td>
<td>Tapir</td>
</tr>
<tr>
<td>Family Felidae</td>
<td>Cats</td>
</tr>
<tr>
<td>Panthera onca</td>
<td>Jaguar</td>
</tr>
<tr>
<td>Family Canidae</td>
<td>Dogs, foxes, coyotes</td>
</tr>
<tr>
<td>Canis familiaris</td>
<td>Domestic dog</td>
</tr>
<tr>
<td>Trichechus manatus</td>
<td>West Indian manatee</td>
</tr>
<tr>
<td><strong>Class Osteichthyes</strong></td>
<td></td>
</tr>
<tr>
<td>Family Scaridae</td>
<td>Bony Fishes</td>
</tr>
<tr>
<td>Family Carangidae</td>
<td>Parrot fish</td>
</tr>
<tr>
<td><strong>Class Reptilia</strong></td>
<td></td>
</tr>
<tr>
<td>Order Testudines</td>
<td>Reptiles</td>
</tr>
<tr>
<td>Trachemys scripta</td>
<td>Turtles</td>
</tr>
<tr>
<td>Dermatemys mawii</td>
<td>Slider turtle</td>
</tr>
<tr>
<td>Staurotypus triporcatus</td>
<td>Central American river turtle</td>
</tr>
<tr>
<td>Kinosternon sp.</td>
<td>Giant Mexican musk turtle</td>
</tr>
<tr>
<td>Crocodylus sp.</td>
<td>Mud turtles</td>
</tr>
<tr>
<td>Order Lacertilia</td>
<td>Crocodiles</td>
</tr>
<tr>
<td>Family Iguanidae</td>
<td>Lizards</td>
</tr>
<tr>
<td>Canis familiaris</td>
<td>Iguanas and allies</td>
</tr>
<tr>
<td>Order Serpentes</td>
<td>Snakes</td>
</tr>
<tr>
<td><strong>Class Aves</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td></td>
</tr>
</tbody>
</table>

All faunal remains were examined in Belize 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. As such all listings of unidentified fauna below are tentative.

Taxonomic nomenclature is based on the following references: for mammals, Reid (1997), shells follow Tucker Abbott and Morris (1995), turtles follow Ernst and Barbour (1989), while snakes and lizards follow Villa et al. (1988).

For each specimen the following observations were recorded when possible: lowest taxon, skeletal element and side represented, portion represented (e.g., distal, proximal, mid, complete) and percentage thereof, age (e.g., juvenile, immature, subadult, adult), and natural or cultural modifications (e.g., heat alterations, weathering, butchering, and artifact manufacturing). For the purposes of this report all taxa are listed as number of specimens (NSp). Minimum number of individuals will be provided in the final report.
Before discussing each of the surface sites individually a few general observations on the distribution of fauna are presented here (Table 27.5 and 27.6). The majority of invertebrate remains were recovered from the Hershey site and they account for the majority of the Hershey site assemblage with 227 specimens or 94.2% of the sample total. The majority of these are jute remains representing at least one species (*Pachychilus indiorum*) and possibly more. A large number of land snails (n = 49) were included in the sample but are not considered food species. Other invertebrates from the Hershey site include one fragment of conch shell (*Strombus* sp.) but identification to species was not possible (Table 27.5).

Both the Oshon site and Pakal Na had few invertebrate remains. Interestingly the Oshon site marine shell sample accounts for 42% of the total. This focus on marine faunal utilization is also seen among the vertebrate assemblage from the Oshon site. Pakal Na’s invertebrate assemblage consists primarily of jute snails, land snails, and apple snail. The Pechtun Ha invertebrate assemblage is somewhat similar to that from the Hershey site in terms of overall percentages. *Jute* and land snails, as at Hershey, account for the majority of the shell sample, and as at Hershey, the land snails are not considered to represent food refuse.

The vertebrate assemblage from the surface sites indicates that the Xibun Maya utilized a wide variety of resources including terrestrial and marine species of mammal, fish, and reptile. The highest number of vertebrates comes from the Pechtun Ha excavations but many are highly fragmented pieces of a few individual species and the vertebrate numbers, in terms of specimen counts, are inflated. For example, the greater than 500 unidentified mammal specimens are probably all highly fragmented skull and long bone fragments of only a few peccary or tapir recovered from Pechtun Ha. At Pechtun Ha at least 18 taxa of vertebrates are represented, at the Oshon site there are also at least 18 taxa represented. Pakal Na also has a high number of vertebrate taxa (at least 15). In contrast the Hershey site assemblage contains only 6 vertebrate taxa. The high diversity in taxa utilization is a common element in Maya faunal utilization at many sites and indicates familiarity with local environments.

### Table 27.4 Distribution of Faunal Remains by Site.

<table>
<thead>
<tr>
<th>Site</th>
<th>Invertebrates</th>
<th>Vertebrates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cave Sites</td>
<td>824</td>
<td>365</td>
<td>1,189</td>
</tr>
<tr>
<td>Usrey Cave</td>
<td>47</td>
<td>-</td>
<td>47</td>
</tr>
<tr>
<td>Actun Ik</td>
<td>233</td>
<td>66</td>
<td>299</td>
</tr>
<tr>
<td>Actun Ibach</td>
<td>17</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td>Glenwood Cave</td>
<td>112</td>
<td>-</td>
<td>112</td>
</tr>
<tr>
<td>Actun Yax Tun</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Ek ‘Waynal</td>
<td>212</td>
<td>53</td>
<td>265</td>
</tr>
<tr>
<td>Actun Chanona</td>
<td>202</td>
<td>222</td>
<td>424</td>
</tr>
<tr>
<td>Surface Sites</td>
<td>333</td>
<td>1,500</td>
<td>1,833</td>
</tr>
<tr>
<td>Hershey</td>
<td>233</td>
<td>14</td>
<td>247</td>
</tr>
<tr>
<td>Pakal Na</td>
<td>13</td>
<td>194</td>
<td>207</td>
</tr>
<tr>
<td>Oshon</td>
<td>12</td>
<td>289</td>
<td>301</td>
</tr>
<tr>
<td>Pechtun Ha</td>
<td>75</td>
<td>1,003</td>
<td>1,078</td>
</tr>
<tr>
<td>Total Assemblage</td>
<td>1,157</td>
<td>1,865</td>
<td>3,022</td>
</tr>
</tbody>
</table>

The Xibun Valley Surface Sites
Mammals account for most of the vertebrate remains at each of these sites. Except for the Hershey site it appears that medium to large mammal species were preferred. Among these are deer (probably both brocket and white-tailed), peccary (collared or white-lipped), manatee, and tapir. Domestic dog remains are relatively rare as are some of the smaller game species such as pacas and armadillos. Reptilian species are common and include representatives of at least 4 species of turtle, the iguana family, snake, and crocodile. Turtle species identified include slider or bokatura (*Trachemys scripta*), hickety (*Dermatemys mawii*), and the giant Mexican musk turtle (*Stuarotypus triporcatus*). Identified fish species are marine species and include parrotfish and jack fish remains. Approximately 200 fish remains have not been identified and many of these are probably marine species as well. The majority of the fish comes from the Oshon site and as noted earlier for invertebrate remains, this site appears to have a focus on marine species, particularly fish. Other marine species recovered from the Oshon site include manatee and crocodile. The location of the Oshon site relative to the coast can account for this.

**Table 27.5 Distribution of Invertebrate Taxa by Surface Site.**

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Hershey Site</th>
<th>Oshon Site</th>
<th>Pakal Na</th>
<th>Pechtun Ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land snails</td>
<td>46</td>
<td>-</td>
<td>-</td>
<td>37</td>
</tr>
<tr>
<td>Marine shell</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Orthalicus sp.</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td><em>P. indiorum</em></td>
<td>133</td>
<td>-</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Pachychilus sp.</td>
<td>43</td>
<td>-</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Euglandina sp.</td>
<td>1</td>
<td>-</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Strombus sp.</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nephroniais sp.</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>P. flagellata</em></td>
<td>-</td>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Crown conch</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>227</strong></td>
<td><strong>12</strong></td>
<td><strong>13</strong></td>
<td><strong>75</strong></td>
</tr>
</tbody>
</table>

**Table 27.6 Distribution of Vertebrate Taxa by Surface Sites.**

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Hershey</th>
<th>Oshon</th>
<th>Pakal Na</th>
<th>Pechtun Ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>1</td>
<td>163</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>Parrot fish</td>
<td>3</td>
<td>23</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Jack fish</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Reptile</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Snake</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>Iguanid</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Turtle</td>
<td>-</td>
<td>19</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td><em>T. scripta</em></td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td><em>D. mawii</em></td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Musk turtle</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Crocodile</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manatee</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Armadillo</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 27.6 continued from previous page

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaguar</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Canidae</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Domestic dog</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Tapir</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>248</td>
</tr>
<tr>
<td>O. virginianus</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Deer</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Peccaries</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>161</td>
</tr>
<tr>
<td>Rodent</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rat or mouse</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Artiodactyl</td>
<td>-</td>
<td>8</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Mammal</td>
<td>4</td>
<td>26</td>
<td>67</td>
<td>513</td>
</tr>
<tr>
<td>Bird</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Class unknown</td>
<td>2</td>
<td>15</td>
<td>46</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>289</strong></td>
<td><strong>194</strong></td>
<td><strong>1,003</strong></td>
</tr>
</tbody>
</table>

The Hershey Site

A total of 247 faunal remains were presented for analysis (Table 27.7). Of these, 233 or 94.3% are invertebrate specimens representing 7 taxa including both freshwater snail and clam species, land snails, and marine shell. Only 14 vertebrate remains were recovered including fish, bird, and mammal species (Table 27.8). Faunal remains were recovered from three operations: Op. 50, Op.51, Op.53.

Account of Invertebrates

Snails are represented by freshwater, marine, and land species. The river snail known locally as *jute* (*Pachychilus* sp.) dominates the Hershey invertebrate assemblage. At least two *jute* species are represented, the smooth-shelled *P. indiorum* and the sculptured *P. glaphyrus* (see Healy et al. 1990 for a discussion of species identification problems). *Jute* snails would have been consumed as a food source. One marine shell, a conch shell fragment, was also identified. Land snails include two identified species (*Orthalicus* sp. and *Euglandina* sp.) and at least one additional unidentified species, none of which is thought to have been consumed by the Maya. Bivalves are represented by only one valve fragment of a freshwater pearly mussel.

Account of Vertebrates

Vertebrate remains include marine fish (jack fish and parrotfish), mammal, and bird. Only 2 mammals could be identified and both are of either a rat or mouse species. Neither is considered to represent food refuse. The remaining vertebrate sample could not be identified below the zoological class level. However, all bones are considered to be food refuse products.
Table 27.7 Distribution of Hershey Site Fauna by Operation.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Invertebrates</th>
<th>Vertebrates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>p. 50</td>
<td>50</td>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td>Op. 51</td>
<td>181</td>
<td>13</td>
<td>194</td>
</tr>
<tr>
<td>Op. 53</td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>233</td>
<td>14</td>
<td>247</td>
</tr>
</tbody>
</table>

Table 27.8 List of Hershey Site Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td>Unidentified land snails</td>
<td>46</td>
</tr>
<tr>
<td>Orthalicus sp.</td>
<td>2</td>
</tr>
<tr>
<td>Pachychilus indiorum</td>
<td>133</td>
</tr>
<tr>
<td>Pachychilus sp.</td>
<td>43</td>
</tr>
<tr>
<td>Pachychilus glaphyrus</td>
<td>6</td>
</tr>
<tr>
<td>Euglandina sp.</td>
<td>1</td>
</tr>
<tr>
<td>Strombus sp.</td>
<td>1</td>
</tr>
<tr>
<td>Class Pelecypoda</td>
<td></td>
</tr>
<tr>
<td>Nephronaias sp.</td>
<td>1</td>
</tr>
<tr>
<td>Vertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Osteichthyes</td>
<td></td>
</tr>
<tr>
<td>Unidentified fish</td>
<td>1</td>
</tr>
<tr>
<td>Family Scaridae</td>
<td>3</td>
</tr>
<tr>
<td>Family Carangidae</td>
<td>1</td>
</tr>
<tr>
<td>Class Mammalia</td>
<td></td>
</tr>
<tr>
<td>Family Muridae</td>
<td>2</td>
</tr>
<tr>
<td>Unidentified mammal</td>
<td>4</td>
</tr>
<tr>
<td>Class Aves</td>
<td></td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>1</td>
</tr>
<tr>
<td>Class Unknown</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>247</td>
</tr>
</tbody>
</table>
**Operation 50 Summary**

Faunal remains from Operation 50 included one worked freshwater clam fragment and several remains of the *jute* snail. Only one vertebrate specimen, the body portion of a large fish vertebra, was recovered. It is possible that a marine fish is represented based on the size of the vertebra.

**Operation 51 Summary**

The majority of the Hershey site faunal assemblage comes from excavation of this operation. Invertebrates include intrusive land snails and freshwater *jute* snails. Most of the *jute* snails are the smooth shelled *P. indiorum* and many of these exhibit a very battered surface with characteristic indents present. It is likely that the shells received this surface type due to their impact against rocks in fast moving rivers. This type of battered surface may indicate that the snails survived at least one yearly flooding cycle of the local rivers. Conch shell is also present, possibly queen conch. Vertebrates identified include a parrotfish skull elements and jack fish bones, mainly hyperostotic rib fragments. Mammal bone includes unidentified medium to large sized mammal fragments. Rat or mouse bones are represented by two specimens. A long bone fragment of a small to medium sized unidentified bird species is also present.

**Operation 53 Summary**

Only two shells were presented for analysis. Both are *jute* (*P. indiorum*) snails.

**The Pakal Na Assemblage**

A total of 207 faunal remains were examined including 13 (6.3%) invertebrate and 194 (93.7%) vertebrate specimens (Table 27.9). Faunal remains were recovered from Operations 14, 16, 20, and 22.

### Table 27.9 Distribution of Pakal Na Faunal Remains by Operation.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Invertebrates</th>
<th>Vertebrates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. 14</td>
<td>2</td>
<td>31</td>
<td>33</td>
</tr>
<tr>
<td>Op. 16</td>
<td>-</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Op. 20</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Op. 22</td>
<td>11</td>
<td>97</td>
<td>108</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>194</strong></td>
<td><strong>207</strong></td>
</tr>
</tbody>
</table>

**Account of Invertebrates**

The 13 invertebrate remains analyzed consist of land snail (*Euglandina* sp.), and 2 freshwater snails, *jute* (*P. indiorum*) and apple snail (*Pomacea flagellata*) (Table 27.10). The *jute* is available in fast moving waters while apple snails are generally restricted to still or slow moving bodies of water. Apple snails are a fairly common occurrence on Maya sites and were consumed regularly.
Account of Vertebrates

Vertebrates identified include nine-banded armadillo, peccary, artiodactyl, deer, domestic dog, rodent, and jaguar (Table 27.10). A total of 67 fragments have only been identified as mammal to date. The jaguar identifications are two perforated canines (probably upper) of one individual jaguar that were placed in a Terminal Classic burial. One perforated dog canine was also placed within the burial. The remaining identified mammals all represent food sources except perhaps for the one rodent bone. A fairly large number of fish remains were recovered and all identified fish are coastal in origin and include specimens of both jack and parrot fish. Fish are represented by both cranial and post-cranial elements. Turtles were also identified including ‘hickety’ (Dermatemys mawii) and slider (Trachemys scripta). All turtle specimens are shell fragments. Bird is represented by 4 fragments of an unidentified species. A large number of bones could not be identified to zoological class due to excessive fragmentation.

Table 27.10 List of Pakal Na Faunal Remains.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>7</td>
</tr>
<tr>
<td><em>Euglandina sp.</em></td>
<td>5</td>
</tr>
<tr>
<td>Vertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Mammalia</td>
<td></td>
</tr>
<tr>
<td><em>Dasypus novemcinctus</em></td>
<td>7</td>
</tr>
<tr>
<td>Unidentified mammal</td>
<td>67</td>
</tr>
<tr>
<td>Order Artiodactyla</td>
<td>3</td>
</tr>
<tr>
<td>Family Tayassuidae</td>
<td>2</td>
</tr>
<tr>
<td><em>Panthera onca</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Canis familiaris</em></td>
<td>1</td>
</tr>
<tr>
<td>Family Cervidae</td>
<td>1</td>
</tr>
<tr>
<td>Order Rodentia</td>
<td>1</td>
</tr>
<tr>
<td>Class Osteichthyse</td>
<td></td>
</tr>
<tr>
<td>Unidentified fish</td>
<td>35</td>
</tr>
<tr>
<td>Family Carangidae</td>
<td>10</td>
</tr>
<tr>
<td>Family Scaridae</td>
<td>5</td>
</tr>
<tr>
<td>Class Reptilia</td>
<td></td>
</tr>
<tr>
<td>Order Testudines</td>
<td>4</td>
</tr>
<tr>
<td><em>Trachemys scripta</em></td>
<td>3</td>
</tr>
<tr>
<td><em>Dermatemys mawii</em></td>
<td>3</td>
</tr>
<tr>
<td>Class Aves</td>
<td></td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>4</td>
</tr>
<tr>
<td>Class Unknown</td>
<td>46</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>207</strong></td>
</tr>
</tbody>
</table>
**Operation 14 Summary**

Vertebrates include mammal, fish, and reptilian species. Nine-banded armadillo (only a dermal scute is present), a few artiodactyl vertebrae and long bone fragments, (possibly deer), and several unidentified long bone fragments represent the mammalian remains. The unidentified mammal bone fragments are from a medium to large animal, also possibly deer species. One unidentified large mammal femur is charred indicating heat exposure. Other unidentified mammal includes both vertebral and long bone fragments, some exhibiting flake scars. Fishes include marine jack fish and other unidentified small to medium fish skull elements and vertebrae. Reptile fragments are all turtle specimens and include some unidentified turtle shell fragments, one possibly from a mud turtle (*Kinosternon* sp.) base on size. Other turtle elements include a shell fragment of a slider and a long bone from what appears to also be a mud turtle species. Invertebrates identified include a shell fragment of a slider and a long bone from what appears to also be a mud turtle species. Invertebrates identified include apple snails and *jute*.

**Operation 16 Summary**

Only vertebrate remains were recovered from this operation and include mammal, fish, and turtle species as well as several unidentifiable bones. Fish include both jack and parrotfish elements as well as a number of unidentified vertebrae from a large fish species, possibly marine in origin. Turtle is represented by the shell fragments of a slider turtle. Mammalian remains include those identified only as artiodactyl, representing either deer or peccary species. Among these is a phalanx and a femur shaft exhibiting 5 cut marks on its anterior surface indicative of butchering by humans. A large number of bones could only be identified as mammal, mainly of large sized game, possibly peccary or deer species. Most of these are long bone fragments and some are rib fragments including one rib shaft that also has a few cut marks on it.

**Operation 20 Summary**

The sole specimen, a badly fragmented and charred turtle shell, has been identified as *hickety* (*Dermatemys mawii*).

**Operation 22 Summary**

A total of 11 invertebrate remains were analyzed and 5 were identified as land snails (*Euglandina* sp.), and 6 as freshwater *jute* snails (*P. indiorum*). Vertebrate remains include fish, mammal, reptile and bird bones as well as a number of unidentifiable fragments. Identified fish include parrotfish, all skull elements. Several unidentified vertebrae, spines, and other post-cranial elements of small to medium sized fishes are present. One of these fish specimens appears to be recently deposited.

Mammal species identified include nine-banded armadillo, deer species, rodent species, peccary, jaguar, dog, and possibly human. Armadillo is represented by calcaneum fragments and a few dermal scutes. Deer is represented by an incisor tooth, from a brocket or white-tailed deer. Peccary is represented by phalanges, probably all from the same foot of an individual animal. Identification to specific peccary species was not possible. Human bone may be present in the form of five fragments of a tarsal bone. Since a burial was found in this operation it is quite possible that human bone may be present in the faunal sample. Jaguar is represented by two perforated canines associated with a human burial as is domestic dog (one incised canine). There are several unidentified mammal specimens, mostly long bones of various sized animals and armadillo is probably among them. There is also a vertebra of an immature
mammal as well as rib fragments of various sized mammals. One small rodent pelvic bone, possibly from a squirrel is also present. This element is not believed to represent food refuse. Other unidentified mammal specimens include a long bone fragment with flake scars and fracturing, from a medium to large sized animal and large mammal cranial fragments.

Bird is represented by one worked long bone from a medium sized bird. This specimen is incised and perhaps may have been cut in preparation for bead manufacturing. In addition, three unidentified and unmodified long bone shaft fragments of a small to medium sized bird species are present.

Reptile is present in the form of an unidentified vertebra of either a turtle or lizard species. Hickety plastron fragments and one slider turtle carapace fragments are also identified. A snake vertebra has also been identified.

The Oshon Site

A total of 301 faunal remains were examined (Table 27.11). Of these, 12 (4%) are invertebrates and 289 (96%) are vertebrate specimens (Table 27.12). Faunal remains were recovered from Operations 17, 18, 19, 20, 21, and 23. One surface collected specimen was also analyzed.

Table 27.11 Distribution of Oshon Site Fauna by Operation.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Invertebrates</th>
<th>Vertebrates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. 17</td>
<td>2</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Op. 18</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Op. 19</td>
<td>-</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>Op. 20</td>
<td>2</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>Op. 21</td>
<td>7</td>
<td>178</td>
<td>185</td>
</tr>
<tr>
<td>Op. 23</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Surface Collection</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>289</strong></td>
<td><strong>301</strong></td>
</tr>
</tbody>
</table>

Account of Invertebrates

Invertebrates identified include marine and freshwater snails. Two fragments of conch shell (Strombus sp.) were analyzed but neither could be identified to species but both may either queen conch (S. gigas) or W. Indian Fighting conch (S. pugilis). One surface collected whelk shell fragment is identified as belonging to the crown conch family (Melongenidae). This specimen most closely follows a turnip (Busycon coarctatum) or lightning (Busycon contrarium) whelk and is considered identifiable with a proper reference collection. However, its presence on the surface makes any inferences regarding ancient Maya utilization questionable. The remaining invertebrate sample consists of a few apple snails. These probably represent discarded food resources.

Account of Vertebrates

Vertebrates include fish, reptile, bird, and mammalian representatives. Fish account for 190 specimens and include parrotfish and jack fish remains. A large number of the fish remains have yet
to be identified and undoubtedly contain more jack and parrotfish and quite possibly additional marine species. Fish elements identified include both cranial and post-cranial elements, some of which were charred and/or calcined indicating exposure to heat. Although both the parrotfish and jack fishes are marine fishes, the latter is perhaps best described as a peripheral fish. This means that the jacks are found in several differing environments including reef, inshore, and estuarine zones (Graham 1994:257). Estuarine environments include the waters of estuaries, rivers, or creeks that are brackish in nature. The jack fishes may have been taken in brackish areas of the Xibun River. The presence of parrotfish indicates reef fishing by the Maya. Graham (1994:261) suggests that some sort of pot fishing would have facilitated the procurement of parrotfish.

Reptiles (n = 35) are represented by at least 4 taxa and include turtle species, crocodile, snake, and unidentified remains. Turtles species identified include the giant Mexican musk turtle (*Staurotypus triporcatus*), and slider or *bokatura* as it is locally known (*Trachemys scripta*). All identified turtle fragments are parts of the carapace or plastron and several fragments could not be identified to specific species but appear to be of small to medium sized species. Crocodile (*Crocodylus* sp.) is represented by 3 bone fragments, including two dentary fragments and one post-cranial fragment. Unfortunately, none of the elements identified is useful as indicators of specific crocodile species present. Two species of crocodile occupy Belize, the smaller Morelet’s crocodile (*Crocodylus moreletii*) and the larger saltwater American crocodile (*Crocodylus acutus*). It is possible that several of the unidentified reptilian bones could also be crocodilian. One large unidentified snake vertebra was also identified.

Mammals (n = 44) include manatee (*Trichechus manatus*), rodent species (probably agouti or paca), white-tailed deer as well as unidentified deer species, peccary, and canid (fox, dog, or coyote). Several bones could only be identified as artiodactyl and represent either deer or peccary species. The West Indian manatee is represented by only one identified specimen, a worked fragmented long bone, possibly from a juvenile animal. Worked or carved manatee bone have been found at many sites including Altun Ha (Pendergast 1979:50, fig. 12a; Pendergast 1979:138, fig. 46b), Moho Caye (McKillop 1985:342-343, fig. 2-4), Colha (Scott 1980:324, fig. 1g), and Seibal (Willey 1978:169-170, fig. 170). Manatee was also a food source for the Maya (see McKillop 1985 for a general discussion on manatee utilization), especially for those communities at or close to coastal waters such as Moho Caye (McKillop1984) and Kakalche and Watson’s Island in southern Belize (Graham 1994:255) to name but a few sites. The white-tailed deer and peccary remains probably also represent food refuse, as do the unidentified mammal bones. A few of the mammal fragments show signs of heat alteration in the form of charring.

Bird specimens include unidentified long bone fragments of small to medium sized species.
Table 27.12 List of Oshon Site Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td>Unidentified marine shell</td>
<td>2</td>
</tr>
<tr>
<td><em>Strombus</em> sp.</td>
<td>2</td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>7</td>
</tr>
<tr>
<td>Family Melongenidae</td>
<td>1</td>
</tr>
<tr>
<td><strong>Vertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Osteichthyes</td>
<td></td>
</tr>
<tr>
<td>Family Scaridae</td>
<td>23</td>
</tr>
<tr>
<td>Unidentified fish</td>
<td>163</td>
</tr>
<tr>
<td>Family Carangidae</td>
<td>4</td>
</tr>
<tr>
<td><strong>Class Reptilia</strong></td>
<td></td>
</tr>
<tr>
<td>Order Testudines</td>
<td>19</td>
</tr>
<tr>
<td><em>Staurotypus triporcatus</em></td>
<td>4</td>
</tr>
<tr>
<td><em>Crocodylus</em> sp.</td>
<td>3</td>
</tr>
<tr>
<td>Unidentified reptile</td>
<td>7</td>
</tr>
<tr>
<td>Order Serpentes</td>
<td>1</td>
</tr>
<tr>
<td><em>Trachemys scripta</em></td>
<td>1</td>
</tr>
<tr>
<td><strong>Class Mammalia</strong></td>
<td></td>
</tr>
<tr>
<td>Unidentified mammal</td>
<td>26</td>
</tr>
<tr>
<td><em>Trichechus manatus</em></td>
<td>1</td>
</tr>
<tr>
<td>Order Rodentia</td>
<td>1</td>
</tr>
<tr>
<td><em>Odocolleus virginianus</em></td>
<td>5</td>
</tr>
<tr>
<td>Order Artiodactyla</td>
<td>8</td>
</tr>
<tr>
<td>Family Cervidae</td>
<td>1</td>
</tr>
<tr>
<td>Family Canidae</td>
<td>1</td>
</tr>
<tr>
<td>Family Tayassuidae</td>
<td>1</td>
</tr>
<tr>
<td><strong>Class Aves</strong></td>
<td></td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>5</td>
</tr>
<tr>
<td><strong>Class Unknown</strong></td>
<td></td>
</tr>
<tr>
<td>Unidentified bone</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>301</td>
</tr>
</tbody>
</table>

**Operation 17 Summary**

A total of 20 remains were presented for analysis. Fish is represented by a parrotfish skull element. Another 5 fish vertebrae and one skull bone could not be identified to lower taxon. Reptilian bones include carapace fragments of a giant Mexican musk turtle and an unidentified small turtle. Mammals identified include manatee and rodent. The manatee bone is a worked long bone fragment, possibly of a juvenile animal. Rodent is represented by a complete molar of an agouti or paca. Two marine shell columella fragments account for the invertebrate sample and a total of 7 bones could not be identified to zoological class.
**Operation 18 Summary**

Only 2 unidentified fish vertebrae were presented for analysis.

**Operation 19 Summary**

A total of 66 vertebrate specimens were analyzed. Fish (n = 39) include 10 specimens identified as jack and parrotfish skull elements. The remaining unidentified fish bones include cranial and post-cranial elements. Charring is evident on one vertebra. Mammal (n =13) species represented include two white-tailed deer molars (2 individuals), and 6 bone fragments identified only as artiodactyl. These may all represent fragments of a peccary or deer metapodial and phalanx. Additional unidentified long bone and skull fragments are from a medium to large sized mammal. The unidentified skull fragment could be from a tapir based on size. Reptiles (n = 11) include one metatarsal of a crocodilian species, 8 turtle shell fragments, and one unidentifiable element. The turtle shell fragments include 5 calcined elements; all fragments suggest a small to medium sized turtle species. Two long bone shaft fragments could not be identified to zoological class with any certainty, although they do resemble crocodilian bone in texture.

**Operation 20 Summary**

A total of 2 invertebrate and 24 vertebrate specimens were analyzed. Mammal bone (n = 13) includes one deer metapodial fragment (size suggests brocket deer), one canid (probably dog) metatarsal and several unidentified long bone fragments of medium to large sized animals. None of the 6 fish bones have been identified but all are of a large species. Reptiles (n = 4) include one large snake vertebra, two turtle shell fragments, and one cranial element of an unidentified reptile. Conch shell fragments account for the invertebrate sample. Both specimens most resemble fighting conch (S. pugilis) and exhibit signs of exfoliation of the outer layers, possibly due to heat exposure.

**Operation 21 Summary**

A total of 185 specimens, mainly of fish, were examined. Fish account for 136 specimens and include parrotfish and jack fish elements. Many of the unidentifiable fish vertebrae and other elements are of large species and could be jack or parrotfish as well as other marine fishes. Reptile (n = 17) includes crocodile (Crocodylus sp.), giant Mexican musk turtle, and bokatura (Trachemys scripta) specimens. Crocodile includes 2 fragments of dentary bone. Turtle remains are all shell fragments, except for one long bone, of small to medium sized species. Three specimens could only be identified as reptilian, and 2 of these may be crocodilian fragments. Mammal (n = 16) bones include 3 white-tailed deer elements, two of which are charred, one peccary metapodial, and 12 unidentified mammal bones. Of these, 2 long bone fragments show signs of grooving and polishing associated with bead or tube manufacturing. These are from a large sized animal and could be deer. Of the remaining unidentified mammal bones, 2 are of a small to medium sized animal and could be opossum long bones, one is a phalanx of either a paca or agouti, and several long bone fragments are of medium to large sized animals. Bird includes 5 fragments, all of which are long bone pieces of either a small or medium sized bird. Invertebrates include 7 apple snails.
**Operation 23 Summary**

Only one specimen, an unidentified reptilian vertebra, was examined.

**Oshon Site Surface Collection Summary**

Only one specimen was analyzed and is a whelk of the Family Melongenidae. The specimen most closely resembles a lightning or turnip whelk.

**Pechtun Ha**

A total of at least 1,078 faunal remains were recovered from 4 operations (Table 27.13). Of these, 75 (7.1%) are invertebrates and 1,003 (92.9%) are vertebrate specimens (Table 27.14). Table 27.13 below shows the distribution of faunal remains by Operation. The majority of the sample comes from the Op. 12 excavations but the number is exaggerated due to heavy fragmentation of tapir and peccary skull elements.

*Account of Invertebrates*

All invertebrates recovered from Pechtun Ha are gastropods and include land snails, freshwater, and marine shell. Freshwater snails present include *jute* (*Pachychilus* spp.) and apple snails, both of which were consumed as food sources. One unidentified marine shell fragment was also present.

*Account of Vertebrates*

Mammals dominate the vertebrate sample although their specimen numbers are exaggerated by the presence of highly fragmented skull and long bone elements of only a few large game individuals. Although the analysis of the Pechtun Ha fauna is incomplete, to date there are at least 161 specimens attributable to peccary and a further 248 specimens identified as tapir bone. Almost all of the tapir and peccary bones are from Operation 12 and include primarily skull and teeth fragments of only a few individuals. A further 513 bone fragments could not be identified to specific mammalian species due to their highly fragmented condition, but, it is likely that many of these are those of tapir and/or peccary. A minimum of 4 peccaries and 2 tapirs are present among the 400+ bones. Many of these bones are charred and/or calcined and a few have cut marks, both indicators of butchering and preparation of the animals as food sources. Other mammals present in the Pechtun Ha assemblage are white-tailed deer, nine-banded armadillo, and domestic dog. Many bones could only be identified as deer or artiodactyl. These were undoubtedly food sources as well for the Pechtun Ha Maya. One rodent incisor, possibly from agouti, paca, or perhaps pocket gopher, was also present.

Reptiles recovered include snake, iguana (Family Iguanidae), and turtle including the large freshwater *hickey*. Several reptilian remains could not be identified to species while several turtle shell pieces were too fragmented to identify to species. The several snake vertebrae recovered may represent a natural death. The turtles were probably consumed by the site inhabitants.
Fish (n = 14) include both jack and parrotfish remains. Bird is represented by only one unidentified long bone specimen.

Table 27.13 Distribution of Pechtun Ha Faunal Sample by Operation.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Invertebrates</th>
<th>Vertebrates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. 6</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Op. 8</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Op. 9</td>
<td>1</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Op. 10</td>
<td>40</td>
<td>41</td>
<td>81</td>
</tr>
<tr>
<td>Op. 11</td>
<td>34</td>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>Op. 12</td>
<td>-</td>
<td>943</td>
<td>943</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>1,003</td>
<td>1,078</td>
</tr>
</tbody>
</table>

Table 27.14 List of Pechtun Ha Fauna.

Invertebrates

- **Class Gastropoda**
  - Unidentified land snail: 37
  - *Pachychilus* sp.: 5
  - *Pachychilus indiorum*: 22
  - *Euglandina* sp.: 8
  - Unidentified marine shell: 1
  - *Pomacea flagellata*: 1
  - *Orthalicus* sp.: 1

Vertebrates

- **Class Mammalia**
  - Family Tayassuidae: 161
  - Family Cervidae: 3
  - *Tapirus bairdii*: 248
  - Unidentified mammal: 513
  - Order Rodentia: 1
  - *Odocoileus virginianus*: 7
  - Order Artiodacytla: 2
  - *Dasypus novemcinctus*: 1
  - *Canis familiaris*: 1

- **Class Reptilia**
  - *Dermatemys mawii*: 5
  - Order Testudines: 17
  - Unidentified reptile: 8
  - Order Serpentes: 11
  - Family Iguanidae: 1

- **Class Aves**
  - Unidentified bird: 1

- **Class Unknown**
Table 27.14 continued from previous page

<table>
<thead>
<tr>
<th>Unidentified bone</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Osteichthyes</td>
<td></td>
</tr>
<tr>
<td>Family Carangidae</td>
<td>7</td>
</tr>
<tr>
<td>Unidentified fish</td>
<td>4</td>
</tr>
<tr>
<td>Family Scaridae</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,078</strong></td>
</tr>
</tbody>
</table>

**Operation 6 Summary**

Only one specimen, a peccary tooth fragment, was recovered. Only the crown portion of the tooth survives and it exhibits cracking due to heat exposure.

**Operation 8 Summary**

Both of the bones from this operation are identified as deer long bone fragments and should be identifiable to either brocket or white-tailed with proper reference collections.

**Operation 9 Summary**

A total of 13 specimens were analyzed and include one unidentified land snail, 8 reptile, 2 mammal, and 2 unidentifiable bones. Reptile is represented by turtle shell fragments, including *hickety*. These are badly calcined and exfoliated due to prolonged heat exposure. One pelvic portion of an iguana species (Family Iguanidae) is present, as are unidentified turtle shell fragments. Two mammalian long bone shaft fragments of medium to large sized animals are present. One of these appears to be charred. Two long bone fragments could not be identified to zoological class.

**Operation 10 Summary**

A total of 81 remains were analyzed. The majority are invertebrate remains consisting of a large number of unidentified land snails and several freshwater *jute* snails. One unidentified marine shell was also present. A total of 21 mammal remains were examined including 5 identified as peccary. All of these are either mandibular bone fragments or portions of teeth and may come from one mandible. Of the unidentified mammal bone, several skull fragments could also be part of the peccary mandible. All of the reptilian remains from this operation are vertebrae, 11 from a large sized snake and a further 6 that could not be identified but are from a medium sized reptile. Fish remains include a jack fish skull fragment and one unidentified small to medium sized fish skull fragment.

**Operation 11 Summary**

Of the 38 specimens from Operation 11, all but 4 are invertebrates including apple snail, *jute*, and several land snail species. One turtle carapace fragment and three mammalian specimens, including 1 large rodent incisor and 2 unidentified skull fragments, account for the vertebrates. It is possible that the rodent incisor is from an agouti or paca but may also be from the Hispid pocket gopher. This
could be an intrusive element in the sample. The two unidentified skull elements are from a medium sized animal such as a peccary but a proper reference collection is needed to provide a more specific identification.

**Operation 12 Summary**

All of the 943 specimens examined are vertebrate remains. Mammal accounts for 908 or 96.3% of the Operation 12 assemblage. White-tailed deer, deer species, artiodactyl, armadillo, and dog are represented. But by far the greatest numbers are accounted by peccary and tapir skull and dental fragments. At least 4 peccary are present and 2 tapir. It is likely that both species of peccary, the collared and white-lipped, are represented among the 155 specimens. Many of the tapir and peccary cranial elements are charred or calcined perhaps suggesting ritual burning of the animal heads. White-tailed deer and remains only identified as members of the deer family or artiodactyl order, include mainly post-cranial long bone fragments indicating access to fairly good meat cuts. Of the over 500 unidentified mammalian specimens, many are thought to be highly fragmented peccary and/or tapir skull and possibly long bone elements. Deer is also undoubtedly represented among them. Several bones show signs of both butchering (e.g., spiral fracturing) and cooking (charring and/or calcination). Jack and parrotfish are identified among the fish sample. Reptiles include turtle shell fragments and one bone of a member of the iguanid family. Only one bird bone is present, an unidentified long bone of a small to medium sized species.

**The Xibun Valley Cave Fauna**

A total of 1,189 faunal remains recovered from seven caves, are reported on below (Table 27.15). Of these, 824 (69.3%) are invertebrates and 365 (30.7%) are vertebrate specimens (Table 27.16). Fauna was recovered from Actun Ik, Actun Chanona, Ek ‘Waynal, Actun Ibach, Glenwood Cave, Actun Yax Tun, and Usrey Cave.

<table>
<thead>
<tr>
<th>Cave</th>
<th>Invertebrates</th>
<th>Vertebrates</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usrey Cave</td>
<td>47</td>
<td>-</td>
<td>47</td>
</tr>
<tr>
<td>Actun Ik</td>
<td>233</td>
<td>66</td>
<td>299</td>
</tr>
<tr>
<td>Actun Ibach</td>
<td>17</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td>Glenwood Cave</td>
<td>112</td>
<td>-</td>
<td>112</td>
</tr>
<tr>
<td>Actun Yax Tun</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Ek ‘Waynal</td>
<td>212</td>
<td>53</td>
<td>265</td>
</tr>
<tr>
<td>Actun Chanona</td>
<td>202</td>
<td>222</td>
<td>424</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>824</strong></td>
<td><strong>365</strong></td>
<td><strong>1,189</strong></td>
</tr>
</tbody>
</table>

In contrast to the surface site fauna, those of the caves are predominantly invertebrate species and include several hundred freshwater jute snails. At least 2 species, *P. indiorum* and *P. glaphyrus* have been identified to date. Almost all exhibit broken spires, which is assumed to be an indicator of food use by the Maya (see Healy et al. 1990). Complete specimens of *jute*, when found in cave contexts, are assumed to be indicators of ceremonial offerings (Pendergast 1969:58). However, almost all of the snails were broken suggesting food use. Other freshwater snails identified include several apple snails. A large number of land snails, mostly unidentified, were also collected and presented for analysis. The land snails are considered modern intrusive elements. Both the *jute* and apple snails would have served as a food source. Two
specimens of conch shell were also collected. Humans undoubtedly brought these into the cave. Bivalves are also present and can be considered to be a food source. Crab claws were also found but may be modern inhabitants of the caves.

Mammals account for the majority of the vertebrate assemblage and include bat, rat or mouse, brocket and white-tailed deer, armadillo, paca, peccary, and large cat species. Several specimens could only be identifed as deer family or as artiodactyl bones (deer or peccary). The bat and rodent bones, including the paca specimens, are considered to represent natural deaths. This may also be true of the large cat bone (either jaguar or puma), although there is the possibility that this may have been placed in the cave as a ritual offering. The deer, peccary, and armadillo may all represent food refuse although this interpretation is tentative and awaits a complete taphonomic analysis of the assemblage.

Table 27.16 List of Cave Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td>Unidentified land snails</td>
<td>100</td>
</tr>
<tr>
<td><em>Pachychilus</em> sp.</td>
<td>17</td>
</tr>
<tr>
<td><em>Pachychilus</em> indiorum</td>
<td>592</td>
</tr>
<tr>
<td><em>Pomacea</em> flagellata</td>
<td>67</td>
</tr>
<tr>
<td><em>Pachychilus</em> glaphyrus</td>
<td>6</td>
</tr>
<tr>
<td><em>Orthalicus</em> sp.</td>
<td>10</td>
</tr>
<tr>
<td><em>Strombus</em> sp.</td>
<td>2</td>
</tr>
<tr>
<td><em>Euglandina</em> sp.</td>
<td>7</td>
</tr>
<tr>
<td>Class Crustacea</td>
<td></td>
</tr>
<tr>
<td>Unidentified crab</td>
<td>5</td>
</tr>
<tr>
<td>Class Pelecypoda</td>
<td></td>
</tr>
<tr>
<td><em>Nephronaias</em> sp.</td>
<td>18</td>
</tr>
<tr>
<td><strong>Vertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Unknown</td>
<td></td>
</tr>
<tr>
<td>Unidentified bone</td>
<td>70</td>
</tr>
<tr>
<td>Class Osteichthyes</td>
<td></td>
</tr>
<tr>
<td>Unidentified fish</td>
<td>3</td>
</tr>
<tr>
<td>Class Reptilia</td>
<td></td>
</tr>
<tr>
<td>Order Lacertilia</td>
<td>1</td>
</tr>
<tr>
<td><em>Kinosternon</em> sp.</td>
<td>5</td>
</tr>
<tr>
<td><em>Trachemys scripta</em></td>
<td>7</td>
</tr>
<tr>
<td>Order Testudines</td>
<td>19</td>
</tr>
<tr>
<td>Unidentified reptile</td>
<td>2</td>
</tr>
<tr>
<td>Order Serpentes</td>
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</tr>
<tr>
<td>Class Mammalia</td>
<td></td>
</tr>
<tr>
<td>Order Chiroptera</td>
<td>14</td>
</tr>
<tr>
<td>Family Muridae</td>
<td>4</td>
</tr>
<tr>
<td><em>Mazama</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td><em>Dasypus novemcinctus</em></td>
<td>2</td>
</tr>
<tr>
<td>Unidentified mammal</td>
<td>201</td>
</tr>
</tbody>
</table>
Table 27.16 continued from previous page

<table>
<thead>
<tr>
<th>Family/Cerebroide</th>
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</tr>
</thead>
<tbody>
<tr>
<td><em>Odocoileus virginianus</em></td>
<td>12</td>
</tr>
<tr>
<td>Order Artiodactyla</td>
<td>3</td>
</tr>
<tr>
<td>Family Felidae</td>
<td>1</td>
</tr>
<tr>
<td>Order Rodentia</td>
<td>8</td>
</tr>
<tr>
<td><em>Agouti paca</em></td>
<td>2</td>
</tr>
<tr>
<td>Family Tayassuidae</td>
<td>1</td>
</tr>
<tr>
<td>Class Aves</td>
<td>7</td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,189</strong></td>
</tr>
</tbody>
</table>

Actun Ik Cave

A total of 299 specimens, including 233 invertebrates and 66 vertebrates were examined (Table 27.17). At least 8 invertebrate taxa are identified including freshwater snail and bivalves, land snails, and marine shell. Vertebrates are represented by at least 10 separate taxa including reptilian, mammal, and bird species.

Account of Invertebrates

Of the 233 invertebrates examine, the majority (n = 181 or 77.7%) are jute snails. Most of these are the smooth shelled *P. indiorum* while the remaining specimens are identified as *P. glaphyrus* or simply to genus (*Pachyphilus*). All show signs of intentional breakage of the spire associated with the extraction of the snail meat indicating food use. The apple snail accounts for 35 specimens and this too would have been procured from nearby freshwater systems and brought into the cave as a food source. Land snails account for 12 specimens, and at least two species are represented but none are considered to be food refuse. Two unidentified crab claw elements (Order Brachyura) and 2 freshwater clam valves were also present. The crab elements resemble land crabs (possibly *Cardiosoma* sp.), however, no adequate reference material was present to secure identification below the zoological order Brachyura. Marine shell includes one conch (*Strombus* sp.) octagonally shaped pendant.

Account of Vertebrates

Reptiles (n = 18) remains include mud turtle (*Kinosternon* sp.), slider or bokatura (*Trachemys scripta*), lizard (Order Lacertilia), and snake (Order Serpentes). Several specimens are only identified as reptile or turtle. All turtle fragments are of either carapace or plastron elements. At least two mud turtles are present. The unidentified reptile specimen is a coracoid or scapula fragment, possibly from a turtle. Snake is represented by one vertebra. Lizard, possibly gecko, is represented by one jaw fragment. Apart from the turtles, the remaining reptile species identified probably do not represent food sources. The snake and lizard remains could be natural deaths within the cave. The turtles themselves may also be the product of either human consumption or the remains of a natural predator’s meal.

A total of 46 specimens are identified as mammal and include rat or mouse (2), brocket deer (1), nine-banded armadillo (1), unidentified deer (1), white-tailed deer (1), large cat (1), artiodactyl (1), and
unidentified mammal bone (38). The two rat or mouse bones include one tooth and one mandible fragment. These are not considered to be cultural deposits. Armadillo is represented by one femur fragment. Although armadillo is a common food source for the Maya, the presence of the armadillo may be either culturally related or a natural death. The large cat is either a puma or jaguar and is represented by one tibia shaft portion. The presence of the cat is also difficult to assess and could represent a natural death or ceremonial inclusion. Cats, as well as most carnivores, were not a favourite food source for the Maya by any means.

Artiodactyl (deer or peccary) is represented by one long bone fragment of a juvenile individual. Cut marks are present at one end of the shaft fragment and incision lines suggest that this bone may be discard from bead or tube manufacturing. The size of the fragments suggests that this is probably from a young white-tailed deer. The two positively identified deer specimens include one immature white-tailed deer ulna portion and a distal phalanx of either a white-tailed or brocket deer. One phalanx of a brocket deer was also identified. Although most likely to be from a red brocket (*Mazama americana*), without a proper reference skeleton it is extremely difficult to distinguish post-cranial elements between brocket species. Today only the red brocket occupies Belize.

Unidentified mammal bones include 38 specimens representing small to large animal species. Most of these are medium to large sized animals and many of the specimens exhibit signs of butchering or trampling, and heat exposure. The majority are long bone pieces that may be deer. Many of these exhibit spiral fractures, flake scars, and one has what appear to be carnivore tooth marks. Charring is also present on some of the fragments. There is also what appears to be a tibia shaft portion of a large cat, either jaguar or puma. One orbital fragment of a large mammal has a cut mark. Large mammal rib shaft fragments are also present. A small sized carnivore also appears to be present, possibly gray fox.

The presence of several mammalian long bone fragments exhibiting flake scars, spiral fractures, charring, cut marks, and bone flakes would suggest that these represent animals that were brought to the caves and butchered by humans. This is almost certainly true of those pieces with cut marks and charring. However, spiral fractures and flake scars by themselves do not indicate the agent responsible for fracturing. Spiral fractures can result from trampling of bone, carcasses falling some distance or being thrown for some distance, and non-human agents such as carnivores intentionally breaking bone for marrow extraction (Lyman 1994: 317). Spiral fracturing was traditionally taken as evidence for the breakage of ‘green’ or fresh bone immediately following a kill. However, it is now known that this type of fracturing can occur on dry and somewhat mineralized bone (Lyman 1994: 326).

Carnivore breakage of bone also produces spiral fractures. However, carnivore fracturing of bone differs from humans in a few respects. First, carnivores generally apply static loading while humans will use dynamic loading, i.e., direct percussion and point loading (see Lyman 1994: 326). These two mechanisms for impact leave different imprints on fractured bone. Carnivores will usually first remove the epiphyses of a long bone by gnawing and chewing. This will weaken the shaft of the bone and continued breakage by chewing on the shaft will result in rectilinear splinters. Gnawing marks such as furrows and punctures will also be evident (Lyman 1994: 325). However, carnivores may also simply apply pressure directly to a long bone shaft until it breaks. This can leave fracture patterns such spiral fractures. In most cases though, such bone breakage will also result in scoring and pitting of the shaft from the animal’s dentition. Only one bone examined thus far has any evidence of teeth marks.
Although the taphonomic analysis of the cave fauna is far from complete, it does appear at this point that breakage of the medium to large sized mammalian long bones appears to be the result of human agents. However, until a full analysis is undertaken examining all variables related to bone breakage and accumulation, this interpretation is tentative.

Bird remains include only two elements, but both are complete and considered identifiable with proper reference material. The first is a complete humerus very similar in shape to that of a motmot (*Momotus* sp.). The second is a coracoid of a medium to large size bird. However, this appears to be a recent introduction into the cave.

**Table 27.17 List of Actun Ik Fauna.**

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td>Unidentified land snails</td>
<td>9</td>
</tr>
<tr>
<td><em>Pachychilus</em> sp.</td>
<td>10</td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>166</td>
</tr>
<tr>
<td><em>Strombus</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>35</td>
</tr>
<tr>
<td><em>Pachychilus glaphyrus</em></td>
<td>5</td>
</tr>
<tr>
<td><em>Orthalicus</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td><em>Euglandina</em> sp.</td>
<td>2</td>
</tr>
<tr>
<td>Class Crustacea</td>
<td></td>
</tr>
<tr>
<td>Unidentified crab</td>
<td>2</td>
</tr>
<tr>
<td>Class Pelecypoda</td>
<td></td>
</tr>
<tr>
<td><em>Nephronaias</em> sp.</td>
<td>2</td>
</tr>
<tr>
<td><strong>Vertebrates</strong></td>
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</tr>
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<td>Class Reptilia</td>
<td></td>
</tr>
<tr>
<td>Order Lacertilia</td>
<td>1</td>
</tr>
<tr>
<td><em>Kinosternon</em> sp.</td>
<td>5</td>
</tr>
<tr>
<td><em>Trachemys scripta</em></td>
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</tr>
<tr>
<td>Order Testudines</td>
<td>4</td>
</tr>
<tr>
<td>Unidentified reptile</td>
<td>1</td>
</tr>
<tr>
<td>Order Serpentes</td>
<td>1</td>
</tr>
<tr>
<td>Class Mammalia</td>
<td></td>
</tr>
<tr>
<td>Family Muridae</td>
<td>2</td>
</tr>
<tr>
<td><em>Mazama</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td><em>Dasypus novemcinctus</em></td>
<td>1</td>
</tr>
<tr>
<td>Unidentified mammal</td>
<td>38</td>
</tr>
<tr>
<td>Family Cervidae</td>
<td>1</td>
</tr>
<tr>
<td><em>Odocoileus virginianus</em></td>
<td>1</td>
</tr>
<tr>
<td>Order Artiodactyla</td>
<td>1</td>
</tr>
<tr>
<td>Family Felidae</td>
<td>1</td>
</tr>
<tr>
<td>Class Aves</td>
<td></td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>299</td>
</tr>
</tbody>
</table>
Actun Chanona Cave

A total of 424 specimens were examined: 202 invertebrates and 222 vertebrates (Table 27.18). All invertebrates are snails, and except for 4 specimens, all are jute shells.

**Account of Vertebrates**

The vertebrate assemblage is dominated by mammals (n = 164) and includes rodent, bat, white-tailed deer, unidentified deer, and a large number of unidentified mammal species. The rodent and bat bones are not considered cultural features of the assemblage. White-tailed deer bones include 11 specimens, most exhibiting signs of butchering and cooking. Some, however, have heavy mineral deposits on them and show signs of step fracturing perhaps suggesting recent breakage due to trampling. The heavily mineralized state of the bone would facilitate such a fracturing pattern. It is unclear if humans or other predators brought this deer specimen into the cave. Unlike the Actun Ik mammalian fauna, the majority of the unidentified Actun Chanona mammals do not show signs of butchering. However, many are so fragmented that such signs may be obscured. A closer analysis of this material remains to be completed. Most of these highly fragmented pieces appear to be long bones of medium to large sized animals.

A total of 3 fish bones were identified as belonging to a small species. These were undoubtedly brought into the cave but their appearance suggests that they are recent cave inductees and may represent the leftovers of a bat or bird’s meal.

Bird is represented by 2 bones of a small, probably, passerine species. These are not considered cultural inclusions.

Table 27.18 List of Actun Chanona Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>197</td>
</tr>
<tr>
<td>Unidentified land snail</td>
<td>3</td>
</tr>
<tr>
<td><em>Pachychilus sp.</em></td>
<td>1</td>
</tr>
<tr>
<td>Class Crustacea</td>
<td></td>
</tr>
<tr>
<td>Unidentified crab</td>
<td>1</td>
</tr>
<tr>
<td><strong>Vertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Mammalia</td>
<td></td>
</tr>
<tr>
<td>Order Rodentia</td>
<td>3</td>
</tr>
<tr>
<td>Unidentified mammal</td>
<td>135</td>
</tr>
<tr>
<td>Order Chiroptera</td>
<td>13</td>
</tr>
<tr>
<td><em>Odocoileus virginianus</em></td>
<td>11</td>
</tr>
<tr>
<td>Order Artiodactyla</td>
<td>2</td>
</tr>
<tr>
<td>Class Unknown</td>
<td></td>
</tr>
<tr>
<td>Unidentified bone</td>
<td>53</td>
</tr>
<tr>
<td>Class Osteichthyes</td>
<td></td>
</tr>
<tr>
<td>Unidentified fish</td>
<td>3</td>
</tr>
<tr>
<td>Class Aves</td>
<td></td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>424</strong></td>
</tr>
</tbody>
</table>
Ek ‘Waynal Cave

A total of 265 bone and shell remains were examined (Table 27.19). Of these, 212 are invertebrates representing at least 7 taxa of freshwater, marine, and land snails and bivalves. At least 7 taxa, including mammalian, reptilian, and avian species, are represented among the 53 vertebrate specimens.

Account of Invertebrates

The invertebrate sample distribution is similar to both the Actun Ik and Actun Chanona samples. Jute accounts for the majority of snails, and at least one variety (P. indiorum) is present. Apples snails are also present in the sample. At least 3 species of land snails are accounted for, none of which represent a food source. Two probable land crab claw fragments were also examined. These too are considered natural occurrences in the cave context. A total of 12 freshwater clam valve and valve fragments were also present. The jute, apple snail, and clam specimens probably all represent domestic food refuse.

Account of Vertebrates

Vertebrates identified include 21 mammal, 15 reptile, 2 bird, and 14 bone fragments. Mammals are represented by peccary (1), rodent (5), bat (1), armadillo (1), and several fragments of small, medium, and large sized animals. Of the above species, the rat and bat bones are considered natural deposits. Peccary is represented by one lower canine fragment and armadillo by a vertebra. Both of these could represent food refuse. None of the unidentified mammal bone specimens show any signs of butchering or other signatures of food production and consumption.

Reptile bones are all turtle shell fragments. Slider or bokatura is positively identified and the rest of the shell fragments belong to a small turtle, possibly a mud turtle. The bird bones are not identified but belong to a vulture-sized species.

Table 27.19 List of Ek ‘Waynal Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Crustacea</td>
<td></td>
</tr>
<tr>
<td>Unidentified crab</td>
<td>2</td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>28</td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>113</td>
</tr>
<tr>
<td>Unidentified land snail</td>
<td>44</td>
</tr>
<tr>
<td><em>Orthalicus</em> sp.</td>
<td>5</td>
</tr>
<tr>
<td><em>Euglandina</em> sp.</td>
<td>5</td>
</tr>
<tr>
<td><em>Strombus</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td><em>Pachychilus</em> sp.</td>
<td>2</td>
</tr>
<tr>
<td>Class Pelecypoda</td>
<td></td>
</tr>
<tr>
<td><em>Nephronaias</em> sp.</td>
<td>12</td>
</tr>
</tbody>
</table>
Table 27.19 continued from previous page

Vertebrates

Class Mammalia
   Family Tayassuidae  1
   Order Rodentia  4
   Family Muridae  1
   Order Chiroptera  1
   *Dasypus novemcinctus*  1
   Unidentified mammal  13

Class Reptilia
   Order Testudines  15
   *Trachemys scripta*  1

Class Aves
   Unidentified bird  2

Class Unknown
   Unidentified bone  14

Total  265

Actun Ibach Cave

Only 41 remains were presented for analysis (Table 27.20). Invertebrates (n = 17) include *jute*, land snails, freshwater clam, and apple snail specimens. Vertebrates (n = 24) include mammal, reptile, and bird species. Mammal species identified include paca, and bones of rat or other small to medium sized rodents. Several specimens could not be identified below the class level. Of these 15 fragments all but two could be fragmented paca bones. Two are vertebra fragments of a medium sized mammal. The coloration of the small mammal bones suggests that they are recent and natural introductions to the cave. One unidentified large bird humerus and one unidentified reptile bone fragment were also present. The bird bone appears to be recent and non-cultural.

Table 27.20 List of Actun Ibach Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td><em>Pachychilus glaphyrus</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Pachychilus sp.</em></td>
<td>2</td>
</tr>
<tr>
<td>Unidentified land snail</td>
<td>5</td>
</tr>
<tr>
<td><em>Orthalicus sp.</em></td>
<td>4</td>
</tr>
<tr>
<td>Class Pelecypoda</td>
<td></td>
</tr>
<tr>
<td><em>Nephroniais sp.</em></td>
<td>1</td>
</tr>
<tr>
<td>Vertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Mammalia</td>
<td></td>
</tr>
</tbody>
</table>
Table 27.20 continued from previous page

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unidentified mammal</td>
<td>15</td>
</tr>
<tr>
<td><em>Agouti paca</em></td>
<td>2</td>
</tr>
<tr>
<td>Family Muridae</td>
<td>1</td>
</tr>
<tr>
<td>Order Rodentia</td>
<td>1</td>
</tr>
<tr>
<td>Class Reptilia</td>
<td></td>
</tr>
<tr>
<td>Unidentified reptile</td>
<td>1</td>
</tr>
<tr>
<td>Class Aves</td>
<td></td>
</tr>
<tr>
<td>Unidentified bird</td>
<td>1</td>
</tr>
<tr>
<td>Class Unknown</td>
<td></td>
</tr>
<tr>
<td>Unidentified bone</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

Actun Yax Tun Cave

Only one specimen, a *jute* snail was presented for analysis (Table 27.21).

Table 27.21 List of Actun Yax Tun Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td><em>Pachychilus</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

Usrey Cave

All 47 remains analyzed are invertebrate species and include *jute*, apple snail, freshwater clam, and unidentified land snails (Table 27.22).

Table 27.22 List of Usrey Cave Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invertebrates</td>
<td></td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td>Unidentified land snail</td>
<td>38</td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>5</td>
</tr>
<tr>
<td>Class Pelecypoda</td>
<td></td>
</tr>
<tr>
<td><em>Nephronaias</em> sp.</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47</strong></td>
</tr>
</tbody>
</table>
Glenwood Cave

As with Usrey Cave, all of the material from Glenwood is invertebrate (Table 27.23). Jute snails dominate the sample of 112 and account for 97.3% of the sample. Apple snail and one unidentified land snail are also present.

Table 27.23 List of Glenwood Cave Fauna.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Gastropoda</td>
<td></td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>1</td>
</tr>
<tr>
<td>Unidentified land snail</td>
<td>1</td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>109</td>
</tr>
<tr>
<td><em>Pachychilus</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>112</strong></td>
</tr>
</tbody>
</table>

Summary and Conclusions

Although the analysis of the Xibun faunal assemblages is incomplete, a few preliminary observations are offered. Analysis of the surface site faunas indicates procurement of locally available species. Assuming this, the species identified so far suggest similarity between present and past environments in the Xibun area. Furthermore, the presence of large game species among the identified fauna and, what appear to be mainly medium to large sized species among the unidentified mammalian bones, may indicate fairly consistent access to such species.

Invertebrate utilization among the surface sites is similar for Hershey and Pechtun Ha, and to a lesser degree Pakal Na, both in terms of quantity and types of species procured with a focus on freshwater shell meat. Shellfish remains are few at the Oshon site. However, the fairly large numbers of fish bones from the Oshon site and Pakal Na, may explain the relatively low percentages of shellfish at both sites.

Vertebrate utilization among the surface sites indicates access to a high diversity of game with mammalian, reptilian, and avian species present. Except for the Hershey site, vertebrate remains dominate the assemblage. At Pechtun Ha, the high numbers of large mammals represented may indicate a focus on large game species. But, as mentioned earlier, the highly fragmentary condition of mainly skull elements of what appear to be only a few representatives of peccary and tapir, may in fact be introducing a bias into the sample and disproportionately indicating a focus on large mammals. Moreover, the high number of tapir and peccary skull elements may also represent ritual use of these animals. However, until the analysis of all of the unidentified long bone fragments is complete, this too could be a bias in the sample. Although the data are not included here, preliminary analysis of body portion representation among the mammalian specimens from the Oshon site and Pakal Na, appear to indicate that fairly good cuts of meat were available for consumption. Deer species, peccary and tapir appear to be favoured among mammals and would have provided large amounts of meat.
Fish numbers are particularly high in the Oshon site assemblage and to a lesser degree at Pakal Na. Marine fishes account for the majority of those present at the Oshon site and, to date, jack fish and parrotfish species have been identified. These fish are also present at Pakal Na and Pechtun Ha. All parts of the fish are present indicating that whole fishes were brought to the sites and processed there. The high numbers of Caribbean fish at these sites, and particularly at the Oshon site, may simply be a reflection of their proximity to coastal waters. This is particularly true of the parrotfish. These fish would have to be procured in reef waters and this indicates the presence of reef fishing technology. The presence of jack fish, a peripheral fish, does not necessarily imply coastal fishing since these fish are known to travel in schools (particularly among the young) into brackish areas of the Xibun and other major rivers in Belize.

In contrast to the surface sites, invertebrates dominate the cave faunal assemblages, particularly with the presence of large numbers of jute specimens. The snails would have been collected from the Xibun River and brought into the caves by the Maya. The fact that the overwhelming amount of jute had broken spires suggests that they represent food refuse. Whether or not they are domestic refuse or consumed as part of some ritual event within the cave and then discarded, is unknown. The remains of jute in caves have been interpreted as representing offerings, particularly where the shells were found complete (Pendergast 1969: 58).

The cave reconnaissance vertebrate assemblage is similar to those found in other caves in Belize (see Luther in Pendergast 1974:62-80 and Savage in Pendergast 1971:78-111). The assemblage consists of both species that died natural deaths within the caves and others intentionally brought into the caves either by predators or humans. The land snails, crab claws, bat and small rodent bones are most likely to represent natural deaths since all of these are inhabitants of cave environments. Some of the larger species, such as the agouti or paca, and armadillo, may represent kills by natural predators or humans. The remains of large mammal game such as deer species and peccary could represent kills of predators, although a preliminary taphonomic analysis of the material suggests breakage of long bones by human agents. All of the vertebrates identified are of locally available species. The presence of felid bones is somewhat problematic. These could have been natural deaths or brought into the caves by the Maya. If the latter were the case, a likely explanation would involve their use in cave rituals. Carnivores are generally not a favoured food source among the Maya or many other cultures and large cat bones are extremely rare occurrences in middens at Maya sites. The association between the jaguar, the underworld, and caves, is an all too common theme in Maya cosmology. Large cat bones have been recorded in other Belize cave contexts, such as Actun Polbilche (Pendergast 1974:62). It seems likely that ritual can account for the presence of the cat bones. However, this will be investigated more fully in the final report. It may even be the case that the majority of the vertebrate assemblages are the products of the ritual use of fauna in cave contexts. It is hoped that the ongoing detailed taphonomic analysis of the material will be of use in clarifying this important interpretive dilemma.

This preliminary report on the Xibun excavation and cave faunas provides only a few interpretations with regard to faunal utilization. Upon completion of basic identifications and taphonomic analysis, the final report will present more complete data such as minimal number of individuals (MNI), body portion representation, culturally modified bone, etc. A more detailed discussion of environmental reconstruction
based on the faunal identifications will also be presented. Finally, temporal and spatial trends in faunal utilization by the Xibun Maya will be discussed in the context of inter and intra-site comparisons both within and beyond the Xibun River area. Until the final analysis of the material is complete, any further interpretation would be at worst, speculative, and at best, tentative.

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Chapter 28
Faunal Taphonomy and Ritual Offerings in Five Caves of the Sibun Valley

Daniel I. Leonard

Faunal analysis is the study of animal remains from archaeological sites in order to understand the relationships between people and fauna. It can be a crucial aid in reconstructing subsistence and diet, trade, and ritual activity of the group under study. The sites investigated during the 1999 and 2001 seasons of the Xibun Archaeological Research Project (XARP) have provided a wealth of faunal material. This paper provides a description and analysis of the faunal remains collected from the caves of the Sibun River Valley during these two field seasons. The study included five caves in four districts. All the faunal remains were surface-collected, except for the material at Arch Cave, which was left in situ. The goal of this project was to quantify and qualify the animal remains in order to determine whether the bones collected were deposited in the caves by natural or cultural means. The bones that were determined to be cultural were scrutinized for any evidence that would shed light on ancient Maya lifeways and the relationship of the Maya with their animal environment. Although many of the bones from smaller animals likely were deposited naturally, the bones of larger mammals and turtles, which would not normally be found in a cave environment, may well have ritual significance.

Methods

The caves selected for this study are some of the most prominent in the Sibun Valley, and based on the artifacts and modifications to the cave, the ancient Maya obviously were very familiar with them. Everything collected from the caves was taken directly from the cave surface. No excavation was involved. Areas particularly rich in artifacts or other cultural evidence were chosen for surface collection, so the sampling was not random. Each of these caves was thoroughly explored and the archaeological remains well documented. The faunal material was collected and catalogued according to a specific set of guidelines. Each cave was given a unique identification number. A component number designated areas of the cave that were subjected to mapping or surface collection of artifacts. Depending on the size of a component and the artifact density, components were subdivided into numbered units. Lab collection bag (LCB) numbers were the most specific form of classification– every sample taken from every unit of every cave and surface site studied in the XARP project received a unique number that distinguishes it from the rest.

Norbert Stanchly, Erol Kavountis, and I established a set of criteria to identify and analyze the 1999 and 2001 faunal remains. These criteria included provenience, LCB number, Number of Specimens, Zoological class, specific taxa, body portion, element, side, percentage of the element present (50% -, 50% +, complete), size, modifications, and comments. Before analysis, all bones were cleaned with water and a toothbrush. There are two main steps in the analysis of bone: 1) identifying the bone in terms of species, element, and side, and 2) investigating taphonomy. Preliminary analysis (step 1) involves taking the bones from a lab collection bag and identifying whether they are mammal, fish, bird, amphibian, reptile, or unidentifiable. When class could be determined, the bone was identified to the lowest taxon beneath this, (i.e., Order, Family, Genus,
Regardless of whether class could be identified, an effort was made to identify the portion of the body from which the bone came (i.e. cranial, axial, appendicular, or appendage), and if this was successful, then to identify the specific element (i.e., femur) and the side. It is generally possible to determine size of the animal from a bone or bone fragment, as long as the portion could be identified. Taphonomy includes the processes that promote the degradation of a bone. Reconstructing the depositional history of a bone (step 2) is the most difficult aspect of analysis but the one that yields the greatest insights. All bones were examined for natural and cultural modifications that could affect the current state of the assemblage such as rodent gnawing, weathering, cut marks, burning, and peculiar breakage patterns. An unfused longbone epiphyses or under-developed cortex on the ball of a femur, for example, was the primary indicator that an animal had not reached the status of adult. In most cases where long bone ends were in tact, the animal was found to be fully developed, but there were a few cases where was determined that an animal was a sub-adult, and this was noted in “comments”. Because soil generally quickly leeches the soft tissue material from a bone, bones retaining this material were determined to be recent phenomena and were labeled “green bone” under the “comments” section. Stanchly’s comparative collection, several animal osteology books, and Norbert himself served as vital aids in categorizing, identifying and analyzing the faunal assemblage. The comparative collection included a dog, red brocket deer, white-tailed deer, peccary, gibnut, turtle, and armadillo. Mammalian Osteology (1990) and Avian Osteology (1985), both by B. Miles Gilbert, Mammal Remains from Archaeological Sites (1990) and Fish, Amphibian, and Reptile Remains from Archaeological Sites (1980) by Stanley Olsen, proved to be very useful for bone identification. Mammalian Osteology also had a very helpful section describing different kinds of bone modification. Although the Mammalian osteology books only covered fauna common to the Southeastern and Southwestern US, the extensive compilation of drawings served as a good basis for comparison.

All in all, the resources aiding the faunal analysis were decent. Ideally, one would have a complete skeleton of every animal in Belize with which to compare the archaeological fauna. My limited knowledge of osteology and brief experience with bone analysis added difficulty. The fragmentary nature of the majority of specimens, combined with the absence of an Osteology book specific to the fauna of Belize or Central America, was the greatest obstacle in identifying a bone down to genus or species. Belize: Country Environmental Profile listed all animal species in Belize and was helpful. Complete, diagnostic bones were rare, but species, element, and side could almost always be determined when they were present.

Data Description

The faunal sample under study was composed of 543 specimens: 446 mammals, 50 reptiles, 16 birds, 8 crabs, 1 fish, and 22 unidentifiable remains. Distribution of size across the classes was fairly even: tiny and small = 25%, small-medium and medium = 20%, and medium-large and large = 19%. Long bones were the most common type of bone (for which portion could be determined), at 30% of the total sample. No specific element was particularly over represented. Overall preservation of the bone material was good, but preservation of the bones as whole elements was poor. Sixty percent were less than 50% complete, making many specimens difficult to identify. All but 22 specimens were identified to Class. Ninety bones were identified down to Order, 37 to Genus, and 26 to Species. Peccary was the most heavily represented animal. Human modifications were only noted in 24 cases. Many bones were encrusted with cave formations or bat guano. There
was also a lot of recent breakage of the bones probably due to trampling during the collection process.

Analysis of Fauna by Cave

Actun Ik

Actun Ik (Wind Cave) is made up of two large, pass-through caves connected by a crawlspace at the base of the Thumb. Both have entrances at their east and west ends and are easily accessible. The larger, southern cave contained pictographs. Red handprints on a low overhang near the west entrance were made by pressing paint-covered hands directly onto the limestone. Fire clouding and evidence of charcoal sketching was noted on the ceiling surrounding the prints. Allan Cobb heated some soot from the ceiling and identified the fragrance as copal incense. A sample from the charcoal pictographs was collected for dating and produced an age of 1100BP ± 50 (Rowe et al in McAnany 2001: 44). Seventy-four bone specimens were collected from nine different proveniences. The contexts included entranceways, chambers, alcoves, and niches. Fifty-one bones were mammalian, 17 reptilian, 1 avian, 1 Order: Brachysura, and 3 unidentified. A worked right tibia from a juvenile peccary was found inside the small artificially walled area (component 3) just within the west entrance of the “assassin chamber.” Cut marks are evident where this bone was sawed off at its proximal end to make a bone bead (N. Stanchly, personal communication 2001). Three other long bone fragments from medium-large mammals display spiral fractures, indicating they may have been worked by the Maya to make tools or to extract marrow. A niche in the west wall of the assassin chamber yielded an ulna from an immature peccary as well as a white-tailed deer phalange, several large mammal long bone fragments, and 3 turtle shell pieces. The fossilized scute piece of an ancient armadillo, called an eliptadon, was collected in this niche. Judging by the size of this scute, this armadillo could have grown as large as a Volkswagen Beetle (N. Stanchly, personal communication 2001)! At the west entrance of the assassin chamber (component 11), in an alcove along the south wall, 2 reconstructable pieces of the proximal end of a humerus were found. Steve Morandi believes this humerus is human. In the west entrance chamber of the larger pass-through, where evidence of recent human visitation was found (tent stakes, candles, ticket stubs), two parts of a raccoon femur were collected, along with 3 unidentifiable mammal long bones. Moving east from this chamber into component 12, one reaches a flowstone mound and a red rock outcrop. A red brocket deer phalange was found with a long bone fragment with spiral fracture from a large mammal. Also, 5 turtle shell pieces, 2 rodent mandibles, 1 small lizard mandible, and a bird humerus were collected from this component.

Actun Ibach

Actun Ibach is the second cave in the Thumb district. It is a multi-level maze of small chambers and crawl spaces. The name means armadillo cave, for a complete skeleton that was found in 1999. This skeleton, however, is believed to be modern and therefore was not included in the sample. Animal bone, sherds, and unworked shell are present throughout the cave. Cave modifications include construction of artificial walls, steps, and a vault, using material available inside the cave. This cave has many entrances. Accessibility to the ground level is easy, but to the upper levels, much more difficult (Peterson 2001: 41-54). As in Actun Ik, mammal bones formed the majority of the sample. Twenty-four pieces of a peccary cranium were found in the north
chamber (B) of the main (NE) entrance. Several peccary cranial parts were collected: 2 partial mandibles with teeth and 14 tiny mandible fragments that were calcified and badly eroded, probably due to their close proximity to the cave entrance and the outside elements. Additionally, there were 2 peccary tusks, 2 incisors, and 4 molars. It is possible that all of these specimens came from the same peccary. Two gibnut incisors, 13 tiny mammal bones, and 13 tiny unidentifiable long bones were also collected from this provenience. Climbing up a flowstone bank at the east end of Chamber B, one reaches the long, narrow passageway containing components 3, 5, 6, and 7. The floor of component 3 (Chamber D) is covered with sherds. Chamber D turns into a tiny crawl space, through which only the smallest field student could fit. The crawl space ends in an alcove containing a number of small animal bones including rodent, snake, and bird. Two vertebra from a small-medium and medium-large mammal, and a long bone from a small mammal were recovered from a pit in the floor of this alcove. Components 10 and 11, Chambers H and I respectively, were accessed by climbing up the flowstone shelf in Chamber F, adjacent to where the armadillo skeleton was found. H and I form a small passage, directly above the armadillo room, which leads to the outside. A peccary humerus and fused radius/ulna were found in Chamber H along with several medium-large mammal long bones. All the bones here showed root etching and soil damage and the 2 peccary bones displayed spiral fractures. Finally, right and left mandibles of a gibnut were found in a large room at the SE end of the cave, with access to the outside.

**Ek Way’nal**

Ek Way’nal is a cave in the Tiger Sandy Bay District containing charcoal drawings similar to those found at Actun Ik. An upper level chamber is accessed through three ceiling entrances. Four vessels with kill holes were discovered *in situ* in two separate offerings here. The vessels include two inverted ollas, a Roaring Creek Red bowl, and a small, black, incised bowl apparently used to burn an offering. A small conch shell was collected below the chimneys in the main chamber, which is located at the east entrance. The pictographs are drawn on a wall near the Usrey Valley entrance, at the west end of the cave. The abstract drawings are in the same style as those at Actun Ik, and are therefore believed also to date to the Late Classic (McAnany 2001: 48). Ek Way’nal produced the smallest number of faunal remains of the five caves. Half of the bones were mammalian, the other half avian, reptilian, and crab. Over 50% came from tiny-small animals. The cave proceeds NE from the main entrance in the west. Past the chimney chamber is component 2-4. Several vessel fragments- some with mend holes, others fire blackened- came from a niche in the north wall where everything was covered with a micaceous dust. Five turtle shell pieces, as well as 2 crab claws, were found with the sherds. In the center (component 2-5) of the next chamber, a turtle shell piece and several pieces of a reconstructable bird long bone were found. A concentration of rodent bones was found along the north wall (component 2-8) of this same chamber. Continuing east, up “Polly’s slide,” one reaches the large chamber where the pictographs were found. Two armadillo pelvi, 3 crab claw fragments, and a tapir tooth were found in this room. The east entrance is very close to this room and there was lots of disturbance in the form of root growth, termite trails, and bats.

**Actun Chanona**

Chanona is the largest known cave in the Hummingbird karst and was studied extensively for the first month of the 2001 field season. Chanona is oriented east-west, with a gigantic mouth (approximately 100 m wide) opening east, and a diagonal crevice (less than 1 m wide) letting light in from the west. The cave is 485 m long according to a map produced by Mark Gutchen, Tom Miller,
and J. Wyeth in 1979. The actual passageway into the cave at the main eastern entrance is only a fraction of the width of the cave mouth itself. Water movement is concentrated near the east entrance with a series of gours. The west entrance is drier but active formations are found throughout. Past the gours, the cave opens into a massive chamber where the huge, heavily modified feature called the Great Platform is situated. Breakdown is present everywhere making it very difficult to traverse the cave. Perhaps this difficulty added to its allure, because the cave is a wealth of cultural material. Shards are scattered on the floor throughout almost the entire cave. Multiple altars constructed of cave formations were present. Huge areas of burning are located at the north, south, and east sides of the Great Platform. Six whole vessels with kill holes were studied in situ, as were the remains from at least 5 human individuals (see Hauksdottir and Morandi, Chapter 26). Chanona produced the greatest amount of fauna of all the caves: 250, 243 of which were mammalian. Unfortunately, more than half of them could not be identified beyond Class. The bones that could be identified came mostly from tiny and large mammals. Interestingly, there were more worked and burned bones found here than in the other caves. The first area of collection (component 1) was the Great Platform. Rodent bones and 2 crab claws were found amongst the cultural materials to the north (1-1) and to the east (1-2) of the altar. There was a large concentration of bones (90 total) in a crevice adjacent to the mountain of breakdown forming the Platform’s west boundary. The majority were too fragmented to be called anything but “mammal,” but the remainder included a fish vertebra and 22 medium and large mammal bones, 5 of which were calcined (the highest degree of burning), and 2 of which may have been worked. All these specimens displayed cracking and exfoliation. Component 2 is the room at the bottom of the slope on the south side of the Great Platform. This area is called the “drum room” (named for the ceramic drum body found here). Tons of artifacts were found in a shallow depression that runs along the south wall. Component 2-1 is located on the east side of the room. Along with innumerable potsherds, jute, and a ballplayer figurine/ocarina, 113 bones were found. Ninety-two were unidentifiable mammal fragments, 2 were turtle shell pieces, and the rest included a White-tailed Deer calcaneus, 6 mammal long bone fragments with flake scars, and several more small, medium, and large mammal bones. Component 5 is located above the breakdown mountain, on the balcony near human remains #4. Unit 1 is on the east side of this component. A triangular hearth sits adjacent to a large floor crevice. A small jade bead, a medial obsidian fragment, and the distal end of a small-medium mammal tibia were found beside the hearth. An area of burned and broken speleothems characterizes the west side of this component (5-2). Cave formations are growing on everything in this area. The right tibia and right humerus, both distal, of a white-tailed deer were collected near the edge of the burned area.

**Arch Cave**

Arch Cave is located at Gracy Rock and, according to caver Polly Peterson, is “the most amazing thing I have ever seen!” Studying the faunal remains here was a rushed, last minute endeavor. Since nothing was collected from this cave and there was little time, the more glamorous finds received attention. This cave’s fame lies in the 13 complete vessels found deep inside the cave in a perilous room called the “assassin bug chamber.” Much closer to the entrance, which is a diagonal crevice similar to Chanona’s west entrance, 2 jaguar canines were lying beneath an overhang that features spots of fire clouding. Also found here were 6 molars, 13 phalanges, 2 skull fragments, a humerus, and a tibia, all believed to be from a jaguar. This area was called component 2. Further into this main chamber, along the south wall is an alcove adjacent to the “chamber of the royal rat.” Here, 2 metacarpals, a humerus, and a fused radius/ulna from a peccary were found.
Several other elements from a medium-sized mammal, perhaps a peccary, were present. The last set of animal remains studied here was a group of 24 snake vertebra found in a very low chamber on a shelf to the NW of the main chamber.

Discussion

The primary goal in this analysis was to determine which bones in the sample were deposited naturally, and which were deposited culturally. Mammal and reptile were the only two classes significantly represented. The bird, fish, and crab specimens seemed random and most likely are non-cultural. They were either killed and brought inside by another animal, or, in the case of the birds and crabs, flew or crawled in themselves, which is a reasonable assumption considering some of these caves are very open and easily accessible from the outside. There are three reasons why mammals might be so over represented in this sample: (1) mammal bones preserve very well, (2) many small mammals make their homes in these caves, and (3) for the Maya, mammals had the highest nutritional value, and perhaps greater religious significance than other animals. Approximately 45% of the sized mammal bones come from tiny, small, and small-medium individuals like bats, rodents, gibnuts and armadillos. It is fairly safe to dismiss these bones as natural occurrences. The rest of the mammal bones come from medium, medium-large, and large mammals such as peccaries, ocelots, deer, tapirs, and jaguars. These bones are more likely to have cultural associations because these animals are not normally found in caves (except for the cats), and because they represent a desired food source. Furthermore, these larger mammal bones were the ones in the assemblage most often found to be worked and burned. Only 19 mammal bones in this sample displayed evidence of human modification such as cut marks, flake scars, spiral fractures, and burning. Such meager evidence makes it difficult and dangerous to draw firm conclusions about Maya use of these animals. Another thing to consider is the possibility that a gibnut or rodent transported these larger mammal bones into the cave. As for the gibnut, it is not out of the question to suggest that these bones and those of other small-medium sized mammals are found in the cave because the Maya were eating them.

Many scenarios are possible, so the best course of action is to follow Occam’s Razor while keeping an open mind. The larger mammal bones most likely are associated with Maya use of the cave. The juvenile peccary tibia from Actun Ik was clearly cut with a tool and suggests the Maya were making beads from the bones. The fact that 2 peccary elements found at Actun Ik were juvenile could indicate a Maya preference for young peccaries. Or perhaps the peccary they killed happened to be young. The medial long bone fragments from Actun Ik, Actun Ibach, and Chanona with spiral fractures and/or flake scars indicate the Maya were breaking long bones with hammers. Spiral fracturing, which occurs when bone is still organically active and flexible, suggests that the bone was broken not long after the animal died. Animals tend to chew at the epiphysal ends of bones whereas humans tend to break them at the middle, producing medial fragments with spiral fractures. Bones may have been broken to make tools, although there is very little evidence for this here. Two long bone fragments from the drum room at Chanona and 1 from the walled alcove in Actun Ik’s assassin chamber have very smooth cavity walls, suggesting the Maya scraped the insides for marrow. They may have been cooking, preparing, and consuming these larger animas inside caves, or perhaps they were leaving animal parts as offerings. The 2 peccary mandibles and the tusks and molars found at Actun Ibach (inside the main north chamber) may be the remains of a skull left as an offering. Numerous caches at Cuello were found to contain the heads of deer as
offerings (Hammond 1991). Perhaps the skull, being the least desirable portion for meat, was discarded there as refuse. Or maybe the peccary died of natural causes and post-dates the Maya like the armadillo for which the cave was named.

The deer tibia and humerus found at Chanona were lying suspiciously near the edge of a fire pit and a deer could not make it that far into such a dangerous cave on its own. The 2 bones do not look smashed or worked; they may have been left there as an offering. The beautiful jaguar teeth found at Arch Cave are the most compelling evidence for an animal offering. It would be impossible for a large cat to come in through that narrow diagonal entrance. Furthermore, directly above the teeth and skull fragments on the overhang are black circles from fire clouding. In addition to the canines there are 6 molars, 13 phalanges, a tibia, and a humerus. It is feasible that an entire jaguar was killed and left here for the gods. A total of 26 turtle shell pieces were found at Ek Way’nal, Chanona, and Actun Ik. Caves are believed by the Maya to be the interface of earth with the Underworld. The Underworld is considered a watery place. Caves thus become the most sacred location for communicating with the gods and praying for rain. Animals associated with water like snakes and turtles have come to be connected with the underworld and fertility. God N, Pauahtun, is often pictured emerging from a conch or turtle shell (Peterson 2001: 41-54). The turtle shells pieces and the 24 snake (probably a whole snake) vertebrae found in Arch Cave may have been left for the gods in return for a healthy rainy season.

Conclusion

Despite the ambiguity of some of the faunal evidence, the Maya appear to have been utilizing a number of different animals in a number of different ways. Specifically, larger mammals such as deer, peccary, and jaguar were significant in a number of ways: as an important food source, as raw material for bone tools and jewelry, and as gifts to be offered to the gods of the Underworld. Turtle shell also seemed to play a part in cave ritual. The exact significance of the bones in this faunal assemblage will never be known, but they shine a warm light onto the natural and unnatural (i.e., cultural) activities that transpired in the Sibun River caves.

The following is a discussion of bones that provide some insight into the relationship of the Xibun Maya and their animal environment.

Actun Ik is an easily accessible, fairly open pass-through cave with evidence of modern visitation in the main east entrance in the form of tent stakes, ticket stubs, and sherds set on top of rocks. The most compelling finds here for cultural activity include the worked peccary tibia and several medium and large long bone fragments with spiral fractures. This tibia was found in an artificially walled alcove just inside the assassin chamber. The tibia was clearly sawed off at the proximal end, apparently to make a bead (N. Stanchly, personal communication, 2001). Also found here was a femur with flake scars from a large mammal, 1 long bone, 2 ribs, and 1 vertebra from a large mammal, and 2 M-L mammal bones with spiral fractures. Spiral fractures occur when a bone is still fresh and it is hit with something like a hammer stone. The 4 longbone fragments in this alcove are all medial. Animals normally chew and break off the ends of bones, while humans will break them in the middle. These longbone fragments appear to have been broken by the Maya, perhaps to get the marrow out of them. The 2 M-L mammal long bones may be from a peccary. Both the worked tibia in component 3 and the fused radius/ulna in component 9 come from a sub
adult peccary, possibly suggesting age preference by the Maya. Several other M-L mammal bones were found in the niche in the west wall of the assassin chamber. Perhaps they are the remains of a deer and peccary brought in the cave to be processed. If these larger mammal bones are cultural, it is more reasonable to suggest they were used as a food source rather than for religious purposes. No cranial elements were found in this caves besides the M mammal orbit. Also, if an animal was processed for food, the head would most likely be discarded elsewhere because it is the most undesirable part for food. The 24 S and S-M can be dismissed as natural occurrences, and 16 turtle carapace pieces found in the assassin chamber and the pictograph room, were probably brought in by the Maya, based on the knowledge that turtles do not dwell in caves. Also, the turtle was a ritually significant animal because of its association with water, and thus, fertility for the Maya farmers.

Fire clouding on the ceiling in the main chamber, but no signs of burning in the assassin chamber.

Actun Ibach: of the 79 mammal bones here, 52 came from t, S, or S-M individuals including rodents and a gibnut. This being a fairly accessible cave, even with outside entrances to the upper levels, the smaller mammals can be expected to have died their naturally. 24 specimens from a peccary cranium were collected from the chamber inside the NE entrance. These included 2 partial mandible with teeth, 2 tusks, 2 incisors, 4 molars, and 14 mandible fragments. There are sherds as well as artificial walls in this chamber, but it is difficult to say whether the peccary is cultural. There are no signs of burning in the room or on the bones, and there are no cut marks, but if it crawled in here and died naturally, where is the rest of its body? Perhaps the skull was discarded here while the rest of the body is elsewhere. The humerus and fused radius/ulna of a peccary, both with spiral fractures, were found in the passage way above the armadillo room. Also found here were 3 M and 4 L mammal bones, along with 10 unidentifiable mammal fragments There is evidence of fire clouding on the ceiling as this passage leads to the out side. It would appear all the peccary elements, and perhaps the other larger mammal bones, are cultural, but whether they were part of a ritual, consumption, or just trash is unclear.

Ek Waynal had almost the same number of mammal bones as it did bird, reptile, and crab. The 4 complete vessels with kill holes and the abstract drawings are clear indicators for cultural activity. 6 turtle shell pieces were found throughout the cave. They may be associated with the conch shell found in first chamber inside the west entrance. God N is frequently shown emerging from a conch or turtle shell, and may have been ritually invoked in this cave. Several L bird bones were found in the third chamber in from the west entrance. It is questionable how they got there. The large, eastern-most chamber where the pictographs are located yielded 3 crab claws, a bird skull fragment, and a tapir tooth. Since there are no other L mammal parts near by, the tooth may have been carried in by an animal or blown in by the wind.

Chanona was a place of intense ritual activity as the construction, human remains, and huge area of burning indicate. The Great Platform chamber alone could have held a crowd of several hundred, suggesting Chanona was the site of some very large ceremonies. A lot of the animal bone found here if from bats and rodents, but several contexts contain bones which are definitely associated with Maya use of the cave. The 5 heavily burned longbone fragments and 2 possibly worked long bone fragments make up an interesting crevice deposit at the west edge of the Great Platform. A white-tailed deer metacarpal and 9 L mammal longbone fragments were also collected from this deposit. A nearby alter and hearth contain burned ceramics. Perhaps these bones were burned in ritual at the alter or hearth, then swept into the crevice as trash at some later date. More mammal long bones were found in the drum room along the south wall. 6 of the fragments showed
flake scars, 2 of these had polished marrow cavities, indicating marrow was scaped from these bones and eaten. Included in this collection was a white-tailed deer calcaneus and 2 L turtle shell pieces. The turtle shell pieces may have been part of a ritual, while parts of a deer may have been cooked inside the cave and eaten. 2 more deer bones, a tibia and a humerus, were found on the level above the Great Platform near Human Remains 4. It would be extremely difficult for a deer to come this far into this cave by itself. Both bones are heavily calcified on their ventral sides. The tibia is almost complete (Figure 28.6), and the humerus (distal), has a very strange break. The middle of the crosssection is missing. Perhaps water has eroded it away. Both bones sit at the edge of a heavily burned area. Neither displays spiral fractures or flake scars, so perhaps the meat was cooked on the bone, preventing the bone from burning, or maybe they were left as an offering.

Arch Cave has yielded the most spectacular finds of all the caves in this study. 24 snake vertebra, probably from the same snake, were found fairly deep inside the cave. According to cave director Polly Peterson, it is too cold for a snake to be that far into a cave. Snakes, like turtles, are also associated with water, the underworld, and fertility, so this snake perhaps was left as an offering to the gods in return for a good rainy season. The peccary elements found in the alcove in the SW of the main chamber are interesting. It's doubtful that a peccary could have fit through the diagonal entrance. There is a lot of gibnut activity in the cave—they bring in leaves and cohune nuts, and perhaps dragged in a few peccary bones.
Zooarchaeology is a subdiscipline within archaeology that focuses on interpreting human behavior, ecology, and evolution from the examination of animal, or faunal, remains. Faunal analysis includes the study of animal remains from an archaeological site, and an evaluation of whether the remains naturally occurred or were introduced and altered by humans. This type of analysis is used to address two main topics: (1) to reconstruct ancient diet, and (2) to understand the use of faunal remains, bones, as tools and jewelry. In this study the source location of these organisms is important, as the further an animal is transported the more exotic and valuable it is likely to have become. The only remains that are found at most sites are the “hard parts” of an organism, except for the rare and special cases when actual tissue is found. Durable parts include the skeletal, dentition, shells, operculum, and also in some cases the exoskeleton of crustaceans. There are 5 major classes of animal remains that were found on the Samuel Oshon site, which include mammals, avian (birds), reptiles, osteichthyes (fish), and mollusca.

Taphonomy is the study of the processes, including burial, decay, and preservation, that have affected the remains animal and plant as they become fossilized. If a mark is produced by human usage, then this bone becomes what is termed an artifact. It is important in a faunal analysis to characterize the difference between natural and man-made marks on the bones because more can be learned about butchering practices and food utilization by certain marks. Taphonomy can also be used to discern amongst a domesticated or wild animal, food, tool, and jewelry usage. It is important to find out what processes affected the animal remains. Were they thrown away to form a midden or were they utilized as a raw material to produce a tool or jewelry?

The Xibun Archaeological Research Project (XARP) have undertaken the documentation of Maya sites, large and small, located along the Sibun river of central Belize. In 1999 and 2001, the Samuel Oshon site, which is located off the Western Highway (mile 18), near a town called Freetown Sibun, was mapped and excavated. This site contains 2 plazas, A and B. In both field seasons, excavations were conducted in Plaza A. During the 1999 season Structure 401 and adjacent Structure 437 were the location of 6 operations. During the 2001 season, Structure 402, with 2 associated uncarved stelae was excavated, as one operation. In 1999, 285 animal bones and shells were recovered, and in 2001, 951 animal bones, shells, and corals were recovered.

Four major classes of vertebrate animals were found. They include aves (birds), mammalia, reptilia, osteichthyes (bony fish). Furthermore, two types of invertebrates were found in these two field seasons: mollusca (shelled organisms) and anthozoa (corals). At the Samuel Oshon site there were many exotic marine species of mammals (Trichechidae manatus), osteichthyes (Scaridae, Carangidae), mollusks (Codakia orbicularis, Donaciidae, Polinices lactueus, Cassidae spp., Melongenidae spp., Strombidae spp., Nerite spp.), and anthozoa (Table 29.1). All of these species were imported from the coast, and presumably the Sibun River was a passageway for this transport. From the Samuel Oshon site, the coast is only 27 to 28 miles away. It is also important to keep in
mind that the cranial bones of the Scaridae and Carangidae, and whole shells were found at the site. This means that these exotic items were being brought back to the site whole.

Table 29.1 Identified taxons of vertebrates and invertebrates recovered from the Samuel Oshon Site during the 1999 and 2001 field seasons (Operations 17, 18, 19, 20, 21, 23, and 24).

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Class Mammalia</td>
<td>mammals</td>
</tr>
<tr>
<td>Family Erethizontidae</td>
<td>new world porcupine</td>
</tr>
<tr>
<td>Family Rodentia</td>
<td>rodent</td>
</tr>
<tr>
<td><em>Odocoileus virginianus</em></td>
<td>white-tailed deer</td>
</tr>
<tr>
<td><em>Tayassu tajacu</em></td>
<td>percary</td>
</tr>
<tr>
<td><em>Trichechidae manatus</em></td>
<td>manatee (marine/freshwater)</td>
</tr>
<tr>
<td><em>Didelphis marsupialis</em></td>
<td>common opossum</td>
</tr>
<tr>
<td>Class Osteichthyes</td>
<td>bony fish</td>
</tr>
<tr>
<td>Family Scaridae</td>
<td>parrotfish (marine)</td>
</tr>
<tr>
<td>Family Carangidae</td>
<td>jackfish (marine)</td>
</tr>
<tr>
<td>Class Reptilia</td>
<td></td>
</tr>
<tr>
<td>Order Testudines</td>
<td>turtles</td>
</tr>
<tr>
<td>Order Serpentes</td>
<td>snake</td>
</tr>
<tr>
<td>Order Iguanidae</td>
<td>iguana</td>
</tr>
<tr>
<td>Order Crocodylidae</td>
<td>crocodile</td>
</tr>
<tr>
<td>Class Aves</td>
<td>birds</td>
</tr>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Phylum Mollusca</td>
<td></td>
</tr>
<tr>
<td>Class Bivalvia</td>
<td></td>
</tr>
<tr>
<td>Family Donaciidae</td>
<td>Bean Clam Family (marine)</td>
</tr>
<tr>
<td><em>Codakia orbicularis</em></td>
<td>Tiger Lucine (marine)</td>
</tr>
<tr>
<td><em>Polinices lacteae</em></td>
<td>Milk Moon Shell (marine)</td>
</tr>
<tr>
<td>Genus Nerita</td>
<td>Nerite (marine)</td>
</tr>
<tr>
<td>Class Gastropoda</td>
<td>Univalve</td>
</tr>
<tr>
<td><em>Euglandina cylindracea</em></td>
<td>terrestrial snail</td>
</tr>
<tr>
<td><em>Orthalicus princeps</em></td>
<td>aboral snail</td>
</tr>
<tr>
<td><em>Pachychilus glaphyrus</em></td>
<td>Jute (freshwater)</td>
</tr>
<tr>
<td><em>Pachychilus indiorum</em></td>
<td>Jute (freshwater)</td>
</tr>
<tr>
<td><em>Pomacea flagellata</em></td>
<td>Apple snail (freshwater)</td>
</tr>
<tr>
<td>Family Cassidae</td>
<td>Helmet Shell Family (marine)</td>
</tr>
<tr>
<td>Family Melongenida</td>
<td>Crown Conch Family (marine)</td>
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<tr>
<td><em>Melongena melongena</em></td>
<td>West Indian Crown Conch (marine)</td>
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<tr>
<td>Genus Strombidae</td>
<td>Winged Conch or True Conch Family (marine)</td>
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<tr>
<td><em>Strombidae pugilus</em></td>
<td>Pink Conch (marine)</td>
</tr>
<tr>
<td>Anthozoa</td>
<td>Corals</td>
</tr>
</tbody>
</table>
Besides the exotic marine organisms there was a striking difference between the types of organisms found at each of the two structures, 401 and 402. At Structure 402, there was a large percent of mammalian bones, specifically long bone fragments. This difference is significant in light of the fact, discussed in further detail below, that circular Structure 402 does not appear to have been residential in function. At Structure 401 on the other hand, a high percentage of osteichthyes bones were found. This latter pattern may be evidence of an elite residence, and as considered below, may even be the remains of a feast that occurred long ago.

In this paper two topics will be explored, using the faunal remains of the Samuel Oshon site. These include the importance of exotic species from the coast and the use of faunal remains to solidify our understanding of how structures were utilized by the Maya. These topics will be considered by examining both the types of remains present, and the percentage of the different types of remains found at the two structures.

Methods and Material

In the 1999 and 2001 seasons, a combined 1236 animal bone, shell, and coral remains were found by combining the total number of specimens (NSp) in all of the classes. These artifacts were found during excavation or were collected from a ¼ inch screen. All the soil that was removed from the site was screened. Each of the specimens recovered was examined separately and the following observations noted.

Provenience was recorded for specimens. This included, operation, zone, square, and FCB or LCB number. Each specimen was identified by class: mammalian, avian, osteichthyes, reptilian, mollusca, anthozoan, or unidentifiable. The class “unidentifiable” was employed when bones were either too eroded or fragmentary to be placed into a class with certainty. After assignment to a class each artifact was placed into the most specific taxon possible. To be able to place the specimens into a specific taxon both a comparative set of bones and many published keys were consulted (specific keys listed in the Reference Cited at the end of this chapter). Most of them were unidentifiable beyond classes. Other parameters noted were the number of bones, body portion (cranial, axial, or appendicular, this is, pelvic, pectoral, or appendage), element (actual bone type), percent of the element (50%-, 50%+, or complete), size (small, small-medium, medium, medium-large, or large), and modifications (burnt, scratched, etc.).

Results

During the 1999 and 2001 seasons, 7 excavation (Operations 17, 18, 19, 20, 21, and 23 in Str. 401, and Operation 24 in Structure 402), were performed at the Samuel Oshon site. Operation 17 included 6 shovel test pits (STP), excavated around Str. 401 to locate artifact concentrations. Operations 18 and 20 were located were high artifact densities were found, and Operations 19, 21, and 23 were extensions of these two operations. Operation 24 was a large 5 m by 5 m units, split into squares A, B, C, and D, that was concentrated around the two stelae and the northeastern quadrant of a circular structure.
In these two seasons a combined 1236 animal bones, shells, and coral remains were found on the site, this number was the sum of the total number of specimens (NSp) of each class. At Str. 401, 272 animal bones and 13 shells were found. At Structure 402, 674 animal bones, 277 shells, and 2 coral remains were found. A list of all of the species found at the Samuel Oshon site was compiled and if the organism was from marine or freshwater environment it was recorded in parentheses next to the common name (Table 29.1). The faunal remains from each of the 2 excavation areas are presented separately so that any difference in the assemblage by structure can be noted. Fortunately, each area yielded a large sample of fauna and provides a good representation.

Operations 17, 18, 19, 20, 21, and 23 In and Around Structure 401

From the 1999 season a total 272 animal bones and 13 shells were recovered. Of the 272 animal bones, 65.4% were osteichthyes, 18% mammalian, 11.1% reptilian, 3.7% avian, and 1.8% were unidentifiable. Since there is such a low percent of unidentifiable bones, the preservation is considered to be very good. A total of 63 (23.2%) animal bones were identified to a lower taxa, while all 13 of the mollusca remains were identified at least to the genus. The following sections discuss each class remains separately.

Osteichthyes Remains

There were a total of 178 osteichthyes bones, or 65.4% of all the animal bones. Two families of fish were identified found in this sample, the rest were unidentifiable. The Family Scaridae includes the parrotfish. These remains were identified because they were all cranial bones, which included the pharyngeal plates and dentary fragments. The Family Carangidae, included the jackfish, which was identified by the abnormally large growth of the ribs, and cleithrum, two normally thin bones. There were a high number of unidentifiable osteichthye bones because most (65.7%), of the bones were axial, specifically vertebrae, which are very difficult to identify down species without a comparative fish collection.

Mammalian Remains

A total of 49 mammalian bones, or 18.0% of all the animal bones were recovered. There were 4 species and 1 family that was identified in this sample, the rest were unidentifiable. Of particular interest is *Trichechidae manatus*, the species of manatee found in the Belize region. The unnatural scratch marks on the distal end of the humerus suggest that this bone was worked (Figure 29.1). There were also fragments of the species *Odocoileus virginianus* (white-tailed deer), *Tayassu tajacu* (peccary), *Didelphis marsupialus* (common opossum), and the Family Erethizontidae (New World Porcupine). There were high numbers of worked and burn bones in this sample of mammalian remains. Two of the worked bone included a burnt and broken bead fragment, which the other was the distal end of a radius that was worked to make a bead (Figure 29.2). Many of the of mammalian bones were unidentifiable because most were long bone fragments (Appendicular-Pectoral or Pelvic Girdle), 28.6%, which are very difficult to identify down species.
Figure 29.1 Possibly worked manatee bone (illustration by author).

Figure 29.2 Bone bead and worked bone (illustration by author).
**Reptilian Remains**

There were a total of 30 reptilian bones, or 11.1% of the entire 1999 sample. These families were identified in this sample, the rest were unidentifiable. The 3 families include the Order Testudine (turtle), which were mainly identified by the carapace or plastron fragments of the turtle shell. The Order Serpentes (snake) was only found in the form of vertebrae fragments. The 2 bones from the Order Crocodylidae (crocodile) were both dentary fragments. There was not a larger amount of unidentifiable bones because the reptilian bones were very distinct to family.

**Avian Remains**

There were a total of 10 avian bones, or 3.7% of the 1999 sample. All of the avian bones were unidentifiable, partly due to their fragmentary conditioned.

**Mollusca Remains**

A total of 13 mollusca shell fragments were found during the 1999 season. In this sample there were a large number of marine organisms, including Strombidae sp. and *Melongena melongena*. The terrestrial snail *Pomacea flagellata* (apple snail) possibly eaten by the Maya was also well represented.

**Operations 24, Squares A, B, C, and D of Structure 402**

The findings from the faunal analysis of the XARP 2001 excavation of the Samuel Oshon site are listed in Table 29.6. A total 674 animal bones, 277 shells, and 2 corals were recovered. Of the 674 animal bones, 10.8% were osteichthyes, 63.5% mammalian, 22.6% reptilian, 1.9% avian, and 1.2% were unidentifiable. As in Structure 401 there was such a low percent of unidentifiable bones the preservation was also considered to be very good. A total of 169 (25.1%) animal bones were identified with a lower taxa, while only 6 (2.2%) mollusca remains were not identified to a lower taxa. Each class is discussed in the following sections.

**Osteichthyes Remains**

There were a total of 73 osteichthyes bones, or 10.8% of all the total. There were only two family of fish found in this sample, the rest were unidentifiable. The two families that were distinguishable include the Family Scaridae, parrotfish, and the Family Carangidae, jackfish. Once again, there were a high number of unidentifiable osteichthye bones because most of these bone were vertebrae (Axial), 86.3%, which are very difficult to identify down species without a comparative fish collection.

**Mammalian Remains**

There were a total of 428 mammalian bones, or 63.5% of the total. There were 2 species and 1 family that was identified in this sample, the rest were unidentifiable. There were fragments of the
species *Odocoileus virginianus* (white-tailed deer), and *Tayassu tajacu* (peccary), and the Order Rodentia ( rodents). Large numbers of highly fragmentary long bones contributed to the high percentage, 77.8%, of unidentifiable species in Appendicular- Pectoral or Pelvic Girdle region of the body.

**Reptilian Remains**

Reptilian bones totaled 152, or 22.6% of all the animal bones found in the 2001 season. Three families were identified in this sample, the rest were unidentifiable: the Order Testudine (turtle), which were mainly identified by the carapace or plastron fragments of the turtle shell, the Order iguanidae (iguana), and Order Serpentes (snake) which were only found in the form of vertebra fragments.

**Avian Remains**

A total of 13 avian bones, or 1.9% of all the total were recovered. Most of the avian bones were unidentifiable due to their highly fragmentary and general appearance.

**Mollusca Remains**

Of all the invertebrates found, 99.3% (n=277) were mollusca shell fragments. In this sample there were many different marine organisms, including the Family Cassidae, *Codakia orbicularis*, Family Donaciidae, Nerite sp., Family Melongenidae, and Strombidae sp. There was also large amounts of *Pomacea flagellata* (apple snail), and Pachychilus sp., the latter were commonly eaten by the Maya. The majority of the Pachychilus sp. were also missing their apexes which may have occurred during processing by the Maya. Also present were *Orthalicus princeps* (an arboreal snail) and *Euglandina cylindracea* (a terrestrial snail). There was also one worked shell fragment. It was worked to form what is believed to be either an ear flare or a bead. Finally, there were also 2 limestone fossilized gastropod shells found in the sample.

**Anthozoa Remains**

Unlike the 1999 sample there were 2 small coral fragments found in Operation 24, which accounted for 0.7% of all the invertebrates found in the 2001 season. These two fragments were very worn down and could not be distinguished past the Phylum Anthozoa.

**Discussion**

The XARP 1999 and 2001 excavations at the Samuel Oshon site were placed within two primary structures of Plaza A. Overall, the site contained a large amount of marine organisms. This means that the Maya who occupied this site were acquiring sea food, possibly through trading connections with the coast. Throughout Belize, many other sites located along rivers have Scaridae (parrotfish) and Carangidae (jackfish) remains (Powis et al 1999; Stanchly 2001). Since the only distinctive remains found in the Samuel Oshon site were cranial fragments (pharyngeal plates, dentary, cleithrum fragments), the fish probably being brought to the site whole. This researcher believes that they were probably salted and transported up the river as complete fish. Another thesis
postulates that the fish were transported in dugout canoes filled with salt water (personal correspondance). This theory would involve a lot of effort because the fish would have to be kept alive in salt water for a 3 to 4 day trip upstream to the site (27 to 28 miles). The water in the canoe would also make it harder to keep afloat, and the water salinity would become lethal for the fish to survive as the salt water evaporated.

There was also a larger amount of mollusca shell and some anthozoans that are from the coast. Most of the marine shells were large conch and their relatives. These shells were found intact, which indicates that they were also being brought from the coast to the site whole. There were some smaller marine mollusca from the coast found at the site and these were only found in the sample from the 2001 season. The anthozoan fragments were both found in different zones. One was found in Zone 1 and may have served as part of the floor fill, while the other was found in Zone 5, and used as construction fill. There was also a shell ear flare or bead, which was made from a marine shell because of how thick it was (Figure 29.2)

The two field season yielded different percentages of the types of organisms. The 1999 season, Structure 401, yielded a high amount of osteichthyes, 65.4%, and a low amount of mammalian, 18.0%, remains. This contrasts with the finds during the 2001 season, Structure 402, which contained a higher percentage of mammalian bones, 63.5%, than the osteichthyes, only 10.8%. It is hard to believe that the two structures (401 and 402), located only 20 m apart, had such different percentage of faunal remains. The large amount of mammalian bones found around Str. 402 may have occurred because the Maya were known to sacrifice more mammals than any other animal class. The high percentage of fish bones on Structure 401, included exotic marine species. This structure was probably an elite residential structure.

To further understand the Samuel Oshon site it would help to open up an excavation on a mound associated within the Plaza B group. Opening an operation in this area would allow a better understanding of the site. It may also help in our understanding if another operation is opened in Plaza A. The Samuel Oshon site is located the closest to the coast. To better understand its importance in the Sibun river valley there should be more excavations and research done on the highest site on the Sibun River, the Hershey site where parrotfish pharyngeal jaws and beaks also were found. If more marine organisms are found at this site, there may be a connection between the coast and the Hershey site, or there may also be a connection between the Samuel Oshon site, located close to the coast, and the Hershey site, located the farthest from the coast.

To close, investigation at the Samuel Oshon site have prompted new questions about the Sibun River sites, and how they interacted with each other and the coast. But by using faunal analysis we have been able to gain a better understanding of the close connection with the coast and also of the function of two of the Plaza A structures.
The Sibun River flows through central Belize, and along its banks are located a number of ancient Maya settlements. This beautiful and interesting area is being investigated by the Xibun Archaeological Research Project (XARP). One of the goals of XARP is to explore the possibility of ancient cacao (*Theobroma cacao criollo*) cultivation in the Sibun River Valley. To investigate this issue, as well as to gain an increased understanding of the region’s paleoenvironment and of the ancient Maya’s utilization of natural resources, the project is working to recover and study botanical remains from key contexts. Fourteen soil samples were collected for flotation sieving from Pakal Na, a settlement in the middle reaches of the Sibun, and one was taken from the Oshon site, a settlement located downstream. John Jones collected pollen cores for his studies in palynology, and samples from these cores were sieved to recover botanical remains (see Jones, Chapter 34). These samples include a pollen core from the Storkbill Wallow sinkhole, located near the Pakal Na settlement, and another from the Boat Bill Heron oxbow, which is located near the Pechtun Ha settlement, downstream from Pakal Na, but still in the middle reaches of the Sibun. All samples were obtained during the 2001 field season, with the exception of one Pakal Na flotation sample, which was collected during the 1999 field season. This paper presents preliminary results from the processing, sorting, enumeration and basic identification of the botanical remains and artifacts recovered. Dr. Kirsten Tripplett (Chapter 35) presents further information on botanical identification.

**Methods for Sieving**

John Jones used 2-inch metal pipe to collect the pollen cores. All provenience measurements were taken from the top of the pollen core. The Boatbill Heron sample was 275 cm in length and was collected on March 23 and 26, 2001. The sample was divided into 5 cm increments, and every third section was processed. However, the sampling pattern was altered when samples were taken for processing at 115-120 cm, 120-125 cm, and 130-135 cm, due to a visible concentration of organics. The 270-275 cm sample was removed by Tripplett for processing and study in the United States. The Storkbill Wallow sample was 120 cm in length and was collected on March 27, 2001. That sample was also divided into 5 cm increments, though the sampling frequency was increased to every other section, due to the excellent preservation observed in the botanical material recovered from Boatbill Heron. The sampling pattern was altered when a sample was processed from 115-120 cm, as to have information from the deepest, and therefore earliest, extreme of the pollen core.

The sample was placed in a 1 mm plastic mesh sieve that was partially submerged in a bucket of water. The sample was allowed to soak and was gently agitated until most, if not all, of the matrix filtered through the sieve and only the botanical material remained. The sieve was then emptied onto a piece of muslin fabric. An aluminum tag, bearing the sample...
number, collection date, sample location, and sample depth, was placed on the muslin. The fabric was then tied up and hung on a clothesline to dry. When dry, the botanical material and the metal tag were transferred into a plastic bag, the outside of which was also labeled with the pertinent information. The smallest and largest particles were measured to determine the particle size range, and the botanical material was also weighed. Observations were made as to what types of material the samples seemed to contain, and more detailed notes were taken about the more noteworthy objects. Tripplett (Chapter 35) reports on the identification of the macrobotanical material retrieved from the cores.

A couple of problems were encountered with this sampling technique and with the processing of the samples. In cases where the agitation needed to completely remove the matrix may have damaged fragile botanical material, some of the matrix was allowed to remain. This decision undoubtedly had a negative impact on the accuracy of the botanical weights. These conditions affected Storkbill Wallow samples 1, 4, and 5, and to a lesser extent samples 6, 8, and 9. Also, sample 14 from Boatbill Heron was collected from 190-191 cm below the top of the pollen core, as the portion of the core at 191-195 cm below the surface had been removed for pollen analysis. The smaller size of this sample prevents precise comparisons of the quantity of botanical material with other samples.

Methods for Flotation

Seventeen soil samples were processed using a flotation tank (Figure 30.1). The tank is a 50-gallon PVC drum filled with water to about 15 cm from the top of the barrel. Approximately 30 cm from the top of the barrel, “L” brackets are attached on the inside. Upon these brackets rests a 1-2 mm wire screen supported by a steel frame. Penetrating the drum, roughly at water level, is a 2-inch diameter PVC pipe that extends outside of the drum and then bends downward. Water is therefore drawn off from the surface and flows down the pipe.

![Figure 30.1 Schematic of the Flotation Tank.](image-url)
For each sample, a piece of muslin fabric was folded into a bag, and a metal tag bearing the sample’s provenience was placed inside. The bag was then secured with duct tape to the end of the PVC tube. Samples were dumped onto the screen and large rocks resting on the screen were removed and set aside. The materials on the screen were gently agitated so the soil would pass through the screen and botanical materials would float to the surface. Because of their light densities, most botanical remains will float. In the flotation tank, these botanicals, as well as any other materials floating on the surface of the water, were drawn down the pipe and caught in the muslin bag, while the water drained out. Additional water was added with each sample to facilitate the drawing off of the botanicals, and care was expended so that materials would not remain stuck on the sides of the drum. When it was determined that all of the soil had passed through the screen, the screen was then removed from the tank. The materials on the screen, known as the heavy fraction, were then placed onto a piece of muslin along with a provenience tag. The muslin was tied up and hung on a clothesline to dry. The material that floated and had been collected in the muslin bag, known as the light fraction, was also placed on the line to dry.

When the material had thoroughly dried, each fraction was further processed separately under bright lights and with the aid of a 10X magnification hand lens. The fractions were sorted, enumerated, and when possible, identified. Each category was placed into a plastic bag along with a provenience tag, and provenience information was recorded on the outside of the plastic bag as well. The quantity of objects and the weight of each category were recorded, as well as a basic description and any notable information. All of the botanicals recovered were separated and sent to Dr. Kirsten Tripplett for laboratory analysis.

Flotation samples 1, 2, and 3 were from a midden at the Hershey site, which is located in the upper reaches of the Sibun River Valley. After sorting, the heavy and light fractions were removed by Tripplett for laboratory analysis in the United States. This study reports on the heavy and light fractions from flotation samples 4-17.

The generation of samples done for flotation was not random in nature but rather opportunistic, and this poses difficulties in the analysis. Nearly all of the samples analyzed were obtained from a burial at Pakal Na. While this high concentration of sampling provides a basis for making comparisons within the burial context, there is scant material for comparisons between contexts. The three samples from the Hershey site were not available for analysis, and only one sample each was taken from Operation 37 at the Oshon site and Operation 24 at Pakal Na. Another limitation of the sampling was that no control samples were taken. For example, it is difficult to determine if animal bones found in a sample represent a concentrated cultural deposit or merely a natural occurrence. Another limitation of the project was that the volume of the samples was not uniform. At times the possible volume of the sample was constrained by the sample context (e.g. Sample 15 was the contents of Vessel 2). For other samples, the quantity of material collected was left up to the discretion of the collector. Also, there was a lack of appropriate equipment to both weigh and measure the samples before they were processed in the flotation tank. The volume given for each sample is therefore an estimate. With the exception of the soil, each component of the sample was weighed after being processed and sorted. The scale used was not sensitive enough to weigh some of the extremely light objects; in the tables, the weights of these
objects are listed as “n/a.” Another difficulty involved in the project was the poor preservation of botanical remains that occurs in the humid tropics. The hot and wet climate promotes quick and thorough decomposition of organics. The only ancient botanicals that escape decay are usually those that have been charred, as they then become inert organics. However, charring obscures some of the characteristics used in identification.

Results from Pollen Core Sievings

The pollen core sievings resulted in the recovery of sizable quantities of well-preserved botanical remains. Each sample yielded between 0.2 and 14.9 g of botanical remains (Tables 30.1 and 30.2). The botanicals ranged from less than 0.05 cm, up to 7.9 cm in length. Neither particle size nor weight decreased with depth, but rather the size and amount of botanical material seemed random throughout the samples. However, the Storkbill Wallow material was on average smaller and lighter than was the material from Boatbill Heron. Almost all of the samples seemed to include wood, rootlets, and leaf fragments.

Two sizeable leaf fragments, both from Boatbill Heron, were the most notable botanical remains recovered. One came from BBH sieving 3, which corresponds 45-50 cm below the top of the pollen core. The leaf was not complete, but the part that remained measured 3.95 x 1.9 cm. The leaf was attached to a small petiole, but the leaf tip was not present. The leaf had alternating pinnate venation; the primary and secondary venation was clearly visible on both sides of the leaf. The edges of the leaf were smooth, and the leaf base was slightly heart-shaped, though not symmetrical. The front of the leaf was darker and shiny, while the back of the leaf was lighter and slightly fuzzy, although it was unclear whether these are characteristics preserved from when the leaf was alive or whether taphonomy has affected these aspects.

The other leaf fragment, from Boatbill Heron sieving 15, was collected from 205-210 cm below the top of the pollen core. The fragment measured 7.9 x 2.3 cm, and was seemingly part of a much larger leaf. The leaf had parallel pinnate venation, with tertiary veins running roughly perpendicular to the secondary veins. The venation was visible on both sides of the leaf. The leaf edges were smooth and the leaf base was tapered and rounded.

Categories Used in Analysis of Flotation Samples

In the tables to follow, sixteen separate categories of material retrieved from flotation samples 4-7 are enumerated (Tables 30.3-16). For each material, it is indicated whether the objects were found in the light fraction (LF), or heavy fraction (HF).

There is a category for charcoal, and another for “charred botanicals.” The charred botanicals category consisted of objects that were black or dark brown in the interior, with brown, reddish-orange, and/or mustard colored coatings on parts of the exterior. Some of the
objects in the category bore wood-like striations and shape, while others were more amorphous.

There is a category for fire-cracked rock (FCR) and another category labeled “FCR?” The objects in the “FCR?” category were black, brown, purple, or red. They were spherical, 0.15-0.35 cm in diameter, and some appeared to have a coating. They bore resemblance to seeds, and so were placed in a separate category, though it is now thought that they are small pieces of FCR.

The other categories are modern botanicals, animal claw, baked clay matter (BCM), bead, bone, charred seeds, debitage, human teeth, obsidian, rock, and sherds & eroded fragments. Shells identified as from land snails were placed in one category, while unidentifiable shells were placed in another.

Results

Comparison of Materials Recovered from Field Screening and from Flotation Sieving

Flotation sample 12 (Table 30.3) came from Operation 24 at the Oshon site. The sample was collected from Zone 2 of Square B, which was a layer of cobble debris underlying the topsoil. Square B was located on the eastern side of Structure 402, and the square encompassed part of the rounded structure as well as one of the two uncarved stelae, which stood in front of the structure. The silty matrix had a high density of limestone cobble and gravel inclusions, and this material may have been placed on the plaster floor and around the stelae to prevent the stelae from falling over (see Harrison, Chapter 16). A heavy density of artifacts was recovered both during field screening and from flotation sieving. Both retrieval methods yielded animal bone, debitage, sherds, and shell. Field screening additionally recovered a groundstone tool and obsidian. Charred seeds, charcoal, charred botanicals, and FCR were collected during flotation.

Flotation Sample 5 (Table 30.4) was collected from Operation 37 at Pakal Na. Operation 37 was located on a small 0.5 m high platform that projected off the north of Structure 109. This area was selected for excavation because magnetometry exploration of Pakal Na recorded an anomaly on the mound. Zone 4 of Operation 37 was defined as a black stain in Square A, thought to be a hearth feature, which contained charcoal flecks and burned sherds. No inclusions were noted in the zone, though debitage, obsidian, sherds, BCM, and a high concentration of FCR were recovered in the field. Flotation screening also yielded charcoal, debitage, sherds, and FCR, in addition to a small fragment of bone.

Samples 4, 6-11, and 13-17 all came from Operation 22 at Pakal Na. Operation 22 was located on structure 130, the largest structure of the settlement. Skeletal remains of five individuals were uncovered in the excavation. Burial 2 seems to have been the earliest interment, which was disturbed by a second interment. In this later interment, individual 1-A was placed in an extended position and nearby were placed bundle burials 1-B, 1-C, and 1-D.
Sample 8 (Table 30.5) came from Zone 2 of Square B in Operation 22. The zone consisted of tumble and a silty clay matrix from the east side of the structure, and the sample was taken from an area of debris seemingly associated with the terminal occupation of the structure. Both field screening and flotation sieving yielded bone, debitage, sherds, BCM, and FCR. Chipped tools, obsidian, and a net weight were also recovered in the field, while charcoal and shell were also recovered during flotation.

Sample 13 (Table 30.6) was soil from a pit feature in Zone 4 of Square B in Operation 22. Zone 4 consisted of gravel fill that covered the lowest terrace of structure 109, and of the darker gravel matrix that underlay the terrace surface. The pit was identified by a lack of inclusions and by its texture, which was much less compact than the surrounding matrix. During construction phase 2a, which seems to have immediately followed the interment of Burial 1, a second terrace was built over part of the earlier terrace, including the pit feature of Zone 4. During excavation, a groundstone tool was recovered, in addition to a light density of animal bone, debitage, obsidian, sherds, and FCR. Flotation sieving also yielded sherds and FCR, as well as charcoal and charred botanicals. Additionally, the flotation sample contained 356 spherical, blackish-tan seeds about 0.1 cm in diameter.

Sample 6 (Table 30.7) was taken from Zone 5 of Square B of Operation 22. Zone 5 constituted the top portion of the pit fill for Burial 1. The sample was collected because a relatively high density of carbon and other organics were noted in the matrix. The zone contained a high density of FCR, and both charcoal and burned sherds were also present, indicating either burning in the area or a secondary deposition from a hearth. A light density of artifacts was recovered at the screen, consisting of animal bone, debitage, obsidian, sherds, BCM and FCR. Like the material screened in the field, the flotation sample contained charcoal, FCR, animal bone, obsidian, and sherds. The flotation sample additionally included charred botanicals, jute, land snail shells, and other unidentified shells. The bones recovered from flotation sieving include two pherengial jaw fragments, three fish vertebrae, a jaw fragment with tiny teeth, longbone fragments from small animals, and other bone fragments that may be human.

Sample 11 (Table 30.8) came from Operation 22 in Zone 6 of Square B. The distinction between Zone 5 and Zone 6 was arbitrary, with Zone 5 being changed into Zone 6 after 25-30 cm. Zone 6 was thus a continuation of the burial pit fill. The density of artifacts was medium, and those recovered both in the field and in flotation sieving were bone, charcoal, charred botanicals, debitage, sherds, shell, BCM, FCR, and human teeth. Field excavations also recovered obsidian, a speleothem, a complete vessel, and a human cranial fragment. The human remains may be part of the partially disturbed Burial 2. That is, the bones may have been removed with the matrix during the creation of the pit, and then were reinterred along with the matrix when the burial pit was in-filled (Harrison and Acone, Chapter 10). The flotation sample was collected because of a high density of charcoal and other organics. Its contents included five charred seeds.

Sample 4 (Table 30.9) was taken from the pit fill just above the burial, which was classified as Zone 7 in Square B of Operation 22. A complete vessel (Vessel 5) was encountered during excavation. Both field screening and flotation sieving recovered animal bone, obsidian, sherds, botanical material, and BCM. Flotation proved very productive in
this sample; also contained in Sample 4 were charcoal, four charred seeds, land snail and other shells, an animal claw, a seed bead, debitage, and two human teeth.

Samples 16 (Table 30.10) and 17 (Table 30.11) also came from Operation 22, in Zone 7 of Square B. Vessel 5 was found inverted and so sediment samples were taken from beneath the vessel. The sediment was divided into two different samples for ease of transport. The matrix of in the vessel was similar to the matrix surrounding it in that both contained animal bone, sherds, botanical material, obsidian and BCM. The matrix inside vessel 5 also contained charcoal, shell, debitage, and a charred seed.

Samples 14 (Table 30.12) and 15 (Table 30.13) were collected from Zone 8 of Square A in Operation 22. Zone 8 is the matrix that surrounds the grave goods associated with Burial 1. Continuing a trend seen throughout the burial pit, a high density of charcoal and FCR was noted, indicating either a redeposited hearth or a ritual burning event. Artifacts were found in medium density in the field. A human cranial fragment bearing an incised mat design was uncovered resting on a mano fragment. Part of Vessel 1 was found in Zone 8. Vessels 2, 3, 4, and 5 were found lined up in a north-south orientation (though Vessel 5 was found in Zone 7, Square B, as indicated above). Two large jaguar teeth and two dog canine teeth, all perforated, also were found. Cinnabar, animal bone, debitage, obsidian, sherds, and botanical material were also uncovered. In addition, three seeds were found in a cranial fragment of Burial 1-C. Sample 14 was taken from the east side of the burial cut, near Burial 1-C. The sample was chosen because of its highly visible carbon. Flotation sieving led to the recovery of charcoal, FCR, animal bone, debitage, sherds, charred botanicals, shell, a cranial fragment and 12 charred seeds. Sample 15 consisted of the contents of Vessel 2. The sample contained charcoal, FCR, animal bone, sherds, charred botanicals and shell.

Sample 7 (Table 30.14) was taken from Zone 10 in Square A of Operation 22. The matrix of Zone 10 relates to the primary construction phase of Structure 130 (Zone 10 was not disturbed by later interments). The matrix is mostly compact clay and shows basket load stratigraphy. The light density of artifacts in the zone consists of sherds, animal bone, debitage, FCR, and complete Vessel 6. The sample was taken from underneath the vessel, which seems to have been part of a dedicatory offering during phase 1 construction. Flotation sieving of the matrix within Vessel 6 yielded charcoal, charred botanicals and FCR.

Samples 9 (Table 30.15) and 10 (Table 30.16) were collected in Zone 11 of Square A in Operation 22. Zone 11 consists of Vessel 7 and the immediately surrounding fill. The zone bears the basket load stratigraphy of construction phase 1, and is associated with Burial 2. Sherds and FCR constituted the light density of artifacts found in the field in Zone 11 of Square A. Samples 9 and 10 were taken from around the vessel, as charcoal and brown organic flecks were noted. Flotation sieving, like field excavation yielded charcoal, charred botanicals, FCR, and sherds. This method also led to the recovery of debitage, shell, animal bone, and two charred seeds.
Discussion

Sample 5 (Table 30.4) contained the highest concentration of charcoal of any sample (at 24.9 g per liter of matrix), as would be expected for a sample coming from a hearth. Further testing of the charcoal may reveal what type of firewood was being burned at Pakal Na during a specific time period, which in turn could provide information about the local environment at that time.

Sample 13 (Table 30.6) came from a pit feature and contained 356 of the same type of small seed. Laboratory analysis would provide further information on the deposit, and may help clarify whether the deposit had ritual significance.

Sample 11 (Table 30.8) and Sample 14 (Table 30.9) both contained human teeth, further supporting the theory that Burial 2 was disturbed by the interment of Burial 1, and that the disturbed bones were reinterred in the pit fill of Burial 1. The heavy fraction of Sample 14 also contained a seed bead and an animal claw. As the sample was taken from just above the burial, these objects may be grave goods associated with Burial 1.

Samples 4 (Table 30.9), 16 (Table 30.10), and 17 (Table 30.11) all came from Operation 22, Zone 7, Square B, though Samples 16 and 17 came from the soil under Vessel 5. Unlike the field excavation of Zone 7, Samples 16 and 17 yielded charcoal, shell, debitage, and a charred seed. However, similar artifacts where recovered from the flotation sieving of Zone 7 (Sample 4). Considered together, Samples 16 and 17 contained roughly 0.3 g of charcoal per liter of matrix (0.9 g in a three liter sample), while Sample 4 contained only 0.06 g per liter (0.9 g in roughly 15 l of matrix). While further analysis may provide more information, it seems that there was a burning event in Vessel 5 near the time of interment.

Sample 14 (Table 30.12), which was collected near the grave goods of Burial 1, contained 12 charred seeds, seemingly of 6 different types. These seeds may be grave goods themselves or perhaps were used in a mortuary ritual. A possible cranial fragment was also found in the sample, which may have been from nearby Burial 1-C. Alternately, the bone could be another fragment from the disturbed Burial 2. Sample 15 (Table 30.13) came from the contents of Vessel 2, which was located in the same zone. Roughly 1.47 g of charcoal per liter of matrix was recovered in Sample 15. In contrast, Sample 14, which was collected due to visible carbon, contained only about 0.3 g of charcoal per liter. Sample 15 also contained about 3.45 g of FCR per liter, while Sample 14 contained roughly 43.65 g of FCR per liter. The presence of five times as much charcoal, but only 1/13 of the amount of FCR in Vessel 2 as in the surrounding matrix seems to indicate that while the burial fill in general was subjected to a burning event, an additional, distinct burning event occurred inside Vessel 2.

Sample 7 (Table 30.14) contained less cultural material than other samples. The sample came from the first construction phase of structure 130, which incorporated a lot of culturally sterile clay. Zone 10 of Square A was apparently not disturbed by the later cultural activity which affected most of the other zones. The presence of 0.17 g of charcoal per liter in Sample 7 could indicate that low levels of charcoal may be characteristic of the matrix in
the region. Therefore, low quantities of charcoal in a sample may not indicate a burning event specifically associated with the sample context.

Flotation sieving of Samples 9 and 10 again yielded more information than excavation alone. Unlike Vessels 2 and 5, the matrix around Vessel 7, with only 0.08 g of charcoal per liter did not seem to indicate a burning event within the vessel. The results of flotation sieving included fish bones, microdebitage, and seeds—the types of small, delicate artifacts difficult to recover during excavation screening.

All of the soil samples processed showed some evidence of burning, containing both FCR and charcoal. However this pattern is at least partially due to the sampling procedure. The samples were taken mainly to recover botanical remains, and so soil with charcoal often was sampled because it visibly contained the sought-after material. Animal bone, including fish bone, was found throughout the burial fill of Operation 22, perhaps indicating that the fill was redeposited from another location.

The difference between the artifacts recovered in the field verses those recovered through flotation sieving was partially a function of size and fragility. For example, human bones and stone tools were often recovered in the field, while seeds and small bird and fish bones were more likely to be recovered in flotation. Flotation utilizes a smaller screen mesh, and the smaller quantity of matrix allows for a more detailed investigation of the sample. Flotation sieving also enables the separation of small and/or delicate botanical remains of which may be easily overlooked in the field.

Conclusion

Flotation sieving is a useful archaeological technique because it aids in the recovery of microdebitage, shell and bone fragments, and other small artifacts that may otherwise escape detection. In addition to presenting a more complete picture of the archaeological record, it is one of the more efficient means for separating out botanical remains.

After the seeds, charcoal, and other botanical remains are fully analyzed, a richer and more complex understanding of the areas from which these samples came will be possible. More information may be gleaned as to the local environments, the natural resources available, and the ways in which people utilized these resources. Further clues may be found as to what people ate, what fuel they burned, what plants they used in ritual, and what they interred with their dead.

Plants were undoubtedly of great importance to the ancient Maya living amidst the jungle. Crops were planted and harvested, food was consumed, shelters were erected, firewood was burned, medicines were prepared, rituals were performed, cloth was woven, etc.—all with the aid of plants. Since plants fulfilled so many key functions for the ancient Maya, it is fitting that plants should also play a key role in archaeologists’ understanding of these people.
The discovery of archaeological sites situated on terraces adjacent to, as well as several hundred meters from the Sibun River channel suggests a preference for locating habitation sites near rivers. Sites situated away from the main channel are commonly associated with small oxbows (abandoned stream meanders) or other river landforms such as terraces. These findings suggest that the dynamic nature of the Sibun River may have influenced the loci of human activities in the Sibun River Valley. The geomorphology of the river and the stratigraphy contained in natural stream deposits provide insight into the longer-term behavior of the river, which may have influenced the populations living along its banks. This section briefly summarizes observations and measurements made during a nine-day field reconnaissance visit in March 2001.

**Fluvial Geomorphic Reconnaissance**

Fluvial geomorphology refers to processes and landforms associated with streams and rivers (Ritter et al. 1995; Knighton 1998). Understanding fluvial processes, such as sediment entrainment, erosion, and deposition allows interpretation of stratigraphy contained in stream deposits. Materials that can be dated by conventional radiometric methods and other indirect indicators of relative time, for example the degree of soil development (e.g., Birkeland 1990, 1999), help provide constraints on periods of fluvial activity. Crosscutting relationships between fluvial landforms, such as terraces and cultural features also provide constraints on the timing of changes in fluvial processes. Paleobotanical evidence contained in sediments deposited in abandoned meanders often yield valuable information regarding not only the vegetation of the nearby area, but also important climatic and paleoflood information (see Jones, Chapter 34).

The reconnaissance field visit to investigate the fluvial geomorphology of the Sibun drainage had several purposes:

1. Gain an overall overview of the drainage system and general geologic and geomorphic framework.
2. Visit archaeological sites to observe their relation to the present channel and abandoned meanders of the Sibun River.
3. Observe changes in the morphology of the river from headwaters to the estuary.
4. Measure channel cross sections to describe the physical character of the river channel and its relation to the geologic substrate.
5. Observe and describe the fluvial stratigraphy exposed in stream banks and road cuts.
6. Measure profiles of stream terraces at selected sites to gain a better understanding of the geologic, geomorphic, or climatic influences on fluvial behavior.
7. Describe the soil morphology on fluvial terraces for correlation and relative age information.
Field Activities

During the field reconnaissance most parts of the drainage basin were visited. An aerial overflight was arranged to gain a regional perspective of the drainage and to observe changes in the character of the stream channel from the headwaters to the outlet. Ground reconnaissance trips included visits to:

1. Echo Canyon to observe fluvial terrace sequences at the mountain front.
2. Hershey site to observe fluvial terrace sequences, abandoned meanders, and to describe the stratigraphy and soil exposed in the principal river terrace.
3. Pakal Na and Pechtun Ha to observe abandoned meanders.
4. Samuel Oshon site to record fluvial terraces, stratigraphy, and soils.
5. Freetown Sibun to collect stream cross section data
6. The Jaguar Crossing area to profile stream terraces, describe soils, and to measure stream cross sections.
7. Measure the stream cross section near Churchyard.

Additional analysis of the longitudinal profile, river planform, and meander cutoffs was made at the field camp from topographic maps. Soil profiles were described following standard procedures outlined in Birkeland (1999).

Sibun River Overview

The Sibun River drainage is divided into three sections that roughly correspond to the geology of the region. These sections correspond to the headwaters, mid-reaches, and lower reaches sections described by Boles (1998). The drainage basin, which is about 1,200 km² in area, has relief of more than 1,000 m and is about 85 km long. More than 50% of the drainage lies below 80 m elevation and most of that area lies downstream from the Hummingbird Highway. The general hydrologic characteristics and behavior of a drainage basin can be described and partly explained through detailed geomorphic analysis of drainage networks and derivative products (Ritter et al. 1995; Knighton 1998). Although, this type of analysis was not performed during this reconnaissance visit, Boles (1998) performed morphometric analysis of 31 sub-basins in the Sibun drainage that helps to understand some of the spatial variation in the loci of fluvial erosion and deposition.

Headwaters Section

The headwaters section is underlain by metamorphic rocks and is bound by a system of range-front faults along which significant uplift of the Maya Mountains has occurred. The majority of the relief is contained in the steep headwaters region, which comprises about 50% of the drainage. The greatest number of tributary streams and total stream length is found in the headwaters region (Boles 1998). Geologic structures (e.g., bedding, fractures, and faults) control the orientation of stream reaches, but overall the stream segments are relatively straight and steep. The streams in the headwaters section transport a coarse bedload of gravel and cobbles derived from erosion of the metamorphic rock units. The stream channels are cut in bedrock; cascades and precipitous drops are common. The channel width to depth ratio is typically less than one, although local variations occur.
Little lateral migration of stream channels occurs in the immediate headwaters region, however, fluvial terrace remnants in some reaches suggest that channel migration has occurred in local areas.

The transition from the headwaters section to the mid-reaches section occurs at the northern margin of the Maya Mountains. In the transition section, a large alluvial fan has formed and a complex sequence of fluvial terraces is present. This zone is typical of mountain front piedmont settings where streams are less confined, thick fluvial deposits occur, stream channel banks are erodible, and complex cut-and-fill sequences of fluvial terraces are common (e.g., Ritter et al. 1995). Soil development on terrace remnants suggests that portions of the landscape may be in excess of 20,000 years old.

**Mid-reaches Section**

The mid-reaches section is underlain by Cretaceous limestone and dolomite and Paleocene limestone and chert (Boles 1998). Relief is greatest in the section near the mountain front and abruptly decreases downstream. The stream channel through the mid-reaches section has a high width to depth ratio and a channel bed that alternates between gravel and limestone bedrock. Stream pattern alternates from straight pool and riffle reaches ($P = 1.1 – 1.3$) to sinuous meandering reaches ($P = 1.5 – 2.4$). The straighter reaches typically have a bedrock channel that has alluvial banks and terraces that consist of sand and gravel. The relatively coarse fluvial deposits comprising the banks and adjacent terraces offer relatively low resistance to lateral erosion. The presence of relatively young point bars and steep cut banks indicate that channel widening is common. Broad fluvial terraces are common in this area, especially near the Hershey site, which is situated on a fluvial terrace approximately 4 m above the river. The presence of shallow abandoned channels and coarse cobble bars on the terrace clearly demonstrate the vulnerability of the Hershey site to flooding during extreme rainfall events (e.g., associated with hurricanes). The likelihood of inundation of the Hershey site area by relatively high-energy floodwaters is elevated because of its proximity to the mountain front.

Further downstream, the mid-reaches section has a prominent terrace that ranges in height from about 3 to 9.5 m above the river. Deposits are finer grained than observed near the Hershey site, however the river is presently transporting a gravel bedload. The gravel source is largely the in-stream channel bars that were deposited during floods associated with one of the large hurricanes in recent decades. The gravel is also being mined in the reach near Jaguar Crossing. The absence of paired fluvial terraces further substantiates the tendency of the river channel to migrate laterally in the mid-reaches section. The downstream boundary of the mid-reaches section corresponds to the constriction of the Sibun River valley at Gracy Rock.

Channel cross-sections were measured across pools and riffles using a level tape and a rod to measure depth at regularly spaced intervals across the channel. Channel cross-sections were measured at three stations near Churchyard and at the Jaguar Crossing. The channel at both sites is between 40 and 50 m wide. Stream depth rarely exceeded 1 m.

**Lower-Reaches Section**

The upstream limit of the lower-reaches section begins downstream from the bedrock constriction at Gracy Rock and Cedar Bank. The stream channel has a low width to depth ratio
indicating more cohesive banks that are resistant to lateral erosion and an erodible stream bed. The stream channel cross-section at Freetown Sibun was measured from a boat using a tape measure and a weighted line to measure depth. The channel in this section is nearly 5 times as deep and about 80% as wide as channel measured upstream in the mid-reach section.

A broad 3.6 m high terrace, prominent in the lower reaches is especially notable near the Oshon site. At Freetown Sibun the same terrace is approximately 2.6 m above the river.

Meanders

Analysis of aerial photographs, topographic maps, and field reconnaissance shows that meandering of the Sibun River occurs primarily in the lower part of the mid-reaches section and in the lower-reaches section. The frequency of meander cut-off activity is greatest in the lower-reaches between Freetown Sibun and Cedar Bank, and in the mid-reaches from Gracy Rock to just upstream from Churchyard. There may be a fundamental geomorphic reason for the location of the meandering upstream from Gracy Rock that differs from the cause for meandering in the lower-reaches section of the river.

Soil Geomorphology

Soil development can be expressed as a function of the soil forming factors of climate, vegetation, topography, parent material, and time (Jenny 1980). If the soil forming factors (with the exception of time) can be held constant then soil development becomes a function of time. Thus, for a soil formed under constant climate, vegetation, topography, and parent material the degree of development is time dependent. Although it is nearly impossible to hold all factors constant in the strictest sense, in the mid- and lower-reaches of the Sibun River drainage the factors have been relatively constant over the past few thousand years. Therefore, the relative age of fluvial landforms, such as flights of river terraces can be determined by comparison of the morphological characteristics of soils formed on the deposits underlying the terraces. This concept of time as the principal factor in the relative degree of soil formation is a powerful tool in identification and correlation of river terraces and other fluvial landforms along the Sibun River. Knowing the relative ages of terraces strengthens interpretations of the timing of fluvial system changes such as episodes of meander migration and cutoff.

Fluvial Terraces and Soil Formation

The degree of soil development was observed and described in river terraces at the following locations:

- Upstream from the Hershey site
- Near the Hershey site
- At the Jaguar Crossing site
- Near the Oshon site in the lower-reaches section.

Descriptions followed standard soil geomorphic procedures and nomenclature (Birkeland 1999; Soil Survey Staff 1999). Detailed descriptions were only obtained for the terrace sequence at the
Jaguar Crossing site, although brief, general descriptions obtained at the other sites were sufficient to make preliminary correlations. Figure 31.1 shows the spatial relationship of the fluvial terrace sequence at Jaguar Crossing. Table 31.1 lists the major characteristics of the soils formed on the Jaguar Crossing terraces as well as upstream sites and the Oshon site.

The terrace sequence at the Jaguar Crossing site contains at least 5 terraces that range in height from about 1 m (T5) above the river up to 9.5 m (T1). The youngest terrace (T5) is a small terrace inset into the slightly older T4 terrace. Both T4 and T5 terraces preserve evidence of recent fluvial deposition including bar and swale topography indicative of low and high flow channels. The oldest terrace T1, and the younger T2 and T3 terraces have less distinct primary fluvial erosional and depositional features because of surface modification. Drainage networks that have formed on terraces T1, T2, and T3 become progressively more developed (more defined branching stream network) with increasing age.

Higher terraces and erosional remnants along the drainage divide between the Sibun and Belize rivers indicate that the Sibun River is inset into a much older (Pleistocene and perhaps Pliocene) landscape. These soils are of such age that they are of limited use in the archaeological studies of this area, however.

**Relative Degree of Soil Development on Sibun River Terraces**

Terrace T1 has the most strongly developed soil found in the terrace sequences immediately adjacent to the Sibun River in the mid- and lower-reaches. The T1 soil a Bt horizon that is more than 270 cm thick and has color with 5YR to 2.5YR hue (Munsell Color Company 1975). In contrast, the T2 soil has a Bt horizon that is only about 1 m thick and is reddened only to 7.5 YR hue. The intermediate terrace (T3) has a B horizon that is only about 40 to 60 cm thick and reddened to 7.5 YR to 10 YR hue. The soils on these upper terraces are formed in sandy and silty
deposits that are consistent with overbank deposits. All soils show evidence of bioturbation (insect burrows, fecal pellets), obliteration of primary sedimentary structures, accumulation of pedogenic clay, mottling, and formation of soil structure (peds).

The next to youngest terrace, T4, has a thin organic horizon and relatively unaltered parent material. The deposit consists of alternating sand and silty sand and shows clear evidence of multiple erosion and deposition events. Primary sedimentary structures (e.g., ripples, planar bedding) are preserved and have not been destroyed by pedogenesis. The soil described on the 4 m terrace near the Hershey site and the soil described on the 3.6 m terrace at the Oshon site are most similar to the T2 soil at Jaguar Crossing.

**Age of Terraces**

The ages of the terraces have not been determined, however it is clear that terraces T1, T2, and T3 predate the occupation sites at Hershey, Pakal Na, and Pechtun Ha. Related to soils from a dated soil chronosequence in coastal Costa Rica (Bullard 1995) that have similar morphologic characteristics to the Sibun River soils, terrace T1 is likely greater than 25,000 years old. Terraces T2 and T3 have soil morphology that are similar to Costa Rican soils that have formed on fluvial deposits that are 4,000 to 6,000 years old.

**Implications for Archaeological Sites**

The success of the initial soil geomorphic reconnaissance shows that soil geomorphology will be a useful tool for correlation of fluvial landforms along the Sibun River. Subtle differences in the relative degrees of soil development can be used to better understand the location and timing of meander cutoff activity. Combined with ongoing paleobotanical and palynological studies, a clearer picture of fluvial behavior of the mid- and lower-reaches of the Sibun River will emerge. A better understanding of the timing of meander cutoff activity should be of use in the interpretations of archaeological sites that presently may be hundreds of meters from the active stream channel.

**Future Fluvial and Soil Geomorphology Research**

Field reconnaissance has reinforced the notion that the fluvial geomorphology of the Sibun River will be important to the understanding of the prehistory of the region. Having a better understanding of the Holocene history of the fluvial system will be important to understanding what parts of the landscape may or may not have been inhabited and during what periods. The history of the fluvial system may also be able to provide additional detail regarding settlement and trade patterns, village abandonment or expansion.

Future fluvial geomorphic studies will focus on three principal areas:
1. Late Quaternary geology of the Sibun River valley; this will be accomplished through aerial photograph interpretation and field mapping
2. Soil geomorphology along the river to allow for better correlation of river terraces and timing of meander cutoff activity
3. Changes in the locations and frequency of meander migration and cutoff activity over the past several thousand years.
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Jenny, H.

Knighton, D.

Munsell Color Company, Inc

Ritter, D.F., C.R. Kochel, and J.R. Miller

Soil Survey Staff
Chapter 32
Soils of the Sibun Valley: Modeling the Ancient Landscapes

Pat Farrell

The edaphic setting of the Sibun River Valley enjoys a rich diversity of soil types and potentials: a result of the dynamic nature of the alluvial history of the river and the varied terrain it traverses, from its headwaters in the Maya Mountains to its mouth at the Caribbean. The soil survey whose preliminary results are presented here was designed to examine present and past soil fertility, its susceptibility to erosion, potential for arboriculture, and pedogenic history. Transects were established in a variety of representative landscape assemblages such as karst slopes, solution valleys, and modern floodplains. Landscape models of the soils were developed with an eye towards situating ancient Maya settlement within the soils and landscape framework. The choice of settlement location within the landscape suggests the early inhabitants’ resource preferences and vulnerabilities. It may also be used to predict settlement location in similar soil-landscape settings. This approach follows the methodology of Dunning and others (Dunning et al. 1998; Fedick 1996), who emphasize the need for regional-scale studies of Maya adaptive strategies when examining the tremendous spatial variability of the lowland environment.

The models proposed here are tentative “first attempts” at landscape interpretation and are based solely on field observation. Subsequent laboratory analyses of the 150 pounds of soil samples collected during the 2001 field season will no doubt confirm, confound, and complicate these models. This analysis contributes to and broadens the scope of a preliminary report of the middle and lower reaches of the valley based on fieldwork conducted in 1999 (Farrell and Adkins 2001). That report provides the reader with background material on the climate, geology, and land use in the Sibun watershed. Figure 32.1 shows the location of the 1999 survey transects. The 1999 soil survey of the middle reaches of the watershed found striking differences in soils on the north and south sides of the river, due to its close proximity to the Sibun-Manatee karst hills on its southern border. North of the river a chronosequence of alluvial soils found on several terrace levels drapes the landscape from the river to the upland. South of the river, vertic, poorly drained clay soils separate the karst foothills from the modern floodplain. The preliminary examination of soils of the lower reaches of the watershed illustrated several alluvial soil landscapes, including terraces, alluvial splays, and poorly drained backswamps.

Study Location and Methods

Boles (1998) divided the Sibun watershed into four heuristic regions (headwaters, mid-reaches, lower reaches, and coastal zone) that differed markedly from one another in topography, geology, hydrology and vegetation. This scheme also offers beneficial application to the soil survey because these factors similarly control soil distribution. Figure 32.2 illustrates the soil study areas discussed in this report within the context of these heuristic regions.

Soil study locations were selected to represent the major soil landscape assemblages in the survey. Soils were described in the field according to USDA standard methods (Soil Survey Staff 1999). Where possible, soils in road cut, stream bank, or excavation exposures were studied. Where exposures were not
available, soils were extracted with a push tube, one inch diameter, Oakley soil probe. Selected soil samples were collected for laboratory analyses, including total phosphate, loss on ignition, particle size, and base saturation. Samples were transported to the Soils and Physical Geography Laboratory at the University of Minnesota Duluth for analysis. This report does not include lab analysis results.

To create the landscape models, soils representing various landscapes (for example, slope angle classes on the karst slopes) were described and sampled in the field by Rhiannon Jones, Chen Siam Lim, and Pat Farrell, in February and March of 2001. Based on field descriptions, soils were tentatively classified according to USDA taxonomy, and typical soil profiles chosen to include in this report. The models are idealized representations of the soil’s relationship to landscape and are not intended to be scale models. Given the preliminary nature of these findings, the soil taxonomic and horizon designations are tentative, and may change after laboratory analysis.

The chapter in this volume by Rhiannon Jones complements this report, providing details of soil transects, particularly with reference to karst and alluvial soil suites, and relates these soil types to ancient Maya land use.

I. Karst Slope Transect

The karst transect is located at the base of the Sibun Gorge, in the upper portion of the mid-reaches section (Figure 32.2). Here, thin stony soils mantle the steep slopes of kegelkarst cones in the Boundary Fault Karst Zone of Cretaceous age limestone, characterized by steep slopes and high elevation due to the structural fault, which forms its southern border. Streams originating in the Maya Mountains discharge low pH water onto the limestone, enhancing solution (Miller 1996). Soil depth and moisture content generally increase downslope due to colluvial accumulation. Small enclosed depressions may accumulate soils of significant depth (Day et al. 1987). To investigate the soils represented in this landscape, a transect was established in a southeast direction, down slope from the mouth of Chanona Cave to the valley floor. The transect includes soils in varying topopositions, soils in enclosed depressions, and soils formed on stream deposits.
The soils in the transect represent a toposequence (or “catena”) of soils that share the same climate, parent material, age, and vegetative cover, but differ in topoposition (slope angle). Figure 32.3 shows a landscape model diagram of the five soil types in the karst catena and one alluvial soil (Fluventic Haplustept) of non-karst parent material. In the actual landscape, these slope angles and soil types occur at all elevations on the slope, varying with micro-scale changes in relief. Each of these soils is described below.
Karst Slope Soil Type #1: Bajo Soil

Solution features in the limestone produce small, enclosed depressions (or bajos), in which cumulic soils exist to depths of over 100 cm. A typical bajo soil is a Haplustept, such as that described below. The A horizon is a very dark brown, silty clay loam with crumb structure. (These soils may have an O horizon due to the accumulation of litter in the depression.) The B horizon consists of an upper dark, reddish brown clay with subangular structure, and a lower illuvial dark, reddish brown clay layer. Limestone bedrock lies beneath the B horizon.

Haplustept, Bajo Soil

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth (cm)</th>
<th>Description</th>
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<tbody>
<tr>
<td>A</td>
<td>0-8</td>
<td>7.5YR 2.5/3 very dark brown, silty clay loam; crumb; organic; many fine roots</td>
</tr>
<tr>
<td>B1</td>
<td>8-27</td>
<td>5YR 3/3 dark reddish brown, clay; limestone flecks; weak subangular blocky</td>
</tr>
<tr>
<td>B2t</td>
<td>27-90</td>
<td>5YR 3/3 dark reddish brown, clay; weak platy; firm; clay skins; limestone flecks</td>
</tr>
</tbody>
</table>

Karst Slope Soil Type #2: Soils on 45-70% slopes

On the steep karst slope, the catena varies according to slope angle. The level of incline not only affects the amount of erosion and therefore soil thickness, but also affects the drainage, which determines the degree of downward translocation of clay and of mottling in the subsoil. As a result, with decreasing slope, soils become more highly developed and differentiated (demonstrated in the profile by an increase in the number of horizons and subhorizons). The sequence shows increasingly thick soils with an accompanying increase in the amount of clay translocation and horizon development. Figure 32.4 is a graph illustrating this relationship between soil depth and slope angle of the karst soils in the transect.

The steepest slopes consist of bare exposures of limestone, in boulders and escarpments, where no soils exist except in small fractures or tiny low angle surfaces. The steepest soil-bearing slopes (45 to 70 percent slope) have a very thin, stony, poorly developed soil, a Lithic Ustorthent. The typical profile is described in the table below. It consists of an A horizon of black or very dark gray-brown clay loam, with crumb to weak, subangular structure. The C horizon is a regolith layer of weathered limestone with pockets of dark brown clay.

Lithic Ustorthent, 45-70% Slope

<table>
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<tr>
<th>Horizon</th>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-5</td>
<td>7.5YR 2.5/1 black, clay loam; coarse limestone gravel with crumb</td>
</tr>
<tr>
<td>A2</td>
<td>5-13</td>
<td>10YR 3/2 very dark gray brown, clay loam; weak subangular</td>
</tr>
<tr>
<td>C</td>
<td>13-27</td>
<td>7.5YR 3/2 dark brown clay; weak subangular; limestone gravel at 27 cm</td>
</tr>
</tbody>
</table>
Karst Slope Soil Type #3: Soils on 25-45% Slopes

As the slope lessens to 25 to 45 percent and erosion has less influence, soil depth increases, distinguishing these soils from the ones described above. However, these soils do not exhibit B horizons, and are therefore classified as Entisols. They are not “Lithic” because the lithic contact is greater than 50 cm below the surface. The profile typically consists of a thin O horizon of dark reddish brown, clay loam with crumb structure, over an A horizon of dark reddish brown clay with weak subangular structure. At deeper levels, one finds a regolith and clay layer of reddish brown platy clay and limestone gravel. Parent limestone bedrock is encountered below this layer.
**Typic Ustorthent, 25-45% Slope**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>0-7</td>
<td>5YR 3/2 dark reddish brown, clay loam; crumb; many fine roots; limestone gravel; organic</td>
</tr>
<tr>
<td>A</td>
<td>7-50</td>
<td>5YR 3/2 dark reddish brown, clay; weak subangular; limestone flecks; firm</td>
</tr>
<tr>
<td>AC</td>
<td>50 - 80</td>
<td>5YR 4/3 to 5YR 4/4 reddish brown, clay; platy; limestone gravel</td>
</tr>
</tbody>
</table>

**Karst Slope Soil Type #4: Soils on 10-25% Slopes**

At this relatively low slope angle, soils develop subsurface clay horizons as a result of the stable slope environment, allowing steady translocation and accumulation of silicate clay over time. The soils at these slope angles belong to the Alfisol order because they have developed an argillic (clay) subsurface horizon, and are generally productive soils, with medium to high base status (Brady and Weil 2002). A typical Haplustalf from the transect is described below. A dark brown surface horizon of silty clay loam to clay covers a B horizon of strong brown clay, with illuviated clay skins, faint yellowish brown mottling and subangular to platy structure. The mottling demonstrates alternating wet and dry conditions. Limestone bedrock occurs at 93 cm.

**Haplustalf, 10-25% Slope**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>0-8</td>
<td>7.5YR 3/2 dark brown, silty clay loam; crumb</td>
</tr>
<tr>
<td>A</td>
<td>8-20</td>
<td>7.5YR 3/4 dark brown, clay; weak subangular; fine roots</td>
</tr>
<tr>
<td>B1</td>
<td>20-45</td>
<td>7.5YR 4/4 brown, clay; weak platy; fine limestone gravel</td>
</tr>
<tr>
<td>Bt</td>
<td>45-60</td>
<td>7.5YR 4/6 strong brown, clay; very firm; platy to subangular; clay skins; fine to medium gravel; black flecks</td>
</tr>
<tr>
<td>B2</td>
<td>60-93</td>
<td>mottles of 10YR 4/4 dark yellowish brown and 7.5YR 4/6 strong brown; clay; mottles increase with depth</td>
</tr>
</tbody>
</table>

**Karst Slope Soil Type #5: Soils on 0-10% Slopes**

Deep fertile soils belonging to the Mollisol order develop on the gently sloping to flat surfaces on the hillside. These soils possess a relatively thick, organic-rich surface horizon, overlying a clay subsurface horizon. While relatively rare on the steep karst slopes in the region, the existence of these soils in small pockets illustrates the great variation in soil productivity available on the karst. The Paleustoll encountered in the transect had a strong brown, 40 cm thick A horizon, with loamy texture and granular to crumb structure. The B horizon is a weakly developed layer of red and yellowish red, faintly mottled, silty clay to clay. The weathered limestone C horizon was 143 cm below the surface. In other karst regions of the Maya lowlands, these have proven to be very productive soils (Dunning 1992).
**Paleustoll, 0-10% Slope**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-10</td>
<td>7.5YR 4/6 strong brown, sandy clay loam (medium to coarse sand); granular</td>
</tr>
<tr>
<td>A2</td>
<td>10-30</td>
<td>7.5YR 4/6 strong brown, clay loam; few coarse sand; crumb</td>
</tr>
<tr>
<td>B1</td>
<td>30-50</td>
<td>5YR 4/6 yellowish red, clay; subangular</td>
</tr>
<tr>
<td>B2</td>
<td>50-67</td>
<td>2.5YR 4/6 red, clay; weak subangular</td>
</tr>
<tr>
<td>B3</td>
<td>67-75</td>
<td>5YR 4/6 yellowish red, clay; weak subangular; black flecks</td>
</tr>
<tr>
<td>B4</td>
<td>75-107</td>
<td>5YR 4/6 yellowish red with weak mottles of 7.5YR 6/6 reddish yellow mottles, silty clay; crumb to weak subangular; mottles decrease with depth</td>
</tr>
<tr>
<td>B5</td>
<td>107-132</td>
<td>5YR 4/6 yellowish red, silty clay loam to silty clay; crumb to weak subangular; black flecks</td>
</tr>
<tr>
<td>B6</td>
<td>132-143</td>
<td>5YR 4/6 with weak mottles of 10YR 5/6 yellowish brown, silty clay; black flecks</td>
</tr>
</tbody>
</table>

**Karst Slope Soil Type #6: Alluvial Soil**

A small stream incises the limestone in the transect. Judging by the varied lithologies of the gravel and cobbles in the bed load, the stream originates in the granites and metasediments of the Maya Mountains and discharges as tributaries to the Sibun River in the valley bottoms or disappears into poljes and trunk conduits (Miller 1996, Williams 1996). Not only are they carrying solution-enhancing waters from the mountain catchment, but also they are highly saturated with calcium bicarbonate from the carbonate rocks they incise. This was demonstrated by the travertine deposits in the stream bank traversed by the transect. Alluvial soils flank the streambed and a relatively poorly developed Fluventic Haplustept mantles the top of the steep banks. While these soils add variety to the suite of soils found on the slopes, their areal extent is limited. The Haplustept that we encountered had several sequences of buried B and BC horizons from accumulated stream deposits from earlier times of higher base level. The A horizon was a yellowish to dark brown sandy clay loam. The B horizons are yellowish red, sandy clay loam, sometimes containing fine gravel. Transitional BC horizons consist of firm silty or sandy clay loams, with fine gravel and weak mottling.

**Fluventic Haplustept, 0-10% slope**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-10</td>
<td>10YR 3/4 dark yellowish brown, sandy clay loam to clay loam</td>
</tr>
<tr>
<td>A2</td>
<td>10-30</td>
<td>7.5YR 4/6 strong brown, clay loam; weak subangular to crumb; fine to coarse sand</td>
</tr>
<tr>
<td>B1</td>
<td>30-40</td>
<td>5YR 4/6 yellowish red, sandy clay loam; very weak subangular; concretions</td>
</tr>
<tr>
<td>B2</td>
<td>40-50</td>
<td>5YR 4/6 yellowish red, clay loam; medium and coarse sand; fine gravel; firm; weak subangular</td>
</tr>
<tr>
<td>BC</td>
<td>50-66</td>
<td>2.5YR 4/6 red, silty clay loam; coarse sand to fine gravel; crumb to weak subangular; firm</td>
</tr>
<tr>
<td>2Bb1</td>
<td>66-76</td>
<td>5YR 4/6 yellowish red, silty clay loam; subangular; few fine roots;</td>
</tr>
<tr>
<td>2Bb2</td>
<td>76-89</td>
<td>5YR 4/6 yellowish red, loam; fine to very coarse sand; subangular</td>
</tr>
<tr>
<td>2Bb3</td>
<td>89-105</td>
<td>2.5YR 4/6 red, clay loam; coarse sand; subangular</td>
</tr>
<tr>
<td>3Bb</td>
<td>105-120</td>
<td>5YR 4/6 yellowish red, sandy loam; subangular; coarse-very coarse sand</td>
</tr>
<tr>
<td>3BCb</td>
<td>120-150</td>
<td>5YR 4/6 yellowish red, sandy clay loam to clay loam; subangular; weak mottling of 10YR 7/6 yellow; firm; coarse sand</td>
</tr>
</tbody>
</table>
Soils on the karst slopes are often described in soil surveys as thin, stony, and unproductive. However, our survey revealed a surprising amount of variation in soil type along these slopes. While the deeper, more promising soils occur in limited areal extent, the fact that soil variation is controlled solely by changes in slope angle, demonstrates the feasibility of increasing soil depth and productivity by artificial modification of slope angle, e.g., terrace construction. While no evidence of terrace construction was evident along this transect, possible terrace constructions were observed on slopes nearby. In other regions of the Maya lowlands, steep slopes were cultivated when population increase required marginal lands to be used for food production (Dunning and Beach 1995, Farrell and Smyth 1997).

II. Valley Soils

Valley soils in the study area range from fertile alluvial soils to highly weathered “old” soils, currently cultivated extensively for citrus production. Several transects, cores, and soil exposures were examined in order to create a landscape model of valley soils in the study area. The resulting diagram, Figure 32.5, and profile descriptions below are highly generalized summaries of field investigations.

![Landscape model of valley soils.](image)

Large solution valleys between the karst cones and towers are filled with deep deposits of highly weathered soils. Many of these soils are Pleistocene surfaces, which have subsequently been incised by various stages of the Sibun and its tributaries during the former times of higher base level and higher discharge. These incised valleys were subsequently filled by alluvial deposition in several sequences, the most recent forming the modern floodplain of the Sibun River (the Hershey archaeology site is located on this modern floodplain).
The surfaces formed by this sequence of events are subtle in expression, and have been greatly disturbed by citrus operations. The clearest expression of these surfaces in the study region was observed in Echo Valley, formed by a tributary stream originating in the Mountain Pine Ridge region of the Maya Mountains. Figure 32.6 shows the three surfaces observed in Echo Valley. The elevation of the surfaces decreases from level 1 to level 3 (the tributary stream is located roughly along the dashed line above the number ”3”). In addition to the Echo Valley transect shown in Figure 32.6, the soils of three other study area transects were combined to produce the Landscape Model, profile descriptions, and taxonomic classifications. These study areas include a second Echo Valley transect, an orchard transect near the archaeological site of Pakal Na, the transect through the cacao orchard near the Hershey archaeological site, and a roadcut exposure on the Hummingbird Highway near the Hershey site (Figure 32.2).

![Figure 32.6 Terrace levels in Echo Valley.](image)

**Valley Soils #1: Colluvial Soil in Solution Valleys**

The highly weathered soil mentioned above is great in areal extent in the study region and has been extensively cultivated for citrus production. Citrus is particularly amenable to this climate; budding will only occur in a dry season, and there exists no danger of frost. The nutrient-poor nature of this soil requires that it be fertilized in May and November with Nitrogen, Phosphorus, and Potassium (personal communication, Bert Fox 2001). Citrus is fairly flood-tolerant and elevation of the valley surfaces where this soil is found, are high enough that they are infrequently flooded for long periods of time (Boles 1999). These soils are extremely sensitive to erosion, demonstrated in the study region by severe gully erosion and loss of topsoil, revealing the rounded tops of B horizon columnar structure (Figure 32.7).

This soil is a Typic Paleustults. The most striking characteristic of this soil is strong red and white mottling in subsurface horizons. The soil has a brown silty clay to silty clay loam A horizon. A transitional AB horizon shows incipient yellowish mottling and strong structure. The extremely thick B horizon is deeply cracked due to shrink-swell clays, has a strong primary columnar structure and a strong secondary blocky
and platy structure. The consistence of the clay becomes very firm and hard with depth. In places, slickensides are evident on ped surfaces, further demonstrating the shrink-swell nature of the clay. From 55 cm downward, prominent clay skins cover the ped surfaces. Red and pale yellow mottles dominate the color profile at depth and gray colors are evidence of periodically saturated subsoils below depths of 240 cm. The roadcut exposure that was used for subsoil descriptions ended at 360 cm. Based on past soils surveys of Belize, the parent material for this soil is soft weathered limestone marl (King et al. 1992).

Figure 32.7 Exposed rounded tops of columnar structure in B horizon of orchard soils.
Typic Paleustult

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-10</td>
<td>10YR 4/4 brown, silty clay loam; organic flecks, many fine roots</td>
</tr>
<tr>
<td>A2</td>
<td>10-15</td>
<td>faintly mottled 7.5YR 5/6 strong brown and 2.5Y 5/4 light olive brown, silty clay; weak subangular</td>
</tr>
<tr>
<td>AB</td>
<td>15-40</td>
<td>moderately mottled 5YR 5/8 yellow red and 2.5Y 6/4 light yellow brown, clay; strong subangular; root pores</td>
</tr>
<tr>
<td>B1</td>
<td>40-55 cm</td>
<td>mottled 5YR 5/6 yellowish red and 10YR 5/4 yellowish brown clay; cracks</td>
</tr>
<tr>
<td>Bt1</td>
<td>55-70</td>
<td>firm compact clay; blocky to platy; root stains, clay skins, cracked, mottled 5YR 5/8 yellowish red and 2.5Y 5/4 light olive brown and 2.5YR 5/4 reddish brown</td>
</tr>
<tr>
<td>Bt2</td>
<td>70 – 100</td>
<td>strong blocky clay; strongly mottled 10R 4/6 red; 5YR 5/8 yellowish red and 5Y 7/6 yellow</td>
</tr>
<tr>
<td>Btss</td>
<td>100-130</td>
<td>strongly mottled 2.5YR 5/6 red, 5YR 5/8 yellowish red, 2.5Y 7/6 yellow clay; clay skins; slickensides; strong blocky</td>
</tr>
<tr>
<td>B’t1</td>
<td>130-160</td>
<td>strong mottles 5YR 4/6 yellow red, 5YR 5/8 yellowish red, 2.5Y 7/6 yellow mottles, clay, strong blocky, clay skins, firm and compact</td>
</tr>
<tr>
<td>B’t2</td>
<td>160-190</td>
<td>5YR 5/6 yellowish red, 2.5YR 4/8 red, 2.5Y 8/6 yellow, 10YR 6/6 brownish yellow strong mottles; clay; strong blocky; firm</td>
</tr>
<tr>
<td>B’t3</td>
<td>190-210</td>
<td>2.5YR 5/8 red, 5YR 5/6 red, 10YR 6/6 brownish yellow, and 5Y 8/3 pale yellow strong mottles; clay; strong blocky</td>
</tr>
<tr>
<td>B’t4</td>
<td>210-240</td>
<td>2.5YR 3/6 dark red, 5YR 5/6 yellowish red, 10YR 6/6 brownish yellow, and 2.5Y 8/4 pale yellow strong mottles; clay; strong blocky</td>
</tr>
<tr>
<td>Btg1</td>
<td>240-270</td>
<td>strong mottles 5Y 8/3 pale yellow, 10YR 7/6 yellow, 10R 4/6 red, 7.5YR 6/6 reddish yellow, and gley(1) B/10Y light greenish gray</td>
</tr>
<tr>
<td>Btg2</td>
<td>270-300</td>
<td>strong mottles 2.5YR 5/6 red, 7.5YR 6/6 reddish yellow, and gley(2) 8/10BG light bluish gray; clay; strong blocky</td>
</tr>
<tr>
<td>Btg3</td>
<td>300-330</td>
<td>strong mottles 2.5YR 4/8 red, 5YR 5/6 yellowish red, 2.5Y 5/4 pale yellow, and gley(1) 8/5 6Y light greenish gray; clay; strong blocky</td>
</tr>
<tr>
<td>Btg4</td>
<td>330-360</td>
<td>strongly mottled 2.5YR 4/8 red, 5YR 5/8 yellowish red, 10YR 6/6 brownish yellow, 5Y 7/4 pale yellow, and gley(1) 8/5 6Y light greenish gray; clay; strong blocky</td>
</tr>
</tbody>
</table>

Valley Soil #2: Terrace Soil

Several terrace segments are inset into the Paleustult. The first of these segments (Level 2 on Figure 32.6) is also a highly weathered soil belonging to the Ultisol order. It differs from the previously described soil in that the surface horizons have a higher silt content and mottling occurs at a greater depth. At 90 cm, a discontinuity separates the upper B horizon from the mottled subsoils described for the previous soil. The Landscape Model, Figure 32.5, shows a possible explanation for this sequence. The original surface was incised by fluvial erosion of an ancient stream. The A and upper B horizons (0 - 90 cm.) were subsequently deposited as alluvium in the basin eroded by that stream. Further excavation and analysis are required to confirm this scenario.
A typical profile of this Haplustult is presented below. Unfortunately, all soils in this category were examined using a hand coring device, which was unable to penetrate the clay beyond a depth of 120 cm.

**Haplustult**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-6</td>
<td>10YR 4/2 dark gray brown, silt loam, abrupt boundary</td>
</tr>
<tr>
<td>A2</td>
<td>6-30</td>
<td>7.5YR 4/6 strong brown, silty clay; weak subangular, fine roots, black flecks</td>
</tr>
<tr>
<td>AB</td>
<td>30-65</td>
<td>7.5YR 4/4 brown, clay; weak to strong subangular; black flecks</td>
</tr>
<tr>
<td>B1</td>
<td>65-80</td>
<td>10YR 5/4 yellowish brown, clay; strong subangular</td>
</tr>
<tr>
<td>B2</td>
<td>80-90</td>
<td>7.5YR 5/4 brown, clay; strong subangular</td>
</tr>
<tr>
<td>2Bt1</td>
<td>90-120</td>
<td>5YR 5/6 yellow red with strong mottles of 5YR 4/6 yellow red and 10YR 6/6 brownish yellow, clay; clay skins; black flecks</td>
</tr>
<tr>
<td>2Bt2</td>
<td>120-</td>
<td>strong mottles, clay; blocky; no longer able to penetrate clay</td>
</tr>
</tbody>
</table>

**Valley Soil #3: Terrace Soil**

The third terrace level (Level 3 in Figure 32.6), which is the floodplain of the tributary stream in Echo Valley, is an Ustorthent, a very poorly developed Entisol. A layer of gravel of various lithologies lies beneath 25 cm of sandy clay loam in this soil. This gravel layer is quite extensive in Echo Valley, further upstream, where the stream descends from the Maya Mountains. In that part of the valley, the gravel (and cobbles) may represent alluvial fan deposits, although fan morphology has been disturbed by reworking of the surface for citrus cultivation. A more detailed analysis of Echo Valley deposits is required to confirm this hypothesis. The gravel layer at 25 cm in the profile was presumably deposited by a high discharge stream in the valley in the past, as suggested in Figure 32.5. Below is a typical profile of an Ustorthent.

**Ustorthent**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-10</td>
<td>10YR 4/3 brown, sandy clay loam, medium to coarse sand</td>
</tr>
<tr>
<td>A2</td>
<td>10-25</td>
<td>7.5YR 4/4 brown, sandy clay loam; medium to very coarse sand</td>
</tr>
<tr>
<td>C</td>
<td>25-35</td>
<td>fine to medium gravel with sandy clay loam matrix, 7.5YR 4/4 brown</td>
</tr>
</tbody>
</table>

**Valley Soil #4: Modern Floodplain Soil**

The modern Sibun River has eroded older gravel deposit and the modern floodplain is being actively built by alluvial deposition. This interpretation is confirmed by the existence of the gravel and cobble layer at 250 cm in a cutbank exposure of the river, near the Hershey archaeological site. The fertile alluvial soil of the modern floodplain has been preferred in the recent past for cacao cultivation and it is likely no accident that a major Maya settlement was established on this soil. Alluvial soils are ideal for cacao cultivation, due to their structural stability, moderately developed texture, good drainage, high nutrient status, and high organic matter content. Deep roots allow them to withstand low magnitude floods (Muhs et al. 1985; Wood 1986). It is feasible that the alluvial landscapes of the Sibun were important cacao production centers for the ancient Maya as well. A transect through the Hummingbird Hershey cacao plantation at the
site revealed Ustifluvent soils, differing along the transect only in having slight textural differences in the surface horizons. These soils are extensively bioturbated by fauna in the shady cacao orchard, and therefore the upper horizons are greatly mixed. Two Ustifluvent profiles are presented below. The first is characteristic of soils closer to the stream and the second is typical of soils at a greater distance from the stream. There is a slight coarsening of texture in the surface horizons with distance from the stream but, again, the tremendous bioturbation makes this interpretation suspect.

These soils have deep loamy, brown and yellowish brown surface horizons. A transition is marked in the AC horizon by an increase in the amount of sand in the horizon. The C horizon is brown loamy sand over brown coarse sand.

**Ustifluvent 1**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-10</td>
<td>10YR 4/3 brown, silty clay loam; crumb</td>
</tr>
<tr>
<td>A2</td>
<td>10-40</td>
<td>10YR 4/4 dark yellowish brown, silty clay loam;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>very fine sand; crumb</td>
</tr>
<tr>
<td>A3</td>
<td>40-70</td>
<td>10YR 4/4 dark yellowish brown, sandy clay loam;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fine sand</td>
</tr>
<tr>
<td>AC</td>
<td>70-85</td>
<td>7.5YR 4/4 brown, sandy clay loam; medium to fine</td>
</tr>
<tr>
<td>C1</td>
<td>85-110</td>
<td>10YR 4/4 dark yellowish brown, loamy sand;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>medium sand; granular</td>
</tr>
<tr>
<td>C2</td>
<td>110-150</td>
<td>7.5YR 4/4 brown, coarse sand; single grain</td>
</tr>
</tbody>
</table>

**Ustifluvent 2**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-10</td>
<td>10YR 4/3 sandy clay loam, fine sand; crumb</td>
</tr>
<tr>
<td>A2</td>
<td>10-60</td>
<td>10YR 4/4 dark yellowish brown, sandy clay loam;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>crumb to weak subangular</td>
</tr>
<tr>
<td>AC</td>
<td>60-90</td>
<td>10YR 4/4 dark yellowish brown, sandy clay loam;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fine to medium sand; granular to weak subangular</td>
</tr>
<tr>
<td>C1</td>
<td>90-100</td>
<td>7.5YR 4/4 brown, loamy sand, medium sand;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>granular</td>
</tr>
<tr>
<td>C2</td>
<td>100-150</td>
<td>7.5YR 4/4 brown, coarse sand; single grain</td>
</tr>
</tbody>
</table>

**Valley Soil #5: Drainage Channel Soil**

The surface of the floodplain in the vicinity of the Hershey site is incised by shallow channels and swales. These are probably incipient drainages incised into the floodplain soils during floods. It is reported by local residents that during extremely high water periods in the rainy season, water covers the floodplain surface of the site. This amount of water would have the energy necessary to carve small drainage channels. A different soil type was observed at the base of these drainage channels. This soil is slightly more weathered than the surrounding floodplain soils, as shown by the presence of a weak B horizon, which is mottled due to alternating periods of wetting and drying. A typical Haplustept profile is described below. The soil has a dark brown loamy surface horizon. The B horizon is a mottled sandy clay loam. The hand corer prevented penetration of the soil to the presumed underlying sand parent material.
### Haplustept

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0-20</td>
<td>7.5YR 3/2 dark brown, sandy clay loam, fine sand; crumb</td>
</tr>
<tr>
<td>A2</td>
<td>20-70</td>
<td>10YR 4/3 brown with faint mottles of 5YR 4/4 reddish brown and 5YR 4/6 yellowish red, sandy clay loam (fine to medium sand); weak subangular</td>
</tr>
<tr>
<td>B1</td>
<td>70-80</td>
<td>10YR 4/3 brown with mottles of 7.5YR 4/2 brown, 5YR 4/6 yellow red, 5YR 4/4 reddish brown, sandy clay loam, weak subangular</td>
</tr>
<tr>
<td>B2</td>
<td>80-115</td>
<td>10YR 4/4 dark yellowish brown with mottles of 5YR 4/4 reddish brown and 2.5Y 5/4 light olive brown, sandy clay loam, medium sand; crumb to weak subangular</td>
</tr>
<tr>
<td>B3</td>
<td>115-150</td>
<td>7.5YR 4/4 brown with mottles of 2.5Y 5/4 light olive brown, sandy clay loam, fine to medium sand</td>
</tr>
</tbody>
</table>

### III. Soil Studies in the Lower Reaches of the Watershed

A soil survey of the Lower Reaches section of the watershed, although not as extensive as the Karst Slope and Valley surveys, was carried out near the archaeological sites of Oshon and Obispo, near the transition from the lower reaches of the Sibun to its coastal zone (Figure 32.2). Soils in this region were examined in two stream bank exposures—one near the Obispo site and one near the Oshon site—and one exposure at the Obispo site in a depression feature, locally known as the “noisy hole”. The origin of this feature is unknown, but it is possibly a soil pipe. Major differences between the lower and middle reaches of the basin are the higher water table, reduced stream gradient, and the low relief of the surface. The landscape is characterized by abundant oxbow lakes, abandoned meander channels, and poorly drained marshes (Boles 1998). Sediments are alluvium, colluvium, and occasional beach ridges, a result of sea level change in the Quaternary (Baldwin 1979). The 1999 survey described alluvial terrace, modern floodplain, and alluvial splay soil landscapes of the lower reaches zone (Farrell and Adkins 2001).

The three soil profiles, described in detail below, characterize alluvial soils which are more highly developed than those formed on the modern floodplain in the middle reaches, such as at the Hershey site. Unlike the Hershey floodplain soils, the soils described below belong to the Inceptisol order because they possess incipient B horizons, suggesting a higher degree of weathering, and less frequent cycles of flood erosion and deposition.

#### Lower Reaches Soil #1: Oshon Profile

This soil was exposed on the northeast bank of the Sibun River near the archaeological site of Oshon. The soil is a Haplustept, showing a typical alluvial sequence of soils buried by subsequent flood deposition. An AC horizon of yellow loamy sand overlies a yellowish brown loamy sand layer, a C horizon, deposited by the river in a flood. This layer has buried a former river deposit, which has an AB horizon of yellowish brown sandy clay loam over a strong brown sandy clay loam B horizon, with evidence of clay accumulation and faint mottling. The accumulated clay and mottling increases with depth in the lower subhorizons of the B layer. The stream surface obscured soil below 183 cm.
### Haplustept

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>0-32</td>
<td>2.5Y 5/4 light olive brown (moist), 2.5Y 7/4 pale yellow (dry) loamy sand; granular (1º) and single grain (2º); non-sticky, non-plastic; many fine to medium roots and pores; sl. hard (dry) and loose (moist); clear smooth boundary</td>
</tr>
<tr>
<td>C</td>
<td>32-43</td>
<td>10YR 5/4 yellowish brown (moist), 10YR 5/6 yellowish brown (dry) loamy sand; granular; non-sticky, non-plastic; soft (dry) and loose (wet); gradual wavy boundary</td>
</tr>
<tr>
<td>2ABb</td>
<td>43-80</td>
<td>10YR 5/6 yellowish brown (moist) and 2.5Y 5/4 light olive brown (dry) with common, faint 2.5YR 4/8 mottles; sandy clay loam; granular; soft; sl. sticky, mod. plastic; many medium pores; fine to medium roots; fine laminations; gradual, broken boundary</td>
</tr>
<tr>
<td>2Bb</td>
<td>80-155</td>
<td>7.5YR 4/6 str. brown (moist), 10YR 5/6 yellowish brown (dry) with faint mottles; sandy clay loam; weak subangular (1º) and crumb (2º); sl. sticky, mod. plastic; soft and loose; many v. fine pores; faint clay films in pores; clear irregular boundary</td>
</tr>
<tr>
<td>2Btb</td>
<td>155-183</td>
<td>7.5YR 4/6 str. brown (moist) with common faint 7.5YR 5/8 mottles, silty clay loam; coarse subangular (1º) and fine subangular (2º); mod. sticky, mod. plastic; firm, mod. hard; many fine pores; clay skins in pores and cracks; clear smooth boundary</td>
</tr>
<tr>
<td>2Btb</td>
<td>183-350</td>
<td>common distinct mottles 7.5YR 4/6 str. brown, 10YR 5/4, 10YR 5/6 yellowish brown (moist) clay; coarse subangular (1º) and fine subangular (2º), platy at depth; many fine pores; common prominent clay skins in pores increases to many at depth; very sticky, very plastic; firm;</td>
</tr>
</tbody>
</table>

### Lower Reaches Soil #2: Obispo Profile, “Noisy Hole”

A depression in the surface at the Obispo archaeological site is locally referred to as “noisy hole”. The surface expression and name suggest that this feature may be soil pipe, a collapse feature cause by a shallow subsurface drainage channel, sometimes forming downstream from water impoundments. A soil pipe would indeed be “noisy” during the rainy season in a region of high water table, such as the lower reaches of the Sibun. The soil exposed in this depression is another Haplustept, with two sequences of burial, due to flood deposits covering an existing soil. An A horizon of light yellowish brown clay loam covers a transitional AB horizon of dark yellowish brown, faintly mottled clay loam, showing clay accumulation. The B horizon is mottled and contains iron manganese concretions, both signs of cyclic wetting and drying of the subsoil. There is a buried B horizon of a yellowish brown sandy loam with mottles and clay skins. This covers a loamy sand, which buried a light olive brown clay layer, which is the B horizon of a previous soil surface. The exposure terminated at 135 cm.
**Haplustept**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0-14</td>
<td>2.5Y 4/3 (moist), 2.5Y 6/3 (dry) clay loam; medium subangular (1º) and fine granular (2º); sl. sticky, very plastic; firm, very hard; many fine to medium roots</td>
</tr>
<tr>
<td>AB</td>
<td>14-40</td>
<td>10YR 7/6 (dry) and 10YR 4/6 (moist) with many faint mottles of 10YR 5/6 (dry) and 5YR 4/6 (moist); clay loam; coarse subangular (1º) and med. subangular (2º); mod. sticky, mod. plastic; mod. hard (dry) and friable (wet); many fine roots; very faint clay films</td>
</tr>
<tr>
<td>Bt</td>
<td>40-65</td>
<td>10YR 7/6 (dry) and 7.5YR 5/8 (moist) with many distinct mottles, clay loam; massive (1º) and v. fine granular (2º); sl. sticky, very plastic; firm; very hard; many very fine pores; common faint and v. few distinct clay skins; dark stains and FeMn concretions</td>
</tr>
<tr>
<td>2Btb</td>
<td>65-100</td>
<td>10YR 5/6 (dry and moist) with many prominent mottles 5YR 5/8 (dry) and 5YR 4/6 (moist); sandy loam, fine to v. fine sand; massive (1º) and fine granular (2º); sl. sticky, non-plastic; soft, very friable; many prominent clay films</td>
</tr>
<tr>
<td>2Cb</td>
<td>100-135</td>
<td>2.5Y 6/4 (moist) with common distinct mottles 10YR 5/8 (moist); loamy sand; massive; non-sticky, non-plastic, loose; faint clay films</td>
</tr>
<tr>
<td>3Bb</td>
<td>135- ???</td>
<td>2.5Y 5/4 (moist) with many prominent mottles 2.5YR 4/8, 7.5YR 5/8, clay; subangular (1º) and platy (2º); mod sticky, very plastic, very friable; FeMn concretions</td>
</tr>
</tbody>
</table>

**Lower Reaches Soil #3: Obispo Profile, Stream Bank**

The soil on the west bank of the Sibun was exposed near the Obispo site. This soil again belongs to the Haplustept suborder. It has a thin O horizon of dark yellowish brown, highly organic, sandy loam. The A horizon is a dark yellowish brown clay loam. The B horizon is a strong brown silty clay loam, with accumulated clay. Beneath this layer is a transitional BC horizon of light olive brown, finely laminated sandy loam. The first C horizon in the sequence is a light olive brown loamy sand. This buries a sandy clay loam B horizon of a former soil surface. The parent material for this B horizon is a sand layer. The water level was encountered at 240 cm.
**Haplustept**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth(cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>0-7</td>
<td>10YR 6/4 (dry) and 10YR 3/6 (moist) sandy loam (v. fine to fine sand); granular (1º) and single grain (2º); non-sticky, non-plastic; loose; abundant organic litter; many fine to medium roots</td>
</tr>
<tr>
<td>A</td>
<td>7-50</td>
<td>10YR 5/6 (dry) and 10YR 4/6 (moist) clay loam; coarse subangular (1º) and fine subangular (2º); sl. sticky, very plastic; friable, slightly hard; charcoal flecks</td>
</tr>
<tr>
<td>Bt</td>
<td>50-100</td>
<td>10YR 5/8 (dry) and 7.5YR 4/6 (moist) with few faint mottles, silty clay loam; strong subangular; sl. sticky, very plastic; soft and friable; clay skins</td>
</tr>
<tr>
<td>BC</td>
<td>100-110</td>
<td>2.5Y 5/4 (moist) sandy loam; massive; sl. sticky, non-plastic; loose, finely laminated</td>
</tr>
<tr>
<td>C</td>
<td>110-120</td>
<td>2.5Y 5/4 (moist) loamy sand to sand; single grain; loose</td>
</tr>
<tr>
<td>2Btb</td>
<td>120-140</td>
<td>10YR 4/6 (moist) sandy clay loam (very fine to fine sand); few faint mottles; finely laminated; subangular; clay skins in pores</td>
</tr>
<tr>
<td>2Cb</td>
<td>140-240</td>
<td>10YR 4/6 fine, medium, and coarse sand</td>
</tr>
</tbody>
</table>

The modern floodplain alluvial soils of the mid and lower reaches of the Sibun belong to a different taxonomic classes because the river dynamics change from the mid to lower reaches of a stream. The mid-reaches of the Sibun is an area where sediment is actively being transported, with sand and gravel deposits constantly built up and washed away. The lower reaches, on the other hand, is a landscape of sediment deposition, with less frequent erosion intervals. In the lower reaches, the vast flat-lying landscape is almost entirely floodplain, and marshes and swamp forests are covered with water even in low-level floods. In other words, there is a greater surface area to receive flood water, thus decreasing erosion and increasing the amount of deposition (Boles 1999). This creates a more active soil environment in the mid-reaches, where soils are washed away by floods, and new soils formed on fresh deposits, with high frequency. In the lower reaches, soil surfaces are more stable allowing for greater weathering, rendering these soils less fertile and less vulnerable to flood erosion.

**Summary and Conclusions**

This soil survey demonstrates the need for watershed-scale soil surveys in order to reveal the tremendous variety of soil landscapes, obscured by smaller scale examinations. The karst slopes, where the Sibun descends from the Maya Mountains to the solution valleys, possess a complex suite of soil types caused by micro-scale changes in relief. The soils in this suite offer the possibility of artificial slope management to increase soil depth and cultivation potential. While there was no direct evidence of terrace construction in the transect, similar karst slopes were managed by ancient Maya agriculturalists for cultivation.

Soils in the solution valleys represent a chrono-sequence of varying ages. The old highly weathered colluvial soil, eroded from surrounding karst cones and towers, fills the majority of the surface area in the valleys, forming a flat surface well above the modern floodplain, which has been used extensively in this century for citrus production. These soils are low in fertility and very vulnerable to erosion. They must be fertilized and carefully managed in order to be sustainably productive. Solution valley soils in other karstic
regions of the Maya lowlands have proven to be agriculturally productive, if properly managed. The upper alluvial terrace soils are also used for citrus production. These soils are slightly more fertile but are also flood prone due to the lower elevation of their surface. The sequence of deposits underlying these terraces represents a complex history of the stream channel through changing climate and sea level. This study has merely “scratched the surface” of the nature of these changes. While many of these changes may be pre-Holocene, it will be instructive in future investigations to verify that assumption and to place the time of Maya settlement within the extremely dynamic alluvial history of the river. The lower terrace and modern floodplain soils are highly fertile due to frequent deposition of fresh alluvium, but they are susceptible to flood erosion and inundation. They are highly suitable to cacao due to the high nutrient status and the deep-rooted nature of the crop. Currently, they are cultivated for cacao and it is highly likely that they were used in much the same manner in the ancient past.

The differences in floodplain soils in the mid and lower reaches of the river illustrate the changes in floodplain morphology as the river approaches the sea. They also suggest that habitation requires a different suite of environmental adaptations. Soils are slightly more highly weathered and therefore less fertile. The hazards of these environments differ also; the lower reaches are less vulnerable to erosion, but the high water table makes a greater surface area vulnerable to flooding than in the lower reaches. The implications of this for modern day valley dwellers are no doubt much the same as they were for ancient inhabitants.
As Belize’s Sibun River flows out of its narrow mountain gorge, it enters a flat alluvial plain, nestled between karst foothills. Here, it passes the remains of ancient Maya settlement both grand and mundane. The Maya of this region were presented with two sharply contrasting landscapes: the karst and the valley floor. One has sharp relief, rocky outcrops, and is pitted with caves, the other is relatively flat and predictable with easy access to water, although flooding is a common problem. A soil survey was conducted in the vicinity of the Sibun’s exit from the mountains. In this paper, the soils from the karst and alluvial plain are compared to assess differences in resource potential and adaptive strategies for these two landscapes.

The Sibun River: An Overview

Belize enjoys a tropical climate with distinct wet and dry seasons. Much of the country is underlain by limestone, sometimes visible as spectacular karst topography. The Sibun River drains the Maya Mountains, which are composed primarily of the Santa Rosa Group of metamorphosed rocks with granitic intrusions. The Santa Rosa Group dates to the late Paleozoic and contains argillites, phillites, slates, and mudstones (King et al. 1992). The Sibun then passes through a region of karst before flowing across a broad, flat plain to the sea.

There is evidence of Maya occupation all along the river’s length. The area of study, the “upper mid-reaches,” provides the first habitable landscape along the Sibun, as upstream the river flows through the steep-sided Sibun Gorge among very rough terrain. In the alluvial valley of the upper mid-reaches can be found the large site of Hershey, smaller-scale occupation, such as seen in Echo Valley, and evidence of cave activity, as at Actun Chanona.

Today, the flood plains of this project area are used primarily for pasture and the growing of citrus and cacao. The slopes of the karst, covered in broadleaf forest, are for the most part unused, although signs of illegal logging were observed near Actun Chanona. Modern settlement in the area is relatively limited and is concentrated along the well-paved Hummingbird Highway, which runs through the area linking Belmopan to the north with the coastal town of Dangriga to the south east (Figure 33.1).
Soil Survey

Soil profiles were taken with a hand probe along five transects in the project area. Two transects were located at the Hershey site, two in Echo Valley, and one along the path through the karst to Actun Chanona. The soil profiles observed in these cores were described in the field for texture, color, structure, organic content, limestone inclusions, sand and/or gravel content, and any other features of note. Samples were taken from each profile for later laboratory analysis.

The landscape observed in the project area today is by no means identical to the landscape that existed when the Hershey site was inhabited over one thousand years ago. However, since the region must contain the same geologic materials and is subject to the same weathering, depositional, and pedogenic processes today as at the time of Maya occupation, it is assumed that the landscape and soil conditions of the past were very similar to those found in the present.

Alluvial Soils: Hershey

The Hershey site—named for the surrounding cacao orchard once owned by Hershey Chocolate—is located along the Sibun River, not far from the Hummingbird Highway. Hershey boasts an eleven meter tall pyramid and numerous platforms and other structures, all greatly disturbed by floral turbation. The site was investigated through survey and excavation for the first time during the 2001 field season.

Two soil transects were studied at the Hershey site: Hershey A and Hershey B. Hershey A spanned an area between the river and the Group B structures at the eastern end of the site core (Figure 33.2). Six profiles were examined, one every twenty five meters beginning at the top of the river bank. The first four profiles were located under mature cacao trees, the fifth among some wild cane plants growing in a seasonally inundated
elevation lower than the cacao, and the sixth close to Group B at the edge of an unsurfaced orchard road. Hershey B crossed a wide, shallow ditch running through the cacao, also near Group B (Figure 33.3). This feature could possibly be an artificial drainage ditch, of either Maya or historical origin, constructed to channel runoff into the Sibun. Transect B consisted of five profiles from the banks and bottom of the ditch.

As seen in Table 1, the soil of the Hershey A transect is fairly homogenous. Profiles 1 through 4, taken among the cacao, are all very similar and can be summarized in one generic profile (Table 33.2). Near the surface, this soil is an organic-rich, sandy clay loam. With depth, sand content increases until the soil becomes coarse sand. This sand may be from an old river channel or from past flooding events that were more serious than floods of today. There is little color change throughout these profiles, either between profiles or with depth.

Profile 5 is similar in its upper ten centimeters to the corresponding sections of the profiles from the cacao, but below that point, the soil becomes more gray in color and mottles appear. This profile remains sandy clay loam with depth, rather than increasing in sand content. Profile 6 is also similar near the surface to the rest of Hershey A, but this upper portion is all that could be recorded of the profile. An impenetrable surface—possibly a platform or plaza surface related to Group B—was encountered at 20 cm depth, although no limestone or plaster was found in the end of the probe.

The cut bank near the beginning of the Hershey A transect was observed and samples taken (Figure 33.4 and Table 33.3). These samples were collected from a greater depth than any of the Hershey A profiles. The cut bank displays a trend of increased sand with depth like that seen in the profiles from the cacao orchard. However, none of the three samples taken from the cut bank is as sandy as the bottom of Profiles 1-4 of Hershey A, even though they are from a greater depth. The sediment becomes extremely rocky near the water and was too solid for sampling beyond a depth of 220 cm.
The soil in and around the drainage ditch is similar to that found along the Hershey A transect, if a bit higher in clay content (Table 33.4). As with Hershey A, the profiles of Hershey B generally get sandier and/or coarser with depth. The bottom of the ditch contains mottling, while there is none atop the banks to either side. This is probably due to a greater amount of saturation in the ditch bottom than the land above it as water drains though the ditch to the river.

![Figure 33.4 River Cutbank Profile](image)

**Figure 33.4 River Cutbank Profile**

**Alluvial Soils: Echo Valley**

Flowing near the west entrance of Actun Chanona and entering the Sibun River from the west, tributary Echo Creek cuts a narrow valley through the karst (Figure 33.5). Maya occupation is apparent here in a number of mounds along the valley’s length. Today, this valley (dubbed “Echo Valley”) is used for growing citrus. A great deal of bulldozing has been done here to prepare the land for cultivation. Several mounds have been partially or completely leveled and all soils examined should be considered disturbed soils. Two transects were made in Echo Valley, the first near the head of the valley where the land has been cleared but not yet planted, the second further down the valley among mature orange trees. Transect Echo A spans three alluvial terraces while Echo B spans four.
Three profiles were taken in the Echo A transect, one on each terrace (Figure 33.6 and Table 33.5). There are many rocks of varying lithologies on the surface here, probably having been exposed by bulldozing. Profiles 1 and 2 were relatively shallow due to rocks and gravel halting the progress of the probe. Profiles 1 and 3 grow sandier with depth while Profile 2 gains more clay. Profile 3 contains more clay overall than Profiles 1 and 2.

As seen in Figure 33.7, a greater number of terraces are found further down the valley where the Echo B transect was made. This area is near the road leading from the Hummingbird Highway and there is a loading dock for orange trucks built above a high bank. One profile was taken on each of four discernable terraces, descending towards the creek. Profile 2 was taken on a higher terrace than Profile 1 when it was discovered that the site of Profile 1 was not on the highest point in this section of the valley.

The near-surface soil in these terraces generally seems to become coarser as one draws nearer the creek (Table 33.6). When the creek was at the same level as the upper terraces, the channel may have been well away from the location of the profiles taken there, and thus the sediment deposited in these areas was finer-grained than that found below. The sandy clay loam on the surface of the lower terraces may be from relatively recent flooding events, proximity to the stream allowing sandier sediment to be deposited there. The clay content of Profiles 1 and 2 increases with depth. Profiles 3 and 4 could only be extended 30 or 40 cm in depth before impenetrable surfaces were reached, so it is unknown if this trend continues into the lower terraces.
Flood Plain Land Systems and Soil Types

The soils found at Hershey and in Echo valley are derived from alluvial parent material. This alluvium consists mostly of siliceous sediments transported from the Maya Mountains with some calcareous sediment eroded from the karst (King et al. 1992). The Echo Valley soil profiles do not match the Hershey profiles very closely; only Echo A Profile 3 becomes sandier with depth in a similar manner to the soil in the Hershey cacao.

According to King et al. (1992), Echo Valley and the Sibun Valley proper are part of the Cayo Flood Plains land system, which is subdivided into low flood plain bench, high flood plain bench, and terrace landscapes, in order of increasing elevation above the river channel. Echo Valley has high bench and terrace landscapes, while the Hershey site is located on low and high bench flood plain. King et al. (1992) state that soils of the Melinda Suite are found in Cayo Flood plain alluvium. Melinda soils form in siliceous material and are well to moderately drained. The soil in the Hershey transects is probably from the Monkey River subsuite, which forms on low flood plain bench terrain. It is described as being young, gray or brown in color, subject to occasional floods, and ranging in texture from cobbles beds to clay. The soil seen in both Hershey transects fits this description, the homogeneity with depth being a sign of relatively undeveloped and thus young soil.

One interesting feature of the alluvial soil among the Hershey cacao is the lack of an O Horizon. The O Horizon consists of decaying organic matter - namely leaf litter. The leaf litter produced by the cacao is very thin and little of it has decayed. The absence of an O Horizon may be due to the periodic addition of alluvium to the surface during floods. Leaves and other organic matter may be buried before enough has accumulated and decayed to form an O Horizon. Such buried cacao leaves were observed fairly deep in the matrix of Op 50 in the Hershey D Group.

The soils in Echo Valley—at least those on the upper terraces—are doubtless older than the Hershey soils, being well above the present level of Echo Creek and thus not subject to the addition of sediment. However, since the Echo Valley profiles were relatively shallow and the soil recently disturbed, the maturity of these soils is not apparent. Erosion also may have altered Echo Valley soils by removing topsoil from the upper terraces and depositing it on the lower ones.

The soil subsuites found in terrace and high flood plain bench terrain are Quamina and Canquin. Quamina is similar to Monkey River, but older and formed from mixed siliceous/calcareous alluvium.
Canquin is even older, highly weathered and usually red or yellow (King et al. 1992). The Quamina subsuite more closely describes the soil from the two Echo Valley transects. Brightly mottled red and yellow clays seen in road cuts along the Hummingbird Highway may be examples of older, highly leached Canquin soil.

**Karst Soils**

The karst soil profile was taken along the path between Actun Chanona and the citrus orchard at the foot of the karst (Figure 33.8). The first three profiles were taken in a small depression at roughly the same elevation as the cave entrance. Profile 4 was observed downslope from this depression, near the base of a short limestone escarpment. Profiles 5 through 12 continue down the slope to the edge of a high stream bank. Profiles 13 through 15 cross the stream to the top and flanks of a broad, flat ridge. All along its length, the path is shaded by broadleaf forest that includes cohune palms and mahogany trees. Leaf litter is abundant under the canopy and contains many cohune nuts.

![Figure 33.8 Karst Transect.](image)

Soil along the karst transect is mostly clay, or at least contains a great deal of clay (Table 7). At the surface, soils are dark brown and organic rich. With depth, these soils become lighter and redder. There is much variation in the karst soil, both vertically and laterally, the primary reason most likely being abrupt changes in the topography of the surface and of the underlying limestone.

The soil in the depression at the head of the transect is very shallow, having formed in a pocket in the limestone. Profiles lower down the transect are deeper, as this is where sediment eroded from above is deposited, forming much thicker beds of parent material. Profiles 11 and 12 are much sandier than any profile before them and show a trend of progressively higher sand content closer to the stream. Profiles 13 through 15—located on the far side of the stream—are also relatively sandy near the surface, but become less so with depth. This sand near the stream is an odd phenomenon. All of the soil profiles are too far above the level of the stream for sand to be deposited over them during normal stream flow or even most floods. Nor does there appear to be a sand source on the slope above from which this material could be washing down.
Karst Land Systems and Soil Types

King et al. (1992) designate the karst in this region as part of the Xpicilha Hills with Plains karstic land system. A variety of landscapes are found within this system, including high, medium, and low karst, gently sloping foot slope, and rolling plain. Chanona and most of the karst soil transect fall within a zone of High Karst. The soil type listed by King et al. for this landscape is Cabro, a subsuite of the Chacalte Suite of soils. These soils are clays formed over cretaceous limestone and subsuites are distinguished by soil depth. Cabro is the most shallow, and can be black, brown, or reddish. This certainly describes the soil found in the uppermost profiles of the karst transect, but the soils closer to the stream may represent the deeper Xpicilha and San Lucas subsuites. These soils can be black, dark grey, reddish or have yellowish brown mottles and may have black magniferous concretions. Such colors, along with black flecks, were observed in the lower profiles of the karst soil transect.

According to Land Systems Map 1-D of King et al. (1992), the area at the base of the Chanona karst, near the Sibun, is part of a different land system: Ossory Plains with Hills. This consists of a foot slope region that also contains Chacalte soils, probably formed of material eroding from the karst.

Discussion: Agriculture and Resource Potential

Alluvial soils have the advantage of being deep and at less risk from erosion, and their nutrients may be replenished by new flood deposits. King et al. (1992) describe the Melinda Suite soils as very suitable for agriculture, being fertile and adequately drained. Monkey River soils are especially chemically fertile as they are relatively unweathered and thus little clay and organic material has been translocated away. Quamina soils have the benefit of a lower risk of floods. The alluvial soil along the Sibun and in Echo Valley should have been appropriate for growing just about any crop the Maya could have needed. This, and proximity to the Hershey site and the mounds in Echo valley make any land in the flood plains of the project area extremely likely to have been cultivated for a variety of crops by the Maya.

The high karst at the head of the karst soil transect is described by King et al. (1992) as an agriculturally unproductive landscape due to erosion hazards and shallow soils. One must keep in mind, however, that just because this land falls under one modern concept of “agricultural unsuitability” does not necessarily mean it was such to the Maya.

“High karst” aside, Chacalte soils do have some agricultural potential, depth and slope permitting. King et al. (1992) suggest timber, rootcrops, and pasture as the best strategies for exploiting medium and low karst terrain, with various crops such as beans, cacao, and maize being possible but less successful. Xpicilha soils are described as moderately suitable for cacao cultivation, but less so for citrus due to the chemical nature of the soil. Therefore, at least some land in the karst could have been cultivated if the Maya so desired, most likely through the construction of artificial terraces to compensate for the rough terrain.
Evidence has been found across the Maya region that terracing was employed as an intensive means of agriculture. Terraces allow for the cultivation of fertile land where the soil would otherwise be too shallow, too easily eroded, or lying at too steep an angle for crops to be easily grown. The calcareous soils that accumulate among the foot slopes of karst hills are generally fertile and suitable for continuous agriculture (Turner 1978).Fedick states that “terraces are consistently associated” with such soils (1996:128).

Hammond (1978) has suggested that terracing is a mark of expansion into areas usually left uncultivated in response to a growing population’s demands on the food supply. The energy required to construct terraces is such that if there were no need to do so, such as on land flat enough to be cultivated without terracing, the task may not be undertaken in the first place (Turner 1978). No artificial terraces were observed along the path to Actun Chanona, however. If none exist here, it could suggest that populations in the project area were never high enough to warrant agricultural expansion into the karst foothills. On the other hand, since King et al. (1992) suggest that this section of karst is unsuitable for agriculture, the slopes near Actun Chanona may never have been a target for agricultural expansion, whether the demand existed or not.

The Maya used soil for more than just a medium for agriculture. Soil could be material for construction fill or a source of clay for construction and ceramic production. Most likely, the construction fill found in the structures at Hershey came from within the immediate vicinity of the site, as the closer the source, the easier and faster the process of construction. The soil in the karst contains more clay than the alluvium along the river. If Maya were gathering clay from anywhere in this area for ceramics, it is likely to have been in the karst. It is possible some of the vessels found in Chanona cave were made from local clay. This clay could have been collected near the entrance and vessels made just outside or even inside the cave, although no evidence of pottery firing has been detected. Petrographic analysis of Chanona vessels would have to be conducted to determine their origin.

Conclusions

The Maya of the upper mid-reaches of the Sibun watershed were presented with two distinct landscapes off of which they could subsist. The alluvial plains would have been the more desirable land for cultivation, as is the case today. Agriculture may have been expanded into the karst slopes if demand was great enough, and terraces would be evidence of such expansion. Work remains to be done in the project area, both in terms of soil survey and overall archaeological investigation, and laboratory analysis will no doubt add to the findings presented here. The lower slopes of karst hills elsewhere in the region around Hershey should be surveyed for signs of terracing, as this would give some insight into population levels at the time the site was inhabited, and pollen and archaeobotanical analysis might yield clues as to exactly what crops were grown by the Maya in this area.
Fedick, Scott L.

Hammond, Norman

1992 *Land Resource Assessment of Northern Belize* Bulliten #43. Kent, UK: Natural Resources Institute, Britain’s Overseas Development Administration.

Turner, B. L.
As part of the Xibun Archaeological Research Project (XARP), pollen coring and analytical efforts were undertaken during the 2001 field season. It was anticipated that a detailed examination of fossil pollen might provide insights into past human activities in the project area. Further, the detailed examination of both pollen and charcoal might offer information on agriculture, forest clearing and cycles of reforestation. Finally, the examination of ancient grinding surfaces on stone tools might provide information on specific crops grown and utilized by the ancient inhabitants.

To accomplish these goals, we decided to core a series of oxbow lakes and ponds adjacent to well-dated archaeological sites. By obtaining these cores, we were hoping to collect a continuous stratigraphic sequence spanning the period from Maya times to present. A detailed examination of the sediments might provide information on past events, including hurricanes, and massive erosion from natural and human-caused disturbances. Changes in vegetation, apparent in the pollen record from these sediments, would provide important baseline information on both paleoenvironmental and archaeological data from the little-studied central Belize area.

Collection

Sediment coring locations were selected based on their proximity to documented archaeological sites, and their likelihood of providing long cores extending to Maya times. Sites selected for coring were Churchyard Oxbow (CHOX-1), Oshen’s Lagoon (RL-1), an oxbow at Pechtun Ha (BBH-1) and a small pond in a sink feature at Pakal Na (SW-1). Prior to coring, a brief survey of the local vegetation was undertaken.

Sub-surface sediments were collected by pushing a two-inch diameter tube into the soft sediments of the oxbows. Although this is not the most desirable method of coring, it was quite effective in the clay-rich oxbow sediments. The heavy clay sediments present in these environments are difficult to collect with either a Livingston type piston-core or a vibracore apparatus. When full, the tubes were sealed and extracted from the ground. In some cases, it was apparent that organic-rich sediments continued into the lake sediments, and deeper cores were collected by inserting a new core tube into the same hole. A certain amount of compression of the softer sediments was present in all of the cores, but organic-rich sediments were collected in all of the locations. The total length of the core extracted from the Churchyard Oxbow was 83 cm representing about 150 cm of deposits. The core from Oshen’s Lagoon contained 170 cm of sediments representing a total depth of 280 cm. The core from the oxbow at Pechtun Ha represents our longest record with a total of 278 cm of deposits representing a total depth of approximately 390 cm. This core could not be continued as the core tube encountered a deeply buried log. Wood samples were collected from the log and will provide a date for the age of this core. The core from Pakal Na represented a total of 127 cm of deposits spanning an approximate depth of 2 m.
After the sediments were collected, the tubes were carefully labeled, cut to length, and transported to camp for extrusion and sampling. Extruded sediments were carefully described, and were sampled every 5 cm, and at significant sediment boundaries. Pollen sediment samples were placed in sterile whirlpaks for transport to the pollen laboratory at Texas A&M University.

At the time of sediment sampling, it became apparent that the sediments from two of the cores were better than the others. Both the Oshen’s Lagoon and Churchyard Oxbow cores were thought be young in age, representing perhaps the last 50 to 100 years of sediment deposits. The Pakal Na and Pechtun Ha cores, however, were thought to represent a longer sequence, and were selected for subsequent analysis.

In addition to the sediment cores, pollen samples were collected from a mano and metate recovered from Metate Cave. A standard pollen wash technique was employed in the collection of pollen from the artifact, where a portion of the grinding surface was washed with water, then Acetic Acid, followed by another wash. During each wash, the grinding surface was gently scrubbed with a clean brush, and the liquid was collected.

**Processing**

As sediments were collected from fill below the water, excellent pollen preservation was expected, thus small sediment samples were utilized in this project. The Pakal Na and Pechtun Ha pollen samples were first quantified (1 cc), placed in sterile beakers, and a known quantity of exotic tracer spores was added to each sample. Here, European *Lycopodium* spp. spores were chosen as an exotic, because these spores are unlikely to be found in the actual fossil pollen assemblages from this region. Tracer spores are added to samples for two reasons. First, by adding a known quantity of exotic spores to a known quantity of sediment, fossil pollen concentration values can be calculated. Second, in the event that no fossil pollen is observed in the sediment sample, the presence of *Lycopodium* tracer spores verifies that processor error was not a factor in the pollen loss.

Following the addition of the tracer spores, the samples were washed with concentrated Hydrochloric Acid. This step removed carbonates and dissolved the bonding agent in the tracer spore tablets. The samples were then rinsed in distilled water, sieved through 150 micron mesh screens, and swirled to remove the heavier inorganic particles. Next the samples were consolidated, and 60% Hydrofluoric Acid was added to the residues to remove unwanted silicates. After the silicates had been removed, the residues were rinsed thoroughly, and sonicated in a Delta D-5 sonicator for 30 seconds. This step deflocculated the residues, effectively removing all colloidal material smaller than two microns.

Next, the samples were dehydrated in Glacial Acetic Acid, and were subjected to an acetylation treatment (Erdtman 1960) consisting of 9 parts Acetic Anhydride to 1 part concentrated Sulfuric Acid. During this process, the samples were placed in a heating block for a period not exceeding 8 minutes. This step removed most unwanted organic materials, including cellulose, hemi-cellulose, lipids and proteins, and converted these materials to water-soluble humates. The samples were then rinsed in distilled water until a neutral pH was achieved.

Following this treatment, the samples were next subjected to a heavy density separation using Zinc Bromide (Sp.G. 2.00). Here, the lighter organic fraction was isolated from the heavier minerals.
After this treatment, the lighter pollen and organic remains were collected and washed in 1% KOH to remove any remaining humates. The residues were then dehydrated in absolute alcohol, and transferred to a glycerine medium for curation in glass vials.

Pollen wash samples were processed in a similar fashion. As the wash was prepared with dilute Acetic Acid, it was not necessary to use Hydrochloric Acid to remove carbonates. Residues were consolidated, screened through 150 micron mesh sieving, and were dehydrated in Glacial Acetic Acid. The residues were next acetylated, and subjected to a heavy density separation. Samples were then placed in vials for curation.

Permanent slides were prepared using glycerine, and identifications were made on a Jenaval compound stereomicroscope at 400-1250x magnification. Identifications were confirmed by using the Palynology Laboratory’s extensive pollen reference collection.

A standardized technique was utilized in counting the XARP pollen, where a minimum of 200 fossil pollen grains were counted from each sample, as suggested by Barkley (1934). This technique has become standard practice among most palynologists, and is thought to reflect past vegetation or economic plant usage fairly well.

Concentration values were calculated for all sediment samples. Hall (1981) and Bryant and Hall (1993) note that concentration values below 2,500 grains/ml of sediment may not accurately reflect past vegetation conditions, and usually indicate a record of a differentially preserved pollen. As a result, counts with low concentration values should be viewed with caution. Fossil pollen concentration values could not be calculated for the pollen wash samples, as a known volume of sediment was not collected.

Results

Well-preserved fossil pollen was noted in all of the sediment samples examined. Pollen concentrations were high in most of the core samples, indicating that the ancient sediments probably remained consistently wet since they were deposited. These conditions inhibit pollen-destroying fungi and bacteria. Pollen washes from the mano and metate also contained well-preserved fossil pollen, and counts and percentages are presented in Table 34.1. As a known volume of sediment was not examined, it was not possible to calculate concentration values. The presence of pollen grains that are considered to be fairly fragile, however, confirms that pollen preservation on the wash samples was excellent.
Table 34.1 Pollen Counts and Percentages from the Mano and Metate Washes.

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Mano</th>
<th>Metate</th>
</tr>
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<tbody>
<tr>
<td>Cyperaceae</td>
<td>2 (1.0)</td>
<td>3 (1.5)</td>
</tr>
<tr>
<td>Typha</td>
<td>2 (1.0)</td>
<td>2 (1.0)</td>
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<tr>
<td>Juncus</td>
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<td>Asteraceae Low Spine</td>
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<tr>
<td>Poaceae</td>
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</tr>
<tr>
<td>Polygonaceae</td>
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<td>3 (1.5)</td>
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<tr>
<td>Verbenaceae</td>
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<tr>
<td>Vitis</td>
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<td>2 (1.0)</td>
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<tr>
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<tr>
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<tr>
<td>Sabal</td>
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<td>Bursera</td>
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<tr>
<td>Cf Byrsonima</td>
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</tr>
<tr>
<td>Cecropia</td>
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<td>7 (3.4)</td>
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<tr>
<td>Ceiba</td>
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<tr>
<td>Celtis</td>
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</tr>
<tr>
<td>Coccoloba</td>
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<td>8 (3.9)</td>
</tr>
<tr>
<td>Combretaceae</td>
<td>8 (3.9)</td>
<td>10 (4.9)</td>
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<td>Fabaceae</td>
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<tr>
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<td>Spondias</td>
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<tr>
<td>Tiliaceae</td>
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<tr>
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</tr>
<tr>
<td>Unknown P</td>
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<td></td>
</tr>
<tr>
<td>Unknown R</td>
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<td></td>
</tr>
<tr>
<td>Unknown Z</td>
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</tr>
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<td>Total</td>
<td>203 (100)</td>
<td>204 (100)</td>
</tr>
</tbody>
</table>
Discussion

Pechtun Ha

A total of 15 pollen samples from the Pechtun Ha oxbow core was examined. These samples were collected in 20 cm increments from a core 278 cm in length, and well-preserved fossil pollen was identified in all of the samples. Although undated, the presence of domesticated maize pollen from the lower part of the core, along with a slight increase in charcoal (not graphed) near the base suggests that the sediments go back to the time of Maya occupation in the area.

It is clear that the pollen record from Pechtun Ha is dominated by arboreal taxa, reflecting the natural forest in the oxbow area. Samples below 180 cm (Zone I) reflect a slightly more open environment, probably reflecting the naturally regenerating forest after large scale Maya occupation in the area. Here, there is a slightly higher percentage of both Pinus (pine) and Quercus (oak) pollen. These taxa have been transported into the closed oxbow through the action of the wind, and their percentages increase in a more open environment. The presence of Zea mays (maize) in this zone probably reflects small-scale milpas in the vicinity, while the slightly higher percentage of Sapotaceae (Sapote Family) and Spondias (hogplum) pollen in the lower zone may signal the continued presence of these trees, species likely to have been cultivated by the Maya. Alchornea, Arecaceae (Palm Family) and Cassia pollen are present in higher percentages near the base of the core, and are probably pioneer species.

Above 180 cm in the core, the pollen samples reflect a heavily forested environment. With time, there is a gradual increase in the percentage of Orbignya (cohune) pollen indicating that a corozo thicket had at one time been present in the oxbow area. Non-economic forest taxa become common, including Gymnopodium and Sapindaceae (Soapberry family), and there is a significant increase in Cyperaceae (sedge) and Typha (cattail) pollen. These non-economic taxa would all be selectively removed were the region to have been inhabited during this period.

Above 30 cm, there is a sudden and dramatic change in the local environment. Many forest taxa are significantly reduced, while Poaceae (Grass Family), Moraceae (Mulberry Family, Ramon) grains suddenly increase. These changes reflect the partial clearing in the area, probably for historical period subsistence farming, pasturage, and more recently for large-scale citrus orchards. While it is unlikely that Moraceae trees were spared the axe during this period, it is important to realize that this is one of the few tropical arboreal taxa in Belize that is pollinated by the wind rather than by insects, and is thus usually over-represented in pollen spectra from this region. The increase in Moraceae pollen near the top of the Pechtun Ha core probably records the removal of the forest surrounding the oxbow, thus allowing its pollen to blow into the lake, to be subsequently incorporated into the sediment record.

Pakal Na

A total of 15 pollen samples from the small aguada near Pakal Na were also examined. These, samples, examined in 10cm increments, represent the entire 127 cm length of the core. It was clear that pollen-bearing sediments continued below the samples, and future efforts should concentrate on obtaining a longer core. Well-preserved fossil pollen was identified in all of the samples, including the uppermost zone, which displayed a considerable amount of oxidation. I had feared in the field that this zone would be barren of fossil grains, as it was evident that these sediments had periodically dried out. However, the
heavy clays apparently protected the pollen grains from oxidation and these sediments contained large amounts of well-preserved grains.

From the base of the core to 30 cm, the Pakal Na pollen data records a largely forested environment, similar to the core from Pechtun Ha. However, here, cycles of small-scale milpas are likely recorded, most evident by increases in *Pinus* pollen. Periods of increased clearing around the aguada allow greater amounts of pine, and to a lesser degree oak pollen to be carried into the pond. These episodes are reflected in the profile at 110-90 cm, 70-60 cm, and at 40 cm. At these points, there is a corresponding increase in weedy taxa, including *Croton*, Asteraceae (Composite Family) and Poaceae grains. Cultigens are wholly lacking in the core, and it is likely that these periodic milpas were located some distance from the aguada. Between milpa episodes, undesirable taxa increased including Combretaceae (White Mangrove Family), Cyperaceae, *Typha*, *Orbignya* and *Gymnopodium*.

Above 30 cm, there is a dramatic decrease in pine pollen, coupled with an increase in disturbance vegetation including Brassicaceae (Mustard Family), Cheno-Ams (Goosefoot and Amaranth) and Asteraceae. These taxa probably reflect large-scale clearing some distance from the aguada. The high percentage of Apocynaceae (Dogbane Family) pollen in the 20 cm sample probably reflects the accidental inclusion of an anther artificially inflating this rare plant’s importance. Above 10 cm, Poaceae pollen increases significantly, reflecting the modern conditions in the area. Although the region surrounding the aguada currently consists of a citrus orchard, the understory is made up of grasses and weeds. The relative increase in *Mimosa* pollen in the upper zone probably reflects the generally shallow depth of the water as *Mimosa* shrubs are currently growing in the shallow water of the pond.

**Pollen Washes**

Ancient pollen was washed from the grinding surfaces of a metate and associated mano collected in a cave located in the project area. Through the examination of fossil pollen preserved on the grinding surface of prehistoric tools, it may be possible to identify plants that may have been ground by these tools. The age of the tools is not known, but is presumed to be contemporaneous with other Classic period artifacts present in the caves.

A surprising array of pollen types were noted on the ground stone artifacts, and a minimum of 44 different taxa were identified (Table 34.1), although cultigens are wholly lacking. Both the mano and metate pollen assemblages were dominated by Moraceae (cf *Brosimum alicastrum* [ramon or breadnut]) and *Metopium* (chechem or poisonwood) grains. *Metopium* has no known use as a food, and its occurrence on the grinding surfaces is somewhat of a mystery. *Brosimum*, however, does have a documented usage as a food among the Maya, and has been thought to be a singularly important food source (Puleston and Puleston, 1971). Interestingly, in sediment cores from northern Belize, *Brosimum* pollen is always dramatically reduced during Maya times, indicating that it was not favored by the Maya in that region (Jones 1991, 1994). *Brosimum* pollen, however, is often quite abundant in samples dating before 2500 BC, suggesting that this plant may have been more important to Archaic populations. Thus it is tempting, but not likely, to think that these ground stone tools are actually quite old, predating the Maya artifacts in the cave by several thousand years. Alternatively, *Brosimum* may have been an important food in central Belize during Classic times, whereas large-scale agricultural activities in northern Belize led to the widespread destruction of these trees in favor of maize and other cultivated crops. Finally, *Brosimum* may have been used as an ingredient in a ritually important food substance for which there is no ethnographic documentation.
An interesting feature of the ground stone pollen assemblages is that apart from the Moraceae pollen, most of the pollen taxa represent uncommon or rare insect-pollinated types. It is possible that these rare types may have been introduced onto the grinding surface by grinding a material with honey. Stingless bee honey contains pollen from flowers visited by the bees when they collect nectar. Additionally, it is possible that these rare pollen types were introduced onto the grinding stones through the feces of fruit or flower-eating bats. Further investigation of the grinding stones and artifacts from these caves is strongly warranted.

Summary and Recommendations for Future Research

A total of 30 sediment samples from two cores were analyzed for fossil pollen content. These cores were collected in oxbows of the Sibun River in central Belize and it was anticipated that a detailed palynological analysis might offer insights into the region’s past vegetation history, and provide information on Maya subsistence and settlement. In addition, pollen from the grinding surface of two ground stone artifacts was also examined.

All sediment samples collected from oxbows near the site of Pechtun Ha and Pakal Na contained well-preserved fossil pollen and detailed environmental reconstructions were made. Despite the fact that both cores reflect some degree of human activity in the region, it is likely that neither core extends back to the period of intensive site occupation. The base of both cores records what is probably forest regeneration following site abandonment. The presence of maize pollen in the core from Pechtun Ha indicates continued human presence in the vicinity after site abandonment. In the Pakal Na core, cycles of nearby milpa activity are evident throughout most of the sequence, despite the absence of pollen from cultigens.

Pollen from the grinding surface of an undated metate and associated mano revealed no cultigens, but relatively high percentages of ramon or breadnut pollen suggesting this plant may have been used for food. High percentages of chechem or poisonwood pollen along with the high diversity of other rarely encountered insect-pollinated taxa is unexplained however, and may signal the prehistoric presence of honey.

Future efforts in this region should target additional oxbows or ponds, as the value of these types of studies has been well demonstrated. While obtaining samples from these sediments is difficult, the heavy clays serve to protect the fossil pollen grains from mechanical and organic degradation, and the anaerobic environment affords excellent plant preservation. Efforts should be made to collect a complete sediment sequence from both of these coring locations, and radiocarbon dates will serve to establish temporal control.

The wealth of data obtained from the grinding surfaces was most surprising, as these tools have not been previously examined in Belize. Future efforts in regional cave exploration should target these artifacts for analysis. Grinding stones can be bagged in the cave to minimize the potential for contamination, and then carefully washed either near the cave site, or in a field laboratory. The artifact can then be immediately returned to its original position in the cave. Ceramic vessels offer the same potential for data recovery.
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Jones, John G.

Puleston, D.E. and O.S. Puleston
The Xibun Archaeological Research Project (XARP), initiated in 1997, determines to assess, in part, the history and dynamics of the Sibun Valley environment. The contemporary flora of the region reflects past human uses and natural formation processes (Baleé 1994; Folan et al. 1979; Gómez-Pompa et al. 1990; Lundell 1938) and documentation of the present natural flora may help inform us of the natural resources available and utilized by the Maya, especially of the Postclassic period. A primary aim of this study is to document and qualitatively describe the major vegetative communities and associations in the Sibun River Valley, and to identify the predominant tree species extant in the areas immediately surrounding the two archaeological sites, the Hershey site, and the Pakal Na site. A second aim is to identify “feral” cacao in the Sibun River Valley. Cacao cultivation and production in the Sibun during the Colonial period was identified in ethnohistorical records by Jones (1989) and it was expected cacao would be found in the valley if subsequent patterns of land use had not radically altered the forest community structure (Baleé 1994; Folan et al. 1979; Gómez-Pompa et al. 1990; Lundell 1938; Young 1994; pers. obs.). The present report of the flora of the XARP study area is preliminary in nature, and is a work in progress. Contiguous analysis of the paleoenvironment by means of pollen analysis (Jones, Chapter 34) will provide a platform from which to interpret changes in the environment over cultural and geological time, and the degree(s) to which the Maya modified the environs of the Hershey and Pakal Na sites. Comparison to the present flora may provide insight into landscape transformations (Lentz, ed., 2000) in the Xibun archaeological research region over time. Furthermore, using and referring to ethnobotanical sources that document the contemporary uses of plants in Belize will enhance our understanding of the potential of the natural resources available to the Pre-Columbian Maya populations.

Belize is located at approximately 15° 52’ and 18° 30’ longitude and Hartshorn et al. (1984) describe the climate of Belize as subtropical, with a well-marked dry season from February to May. There is a general increase in rainfall from the northern part of the country to the southern portion (approximately 1,347 mm or 53 inches in the north to approximately 4,526 mm or 178 inches; Hartshorn et al. 1984). Coastal winds are predominantly easterly. Soil and vegetation disturbances caused by hurricanes are common and play a significant role in creating the mosaic of vegetation throughout this part of Belize. Wright et al. (1959) produced the most important vegetation map for the country, but deforestation has altered the forest patterns greatly.

For Belize, Balick et al. (2000) report more than 3,440 species of vascular plants, consisting of 1,216 genera, and 211 families. Hartshorn et al. (1984) compiled a list of approximately 720 tree species for the country. A full account of the history of botanical collection in Belize is given in Balick et al. (2000). The first “modern” and European extractions and modification of forest resources in Belize consisted of selective harvesting of mahogany (Swietenia macrophylla, Meliaceae) and Spanish Cedar (Cedrela odorata, Meliaceae), and the tapping of latex from sapodilla (Manilkara zapote, Sapotaceae). Since that time extraction activities have proceeded rapidly, resulting in a highly modified and restricted forest environment. The rough terrain and difficulty of access to forests in the Maya Mountains, in the southern part of the country, however, have helped to preserve an extensive tract of ancient montane rainforest.
Forest areas in Belize are shrinking dramatically, because of encroaching habitations and the establishment of numerous monocultural export-crop plantations, such as citrus farms. Balick et al. (2000) report, still, that 35% of Belize currently is under some sort of protection. Blue Hole National Park is the nearest federally protected land, but is not located in the Sibun Valley. The Sibun River Valley can be perceived as one of the “breadbaskets” of Belize, and clearing of old forest and the improvement of old cultivated lands in the watershed has been promoted by government policies and is very widespread. The karst formations and the nearby Maya Mountains and their outcroppings provide a natural barrier of sorts to monocultural expansion. With accessibility to powerful earth-moving machines, however, deeper incursions into the forests are being made and farms extended.

Geographically, the Sibun Valley study area occurs in the Cayo and Belize Districts, in the central region of the country. In a manner of speaking, the Sibun marks a midpoint between the vegetation and geology of the Yucatan Platform to the north and the wet, mountainous regions of the southern portion of the country. Lundell identifies the Sibun as the southernmost boundary of the Yucatán Peninsula (Lundell 1934: Figure 1), both floristically and geologically. The geology of the Sibun River is complex and the reader is referred to the findings of Bullard and Farrell (Chapters 31 and 32, respectively) for an introduction to the geomorphology and soils of the watershed. In a general sense, the study areas in which floristic observations took place are distinct: the upper valley area, which includes the Hershey site, is located close to the Sibun Gorge, from which the Sibun River emerges at the northeastern-most point of the Maya Mountains onto a relatively narrow flood plain; the middle section of the river includes the Pakal Na site, and skirts the last remnants of eruptive limestone outcrops to the south and east, with coastal flood plain habitat to the east and north. Although rainfall measurements are not available to the author at this time, the average annual rainfall certainly is greater in the upper Sibun.

The Sibun Valley of Central Belize is a geologically and floristically diverse region, characterized by the Sibun River and its powerful hydrology. The Sibun’s headwaters originate in the granitic teeth of the Maya Mountains and spill onto the karstic limestone plain to the east. The Sibun River has a great range of flooding and drought levels, and has dramatically affected the landscape around it. The Hummingbird site, for example, is bounded by karst formations and cave-networks to the west. To the north is the Sibun Gorge and the mountain ridge known locally as “The Sleeping Giant,” from which the Sibun River emerges. To the east, a large flood plateau extends to further karst formations, beginning one mile to the east of the site. Farther south the river expands in width and flows through gallery forest and eventually into coastal savannah until it reaches the coast. The Pechtun Ha site is located on an upper terrace of the river valley, where the Sibun borders the eastern edge of the site, while to the east is savannah. If the site was located, in part, to benefit from a wide range of forest and savannah resources, than the decision was an excellent one.

The Sibun River carries great volumes of silt, causing periodic deposition of large concentrations of minerals and organics along its course. This particular feature renders the valley floor as well-drained, prime agricultural land in the modern Belizean agroeconomy, and undoubtedly did so to ancient Maya living in the area. The founders of the former Hershey Hummingbird Plantation took advantage of the fertile soils and established extensive cacao orchards on the banks of the eastern bank of the river, and still harvest and sell small quantities of cacao beans (P. McAnany, personal communication., 2001). Today, however, much of the prime arable land around the northern end of the Sibun is occupied by rapidly expanding citrus plantations. Downriver, a great deal of land has also been cleared for new plantations for exotic economic plant crops, and most recently, for the cultivation and production of talapia, a popular eating fish originating in Mexico. Populations of escaped talapia are increasing, disturbing and further altering the ecology of the
river. In short, as in many tropical areas with a high concentration of export-crop plantations, the vegetative face of the valley has altered dramatically. Indeed, in 1988 the author observed almost intact forest vegetation in the northern Sibun Valley; today there are only remnants of ancient (but perhaps human-modified forest) on the lower mountain reaches and on karst formations.

Cacao tends to grow in areas with climates Am of the Köppen system that are hot and humid with rainfall in the summer and autumn, or in areas with less rainfall, but with soils with favorable humidity (Ernholmb, in Gómez-Pompa et al. 1990:249). In central Belize, the short period of the dry season occurs in mid- to late winter and some rain nearly always occurs (pers. obs.). The rainfall in rainfed cacao plantations usually exceeds 2,000 mm per year without a clearly marked dry season (months with less than 60 mm of rainfall; Gómez-Pompa et al. 1990). Cacao is a typical rainforest tree species: it tends to occur in lower to mid-level forest canopies, is shade-tolerant, and thrives in high evergreen forests with deep or mottled shade, high humidity, deep shade, rich, well drained soils (Schultes 1984; Gómez-Pompa et al. 1990; Young 1994). It possesses specialized flower morphology, a conservative breeding system (entomophily, or insect pollination) and the fruit is dispersed by arboreal mammals (Young 1994).

Methods

Qualitative descriptions of forest elements were made in the course of surveys in both localities, conducted between the 23rd of February and the 29th of March, 2001. Identifications were made in the field, often upon vegetative characteristics, rather than in the herbarium, and a preliminary list of the observed plants species is provided in the appendix. A Research and Scientific Collection Permit was issued to the author by the Forest Department, Ministry of Natural Resources, Environment and Industry (Ref. No. CD/72/1/01A8) in 2001. Numerous leaf, fruit, flowers, and wood collections (cacao and other plant taxa) were made and samples are on deposit at the Herbarium, Forest Department. Future field- and herbarium work will continue to identify shrub and tree species in the Sibun River valley. Additional collecting and herbarium work, in collaboration with the Herbarium, will increase our knowledge of the plant species growing in the study region. A working relationship with the Herbarium was also initiated. Consultations with Hector Mai, Herbarium Officer, and use of the Herbarium Database, resulted in better understanding of the floristic components of the Sibun Valley. Taxonomic nomenclature follows that utilized by Balick et al. (2000).

The two focal sites of the botanical survey in the Sibun River valley are the Hershey site, located at the base of the Sibun Gorge, at the foot of the Maya Mountains (in the former Hershey Hummingbird Plantation, approximately 30 miles southwest of Belmopan). The Pakal Na site, located in the middle Sibun River Valley (east of Belmopan, approximately 15 miles northeast of Belmopan, the capital) is located in the middle reaches of the Sibun near the Monkey Bay Wildlife Sanctuary. The vegetation associated with each site is distinctive. Whenever possible, taxonomic identifications of major tree and understory species were made.

Cacao specimens (*Theobroma cacao* and other species) were looked for with particular scrutiny, in line with the second goal of this study. Inquiries were made in each community visited and of informants regarding its presence and distribution. Numerous efforts were made to observe cacao in the field. Cacao fruit and other materials were collected when available.
Results and Discussion

The vegetative associations observed were highly diverse and species rich, and often reflect edaphic conditions. The broad descriptions of plant communities encountered in this study are given below.

Vegetation of the Hershey Site

The Hershey site is located in the former Hershey Hummingbird Plantation. The only remotely “intact” forests observed were those on the trail to Actun Chinona Cave and the foothills behind Sleeping Giant Farm, where the Sibun emerges from the narrow granitic confines of the Maya Mountains.

A couple of kilometers northeast of the site is forest preliminarily defined by this author as lowland semi-evergreen moist broadleaf forest (Holdridge et al. 1984; Pennington and Sarukhán, 1998), rich in undergrowth and lianas. Lundell (1934) characterizes the upland forest of the area bounded by the Sibun, and areas north, as dominated by *Achras sapota* (present-day nomenclature labels this as *Manilkara zapota*, Sapotaceae); this appears to be the case in the Sibun Gorge area as well. A number of features define the forests: they occur frequently in areas with an average annual rainfall of between 1000 and 1300 mm. Karst topography, and other rapidly draining limestone-derived soils are present, at an altitude below 1200 m. The slope is moderately steep in this forest, with occasional limestone outcrops of rock present. Often some 50-75% of the canopy is evergreen, with about 75% consisting of broadleaf tree species. The trees display moderate to strong seasonality of flowering and fruiting. The highest level of the tree canopy ranges between 15 to 20 m.

To the west of the site is the range of karst formations in which the cave site of Actun Chanona is located. The forest here is mostly evergreen and diverse, with shrubby undergrowth and lianas. The tallest trees range from 15 to 30 m in height. The slope of the path to the site varies greatly, as does the vegetation, with a shallow plateau located about two thirds of the way up the path. Another small plateau occurs directly in front the cave entrance. More critical studies of the tree species are needed in that particular locale.

Just east of the site is a series of wide bands and shallows in the river. The riverbed transforms from rocky, shallows to a deep, rapid-flowing river in limestone. The Hummingbird Plantation extends to nearly the river’s edge, and further citrus plantation continues north to the foot of the Maya Mountains, and to the semi-evergreen moist broadleaf forest discussed above. Large stands of bamboo (*Bambusa* sp., Poaceae) and *Heliconia* sp. (Heliconiaceae) inhabit the shallow, pebbly banks. Rainy season river levels are apparently a leveling force in this section of the river, and vegetation typical of high disturbance are observed. This vegetation and river pattern continues until it reaches Pakal Na.

The structure of the forest along the river itself, immediately east of the excavated core of the Hershey site, is typical gallery forest. It must be noted that the east and north side of the river appear to be much less modified by human activities and clearing. The bank opposite the site was found to be steep and consist of spiky karstic outcrops but was not explored. The uneven topography is likely to create microclimates and diverse flora. Numerous epiphytes and ferns on rocks and tree branches are present,
and lianas sprawl across the uneven canopy. South of the site the walls of the north bank become highly eroded and sheer, with temporal beaches manifesting in the dry season. In many places water erosion has caused limestone formations akin to large “corridors” to be cut by the river.

The western side of the river encompasses a large, flat area that displays clear evidence of river flood plain processes at work. This area extends roughly north, for about 2 miles, east about 1 mile, and then south for an undetermined length. Vegetation on these beaches is typically that of high disturbance regimes. Periodic floods just inland from the river would tend to deposit silts rich in organic matter and high mineral content, often in deep layers (see Farrell, Chapter 32). These conditions predispose the area to settlement and cultivation of crop plants. The presence of the cacao orchard, although modern, testifies to the rich organic, alluvial soils that many tropical tree crops, such as cacao, prefer.

Vegetation of the Pakal Na Site

Vegetation near the Pakal Na site (including the Monkey Bay Wildlife Sanctuary) is better preserved in contrast to the Hershey site and generally consists of savannah, evergreen perennial, and riparian forests. We must refer to the Monkey River preserve flora as a proxy for former vegetation associations, since the Hershey site occurs directly in the middle of a cacao and citrus plantation. In addition, the presence of palms (Areceaceae) in the Middle Sibun River Valley is underrepresented in the plant species list. Further identifications are necessary and will be provided by the author in the next study season.

The forest near K’in Rockshelter, located in the Glenwood Cave District, is currently described as lowland deciduous forest. *Ficus* sp. (Moraceae), or fig, trees are common in this area. *Trichospermum* (grewiifolium? Tiliaceae), *Bambusa* (Poaceae), *Castilla elastica* (Moraceae), *Poulsenia armata* (Moraceae), *Psuedolmedia oxyphyllaria* (Moraceae), *Bursera simaruba* (Burseraceae), *Brosimum* sp. (Moraceae), possibly *Terminalia amazonica* (Combretaceae), and *Guatteria* sp. (Annonaceae), *Aspidosperma cruentum* (Apocynaceae), *Clusia* sp. (Clusiaceae), *Pterocarpus* sp. (Fabaceae), *Psuedobombax ellipticum* (Bombaceae), *Attalea cohune* (Areceaceae), a Sapindaceae vine, are present. *Coussepoa oligocephala* (Cecropiaceae) is uncommon.

A swampy wooded area, which appears to be periodically inundated by river floodwaters, exists on the trail to Howler Cave. The forest does not correspond to Lundell’s (1934) definition of a pan, *bajo*, or *alkalche*, because there is some drainage present. Trees observed here were no more than 20 meters in height. *Coccoloba* sp. (Polygonaceae), members of the Areccaceae, Bromeliaceae, Cyperaceae and Poaceae are present.

There was no opportunity to examine and characterize the flora of the *aguadas* or *bajos* that were tested for pollen and soil chemistry and structure (see Jones, Chapter 34, Farrell, Chapter 32, and Bullard, Chapter 31). Future fieldwork will address this absence.

Plant specimen collections were made from the valley that Tiger Cave and Pottery Cave opens onto, on Mr. Steve Downard’s property, and are deposited at the Herbarium. This is a unique area: from a flat, apparently alluvial plain emerges a series of limestone rings. One of these “rings” was visited and reached only by walking through a short cave. Once through the cave, one emerged into a roughly rounded clearing, edged by limestone walls approximately 10 m in height. Unlike a traditional *cenote*, the geological formation was not below the ground level of the surrounding area, but above it. The walls effectively act as
a barrier to much of the vegetation outside of the walls. The vegetation in this valley deserves far more
attention: there is clear evidence of human modification of the cave system here and it is likely that the Maya
using the caves may have utilized the formation as a kind of protected garden. A study of the vegetation in
the cockpit karst, following the methodology of Gómez-Pompa et al. (1990), might reveal the presence of
tree species and layering effects that reflect anthropogenic influences. Sample pits for flotation and
archaeobotanical analysis in the broad space of the vegetation, as well as near the cave mouth, might yield
some interesting plant remains. Such analyses would help to tie the study of the modern flora to that of the
past, and provide interdisciplinary evidence of botanical resources and their use over time.

To the west of the Pakal Na site is savannah, dominated by short grasses (Poaceae) and
characteristic perennials, such as sedges (Cyperaceae), palms (Sabal sp.), spiny legumes (Mimosa
pudica), members of the Anacardiaceae which secrete toxic substances (Metopium browneii), and
calabash trees (Crescentia cujete). After a short period of rain in mid-March, an orchid species
(Spiranthes torta?, Orchidaceae) emerged and bloomed rapidly. Woody underground stems help
these various taxa to withstand the periodic fires that sweep through the savannah and any trees tend
to be very low in stature, except for the occasional hummocks of taller trees and greater plant
diversity.

Cacao

In a few plantations visited in the course of this study, old extant cacao (Theobroma cacao and
hybrids) orchards, often remnants of the first original large-scale crop plantings in the area, could be found
growing amidst acres of citrus orchards. Such is the case in the Blue Hole National Park, technically out of
the study area range. The former Hershey Hummingbird Plantation contains some 149,000 cacao trees, in
addition to citrus (unpublished manuscript map in possession of the Hummingbird plantation manager,
copied by David Buck, XARP staff member, and made available to the author). It is not known how many
hectares of land are presently under cacao cultivation. The cacao harvest is secondary to the citrus harvest
and the cacao market is specialized. The Hummingbird harvest is sold to a European chocolate
manufacturing companies (Patricia McAnany, personal communication, 2001). Citrus is a more dependable
and revenue-generating economic crop plant in the Sibun Valley. Interestingly, there were few shade trees
observed in the Hummingbird plantation. This would imply that the varieties growing there reflect selection
for sun-tolerance. During the study period the author was not able to ascertain the cultivars maintained and
cultivated at the site, although a wide range of morphological forms were observed, combining both
Mesoamerican, or “criollo,” forms, and South American cultivar characteristics. Even most fruits bearing
typical exterior “criollo” characteristics, such as deep red to almost purple fruits, with deep ridges, were
found to contain seeds possessing violet cotyledons, a strong marker of South American parentage.

To date, wild or “feral” cacao has not been encountered in the field study area, and only one
specimen was actually encountered, outside of the Sibun River Valley, in Five Blues National Park. A
potential, intriguing line of research would be to generate cacao capability soil classes for the Sibun River
valley, and to use this model as a means of testing the distribution of natural cacao populations (cf.
Hammond 1975, based, in part, upon Belize general soil classifications by Wright et al. 1959). One
informant had recently observed a flowering wild cacao in forest located some distance behind the
Mennonite settlement of Springfield, and offered to accompany the author to the tree, but this field trip could
not be arranged at that time. Future fieldwork will endeavor to comb the Sibun River Valley for the elusive
wild cacao.
Discussion

The initial findings of this study indicate that contemporary forest resources in the Sibun River Valley are rich and species diverse, although restricted in area. The close proximity of the Maya Mountains to the Hershey site, and the transitional ecosystem in which Pakal Na is located, would, in theory, have provided abundant and productive sets of resources to the ancient Maya. Forests abundant in foraging and timber resources surround modern inhabitants of the valley. Today, the most diverse vegetation exists mostly on the uncultivated hills and riverbanks. To follow one train of thought, past settlement and agricultural practices in the area, particularly the Classic and Postclassic periods, may have duplicated a similar pattern of land use. If so, it is likely that the hills and resulting forest refugia acted as seed banks for reforestation of the plain after abandonment. A few hundred years may be all the time needed to reforest the area, but forest regeneration systems in tropical Central American forests are not well understood. Questions regarding the extent of past forest clearance, cultivation and management, as well as the area which agricultural systems may have occupied, are beyond the scope of this paper. It is clear, however, that if the contemporary flora bears resemblance to the flora of the past, the Sibun Valley is both suitable and capable of agricultural production and/or agroforestry management, especially of cacao. The rich yield and success of cacao and citrus cultivation in both the upper and middle valley provides support for this hypothesis. The author believes, however, that former and critical floristic elements, such as cacao, are absent due to current monocultural agricultural practices.

Feral cacao was found, in the first round of fieldwork, to be rare in the Sibun River Valley. Indeed, this is not surprising, as so much of the original forest has been logged and cleared for the establishment of citrus plantations. Cacao trees in the nearby Blue Hole National Park are apparently remnants of former plantations which extended into the Caves Branch region. These trees are merely abandoned, and cannot, therefore, be defined as wild or escaped cultivars. They display a wide range of morphological characteristics, as do the trees at the Hummingbird Plantation. In 1988, the author observed *Theobroma* trees in the Bladen Nature Preserve, in the Maya Mountains, in southern Belize. The Bladen population may represent one of the last extant populations of native Mesoamerican cacao in Central America. Efforts are being made to arrange collecting permits and exploration of the Bladen Nature Preserve. It is critical to collect, examine, and analyze individuals from this region, before they, too, are lost. Recent collecting fieldwork by the author (Joyce et al. 2001) in Mexico addressed, in part, the distribution of wild or native cacao in Central America. Evidence suggests that *Theobroma cacao* and its most closely related subspecies may be threatened or virtually extinct in that country, having been largely supplanted by hybrids of *T. cacao* and South American hybrids. A move is being made by the experimental station, INIFAP, in Rosario Izapa, Chiapas, to breed criollo characteristics back into cacao orchard populations, but little effort is made elsewhere to actually conserve the native species.

The scarcity of wild cacao in the Sibun River Valley may be, however, an artifact of a small sample size area, and may be resolved by future observations in a larger area. Intact remnants of forest were expected to contain at least a few specimens of cacao trees, although it would be difficult to prove the origin of the trees; whether they were remnants of ancient cultivation, planted recently, or whether they are truly wild. The area most certainly meets the usual ecological requirements of cacao: high evergreen forest, deep shade, high humidity, and rich, well drained soils (Muhs et al. 1984; Schultes 1984; Gómez-Pompa et al. 1990; Young 1994). An absence of cacao in the valley has interesting implications. It is well known that the Maya practiced sophisticated agriculture (Flannery 1982; Harrison and Turner 1978; Turner 1979), and ethnohistorical documents (Jones 1989) suggest that the Sibun Valley was a cultivation and production site.
in the pre-Contact period. It is possible that “high-magnitude” flooding (Muhs et al; 1985) in the historical period has removed wild cacao from the alluvial plain.

Unfortunately, there are few modern studies of the ecological conditions, or the present distribution, of deliberately planted or “wild” orchards of cacao in Mesoamerica (de la Cruz et al. 1995; Folan 1979; Lambert and Arnason 1982; Lundell 1938, 1940), although there is a widespread assumption in the literature that ancient Mesoamericans planted and tended cacao in small clumps or in rainforest “gardens.” Only recently have modern studies of Maya “forest gardens” been carried out (Atran 1993; Gómez-Pompa 1987; Gómez-Pompa et al. 1990; Peters 2000). Gómez-Pompa et al (1990) found definitive evidence of Postclassic forest micromanagement and cultivation of cacao within a Yucatán cenote, where it was a component of a larger forest management strategy that permitted the cultivation of cacao in an ecological environment with a six-month dry season. Further scrutiny of potential microclimates in the Sibun River Valley study sites, such as the intriguing geological formations near “Cave Valley,” as well as aguadas and rejolladas (see Kepecs and Boucher 1996), might reveal anthropogenic influences on the present flora.

From an ethnobotanical standpoint, a good deal of local knowledge regarding medicinal properties of forest plant species can be had, and a number of local informants expressed knowledge about the trees and their cultural uses. Not surprisingly, relative newcomers to the area, such as young Q’eqchi Maya recently located from Mirador, which is located on the Belize-Guatemala border, admit to knowing less about the local tree species than in the forests near Mirador and less than their elders about practical uses of the forest plants. Recent ethnobotanical work by Arvigo and Balick (1998) identifies the medicinal uses of some one hundred tropical plants that grow in Belize, including common and scientific names, and broad habitat descriptions. Balick et al. (2000) document the vascular plants of Belize; each taxon is accompanied by a list of recorded cultural uses of the plant (e.g., beverage, dye, oil, poison, ritual). These data will be integrated into the species list at a later date.

Conclusions

Several well-defined habitats or vegetative associations in the upper and middle Sibun River Valley have been defined thus far: lowland semi-evergreen forest, riparian or gallery forests, and savannah. At this time, the relation of the contemporary flora of the Sibun River Valley to the flora of the past is incomplete but tantalizing. Pockets of relatively undisturbed vegetation still exist in the area, despite the rapid expansion of citrus export-crop plantations. Such forest remnants attest to the rich resources that have been available to past knowledgeable Mayan societies. The Sibun forest sites certainly warrant further study and exploration. More herbarium sample collecting is necessary as well, as the Sibun is underrepresented in the herbarium collections at the Belize Forest Department. As to the age of the forests, a cautionary note is necessary: it is difficult, if not impossible, to calculate the age of the vegetation associations in the Sibun. All of the forests are likely to have been heavily modified, with sections perhaps even completely deforested by the Maya in the last two thousand years (see Dunning and Beach 2000), as a consequence of clearing for milpa or intensive cultivation systems (Wilkin 1971). Nevertheless, the complexity and diversity of the extant forests argue for an extended period of relative absence of disturbance, as well as a rich source of
species from which the forests were replenished (a kind of historical, living seed bank). An issue not yet addressed by the author’s research is investigation of any evidence of the effects and consequences of potential silvicultural and indigenous management practices in the area (Alcorn 1984; Caballero 1989; Peters 2000) and potential anthropogenic influences on forest community structure (Balée 1994; Folan et al. 1979; Gómez-Pompa et al. 1990; Lundell 1938). A further issue is the potential identification of agricultural facilities (e.g., retaining walls, terraces) in or near settlement areas in the archaeological sites and systematic investigation of archaeobotanical remains (but see Hall, Chapter 30). Such archaeobotanical discoveries, in tandem with further floristic inventories, and an understanding of the paleoenvironments of the area during Maya occupation (Jones, Chapter 34), will help us to identify and refine past relationships and associations between the Maya and their environment.

Acknowledgements

Many thanks are given to the Smith family, of Yam Wits, for their kindness and hospitality during the first period of fieldwork. Rupert Smith was particularly helpful in his explanations of the (then) current state of citrus farming and export economy in Belize. My field companion and informants were very helpful with their knowledge and for guiding me through the Gorge forests safely. I am grateful to Mario Pérez, who took me to the wild cacao in Five Blues National Park. The managers and staff of the Monkey River Nature Preserve are thanked, too, for their effective efforts to preserve the forest and savannah habitats in the middle Sibun River Valley. Thanks to Steve Downard for permitting exploration and collection of plant materials on his property. I am indebted to Hector Mai, Herbarium Manager, and to John Pinelo, representing the Chief Forest Officer, for issuing a collection permit for the Sibun River Valley, and for rewarding discussions on the plants of Belize.

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