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Analysis of Samples and Artifacts from the Mirador Group, El Perú-Waka'

Research Year: 2007
Culture: Maya
Chronology: Classic Period
Location: Petén, Guatemala
Sites: El Perú-Waka

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Abstract

Monumental architecture at the Mirador Group defined an area of ritual importance to the ancient Maya of El Perú-*Waka'*. Four seasons of excavation in this complex produced significant numbers of carbon, matrix and textile samples warranting analysis for two reasons: first, radiometric dates provide a baseline to cross-check dates acquired through ceramic analysis, for both the Mirador and the entire site. Second, analyses of matrix, mineral, pigment and textile samples collected primarily from tomb contexts are critical as these fine-grained data are integral components of complex ritual burial tableaux, yet may be overlooked relative to other tomb artifacts. During the course of this project, specialists were contracted to analyze samples using accelerator mass spectrometry (AMS), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy with energy dispersive x-ray (SEM-XEDS). The originally proposed project was expanded to also include zooarchaeological, lithic and ceramic analysis.

Resumen

La arquitectura monumental en el Complejo Mirador caracterizó una área de importancia ritual para los antiguos mayas de El Perú-Waka'. Cuatro temporadas de excavación realizada en este complejo han producido cantidades significativas de muestras de carbón, de matriz y de tejidos, que justifican el análisis por dos razones: La primera es que las dataciones radiométricas proporcionarán una base de referencia para la verificación cruzada de las dataciones obtenidas por medio del análisis de la cerámica, tanto del Complejo Mirador como del sitio entero. La segunda razón es que los analices de las muestras de matriz, de minerales y de pigmento, recogidas en los contextos de las tumbas, son esenciales, ya que estos datos sutiles son componentes integrantes de los intrincados rituales de entierro, datos, los cuales no obstante pueden pasarse por alto en relación a los otros artefactos de las tumbas. Durante el curso de este proyecto, contrataron a los especialistas para analizar muestras usando las técnicas conocidas como espectrometría de masa con aceleradores (AMS), espectroscopía infrarroja por transformación de Fourier (FTIR) y microscopio electrónico de barrido con análisis por dispersión de energía de rayos X (SEM-XEDS). El proyecto original fue ampliado para incluir analices zooarqueológicos, de la lítica y también de la cerámica.

Introduction

This report details results of analyses conducted on samples and artifacts collected during excavation in the Mirador Group at the Maya site of El Perú-*Waka'*. Located in the Department of Petén, Guatemala, the El Perú-Waka' Archaeological Project has been investigating this ancient Maya city since 2003. Four years of research (2003-2006) conducted by the author in the Mirador Group resulted in the systematic excavation of several structures and associated architecture, various test pits, two royal tombs and a cist burial. The artifacts collected include ceramic sherds, chipped stone, groundstone, faunal bone, shell, modeled stucco fragments and special finds along with 115 carbon, matrix and textile samples. FAMSI funding supported radiocarbon dating, SEM analysis of textile samples, and FTIR analysis of pigment, matrix and textile samples. The original scope of the project was broadened to include zooarchaeological analyses, ceramic analysis and, finally, analysis of chert and obsidian tools and debitage.

Background - El Perú-*Waka'*s Mirador Group

El Perú-*Waka'* (henceforth referred to as El Perú) was favorably positioned near the major riverine route of the San Pedro Martir, which provided a centrally located communication and transportation route situated between Tikal and Uaxactun to the east, and the Usumacinta River kingdoms of Piedras Negras and Yaxchilan to the west (Figure 1). Mapped by Ian Graham in the early 1970's in order to record the abundant stelae, the site was not archaeologically investigated until the El Perú-*Waka'* Archaeological Project initiated fieldwork in 2003. Since that time, a number of excavation operations have been carried out in and around the site, a comprehensive site-wide test pitting program was implemented and the site is being re-surveyed using modern surveying equipment. The site core at El Perú is at least 0.8 x 1.2 km, and contains upwards of seven hundred structures (Figure 2). Archaeological data indicate El Perú was occupied from the Middle Preclassic through the Terminal Classic period, approximately 300 BCE - 1000 CE. These preliminary dates are based on ceramic chronology (Eppich, et al. 2005; Pérez Robles 2005; Pérez Robles, et al. 2008). The size and geographic position of El Perú suggest it was a key political and economic center integrated into Classic period lowland Maya civilization, and this status is confirmed by textually documented interactions between El Perú and the dominant capitals of the Maya lowlands, Tikal and Calakmul (Martin and Grube 2000). El Perú remains important in the modern era, as it is the largest known archaeological site in the Laguna del Tigre National Park in northern Guatemala's Maya Biosphere Reserve, which has been characterized as being under siege by looters, drug smugglers and invaders.

Figure 1. Map of Guatemala showing location of the archaeological site El Perú-Waka' and modern Guatemalan cities.

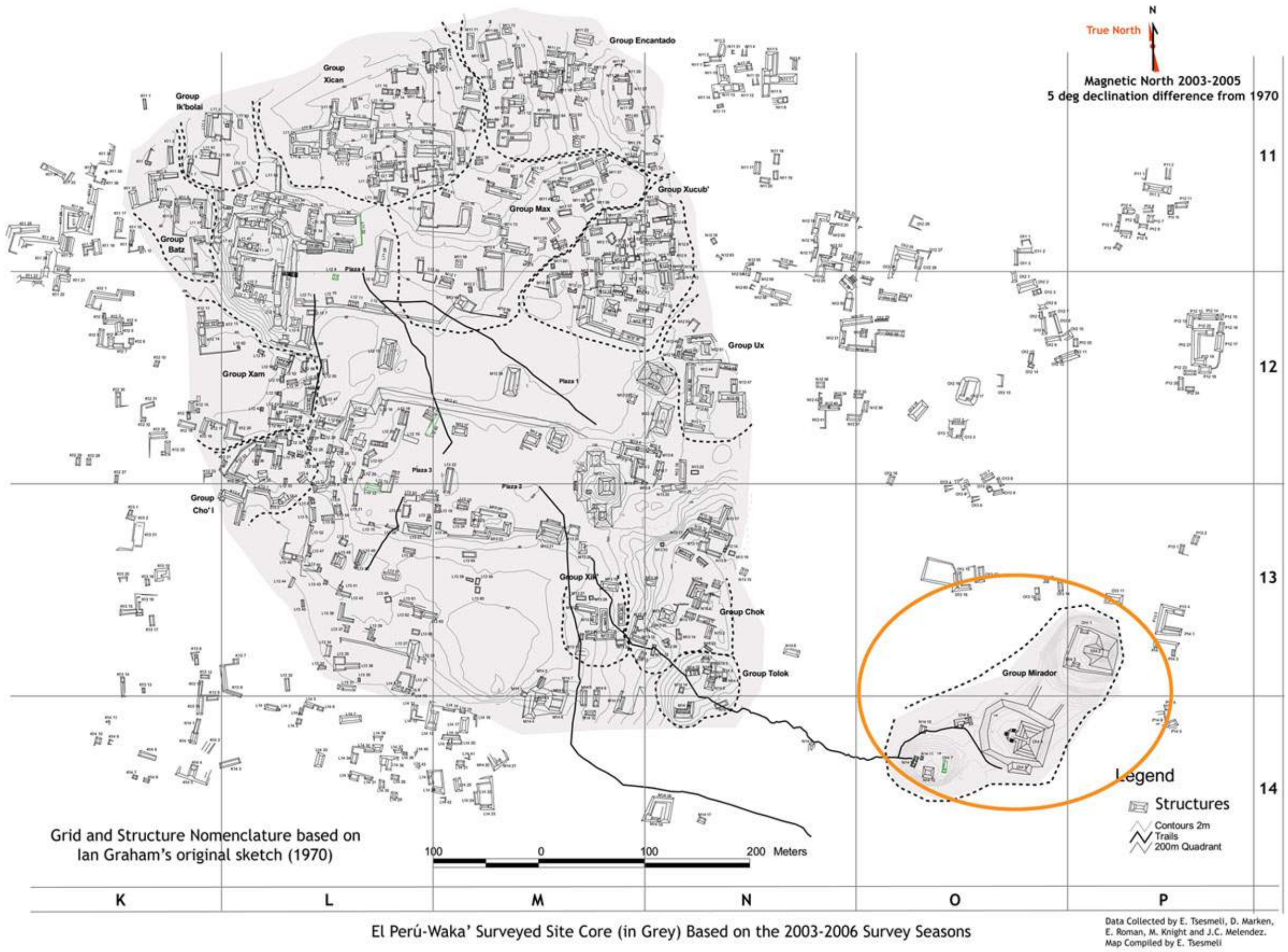

Figure 2. Map of the El Perú site core showing the location of the Mirador Group.

I directed four seasons of excavation at the Mirador Group from 2003-2006. This research was carried out atop an artificially leveled hill in Operation WK08 (Rich 2004, 2005) and in Structure O14-04's Operation WK11 (Rich, et al. 2007; Rich, et al. 2006). Excavation focused on horizontal exposure of architectural features, and was complemented by selective test-pitting exploring architectural stratigraphy. At various points in time, both Varinia Matute and Jennifer Piehl were instrumental in completing excavations in Operation WK11. The methodology, interim hypotheses, objectives, data collected and preliminary conclusions are detailed in the project's annual Spanish-language reports (Rich 2004, 2005; Rich, et al. 2007; Rich, et al. 2006), the complete PDF's of which are available on Mesoweb[1]. I have also made English-language versions of my chapters available on Mesoweb[2]. The completed fieldwork was pursued

[1] http://www.mesoweb.com/resources/resources.html
[2] http://www.mesoweb.com/resources/informes/ElPeru-WK-08-11.html

with the permission of Guatemala's Instituto de Antropologia e Historia (IDAEH) through the logistical organization and financial support of the El Perú-Waka' Archaeological Project, co-directed by David Freidel (Southern Methodist University) and Héctor Escobedo (Universidad de San Carlos de Guatemala), as well as under my National Science Foundation Graduate Research Fellowship (2002-2005).

Topographically distinct within the community of El Perú, the Mirador Group is located in the southeastern extremity of the mapped site core on a mountainous uplift approximately 45m higher than the main Plaza 2 (Figure 3). This locale includes two of the site's largest pyramids (Structures O14-02 and O14-04) and a small group consisting of a temple structure with two flanking buildings (Structures N14-12, N14-13 and O14-05 respectively) clustered together atop a steep natural rise artificially leveled in antiquity (Figure 4). A causeway connects structures O14-02 and O14-04, which are both oriented northwest toward the site center, while the group atop the natural rise faces slightly east of north. Together, excavation and survey in Operation WK11 show Structure O14-04 is a sizeable composite pyramid comprised of an *adosada* (frontal platform) abutting a terraced pyramidal base, atop a large basal platform. The *adosada* supported a shrine room, and the pyramidal base supported a masonry temple on its summit. The *adosada* measures approximately 4 m in height and the pyramidal base 12 m. The roughly square basal platform is 8 m in height. Each side is approximately 40 m in length. Cut stone is visible on all sides of the platform, and the back face of Structure O14-04 is contiguous with the basal platform itself.

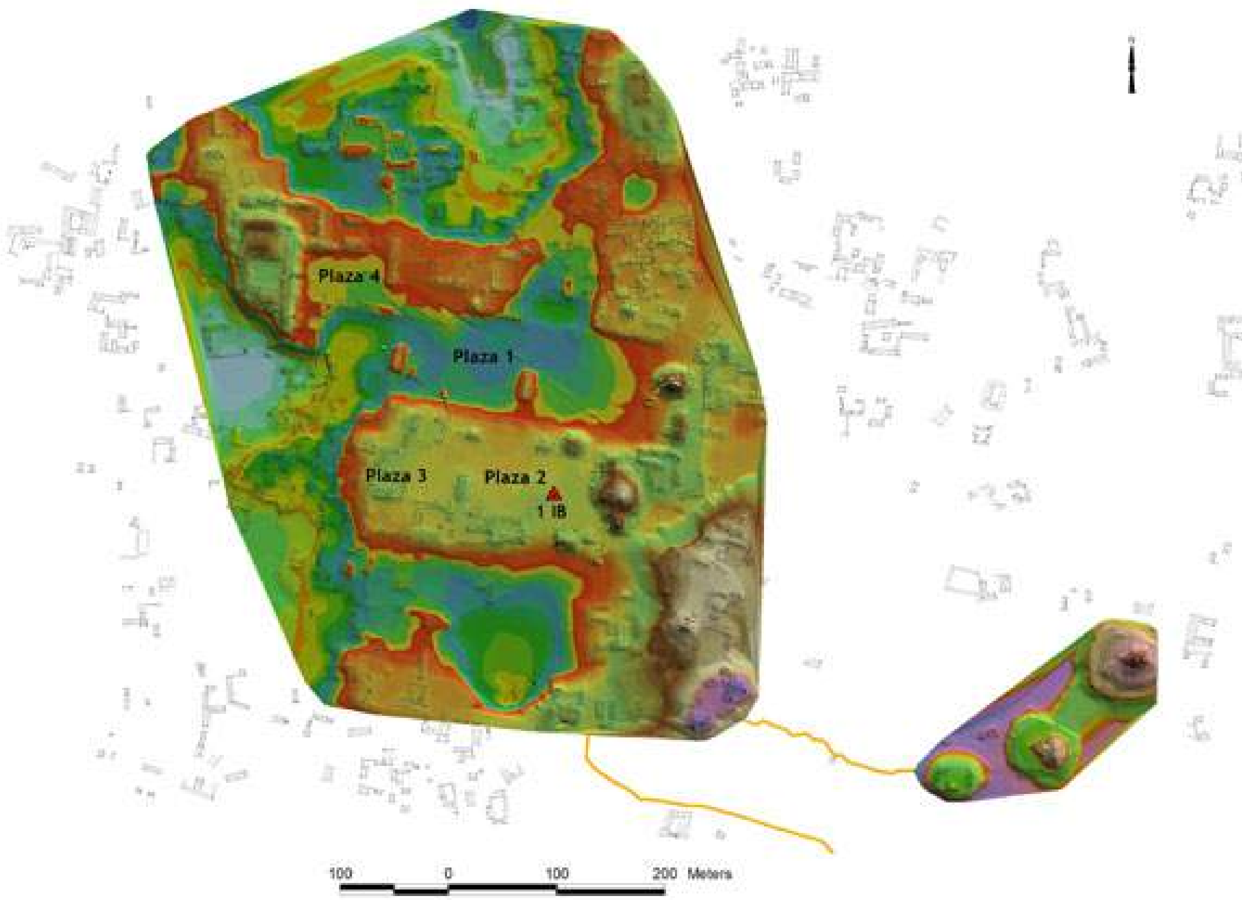

Figure 3. Map of El Perú (generated by Evangelia Tsesmeli).

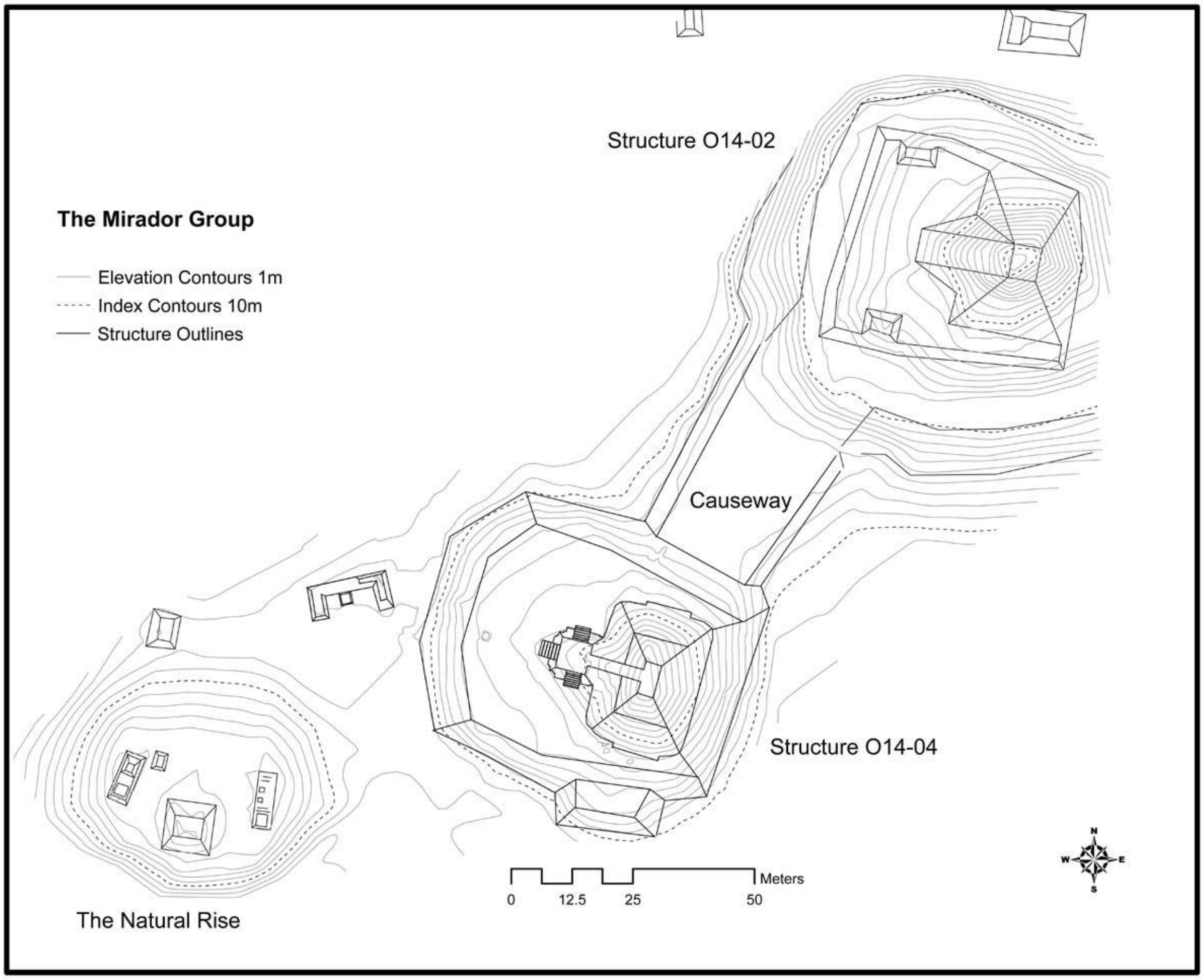

Figure 4. Map of the Mirador Group, 1m contours (generated by Evangelia Tsesmeli).

The grand architecture of Structure O14-04 is in contrast to the smaller group atop the artificially modified hill, excavated in Operation WK08. The principle building of the triadic group is the 2.16 meter-high Structure N14-12, flanked by Structures N14-13 and O14-07. Excavation proved N14-12 to be a vaulted temple structure in its final construction phase. Flanked by masonry piers, the central doorway lead to a poor-quality inset staircase along the structure's centerline that terminated at a small platform at the building's summit. Additional excavations directed by Juan Carlos Ramírez (2006:314) in 2005 tested my hypothesis that the natural rise was artificially enhanced on its northern face by the construction of a staircase. His work confirmed the existence of a plaster floor at the base of the natural rise and a cut stone staircase that did indeed extend up its north face, positioned along the same trajectory as Structure N14-12's primary axis. It can be asserted, therefore, that the natural rise was modified to mimic a human-built platform or pyramidal base, with a temple and flanking structures constructed at the summit.

Finally, each locale has an associated stela. The text on Stela 1 in front of Structure O14-04 is not well preserved, but project epigrapher Stanley Guenter identified a legible date of 657 CE, and he confirms the shape and size of the stela fit well with this date (Figure 5). Stela 3 is in front of Structure N14-12, positioned along the building's centerline, and is either devoid of carving, or is too eroded to be seen with the human eye.

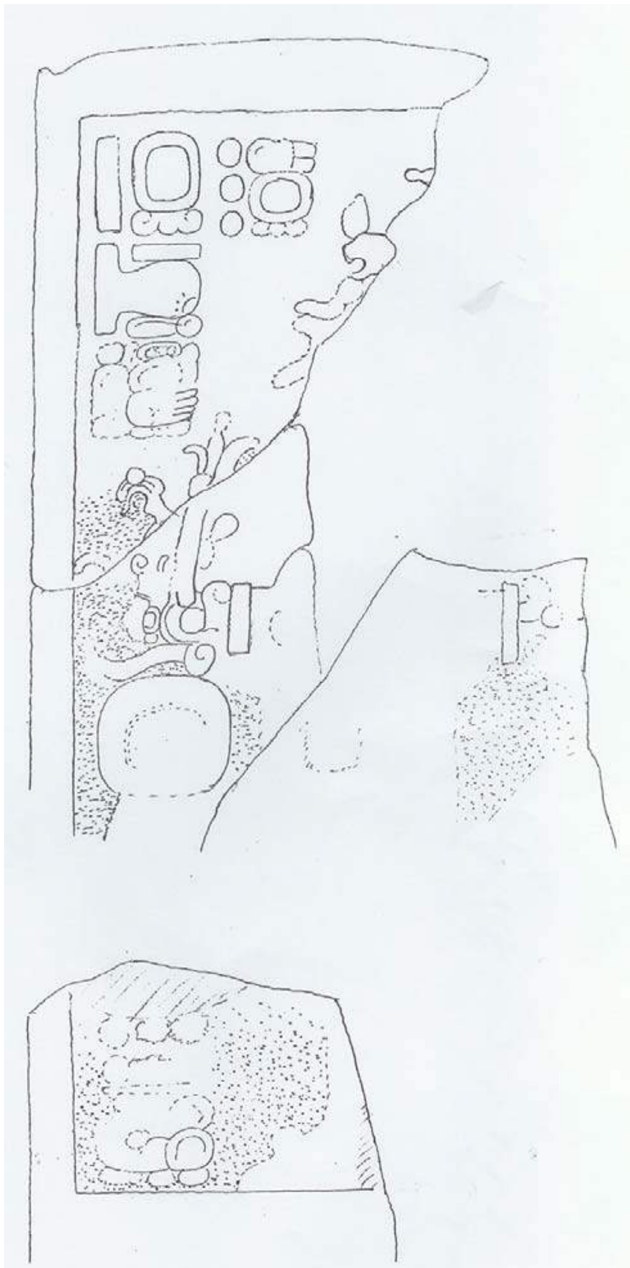

Figure 5. Located in front of Structure O14-04, fragmentary and eroded Stela 1 dates to AD 657, ending the 103-year epigraphic hiatus at El Perú. It suggests a name including "B'ahlam" (drawn by Ian Graham).

Relative dates from Operations WK08 and WK11 indicate the entire Mirador Group was a locus of activity from the Terminal Preclassic through the Terminal Classic period, which constitutes the majority of El Perú's occupation. Initial observations of the Mirador Group indicated a disparity in orientation of the natural rise compared to Structures O14-02 and O14-04, and preliminary inferences based on fieldwork suggest differences in architectural features, artifact assemblages and artifact density hinting at distinct functions for each locale. Moreover, while no burials were recorded in WK08, excavation in WK11 unequivocally demonstrates Structure O14-04 served a mortuary function during the Classic period, as two tombs (Burials #24 and #39) and one cist burial (Burial #25) were discovered along its primary axis in the building's *adosada*. Excavation demonstrated a major construction episode occurred at this building during the Early Classic, after two interments containing the remains of three adults and a fetus were carried out: Burial #24 is a rough-hewn vaulted tomb chamber cut into bedrock containing two young adult females, one of whom was pregnant at the time of death; Burial #25 is a crude cist containing one mature adult female. These interments are approximately 4.5 m apart horizontally, and appear to be under the same buried plaza floor level. Burial #24 is located further toward the center of the pyramid and is at the base of an earlier structure buried inside Structure O14-04's *adosada*. The plaza floor into which both burials are intrusive appears to be directly associated with this earlier substructure.

The female in Burial #25 was interred in an extended position with head to the north, along with a macaw motif Dos Arroyos Orange Polychrome bowl (Figure 6). This vessel is similar to Manik II phase vessels from burials at Mundo Perdido (Laporte and Fialko C. 1995:58-61), indicating the interment dates to the mid-fourth to early fifth centuries. Laporte (1989) defines Manik II as 300-378 CE. Other artifacts include a Triunfo Striated water jar (Figure 6), a jade bead found in the mouth region, and a *Spondylus* sp. shell associated with the cranium. The two females in Burial #24 were stacked back to back in an extended position, and both were oriented with heads to the north. Osteological analyses indicate they were young adults at time of death (Piehl 2006:441-443). The lower female was pregnant, demonstrated by the anatomically correct positioning of preserved fetal skeletal material. The fetus was approximately 5 to 6 months of age. Seven well-preserved, large vessels were included in the tomb. Four of these are basal flange Balanza Black dishes exhibiting post-fire incising, including birds and mat designs. Three polychrome basal flange vessels with scutate lids were also recovered (Figures 7, 8 and 9). They have been identified as Caldero Buff Polychrome, and are clear indicators of the mid-Early Classic period, again comparable to Manik Complex ceramics from burials at Mundo Perdido (Laporte and Fialko C. 1995), Burial 22 at Tikal (Culbert 1993) and Calakmul Vessel 9, Tomb 1, Structure III (Folan, et al. 1995). A small stingray spine was recovered from the pelvic region between the women's bodies, and *Spondylus* sp. shells were also associated with their crania.

Figure 6. Dos Arroyos Orange Polychrome bowl and a Trunifo Striated water jar, Burial #25, Structure O14-04.

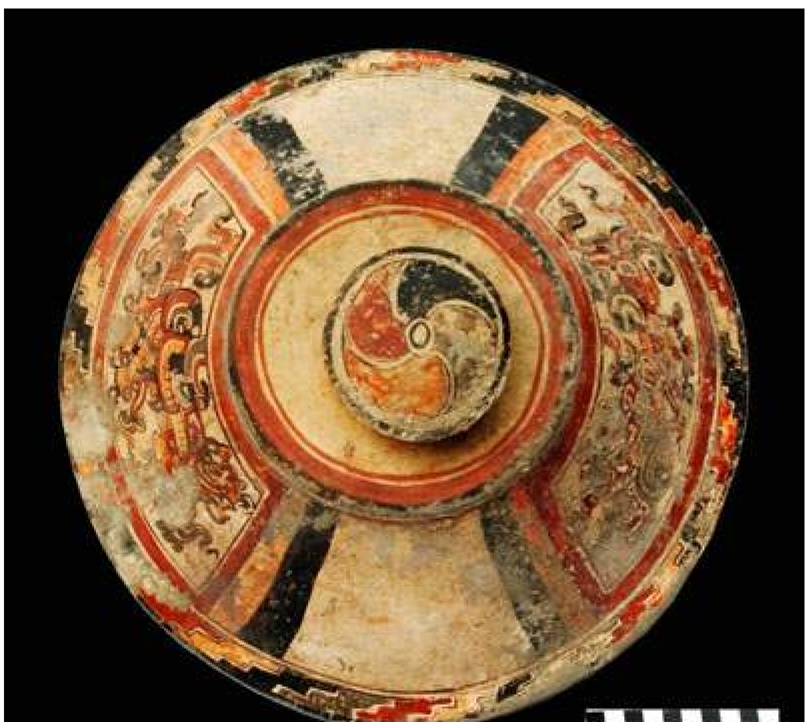

Figure 7. Caldero Buff Polychrome vessel, Burial #24, Structure O14-04.

Figure 8. Caldero Buff Polychrome vessel, Burial #24, Structure O14-04.

Figure 9. Caldero Buff Polychrome vessel, Burial #24, Structure O14-04.

The cause of death of all the women is unclear as there is no direct osteological evidence of perimortem trauma. This led to the interim hypothesis that the women in Burials #24 and #25 may have been sacrificed to accompany the interment of an Early Classic El Perú king. To test this, further excavation was carried out, revealing a vaulted tomb chamber (Burial #39) positioned on top of the previously mentioned substructure inside the *adosada*. This chamber contains the remains of an El Perú ruler (Individual A), and the various types of ceramic vessels in the mortuary assemblage suggest the burial occurred during the early Late Classic, sometime between 550-700 CE, but according to ceramicist Keith Eppich (pers. comm. 2008) the date range most likely falls between 600-650 CE, and this is demonstrated by the presence of several ceramic type-varieties including Petkanche Orange Polychrome: Undesignated Variety (Figure 10) and Palmar Orange Polychrome: Huisquil Variety (Figure 11). Furthermore, Guenter (pers. comm. 2008) suggests the style of the glyphs also indicate an early Late Classic interment date. This is clearly several hundred years later than Burials #24 and #25, thus indicting no immediate or direct link between the interments. In general, this relative date correlates to Tikal's Ik ceramic complex, for which the phrase "Intermediate Classic" (ca. 550-700 CE) has recently been used (Culbert 2003:54). Ongoing examination of the vessels by Guenter has resulted in the identification of the El Perú Emblem Glyph, the royal epithet, as well the names of at least three individuals. At present, none of these names can be associated with certainty to the person buried in the tomb. What *can* be said with certainty, however, is that further examination of the hieroglyphs and other artifacts from this burial will provide new evidence about a period marked by a one-hundred and three year epigraphic hiatus at El Perú from 554-657 CE (Guenter 2005). No monumental stela with texts have been documented at the site during this time frame. This may suggest a pause in the erection of carved stela, the deliberate destruction of these stela by later Maya or possibly a temporary focus on the use of other recording materials or mediums which do not preserve well in the archaeological record. Recall that it is Stela 1 in front of Structure O14-04 that ends this epigraphic hiatus.

Figure 10. Petkanche Orange Polychrome: Undesignated Variety, Burial #39, Structure O14-04.

Figure 11. Palmar Orange Polychrome: Huisquil Variety, Burial #39, Structure O14-04.

The adult individual of indeterminate sex interred in Burial #39 was oriented again with head to the north and laid in an extended position on a bench. Analysis of the skeletal material by bioarchaeologist Jennifer Piehl was hindered because skeletal markers of sex were not well preserved. Consequently, it is unknown whether this individual was male or female, but Piehl was able to determine that he or she was of advanced age, and enjoyed a life of generally good health (Piehl 2008:195-197). Preserved textile fragments present across the surface of, as well as underneath, the skeletal material indicate the individual was wrapped in fabric. A great many artifacts were placed on the bench, including nine ceramic vessels; various greenstone artifacts, including a pendant representing a human figure, three sets of earflares and the remains of a miniature mosaic mask; painted organic objects; nine stingray spines clustered together and underneath a plate covering the torso region; carved *Spondylus* sp. shell beads and other worked bivalve shells. Additional artifacts on the bench include an unprecedented cluster of 23 figurines representing humans and supernatural beings laid out in what appears to be a scene depicting the resurrection of a deceased king (described in

Lawler 2007:978), and two sets of lip-to-lip vessels, one containing an eroded square pyrite mirror and the other a serpentine Middle Preclassic Olmec heirloom statuette possessing supernatural characteristics associated with the Olmec Maize God (Joralemon 1971). A narrow alley west of the bench contained the skeletal remains of a child (Individual B) approximately seven years of age +/- 24 months (Piehl 2008:197) placed on top of four of the vessels in the northern end of the alley; twenty-four ceramic vessels; various carved shell beads and ornaments; and four miniature mosaic jewels, two of which represent monkey scribes. Based on their position in the alley and the discovery of the impression of a woven material, these mosaics along with small shell flowers, stars and intricately carved animals, may have been sewn onto cloth and laid in the alley. Some elements of the mortuary assemblage suggest the ruler enshrined in the tomb may have been a scribe. These include miniature mosaics representing monkey scribes, four figurines portraying scribes and pigment concentrations of various colors on the funerary bench and inside vessels.

Additional data indicate Burial #39 was reentered through the top of the chamber toward the end of the Late Classic or during the Terminal Classic. Evidence for reentry includes a 10cm thick cut floor visible *only* in the south profile of the excavation above the chamber's vault. It must be stressed the cut floor was never repaired or replastered after the reentry event, and the entire tomb chamber was in-filled. Prior to filling the tomb, the interred individual was covered with carefully laid flat stones (Figure 12). After this, the western side of the tomb's vault and the capstones were collapsed into the chamber, which was then filled with matrix and large quantities of stucco sculptural elements, faunal bone, chert and obsidian tools and debitage, ceramic sherds and partial vessels. Moreover, excavation indicates the terminal construction phase shrine room atop the frontal platform was also filled with matrix, representing the sealing off of a major portion of Structure O14-04 from any future use.

Figure 12. Burial #39 during excavation by Jennifer Piehl, Varinia Matute and Michelle Rich (l to r); note the remaining flat slates atop the skeletal material (photograph by Ulises Rodríguez).

Objectives

Research in the Mirador Group resulted in a total of 115 carbon, matrix, pigment and textile samples collected from the previously described architectural and interment contexts. The objectives outlined in the original funding proposal included radiometric dating of carbon samples, the examination of textile samples and impressions using scanning electron microscopy (SEM), and analysis of matrix, pigment and textile samples from tomb contexts using Fourier transform infrared spectroscopy (FTIR) followed by scanning electron microscopy with energy dispersive x-ray analysis (SEM-XEDS). Analyses of such samples provide much needed temporal information and fine-grained data of significance, all of which enhance our understanding of El Perú and the ancient Maya.

Results

All samples were prepared by myself and El Perú-Waka' Archaeological Project member Varinia Matute in the project's Guatemala City laboratory facility. Samples were either hand-carried or shipped via DHL to the United States for processing, with the permission of IDAEH. The objectives, methodology, results, preliminary interpretations and conclusions of all analyses are reviewed below.

Radiocarbon Dates

Objectives

Data from radiometric analyses were sought to help solidify relative dates acquired through ceramic analysis, clarify the temporal relationship between Burials #24 and 25, and provide solid reference points to allow for a more precise comparison of Burial #39's original interment date and subsequent reentry.

Methodology

Carbon samples were reviewed and selected in the project's Guatemala City laboratory facility. They were assessed based on quality of associated contextual data and the integrity of sample, meaning samples collected *in situ* were preferred in all instances to those collected during the screening process. Carbon samples were processed by Beta Analytic, Inc., Miami, FL (www.radiocarbon.com). Accelerator mass spectrometry (AMS) was utilized in order to attain the most precise results. Additionally, this reduced the required sample size such that carbon samples could be preserved for potential future studies. At Beta Analytic, samples were pretreated in order to eliminate secondary carbon components, which may result in a radiocarbon date that is either too young or too old. The conventional radiocarbon age was calculated after applying $^{13}C/^{12}C$ corrections to the measured radiocarbon age. Calibrations were calculated using the newest calibration database (Reimer 2004). Both 1 and 2 Sigma calibrated results were provided by Beta Analytic. Statistically speaking, a 1 Sigma calibrated result provides a 68% chance that the true age of the dated material falls within one standard deviation of the mean date, whereas 2 Sigma calibrated results provide a 95% chance that the actual age of the carbon dated falls within two standard deviations of the mean date. The dates included in this report are the 2 Sigma calibrated results.

Results

After review, only samples from Operation WK11 (Structure O14-04) were selected, as the samples from Operation WK08 were not as contextually robust. Table 1 summarizes the analyzed samples and provides sample numbers, both on the El Perú-Waka' Archaeological Project level and the corresponding number assigned by Beta Analytic.

Table 1. Summary of AMS dates

EPWAP Designation	EPWAP Sample #	Beta Analytic Sample #	Conventional Radiocarbon Age	Cal Date (2 Sigma calibration - 95% probability)	Within expected range
WK11A-19-2-69	6	**239735**	1640 +/- 40 BP	330-540 CE	Yes
WK11A-41-4-83	8	**239736**	3880 +/-40 BP	2470-2260 BCE and 2260-2210 BCE	No
WK11A-41-5-88	10	**239737**	3970 +/- 40 BP	2570-2440 BCE AND 2420-2400 BCE AND 2380-2350 BCE	No
WK11A-41-7-112	21	**239738**	1710 +/- 40 BP	240-420 CE	Yes
WK11A-50-4-109	13	**239739**	1780 +/- 40 BP	130-350 CE	Slightly Earlier
WK11A-50-5-110	14	**239740**	1800 +/- 40 BP	120-330 CE	Slightly Earlier
WK11A-62-2-213	80	**239741**	30140 +/- 250 BP	None	No
WK11A-92-2-228	84	**239742**	1250 +/- 40 BP	670-880 CE	Yes

Beta-239735

Context: Carbon fragments from final construction phase plaster floor, upon which a Teotihuacan-style stucco head was deposited (Figure13). The head was located directly inside the doorjamb of the terminal architectural phase masonry shrine room. The carbon fragments were collected just prior to block lifting the stucco head.

Objective: To date the floor upon which the Teotihuacan-style stucco head was deposited.

Discussion: The provenience of this carbon sample (WK11A-19-2-69) represents excavation into the terminal floor in the shrine room positioned atop Structure O14-04's *adosada*. This excavation was conducted in preparation for block-lifting the larger-than-life Teotihuacan-style stucco head discovered laying at a lopsided angle on the floor of the shrine room. Lot 69 contained no diagnostic ceramics which might have provided a relative date for the floor. This lot, however, corresponds to the first lot excavated in the vertical shaft called Unit 41 (WK11A-41-2-79), which was a unit initiated inside the doorjamb of the shrine room to collect data on the *adosada's* construction sequence. Because both lots represent the terminal floor in the shrine room, data regarding Lot 79 can be used to interpret Lot 69. Since excavation of these two lots in 2005, more intensive ceramic analysis has been completed. In the project's annual report treating 2005 fieldwork, I stated that preliminary ceramic analysis conducted by various members of the El Perú-Waka' Archaeological Project indicated this floor and the associated fill below it date to the Late Classic period (Rich, *et al.* 2006). This has now been corrected to the Early Classic period (ca. 200-550 CE), and is demonstrated by the presence of such ceramic types as Aguila Orange, Tinaja Red and Pucte Brown[3].

Figure 13. Teotihuacan-style stucco head found above the final construction-phase floor in Structure O14-04's shrine room. Carbon was collected from the floor directly associated with this head.

Additional ceramic analysis data from across the pyramid suggests that the bulk of Structure O14-04 was constructed during the Early Classic period, and then remodeled several times during that same period. The calibrated date of 330-540 CE corresponds to the date range expected based on the relative date provided by ceramic analysis.

[3] The *Tipología Cerámica Preliminar de El Perú* (Perez et. al 2008) details the methodology used and extant ceramic typologies employed in the creation of the El Perú sequence. This document defines the various ceramic types identified thus far at El Peru, and places them within a chronological framework.

Beta-239736

Context: Carbon fragments from vertical shaft (Unit 41) inside doorjamb of terminal shrine room, from architectural fill stratigraphically below third plaster floor 3.

Objective: To date the fill below the earliest plaster floor documented in Unit 41.

Discussion: Ceramic analysis for this level (WK11A-41-4-83) documented both Terminal Preclassic (e.g. Boxcay Brown) and Early Classic ceramic types (e.g. Aguila Orange and Azote Orange), providing a relative date of the Early Classic period for the fill beneath the third, or earliest, plaster floor. The calibrated dates of 2470-2260 BCE and 2260-2210 BCE do not correspond to the date range expected based on the relative date provided by ceramic analysis, and are unreasonably old considering the context. One explanation for this unexpected date is that the carbon sample collected was not culturally related to the remodeling of the building, but was carbon present in the soil used as construction fill for the architectural modifications that took place at Structure O14-04.

Beta-239737

Context: Carbon fragments from vertical shaft (Unit 41) inside doorjamb of terminal shrine room, from architectural fill above the hard-packed floor.

Objective: To date the fill below the prepared surface above which the intrusive Burial #39 tomb chamber is positioned. Collected above hard packed floor, which is the last layer above Burial #24 tomb chamber roof.

Discussion: Again, ceramic analysis for this level (WK11A-41-5-88) documented both Terminal Preclassic (e.g. Boxcay Brown, Baclam Orange) and Early Classic ceramic types (e.g. Aguila Orange and Azote Orange), dating this fill again to the Early Classic period. The calibrated dates of 2570-2440 BCE, 2420-2400 BCE and 2380-2350 BCE do not correspond to the date range expected based on the relative date provided by ceramic analysis, and are unreasonably old considering the context. One explanation for this unexpected date is that the carbon sample collected was not culturally related to the remodeling of the building, but was carbon present in the soil used as construction fill for the architectural modifications that took place at Structure O14-04.

Beta-239738

Context: Carbon fragments from Burial #24 at south end of chamber near surface of shallow matrix on tomb floor.

Objective: To corroborate or refute Burial #24's relative date based on vessels in the tomb (Early Classic period, mid-fourth to early fifth century).

Discussion: The Balanza Black vessels indicate an Early Classic date for this tomb, and the similarity of the Caldero Buff Polychrome vessels to those excavated at Tikal and Mundo Perdido suggest a correlation to the Manik II phase (ca. 300-378). The calibrated date of 240-420 CE corresponds to the date range expected based on the relative date provided by ceramic analysis.

Beta-239739

Context: Carbon fragments from fill associated with the construction pen above Burial #25.

Objective: To date construction associated with Structure O14-04 subsequent to Burial #25 interment.

Discussion: Ceramic analysis for this provenience (WK11A-50-4-109) documented only Early Classic ceramic types (e.g. Aguila Orange, Pucte Brown and Tinaja Red), providing a relative date of the Early Classic period for this construction fill above the floor under which Burial #25 was interred. The calibrated dates of 130-350 CE correspond to the date range expected based on the relative date, and are also slightly earlier than expected, representing a portion of the Late Preclassic (ca. 1-150 CE) and the Terminal Preclassic (ca. 150-200 CE) as well.

Beta-239740

Context: Carbon fragments from fill below plaster floor beneath which Burial #25 was interred, identified as an early plaza surface buried beneath later construction episodes. Collected at the edge of the Burial #25 cist

Objective: To corroborate or refute Burial #25's relative date based on vessels in the tomb (Early Classic period, mid-fourth to early fifth century).

Discussion: Ceramic analysis for this provenience (WK11A-50-5-110) documented only Early Classic ceramic types (e.g. Aguila Orange, Pucte Brown and Tinaja Red), providing a relative date of the Early Classic period for the fill beneath the floor at the edge of the Burial #25 cist. The calibrated dates of 120-330 CE correspond to the early end of the date range expected based on the relative date, and are also slightly earlier than expected, representing a portion of the Late Preclassic (ca. 1-150 CE) and the Terminal Preclassic (ca. 150-200 CE) as well. This date suggests the possibility that this burial is earlier than expected, as the presence of the macaw motif Dos Arroyos Orange Polychrome bowl was used to assign a relative date of the mid-fourth to early fifth centuries similar to Manik II phase vessels from burials at Mundo Perdido. Also, these dates overlap with, but do not completely correlate with the date range provided for Burial #24, indicating a possibility of contemporaneity, but simultaneously suggesting Burials #24 and #25 are not contemporaneous interments.

Beta-239741

Context: Carbonized matrix associated with broken miniature zoomorphic frog (Figure 14) vessel in center of figurine assemblage on Burial #39 funerary bench.

Objective: To corroborate or refute Burial #39's relative date based on vessels in the tomb and the style of glyphs on some of those vessels (Late Classic period, early to mid-seventh century).

Discussion: This objective presupposes the figurine cluster was an original component of the mortuary assemblage, and not deposited in the tomb during the reentry event. No calibrated dates were provided, and the conventional radiocarbon age of 30140 +/- 250 BP does not fall within the date range expected for the mortuary assemblage based on the relative date provided by ceramic analysis and glyph style. This date is unreasonably old considering the context, and in this case the primary explanation for this is that the sample was contaminated.

Figure 14. Head of the miniature frog figurine, which was associated with carbonized matrix. A sample was collected and tested in order to try to determine the interment date of Burial #39.

Beta-239742

Context: Carbon in direct association with a cluster of in situ worked polyhedral blade cores and debitage derived from their reduction (WK11A-92-2-228), located in the fill of Burial #39 tomb chamber (Figure 15).

Objective: To corroborate Terminal Classic (ca. 750/800-900 CE) period reentry date of Burial #39.

Discussion: Analysis of ceramic sherds from surface contexts at Structure O14-04 has typically provided relative dates of the Late or Terminal Classic. The occasional occurrence of sherds representing earlier ceramic types in above-floor contexts can be explained via looting activity or taphonomic processes. Architectural slump may occur higher up on the pyramid and thus earlier sherds included in construction fill tumble down the face of the structure (Figure 16), mixing with what may be (but are not necessarily) intact surface contexts. The sherds in the matrix in the shrine room directly above the Burial #39 tomb chamber dated exclusively to the Late and Terminal Classic periods, excepting the presence of a single Terminal Preclassic Achiotes Unslipped sherd. The fill within the chamber itself contained diagnostic ceramic sherds dating from the Terminal Preclassic through the Terminal Classic. The Terminal Classic sherds on the temple-pyramid, and directly above and within the tomb chamber indicate Terminal Classic activity at the building and in the tomb. The calibrated AMS date of 670-880 CE corresponds to the date range expected based on the relative date provided by ceramic analysis.

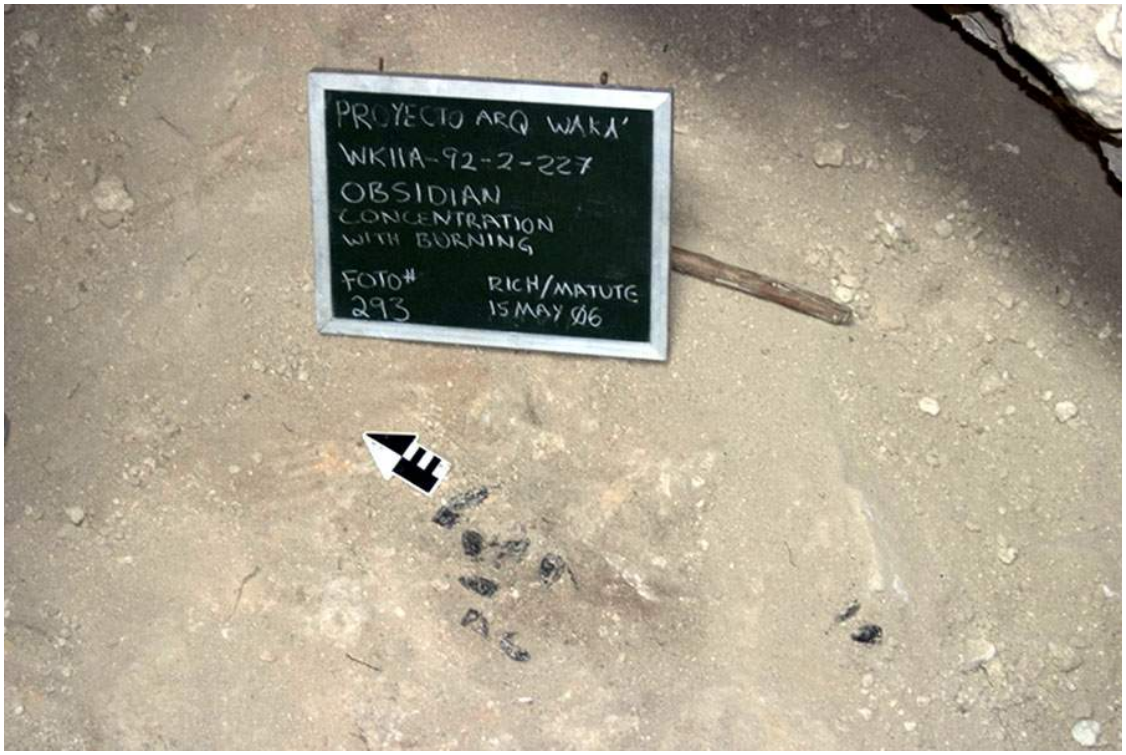

Figure 15. Cluster of obsidian polyhedral blade cores and debitage in the Burial #39 tomb fill associated with carbon sample tested to date the re-entry of Burial #39.

Figure 16. Structure O14-04. Jennifer Piehl drawing at the base of the adosada, with other archaeologists standing in the shrine room atop the adosada. Summit of temple visible in the distance (photograph by Patrick Aventurier).

Conclusions

Interpretation and discussion of each individual date is included above. Overall, some of the AMS results are quite useful in providing absolute dates to confirm relative dates acquired through ceramic analysis. Three of the eight dates did not correspond with the expected date ranges. In two cases (Beta-239736 and -239737), this could be because the carbon sample collected was not culturally related to the remodeling of the building, but was carbon present in the soil used as construction fill for the architectural modifications that took place at Structure O14-04. The third case (Beta-239741) was a complete outlier, suggesting the sample was contaminated. The remaining five dates (Beta-239735, -239738, -239739, -239740, -239742) corresponded to expected results using the 2 Sigma calibrated calendar dates. In two cases, the date ranges were slightly earlier than expected (Beta-239739 and -239740).

Textile Analysis

Objectives

Burial #39 contained two forms of evidence indicating textiles and woven materials had been placed in the chamber. The first was preserved fragments of a woven fabric, and the second was an impression in a dried mud-like matrix. The primary individual (Individual A) interred in Burial #39 was placed in an extended position on the bench inside the tomb chamber, and preserved fragments of textile were present in association with skeletal material. This material appeared to be comprised of two layers: a dried or "leathery" outer layer, and a woven inner layer. The second instance was small fragments of dried mud preserving the impression of what appeared to be a textile. This evidence was collected in the alley of the tomb chamber, near the floor surface, in association with the elaborate miniature mosaics, shell flowers, stars and animals described above. It was hoped that analysis of these two samples by a specialist would result in increased data regarding perishables in tomb contexts.

Methodology

Both samples were packed for shipment and submitted to Margaret Ordoñez, a textile specialist at the University of Rhode Island, who has worked with textiles excavated from tomb contexts at Copán. She used scanning electron microscopy (SEM) to analyze the fabric associated with the skeletal remains (Sample 119) (Figure 17) and the mud impression (Sample 122) (Figure 18). Only a fraction of the fabric recovered in association with the skeletal remains was submitted for this process, ensuring a sufficient quantity exists for future analyses. All examples of the mud impression were submitted, as they were few.

Figure 17. Fabric sample #119, analyzed by Margaret Ordoñez, represents a portion of the fabric recovered in direct association with the primary individual in Burial #39.

Figure 18. Mud impression #122, analyzed by Margaret Ordoñez, was collected in the alley of the tomb chamber.

Results

The results below were compiled by Ordoñez and submitted upon completion of analysis of the two samples:

Sample 119 - Fabric Fragments

Fiber content: Difficult to determine because of grainy deposit on surface of fibers, but can tell that single fibers have been twisted to make up the yarns, so cotton is a distinct possibility (Figure 19). So far in my analysis of Copán textiles, I have not found any bast (from the stem of a plant) fibers that had been separated into ultimates (single fibers); bast fibers are still in bundles, meaning that the producer removed enough of the woody parts of the stem to free the bundles.

Yarn structure: Simple, single, z-spun warp and weft yarns (Figure 19)

Fabric structure: Very open, unbalanced plain weave; fabric count of 20 x 10 yarns per square centimeter (warp is usually highest number and is written first in this type of notation). See Figures 20, 21 and 22. One layer of fabric had a fabric count more like 30 x 12 yarns per square centimeter and a straight edge parallel to this high warp count (Figure 23). This most likely is the edge of the fabric (selvage or selvedge) where a weaver often puts a greater number of yarns for stability.

Figure 19. SEM image of Sample 119. Fiber content is difficult to determine because of grainy deposit on surface of fibers, but the single fibers have been twisted to make up the yarns. The yarn structure is a simple, single z-spun warp and weft yarns (7.5x).

Figure 20. Layers of fabric from Sample #119 (1.75x).

Figure 21. Layers of plain weave from Sample #119 (4.6x).

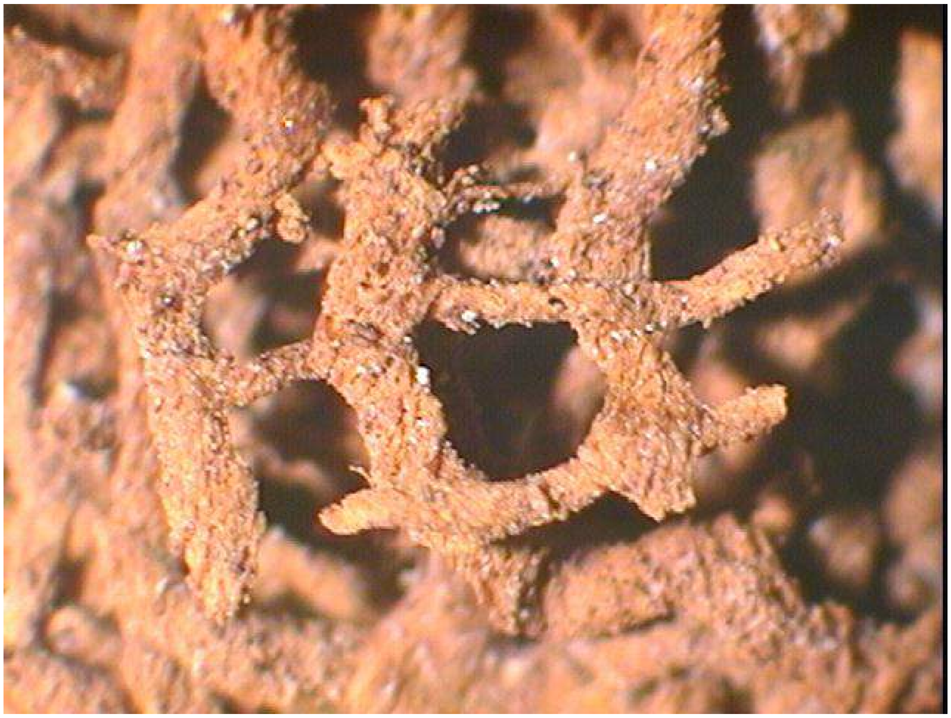

Figure 22. Plain weave from Sample #119 (6.25x).

Figure 23. Layer of fabric with a higher fabric count more (30 x 12 yarns per square centimeter) and a straight edge parallel to this high warp count. Most likely represents the edge of the fabric (selvage or selvedge) where a weaver often puts a greater number of yarns for stability.

Layers: Many of the fragments have multiple layers, but as far as I can tell, they have multiple layers of the same fabric--not layers of different fabrics. One layered fragment has "mud" on one side that has impressions of the same layered fabrics as on the other side (Figure 24). Several explanations for layering are possible; fabric folded and put in grave; multiple layers wrapped around a body; loosely fitting clothing.

Coating: Some surfaces have a red deposit that most likely is cinnabar; many of the Copán textiles are impregnated or coated with cinnabar, but these samples appear to have just a coating of the red mercury sulfide material.

Figure 24. SEM image of "mud" impression of fabric adhering to fragment of fabric from Sample #119 (1.75x).

Sample 122—Mud with textile imprint

Fiber content: Only one set of elements are visible in the imprints, and those have close parallel ridges like many grasses (Figures 25 and 26).

Yarn structure: The one visible set of elements is made from strips of a plant material held together as fabric is being constructed; no processing evident

Fabric structure: Close twining, probably weft twining; determined by positioning fragments so that the peaks are lined up as in (Figure 27). Ridges in the surface of the plant material often lie at a non-90º angle as in the twined wefts in Figure 28. The shape of the peaks often is triangular as opposed to square or rectangular that a woven fabric would produce. Figure 29, the outside of the woven basket, shows triangular holes between the twining elements. An additional factor is that the peaks in one row are a half-step to the right or left of the peaks in the next row. Close weft twining is weft-faced so not much of the warp elements is visible in Figure 27 and in the basket out and inside in Figures 28 and 29. The twined mat that covered the mud had 2.2 twists/cm, 2.5-3.0 rows of twining/cm, and S-slant twining. The basket also is S-slant twining and has smaller elements with 5 twists/cm.

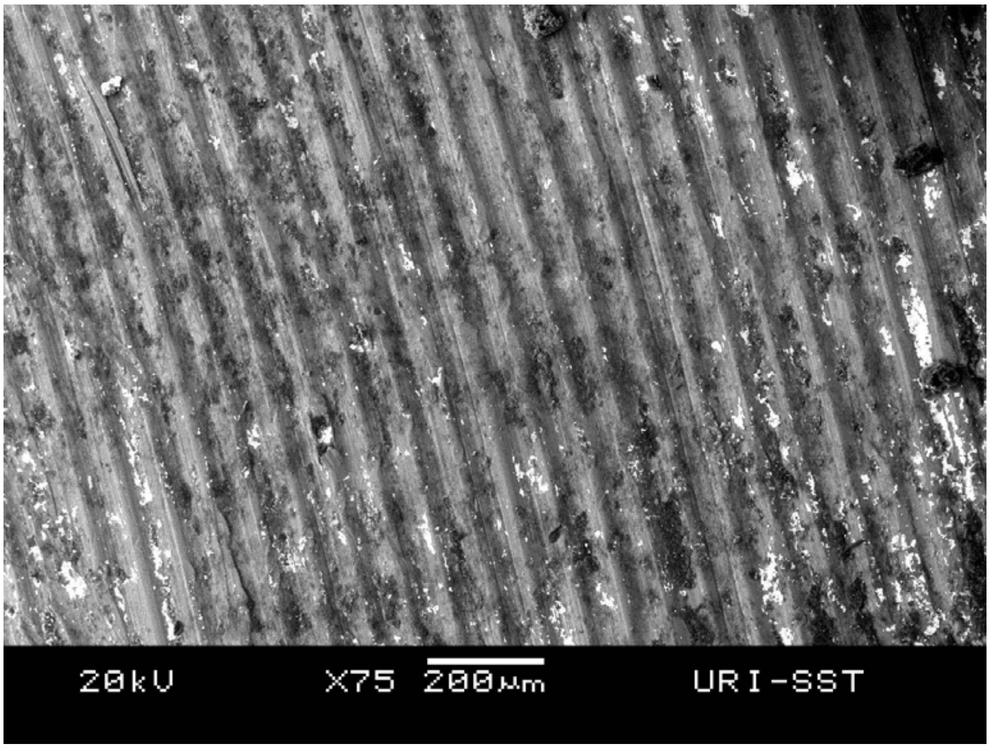

Figure 25. SEM image of ridges in surface of plant material from Sample #122 (75x).

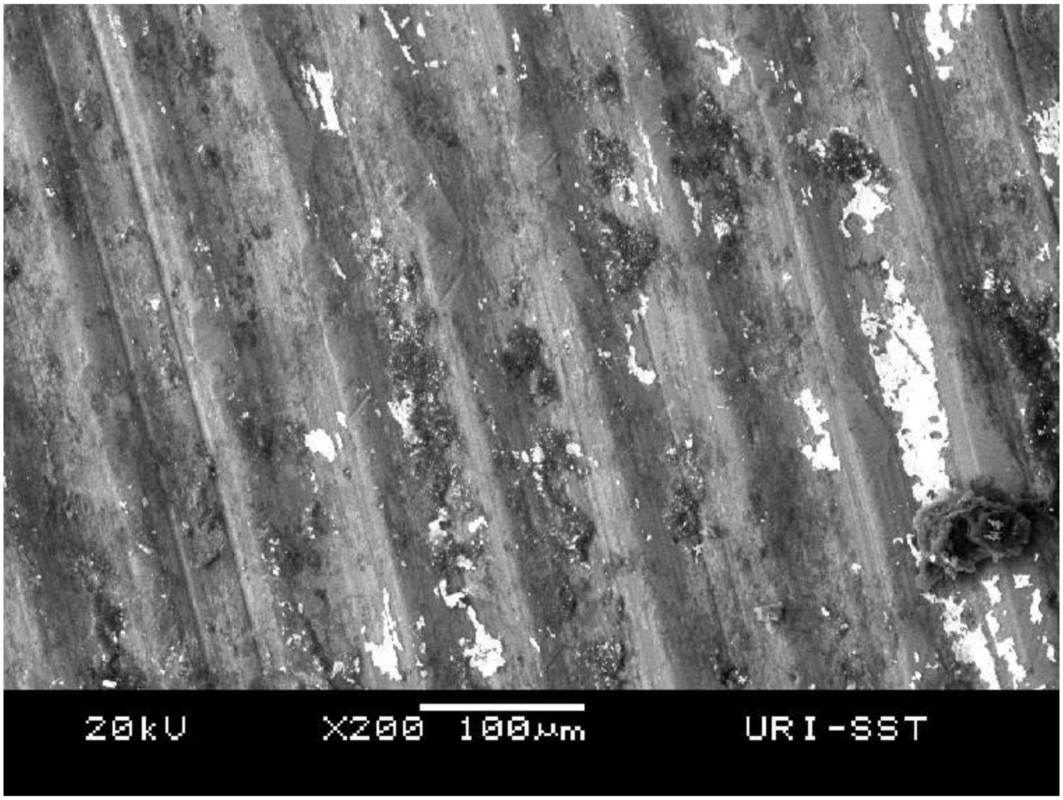

Figure 26. Close-up of ridges in surface of plant material from Sample #122 (200x).

Figure 27. Twined textile impression in mud – Sample #122 (1.75x).


Figure 28. Twined basket warp horizontal backside for comparison with Sample #122 (1.75x).


Figure 29. Twined basket warp vertical for comparison with Sample #122.

Conclusions

The analyses conducted by Ordoñez provided insightful data into the textile samples from Burial #39. Insofar as Sample 119 is concerned, additional communication with Ordoñez (pers. comm. 2008) suggests this fabric is probably cotton yarns woven in a low fabric count fabric. The association of fabric fragments with the upper surface of, as well as underneath, the skeletal material suggests the individual was wrapped or bundled in fabric. This interpretation is bolstered by the position of fabric fragments on top of and beneath the individual's crania.

The impression catalogued as Sample 122 proved to represent a perishable artifact – most likely a mat – weft-twined out of plant materials. Originally, it was thought the miniature mosaics, shell flowers, stars and animals may have been sewn or somehow adhered on onto cloth which this impression represented and laid in the alley, but rather they may have been attached to a plant-based weft-twined "substrate," or conversely, not directly associated with this perishable artifact. Ordoñez indicated that twining can incorporate more than two elements, but she has not seen examples of this in 17th-century native-American textiles she has analyzed, or at Copán. Sample 122 was plain twining; variations of the basic method exist, but she has only found this in the 17th-century textiles, not at Copán. She characterized this impression at quite a rare find.

FTIR and SEM-XEDS Analysis of Pigment, Matrix and Textile Samples

Objectives

As components of complex ritual burials, the analysis of matrix, pigments and textile samples from tomb contexts is warranted because it provides much needed information regarding the use of specific organic and inorganic resources and raw materials in the elaborate ritual interment of elite individuals. These fine-grained data are integral components of complex burial tableaux, yet tend to be understudied or overlooked relative to other tomb artifacts. As such, critical analysis of the tomb's contents as a cohesive whole is noteworthy because it will bring us one step closer to understanding what could be called the "iconography" of tombs. Coe (1988) originally put forth this approach, suggesting royal tombs were intentional arrangements of symbolically charged materials. Much can be learned about ancient Maya ritual behavior through the iconographic deconstruction of the layout and content of rich mortuary contexts, in tandem with the more frequently employed methodologies focused on analyzing individual artifacts and osteological remains.

Methodology

Glass microscope well slides were prepared for analysis in the project's Guatemala City lab facility. During this process, only a tiny fraction of the original sample was used, ensuring a sufficient quantity exists for future analyses. A total of 14 powdery pigment, matrix and textile samples were analyzed using Fourier transform infrared spectroscopy (FTIR) followed by observation with scanning electron microscopy with energy dispersive x-ray (SEM-XEDS) (Figure 30). This first procedure determines if the sample was comprised of organic or inorganic compounds, or a combination thereof. As an analytic procedure, FTIR has several benefits: only a small sample is required, colorants or binders can also be conclusively identified, and samples can be reused for subsequent analyses, such as SEM-XEDS, which more specifically identifies inorganic elements in a sample, but provides no information about organics or binders. The samples were processed by James Martin of Orion Analytical, LLC, Williamstown, MA, a materials analysis and consulting firm (http://www.orionanalytical.com). If a sample was comprised of more than one type of particle, it was broken down into its constituent particles and both FTIR and SEM-XEDS analysis was conducted on each type of particle by Martin.

Figure 30. Samples prepared in microscope well-slides submitted to James Martin of Orion Analytical for FTIR and SEM-XEDS analysis.

Results

The FTIR and SEM-XEDS results were compiled in Table 2 by Martin and submitted upon completion of analysis.

EPWAP Sample #	EPWAP Designation	Context	Contents	Description	FTIR	SEM-XEDS
33b	WK11A-41-7-112	Burial #24	Organic-looking matrix north of skeletal remains	Matrix	Inorganic: clay	Si, Ca (Al, P, Fe, Cl, K, Ti)
40 I (b)	WK11A-41-7-112	Burial #24	Matrix contained in vessel AR#10, which also contained quail bones and 40 II	Chunky material	Inorganic: clay and gypsum	Si, Al (Fe, Ca, S, Ti, Cl)
40 II (b)	WK11A-41-7-112	Burial #24	Matrix contained in vessel AR#10, which also contained quail bones and 40 I	Blackish matrix, with small white chunks (possibly small fragments of limestone from roof or fill stones?)	Inorganic: clay and calcite	Ca, Si (Al, Fe, P, S)
65(b)	WK11A-62-2-185	Burial #39	Taken from clump adhering to interior vessel AR#37 base	Powdery matrix	Inorganic: calcite	Ca (S)
106(b)	WK11A-62-2-185	Burial #39	From material adhereing to interior base of vessel AR#14	Chunky material	White particle - inorganic: calcite, clay	White particle: Ca (Si, P, Al)
106(b)					Glossy brown particle - organic and inorganic/asphaltic type material?	Glossy brown particle: Ca, Si (Al, Fe, Mg, S)
106(b)					Gray particle - organic and inorganic: plant gum? and calcite	Gray particle: Ca (Si, Al, Fe, Mg, S)
80(b)	WK11A-62-2-213	Burial #39	Associated with miniature frog vessel's head (AR#104)	Blackish matrix, with small white chunks (possibly small fragments of limestone from roof or fill stones?)	Inorganic: clay, calcite, gypsum	Ca (Si, Al, S, Fe)
81(b)	WK11A-62-2-213	Burial #39	From inside miniature vessel (AR#103) in figurine cluster	Matrix	Lustrous particle - inorganic: iron oxide/hematite?	Lustrous particle: Fe (Al, Si, Ca) - hematite?
81(b)					Red particle - inorganic: iron oxide/hematite?	Red particle: Fe, Si, Al (K, Ca, Mg, Ti)
81(b)					White particle - inorganic: calcite, clay	White particle: Ca (Si, Al, Fe, Mg)
81(b)						Coating on brown particle: Fe (Si, Al)
81(b)					Brown particle - inorganic: inidentified silicate	Brown particle: Si (Fe, Al)
86(b)	WK11A-62-2-213	Burial #39	From inside "poison" bottle (AR#149), north end of tomb	Powdery matrix	White particle - inorganic: calcite	White particle: Ca (Si, Al, S)
86(b)					Black particle - organic? and inorganic: calcite and unidentified silicate	
87(b)	WK11A-62-2-213	Burial #39	Organic-looking matrix assoc. with right leg of Individual A	Dark brown matrix, with small white chunks (possibly small fragments of limestone from roof or fill stones?)	White particle - inorganic: calcite and clay	White particle: Ca, S (Si, Al, Fe)
87(b)					Red particle - inorganic: cinnabar?, organic?: unidentified	Red particle: Hg, S (Al, Fe)
87(b)						Brown particle: Hg, S (Si, Ca, Al, Fe)
87(b)					Brown particle - organic: plant gum?; inorganic: clay	Brown particle: Si, Al, Ca (Fe, S, Hg, Mg, Cl, Ti, K, Zr?)
88(b)	WK11A-62-2-213	Burial #39	Red-pink pigment collected from north end of tomb near wall	Powdery matrix	Red particle - inorganic: calcite, clay, cinnabar?	Red particle: Hg, S (Ca, Si, Al)
109(b)	WK11A-62-2-213	Burial #39	From material adhereing to interior of miniature vessel (AR#155) at north end of tomb	Matrix, slightly chunky	Black particle - organic (plant gum?); sloped baseline might indicate carbon	Black particle: C, Ca (Si, Al, Mg, S, Cl, Fe)
112	WK11A-62-2-213	Burial #39	From inside shaman figurine (AR#102) in figurine cluster	Matrix, sparkly	Red particle - inorganic: kaolin, quartz, iron oxide?	
112					Lustrous particle - inorganic: hematite?	
120	WK11A-62-2-213	Burial #39	Fabric samples from the material wrapped around Individual A	Bundle material - woven component	"fiber" - organic: plant gum?	"fiber": Fe (Si, Al); Glossy flake from fiber: Fe
120					White particles on fiber - inorganic: gypsum	
121	WK11A-62-2-213	Burial #39	Fabric samples from the material wrapped around Individual A	Bundle material - "leathery" component	Light yellow brown particle - organic: plant gum?; inorganic: clay	White on particles: Ca, S (Si, Al, Mg, Fe)

Table 2. Summary of FTIR and SEM-XEDS results.

Interim Conclusions

Quite a great deal of information was garnered via the FTIR and SEM-XEDS analyses. These tests demonstrate that the samples were both organic and inorganic, and many contained multiple trace elements. The numerous elements comprising each sample were unexpected, and these results lay the foundation for a detailed archaeomineralogy study (Rapp 2002) of the fine-grained data pertaining to the Structure O14-04 tombs. The examination of the implications of this information for the elaborate burial contexts constructed by the ancient Maya of El Perú is ongoing, and will be the basis of a future co-authored publication between myself and Martin.

Zooarchaeological Analysis

Objectives

The baseline goal of the zooarchaeological analyses was to identify the animal species represented in the Operation WK08 and WK11 excavations. A small quantity of faunal bone was recovered in excavations in architectural contexts; most general excavations produced only shell. The majority of faunal material was discovered in the problematic fill deposit associated with Burial #39's reentry. In regard to this specific context, the goals were to identify the species present and try to discern intrusive versus non-intrusive species.

Methodology

Zooarchaeological analysis was conducted by Erin Kennedy Thornton, Ph.D. Candidate, Department of Anthropology, University of Florida, Gainsville and zooarchaeology research assistant at the Florida Museum of Natural History. Faunal material was shipped via DHL from Guatemala City to the University of Florida lab to allow for the use of comparative collections for identification of skeletal elements. Only a representative sample of shell collected from surface excavation and construction fill contexts in Operations WK08 and WK11 was submitted for analysis. This strategy was implemented in order to reduce shipping costs and analysis time, and the information garnered through the analysis of this portion of the sample will be used to create a comparative collection so that the remainder of the shell from similar fill and surfaces contexts can be identified and counted at a later date. Additionally, a small number of ecofacts and artifacts of bone or shell that were components of mortuary assemblages were preliminarily examined by Thornton in the Guatemala City laboratory in 2006 and not subsequently shipped to Florida. In certain cases, these and other materials were studied further using high-resolution digital photographs. The specific methodology employed by Thornton will be discussed in a future co-authored publication.

Results

The results of the analysis are discussed below by context:

General Excavation

No faunal bone was recovered in excavations at Operation WK08. General architectural excavation in Operation WK11 produced faunal material from two contexts: at the summit of the pyramid, and in the tunnel inside the *adosada*. A single faunal bone was recovered at the summit of Structure O14-04 in architecture fill. It was an unidentifiable mammalian skeletal element. The remainder of the faunal material from non-burial contexts was found in the tunnel that lead from the roof of Burial #24 up the red-stuccoed terraces of the earlier structure buried inside Structure O14-04's *adosada* and terminated at the exterior face of the Burial #39 tomb chamber. In this context, the following was recovered: one unidentifiable fragment; one marine gastropod shell carved into a very large tinkler (broken); one *Mazama* sp. (brocket deer) proximal/lateral radius; one *Odocoileus virginianus* (white-tailed deer) proximal phalanx; and a fragment of a Testudines (turtle) carapace. These faunal remains appear to be the type of random, fragmentary remains occasionally recovered in architectural fill.

The representative sample of shell from fill and surface contexts was selected from Operation WK08. Thornton determined this sample was comprised of Gastropoda (gastropods, possibly landsnails), *Pomacea flagellata* (apple snail), Unionidae (*Lampsilis* sp.? – freshwater mussel), *Trivia cf. pediculus* (coffeebean trivia), *Psoronaias semigranosus* (freshwater mussel), *Spondylus* sp. (spondylus), *Orthalicus* sp. (treesnail), *Oliva* sp. (olive shell) and Bivalvia (bivalve). No *Pachychilus indiorum* (jute) was identified in this sample, which are frequently recovered from Maya sites. Counts for these data are not relevant, as the purpose of identifying this sample was to create a comparative collection to use in the future analysis of the remainder of shell collected in fill and surface contexts in Operations WK08 and WK11.

Burial #24

The faunal material from Burial #24 originates from a single source: a Balanza Black tetrapod dish at the northeastern end of the tomb chamber, directly north of the crania of the interred individuals. This vessel has a post-fire incision of a pop or mat design on the interior surface. Inside the vessel were the complete skeletons of two birds (MNI=2), identified by Thornton as adult *Colinus* sp., commonly known as bobwhites or quails (Figure 31). Thornton's report indicated this species has been recovered in burials and caches. They are also a food species, suggesting a ritual food offering in Burial #24.

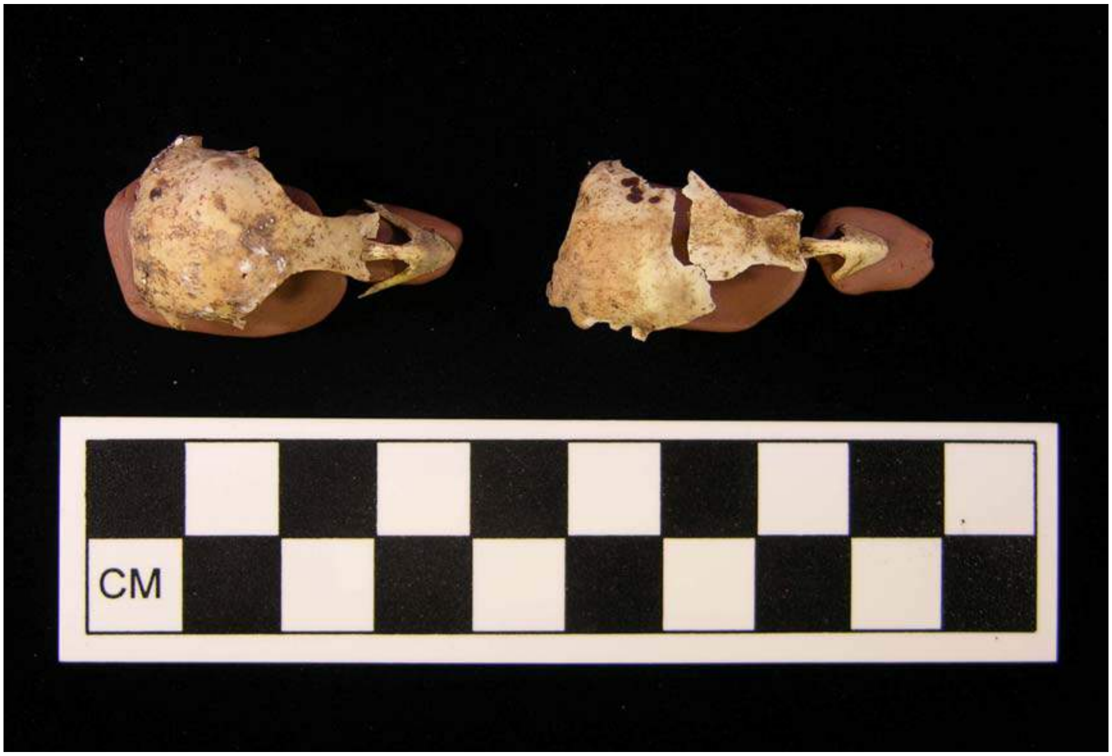

Figure 31. Crania of complete Colinus sp. skeletons found in the Balanza Black tetrapod dish at the north end of Burial #24. Identified and photographed by Erin Thornton.

Burial #39 Artifacts

A number of artifacts included among the Burial #39 mortuary assemblage were made from shell and bone. These items were identified from photographs only, as exportation to the United States of the many small artifacts from this tomb context would have been logistically challenging. A number of small carved stars, flowers and miniature animals were recovered. Thornton was able to preliminarily identify that the raw material used for the production of these small "adornos" was most likely a marine mollusk such as conch (Strombidae). A large shell perforated at inferior end with portion of body whorl cut away to create a shallow cup-shaped pendant (Figure 32) was identified through a photograph as *Cypraea cervus* (Atlantic deer cowrie). A minimum of four, but probably more, full tail spines from Dasyatidae (stingray) were also identified. Finally, the bone used to fashion two picks originated from unknown mammalian longbone shafts. Because all the unique features of the skeletal elements have been removed during the fashioning of the picks, it is impossible to be more precise than this about the origin of the bone, although a valid speculation would be that these were deer longbones.

Figure 32. Cypraea cervus (Atlantic deer cowrie) pendant recovered at the north end of the funerary bench in Burial #39.

Burial #39 Problematic Deposit

Most of the faunal remains recovered in the Burial #39 tomb chamber were associated with the fill that was deposited into the chamber after the reentry event occurred. The notable exception to this are the six *Panthera onca* (jaguar, MNI=1) distal phalanges from an adult individual recovered from various locations on the funerary bench (Figure 33). For most mammalian species the term phalange is used to refer to the small bones in the extremities. These bones can remain intact in a pelt, and their presence in the tomb indicates the deceased was most likely either laid on top of or covered by a jaguar pelt. Another possible exception to this is the almost complete skeleton of a subadult (likely 5-7 months old) *Urocyon cinereoargenteus* (grey fox, MNI=1), found on the northeastern corner of the funerary bench. Several centimeters of matrix between the skeleton and the surface of the bench call into question whether this animal was a component of the original burial, or deposited during the reentry event. The remaining faunal material was clearly associated with the reentry event.

Thornton determined the remainder of this tomb fill sample was comprised of:
Vertebrata (NISP=65)
Mammalia (NISP=19)
Aves/Reptilia (bird/reptile, NISP=1)
Reptilia (reptile, NISP=1)
Rodentia, small/medium (rodent, NISP=1)
Bufo marinus (cane toad, NISP=9, MNI=1)

Colinus sp. (bobwhite, NISP=1, MNI=1)
Dasypus novemcinctus (nine-banded armadillo, NISP=6, MNI=2)
Didelphis sp. (opossum, NISP=50, MNI=1) – almost complete skeleton
Lacertilia (lizard, NISP=4, MNI=1)
Odocoileus virginianus (white-tailed deer, NISP=1, MNI=1)
Osteichthyes cranial fragment (fish, NISP=1, MNI=1)
Psoronaias semigranosus (freshwater mussel, NISP=1, MNI=1)
Gastropoda (gastropod, NISP=3)
Pomacea flagellata (apple snail, NISP=1)

The species in the fill that are likely to be intrusive are:
Muridae (rat/mouse, MNI=5)
Sigmodontinae (New World Mouse or rat, MNI=1)
Orthogeomys hispidus (hispid pocket gopher, MNI=1)
Oryzomys cf. couesi (Coues's rice rat, MNI=1)
Ototylomys phyllotis (big-eared climbing rat, MNI=1)
Heteromys sp. (spiny pocket mouse, MNI=1)

Overall, the implications of these results are still unclear. As a whole, this assemblage is not necessarily indicative of a food assemblage, lacking significant food sources such as peccary and turkey. It is possible the diversity of faunal remains in this problematic deposit, coupled with the small number of bones representing any individual species, suggest that midden remains were used to in-fill the tomb chamber; however, additional examination of these results are merited and ongoing.

Figure 33. Distal phalanges of an adult Panthera onca (jaguar) recovered on the north end the funerary bench in Burial #39.

Conclusions

In sum, the zooarchaeological analyses conducted by Thornton identified the species recovered in Operations WK08 and WK11. A comparative collection of shell was developed so that the remaining shell from fill and surface contexts can be analyzed in the future. The small quantity of faunal remains from general excavation contexts has been identified, and the results are within expected parameters for surface and architectural fill contexts. The faunal remains contained in the ceramic dish in Burial #24 were identified, as were the artifacts, ecofacts and faunal remains on the funerary bench in Burial #39. The faunal remains in the problematic tomb chamber fill deposit were taxonomically identified, although much work remains in order to try to understand this deposit, the meaning of the full spectrum of artifacts included in it and what that might tell us about reentry behaviors when looked at within a comparative framework in the Maya region.

Artifact Analysis

Objectives

These analyses were conducted in the El Perú-Waka' Archaeological Project's laboratory facility in Guatemala City during a five week period in June/July 2008. This opportunity was realized due to the generosity of many individuals who donated in-kind labor and services, resulting in the originally proposed project coming in under budget. With the approval of FAMSI, the project was expanded to include additional analyses of faunal material; ceramic, lithic and groundstone artifacts; and special finds from Operations WK08 and WK11. The results of the zooarchaeological analyses were described above. The data collected on special finds and ceramic, lithic and groundstone artifacts are still in a raw format, and will be further analyzed in the context of my dissertation research, to be completed by May 2009.

The results of these analyses will help examine the cohesiveness of the Mirador Group and to test whether the buildings on the natural rise (WK08) had a discrete ritual function relative to Structure O14-04 (WK11). Preliminary observations suggest differences alluding to distinct functions for each locale, and not surprisingly, neither possesses artifact assemblages suggestive of a residential function. More specifically, the buildings on the natural rise (WK08) may be public in nature, whereas Structure O14-04 (WK11) appears restricted for royal elites. If this is the case, then associated artifact assemblages, as well as architectural form and function, should be different. Type, form, concentration and density of artifacts collected in equivalent contexts (e.g. construction fill, secure surface contexts, architectural features, mortuary assemblages, caches and other special deposits) should be qualitatively and quantitatively different, and demonstrate that diverse activities took place at these separate locations. Once the results of the analyses from both operations are entered into spreadsheets, exploratory data analysis (EDA) will be possible. Described as a philosophy of data analysis rather than a set of statistical models or techniques, EDA encourages the analyst to make few assumptions and relies on graphical techniques and data visualization (Aldenderfer 2005:511-513). Gaining insight into and testing assumptions about data structure, defining outliers, and pinpointing variables for further consideration can be accomplished using software such as SPSS, JMP and R. Consequently, EDA will help to identify patterns in the data comparing and contrasting artifacts within and across both Operations WK08 and WK11. While it is expected that data from WK08 and WK11 will demonstrate concrete differences relative to one another, it is also possible that data may register diachronic change within a single structure. If this is the case, it may also be feasible to determine whether the function of the individual structures was static or changing throughout the site's history.

Methodology and Results

The methods and results of the analyses are discussed below by artifact category:

Ceramics

Two separate objectives were pursued in regard to ceramic analysis, the first being to amass information collected by the project. The ceramics from WK08 and WK11 have been analyzed over the course of the past five years as a collective effort by various members of the El Perú-Waka' Archaeological Project staff. The results of these analyses can be found in the project's annual reports (Eppich 2004; Eppich, et al. 2005; Pérez Robles 2005, 2006; Pérez Robles, et al. 2008). These analyses at the project level collect the following information by lot[4]: total count of sherds, discard count, total number of sherds analyzed, the group and type-variety designation with counts by form, chronological information (period) for each type and, finally, miscellaneous observations. The form categories are bowl, plate, cylinder vase, olla (cooking jar), cantaro (water jar) and unidentifiable. Results of these analyses were logged on data forms, and the information for Operation WK08 had already been entered into a spreadsheet format. During the project-level analyses, non-diagnostic sherds were weighed and discarded for Operation WK08, but kept for WK11. The discard weights were recorded on a separate form. I entered the data for Operation WK11 into the Excel spreadsheet while in Guatemala. With the results of the ceramic analysis from both operations entered into spreadsheets, EDA is now possible.

The second objective was not to duplicate the work described above, but to re-familiarize myself firsthand with the scope of ceramic types present in each of the operations. Since excavation occurred over the course of a four-year period (2003-2006), it was imperative that I reacquaint myself with the excavated material to ensure a comprehensive and informed approach to my dissertation analyses. My goals

[4] The lot is the most basic recording device implemented by the El Perú-*Waka'* Archaeological Project and represents arbitrary, natural or cultural levels or features within a unit.

dovetailed with analysis being undertaken by Keith Eppich for his own dissertation research, consequently Eppich and I coordinated efforts in reviewing the ceramic sherds from Operations WK08 and WK11. Each operation was examined separately by unit and lot, allowing for a stratigraphic perspective on each separate context. These analyses systematically recorded the following by lot: total count of sherds, weight of sherds (g), discard count, discard weight, total number of sherds analyzed, the type-variety designation with counts by form, chronological information (period/complex) for each type and, finally, miscellaneous observations. The form categories recorded were rim, body or base. For Operation WK08, the total quantity of sherds analyzed by Eppich and myself will be less than the original quantity analyzed at the project level, since discards of non-diagnostic material were already made. Eppich also documented whole vessels from Operations WK08 and WK11 prior to my arrival in Guatemala City, the results of which have been made available to me. In addition to the important outcome of bolstering my direct knowledge of the ceramics from my operations, this second series of analyses provides a means by which to cross-check information in Operations WK08 and WK11, since the creation of a ceramic typology is often a subjective endeavor.

Lithics

Lithics from general excavations were examined, as well as the chert debitage from the Burial #39 tomb chamber problematical fill deposit. Only the most rudimentary analysis procedures were implemented in the examination of lithics from general excavation contexts. Field counts of chert and obsidian artifacts were cross-checked. Chert and obsidian were classified by description (e.g. tool, flake, core, eccentric) and the weight of all lots was measured in grams. Formal tools were weighed separately, and lithic special finds (discussed below) were incorporated into these analyses. Comparison of these data by context and EDA are now possible, which will isolate basic similarities and differences between Operations WK08 and WK11. Preliminary observations of the lithic sample from both WK08 and WK11 suggest a lack of diversity in the tool types represented, and that the majority of the sample is comprised of flakes and debitage primarily from architectural collapse or construction fill contexts.

The second focus of the lithic analysis was the material recovered from the Burial #39 tomb chamber (Figure 34). Most of these lithics were associated with the fill deposited into the chamber after the reentry. The preliminary analysis of this material was conducted by Zachary Hruby, and indicated the chert debitage recovered in this context is not typical production debitage resulting from the reduction of nodules to form finished bifaces. The high frequency of biface fragments, alternate flakes, and retouch flakes, and notable absence of early-, middle-, and late-stage biface reduction flakes, suggested to Hruby that this debitage was produced during the retooling of broken bifaces. Hruby previously examined the obsidian debitage from this same deposit, which derived from the reduction of polyhedral blade cores. The analysis of this material and its implications is ongoing.

Figure 34. Lithics associated with the fill deposited into the Burial #39 tomb chamber after re-entry.

Groundstone

Field counts of groundstone and worked stone were cross-checked. Groundstone fragments were classified by description when possible (mano, metate, tecomate), portion present and material type. This artifact class was not particularly abundant in

Operations WK08 and WK11, which is consistent with the interpretation that the buildings in the Mirador Group did not serve a residential function.

Special Finds

Special finds is a classificatory category established at the project level, typically encompassing unique artifacts separated from more general artifact categories at the discretion of the operation director. Examples of special finds in Operations WK08 and WK11 include solitary jade or shell beads, a greenstone axe/celt or a small eccentric flint. When appropriate, these may be collapsed back into more basic categories such as lithics. These finds were reviewed and cross-checked against field counts. Photographic documentation was completed, if it had not been done in the past. Preliminary observations indicate that special finds from both Operations WK08 and WK11 are either body adornments (e.g. miscellaneous beads) or complete lithic tools. Of course there are exceptions to this generalization, but the subsequent question is why are these items present in the Mirador Group? Closer examination by context is warranted in order to answer this query.

Interim Conclusions

The data collected during analysis of ceramics, lithics, groundstone artifacts and special finds will aid testing the hypothesis that the buildings on the natural rise (WK08) had a discrete ritual function relative to Structure O14-04 (WK11). This hypothesis was developed because initial observations suggested differences alluding to distinct functions for each locale. The next step is exploratory data analysis (EDA), described above, which will provide some insight into and test assumptions about data structure, define outliers, and pinpoint additional variables for further consideration.

Conclusions

The wide variety of data collected during the course of this FAMSI-funded project are intrinsic to the understanding and interpretation of the Mirador Group. New information resulting from the myriad analyses will contribute considerably to the ability to interpret activity at the Mirador Group, and propose explanations regarding how the group may have been integrated into the community of El Perú. Because El Perú was an ancient city at the crossroads of the southern lowland Maya world during the Classic period, it is imperative that these results be made available to communities of scholars and interested individuals. In addition to this report, the data garnered from this project will be further elaborated on in my dissertation, entitled *Shifting Alliances and Classic Period Politics: The Archaeology of the Mirador Group at El Perú-Waka', Petén, Guatemala.* This research revolves around the fact that historic inscriptions from the Classic period (ca. 200 - 900 CE) document the city of El Perú's involvement with the major powers of that era: Tikal and Calakmul. During this time, a dynamic political landscape in the Maya area set the stage for wide-ranging intra-regional alliances, relationships and rivalries, ostensibly extending to the central Mexican metropolis of Teotihuacan in the Early Classic period. Information from the Mirador Group, clearly one of the principal architectural groups and ritual settings at El Perú, can augment historical knowledge of ancient events through archaeology, providing a means to corroborate or refute epigraphic evidence detailing socio-political interaction in the southern Maya lowlands. To lay the groundwork for this objective, the dissertation project seeks to first provide context for the variability documented in the two excavated foci within the Mirador Group, followed by possible explanations for the purpose of these two locations within the community of El Perú. The investigation then implements a broader approach examining the Mirador Group dataset in conjunction with a regional picture created via epigraphic decipherment and previous archaeological research in the Maya area. Initial observations from the Mirador Group suggest relationships between the activities conducted there and events that occurred in the larger Mesoamerican world, for example Teotihuacan-associated Siyaj K'ahk's arrival in the southern lowlands and Calakmul's rise to power in the Late Classic. Additionally, the results of these analyses will be included in the 2009 El Perú-Waka' Archaeological Project annual report, and incorporated into future conference presentations and publications in both peer-reviewed journals and popular magazines with co-authors when appropriate.

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Photographs included in this report were taken by many people, including project members Jennifer Piehl, Sarah Sage, Keith Eppich and myself. Margaret Ordoñez and Erin Thornton also took some of the photos included in this report. Photographers Patrick Aventurier and Ulises Rodríguez were visitors to the site in 2005 and 2006 respectively, and they are specifically attributed credit in captions associated with their images.

Any errors in this report are the responsibility of the author, not of the many knowledgeable specialists who contributed their expertise to this project.

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Sources Cited

Aldenderfer, M.
2005 Statistics for Archaeology. In *Handbook of Archaeological Methods* edited by H. D. G. Maschner and C. Chippendale, pp. 501-553. AltaMira Press, Lanham, MD.

Coe, M. D.
1988 Ideology of the Maya Tomb. In *Maya Iconography*, edited by E. P. Benson and G. G. Griffin, pp. 222-235. Princeton University Press, Princeton.

Culbert, T. P.
1993 *The Ceramics of Tikal: Vessels from the Burials, Caches and Problematical Deposits*. University Museum, University of Pennsylvania, Philadelphia.

2003 The Ceramics of Tikal. In *Tikal: Dynasties, Foreigners, & Affairs of State: Advancing Maya Archaeology*, edited by J. A. Sabloff, pp. 47-81. School of American Research Press, Santa Fe.

Eppich, E. K.
2004 Análisis Preliminar de la Cerámica de El Perú-Waka'. In *Proyecto Arqueológico El Perú-Waka': Informe No. 1, Temporada 2003*, edited by H. L. Escobedo and D. A. Freidel, pp. 369-384. Report presented to the Instituto de Antropología e Historia, Guatemala.

Eppich, E. K., G. Pérez Robles, A. L. Arroyave Prera, F. Quiroa Flores, J. C. Meléndez and E. Román
2005 La Secuencia de la Tradición Cerámica de El Perú: Un Estudio Cerámico. In *Proyecto Arqueológico El Perú-Waka': Informe No. 2, Temporada 2004*, edited by H. L. Escobedo and D. A. Freidel, pp. 313-350. Report presented to the Instituto de Antropología e Historia, Guatemala.

Folan, W. J., J. Marcus, S. Pincemin, M. d. R. Domínguez Carrasco, L. Fletcher and A. Morales López
1995 Calakmul: New Data from an Ancient Maya Capital in Campeche, Mexico. *Latin American Antiquity* 6(4):310-334.

Guenter, S. P.
2005 Informe Prelimiar de la Epigrafía de El Perú. In *Proyecto Arqueológico El Perú-Waka': Informe No. 2, Temporada 2004*, edited by H. L. Escobedo and D. A. Freidel, pp. 363-399. Report presented to the Instituto de Antropología e Historia, Guatemala.

Joralemon, P. D.
1971 *A Study of Olmec Iconography*. Dumbarton Oaks, Washington D.C.

LaPorte, J. P.
1989 *Alternativas del Clasico Temprano en la Relacion Tikal-Teotihuacan: Grupo 6C-XVI, Tikal, Petén, Guatemala.* Unpublished Ph.D. Dissertation, Universidad Nacional Autonoma de México.

Laporte, J. P. and V. Fialko C.
1995 Un Reencuentro con Mundo Perdido, Tikal, Guatemala. *Ancient Mesoamerica* 6:41-94.

Lawler, A.
2007 Portals to the Supernatural World Uncovered in Maya Tomb. *Science* 316:978.

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

Pérez Robles, G.
2005 Cronología Preliminar de El Perú: Informe del Análisis de la Cerámica Recuperada en la Temporada del 2003. In *Proyecto Arqueológico El Perú-Waka': Informe No. 2, Temporada 2004*, edited by H. L. Escobedo and D. A. Freidel, pp. 351-362. Report presented to the Instituto de Antropología e Historia, Guatemala.

2006 Comentarios Sobre la Cronología de El Perú y Chakah, con Base en el Análisis de la Cerámica. In *Proyecto Arqueológico El Perú-Waka': Informe No. 3, Temporada 2005*, edited by H. L. Escobedo and D. A. Freidel, pp. 421-430. Report presented to the Instituto de Antropología e Historia, Guatemala.

Pérez Robles, G., A. L. Arroyave Prera, A. Rodríguez, J. López, F. Quiroa Flores and V. Matute
2008 *Tipología Cerámica Preliminar de El Perú*. Proyecto Arqueológico El Perú-Waka': Informe No. 5, Temporada 2007. Report presented to the Instituto de Antropología e Historia, Guatemala.

Piehl, J.
2006 Análisis Osteológico Preliminar de los Entierros de El Perú y Chakah, Excavados en las Temporadas de Campo 2004 y 2005. In *Proyecto Arqueológico El Perú-Waka': Informe No. 3, Temporada 2005*, edited by H. L. Escobedo and D. A. Freidel, pp. 431-453. Report presented to the Instituto de Antropología e Historia, Guatemala.

2008 Análisis Preliminar de los Restos Humanos de Contextos Mortuarios y Rituales en *Waka'* y Chakah. In *Proyecto Arqueológico El Perú-Waka': Informe No. , Temporada 2007*, edited by H. L. Escobedo, J. C. Meléndez Mollinedo and D. A. Freidel, pp. 173-206. Report presented to the Instituto de Antropología e Historia, Guatemala.

Ramírez, J. C.
2006 ES: Excavaciones de Sondeo. In *Proyecto Arqueológico El Perú-Waka': Informe No. 3, Temporada 2005*, edited by H. L. Escobedo and D. Freidel, pp. 299-328. Report presented to the Instituto de Antropología e Historia, Guatemala City.

Rapp, G.
2002 *Archaeomineralogy*. Springer, Berlin.

Reimer, P. J.
2004 IntCal04: Calibration Issue. *Radiocarbon* 46(3).

Rich, M. E.
2004 WK-08: Excavaciones en la Estructura N14-12. In *Proyecto Arqueológico El Perú-Waka': Informe No. 1, Temporada 2003*, edited by H. L. Escobedo and D. A. Freidel, pp. 193-226. Report presented to the Instituto de Antropología e Historia, Guatemala.

2005 WK-08: Excavaciones en la Estructuras N14-12, O14-07 y Cerca de la Estela 3. In *Proyecto Arqueológico El Perú-Waka': Informe No. 2, Temporada 2004*, edited by H. L. Escobedo and D. A. Freidel, pp. 171-208. Report presented to the Instituto de Antropología e Historia, Guatemala.

Rich, M. E., V. Matute and J. Piehl
2007 WK-11: Excavaciones en la Estructura O14-4. In *Proyecto Arqueológico El Perú-Waka': Informe No. 4, Temporada 2006*, edited by H. L. Escobedo and D. A. Freidel, pp. 217-257. Report presented to the Instituto de Antropología e Historia, Guatemala City.

Rich, M. E., J. Piehl and V. Matute
2006 WK11A: Continuación de las Excavaciones en el Complejo Mirador, Estructura O14-4. In *Proyecto Arqueológico El Perú-Waka': Informe No. 3, Temporada 2005*, edited by H. L. Escobedo and D. Freidel, pp. 225-274. Report presented to the Instituto de Antropología e Historia, Guatemala City.