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edited by Debra S. Walker

Residue Analysis and Beverage Production at Cerro Maya

Lisa Duffy[1] and Debra S. Walker

UF graduate student Lisa Duffy has begun important new research on the Cerro Maya materials stored at the FLMNH. She is investigating food and beverages consumed by the ancient Maya by searching for trace residues on processing and serving equipment. She describes her research below:

What foods were prepared by the ancient residents of Cerro Maya, and how did they use pottery vessels and grinding stones?

To answer these questions, I am testing different methods of identifying residues on ancient food production tools to discover what foodstuffs they may have processed. Many plant and animal products can be identified by the chemical traces they leave behind. Laboratory analysis such as liquid chromatography/mass spectrometry and gas chromatography/mass spectrometry can reveal traces of residues such as fats, proteins and other organic compounds.

Some of the compounds discovered in pilot tests of Cerro Maya vessels revealed the use of chocolate (caffeine, theobromine), chili peppers (capsaicin), and vanilla (vanillin). By using these different methods in the study of ancient cuisine, we can better understand how food items were processed and served, which ingredients were used for special occasions, and who had access to these resources. In this way, residue analysis can address not only vessel and tool function, but also foodways, economy and ritual activities at Cerro Maya.

Left, SF-029, right, SF-027 from Burial 2

Cerro Maya is situated on the south side of Chetumal Bay. According to early Spanish accounts, Chetumal Province was described as "being rich in cacao and honey."[2] Duffy's research has already turned up evidence for a long lived chocolate economy in the region. Of the two vessels that have tested positive for theobromine, one dates to the Late Preclassic Tulix Phase (254 BCE - 159 CE) and the other to the Late Facet of Postclassic Kanan Phase (1000 - 1532 CE). The former (SF-029) was found buried with a five year old child in the waterfront village burying ground[3] while the latter stems from the surface debris of a processional ritual performed at Structure 6A (Walker this volume). We anxiously await further results from Duffy's ambitious research project.

1 Contact Ph.D. candidate Lisa Duffy at Department of Anthropology, University of Florida, lisagd@ufl.edu

2 Chase, Diane Z., 1986, Social and Political Organization in the Land of Cacao and Honey. In *Late Lowland Maya Civilization*, ed. by J. Sabloff and E. W. Andrews V, pp. 347-377. University of New Mexico Press, Albuquerque, see p. 348.

3 Burial 2. See Cliff, Maynard B., 1982, Lowland Maya Nucleation: A Case Study from Northern Belize. Ph.D. dissertation, Southern Methodist University, Dallas. See p. 256, Fig. 37.

Conservation Treatment of Selected Copper Artifacts from Cerro Maya

Katherine Singley[1]

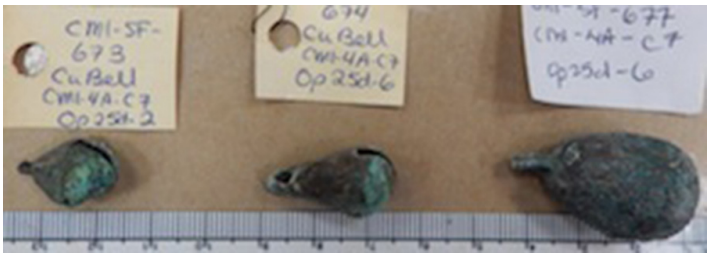
As part of the curatorial process, the FLMNH enlisted the help of an archaeological conservator to stabilize selected copper small finds from Cerro Maya. During the fall of 2013, thirteen small copper bells and three discs with textile fibers and impressions of fibers were treated in Gainesville. Excavated in the 1970s, these artifacts had subsequently been stored at Southern Methodist University and then transferred to FLMNH in 2009.[2]

In addition to conserving these artifacts for the future, physical and chemical stabilization allows them to be handled more safely not only for analysis and study in the laboratory, but also for exhibit and loan in museum settings.

For the thirteen copper bells, the primary goal was to chemically control aggressive "bronze disease" in which chloride ions and available moisture turn the copper to paratacamite, a powdery bright green corrosion product. The mechanics of this specific corrosion involve the generation of hydrochloric acid in a self-perpetuating free radical reaction. The application of the corrosion inhibitor benzotriazole (BTA) is effective in stopping the attack, because its ligand structure effectively ties up the reactive chlorides.

The bells were first brushed to remove any loose corrosion. Under magnification, details such as ridges, cast seams, and crimping were lightly and selectively picked to make them more apparent. The bells were then soaked overnight in 3% BTA in ethanol. After this, the bells were then air dried and protectively lacquered by dipping them in an acrylic resin, *Incralac*, which also contains BTA in its formula. The lacquer may darken the copper surface slightly, but in exchange long-term protection is achieved.

While the treatment was straight forward, it was essential to keep each bell associated with its correct tag and unique accession number. The thirteen bells were divided into small groups, using sizes and/or diagnostic features to differentiate them. Unlike the CROC catalogue's images, the bells were quickly photographed *with* their tags.



Copper bells before and after treatment.
Left to right, SF-673, SF-674, SF-677.

Most metal artifacts from Cerro Maya were recovered from a rich Postclassic Kanan Phase (1200-1532 CE) deposit that includes Cache 7 and Burial 35. Over seventy-five artifacts were discovered in this cache, most associated with Burial 36, a six year old child, who was adorned with jade and shell jewelry as well as the copper bells and tumbaga discs. Each of these bells has a distinct form. Those in the illustrated example include SF-673, a diamond, SF-674, a flat ring and SF-677 a double wire ring.

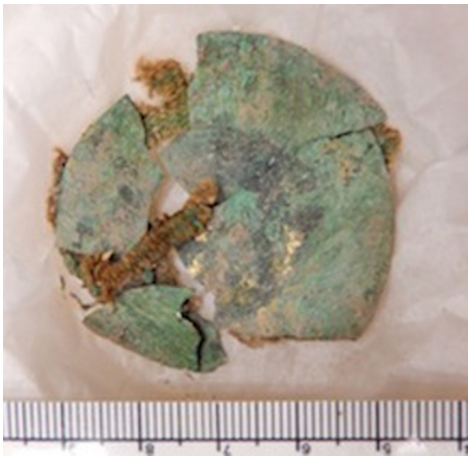
The three tumbaga discs (SF-718, SF-719, SF-720) from the same context were not cleaned or immersed at all. These artifacts were too thin and already fragmented. Handling needed to be minimized. Instead of immersion, brush applications of BTA and *Incralac* were used.

Decorative techniques associated with Mesoamerican copper include surface enhancements such as gilding, plating, washes, and burnishing. Investigations into metallurgical techniques and alloying are ongoing. In the interim, any conservation treatment on these artifacts needed to be minimal and proceed slowly.

1 Katherine Singley, Conservation Anthropologica, may be contacted at singley@mindspring.com

2 Conservation was underwritten by NEH Grant #PW-51116-12.

These three discs are embossed or slightly domed and made of *tumbaga*, a gilded copper. After deposition in the ground, copper in a gold alloy can preferentially corrode, producing mobile soluble copper salts that act as a biocide for associated woven textiles, basketry, or plaiting. Actual fibers are preserved, or the impression of a weave can be preserved as a pseudomorph in a corrosion product.



SF-718 Before Treatment

For these fragmented discs, revealing the side with the most textile information was essential. On SF-718, associated textile remains were not on the domed obverse, but on the recessed underside. The treatment involved realigning the fragments and reshaping the dome as the adhesive dried. Small strips of L-tissue were laid across joins. Used to repair paper, L-tissue is unbuffered and pH neutral. Its 100% abaca fibers have great wet strength. *Acryloid B-72*, an acrylate methacrylate copolymer widely used in conservation, was applied to the tissue strips on the reverse. Once the L-tissue is saturated with B-72, it becomes more transparent and less obvious. The reshaping was performed on a siliconized parchment, so that any excess adhesive and tissue support could be easily trimmed and removed at the end.

Textile fragments on the reverse were consolidated only as needed. Loose edges were reinforced with a thin solution of Klucel G (hydroxy propyl celluose) in ethanol. A thicker dab of Klugel was used to tack a detached fragment of braid onto the reverse surface. A discoloration on the gilding indicated the braid's original placement.

Treatment of SF-718 also included improvement of its storage enclosure. For its archival box, a circular recessed well was cut from polyethylene foam. With this protection the fragile disc would be supported and isolated from excess shifting. A square of acid-free tissue would be used to lift the disc out.

SF-718 After Treatment

Editor's Note: Stabilization of metal artifacts from Cerro Maya was long overdue. Some damage to the tumbaga discs occurred as a result of inadequate long term storage conditions and multiple moves over four decades. Now that the bells and discs have been conserved, they can be made available for study. The rare fragments of textile adhering the back of SF-718, for example, have never been studied. Currently these important materials are housed in a locked, climate controlled environment at FLMNH; they will be well preserved for future analysts.

SF-718 in New Curation Box

Three Decades Later: A New Look at the Cerro Maya Fauna

Ashley Sharpe[1]

Situated on Corozal Bay, Belize, near the mouth of the New River, the ancient site of Cerro Maya allows archaeologists the opportunity to examine how one of the earliest Maya villages developed into a prosperous seaside community. Part of Cerro Maya's fortune came from the ancient

inhabitants' ability to take advantage of the wide variety of animal species from the sea and nearby rivers, supplying the site with an abundant food source as well as shell and bone material for use in crafting decorative items and tools for trade within the community as well as with other settlements.

The identification and analysis of ancient animal bones and shells recovered from archaeological sites is known as zooarchaeology. In the 1980s, Dr. Helen Sorayya Carr used the animal remains recovered at Cerro Maya for one of the first zooarchaeological studies performed in the Maya area.[2] Her analysis, which primarily focused on the animal bones at the site, assessed over 15,300 individual specimens in an effort to reconstruct the past dietary, economic, and ecological aspects of this ancient coastal society. Noteworthy discoveries of the research revealed that although the inhabitants

Miscellaneous Deer Bone Awls
from the Cerro Maya Collections

of Cerro Maya made use of the extensive variety of marine resources at their disposal, particularly parrotfish, snapper, and barracuda, they also relied to a considerable degree on deer and turtles. Dogs also made up a significant proportion of the identified mammal corpus, and were likely raised by the ancient Maya for meat rather than companionship.

SF-1383 Perforated Shark Tooth

1 Contact Ph.D. candidate Ashley Sharpe at Department of Anthropology, University of Florida, asharpe@ufl.edu

2 Carr, Helen Sorayya. 1986. *Faunal Utilization in a Late Preclassic Maya Community at Cerro Maya, Belize.* Ph.D. Dissertation, Tulane University, New Orleans.

Rachel Hamilton later augmented Carr's original analysis by classifying over 17,200 marine and freshwater mollusk specimens excavated from the site in order to assess the degree and diversity of shell species the inhabitants of Cerro Maya procured, either for food or for crafting into decorative items and tools.[3] She determined that the crown conch (*Melongena melongena*) was the most ubiquitous at the site, which was likely favored as a food source since it was often found in hearths and refuse deposits.

The Florida Museum of Natural History (FLMNH) has recently acquired a large portion of the worked bone and shell artifacts from Carr and Hamilton's original collection, as well as a number of shells that had not been previously identified. These additional identifications will be able to expand on what we already know of Cerro Maya's faunal assemblage. Furthermore, new radiocarbon dates obtained by Dr. Debra Walker[4] and Jeffrey Vadala (this volume) will provide a much more accurate chronological assessment of *when* specific animal remains were used and discarded, allowing us the ability to compare changes and trends in the use of animal resources over time. These trends can then be correlated with any sociocultural changes that we know occurred at the site over the centuries, providing us with a better assessment of the dynamic nature of the site's history.

I will be using the new Cerro Maya identifications along with the previous datasets as part of my dissertation research.[5] I plan to include the Cerro Maya data as part of a regional analysis of animal resources recovered from lowland Maya sites occupied during the Preclassic period (1000 BCE - 250 CE), in an effort to discern which species were most important to the ancient Maya as they began to form complex state level communities with extensive trade networks and alliances. In addition to Cerro Maya, other sites in my investigation include San Bartolo, Cival, and Ceibal.

My analysis will assess whether there are any similar patterns of animal resource use identifiable in the zooarchaeological records of these sites, and if any of the sites may have been exchanging animal products across long distances. Cerro Maya is particularly important in this regard, for it can reveal what marine fauna were most commonly exploited at a coastal settlement and, when compared to the other three inland sites, whether any of these species were exchanged across long distances. There are still few zooarchaeological assemblages available that date as far back as the Preclassic period, and even fewer from the coasts; Cerro Maya is thus in the unique position to augment our understanding of the early development of Maya communities as well as how Maya settlements functioned in coastal environments.

Carved Conch Axe Heads, left, SF-1468, right, SF-042

Learn More about CROC
Visit the
Cerro Maya Research Online Catalogue
at
www.flmnh.ufl.edu/cerros/

3 Hamilton, Rachel J. 1987. The Archaeological Mollusca of Cerro Maya, Belize. Bachelor's Thesis, Division of Social Sciences, New College, University of South Florida, Sarasota.

4 Walker, Debra S., 2005, Sampling Cerros' Demise: A Radiometric Check on the Elusive Protoclassic. Report to FAMSI on Grant #03064. Online publication, FAMSI, www.famsi.org/reports/03064/index.html

5 Research funded by NSF Dissertation Improvement Grant #1433043.

Bayesian Analysis Transforms Cerro Maya's Site Chronology

Jeffrey Vadala[1] and Debra S. Walker

UF graduate student Jeffrey Vadala, Ph.D. candidate in Anthropology, is studying the deposition of special deposits, especially caches, associated with important events at Late Preclassic Cerro Maya. He is tying their interment within various construction phases in the monumental architecture of the site core to community growth, social memory and the role of ritual in creating the ancient sacred landscape.

Jeffrey Vadala demonstrating a 3D Cerro Maya walk through to original excavator Jim Garber

Clear sequential dates are essential to his research, thus, he has turned to the range of charcoal samples collected in or near these caches that are currently stored at FLMNH. Radiocarbon dates are computed by sampling the remains of organisms and determining how long it has been since they died. The process depends on the standardized half life of a specific radioisotope of carbon, ^{14}C, and assumes a relatively constant rate of radioactive carbon uptake by an organism during life as well as a constant rate of decay after death (5730 radiocarbon years). Researchers know that the time period under consideration, the Late Preclassic (400/350 BCE to 150/250 CE) has been notoriously difficult to date due to a series of fluctuations in the relative percentage of radioactive ^{14}C available in the food chain between 600 and 1 BCE. As a result, single radiocarbon dates on Late Preclassic materials can have ranges of up to 400 years or longer, sometimes longer than the proposed site occupation. Vadala is creating a tighter timeline for Cerro Maya using Bayesian analysis that combines dating with archaeological stratigraphy. Here are Vadala's comments on the early results:

Cache D, left, SF-801, right, SF-800

Preliminary Accelerator Mass Spectrometry (AMS) dating and Bayesian modeling results from a set of twelve samples[2] indicate that the site of Cerro Maya transformed from a small village society to a large trading port with monumental architecture within a 100 to150 year time span. Prior researchers had believed that Cerro Maya rose gradually over a period of 300 to 400 years.

Bayesian modeling and AMS dating provided a detailed micro-history of Cerro Maya's building events. Bayesian modeling essentially reduces carbon dating error by contextually comparing site stratigraphy to radiocarbon dates.[3] The lack of Bayesian modeling and inaccurate radiometric techniques available to researchers in the 1970s led to a margin of error of hundreds of years in some dates. Additionally, models of site development such as regional interaction spheres traditionally have assumed that slow, gradual social development was a requisite for societies to reach the high levels of social complexity required to plan, organize and construct the monumental site cores common to large ancient Maya sites. New Bayesian modeled dates will be used to rewrite the Cerro Maya chronology, and new models of social development will be employed to explore and explain the rapid growth and expansion at the site's core.

Vadala has more samples to run before finishing the new timeline. Fortunately, there are many waiting to be tested in the FLMNH collections.

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2 Samples processed by Beta Analytic, Miami, Florida. Research was supported in 2013 by a UF Department of Anthropology Jamie Waggoner Award and in 2014 by Wenner Gren Grant #00094601.

3 T. E. Levy, T. Higham, C. Bronk Ramsey, N. G. Smith, E. Ben-Yosef, M. Robinson, S. Münger, K. Knabb, J. P. Schulze, M. Najjar, and L. Tauxe, High-precision radiocarbon dating and historical biblical archaeology in southern Jordan. PNAS 2008 105 (43) 16460-16465.

Santa Unslipped Tripod Cups from the CROC Archives[1]

Debra S. Walker[2]

The Santa Unslipped tripod cup Lisa Duffy sampled for residue analysis is one of six examples collected from Cerro Maya. Two examples were recovered from the summit of Structure 4A in the surface humus above Cache 3.

Tripod Cups from Cache 3, left, SF-387, right SF-4049

These include SF-387, a nearly complete example that lacks only one foot, and SF-4049, the fragmentary base of a tripod cup. Cache 3 was composed of a Rita Red footed shallow bowl (SF- 495) and a small Santa Unslipped short necked jar (SF-496).

Cache 3 Vessels, left SF-495, right, SF-496

The cache also included fragments of at least two censer buckets (SF-4047, SF-4048), one of which retained a dark ring where copal had once been applied. Fragments of a bee effigy "diving god" that retained post-fire blue, red, and white paint were also encountered in the deposit (SF-481).

The vessel Duffy sampled was retrieved during the 1990s excavations[3] in surface debris on Structure 6E at the juncture with the top of the 6A staircase.

Tripod Cups from Structure 6, left, CM1-94154, right, SF-126

It was found with effigy censer fragments including a more complete bee effigy "diving god." Both diving or descending deities are identified by the fragments of bee wings they wear on their backs. Further in on Structure 6, at the 6B summit, another fragmentary cup, SF-126, was retrieved from surface lots mixed with other censer fragments, thus, a pair of tripod cups were retrieved from this building as well.

Tripod Cup Fragment from Structure 5C, SF-4222

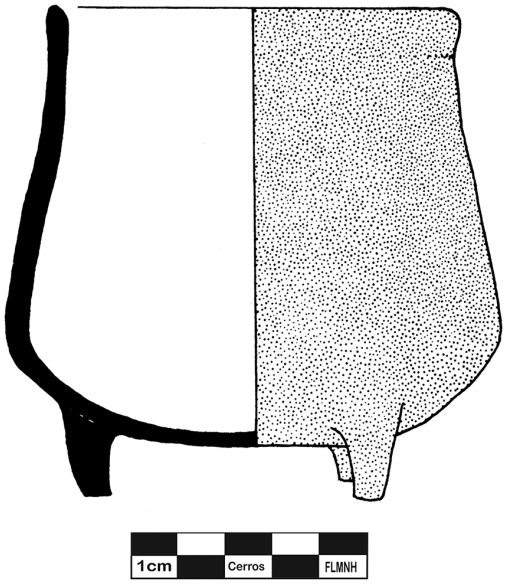
Two other fragmentary tripod cups were recovered in excavations. SF-4222 was discovered with censer sherds in surface debris west of the staircase of Structure 5C, the building famed for its Late Preclassic masked facades. The final example of a tripod cup, SF-

1 More information on most artifacts listed by Small Finds (SF) number can be found online in the CROC files www.flmnh.ufl.edu/cerros/ .

2 Debra S. Walker, Ph.D., curates the CROC archives and can be reached at debraswalker@gmail.com .

3 For more information on the 1990s excavations, see Walker, Debra S., 2005, Sampling Cerros' Demise: A Radiometric Check on the Elusive Protoclassic. Report to FAMSI on Grant #03064. Online publication, FAMSI, www.famsi.org/reports/03064/index.html .

4067, was recovered just outside the site core from Structure 11B, a presumed Late Preclassic residence later reused during the Postclassic. The cup has not been reconstructed but it has been illustrated.



Tripod Cup from Structure 11B, Cache 5, SF-4067

It was discovered in association with Cache 5, a complex non-residential deposit that included several Cehac-hunacti Composite censers (SF-4059, SF-4060, SF-4061, SF-4062, SF-4068) and a conch trumpet with ceramic mute (SF-666).

Conch Trumpet from Structure 11B, Cache 5, SF-666

As the Santa Unslipped tripod cups were retrieved from similar contexts, it is possible they were all used to hold a chocolate and vanilla flavored beverage as identified by Duffy. Similar tripod cups are known from Postclassic sites throughout Yucatan such as Mayapan.[4] They are one component of a more complex set of vessel forms generally associated with calendared ritual events that also include ceramic censer buckets, redware bowls and other effigy forms.[5]

The co-occurrence of bee effigies with tripod cups at both Structures 4 and 6 probably indicates that honey was a component of the drink involved in the ritual. At contact, the Chetumal Bay region was well known for both cacao and honey production. To date, it has been difficult to test for simple carbohydrates that might represent honey in vessel residue, but it is possible beeswax may be identified in future. These and other materials in the CROC Archive are ready to address researchers' unanswered questions about the ancient Maya.

B 31

4 Smith, R. E., 1971 The Pottery of Mayapan, Vol. 2, p. 49, Fig. 31cc-ff

5 For more information on Cache 3, Cache 5 and other deposits with censer materials, see Walker, Debra S., 1990, Cerros Revisited: Ceramic Indicators of Terminal Classic and Postclassic Settlement and Pilgrimage in Northern Belize. Unpublished Ph.D. dissertation, Southern Methodist University, Dallas.