

26 EXCAVATING THE UNDERWATER SHELL DEPOSIT AT AN ANCIENT MAYA SALT WORK IN BELIZE: THE ELEANOR BETTY SITE

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Excavations in the spring of 2013 were carried out at an underwater ancient Maya salt work in Punta Ycacos Lagoon, Paynes Creek National Park, Belize. Eleanor Betty is one of the Paynes Creek Salt Works, which provided salt to the inland Maya during the Classic period (AD 300-900). Excavations were carried out to expose a shell deposit discovered in 2011, with the expectation of better preservation of bone than in the acidic peat elsewhere at the salt works. Sediment samples were recovered to evaluate whether Eleanor Betty was submerged by sea-level rise. Abundant shell was recovered, including mangrove oysters, providing both environmental and dietary information. The virtual lack of bone indicates either bone was absent or not preserved by the shell. Recovered material from the excavations was analyzed. Approximately 215,991 g of briquetage – pottery used for the evaporation of brine over fire to make salt – was recovered along with over 16,000 g of charcoal. Units 2-3 m and 3-4 m across all transects contained the highest concentration of briquetage. The absence of residential and household materials and the abundance of briquetage indicate activities were dedicated to salt production.

Introduction

Excavations of a shell deposit at the Eleanor Betty site in 2013 were carried out to investigate if the shell was a natural or cultural feature and what the shell could tell about ancient Maya salt production. The underwater site of Eleanor Betty is part of the Classic period (AD 300-900) Paynes Creek Salt Works located in Punta Ycacos Lagoon, a shallow salt-water lagoon in Paynes Creek National Park, Belize (Figure 1). Salt flats on the north coast of the Yucatán Peninsula were once thought to have produced salt for the entire Maya area during the Classic period (Andrews 1983). However, the discovery of salt production on the coast of Belize changed that view (MacKinnon and Kepecs 1989; McKillop 1995, 2002, 2004b; Valdez and Mock 1991). MacKinnon and Kepecs (1989) hypothesized that Placencia was involved in seasonal salt production for local consumption. They suggest high-quality salt was imported from the Yucatan for the Maya elite. New River Lagoon was viewed as a permanent Maya settlement where salt was used as a preservative for fish to be traded to inland sites (Valdez and Mock 1991).

At the Paynes Creek Salt Works, salt was produced inside wooden buildings preserved in a peat bog below the sea floor (McKillop 2005a). The acidic peat at the Paynes Creek Salt Works did not preserve bone. However, the shell deposit at the Eleanor Betty site was an ideal matrix for bone preservation due to the calcium

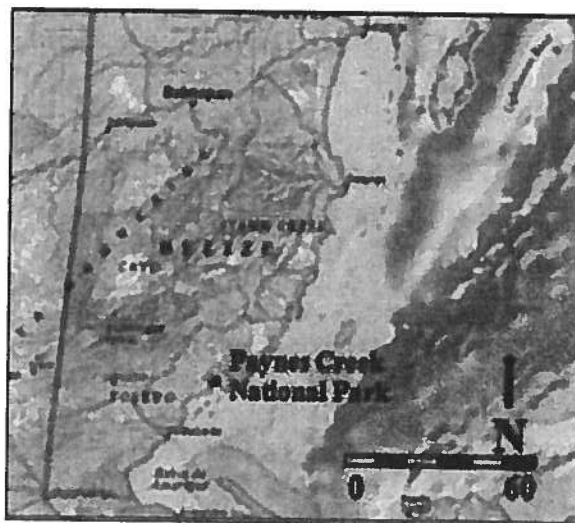


Figure 1. Map of Belize showing location of Paynes Creek National Park. Base map from ESRI® ArcGIS® ArcMap™ 10.3 ©1999-2014.

carbonate (CaCO_3) in the shell, so there was a possibility of identifying human burials and/or food remains. Since burials and animal food remains are typical of Maya residences, the search for bone would help answer if the Paynes Creek salt works were also residential. If human bone was present within the wooden structure located at the site, then Eleanor Betty could have been a coastal residence, perhaps a residential workshop. The presence of bone at the site could be used as a model for excavating other salt works where bone was not preserved due to the acidic peat. The extent and nature of the shell deposit (natural or cultural) and the

accompanying preserved wooden architecture were investigated.

Heather McKillop and her team discovered the salt works during regional survey in Punta Ycacos lagoon (McKillop 1995, 2002). Underwater excavations of the salt-making sites began in 1991. The excavation of four sites (Killer Bee, Stingray Lagoon, Orlando's and David Westby) led to a comprehensive underwater survey of the lagoon. Survey and excavation in Paynes Creek National Park underscore the production of salt during the Classic period (McKillop 1995, 2002, 2004b, 2005a, 2007a; Sills and McKillop 2010). This production is mirrored by the increase in inland Maya population and concomitant demand for dietary salt (McKillop 2002). After the Classic Maya collapse, settlement along the coastline increased. The Paynes Creek salt works collapsed due to the disappearance of the inland demand for salt with the abandonment of the inland cities (McKillop 2009b). Salt was made at the household level in the Postclassic period (A.D. 900 – A.D. 1550) at Wild Cane Cay and Frenchman's Cay (McKillop 2002).

A total of 105 sites have been documented in Paynes Creek National Park (McKillop 2002, 2004b, 2005a, 2007a, 2008, 2009a; Sills and McKillop 2010). The sites contain briquetage – pottery used for the evaporation of brine over fire to make salt. The technique is seen elsewhere at prehistoric sites in Central America (Andrews and Mock 2002; Dillon 1981; MacKinnon and Kepecs 1989; McKillop 1995, 2002, 2004b, 2005a, 2005b, 2007a, 2007b, 2008, 2009a, 2009b, 2010; Santley 2004; Sills and McKillop 2010) and is still employed today (Reina and Monaghan 1981; Williams 1999, 2004, 2009, 2010).

Unlike other ancient Maya sites where materials such as thatching for roofs and wooden posts for residential dwelling and other wooden structures decayed, the Paynes Creek Salt Works have wooden posts preserved by the anaerobic mangrove peat matrix (McKillop 2005a, 2009a, 2010; McKillop et al. 2010a, 2010b; Sills and McKillop 2010). Post locations were mapped and recorded in a geographic information system (McKillop 2002, 2004b, 2007a, 2009a; McKillop et al. 2010a, 2010b; Sills and McKillop 2010). Radiocarbon (^{14}C) dates obtained from wooden

structures date to the Classic period (AD 300–900; McKillop 2005a). The finding of the preserved K'ak' Naab' paddle supports evidence of inland salt trade (McKillop 2005a, 2007a, 2007b).

Mangrove peat is an acidic environment and, therefore, does not preserve bone. However, the peat is ideal for the preservation of wood. The shell deposit contained within the structure contains CaCO_3 from the shells which would preserve bone, if present.

Research Questions

The shell deposit was unexpected, so we were interested to discover if it was a post-inundation deposit or cultural and if cultural, how did it relate to salt production? If the shell deposit was a natural deposit, then there would be paired valves along with an absence of butcher marks, burned shell, faunal remains, charcoal, hearths, ash, or other artifacts, such as ceramics (Marquardt 2010). Alternatively, if the shell deposit was the result of deposition by the ancient Maya, then some or all of the following items would be present: burned shell, charcoal, ash, butchering marks on the shells, a lack of paired valves, and artifacts (Marquardt 2010).

If cultural, was the shell deposit associated with a residence, production workshop, or household workshop? If the area was residential, then human and animal bone (within the shell deposit) would be expected as the Maya buried their dead beneath household floors. Other household materials such as storage containers also would be expected. If the site was used solely for the production of salt, then production refuse material would be found, but animal, human, and other household cultural remains would be absent. If the site was a household workshop, then both household materials and production refuse materials would be expected.

Artifact analysis at other Paynes Creek Salt Works indicates they were not residential areas, but workshops for salt production due to the abundance of briquetage (McKillop 2005c; Sills and McKillop 2010). The trade of salt produced from these coastal workshops to inland communities (along with other marine resources) during the Classic (A.D. 300 – 900) may have been controlled by Wild Cane Cay (McKillop 2005b, 2008, 2009b). Salt likely was traded for

inland items such as ocarinas and serving vessels, ritualistic objects which have been recovered at the Paynes Creek Salt Works (McKillop 1995, 2002, 2009b).

Underwater Excavations

During the 2013 field season, systematic flotation survey was used to relocate and mark previously-mapped wooden posts at the Eleanor Betty site and to locate new posts. Each post was marked with a pin flag. The acidic mangrove peat below the sea floor preserved hardwood and palmetto palm posts (*Acoelorrhaphe wrightii*). Palmetto palm posts are small in diameter with a hard exterior. Hardwood posts are solid and large in diameter. Palmetto palm posts were marked with red flags whereas hardwoods were marked with yellow flags (Figure 2). Previously-discovered posts were easier to locate as they had small PVC pipe markers that had been placed on their north and northeast sides. The PVCs were labeled with the post number. New wooden posts at the site were recorded and mapped (Figure 3). All posts had been vertically placed in the mangrove peat. A curved line of palmetto palms runs north to south along the western edge of the site forming a wall. The curved line of palmetto palm posts surrounding a wooden structure is found at other sites in the lagoon, such as Chac Sak Ha Nal (McKillop 2008; Sills and McKillop 2010; Sills and McKillop 2013).

Upon completion of the systematic survey, the team uncovered the shell deposit in Transect 4 from the 2011 excavations (Aucoin 2012). After the 2011 excavations, the transect had been lined with plastic sheeting and weighted down with sandbags. They were removed along with silt that had washed into the transect. The silt was screened off-site in the water.

Four new transects were set out to horizontally expose the shell deposit (Figure 4). A total of 19 units were excavated (Figure 5). Each 1x1 m unit was marked with a yellow flag (labeled with the Transect and Unit numbers) and a quarter inch PVC pipe. Transects were placed north and south of the 2011 Transect 4, each seven meters in length. Excavations were placed to define the boundaries of the shell



Figure 2. Photo showing flags marking post locations and excavation units on the sea floor. Photo by V. Feathers.

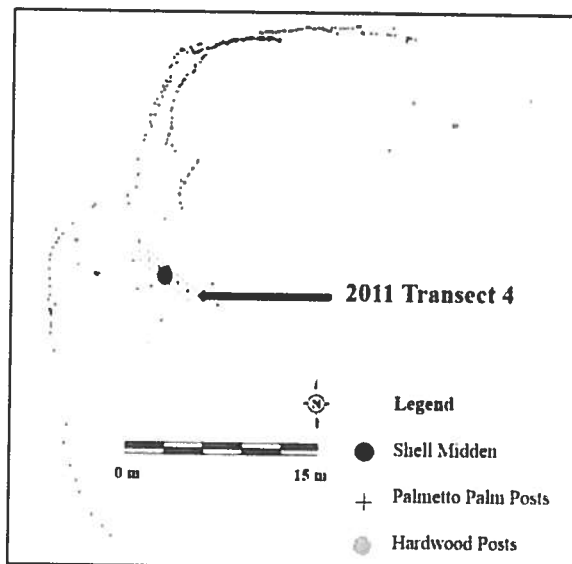


Figure 3. Map of Eleanor Betty. Map by V. Feathers annotated from base map by H. McKillop.

deposit and recover organic material, botanical remains, and microfossils, such as ostracods and foraminifera to inform of sea-level rise and the paleoenvironment.

Each unit was excavated in 10 cm levels to 30 cm depth below the sea floor. The sea floor was 55 cm below the water surface during the 2013 excavations. Levels were measured using a plastic sewing tape. The first level, 0-10 cm depth, was the silt layer above the mangrove peat. The layer was comprised of sand, small shells, and briquetage. The second and third layers were composed of solid mangrove peat. Using a trowel, the peat was excavated, placed in the sandbag without loss of material or

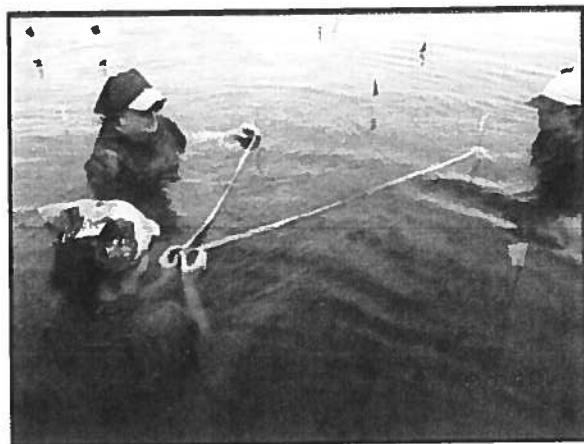


Figure 4. Photo of triangulating with a tape measure to set out an excavation unit on the sea floor. Photo by R. Watson.

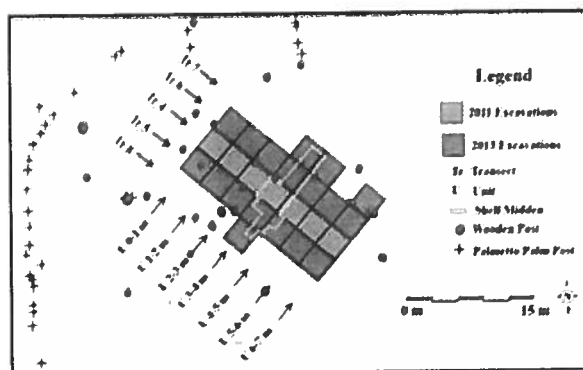


Figure 5. Map of underwater excavations at the Eleanor Betty site. Map by V. Feathers from base map by H. McKillop.

sediment, and secured with ties. A Ziploc bag with the transect number, unit number, level, date, and excavator's name was placed in the sandbag along with the sediment. The bags were ferried off-site in the Marine Transportation Devices (MTDs) which were connected by a pulley system to a screening station.

The screener used a wooden screen box lined with 1/8th inch screen. The material was placed into the screen one bag at a time. The screener pushed the material through the screen and shook it in the water to remove the excess mangrove peat. Items were sorted into material classes (obsidian, chert, charcoal, shell, and pottery). Excavated ceramics were placed in the empty sandbag along with a new label. Smaller labeled bags were placed inside for other materials.

The horizontal extent of the shell deposit measured 5 m in length by 0.5 to 1 m in width whereas the vertical extent was 12 cm thick. The deposit was concentrated in Unit 3-4 m and 4-5 m of all transects and was excavated as a separate feature. After Transect 4 was exposed, the shell deposit was visible in the walls of unit 3-4 m. The north wall of unit 3-4 m was cleaned using a trowel. The profile was drawn and photographed. A transect placed beside Transect 4 to the north was labeled Transect 6. The shell deposit in Transect 6, Unit 3-4 m, was excavated in 2 cm levels. The shell reached a maximum depth of 12 cm. The deposit contained more shell toward the surface of the mangrove peat and less shell as the depth increased. In the mangrove peat surrounding the shell deposit, there was an abundance of briquetage—the remains of pots used to evaporate brine over fires to make salt.

Sediment samples were collected in all levels throughout the shell deposit to evaluate the composition of the marine sediment, if it was marine or terrestrial in origin, and to assess sea-level rise. Sediment samples were taken in the southwest corner of each excavated unit. All samples were placed into whirl pack bags and labeled.

Methods

All recovered ceramics were sorted into type-varieties, drawn, photographed, weighed, and counted during the 2013 and 2014 field season to examine site chronology (following the type-variety system or Maya ceramic classification) and site function (attribute analysis). At the field station at Village Farm, selected rim sherds and other artifacts were scanned using a portable NextEngine 3D Laser scanner from the LSU Digital Imaging and Visualization in Archaeology (DIVA) Lab. The type-varieties include Punta Ycacos Unslipped (sherds from jars, basins, bowls), two types of water jars – Mangrove Unslipped (jars with incurved walls and outcurved necks, with round, square or grooved lips) and Warrie Red (jars and open bowls) as well as Moho Red pottery (open serving bowls; McKillop 2002).

Punta Ycacos Unslipped refers to all salt-making ceramics (briquetage) recovered from the ancient Paynes Creek National Park Salt Works.

Types and varieties include: sherds from jars, basins, and bowls as well as whole and fragmentary vessel supports, including cylinders, spacers, sockets, and bases (McKillop 2002:54,55). Mangrove Unslipped jars were used to house and pour brine into Punta Ycacos vessels (McKillop 2002:77). Warrie Red jars were red-slipped with some of the shoulders of the jar having unit-stamped, impressed, or incised decorations. Other decorations included incised decoration on the exterior of some bowls (McKillop 2002:77). Although smaller in form than Mangrove Unslipped, Warrie Red also was used to store and pour brine into salt-making vessels. McKillop (2002:86) suggests Warrie Red jars may also have been used in salt rituals at Punta Ycacos Salt Works. Warrie Red was found mapped on the sea floor at the site but was not found in the excavations, which were dominated by briquetage. Moho Red consists of red-slipped, yellow paste bowls or dishes with tripod bases that are tempered with volcanic ash (McKillop 2002:86, 87). They were not part of the salt-making process. However, they likely were used as serving vessels in salt production rituals.

Shell and sediment samples were exported to the Archaeology Lab at LSU where wet weights were obtained for all recovered, exported material. Weights were obtained for all shells, charcoal, and botanicals by using a Taylor Glass LED digital scale in the field and Delta Range[®] Mettler PE 3600 in the Archaeology Lab at LSU. A plastic Tupperware container was used to hold items on the scale during this process. The material was then dried in a low-heat drying oven (64°C) and sorted into groups consisting of charcoal, shell, botanicals, and a miscellaneous group of rocks and coral. The materials were reweighed to obtain a dry weight. Fragmentary counts and weights were obtained for the macrobotanical remains of edible tree fruits, which were sorted into species: craboo (*Byrsonima crassifolia*), coyol (*Acrocomia mexicana*), and cohune (*Orbignya cohune*).

Results

Two types of shell were discovered. The first type of shell was small and mixed with sand and silt and was found in several of the excavated units close to the surface layer. The second type

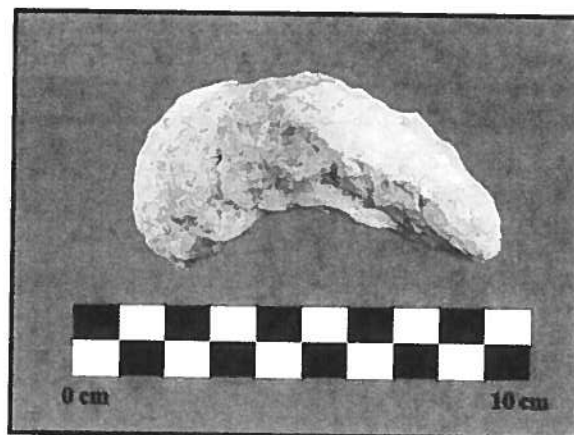


Figure 6. Photo of *Crassostrea rhizophorae*. Photo by V. Feathers.

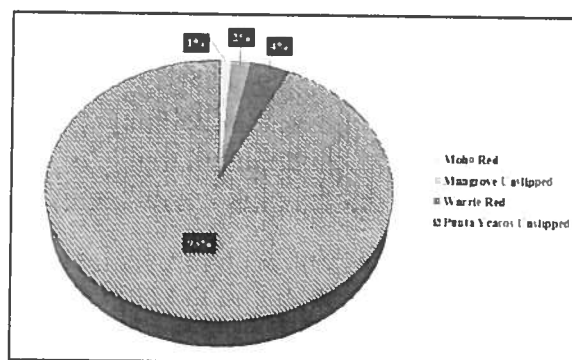


Figure 7. Pie chart showing the percent of all recovered ceramics from the 2013 Eleanor Betty excavations.

of shell consisted of one species of mangrove oyster: *Crassostrea rhizophorae* (Figure 6).

Approximately 5,518 pieces of briquetage and 16,262 g of charcoal were recovered from the excavations. A total of 104 Mangrove Unslipped sherds, 266 Warrie Red sherds, and 47 Moho Red sherds were recovered (Figure 7) in addition to eight Paynes Creek sherds, 14 chert fragments, and 21 obsidian fragments (Table 1). Clay and ash features were encountered in Transects 5 and 6. Transect 5, Unit 2-3 m, contained a clay features in level 10-20 cm. The clay was grey, soft, and malleable. Transect 5, Unit 5-6 m, 10-20 cm, contained an ash feature in the northeast corner of the unit. The ash had hardened into amorphous lumps. The outside was a white-grey color which rubbed off when dried. A clay and ash feature was encountered in the same designation starting at 20 cm and extended to 25 cm. The feature was not excavated.

Table 1. Quantity, Use, and Origins of Artifacts recovered from the 2013 excavations.

Items	Quantity	Uses	Origin
Punta Ycacos Unslipped Rims	391	Salt-making	Paynes Creek
Punta Ycacos Unslipped Body Sherds	4,790	Salt-making	Paynes Creek
Punta Ycacos Sockets	43	Salt-making	Paynes Creek
Punta Ycacos Spacers	3	Salt-making	Paynes Creek
Punta Ycacos Cylinders	290	Salt-making	Paynes Creek
Punta Ycacos Bases	1	Salt-making	Paynes Creek
Mangrove Unslipped Rims	12	Salt-making	Inland?
Mangrove Unslipped Body Sherds	92	Salt-making	Inland?
Warrie Red Rims	1	Salt-making	Inland?
Warrie Red Body Sherds	265	Salt-making	Inland?
Moho Red Rims	1	Serving vessels	Inland?
Moho Red Body Sherds	46	Serving vessels	Inland?
Paynes Creek Rims	4	Water Jar	Unknown
Paynes Creek Body Sherds	4	Water Jar	Unknown
Chert flake and biface fragments	14	Unknown	Unknown
Obsidian flake and biface fragments	21	Unknown	Volcanic Highlands

The ash extended into the southwest corner of Transect 6, Unit 6-7 m, at the 25 cm depth. The feature was not excavated. Transect 6, Unit 6-7 m, contained a separate ash feature in the northeast corner at the 27 cm depth. Transect 6, Units 1-2 m and 2-3 m contained clay features. Clay was found throughout Unit 1-2 m at a depth of 15 cm. The clay was not excavated. Unit 2-3 m contained a concentrated clay feature along the north, west, and south wall and in the center of the unit between 15 and 18 cm. The feature continued to 20 cm depth and was not excavated.

Discussion

The excavated material, in particular the abundance of briquetage and the lack of household material, indicates that Eleanor Betty is not a household workshop, but rather a salt production workshop. The Mangrove and Warrie sherds were from jars used to store brine or loose salt. The paucity of Moho Red sherds indicates they were for serving vessels probably used in ceremonies related to opening the salt making season. No household items, such as pots used for food storage or figurine whistles, were recovered from the underwater excavations.

Approximately 376 macrobotanical remains were recovered during excavations,

including 338 endocarp fragments for *A. mexicana*, the majority of which were found in Transect 7, 3-4 m (n=91; Figure 8). Fragments of endocarps for *O. cohune* and seeds for *B. crassifolia* also were present. The macrobotanicals could have been used as part of the ritualistic feast during the opening ceremony. Alternatively, they could have been snacks or simply fallen onto the ground from nearby trees. The excavated units at Eleanor Betty yielded a large amount of charcoal (~16,262 g). Of this amount, 6,248.48 g were recovered from the shell deposit (Units 3-4 m and 4-5 m of all transects) with the largest concentration in Transect 6, 3-4 m.

The obsidian fragments consisted of proximal (n=7), medial (n=8), and distal (n=6) fragments recovered from Transects 5, 6, and 7. No complete obsidian blades were recovered. The blades could have been used as part of the opening ceremony. Additionally, the blades could have been utilitarian items used to process fish for consumption. The small amount of recovered chert flakes (primarily found in Transects 5 and 6) could indicate the reworking of stone tools that perhaps were used in the modification of post ends.

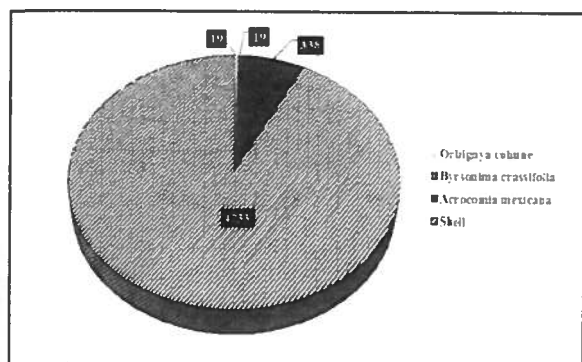


Figure 8. Pie chart showing the number of recovered shell and botanical fragments from the 2013 Eleanor Betty excavations.

The palmetto palm posts on the western edge of the site form a curved line, suggesting the Maya were trying to hold back the rising seas. The location of the hardwood posts to the east of the palmetto palm comprised a rectangular structure. This structure could have been the location of the salt production workshop.

The shell deposit measured 5 m in length by 0.5–to–1 m in width, depending on the location. The deposit was mainly in level 10–20 cm depth in Units 3–4 m and 4–5 m. The maximum thickness was 12 cm. The deposit extended both inside and outside the wooden architecture. Transect 7, 3–4 m and Unit 4–5 m of Transects 4, 5, 6, and 7 were outside the wooden architecture.

The shell deposit was determined to be a midden: Charcoal, clay, and briquetage were intermixed with the shell midden. Briquetage, charcoal, and clay were recovered in levels above and below the shell midden. None of the pottery was shell tempered. The briquetage has sand temper. The Maya at this site probably were eating oysters which were likely available on red mangrove roots as they are today.

Despite the favorable conditions for the preservation of bone due to the CaCO_3 from the shell, no human bone and only two unidentified animal bones were recovered. The lack of bones and household refuse supports our interpretation that the area was used for salt making. Briquetage was abundant in all units. Several units contained clay and ash features. The abundance of clay suggests the salt makers were making or repairing the salt making vessels on-

site. The ash features could indicate possible firing episodes of either the pottery or are the remnants of hearths used to boil brine. Charcoal was present in all units.

Based on the weight of briquetage, water jars, Moho Red, utilitarian items, and ceramics likely were stored in the western portion of the building (Units 0–1 m and 1–2 m). The primary location for salt production was located in the middle of the wooden structure (Units 3–4 m and 4–5 m). Items which could no longer be used (broken pots/water jars and spent charcoal) were disposed of at the eastern edges of the building (Units 4–5 m, 5–6 m, and 6–7 m). The evidence garnered from excavations indicates the area was a salt workshop.

Conclusions

Eleanor Betty was a Classic period ancient Maya salt production workshop which was once situated on the shore of a lagoon. Rising seas and subsidence activities have inundated this site and others in the area (McKillop 2002, 2004b, 2005a, 2005b, 2008, 2009a; McKillop et al. 2010a, 2010b). Excavations of a shell midden associated with a wooden building at the Eleanor Betty salt work indicate the area was used for salt production and not habitation. The presence of briquetage indicates salt production. The absence of household refuse supports the interpretation that Eleanor Betty was a production workshop as evidenced by the presence of briquetage and charcoal. The shells were not used as temper for ceramics, but likely were dietary.

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