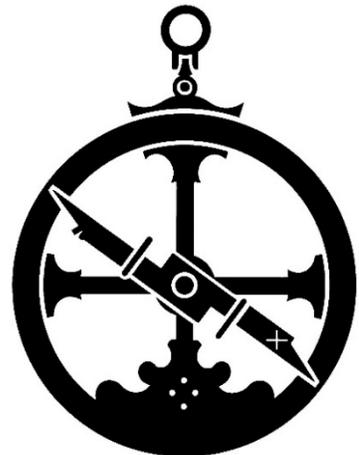


Report of Archaeological Investigations at CC-2, Cotton Cay, Turks and Caicos Islands

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Introduction

CC-2 has been the focus of at least two previous limited excavations (Keegan 1994 and Sinelli 2010), at least four documented surface collections (Keegan 1994; Keith 2002; Sinelli 2010; Sullivan and Freimuth 2014) and numerous undocumented surface collections by tourists and others. The previous documented excavations could not be relocated and the surface collections were random. These previous activities have impacted the site and our research to some extent.

The archaeological time periods in the Turks and Caicos Islands are generally broken into three periods; the Ostionan Phase (A.D. 700 to A.D. 1150), the Meillacan (A.D. 1150 to A.D. 1300) and the Lucayan Phase (ca. A.D. 1300 to A.D. ca. 1520) (Sinelli 2010:195-198; Sullivan 1981). Each of these Phases is characterized by certain styles of imported ceramics described as Ostinoid, Meillacoid, and Chicoid and locally produced Palmetto Ware. This time and ceramic framework will be followed in this report.

Methodology

A grid system was established at the site with a 0,0 datum point located near the western end of the site and marked by two ½” rebar stakes flanking a wooden stake located at 21° 22’ 02”N and 71° 08’93” W. From the 0, 0 datum, elevation readings were taken to produce a site contour map and five by five meter units were laid out to conduct a controlled surface collection (Figures 1 and 2). Most excavation units were dug in 10 cm. levels, except for Units 6 and 7 which were dug as one level (0-20

cm.), and Unit 2 which had discernable stratigraphy and was excavated accordingly. All excavated fill was screened through ¼” by ¼” mesh and selected fill was water screened through 40 mesh screen or water floated along the cliff edge. Most mollusks and coral were processed in the field and deposited along the cliff edge. Selected samples were kept for additional analysis. All ceramics were processed at the base camp. Artifacts are curated at the Turks and Caicos National Museum. All depths are given as centimeters (cm.) below the surface.

Site CC-2

Location, Physical Setting and Environment

CC-2 is located on the northern leeward ironstone shore of Cotton Cay at one of two beaches suitable for landing canoes (Figure 3). The site is approximately 7.8 meters above sea level. Based upon the controlled surface collection the site is estimated to be an oval shape 60 meters east-west and 25 meters north-south based upon the distribution of surface artifacts however, the occupation and midden deposits are probably 40 meters east-west and 20 meters north-south. The larger dimensions are similar to the dimensions postulated by Sinelli (2010:171). The location on the leeward shore reduces the impact of the prevailing winds and waves however the site can be impacted by winds and waves generated by cyclonic storms. Wave erosion has produced the ironstone shore and has eroded conch shells onto the beach at the western end of the site. Storm produced waves could have inundated the site proper and moved surface artifacts. Winds and waves have moved beach sand

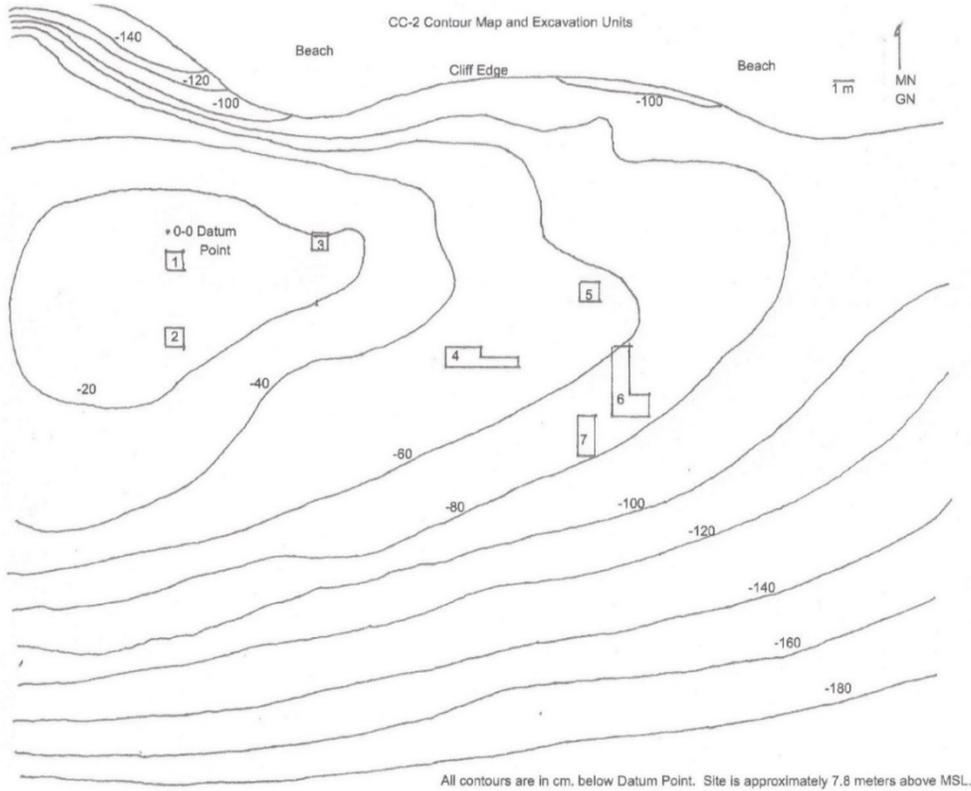


Figure 1. CC-2 Contour map and excavation units.

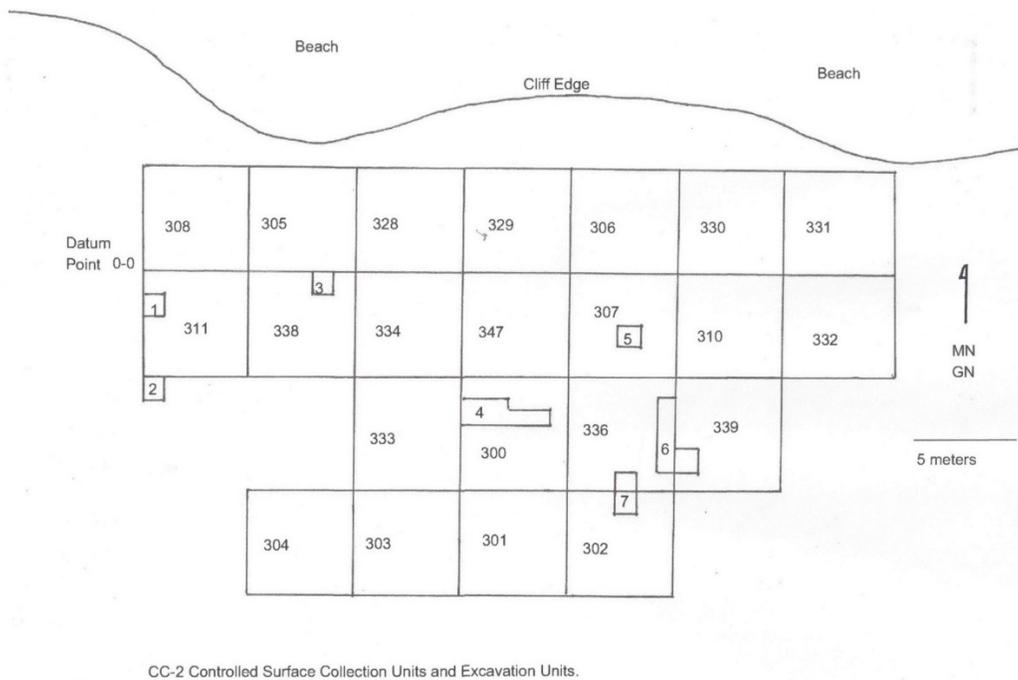


Figure 2. Surface and excavation units.



Figure 3. Cotton Cay and sites CC-1 and CC-2.

onto portions of the site. The western end of the site has a rather large sand dune which we initially thought may have buried cultural remains however shovel testing did not reveal any buried remains. The site location along the route between Turks and Caicos Islands and Hispaniola is one of the last or first landfalls, depending upon direction of travel, available to Lucayan or Taino travelers. This location must have had some influence on the site occupations.

The current vegetation is xeric and very dense in some areas. The Turks and Caicos National Vegetation and Mapping Project defines four major vegetation habitats for the site area: Upland Mixed Evergreen/Drought Deciduous Dwarf Shrubland, Coastal Mixed Evergreen/Drought Deciduous Dwarf Shrubland, Coastal Mixed Graminoid/Forb Herbaceous and Palotrene Nonvascular (listed by size in descending order) (Wood et. al. 2010) (see also Sinelli 2010:167-169).

The natural environment of Cotton Cay has been heavily impacted by human activity. A historic structure still stands on the western end of the Cay and many meters of piled stone walls cross the cay. No documented fresh water supply has been found but healthy looking goat(s) still occupy the cay, indicating that some surface fresh or potable brackish water sources must be present.

Sinelli (2010:168) states the Cay was a land grant at the end of the Revolutionary War, however, communication with Dr. Charlene Kozy does not document any Loyalist land grant for Cotton Cay (Kozy personal communication 2015). Nonetheless, Sinelli is correct that the cay is privately owned, is not under any governmental protection, and is subject to the predations of tourists from Grand Turk and Salt Cay (2010:168-169).

Our initial site visit (Sullivan and Freimuth 2014) and the work of Sinelli

(2010) defined a central core void of surface artifacts surrounded by surface artifacts. This is generally supported by the controlled surface collection. However, unit excavations in this core area produced midden deposits below 10 cm. and raises the question that the surface in this core area may have been covered by 10 cm. of Aeolian sand deposits as discussed above. This is an unresolved issue.

Ceramics

Surface Unit Ceramics

Ceramics from the controlled surface collection are presented in Table 1 and Figure 2 displays the unit locations. The surface units were collected by two individuals within a 10 minute time limit. The ground visibility varied from 90% to 20%.

Units 308, 311, 328, 329, 330, 331, 332, 334, 338, and 347 had no surface ceramics. These units are located along the western, northern, eastern boundaries of the site except 347 which at the approximate center of the site. Units 305, 306, 307, and 310 had one to six sherds. These units are along the northern and eastern site boundaries and generally inside the first set of units. Units 301, 302, 304, and 333 had eight to 16 sherds. These units are located in the southwest corner of the site. Units 300, 303, 336, and 339 had 18 to 32 sherds and are located in the south-central portion of the site.

The density distribution of the surface ceramics generally defines a pattern of high surface ceramics in the south central portion of the site with decreasing amounts outward (Table 1 and Figure 2). This pattern is similar to the surface mollusks presented later in this report.

The percentages of Palmetto Ware and imported surface ceramics was fairly consistent, not counting those units with less than six sherds (Table 1 and Figure 4). The units with the largest number of ceramics (300, 303, 336, and 339) had 66% to 83% Palmetto ware and 17% to 34% imported ceramics. The total for all of the units was 67 % Palmetto Ware and 33 % imports. Decorated Palmetto Ware from the surface included: one broad line incision; one broad line incision followed by punctations and one curvilinear applique. Decorated imported ceramics included: four broad line incised and one zoomorphic adorno (effigy lug). An effigy lug with broad line incision was also found via surface collection at CC-1 in 2019 by Joost Morsink. Images of the effigy lugs appear side by side in association with ceramic provenience tables below (Figure 5, Tables 2 and 3). Among the imported ceramics, 39 (91%) were tempered with mixed-mineral grit, three were virtually temperless, and one was tempered with dark ferro-magnesium minerals. The latter tempering was characteristic of imported Meillacoid ceramics found at MC-8 and MC-10 on Middle Caicos. The broad line incision, line and dot motif, and effigy lug are all characteristic decorative elements of Chicoid ceramics. Since the broad line incision, and line and dot motif were found on Palmetto Ware sherds, we speculate that the motifs were emulation of elements observed on imported Chicoid ceramics.

Examination of the collections attributed to CC-2 at the Turks and Caicos National Museum (TCNM), from 1992, 1993, 1995 surface collections, include a punctated Palmetto Ware sherd, as well as eight imports with broad line incision (one

Ceramics by Surface Units													
Site	CC-2	Palmetto Ware			Imports			Temper				% by count	
Bag	Unit	Rims	Body	Wt.(gr.)	Rims	Body	Wt.(gr.)	MM	VT	FM	Other	Palmetto	Import
300	300	1	12	26		6	19	3	2		1	68	32
301	301		5	6	2	8	19	10				33	67
302	302		5	7		3	14	3				63	37
303	303		15	32	1	6	19	6	1			68	32
304	304	1	5	10	1	3	8	4				60	40
305	305		1	5								100	
306	306		2	6	1	3	14	2		1	1	33	67
307	307					1	7	1				100	
310	310	1	1	1								100	
333	333		16	15								100	
336	336		15	78	1	2	54	2			1	83	17
339	339		21	45		11	31	8	8		3	66	34
Totals		3	98	231	6	43	185	39	3	1	6	67	33

Table 1. Ceramics by surface units. See Figure 2 for unit locations.

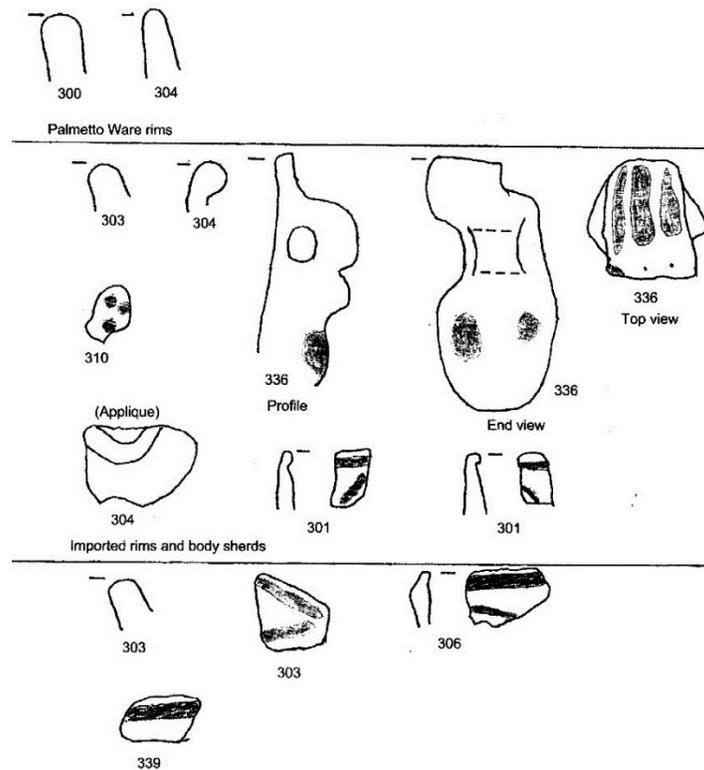


Figure 4. Surface collected unit Palmetto Ware and imported ceramics. Numbers refer to surface collected units.



Figure 5. Left: Effigy Lug, CC-1, Surface Collection, 2019 (Photo courtesy Joost Morsink), Right: Effigy Lug, CC-2, Surface Collection, 2014 (See Figure 4 # 336 above)

Ceramics by Excavation Unit													
Site CC-2 by count		Palmetto Ware				Imports			Temper			%	
Bag	Unit	Depth	Rims	Body	Wt.(gr)	Rims	Body	Wt.(gr)	MM	VT	FM	Palmetto	Import
314	1	20-30		10	10							100	
316	1	30-40		30	39		4	72	4			88	12
	Subtotal			40	49		4	72	4			91	9
317	2	0-10		11	10							100	
320	2	10-20	1	5	22		3	19				67	33
327	2	20-30	1	10	18		2	7		2		92	17
	Subtotal		2	26	48		5	26		2		86	14
322	3	0-10	1		1							100	
	Subtotal		1		1								
312	4	0-10	1	2	7	1	1	1		1		60	40
315	4	0-10	1	5	31							100	
318	4	0-10	1		1		1	10				50	50
	Subtotal		3	7	39	1	2	11		1		73	27
321	5	0-10	1	2	12							100	
	Subtotal		1	2	12							100	
343	6	0-10	3	43	136		3	26	2	1		94	6
340	6	0-20	5	30	132	2	7	52	9			83	17
345	6	10-20		11	12		3	12	3			79	21
	Subtotal		8	84	388	2	13	90	14			86	14
341	7	0-10	6	62	894	1	3	26	4			94	6
344	7	10-24		4	11							100	
	Subtotal		6	102	905	1	3	26	4			96	4
Grand Total			21	225	1433	4	27	225	44	7		89	11

Table 2. Ceramics by excavation unit. See Figure 2 for unit locations.

Ceramics by Excavation Level														
Site CC-2			Palmetto Ware			Imported Ware			Temper				% by count	
Bag	Unit	Depth	Rims	Body	Wt.(gr)	Rims	Body	Wt.(gr)	MM	VT	FM	Other	Palmetto	Import
317	2	0-10		11	10									
322	3	0-10	1		1									
312	3	0-10	1	2	7	1	1	1		1				
315	4	0-10	1	5	31									
318	4	0-10	1				1	10						
321	5	0-10	1	2	12									
343	6	0-10	3	43	136		3	26	2	1				
341	7	0-10	6	62	894	1	3	26	4					
		Subtotal	14	125	1090	2	8	63	6	2			93	7
320	2	10-20	1	5	22		3	19						
340	6	0-20	5	30	132	2	7	52	9					
345	6	10-20		11	20		3	12	3					
344	7	10-24		4	11									
		Subtotal	6	50	185	2	13	83	12				76	24
314	1	20-30		10	10									
327	2	20-30	1	10	18		2	7		2				
		Subtotal	1	20	28		2	7		2			84	16
316	1	30-40		30	39		4	72	4					
		Subtotal		30	39		4	72	4				88	12
		Grand Total	21	225	1342	4	27	225	22	4			89	11

Table 3. Ceramics by excavation level. Temper: MM is mixed minerals, VT is virtually temperless, and FM is Ferro-magnesium. See Figure 2 for unit locations.

example is on a strap handle) and, one fine line incised sherd. As mentioned, the broad line incision is characteristic of Chicoid ceramics. The fine line incision is typical of Meillacoid. Of note, the fine line incised sherd mentioned has ferro-magnesium tempering, linked above with Meillacoid

ceramics from Middle Caicos. From the 1995 surface collection there is also an imported carinated bowl, with ferro-magnesium tempering—again suggestive of Meillacoid origins. Finally, in the TCNM collection, from a 1994 test pit (0-10 cmbs) there is a virtually temperless sherd with

fine cross-hatching cut into wet paste—typically Meillacoid. Also present in the TCNM ceramics was one surface collected Melado Ware sherd (Keegan et. al. 1994:9).

Excavation Unit Ceramics

The ceramics from the excavated units are in Table 2 by unit and Table 3 by level, providing a horizontal and vertical distribution. The unit locations are in Figure 2. All units were dug to bedrock.

Units 4, 6 and 7 were 20 to 25 cm. deep and Units 1, 2, 3 up to 50 cm. deep. Unit 3 had no surface ceramics and Unit 5 had one surface import ware. Units 4, 6, and 7 did have a high number of surface and subsurface ceramics. Thus the subsurface distribution did not reflect the surface distribution in all cases. This has direct bearing on defining the central core area. The total percentages of Palmetto Ware is 87 % and imports are 11 %. The ceramics by level (Table 3) clearly show the presence of imports in the lower levels of the midden, for all levels and for the site as a whole and seems to be consistent with the surface units. Palmetto Ware decorative motifs included one punctated and one broad line incised example. Among imports broad line incised sherds were present, as was a carinated bowl fragment. (Figure 6).

Ceramic Discussion

Sinelli recovered a total of 23 sherds, 21 Palmetto Ware and 2 imports, from his work (2010:173-174). He readily admits this is a very small sample and cautiously interprets the site based upon the sample. He summarizes the CC-2 occupation stating:

“CC-2 was occupied during the Lucayan phase, and after Spanish contact.

Excavations revealed two distinct occupations horizons. The earlier Level 2 horizon included substantial amounts of faunal material, especially fish bone, and an exclusively Palmetto ware ceramic assemblage. The data suggest a longer period of more intensive occupation than is typically observed at Turks Island sites. There is no indication that the people who lived at CC-2 during this period had regular contact with Hispaniola, which raises the possibility that they hailed from elsewhere in the Bahama archipelago, and were drawn to Cotton Cay by local resources and lack of competition. The later Level 1 horizon was occupied in late prehistory and well into the post-contact era. In this horizon, imported ceramics are found in context with Palmetto ware and the remains of a dedicated bead making industry. I argue that the Level 1 horizon was settled by Caicos-based residents of MC-6 and/or MC-32 who sought refuge on Cotton Cay to escape Spanish slave raids and offset their flagging staple trade with Hispaniola by manufacturing beads for export (Sinelli 2010:197-198)”.

He states the site was occupied during the Lucayan Phase (AD 1300 to AD ca. 1520) based upon the presence of Palmetto Ware below two imported sherds (2010:175 and 197). The terminal date is supported by the surface find of the Melado Ware sherd.

Our excavation results clearly show a different pattern. We have both import and Palmetto wares from the surface and subsurface levels in fairly consistent percentages (Tables 1 and 3). In addition, there are now two Sigma 2 radio carbon

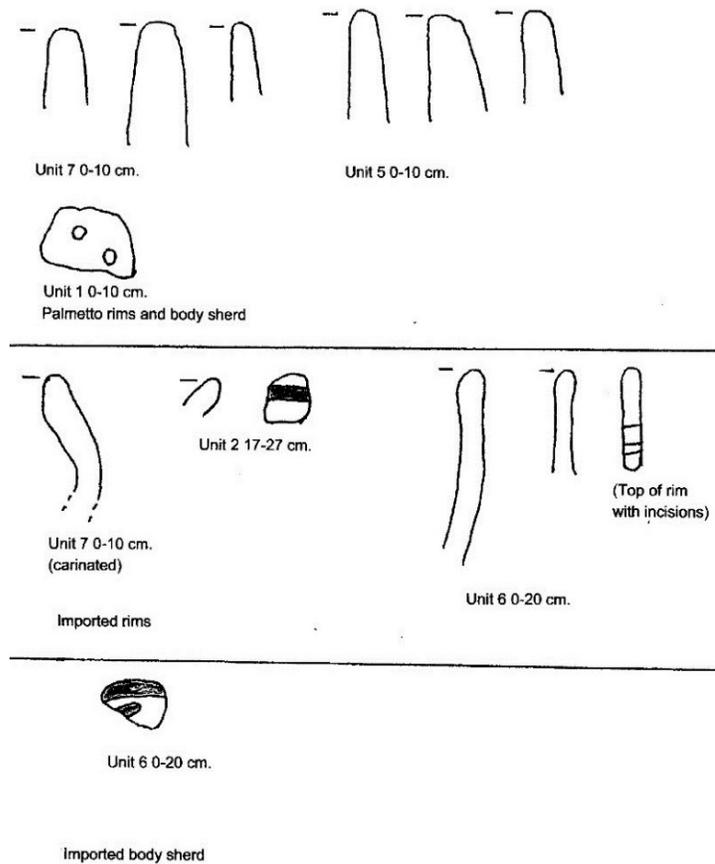


Figure 6. Excavated unit diagnostic ceramics.

dates; AD 1405 to AD 1445 and AD 1315 to AD 1355 or AD 1390 to AD 1430 (Beta Analytic 2014, Appendix B). While this will support a late occupation for CC-2 it does not support a lack of contact with Hispaniola nor peopling of the site from Caicos sites. We also recovered faunal material, including large amounts of fish bone, turtle, and conch, thus the question of a long period of intensive site occupation is questionable; since repeated visitation of the site for food gathering and preparation remains a possibility. The matter of the site occupation after Spanish contact is addressed later in this report.

Vertebrates

For detailed analysis of the vertebrate zooarchaeological faunal remains from CC-2 please see the analysis presented in Appendix A, prepared by Dr. Carla Hadden. That faunal analysis was derived from more than 2000 bone specimens from a wide spectrum of CC-2 site proveniences. The majority of the specimens were from bony fish, to include groupers, grunts, wrasses, and parrotfishes, most of which were small individuals. The corpus of fish vertebrate samples recovered at CC-2 reflects exploitation of marine resources from the grass and sand flats and coral reefs present both immediately adjacent to the site, and more broadly distributed around the

periphery of Cotton Cay and surrounding the Turks Islands group generally.

Mollusks

Mollusks from the controlled surface collection are listed in Table 4 and from the excavation units in Table 5.

The highest numbers of surface mollusks are from Units 329 and 330 located on the northern cliff edge, Units 301, 302 and 303 along the southern margins of the site, and 332 on the eastern margins of the site. Units 311, 338, and 347 had no surface mollusks and Units 306, 307, 308, 328, and 334 had the lowest numbers (Table 4). This surface distribution supports a central “clean” area surrounded by deposits of expended mollusk shells. The most common species are *Strombus* sp., *Citarium pica* and *Nerita* sp. (Table 4).

The mollusks from the excavated units indicate a similar pattern to the surface units. *Strombus* sp. are the most common, followed by *Citarium pica*, *Nerita* sp., *Tectarius* sp., and *Chiton* sp. (Table 5). These numbers are consistent by unit and level indicating that over time and through space the utilization, processing, and deposition of selected mollusks was consistent. (Note: by weight of edible flesh, *Strombus* sp. constitutes over 95% of the mollusks present at the site.) Sinelli (2010:176, Table 4-7) reports 13 *Strombus gigas* and 11 *Citarium pica* mollusks from his test excavations.

Single *Oliva sayana* shells were recovered from surface units 306, 329 (cut), and excavation unit 4 (0-10cm). Sinelli recovered one *Oliva* sp. shell bead from test unit 2 and a large number of blank shell beads mostly from the eastern end of the site (2010:177). In contrast, we did not recover

any blank shell bead blanks, but did recover two small (2 mm diameter) cut shell beads; one whole and one partial.

Strombus sp. Tools

Strombus sp. tools were quite common from the controlled surface collection (33) and the excavated units (97) (Table 6). The surface distribution was concentrated in Units 301, 302, 303, and 304 along the southern limits of the site, 306 along the northern edge, and 307 near the eastern limits of the site (Figure 2). This distribution appears to reflect the discard pattern of *Strombus* sp. shells around the perimeter of the central occupation zone of the site. The *Strombus* sp. tools consisted of punches, columella tools, blades, and anvils which were quickly made, used, and discarded because the task was completed or the cutting edge is no longer functional.

Shell Tool Analysis

Glen Wright has completed an analysis of these tools and his results follow. His definitions, parameters, and processes conform to those set forth by Keegan (1982) and O’Day and Keegan (2001).

It has been noted herein that the physical setting of CC-2 is different from some previously reported sites in that it has a small shallow landing, the site is located just above the beach and mollusk procurement is likely just off shore. In this context, Keegan has noted that the awkward shape, large size and heavy weight of the *Strombus* sp. shells makes it difficult to transport large quantities over a long distance (1982:84).

Site CC-2		Surface Collection Mollusks						
Genus/Species	<i>Chiton</i> <i>sp.</i>	<i>Citarium</i> <i>pica</i>	<i>Nertia</i> <i>sp.</i>	<i>Oliva</i> <i>sayana</i>	<i>Strombus</i> <i>gigas</i>	<i>Strombus</i> <i>sp.</i>	<i>Strombus</i> <i>pugilis</i>	<i>Tellina</i> <i>listeri</i>
	MNI	MNI	MNI	MNI	MNI	MNI	MNI	MNI
Unit								
300		3	1		21			
301		11			24		2	
302		11			76		1	
303		2			24			
304		1			28			
305					11	2		
306		3	1		10			
307					9			
308		1			7			
310		3			20			
328		1			5			
329	1	1	4	1	6			3
330	4	17	3	2	16			
331		6			11			
332	1	6			15			
333		2			19			
334		1				5		
336		5				25		
339		1				3		
Site Total MNI	6	75	9	3	302	35	3	3

Table 4. Surface collection mollusks.

O’Day and Keegan also state:

“Our efforts to recognize expedient tools in archaeological deposits have been conditioned by two assumptions. First, that tools were made from adult shells, and, second, that adult shell were intentionally transported to sites for a *specific* use. ... Today, throughout the Caribbean, shells are commonly discarded in the area at which the meat is removed, usually on the beach; the meat is taken back to habitation areas where it is “cracked” (pounded to break up the muscle)

and dried for preservation. ... We argue that this is a likely scenario for past behaviors that accounts for patterns in artifact assemblages regionally”. (2001: 281).

At CC-2 there was no need to select and transport procured shells any significant distance; the procurement was just off shore and the landing was just below the site. Thus processing evidently occurred at the site where both the shells and the meat were utilized. One should expect to find shells with no alterations, except an extraction hole, shells processed for tools, tools, and the blank shell beads noted by Sinelli. As

Site CC-2	Mollusks (MNI) by Excavation Units												
Genus/species	Level (cm)					Excavation Unit Unit Total(%)							
	0-10	10-20	20-30	30-40	40-53	1	2	3	4	5	6	7	
<i>Amonica simplex</i>	1										1		.1
<i>Callistoma sp.</i>	1									1			.1
<i>Capulus incurbails sp.</i>	2								2				.2
<i>Cerithium sp.</i>		2	1							3			.4
<i>Chiton sp.</i>	5	11	4	1		3	1	3	4	1		9	3
<i>Cittarium pica</i>	89	58	31	16	2	38	7	16	9	4	57	65	25
<i>Codakia orbiculata</i>			2			2							.2
<i>Lianneea carnea</i>	6										6		.8
<i>Littorina sp.</i>	1					1							.1
<i>Nerta sp.</i>	29	83	30	8	1	13	8	17	18	9	29	57	19
<i>Oliva sayana</i>	1	1							1		1		.1
<i>Strombus gigas</i>	128	111	35	30	1	11	17	59	45	2	117	54	39
<i>Strombus sp.</i>	7		8				8	7					2
<i>Tectarius muricatus</i>	33	16	16		2	5	11	10	16	5	9	11	9
<i>Tectarius sp.</i>		10									10		1
<i>Tellina listeri</i>	2			2		2			1		1		.5
<i>Trivela sp.</i>		1									1		.1
Subtotals	305	293	127	57	6	75	52	112	96	25	232	196	
Grand Total	788					788							

Table 5. Mollusks (MNI) by excavation units. Percentages are rounded. Level 30-40 only existed in Units 1 and 3. Level 40-53 only existed in Unit 3.

described below, such an overall assemblage was recovered at CC-2. Since we believe that there was no necessity for the site occupants to make a decision to sort, keep and partially discard shell before transporting them to the site, we make no assumption(s) that what was recovered represented part of a previously sorted assemblage of those shells. We propose that it is also immaterial whether the site was temporary or permanently occupied in this regard.

The shells used in this analysis are from excavation Units 4 (0-10 cm.) which

was a shallow unit on the southern edge of the central area, just inside the outer ring of deposits and lying atop bedrock, excavation Unit 3 which had 50 cm. of deposits, and a small number of surface shells from the site and nearby southern salina.

In Unit 3, as in most of the central area, there was a light brown to gray sandy surface layer that extended approximately 10 cm. with a paucity of cultural material followed by a sandy dark midden deposit consisting of fire cracked limestone, charcoal in the form of powder and lumps, *Strombus sp.* shells and shell fragments,

Site CC-2		Conch Shell Tools by Count		
Unit	Level(cm)	Bag No.	Column Tools	Lip Tools
2	10-20	320	1	
	Subtotal		1	
3	10-20	323	8	
3	20-30	324	14	
3	30-40	338	16	
	Subtotal		38	
4	0-10	312	33	
4	10-20	319	1	
	Subtotal		34	
5	0-10	321	3	
6	0-10	341	10	
	Subtotal		13	
7	0-10	343	7	
7	10-20	345	4	
	Subtotal		11	
Total from excavated units		97		
Surface Units				
301		301	7	
302		302	10	
303		303	1	1
304		304	5	
306		306	6	
307		307	4	
	Subtotal		33	
	Site Total		130	1

Table 6. Conch tools by count. Column tools include blades.

columella tools, blades manufactured from the tips of columella tools, an anvil, a possible shell gouge, and round limestone nodules possibly used as hammerstones. The cultural material in this dark or black zone was exceedingly dense; and, its combined volume including the fire cracked limestone exceeded the volume of sand within which it was imbedded (Figure 6). The dark fire cracked midden was partially stratified. The upper portion of the dark deposit contained angular cracked limestone

that was generally intact and not easily broken, even by a trowel. It is not known if these angular rocks were used to line a fire pit or to cover and cook foods after they were heated. Below this layer, at approximately 40 cm. and extending to 50 cm. the color of the limestone changed to a bluish gray and they were more fragile being easily crushed by hand. It may be this lower level limestone was heated to a higher temperature or exposed to longer and repeated fires (See T. Hester 1994). No



Figure 6. Unit 3. Excavation at 40cm. Note fire cracked limestone and conch shell tools and waste. Glen Wright in the foreground.

distinct “pits” with identifiable edges were observed in any test units, not even from the previous excavations.

The substantially whole *Strombus sp.* shells which retained the initial small round entry hole to enable meat extraction were examined first. These shells are similar to many others described in the Caribbean archaeology literature except for one point; the punched hole to enable meat extraction in every instance was not located in the last (lowest) groove of the conch spire. Previous site reports and reports of experimental extractions described the hole as being in a varying number of grooves below the apex (top) of the shell. We calculated the location by counting up from the bottom of the spiral. All of the shells examined had the

hole located in the next groove above the lowest groove. We suspect this placement was not only related to meat extraction but also to provide the correct start in subsequent columella tool manufacturing.

In order to fully understand this distinction the process of meat extraction is reviewed. It is almost impossible to pull the meat from the shell thus an extraction hole must be made. Lucayans undoubtedly used the apex tip of another *Strombus sp.* shell for this purpose. Once the hole was created, it is believed a sharp needle like object was inserted into the hole to induce or sever meat thereby causing the release of the meat. Once released the meat can be pulled from the shell. Postulated sources of pointed objects include carved wood, *Strombus sp.*

shell tools (columella tool), frond tips, cactus needles, and long thorns from native plants.

Once the meat was extracted the shell could be discarded or utilized for tools. As previously mentioned, the extraction hole placement becomes the basis for this process. Shell tool manufacturing is a two-step process. Using the apex of another *Strombus* sp. shell as a combined hammer and punch, a continuous line of connected new holes are made between the nodules and following the spiral. One can start at the extraction hole or start at a point in an adjacent groove directly across the intervening line of nodules. Due to the fact that the grooves are a continuous downwardly spirally feature of the shell, this continuous line of holes does not connect with its beginning as you come 360 degrees around the center of the shell. The line of punched holes ends up one groove over and across the intervening ridge atop the whorl (Figure 7).

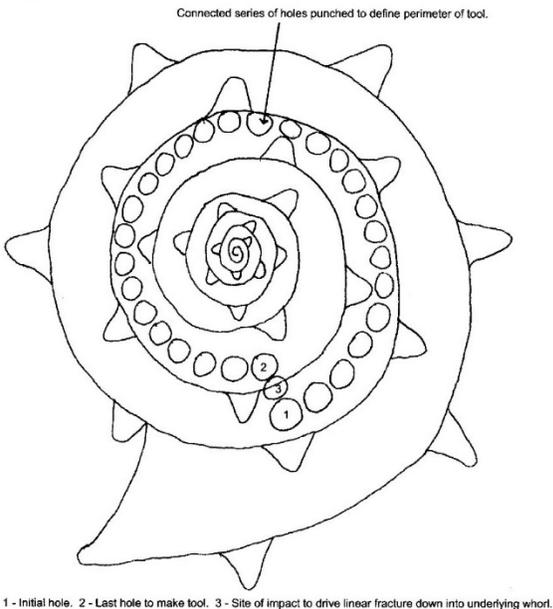


Figure 7. Conch tool manufacturing steps.

This is critical because the very last strike must be placed exactly in the nodule line between the beginning of the circular line of holes and its end. This intervening point lies directly atop a vertical interior whorl of the columella which must be fractured. One last time, the apex of the hammering shell forcefully strikes onto that point in the nodule line between the beginning point and the ending point. That strike sends a shock wave downward into the spiraling wall of the whorl at that point creating a linear or spiral fracture. This instantly detaches the columella tool from the remaining shell (Figure 8). This is the same process as reported by others (Keegan 1982, O'Day and Keegan 2001) but herein is the annotation that the two ends of the circular incision do not meet and the last strike must be on the line of nodules between the two grooves and down into the underlying whorl.

This is an imperfect process, and does not always result in a seemingly perfect tool with a proper edge. Whether caused by imperfections in the shell, or by imperfect application of the shell hammer, this will sometimes create only partial fracturing with a short cutting edge that does not extend the intended distance down the spire. This sometimes results in a stub of a tool that is not optimal for cutting. Several apparently imperfect columella tools were recovered from the excavations and may or may not represent an undesirable tool that was discarded. However, they should not be confused with apex stubs which have had their cutting edges deliberately removed to make a separate blade (Figure 9).

Large numbers (n=97) of *Strombus* sp. columella tools and blades were recovered in the excavation units (Table 6).



Figure 8. Top: Detached Strombus apexes with imperfect edges. Unit 3 at 30 to 40 cm. Bottom: Detached Strombus apexes made by Wright. Right example with blunted apex used as a punch.



Figure 9. Detached Strombus apexes with broken, irregular, or marginally useful tips. Unit 3 at 30 to 40 cm

Columella Blades

Numerous secondarily manufactured blades were recovered from the excavation units that were made by detaching the tips of the columella tools, thereby creating a smaller, more tactile cutting or scraping tool (Figure 10). It appears the Lucayans did not want the apex to remain on the tool and produced a smaller hand held razor-like blade which is more easily controlled, manipulated, and less burdensome in the process of cutting meat, peeling vegetables, and cleaning fish (See Keegan 1982).

Experimentation found that these smaller tools could not be manufactured, at least by us, by the exact same process as that used to make the *Strombus sp.* columella tools. Those tools were produced by the last strike onto the ridge over the whorl producing a fracture running linearly or spirally downward along the edge of the columella tool. The blades, on the other hand, are produced by an additional perpendicular strike toward the distal or lower end of the columella tool. Striking the distal end of the columella tool will break the tip off thereby creating a new blade. This blade was only produced by placing a columella tool firmly on an anvil and striking the tip perpendicularly from the side, thereby producing a fracture that was perpendicular to the linear axis of the original columella tool.

There is some debate regarding whether the columella blades constitute an expedient tool or a formal tool. O'Day and Keegan define expedient tools as those that "... show little or no modification after the shell is broken to produce a particular shape" and formal tools as those that "... display modification beyond initial breakage of the raw material" (O'Day and Keegan

1982:275-276). This definition creates a gray area.

The blades may show some wear along the cutting edge but it should be remembered it is suggested they were used to process soft tissue, used for a short period of time and then discarded. Thus no significant amount of wear patterns would be produced. They definitely do not have any edge reworking in the form of chipping or grinding. This tends to mitigate toward labeling them as expedient tools. But the blades appear to not be, and apparently, cannot be, manufactured by the initial process of detaching a columella blade from the shell by striking the shell in a vertical fashion. They are in fact made by an additional step of secondarily modifying the original *Strombus sp.* columella tool by striking it again, but in the horizontal axis rather than the vertical axis, thereby creating a new tool from its tip. That appears to more closely fit the definition of a formal tool.

Getting bogged down in category placement of artifacts that have diverse attributes, but some of which have shared attributes, extends beyond the purpose of this report. We simply note how and the place in the process where these blades are manufactured.

Strombus sp. Shell Anvil

O'Day and Keegan (2001) report the use of complete *Strombus sp.* shells as anvils used to produce bipolar chert flakes which were made into drill bits at the Governor's Beach site (GT-2) on Grand Turk. An imported hammerstone was also part of the assemblage. Cotton Cay is approximately seven miles from Grand Turk.



Figure 10. Detached columella blades. Unit 3 at 20 to 30 cm



Figure 10 continued

In excavation unit 3 at 15 to 20 cm. one *Strombus sp.* shell was recovered fitting the description of the shell anvil recovered at GT-2. The shell was in a vertical position with the apex at the top and its vertical length extended approximately 20 cm. almost up into the hiatus between the overlying light brown sand surface layer and the underlying dark carbonaceous sandy midden in which it was found. The shell was severely battered about the apex and even the nodules were either severely worn or smashed (Figure 11). We recovered one fragment (6 cm. flake) of pink-beige chert with wear evidence along one edge but no imported hammerstones at CC-2. However we did recover round limestone nodules in the midden (described in the lithics section of this report). Two such nodules exhibiting impact marks were found in association with the shell anvil, the columella tools, and the secondarily manufactured blades.

Shell Gouge

One shell gouge was recovered from the dark midden deposits of Unit 3. It was linear in form, concave on one side and convex on the other. One end was retouched and one side exhibited definite signs of either being ground or then smoothed by wear (Figure 12).

Strombus sp. Celts and Preforms

Celts, preforms and other tools made from the outer lip of *Strombus sp.* shells have been reported from a number of sites in the northern West Indies. O'Day and Keegan distinguish between a "petaloid celt" (well ground working edge, some with ground sides) and "celt blanks" (a preform,

or a chopping, cutting, woodworking or digging tool which lacks a ground working edge, though it is possibly a complete artifact) (2001: 276-278, Table 1 and Figure 3). We did not recover any of the above shell artifacts at CC-2. However along the beach water edge at CC-2, naturally occurring mineralized *Strombus sp.* shell lips which conform to the definitional parameters described by O'Day and Keegan are readily found, except they do not show any indication of human alteration. Since they are fossilized and have all of the attributes of human produced tools and require no additional modifications these naturally formed "blanks" could have been recovered and then used as celts. However, none were recovered in situ during the excavations.

Strombus sp. Lip Tool

One *Strombus sp.* lip tool with substantial grinding and/or wear along the edges was recovered from surface Unit 303. A large *Strombus sp.* columella tool was also recovered from this Unit (Table 6).

Coral

The coral recovered from the controlled surface collection is in Table 7 and from the excavation units in Table 8. Of the species identified from the surface collection, *Montastrea annularis*, *Acropora palmatta*, and *Montastrea caveruosa*, in that order, were the most common. The most common species from the excavated units were *Acropora plamatta* and *Montastrea annularis*. The excavated species were also



Figure 11. Strombus anvil. Unit 3, it extended from 15 to 30 cm levels.

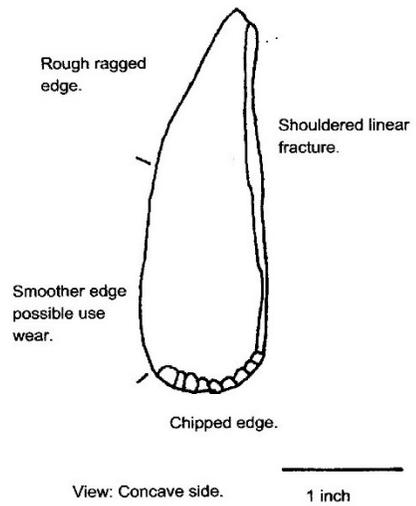


Figure 12. Shell gouge, concave side, with retouching. Unit 3 at 30 to 40 cm.

Site CC-2 Controlled Surface Collected Coral by Weight (gr)											
Genus species	Bag No										
	Unit No										
	300	302	303	306	307	310	329	330	333	336	339
Acropora palmatta	10	276			34				351		319
Acropora cervicornis	2		15		30			306			
Diploria sp.		30				54				438	
Montastrea caveruosa	21	8			8	143	343	180		17	
Montastrea annularis		14			51	940		82		36	
Unidentified	33	330	16	132	521						

Table 7. Controlled surface collected coral by weight. See figure 2 for Unit locations.

Site CC-2 Unit Excavated Coral by Weight (gr)							
Genus species		Acropora palmatta	Acropora cervicornis	Diploria sp.	Montastrea caveruosa	Montastrea annularis	Unidentified
Unit	Level(cm)						
1	0-10		2				
1	20-30		14				
2	0-7			9		3	7
2	7-17		71	28	11	191	
2	27-32					1	
3	0-10			8	7		3
3	20-30		39			5	
3	30-40		20			8	
4	0-10	36	42			1	6
4	10-20						6
6	0-10			102		29	65
6	10-24	3	4	17		1	18
7	0-10		175	13		60	19

Table 8. Unit excavated coral by weight. See figure 2 for Unit locations.

present in fairly consistent in all levels suggesting they were desired species through time at CC-2. Selected coral specimens which exhibited use were kept for additional wear analysis which has not been completed.

Lithics

Lithic Tools

Lithic tools included hammerstones, one utilized limestone flake, one chert flake with evidence of edge ware, and one additional chert flake.

The ten hammerstones consisted of locally available round limestone nodules. When walking to and from the site we noticed round limestone nodules on the surface. During the excavation, like nodules were recovered from the midden that displayed use as a hammerstone. The nodules are about 3.75 cm. to 6.25 cm. in diameter and had a smooth surface except for the use area. The use area always consisted of a single complete circle approximately ¼ inch to 3/8 inch in width around the circumference of the stone (Figure 13). The stones had no preparation for use. Hammerstones were recovered from the following excavation units; one from Unit 1, two from Unit 3, two from Unit 5, and five from Unit 7. The distribution suggests that these expendable tools were used frequently through time.

The size dictated that the stone be held between the thumb and fore finger for use. None of the specimens appeared to be broken. Thus it appears the hammerstones were used for one session of work and then discarded. Since there is a large supply of nodules close to the site, the limited use does not appear to be a problem. The

specific use for the hammerstones is not clear but may be related to the production of the columella blades.

Fire Cracked Limestone

Very large amounts of fire cracked limestone (FCR) were recovered from all of the excavation units (Figure 6). The material was thoroughly mixed with other artifacts. Most of the pieces were 1 inch to 3 inches in size and angular. The excavated limestone was used as backfill and almost completely filled the deeper excavated units. The function is thought to be use in food preparation.

Possible Structure

The possible remains of a structure were exposed in Unit 6. Several large limestone slabs were placed upon bedrock and formed an arc (Figure 14). We did not have time to fully expose the remainder of the arc to verify the remains and interpretation.

Carbon-14 Dates

Two sigma two dates were obtained for CC-2. The first date was on charcoal from Unit 5 at 10 cm. to 20 cm. The date is AD 1405 to AD 1445. The second was on charcoal from Unit 3 at 30 cm. to 40 cm. The date(s) are AD 1315 to AD 1355 or AD 1390 to AD 1430 (the curve is crossed twice) (Beta Analytic 2014, Appendix B). One could surmise a range of ca. 130 years or ca. 55 years of site occupation from this sample or an initial site occupation of ca. AD 1315.



Figure 13. Limestone nodule hammerstones. Unit 3 at 30 to 40 cm.

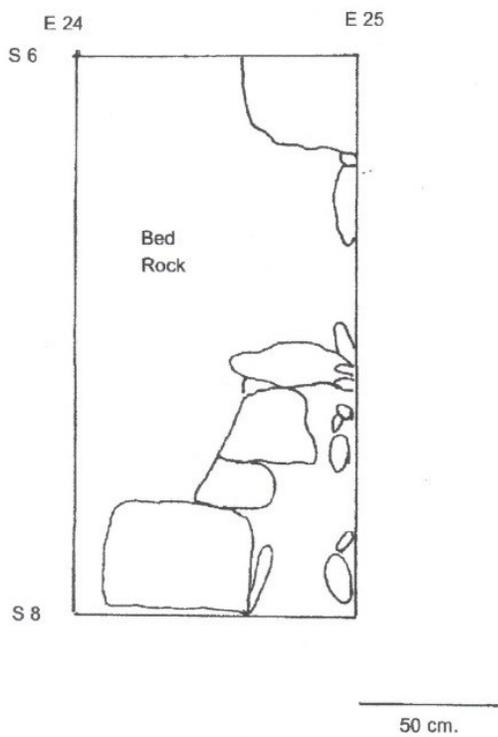


Figure 14. Unit 6 possible structure.

CC-2 Interpretation and Comparisons

Interpretations

The results of our investigations indicate that CC-2 was a small and probably a seasonally occupied site. The site location has a small sheltered beach and high ground at the beach.

Based upon two C-14 dates and the ceramic assemblage, the initial site occupation is ca. AD 1300 or possibly as early as AD 1250. A later period of occupation of the site (10 cm. to 20 cm.) dates from 1405 to 1445. If the ascribed CC-2 provenience of the prior surface collection of a Spanish Melado Ware sherd is correct, then this suggests the possibility that the CC-2 site termination date is post-contact. The recovered ceramic assemblage is a fairly consistent mix, by depth and space, of import and local Palmetto wares.

The identified mollusks are a consistent mix of *Strombus sp.* (dominate), *Citarium pica*, and *Nerta sp.* (in that order). A large number of expedient conch tools were recovered and are also fairly consistent in depth and space. *Olive sayana* beads and 2 finished shell beads were recovered. Certainly a large amount of conch and other food processing occurred at the site.

The vertebrate remains are mostly marine resources from sea grass flats and coral reef zones which are proximal to the site.

The lithics included chert flakes (imported) and locally available limestone nodules, which were evidently used as hammerstones. Large amounts of limestone fire cracked rock were observed.

The identified surface coral included *Montastrea sp.*, *Acropora palmetto*, and *Diploria sp.* (in that order). The excavated

identified coral included *Montastrea sp.*, *Acropora cervicornis*, and *Diploria sp.* (in that order) as the most common species. Many of the coral were used as tools, as evidenced by surface abrasion. The analysis of the coral wear patterns is not complete.

We did not recover any contact artifacts. Thus the Melado ware sherd recovered from a previous random surface collection remains as the only evidence supporting site occupation at or after Spanish contact.

Comparisons

Sinelli interpreted CC-2 to have two occupations. The first, based upon Palmetto Ware sherds below imported wares, was by peoples from the north. The second occupation which included a mixture of imported and local Palmetto Wares was a Chican site occupation and was terminated in post-contact times (Sinelli 2010:169 and 175).

Sinelli's interpretation of CC-2 is, "The site's small size, shallow deposits, and limited material culture place CC-2 neatly within the "outpost" category of my organizational framework. There is no indication that the site was occupied continually over long periods of time, but instead was inhabited on an occasional, seasonal, or perhaps semi-permanent basis by people looking to exploit locally-available resources. However, it seems likely that the objectives and demographics of those occupying the CC-2 outpost changed over time (2010:178)."

Sinelli dates the initial occupation of CC-2 (Level 2) at approximately AD 1300 based upon the presence of Palmetto sherds below imported wares and that the cay was unoccupied at this time (2010:179). Who

moved into CC-2 at this time is not clear but Sinelli suggests a linkage with Hispaniola for these people is “tenuous at best”. He also rules out Caicos migrations because the Caicos people had strong ties to Hispaniola based upon their imported and Palmetto Ware ceramic assemblage. He suggests CC-2 was settled by migrations from the north or central Bahamas drawn by empty islands (2010:180-181).

The final CC-2 occupation (Level 1) with a “strong” bead making industry and a mixed ceramic assemblage of imported and Palmetto Wares, was a less intensive occupation suggesting an occasional occupation of short duration to manufacture shell beads. Sinelli suggests these people came from the Caicos Islands, specifically sites MC-6 and MC-32 which have similar ceramic assemblages and were occupied after contact. While MC-6 and MC-32 did not have evidence of bead manufacturing, sister sites to MC-6, namely MC-8 and MC-10 did (2010:181-183).

Radiocarbon dates for the Middle Caicos sites are listed below (Table 9).

Site	Date (Calibrated)	2 sigma range
MC-12	AD 1230 to AD 1256 ± 70	AD 1030 to AD 1280
MC-12	AD 1282 ± 70	AD 1220 to AD 1410
MC-12	AD 1040 ± 60	AD 990 to AD 1230
MC -6	AD 1437 ± 70	AD 1327 to AD 1636
MC-32	AD 1284 ± 50	AD 1260-1410

Table 9. Dates for the Middle Caicos sites (After Keegan 1994:13).

The ceramic similarities are based upon the mixture of locally manufactured Palmetto ware and imported wares (Meillacoid and Chicoid). However, the size, location, and function of the Middle Caicos sites and CC-2 vary. The important point is to tie CC-2 to the Lucayan occupation of the Caicos Islands, to some

Middle Caicos sites in particular, and in time and activity. In terms of activity, we infer CC-2 to be a food procurement and processing site, and probably a way point along a trade network from the Caicos Islands to Hispaniola.

The bead manufacturing is a central part of Sinelli’s reconstructions and the recovery of beads, bead blanks, and manufacturing tools at CC-2 forms a basis for his CC-2 interpretations. (In contrast, our surface and excavation unit collections include only 2 cut shell beads). He states that in conjunction with Spanish contact and the resulting social upheavals, the Lucayans from Middle Caicos re-established the bead trade industry at CC-2 to fulfill a demand in Hispaniola (2010:188). Although Sinelli is pressed to explain why these Caicos people could not make shell beads in the Caicos Islands, where abundant shell resources are found, he believes that Spanish domination played a role. Cotton Cay was a “hinterland” and open to Caicos peoples to establish a site on Cotton Cay and manufacture shell beads for export to Hispaniola. Here, they could “hide” from the Spanish and conduct their trade (2010:189).

Sinelli admits the CC-2 ceramic assemblage is small and his reconstruction relies upon theory and inference and the single Melado surface sherd (2010:193). The results of our CC-2 investigations indicate a somewhat different interpretation.

The ceramics from the excavated units by level (Table 3) show the presence of a mixture of Palmetto Ware and imports through all levels and units of the site. Most of the imported wares are from the 0 to 10 cm. level, some are from 20 cm. to 30 cm. However, imported body sherds were recovered from 30 cm. to 40 cm. which was

as deep as Palmetto Ware. The percentages of Palmetto Ware to imports are fairly constant for all levels and units (Tables 2 and 3). Thus, there is a mixture of imported and Palmetto wares at the onset and continuing occupations at CC-2. This would suggest the initial and follow-on occupations at CC-2 need not be from the northern Bahamas but more likely were from the Caicos Islands.

When the CC-2 initial occupation occurred is clearer, ca. AD 1300, possibly earlier. This is supported by our two C-14 dates (Figure 17). The first date is from Unit 3 at 30 cm. to 40 cm. on charcoal and has two ranges; AD 1315 to AD 1355 and AD1390 to AD 1430. The second date is AD 1405 to AD 1445 and is on charcoal from Unit 5 at 10 cm. to 20 cm. We would support an initial occupation of AD 1300, possibly earlier, and a termination date after contact. This would support Sinelli's initial occupation and termination dates.

We propose that CC-2 was initially visited and seasonally occupied by people from the Caicos Islands, and possibly Grand Turk, ca. AD 1300; had an early bead industry as part of an ongoing trade between the Caicos Islands and Hispaniola (with Middle Caicos a likely component); and this activity continued after contact. These visits were probably of short duration. We do not see how the Cay could have been colonized to make beads for trade and "hide" from the Spanish. It is consistent with our analysis that these Caicos traders would stop to rest, take shelter, resupply, or add to their trade at CC-2. We assess that CC-2 was occupied seasonally, and we propose that the trade voyages may have been seasonal as well, possibly timed to coincide with periods of favorable wind and sea conditions and trade items from the Caicos Islands. In this

connection, we note that there are periods of reduced winds and waves in the region in the spring (April-May) and fall (September-October) that may favor long ocean passages by dugout canoe.

Cotton Cay Sites

Sinelli stated CC-2 was occupied earlier than CC-1 (2010:169). We have altered the interpretation of CC-2 but the lack of excavated data from CC-1 and the paucity of Palmetto Ware in the surface collections precludes linking the two sites in time at this time.

Recommendations

Cotton Cay and the two known prehistoric sites, as well as the historic features, are threatened by tourists and collectors from Salt Cay and Grand Turk. Since the recent construction of a trail and media coverage this intrusion will most likely increase and possess a direct threat to the Cay cultural and natural resources. Both the cultural and natural resources hold valuable scientific information that may well be lost. The prehistoric sites are not fully investigated, especially CC-1 which has had no excavations. It is hoped that some increased protection for these resources can be provided.

Acknowledgements

The archaeological field research focused on the CC-2 site, Cotton Cay, Turks and Caicos Islands between 23 July and 13 August 2014. The research was conducted with the support and permission of Mrs. Helen Krieble, owner of Cotton Cay. Project support and logistics was provided by Drs. Donald Keith and Toni Carroll of Ships of Exploration and Discovery Research, Inc., Pat Saxton, Director of the

Turks and Caicos National Museum (TCNM) and Kathleen Wood and Bryan Naqqi Manco of the Turks and Caicos Department of Marine and Environmental Affairs (DEMA). Funding for the faunal analysis was provided by Mrs. Helen Kriebel, Mr. Glen Wright and the Anthropological Research Council.

Vertebrate faunal analysis (See Appendix A) was conducted by Dr. Carla Hadden, at The Georgia Museum of Natural History, with comparative collection access facilitated by Dr. Betsy Reitz.

The field crew consisted of experienced field archaeologist Glen Wright, and anthropology/archaeology graduate students Angel Vega, Roberto Munoz, Steve Jankiewicz and Aldo Foe. Glen Wright conducted tool analysis of *Strombus sp.* included below.

The teams' operational base camp was at the Brown House on Salt Cay and at the Pirates Hideaway owned by Candy Herwin who also served as logistics coordinator for the research team. The team commuted between Salt Cay and Cotton Cay via motor launch.

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Appendix A
Vertebrate Faunal Analysis

VERTEBRATE ZOOARCHAEOLOGICAL REMAINS FROM THE COTTON CAY 2 SITE,
COTTON CAY, TURKS AND CAICOS ISLANDS

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Abstract

This report presents the results of a zooarchaeological analysis of 21 archaeological contexts from Cotton Cay-2 recovered during the 2014 excavations supervised by Shaun Sullivan and Glen Freimith. A total of 2,342 vertebrate specimens weighing over 700 g were identified. At least 86 individuals are present in the vertebrate assemblage and these represent at least 27 mutually exclusive taxa. Bony fish individuals and biomass dominate the assemblage. The four most abundant fish families are groupers, grunts, wrasses, and parrotfishes. The distribution of fish sizes is skewed, with most individuals representing small (<1 kg) animals although a few very large (>5 kg) animals are present. Over 80% of the individuals in the assemblage are associated with coral reef habitats. The vertebrate assemblage from Cotton Cay-2 demonstrates that the Lucayan-phase occupants of the site made extensive use of marine environments, but particularly the front reef zone.

Introduction

Archaeological research in the Bahamas archipelago, which includes the Commonwealth of the Bahamas and the Turks and Caicos Islands (Figure 1), tends to focus on the timing of colonization, the origin of colonists, and the first sighting of the islands by Europeans (Newsom and Wing 2004:172). Three archaeological phases are generally recognized in the Turks and Caicos Islands: Ostionan (AD 700–1150), Meillacan (AD 1150–1300) and Lucayan (AD 1300–1520) (Sinelli 2010:195–198; Sullivan 1981). Recent research at the Cotton Cay 2 (CC-2) site, located on Cotton Cay, Turks and Caicos Islands (Figure 2), determined that it was a small, probably seasonally occupied site dating to the Lucayan phase (Sullivan and Freimuth 2015:12). This report presents the first zooarchaeological analysis of the vertebrate faunal remains from the CC-2 archaeological site.

Compared to neighboring islands of the Greater Antilles, the islands of the Bahamas archipelago are relatively depauperate in terrestrial vertebrate resources (Morgan 1989). Turks and Caicos Islands, within the southern Bahamian archipelago, are in the sub-humid to semi-arid provinces according to the Holdridge Life Zone system (Holdridge 1967) and typically receive between 330–750 mm of rainfall per year. No fresh water sources are known for Cotton Cay, although some surface fresh or potable brackish water sources presumably exist (Sullivan and Freimuth 2015:2). The availability of potable water surely had considerable implications for the human occupation of CC-2.

In contrast to the limited terrestrial resources, the Bahamian archipelago boasts some of the most diverse marine ecosystems in the world. Coral reefs ring the island of Cotton Cay. Reefs on the leeward side of the island are protected from strong winds, waves, and storms,

permitting a wider variety of corals to survive in the relatively shallow, calm water. Windward reefs are less diverse, containing branching corals that can endure higher wave energy (Woodroffe 2002). Reef systems are further subdivided into zones (Alevizon et al. 1985; Woodroffe 2002). Back reefs are the most shoreward zone and are generally shallow and protected lagoons. The reef crest is the high-energy boundary between the sheltered back reef and the seaward expanse of the reef. The front reef is the deepest and farthest from shore. These zones influence the structures of coral reef and fish communities (Alevizon et al. 1985).

This report presents the results of a zooarchaeological analysis of 21 archaeological contexts at CC-2 recovered from the 2014 excavations supervised by Sullivan and Freimuth (2015) and commissioned by the same. The goals of this report are to quantify the relative taxonomic abundances of vertebrate fauna, describe noteworthy or unusual fauna, quantify the size ranges of fishes recovered, and compare the relative contributions of various terrestrial and marine habitats to subsistence practices. This report is intentionally brief and descriptive in nature. Future publications related to the CC-2 zooarchaeological materials will explore these themes more deeply and focus on comparisons with other sites within the Bahamian archipelago.

Methods

Vertebrate faunal remains from 21 archaeological contexts recovered using 1/4-in. screen mesh. Faunal samples were identified using the comparative collection at the Georgia Museum of Natural History (GMNH) Zooarchaeology Laboratory, University of Georgia, Athens. All vertebrate specimens were identified to the lowest possible taxonomic level. The notation “*cf.*” denotes uncertainty in the taxonomic identification, due either to lack of modern comparative material or idiosyncrasies of the archaeological specimens themselves. Invertebrate specimens were identified only to phylum (Anthozoa and Mollusca) or order (Decapoda). Standard

zooarchaeological methods were followed in the identification and quantification of vertebrate fauna (Reitz and Wing 2008). Percent ubiquity was calculated for each taxonomic category identified in the study. Percent ubiquity is defined as the percent of archaeological contexts in which a particular taxon was identified. Several primary data classes were recorded during identification. The Number of Identified Specimens (NISP) was determined, with cross-mending specimens counted as one specimen. The symmetry and the portion of the element represented by each specimen were recorded, and age, sex, and modifications were noted when observed. All specimens were weighed to provide additional information about the relative abundance of the taxa identified.

Where preservation allowed, measurements were taken of selected specimens.

Measurements of mammal specimens followed the guidelines published by Driesch (1976). For fishes, the anterior centrum width of atlasses, and the greatest length, width, and thickness of fish otoliths were measured.

The Minimum Number of Individuals (MNI) is the smallest number of individuals that is necessary to account for all of the specimens of a particular species in an analytical unit (Shotwell 1955:330). MNI was estimated for vertebrate specimens based on symmetry, portion (non-repeating elements), size, and age. No attempt was made to estimate MNI for invertebrates. In most cases, vertebrate MNI was estimated for the lowest taxonomic level, i.e. species, rather than genus or family. Occasionally, more individuals were estimated if all specimens identified to a family or genus were considered together, rather than if specimens identified to a lower taxonomic level were considered separately. For example, more individuals were estimated if all materials identified as grunts (*Haemulon* spp.) were considered together, rather than estimating MNI only for lower taxonomic levels within that genus (e.g., *H. album*, *H. aurolineatum*, *H.*

bonariense, and *H. plumieri*). In these cases, MNI was estimated for both taxonomic levels and the larger estimate used in subsequent calculations. The lower MNI estimate was included in the species lists in parentheses for information only and was not included in the total for each list or in subsequent calculations.

Although MNI is a standard zooarchaeological quantification measure, it has several problems (Reitz and Wing 2008:205–210). MNI emphasizes small species over larger ones. For example, 10 grunts (a small fish) in a hypothetical assemblage documents considerable interest in this fish, although a single sea turtle (Cheloniidae) might supply more meat if the entire carcass was used. One possible solution would be to normalize MNI estimates as a function of the biomass of the live animal. To do so would assume that the entire carcass was used. From ethnographic evidence, it is known that this is not always true (Perkins and Daly 1968). This is particularly the case for larger individuals, animals used for special purposes, and where food exchange was an important economic activity (Thomas 1971; White 1953). In some cases only portions of a carcass were brought to a consumption site, in others the meat was redistributed, used more frequently by members of select social groups, used in rituals, or portions were valued as by-products regardless of the amount of meat adhering to the bone or shell.

Additionally, MNI is influenced by the manner in which data from archaeological proveniences are aggregated during analysis. The aggregation of separate proveniences into one analytical whole, the “minimum distinction” method, results in a conservative estimate of MNI (Grayson 1973). The “maximum distinction” method, used when analysis discerns discrete archaeological contexts, produces a much larger MNI estimate because all contexts are assumed to be independent observations. Increasing the number of analytical units generally increases the estimated number of individuals, whereas decreasing the number of analytical units generally

decreases the number of individuals estimated. To facilitate future comparisons with other sites in the region, MNI was estimated during this study following the minimum distinction method.

Estimates of biomass compensate for some of the problems encountered with MNI and provide information on the quantity of meat supplied by the animal (Reitz et al. 1987; Reitz and Wing 2008:238–242). Allometry was used to predict kilograms of meat represented by kilograms of bone for vertebrate specimens identified to class or lower taxonomic level. This is a conservative estimate of meat and other soft tissues obtained from the faunal materials actually recovered from the site. The term “biomass” is used to refer to the results of this calculation. Biomass reflects the probability that only certain portions of the animal were used at the site. This would be the case where preserved and/or redistributed meats were consumed or where only part of the carcass was discarded within the excavated area.

Biomass estimates were based on the allometric principle that the proportions of body mass, skeletal mass, and skeletal dimensions change with increasing body size. This scale effect results from a need to compensate for weakness in the basic structural materials, in this case bone. A given specimen weight represents a predictable amount of tissue following an allometric relationship. The relationship between body weight and skeletal weight is described by the allometric equation:

$$Y = aX^b$$

(Simpson et al. 1960:397). This same relationship holds true for linear dimensions (e.g., atlas width) and body size. In this equation, X is the skeletal weight or a linear dimension of the specimen, Y is the estimate of biomass or body size, b is the constant of allometry (the slope of the line), and a is the Y -intercept for a log-log plot using the method of least squares linear regression and the best fit line (Reitz and Wing 2008:238–242). Values for a and b were

calculated from data obtained from modern comparative specimens at the Florida Museum of Natural History and GMNH (Reitz and Wing 2008:68) and are presented in Table 1.

Vertebrate MNI and biomass estimates were summarized into categories defined by taxonomic groups in order to contrast the percentages of groups of taxa in the assemblage. These categories were: Cartilaginous fishes, Bony fishes, Turtles, Lizards, Birds, and Mammals. The term “fishes” is used throughout this report to refer to both cartilaginous (Chondrichthyes) and bony or ray-finned (Actinopterygii) fishes. Only biomass for those taxa for which MNI was estimated was included in this summary.

The richness, diversity, and equitability of the vertebrate assemblage were used to assess the degree of specialization of resource use (Reitz and Wing 2008:245-247). Richness is defined as the number of taxa for which MNI is estimated. The Shannon-Weaver index (H') is a measure of the diversity of species present in terms of richness and evenness. More precisely, it measures entropy. Equitability (V') measures the degree of dependence on the used resources and the effective variety of species used at the site based on the even, or uneven, use of individual species. These indices allow discussion of food habits in terms of the variety of animals used at the site and the evenness with which species were used.

H' was developed as a mathematical theory of communication and is commonly referred to as the Shannon-Weaver index in zooarchaeological literature (after Shannon and Weaver 1949, in Reitz and Wing 2008:111), and Shannon’s entropy in paleontological literature (after Shannon 1948). Both refer to the same formula (Shannon 1948:14; Shannon and Weaver 1949:61,63):

$$H' = - \sum p_i \log p_i$$

where p_i is the number of i th species divided by the sample size (Shannon 1948; Shannon and Weaver 1949). Diversity can be estimated using the logarithm of p_i to the base 2, e , or 10. Base e was used throughout this study.

To estimate equitability, the Sheldon Index was used (Sheldon 1969). Equitability was calculated using the formula:

$$V' = \frac{H'}{\ln S}$$

where H' is diversity as calculated above, and $\ln S$ is the natural logarithm (\log_e) of the number of observed species (Sheldon 1969).

Diversity and equitability are closely related. Diversity (H') is influenced both by the number of species used and how much each was used, because p_i are proportions related to the evenness of resource use. Diversity increases as both the number of species and the equitability of species use increases. A diversity index (H') of 5 is a high value. A collection with many species identified and in which the number of individuals slowly declines from most abundant to least abundant will be high in diversity. Diversity can be increased by adding a new taxon to the list, but if another individual of an already present taxon is added, diversity is decreased. A low diversity can be obtained either by having few species or by having a low equitability, where one species is considerably more abundant than others. A low equitability value indicates that one species was more heavily used than other species in the collection. A high equitability index, approaching 1, indicates an even distribution of species in the collection.

Vertebrate diversity and equitability were estimated for both MNI and biomass. In the case of MNI, estimates of individuals were taken directly from the species lists. Biomass represents a different problem because biomass was estimated for more taxa than was MNI. For purposes of comparison, only those biomass estimates for taxa for which MNI was estimated

were used in the biomass diversity and equitability estimates. For example, in calculating biomass diversity and equitability, biomass for the genus *Haemulon* was used rather than biomass for the species-level identifications (e.g., *H. album*, *H. aurolineatum*, *H. bonariense*, and *H. plumieri*) because MNI was estimated at the higher taxonomic level. In contrast, the biomass estimates for genus- and species-level identifications of the wrasses (Labridae) family were used, because in that case MNI estimates were based on the lower taxonomic level. This ensures that when comparing MNI and biomass results, data from the same taxa were used in both cases and that MNI diversity and biomass diversity can be directly compared.

Analyses of fish body sizes in archaeological collections relate to fishing technologies and foraging efficiency. Standards measurements of skeletal elements are important in assessing the size range of animals represented in an archaeological assemblage. Most important in this study were measurements of the anterior width of fish atlases, which were used to estimate the masses of individual fish (Table 1). Members of each family were combined in this analysis because the objective was to assess the broader role of large- and small-bodied fishes in the fishing strategy. Fish size is assumed to be related to fishing gear, which takes advantage of the habits and habitats of specific size/age cohorts.

Specimen count, MNI, biomass, and other derived measures are subject to several common biases (Grayson 1979, 1981; Reitz and Wing 2008). In general, samples of at least 200 individuals or 1400 specimens are needed for reliable interpretations. Smaller samples frequently generate short species lists with undue emphasis on one species in relation to others. It is not possible to determine the nature or the extent of the bias, or correct for it, until the sample is made larger through additional work.

Results

A total of 2,342 vertebrate specimens weighing over 700 g were identified. At least 86 individuals are present in the vertebrate assemblage, representing at least 27 mutually exclusive taxa. The assemblage is moderately diverse ($H'_{\text{MNI}} = 2.43$; $H'_{\text{BIOMASS}} = 2.36$), with high evenness of resource use ($V'_{\text{MNI}} = 0.74$; $V'_{\text{BIOMASS}} = 0.73$).

Taxonomic abundances are presented in Tables 2 through 5 of this report. Table 2 is a record of the specimen weights for each taxon by archaeological context (i.e., bag), as well as a measure of the ubiquity of each taxonomic classification across archaeological contexts. The most ubiquitous taxonomic categories were Actinopterygii (applied in 91% of archaeological contexts), Mollusca (71% of contexts), and Decapoda (67%). These higher taxonomic classifications are “catch-all” categories used when lower-level identifications are not possible. Other, more specific, taxonomic categories, however, were also highly ubiquitous: *Haemulon* spp., Labridae, and Scaridae appeared in at least half of the contexts studied.

A complete species list for the entire studied assemblage is presented in Table 3. This includes estimates of the MNI for each taxon using the minimum distinction method. At least 86 individual vertebrate animals are represented, although it should be noted that these conservative numbers almost certainly under-estimate the true number of individuals represented by the faunal assemblage. The most abundant taxa in terms of MNI were grunts (*Haemulon* spp.) and parrotfishes (*Sparisoma* spp.). Of those taxa, grunts (*Haemulon* spp.) and groupers (*Epinephalus* spp.) are represented by the largest NISP. Finally, the taxonomic categories which contributed the greatest biomass were groupers (*Epinephalus* spp.) and hogfish (*Lachnolaimus maximus*). Thus, multiple measures of taxonomic abundance are considered together in order to mitigate the biases of any individual measure.

At least two mammal species were identified in the assemblage, but positive identifications beyond Mammalia were not possible. Few mammals are endemic to the Bahamian archipelago. These include hutia (*Geocapromys ingrahami*), a large rodent, as well as at least five families of bats (Chiroptera). Marine mammals include the West Indian manatee (*Trichechus manatus*), five families of whales (Cetacea), and two species of earless seals (Phocidae). A small mammal is represented by a cervical vertebra (GMNH# 2780168, Bag# 337), probably a large bat or a non-endemic medium-sized rodent. Hutias and *Nesophontes*, a genus of extinct insectivores, both were ruled out because of differences in size range, the former being too large and the latter being too small to account for the archaeological specimen. *Solenodon*, an extant insectivore endemic to other Caribbean islands, is in the correct size range, but was ruled out because the specimen did not compare favorably with an illustration of a *Solenodon* cervical vertebra (McDowell 1958:Figure 27). The large mammal specimen (GMNH# 2780222, Bag# 327) is possibly a rib fragment from a large mammal. Bottlenose dolphin (*Tursiops truncatus*) and manatee were ruled out based on comparison to modern specimens. The specimen possibly represents another species of whale, or possibly a seal.

Overall, bony fishes MNI and biomass dominated the studied assemblage (Table 4). The four most abundant fish families were groupers, grunts, wrasses, and parrotfishes, although the rank order of these families is different for MNI and biomass (Table 5). Individual fishes varied in body size, ranging from small to very large (Table 6). The distribution of fish sizes was skewed, with most individuals representing small (<1 kg) animals although a few very large (>5 kg) animals were present (Figure 3).

The vertebrate assemblage demonstrates an emphasis on marine environments over terrestrial ones, but especially on coral reef environments (Table 7). Over 80% of the individuals

in the assemblage are associated with coral reef habitats, documenting a particular interest in this habitat. The few shore animals, all birds, could reflect either intentional use and discard by humans or incidental inclusion not necessarily related to human activity. Notable for their absence are large terrestrial reptiles such as rock iguanas (*Cyclura* spp.) and tortoise (*Geochelone* spp.).

Discussion

Previous zooarchaeological research at coastal sites in the Bahamian archipelago found several broad patterns: (1) the presence of a distinctive terrestrial fauna which include an extinct species of land tortoise (*Geochelone* sp.), as well as hutias, and rock iguanas; (2) an emphasis on marine resources, especially fishes and molluscs, over terrestrial ones; (3) an emphasis on small fishes over large ones, with fishes larger than 4 kg being generally absent from archaeological collections; and (4) sustained exploitation resulted in profound changes to ecosystem structure and function (e.g., Blick 2012; Carlson 1999; Newsom and Wing 2004; O'Day 2002). The results from the CC-2 study contribute to our understanding of some, but not all, of these themes.

One of the most significant findings of this study is the absence of a suite of terrestrial fauna that is present, albeit in variable numbers, in other Bahamian assemblages. The faunal assemblage from the Coralie site (GT-3), one of the earliest sites known for the archipelago, documented the presence of a an extinct land tortoise, as well as an abundance of rock iguanas (*Cyclura* spp.) (Carlson 1999). Additionally, hutias were reported in small numbers at some Bahamian sites, including Middle Caicos (MC-6) and Crooked Island (CK-14) (Newsom and Wing 2004:Appendix D). Significantly, none of these terrestrial vertebrates were identified in the CC-2 collection reported here.

The absence of animals in zooarchaeological collections always must be interpreted with caution. The absence of animals present, though not abundant, in other Bahamian assemblages suggests that cultural prerogatives such as taboos probably did not strictly prohibit the use of these animals on Cotton Cay. Another interpretation is that CC-2 had a specific function within the subsistence-settlement system; that function involved a focus on marine resources to the exclusion of terrestrial ones. Alternatively, terrestrial resources may have been used at CC-2, but collected, processed, and/or discarded elsewhere on the island or even at the same site, but outside the boundaries of the excavated area. Finally, the absence of these animals in the zooarchaeological assemblage may simply reflect their absence on the island, which has few freshwater sources.

As at other Bahamian sites, animal exploitation focused on marine environments at CC-2 (Table 7). However, there is considerable variety among sites in terms of the types of marine habitats exploited. Either reef fishes or shallow inshore and estuarine fishes predominate in faunal samples from Middle Caicos (Newsom and Wing 2004:180; O'Day 2002). At CC-2, there is a clear emphasis on reef fishes over inshore estuarine and seagrass fauna (Table 7). More specifically, the four most abundant fish taxa in the CC-2 assemblage--groupers, grunts, wrasses, and parrotfishes--are more abundant in front reef habitats compared to the reef crest or back reef zones (Alevizon et al. 1985:Table 1). This suggests that the occupants of CC-2 focused on reef habitats, especially on the seaward or front reef zone. None of the taxa identified are strictly offshore, pelagic fishes, nor are fishes common in shallow coastal waters and seagrass beds, such as bonefishes (*Albula vulpes*) and mojarras (Gerreidae). Although this might reflect the absence of these habitats or intentional avoidance if present, another possibility is that recovery techniques may have biased the collection against these and other small-bodied fishes.

A third theme in Bahamian zooarchaeology is the predominance of small-bodied fishes over larger ones. Although the use of 1/4-in. screen may have biased the collection towards large-bodied animals, small-bodied fishes were nonetheless clearly the focus of fishing activities by the occupants of CC-2 (Figure 3). However, large fishes (>4 kg) were not absent in the CC-2 assemblage as they were in collections from other Bahamian sites (e.g., Carlson 1999:75). Despite the relatively small size of the collection and overall emphasis on small-bodied grunts (Table 6), large groupers over 5 kg in weight were present (Figure 3). More subjectively, specimens from large fishes were observed in the collection, though these specimens could not be measured because none of the specimens were either atlas or otoliths. All of the specimens identified as barracuda (*Sphyraena* spp.) were from large individuals, for example. Future research involving the CC-2 zooarchaeological data might focus on a quantifying the relative abundances of small- and large-bodied fishes, indirect evidence of fishing gear and habitats exploited, but also useful in models of marine foraging efficiency.

A final theme in Caribbean zooarchaeology is change through time in marine ecosystems and economies. These studies focus on changes in the relative abundances of resources, the sizes of animals used, and systemic changes in the structure or function of marine food webs (e.g., Blick 2012; Carder et al. 2007; Carlson 1999; Wing and Wing 2001). No attempt was made to interpret the CC-2 zooarchaeological data from a diachronic/stratigraphic perspective because of both a lack of time depth at the site as well as the relatively small sample. However, the CC-2 data will undoubtedly prove valuable as a contribution to a synthesis of the development of coastal subsistence and settlement systems in the Caribbean in general and in the Bahamian archipelago in particular. Notably, the probably seasonal use of the CC-2 site during the Lucayan

phase may represent an adaptation to changes in human population pressures as well as the availability and distribution of resources.

Conclusions

The vertebrate assemblage from CC-2 demonstrates that the Lucayan-phase occupants of the site made extensive use of marine environments, but particularly the front reef zone, as evidenced by the groupers, grunts, wrasses, and parrotfishes that dominate the faunal assemblage. A broad pattern observed in Bahamian zooarchaeology is an emphasis on small-bodied fishes over large ones. While this pattern generally holds true at CC-2 as well, the mere presence of a few very large animals is notable and merits further research. Understanding the impacts of small-scale or “traditional” subsistence fisheries on marine and terrestrial ecosystems, and particularly the issue of resource overexploitation, is a major theme in fisheries management today. Future research should explore the function of CC-2 in the broader, regional subsistence/settlement system, as well as in the context of changes to marine ecosystems.

Acknowledgements

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Appendix B
Radiocarbon Dates for CC-2



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REPORT OF RADIOCARBON DATING ANALYSES

Dr. Shaun Sullivan

Report Date: 9/3/2014

Material Received: 8/27/2014

Sample Data	Measured Radiocarbon Age	¹³ C/ ¹² C Ratio	Conventional Radiocarbon Age(*)
Beta - 388684 SAMPLE : 325 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1405 to 1445 (Cal BP 545 to 505)	530 +/- 30 BP	-26.6 o/oo	500 +/- 30 BP

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the ¹⁴C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby ¹⁴C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured ¹³C/¹²C ratios (delta ¹³C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta ¹³C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta ¹³C, the ratio and the Conventional Radiocarbon Age will be followed by ***. The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.7 ‰ : lab. mult = 1)

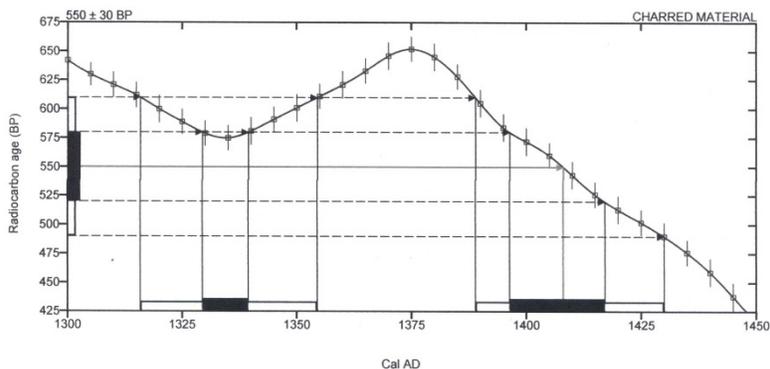
Laboratory number **Beta-388683**

Conventional radiocarbon age **550 ± 30 BP**

2 Sigma calibrated result **Cal AD 1315 to 1355 (Cal BP 635 to 595)**
95% probability **Cal AD 1390 to 1430 (Cal BP 560 to 520)**

Intercept of radiocarbon age with calibration curve **Cal AD 1410 (Cal BP 540)**

1 Sigma calibrated results **Cal AD 1330 to 1340 (Cal BP 620 to 610)**
68% probability **Cal AD 1395 to 1415 (Cal BP 555 to 535)**



Database used
 INTCAL13

References

- Mathematics used for calibration scenario**
 A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
- References to INTCAL13 database**
 Reimer P.J et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887.

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. Shaun Sullivan

Report Date: 9/3/2014

Material Received: 8/27/2014

Sample Data	Measured Radiocarbon Age	¹³ C/ ¹² C Ratio	Conventional Radiocarbon Age(*)
Beta - 388684 SAMPLE : 325 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1405 to 1445 (Cal BP 545 to 505)	530 +/- 30 BP	-26.6 o/oo	500 +/- 30 BP

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the ¹⁴C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby ¹⁴C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured ¹³C/¹²C ratios (delta ¹³C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta ¹³C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta ¹³C, the ratio and the Conventional Radiocarbon Age will be followed by ***. The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -26.6 ‰ : lab. mult = 1)

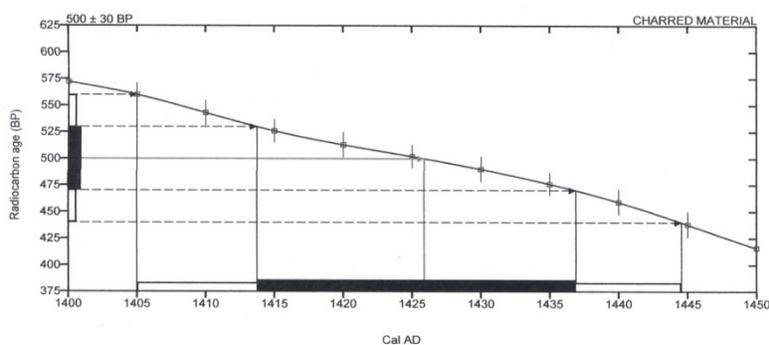
Laboratory number **Beta-388684**

Conventional radiocarbon age **500 ± 30 BP**

2 Sigma calibrated result **Cal AD 1405 to 1445 (Cal BP 545 to 505)**
95% probability

Intercept of radiocarbon age with calibration curve **Cal AD 1425 (Cal BP 525)**

1 Sigma calibrated results **Cal AD 1415 to 1435 (Cal BP 535 to 515)**
68% probability



Database used
INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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