RESULTS OF THE 1998 FIELD SEASON OF THE VALLEY OF PEACE ARCHAEOLOGICAL (VOPA) PROJECT

Report submitted to the Department of Archaeology, Ministry of Tourism
Government of Belize

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1998 Expenditures in Belize

	$(BZ)
Total room and board (five project members)	4650.00
Labor (Zedikiah Scott and Cleofo Choc, Valley of Peace)	
(including social security)	916.13
Vehicle costs:	
insurance	132.00
fuel	1100.00
misc. (e.g., oil change)	35.00
Supplies (maps, phone card, xeroxing, etc.)	150.00
Email costs	60.00
Total	*7043.00*
Adminstration and Consolidation fees	1530.00
Grand total	**8573.13**

Chapter 1

Politics and Ritual in the Valley of Peace Area, Belize: Results of the 1998 Season

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Introduction

The long-term goals of the Valley of Peace Archaeological (VOPA) project include elucidating how Classic Maya political leaders arose and maintained political power. It is only now that Maya archaeologists are realizing the amazing local variability found throughout the Maya area, not so much in terms of the material record, but in terms of the type of available resources. As a consequence, it is becoming impossible to apply broad or general models when attempting to understand ancient Maya sociopolitical organization. At first glance, due to the pan-lowland interaction sphere mostly involving elites, prehistoric Maya society appears to be more or less homogeneous, from the stone tool forms used to the established temple format. However, when any attempt was made to extrapolate models devised in particular regions, it was found that they did not necessarily apply. The recent advances in paleo-environmental and paleo-pedological studies are now beginning to answer why this was the case; local ecological variation is immense, which in turn affected how prehistoric Maya subsisted and organized themselves (Dunning 1995; Dunning et al. 1998). A vital issue to keep in mind, however, is that the processes of human interactions are not so varied; for example, anthropological political theorists (e.g., Earle 1997) are now calling for anthropologists to focus on how various sources of power (economy, military, and ideology) articulate. In light of the current advances in Maya archaeology combined with focusing on how varying sources of power articulated in Maya prehistory are key to understand this system, both locally and at a broader level.

The first phase (June 1 through July 5, 1997) of the VOPA project consisted of conducting the necessary preliminary investigations through mapping prehistoric Maya settlement as well as establishing an initial chronology. Accomplishing these goals provided the basis for the second season, which is described in detail below. The mapping strategy used in 1997 took into account differences in soil fertility, drainage, workability, and root depth, features that present day Maya farmers take into consideration, and ones we can assume the ancient Maya did as well. This being the case, in order to assess the regional settlement, we surveyed areas where conditions were considered to be prime agricultural areas. However, we also surveyed areas with less desirable conditions to make sure less or no settlement were found in areas hypothesized to be agriculturally poor areas.

1998 Season

Staff

The 1998 staff consisted of the PI, Lisa Lucero, assistant professor of anthropology, New Mexico State University, California State-Northridge graduate student Andrew Kinkella, George Washington University graduate student Jason Shields, New Mexico State University undergraduate Anna Osterholtz, New Mexico State University emeritus professor of electrical engineering, Lonnie Ludeman, and employees Zedikiah Scott and Cleofo Choc of the Valley of Peace village. Kinkella and Osterholtz conducted underwater exploration at Cara Blanca. Shields conducted ceramic analysis in our field lab at Banana Bank using the chronological sequence devised by Gifford et al. (1976). Ludeman was responsible for mapping data. All of us participated in excavation, the clean-up of looters trenches, and mapping.

Funding

Funding for 1998 was provided by a NMSU International Program grant and private donations by Mr. David Brennan and Mr. Robert Vitolo.

Background

The research area (c. 200 sq. km; Figure 1) is located in central Belize in the more hilly areas (40-120m asl) north of the Belize River. It is considered both geographically and socio-politically part of the eastern periphery of the central Maya lowlands. The area falls within the drier subtype of the humid tropics. Vegetation is classified as Quasi-Rain forest, predominantly consisting of deciduous broadleaf forests with lime-adapted species and intermittent stands of high marsh forests (Lundell 1942; see Fedick 1988 for detailed soil and vegetation descriptions). As with much of the eastern lowlands, the study area lies on a limestone platform (Fedick 1988:76; West 1964).

Previous Research

Until the first season of the VOPA project (1997), the only archaeological research carried out in the proposed research area had been a salvage operation conducted in 1982 at the founding of the Valley of Peace village by El Salvadoran refugees (see Awe 1984; Awe and Topsey 1984; Morris 1984). The major goal of the first season (June 1-July 10) of the VOPA project consisted of testing a soil classification system devised by Dr. Scott Fedick (UC-Riverside) based on agricultural potential (Class "I" being the best, Class "V" the worst; Fedick 1995, 1996). Preliminary analysis of the collected surface ceramics from the VOPA area indicate at least Middle Preclassic (c. 900 B.C.) to Late Classic occupation (c. 850 A.D.) (Osterholtz n.d.). We surveyed areas in each of the five soil classes and found that high settlement densities were associated with fertile agricultural land, while less fertile land had less or no settlement (Lucero 1997; Lucero and Fedick 1998). However, this strategy also highlighted the fact that factors other than economic and environmental ones need to be taken into account when attempting to evaluate regional settlement patterns and concomitant socio-political implications, especially at Cara Blanca (e.g., ritual or sacred factors). The Cara Blanca area (c. 18 sq. km.; see

Figure 1) has the worst type of agricultural soils, Class V, but has settlement around a series of pools (over 20) at the base of a steep limestone ridge (c. 80 m). This soil type has been defined as unsuitable for farming unless major reclamation and conservation techniques are used (Fedick 1996). For example, in the Belize River Archaeological Settlement Survey (BRASS) area, no settlement was recorded on Class V soils. The selection of site location, therefore, was based on grounds other than ecological ones (cf. Ashmore 1992). Significantly, the Cara Blanca area has features that are key in illuminating the earliest evidence for Maya ritual activities, caves and pools.

1998 Goals

The major goals of the 1998 field season (May 23-July 7) were four, three of which focused in the Cara Blanca area: 1) survey for pools, caves and nearby settlement; 2) test excavate a presumed ceremonial structure at the edge of a pool; 3) explore a pool for offerings; and 4) map the river center of Saturday Creek (see Figure 1). Below, I describe how each of the goals were implemented, as well as preliminary results.

Cara Blanca

Cara Blanca is an area (UTM 1927N) consisting of a number of pools (22) found at the base of a steep cliff running east-west (c. 80-100 meters high). Our goals consisted of locating as many pools as possible, as well as to survey for additional settlement. This was challenging because of the 'road'condition, which even in the dry season was very difficult to drive. In addition, the trail ended at Labouring Creek, where an old and collapsing bridge provided our only means of crossing the creek. Since we could not drive across, all survey at this point involved walking.

Of the 22 pools noted on the 1992 No. 19 UTM map, Zone 16, we located six. Although the vegetation was relatively dense (including bamboo swamp), we feel confident that our survey did not miss locating any settlement. The only pool with mounds nearby is Pool 1, which has a total of seven mounds either at its edges, or quite close. Most of our efforts were at Cara Blanca Pool 1, where we cleaned looters' trenches and tested one of the mounds (see Kinkella, this volume). The 1974 version of the UTM No. 19 map differentiated the types of pools found at Cara Blanca between swamps/hallows (lakes?) and springs/wells. Of the located pools (1-6), numbers 1, 2, 3, and 5 have been distinguished as springs/wells. Six others of the entire series of pools (22 total) have also been defined as springs/wells. The source of springs/wells consist of an apparent subsurface cave and river system. While no caves were located during the 1998 season, we did note what might turn out to be cave openings on the steep cliff faces of Pools 1 and 2. Further exploration would require experienced cavers.

Openings in the earth, especially pools and caves, were and are considered by the Maya as portals to the underworld or Xibalba (Bassie-Sweet 1996; Schele and Freidel 1990; Schele and Miller 1986; Thompson 1970). Consequently, they often have offerings (e.g., Andrews and Corletta 1995; McNatt 1996; Borhegyi 1959). Caves also have some of the earliest evidence for ritual activities (e.g., Brady 1995) and because they are often located in hilly areas, they are associated with sacred ancestral hills and mountains.

Pool 1

Pool 1 was originally located during the 1997 field season (UTM 1927N, 301E) (Figure 2). The pool measures c. 100 meters in length (east-west) and about 61 meters wide (north-south). Indications that we were coming close to the pool were the presence of a number of shallow aguadas likely representing drainage systems of some type. The drainage stream on the southeast portion of the pool is flowing much more noticeably this year than last year; there have already been a few major rainstorms this year, which seem to make a difference. Regarding the presence of caves, we were not able to explore the possible caves noted on the north cliff faces (this would have required us to climb down the steep cliff 40-50 meters) because dense vegetation makes it difficult to assess at present. However, there does appear to be at least one cave, as indicated by a large black area visible through the vegetation. This awaits further exploration; there are valleys that provide possible conduits to the tops of the ridges, from which we could explore below. The only accessible means of getting to the top is through using an alternative route, a private and gated road owned by Yalbac Cattle and Ranch Corporation. A total of seven structures were noted and mapped, some of which are described below. We also explored north and east of Pool 1, all the way to the top of the ridge; no further structures were noted.

Evidence of looting was noted at the largest of the seven structures noted, Structure 1 (22 x 10 m, height=3.25 m; see Figure 2). LT 2, on the east side of Structure 1, faces the pool; as a matter of fact, almost a fourth of this structure appears to have eroded into the pool. We cleaned up, profiled, and photographed LT 1, Structure 1.

We also put in a 1x1 meter unit (Test Pit 1) on top of Structure 1, between LT 1 and LT 2 (see Kinkella, this volume). Structure 1 appears to be a range structure, with at least 4 pillar-like walls that run the length of the building. It looks like test pit 1 happened to hit right at a juncture of one of the pillar-like walls and wall abutting perpendicular. The two looters trenches and the test pit have exposed what might appear to be two rows of rooms, perhaps each with corbel arches. It is difficult to say at present and will require further excavation.

Structure 2 (9 x 11 m, height=1.7 m) has one looters trench. There is also a platform that connects the mounds. We started to clean up the looters trench at Structure 2, which was too large to finish in the limited amount of time we had; it reminds me of a Gann hole. From what we did clean, it appears that Structure 2 consists of at least two construction phases.

We also mapped five other structures (see Figure 2). Structure 3 (height=.75 m) faces Structures 1 and 2; all three are located on a platform and clearly were part of a plazuela group of some type. It is difficult at present to propose a possible function for this group; did it serve a residential function? Or did it serve a specialized ceremonial function? Or both? Structure 4 (height=1.65 m) is also located near the edge of Pool 1, but is not associated with any other obvious cultural feature. The remaining structures, 5 (height=.8 m), 6 (height=1.9 m), and 7 (height=1.33 m) are located some distance from the pool and may have comprised a plazuela group. Since we did not collect any artifacts from Structures 4-7, it is not possible at present to discuss their possible functions.

Pool 1 Underwater Explorations

In order to measure pool depths at various points, Kinkella used a large plumb bob tied to the end of a 50 meter nylon tape. For the following depths, the orientations below were taken from the top of Structure 1, at the top of LT 2:

1. 48°, about 20 meters from Structure 1 edge, depth=17.4 meters
2. 80°, about 75 meters from Structure 1 edge, on top of fallen mahogany tree, depth=26.9 meters
3. 73°, about at center of pool (50 m), depth=39.3 meters

In the process of measuring pool depths, Kinkella noted lots of little fish that nibble, and larger ones found at the edges presumable where the food is to be found.

We were unable to explore the pool bottom since it is too deep (c. 40 meters) for regular scuba diving. Below is a summary of results (see Osterholtz, this volume, for a detailed discussion).

First Dive: The diving platform is located on the southern edge in one of the few areas where a slope exists. John Carr cut a 18-meter rope, knotted every 3 meters, with a rock at the end which they tied around an inner tube to act as a guide underwater. In addition, two 14-meter lines were attached to the longer rope from which Kinkella and Osterholtz could hold on and still explore. The first dive lasted 20 minutes.

Immediately upon coming out of the pool, Kinkella dictated some general information: there were no currents, they dove about 60 ft., visibility was relatively poor (c. 10 ft. at bottom, 20 ft. higher on up), there appears to be a white silt at the bottom, which kicks up quite easily, resulting in cloudy water, almost an orangey color. They did not need as much weight as they typically do for sea diving (freshwater versus salt water). They got pretty cold the deeper they went; temperature was estimated to be 80°F at top, and 70°F at the bottom of diving depth.

There appears to be a white trail leading from LT 2, Structure 1, likely representing the looter's backfill. They collected two sherds from this area; everything else was covered in algae. The slope on the western edge where Structure 1 is located is very steep and oriented c. 300°. The shelf appears to be a smooth slope, and gets steeper closer to shore. They also noted small fish near the surface.

Second Dive: Kinkella and Osterholtz switched tanks since Kinkella used more air during the first dive. They started at the dive platform, headed west then north toward the cliff, where they became a little disoriented with all the trees and roots. They collected some flakes and few rocks (the latter I did not collect). Their second dive lasted 25 minutes.

Other Pools at Cara Blanca (2-6)

From the log bridge at Labouring Creek (called the Blue Nile by some locals), Pool 2 is located just over 1 km to the west using a north-westerly hunter's trail (UTM 1926.6N/300.1E). It is directly west of Pool 1 about 1 km at the base of the ridge (see

Figure 1). Indications that we were coming up to the pools were shallow aguadas with waterlilies immediately to the east of the pools, which likely represent drainage. Cara Blanca or 'white face,' an aptly named steep cliff, is so steep that it cannot support vegetation (estimated at about 80-100 meters in height). Only about a third of the face was completely clean; the other two-thirds did have some vegetation. Through the vegetation we saw perhaps one, if not two possible caves, large ones if they do turn out to be caves. This will require further exploration, namely, climbing down from the ridge tops with ropes.

We noted a crocodile and its nest on the southeast side of the pool--at the same edge with waterlilies. The presence of waterlilies denotes shallow still-bodied water at the edges. It was not possible to reach the northwest side of the pool, not because of the dense bamboo and bajo conditions, but because of two creeks on its southwest edge; interestingly, the more northerly creek enters the pool (easterly), and the more southerly one exits it (westerly). Are the underwater currents causing this change in course? An employee (Antonio Martinez) of local landowner John Carr has informed us that he has skin-dived the pool to fish and has noticed a large cave underwater below the white face--perhaps representing an underwater/cave river. UTM sheet 19 does not show what I think to be Pool 2 as having two creeks converging at it; what it does depict, however, is an area about .5 km west of Pool 1 where two streams do converge.

Less than 10 minutes east from Pool 1 is Pool 3 (UTM 1926.9N/301.3E), which is a very clear teal blue pool with good visibility, a steep drop-off, and a few waterlilies. It is roughly oriented 320° on its longer side; it might be about the same size as Pool 1. We saw lots of fish. About 10 minutes east of Pool 3, following the base of the ridge, we came upon Pool 4 (UTM 1926.9N/301.6E), larger then 1, and more circular in shape. At a little more that 10 minutes distant from Pool 4 is Pool 5 (UTM 1926.8N/301.8E), about as large and circular as 4--might even be larger. All the pools are connected by black, swampy clays which John Carr has informed us completely floods during the rainy season. Also, all pools have drainage creeks on their southern edges. Outside of Pool 1, we have not noted any obvious settlement. Most of our trip consisted of using hunting trails (as we did finding Pools 1 and 2).

We received permission to use the Yalbac Cattle and Ranch Corporation road from their citrus farm to Yalbac camp (25 miles), an east-west road that basically runs along on top of the escarpment. Based on what was depicted on the UTM map, we located the logging road that splits off south above the lake just east of Pool 5. John Carr and I drove down the road a little ways and walked the remaining way down until we came upon a trail that veered down a pretty steep slope. From here, it only took us less than a minute to reach Pool 6 (UTM 1926.8/302.7E). Like the other five pools, the water was blue-green. Also, like the other pools, it had on its north edge a very steep drop-off into the water. I only saw a few waterlilies on the edge. However, something very different about this pool was its southern edge, which was much more lake-like or low-lying with cat-tails and/or long grasses (we were viewing this from the other side of the pool). It does appear to be the largest pool yet, as shown on the map. It also appears to be located at the edge of the ridge system (indicated by the ease at which we were able to reach it).

In conclusion, it is clear that Cara Blanca is a very unique area. There is plenty of water (streams and pools). Limitations consist of small amounts of good agricultural land, steep cliffs, and swampy/clayey areas between pools. Interestingly, while the structures at

Pool 1 are located on the worst soil type, Class V, the soils along the north side of Labouring Creek are some of the best agricultural soils (Class II). It is surprising that we did not note further settlement. Obviously, there were specific reasons the ancient Maya did not densely settle this area. Could Cara Blanca have been a sacred area, perhaps for inhabitants around Yalbac or Saturday Creek? Future field seasons should address some of these questions.

Saturday Creek

Saturday Creek is a river settlement system very similar to Barton Ramie (Willey et al. 1965), that is, it consists of dense hierarchical settlement along the north side of the Belize River (UTM 1916N/312E) with numerous architectural types from temples (c. 13 m high) and large plazuela groups to small single mounds (Figure 3). Like other valley centers, there appears to be areas without settlement (no man's land) around Saturday Creek. Saturday Creek is located on the best soil type for agriculture, Class I soils, mostly Young Girl series of the Melinda Suite, with a small amount of Garbutt (Class Vb, which has limited use as farming land due to annual flooding) and Listowel Series (Class I) (Fedick 1996). It has over 100 structures on the north side of the river, 75 of which we were able to map using an optical transit and stadia rod with dirt roads and the river serving as boundaries (c. 1.35 x .6 km). We were unable to explore the south side of the river. As Figure 3 indicates, there was a low-lying inundated area in the southeast section of the defined (mapped) site (Garbutt series). It was impossible to wade through the deep soggy clay. Visual survey, however, did not seem to indicate the presence of any obvious cultural remains. Since this settlement area is obviously so extensive, we decided to use the numerous dirt roads as boundaries. Most of the site is located in a mechanically plowed (completely cleared) field; however, a large portion of it (c. 350 x 300 m), the center core and surrounding settlement, has been protected (not plowed) by the landowner and shows little evidence for looting in the numerous structures located in the bush.

Analysis conducted by Jason Shields on surface ceramics collected from throughout Saturday Creek demonstrates at least Middle Preclassic through Postclassic occupation (c. 900 B.C. - A.D. 1400), a pattern comparable to settlement throughout the Belize river area (e.g., Ford 1985; Hammond 1981) (e.g., Figure 4). Single mounds comprise the most common prehistoric Maya structure types and likely represent thatched domestic structures (e.g., Ford 1991; Lucero 1994, n.d.; Sheets 1992). There are 52 single mounds (out of the total 75), most of which presumably served as residences. Of the 52, 33 (44% of the 75) were less than one meter high. Extensive excavations conducted elsewhere in the Belize Valley have demonstrated that the height of single mounds often relates to chronological depth. For example, the Belize River Archaeological Settlement Survey (BRASS) project exposed a series of 20 thin plaster floors, most superimposed, from a single mound two meters in height covering a 1500 year time period (Lucero 1994:108-131, 306-309). In contrast, a valley mound barely perceptible on the surface, when excavated, revealed a single component -- similar to one of the construction phases of the two-meter high mound. It should be pointed out that the seasonal plowing may have decreased the height of many, if not most, of the mounds. Surface artifacts such as daub

(Figure 5), grinding stone fragments, plain and decorated bowls, jars, chert tools, and obsidian cutting blades, indicate a probable domestic function (cf. Lucero 1994, n.d.).

An elite compound typically consists of four or five structures facing a plaza which likely housed a local elite family (Ashmore 1981). The four plazuela groups (A-D; see Figure 3) are each comprised of four to five mounds for a total of 22 mounds (29% of the 75). Artifacts noted from the surface include ceramic figurine fragments, decorated vase sherds, and an obsidian core; these types of artifacts obviously differ from the single mound structures and suggest a more wealthy residence. Surface ceramics from one of the structures of Group A (SC-66) has been tentatively dated to the Protoclassic period (Floral Park, 0-A.D. 300). Only two groups have structures over a meter high, Group B (one structure, SC-68, height=1.4 m) and Group C (one structure, SC-31, height=1.5 m). However, we noted lots of daub on top of even the temple-like structures. Another distinctive feature was that a large looters trench on top of what we have called SC-3 has exposed the fill which consists of clay rather than boulders and cobbles. After all, the site is within a few 100 meters of the Belize River

The tallest structure appears to be SC-4, where we noted more limestone boulders on compared to other structures (c. 13 meters high). Collected surface ceramics indicate the presence of both Mount Hope sherds (Late Preclassic/Protoclassic, c. 100 B.C. - A.D. 300). Nearby SC-4 is another high temple structure, SC-3, nearly seven meters high, where surface ceramics indicate Late Preclassic (Barton Creek, c. 300-100 B.C.) construction. SC-40, a large mound/platform site appears to have been built on top of a natural hill (c. 4 meters in height), itself which appeared to have been leveled somewhat. There is also a smaller mound located closer towards the river on the leveled hilltop. The crew collected some obsidian blades, two ceramic ear spools, and a ceramic carved pestle-like figurine from the top of SC-40 (Figure 6).

To the southeast of the southeast corner of SC-42 (itself dated to the Middle Preclassic, specifically, the early facet of Jenny Creek, c. 1000- 600 B.C.) in the plowed field we mapped in an about 11 x 6 meter area with a high concentration of ceramic sherds, mostly bowls and jars (Figure 7). Also noted were some burned sherds, as well as some very porous ones that may indicate over-fired ones, and very thick sherds indicating fairly large vessels. The porous ones remind me of the BRASS sherds that did not react to HCl, but were not obviously volcanic ash tempered. In a rough count of a 1x1 meter area, there were at least 200 sherds. We collected about 20 rim sherds and 3 porous sherds.

The table below summarizes the ceramic complexes we were able to identify:

Complex	Time period	Dates	Freq
Jenny Creek, early and late facets	Middle Preclassic	1000-300 B.C.	1
Mount Hope	Late Preclassic/ Protoclassic	100 B.C.-A.D. 300	1
Floral Park	Protoclassic	0- A.D. 300	4
Hermitage	Early Classic	A.D. 300-600	2
Spanish Lookout	Late Classic	A.D. 700-900	7
New Town, early facet	Early Postclassic	A.D. 900-1100	1
New Town, late facet	Late Postclassic	A.D. 1100-1400	1

It is clear from this table that the entire ceramic chronology is represented. Does this cluster reflect modern activities? If it does reflect looter's backfill, it is a dump that had to be from somewhere else since there is not an obvious looter's trench in the immediate vicinity.

Finally, we cleaned a 2-meter wide (and 4 meter high) section of a large mound (c. 40 x 20 m) bisected by a bulldozer (SC-64) near the middle of the mound that borders the north looter's trench (LT 2) where at least four plaster floors were noted, two of which showed obvious evidence for substantial burning (e.g., a 1.4 m burned area on one of the floors) (Figure 8).

Collected sherds from the looter's trench fill indicate both Late/Terminal Classic (Spanish Lookout, c. A.D. 700-900) and Late Postclassic (New Town-late facet, c. A.D. 1150-1400) occupation. The depth apparent in the stratigraphy (multiple floors) is very similar to what Willey et al. (e.g., 1965:16) found during excavation at Barton Ramie. We also cleaned up LT 2, where we exposed a plaster floor right before closing down on its south wall. We noted some polychrome and carved sherds, as well as burned, presumably, human bone (Figure 9).

River centers like Saturday Creek served vital local ceremonial, integrative, and economic needs (e.g., facilitating the acquisition and distribution of exotic goods to which all Maya had access, such as obsidian blades). In exchange for providing community organizational needs, local elites received smaller-scale tribute than their more powerful cohorts at major centers in the form of labor and goods. Most of this labor was used to build and maintain public monumental architecture, where all members of society benefited from the fruits of their labor. In these cases, there was much less evidence for private or restricted monumental architecture (e.g., large palaces) that only benefited a few members of society, the elite, and certainly not those who built it. While much of the goods contributed to the political economy were consumed exclusively by elites, much of it was also used to sponsor feasts and ceremonies (redistribution).

Yalbac and Old Tom's Milpa

Although Yalbac (UTM 1922.7N/294.5E; see Figure 1) is not part of the Valley of Peace Archaeology research area (it is right outside the western boundary), John Carr expressed an interest in seeing the site as a possible tourist destination (he owns Banana Bank resort and takes tourists all around Belize). The large center of Yalbac minimally has four large plazas, or actually four smaller plazas surrounding the main plaza, which is at least 100 meters in length. The largest temple we noted was about 20-25 meters in height. One of the looters trenches on one of the higher temples exposed a very well constructed and well preserved corbel arch ceiling room with some incredible red plastered walls. We were not able to located the 'lagoon' Frank Thompson, the gatekeeper at the Yalbac Cattle and Ranch Corporation road entrance, told us about; he could not personally show us since that would entail leaving his post. The lagoon does appear on the UTM map, almost directly west of Yalbac camp about 3 km. While searching for the lagoon, we did note several mounds, likely representing what I would expect to be pretty dense settlement around Yalbac.

We also decided to revisit an area we mapped during the 1997 season, Old Tom's Milpa (UTM 1919N, 301.5E; see Lucero 1997). We wanted to come back to take another look in this area since the secondary growth last season made mapping near impossible. Things were not much improved in 1998; the milpa is still very much overgrown with secondary growth, which does not make for much visibility. The looters trench at the base of the eight meter high mound on the eastern side of the hill has been expanded since last year to a total of almost 35 meters (14.1 meters west, c. 8 meters north, and another 13 meters west). We were only able to map in three mounds (A, B, and C), two of which seemed on one side to abut against the base of the hill, which means that one side of the mound has height, and the opposite end does not. I am sure there is more settlement, but until the secondary growth is cleared, which would require a lot of time, we will not be able to map it. However, Albert, Mr. Scott, and I went to Old Tom's house/pasture for a visit. The turn-off into his place is 4 miles (6.4 km) west of the Ceiba tree (Mr. Scott's place) on the road to Yalbac. One then goes about 2 miles north/north-east (c.3.2 km). The approximate location of his place is UTM 1921N/300E, and according to the GIS soil map, it looks like he lives at the base of Class II hills soils with Class III soils in his pastures. In the pastures were a noticeable number of mounds, some rather large.

Concluding Remarks

Maya archaeologists are beginning to realize that the varied economic landscape in the Maya lowlands also mirrors the different types of ancient Maya political systems. The dispersed nature of economic resources (e.g., agricultural land) and settlement patterns presented a unique challenge to ambitious leaders: how to acquire and maintain the ability to extract tribute and institute labor demands. Minor centers did not grow into large centers of power because they did not have the requisite sources of power -- both the means to control an economic resource, and a means to nucleate surrounding farmers (i.e., lacking the ability to prevent people from leaving or not participating). The importance of minor centers, however, was not diminished. The role they had locally provided key social integrative needs to the surrounding populace. It would be interesting to compare the political histories of Yalbac and Saturday Creek. For example, why and how was Yalbac able to achieve greater power than Saturday Creek, as evidenced in the larger scale and more impressive monumental architecture? Does the fact that Yalbac is not located near a major river (albeit it is located near a small stream) have any significance? Did rulers at Yalbac have at their control a critical resource (land)? If so, how did Yalbac elites translate this control into their obvious ability to acquire tribute and labor from the surrounding populace? These and other questions await future research during the 1999 and 2000 seasons.

Additionally, it is clear that ancient Maya settlement practices are not cut and dry; preliminary results from Cara Blanca clearly indicate that some areas, even with good agricultural soils nearby and with plenty of available water sources, were purposely sparsely settled. Although we need to conduct further research, in the Cara Blanca area, it is possible to suggest that certain aspects of the landscape, specifically caves and pools, likely were too important religiously for everyday mundane activities. The question remains, then, as to what role Cara Blanca played regionally, especially being so close to the major center of Yalbac. Again, this and other questions await future research in the Valley of Peace Archaeology area.

ACKNOWLEDGMENTS

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APPENDIX

Valley of Peace Archaeological (VOPA) Project
Permit No.: 282/8/98
Accession No.:10032

Principal Investigator: Lisa J. Lucero

Artifact List

Bag #	Catalog #	Material	Quantity	Provenience	Description
1	CB1	ceramics	2	Cara Blanca Pool # 1, Mound 2, LT upper level	body sherds
2	CB2	ceramics	2	Cara Blanca Pool # 1, Mound 2, LT lower level	rims
3	CB3	ceramics	2	Cara Blanca Pool # 1 c. 10m underwater below Mound 1	body sherds
4	CB4	lithics	4	Cara Blanca Pool # 1 underwater near NW cliff	flakes
5	CB5	ceramics	2	Cara Blanca Pool # 1, Mound 1 Test Pit 1, level 1	body sherds
6	CB6	ceramics	12	Cara Blanca Pool # 1, Mound 1, Test pit 1, level 2	body sherds
7	CB7	ceramics	11	Cara Blanca Pool # 1, Mound 1, Test pit 1, level 2	ceramic cluster
8	CB8	ceramics	15	Cara Blanca Pool # 1, Mound 1, Test pit 1, level 3	rims,body sherds
9	SC1	ceramics	3	Saturday Creek SC-40 surface	figurine, ear spools
10	SC1	obsidian	6	Saturday Creek SC-40 surface	blades
11	SC2	ceramic	1	Saturday Creek SC-47 surface	figurine fragment
12	SC3	ceramic	1	Saturday Creek SC-3 surface	sherd
13	SC4	clay	2	Saturday Creek west field surface	daub with impressions
14	SC5	ceramic	1	Saturday Creek SC-1 surface	rim
15	SC6	ceramic	1	Saturday Creek SC-1 surface	rim
16	SC7	ceramics	23	Saturday Creek ceramic cluster SE of SC-42 surface	rim and body sherds
17	SC8	ceramics , bone, shell	4	Saturday Creek SC-64 LT2 fill	rims, shell, burned bone
18	SC9	ceramics	3	Saturday Creek foot of bulldozer NW of SC-42	rims

19	SC10	obsidian	2	Saturday Creek SC-66 surface	core, flake
20	SC10	ceramic	1	Saturday Creek SC-66 surface	rim

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Chapter 2

Settlement at the Sacred Pools: 1998 Reconnaissance and Excavation at Cara Blanca, Cayo District, Belize

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The 1998 Valley of Peace Archaeological Project (VOPA), under the direction of Dr. Lisa Lucero of New Mexico State University, continued its study on ancient Maya settlement within the Valley of Peace area in the Cayo District of Belize, Central America. Using a model developed by Scott Fedick (Fedick 1996), where settlement can be predicted based on a five tier rating system of the quality of soil (Class I is best, Class V is worst), we have made preliminary inroads into explaining the dispersal of settlement over the landscape. This report describes our reconnaissance, mapping, and excavations at the Cara Blanca site, and applies these findings to a broader framework with the hopes of clarifying current understanding on Maya settlement and identifying future research questions.

LOCATION

Cara Blanca Pool 1 is located approximately 9 kilometers north-northwest of the Valley of Peace Village in the Cayo District of Belize (UTM 1927N/301E; Figure 1). A map compiled by Bryson Geological Services for Anschutz Corporation in 1974 shows an east-west fault, with the north side being uplifted (Robert Johnston, Castle Belize Ltd., personal communication, 1998). The two rock types at the fault are defined as Kbc (Barton Creek Formation limestone and dolomite of the Cretaceous age, 65-70 million years) and Trb (Redbank Formation clay, sands, and gypsum of Miocene-Pleistocene ages, 25-2 million years).

The pool is a natural spring located at the base of a steep cliff (fault), part of a string of 22 pools that run east-west along the southern edge of a natural limestone ridge. We were able to locate 6 of the pools (see Lucero, this volume). The water is supplied via an underground water system, evident by the small stream running out from the southernmost edge of the pool (and continuing in a south-easterly direction), but there is no stream running into the pool. Thus, the excess water must be coming from underground.

The closest large ceremonial center to Cara Blanca is the center of Yalbac, located some seven kilometers to the southwest (UTM 1922.7N/294.5E). The minor riverine center of Saturday Creek is also nearby, at about 11 kilometers to the southeast (UTM 1916N/312E).

The site itself consists of seven structures, ranging in height from one to four meters (Figure 2). The four largest structures are situated around a freshwater pool, with dimensions of approximately 100 meters east-west and 60 meters north-south. The remaining three smaller structures of Cara Blanca are clustered roughly 125 meters east of the eastern edge of the pool.

RESEARCH GOALS

There were three goals for Cara Blanca in the 1998 season. First, the preliminary site map of Pool 1 made in 1997 was to be improved (see Lucero 1997; Lucero and Fedick 1998). This meant conducting a more intensive survey of the surrounding terrain (including searching for new pools), and recording any mounds that went previously unrecorded. We would also take more detailed measurements of the known structures, and get a better measurement of the overall dimensions of the pool itself.

The second goal was to get a better idea of the settlement and building chronology of Pool 1 settlement, on which this chapter focuses. This would be done by clearly exposing the looters' trench sidewalls, and excavating a 1x1 meter test pit at the top of the largest structure. The information gained from the looters' trenches and the test pit would give a better understanding of floor and wall orientation as well as providing a sample of potsherds that could be used as a datable estimate of occupation history.

The final goal of the 1998 season was to scuba dive Pool 1. This would enable us to locate any visible Maya offerings, make preliminary measurements of the pool, and get a general overview of the underwater environment to ascertain the feasibility of later, more elaborate dive strategies (see Osterholtz, this volume).

CARA BLANCA POOL 1 SETTLEMENT

STRUCTURE ONE

Structure one is the largest structure at Cara Blanca . It appears to be a range building consisting of six rooms, three on a side, radiating out from a series of four pillar-like central walls which run the length of the building. It is approximately 15 meters wide, 22 meters long, and 4 meters tall. The orientation of the long axis is roughly north-south. This structure has lost its northeast corner due to severe erosion into the adjacent freshwater Pool. It contains two large looter's trenches, appropriately titled Looters' Trench 1 (LT 1), and Looters' Trench 2 (LT 2). Although the actions of the looters have brought an unfortunate amount of destruction to the mound, at least the location of walls and floors can be seen in the looter's trench sidewalls.

Looters' Trench 1 runs east-west on the west side of the central axis. It is oriented a bit to the south of the center of the building, and gives us a good cross-section of the mound. Within the north wall of LT 1, two walls are easily discernible, the outer one lower than the inner one, indicating a possible platform/range structure design (Figure 3). It is also important to note that the east wall of LT 1 contains a nicely preserved wall which runs north-south, quite a bit longer than the pillar-like walls that are in line with it on the north-south axis. There were several weathered faced stones strewn about, some about 0.5 meters in length (rectangular in shape). There were also a number of sherds about, all out of context, and none collected.

Looters' Trench 2 was cleaned and profiled; it runs east-west on the east side of the central axis. It is about five meters north of LT 1, and on the opposite side of the mound, facing out towards the Pool. It provides an excellent vantage point of one of the pillar-like spine walls. Pieces of two other pillar-like walls can be seen, helping the viewer become oriented to the overall plan of the building. The north face is 2 meters in length and the south face is 4 meters in length (the shorter wall has collapsed into the pool) and 2.5 meters wide. In the north wall appears to be c. 0.8 meter wide wall with shaped stones, underneath which is a plaster floor with a cobble ballast.

TEST PIT ONE

A 1x1 meter test pit was placed at the top of the mound, between LT 1 and LT 2. Natural levels were used. The soil was dark and organic near the surface, changing to a typical grey sandy loam in the lower levels.

Level 1 was comprised largely of humus and roots, and contained only two body sherds. The soil was dark and organic (Figure 4. The average depth of this deposit was between 17 cm and 20 cm thick. Level one's Munsell color was given at 7.5YR 3/2 (dark brown).

Materials excavated from Level 2 include 23 pottery sherds, some of which were identified as the Belize Red: Belize Variety of the Spanish Lookout Complex, indicating Late Classic occupation (c. A.D. 700-900) (Figure 5). Eight of these sherds were obviously from the same vessel (a jar). Level two's average deposit depth was between 25 cm and 31 cm thick, and Munsell was recorded at 10YR 4/2.

By the time we hit the bottom of Level 2, we could begin to see the general outlines of one of the central pillars running along the north-south axis of the building, and an abutting eastern perpendicular wall. Level 3 was dug in order to solidify our assumptions of this fact. It consisted of more compact matrix and contained 15 sherds, and had an average deposit depth of between 5 cm and 58 cm thick. It had a Munsell color of 10YR 5/1. Once we were deep enough to get accurate measurements of the pillar and abutting wall, the unit was closed. We were able to uncover at least five courses of the north-south wall, and two courses of the east-west perpendicular wall: one wall runs 20° and the other 120°. The N-S one looks like it may be a corbel going north, but it is hard to say. The maximum depth, recorded at the northeast corner of the unit, was approximately 1.1 meters below ground surface (Figure 6).

The unit was backfilled upon completion. The bottom of the test pit was indicated by placing a package of Ramen, a plastic bag, and a Gamisa cookie wrapper.

STRUCTURE TWO

Structure 2 is the second largest mound of the Cara Blanca site, located five meters to the southeast of Structure 1, and 15 meters due south of the edge of Pool 1. It is about 2 meters tall, and has a footprint of about 5 x 10 meters, oriented roughly east-west (height=1.7m). Structure 2 has been devastated by looting, with the entire top resembling a bomb crater. We were able to recover five potsherds from the looter's sidewalls, three from a possible upper construction phase, and two from an earlier construction phase. One of these from the earlier phase was datable to the Alexander's Unslipped Beaver Dam Variety of the Spanish Lookout Complex, c. A.D. 700-900 (Late Classic) (Figure 7).

STRUCTURE THREE

Structure 3 lies 17 meters east of Structure 1, and four meters northeast of Structure 2. When viewed together, Structures 1 through 3 form three-quarters of a plazuela group. It is about 10 meters square at the base, and only about .75 meter tall. Structures 1-3 are located on a platform, and obviously comprised a patio group of some sort.

STRUCTURE FOUR

Structure 4 lies at the southeast corner of Pool 1. It is solitary, being 55 meters away from Structure 3, and 90 meters away from Structure 1. It appears that Structure 4 is also eroding into the Pool, but not with the severity found in Structure 1. It is approximately 15 meters by 11 meters at the base, oriented upon an east-west axis, and about 1.5 meters tall.

STRUCTURES FIVE, SIX, AND SEVEN

Structures 5 through 7 appear to be average housemounds, ranging in height from 0.8 to 1.9 meters, and instantly discernible as "typical" to anyone who has worked elsewhere in the Belize Valley. Although these three mounds are located in the same general area, Structure 5 seems to be an independent unit, while Structures 6 and 7 were probably closely interrelated because of their close proximity to one another (7 meters). Structures 6 and 7 also delineate the easternmost known limit of the Cara Blanca site.

UNDERWATER EXPLORATIONS

Two crew members (Osterholtz and Kinkella) conducted preliminary exploration of Pool 1 by scuba diving to a depth of about 20 meters. A sounding of the pool undertaken earlier by Kinkella gave its deepest depth at about 40 meters, but the dive crew was not able to explore that far down, as our limited light source was not able to illuminate the surroundings below about 20 meters. Two potsherds were found at about a 10 meter depth, one of which has been tentatively identified as being from the Jenny Creek Complex, which dates to the Middle Preclassic. The sherds were both found immediately under Looters' Trench 2 of Structure 1, so as to indicate that they were probably from looters' debris, and not a part of any offering made in prehistory.

CONCLUSION

From the chronological interpretations of the potsherds, it appears that the Cara Blanca site was inhabited at least as early as the Middle Preclassic and as late as the Late Classic, and probably during the interim periods. It was most likely related to the major center of Yalbac, located just 8 kilometers to the southwest. It is unique in location, as the rarity of natural springs of this size attest in the Maya area.

We have speculated that this site may have been used as a pilgrimage center during prehistory, as it is associated with a freshwater pool containing an underground water source. The Maya viewed anything pertaining to the underworld as sacred (Bassie-Sweet 1996), and this may have been seen as a portal to that world. Natural Pools of water such as the ones in the Cara Blanca area often contain ritual offerings; so the presence of multiple Pools in this area may earmark it as a very unique location (Andrews and Corletta 1995). With an extremely reliable supply of fresh water, and good soil (Class II and III) only a short distance away, the relative lack of settlement is surprising. This could be explained by not classifying this as a pilgrimage center, but instead as an elite compound, where plentiful resources were restricted due to the relative ease of control. Since the primary water source is a pool and not a river, the entire water source could have been delineated for the elite, while the commoners were forced to share nearby Labouring Creek.

Considering the settlement characteristics in the immediate area encompassing the Cara Blanca site (settlement on poor soil), and the relatively good soil characteristics (Class II and III) of the surrounding uninhabited area, it would appear at first glance as though Fedick's model is not viable. But if we look a little closer, it becomes clear that the model works. Although the Cara Blanca settlement is built upon Class V soil, which is the very worst in the Maya area, the good Class II and III soils are located less than a kilometer away. It appears as though the Maya are truly getting the most out of their available resources by building their dwellings upon poor soils adjacent to good soils, so as to be close to good farm land while not covering it up with living space.

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Chapter 3

Underwater Archaeology at Cara Blanca, Central Belize

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This chapter covers the logistical information involved in conducting underwater archaeology in the Maya area. Research was conducted both in a controlled environment (the NMSU indoor swimming pool at the Natatorium) and in the field at the Maya site of Cara Blanca in Belize. Beginning with a review of literature and the history of underwater archaeology in the Maya area, my purpose is to provide a background to the research conducted by myself under the auspices of the Valley of Peace Archaeological (VOPA) project, under the direction of Dr. Lisa Lucero, New Mexico State University. The next section deals with a study that was performed to gauge the effects of submergence on cultural objects. The following sections deals with methods including preservation, excavation, artifact recovery, and artifact conservation. The final section describes the techniques and results of underwater exploration at Cara Blanca Pool 1.

A Brief History of Previous Underwater Research in the Maya Area

The history of underwater archaeology in Mesoamerica is long and colorful. In fact, many of the underwater techniques now commonly used by underwater archaeologists throughout the world were developed and first used in this area. Despite the wealth of research for the entire region, little work has been done to date in inland pools. Most of the work that has focused on three purposes, briefly discussed below: 1) to discover trade routes and practices; 2) to investigate sites that once had been on land, but due to water levels rising are now submerged; and 3) to discern ritual practices. The focus of this research is to examine pools for signs of ritual use via research with the valley of Peace Archaeological (VOPA) Project. The first of these purposes has been served by excavation at presumed ports on the coasts. Some such sites are Xelha, Quintana Roo, Cerros and Wild Cane. There are, of course, many others. Heather McKillop (1995) has investigated Cerros. Her purpose in this was to discern ancient salt trade routes of the Maya. She was able to establish that the site was entirely devoted to salt production, as there were no residential buildings. She was also able to establish that salt was not used for processing or preserving fish from the coastal waters. The specialization of this site shows a degree of craft specialization that is rarely seen in the Maya area. The site also fulfills the third goal of underwater research already conducted in the area, the investigation of once terrestrial sites that are now submerged.

Evidence of Maya watercraft has been sparse. Historic accounts tell us that sea-faring canoes were constructed with hard wood, and varied in size from one-man dugouts to larger crafts capable of carrying 40 to 50 people (Andrews and Corletta 1995). A canoe has never been archaeologically recovered from any port site. Ports have been found and excavated at Xelha and at Isla Cerritos. These sites contain high retaining walls and structures that open into gaps in the coral structure, giving the perfect access to the calm waters of the Gulf of Mexico and the Caribbean Sea. Navigation between ports ranged from a simple navigation among a series of interconnected mangrove estuaries to braving coastal reefs. Other sites investigated were believed to have been of a terrestrial nature. Mentioned earlier, the site of Cerros was submerged when ocean levels rose. Other sites that meet these criteria are Consejo, Corozal and Sarteneja, all located along the north coast of Belize. Of particular interest is the site of Carwash Cave, near Tulum. At this site, divers found what appears to be a hearth at a depth of 27 meters; this is believed to be the first evidence of sea level changes in Early Archaic times (Andrews and Corletta 1995; Coke et al. 1990). Charcoal dated from this hearth has yielded a date of 8250± 80 years B.P. Cave divers Mike Madden and Pete Turner discovered this site in 1986.

Three main types of bodies of water can be found inland in the Maya area: cenotes, lakes and pools. Cenotes are deep sinkholes fed by the water table and are largely found in the northern lowlands. In contrast, cenotes are not found in the southern Maya lowlands where the water table is much too low (e.g., the Petén, Belize). Lakes are river-fed sources of water, and finally, pools are fed by underground water through underground cave systems. Aguadas are not included in this discussion because water does not come from an underwater source, but rather is rain-fed. The first two of the three have been investigated extensively from the time the Maya were "discovered" by the western world. The most memorable of the cenotes to have been investigated is the Cenote of Sacrifice at Chichen Itza. The cenote is located 400 meters north of the main plaza and is connected to the main plaza by a sacbe, a raised causeway. The cenote has an approximate diameter of 60 meters, and its maximum depth is 13.4 meters. Along the southern edge of the cenote is a structure, so close to the cenote that part of it has fallen into the water (see Sharer 1994:Figure 7.3). This is repeated throughout the Maya area in association with sacred bodies of water. It has been known since colonial times, via the writings of Bishop Landa, that the cenote figured heavily in the religious activities of the occupants of Chichen Itza (Tozzer 1941). These accounts were justifications of the notably harsh conversion methods practiced by Landa and others. Through his writings he strove to prove that the native peoples were savage, and therefore, did not need to be treated with the respect shown to a human being. Included in his descriptions were numerous accounts of human sacrifice. Over time, these descriptions flowered from descriptions of victims being thrown into the water to the sacrifice of virgins. However, numerous osteological studies of the remains recovered by the researchers discussed below have shown that the "inhabitants of the well" were a mixed lot of males, females and children (Saul and Saul 1989; Hooten 1940).

No mention is made as to whether any of the skulls recovered shows signs of skull modification, such as elongation or dental modification. Such distinctions would be helpful in reconstructing the status of the individuals sacrificed, which would help to gain an insight into the religious importance of the sacrifice. If the sacrifice is extremely important and indeed the nobility is divinely chosen, the better sacrifice would be the one closer to the gods, or more noble (Freidel 1986). One example of the added importance of the nobility as sacrificial offerings is evinced by Bishop de Landa's descriptions (Tozzer 1941). Another example of the elevated status of important sacrificial victims is their depiction in stelae with elaborate headdresses (Schele 1984) or identified by hieroglyphic depictions along their legs (Sharer 1994). Understanding who went into the well (here or elsewhere) will give us a clearer idea of what role these sacrifices played in the overall ideology of the Maya.

Edward Thompson made the first successful attempt to dredge the Cenote of Sacrifice, between 1904 and 1911. From a nine-meter high boom, Thompson lowered a dredge with a 2.5 cubic foot capacity bucket and dragged the bottom. This method is not only dangerous for those operating the machinery, it is also extremely destructive. It destroys all evidence of provenience and context, thus giving us an incomplete picture of the ritual nature of these deposits.

In 1909 Thompson began helmet diving, but visibility in the cenote was so poor that a combination of the two methods was used. Among the objects removed from the cenote by Thompson were gold, silver and copper artifacts, as well as jade, shell, chert, obsidian, ceramic vessels and figurines, and human and faunal remains. The first map of the cenote floor was not made until 1935, when Manuel Cirerol Sansores mapped and conducted a study of the cenote's physical properties (Andrews and Corletta 1995; Folan 1966). In 1954, more studies were made, as were recommendations for further investigative techniques. These techniques recommended the drainage of the cenote with pumps (Andrews and Corletta 1995; Folan 1966). It was also in this year that the Aqualung was first used. Its usefulness, however, was limited due to poor visibility. The site was investigated again in 1960 and 1961 by INAH, led by William Folan, CEDAM, a Mexican exploratory club led by Pablo Bush Romero and the National Geographic Society (NGS), led by Norman Scott and Bates Littlehales. This expedition used a newly developed device called an airlift, basically a large vacuum used to remove sediment and small artifacts from the pool floor. Work was halted following an assessment by INAH officials that too many artifacts were damaged by the airlift.

The last excavation of the cenote took place during three months in 1967 and 1968. Once again, INAH and CEDAM were involved, along with Unlimited Expeditions (EL). The most significant contribution of this expedition had to do with water clarification. In order to increase visibility, attempts were made to clear the water by chlorination filtration and soda ash. Flocculation, with infusions of chlorine and muratic acid, proved to be the only effective means of clarification. However, no one was concerned with lasting effects on the water table, which must be considered because cenotes are natural wells through which a constant supply of ground water percolates through the limestone. Inevitably, whatever is added to the water in the cenote will be added and dispersed through the entire water table. Even after these extensive steps toward clarification of the cenote, diver activity soon muddied the waters once again. The final suggestion was that only when a complete stratigraphic study could be done should any further exploration be attempted. The only way, then, to have a complete stratigraphic study of the floor is to drain the entire cenote and use a sealant to stop ground water seepage. For this reason, the immense time and monetary commitment that would be needed for such an undertaking, no further exploration of the cenote has been attempted.

In 1966, Stephan de Borhegyi led an expedition to conduct a preliminary reconnaissance of archaeological sites in the southern highlands of Chiapas, Mexico. One site surveyed was Chinkultic, and the exploration of its Cenote Azul was initiated. The location of the cenote was of extreme interest, as it is located at the foot of a cliff immediately beneath the site's main temple. The first underwater exploration was carried out in 1966, with a second one in 1968, which revealed a large deposit of ceramics on the north shore of the cenote. It was determined that a proper investigation would require the draining of the cenote, undertaken in 1969. Although hampered by the natural water table (this was the main reason that an emptying of the Cenote of Sacrifice was not attempted), they significantly lowered the water level to the point where excavation could be carried out along the shore by using artificial levels (Mericle 1971). A stratigraphic sequence could not be determined, and for this reason, excavation ceased. Evidence obtained from these excavations shows that objects were tossed from the shoreline or from the top of the cliff on its south side.

Another major cenote that has been explored is the Well of Time, also known as Cenote Xlacah, located at the site of Dzibilchaltun. The site of Dzibilchaltun is located 22 km from the north coast of Yucatan. Excavations at the site have shown an occupation period ranging from the Middle Formative (ca. 800 B.C.) to the early colonial period. Investigations at the site were conducted between 1956 and 1966. During the years of 1956 and 1959, divers explored Xlacah, in association with the site. The diving was conducted by local, University of Florida, and NGS divers. Due to the involvement of NGS, an account of the 'adventure' was written by Luis Marden and published in National Geographic Magazine.

Reading more like a dime novel than a report, it does provide a few important details. For instance, a number of diverse objects were recovered from the cenote, including decorated and undecorated ceramics, jade masks and thousands of beads (Marden 1959; Taschek 1994). Most ceramics found date to the Late and Terminal Classic periods, a pattern also found in the Cenote of Sacrifice. This connection points to a cult of ritual offerings during that time (Andrews and Corletta 1995; Marden 1959). Few human remains were recovered from this cenote, suggesting that human sacrifice was not practiced at this site, as opposed to the Cenote of Sacrifice at Chichen Itza. One interesting parallel between Xlacah and the Cenote of Sacrifice is the presence of a structure at the cenote's edge. Marden states: "On the north rim of the cenote stands a great mound of rubble. As we dived day after day; we became convinced that much of the worked stone from the facing of this pyramid had at some time in the past slid into the deep waters of the well" (1959:114).

Lakes are the second type of body of water found in the Maya area. Work has been done at many lakes throughout the Maya area. The first of these to be discussed is Lake Peten Itza, in Guatemala. Work began in 1959 to find the remains of a stone horse said to have been thrown into the lake by missionaries in 1618 (Borhegyi 1963). Although the horse was not recovered, many incense burners and ceramics were, dating from the Late Preclassic to contact period. Some appear to have been offerings to the Rain god, as is evidenced by their ceremonial type (Borhegyi 1960). Investigations at Lake Amatitlan, Guatemala shows the first use of the aqualung in the Maya highlands in 1954. In that year, amateur divers began a casual exploration. In 1955, they began to recover pre-Hispanic specimens, and over the proceeding three years recovered over 400 ceramic vessels. Stephan de Borhegyi joined the project and produced the first map of the lake, including all sites on or near the lakeshore, as well as nine underwater sites. Ceramics recovered have extremely exotic designs portrayed on them, ranging from spider monkeys, papaya fruits, flowers, snakes, lizards and human heads. Chac or Tlaloc were also represented along with a fertility god and a death god (Borhegyi 1961). The styles of these artifacts range from those clearly influenced by Teotihuacan to those influenced by contact from the central Mexican highlands. From the geographic diversity of the materials recovered, it was clear that the lake was the focus of pilgrimages from different regions, according to the types of the ceramics from all over the highland area. Few human remains have been recovered, but representations of Xipe Totec, the god associated with sacrifice have been found; this indirect evidence for human sacrifice dates to the Classic period, earlier than the evidence for human sacrifice found at Chichen Itza. The waters at Lake Amatitlan are notoriously warm, and this has been used by Suzanne de Borhegyi to claim that the lake was used by the prehistoric peoples of the area as a curative and magical place (Borhegyi 1961). The structures along the shore are in association with the hotsprings, which has been described as a "shrine."

Lake Guija, El Salvador was investigated in 1960, and was found to contain a few censor fragments dating to the Postclassic (Borhegyi 1960), and two Late Postclassic effigy censers, both depicting the god associated with sacrifice, Xipe Totec (Boggs 1976). Also found at this site was an Early Classic engraved jade plaque (Houston and Amaroli 1988). While conducting a reconnaissance of lakes in Guatemala in 1960, Stephen de Borhegyi found a number of lakes to be devoid of ritual debris. In the case of Lake Atitlan, in western Guatemala, utilitarian ceramics were found, which were thought to have fallen into the lake from the surrounding slopes. Also during this reconnaissance, Borhegyi explored Lake Atescatempa, Guatemala and Lake Ixpaco, Guatemala. Neither of these produced any cultural remains.

Since pools have not been previously studied before the VOPA 1998 field season, I will discuss them in the last section.

Due to the nature of underwater archaeology, the issue of its necessity must be carefully assessed. Underwater archaeology, because it is even more destructive than most archaeology, should only be conducted when an important aspect of the cultural system can be found submerged. Some examples of this include searching for ritual deposits to gauge the importance of water ideology among the Maya and the discovery of trade practices. Objects that have been underwater for extended periods of time are more susceptible to environmental stresses and change; they are more fragile. Competent professionals must carry out this research with an eye toward the eventual conservation of the materials recovered. Steps must be taken to insure that as little harm as possible is brought to bear either on the underwater environment or to the underwater cultural environment.

When determined necessary, underwater archaeology can be extremely useful in determining the roles of both trade and religion in the lives of the Maya. Several conclusions can be drawn from previous underwater research involving the ritual activities. Sacrifice of objects, especially ceramics, into water was common throughout the Maya area. The distribution of sacred water sites does not concentrate in any one geographic location. Most of the artifacts brought to the surface as a result of this research date to the Late or Terminal Classic, perhaps indicating an ideological shift. Certain concepts remain the same throughout the Maya area in respect to water ritual.

Most underwater sites have ceramics deposited ritually; these are determined from their non-utilitarian appearance. These ceramics contain an amazing variety of pictorial representations, from waterlilies to representations of Xipe Totec. Underwater archaeology has also shown quite effectively that there was a good amount of geographic variation in the ritual practices. At the Cenote of Sacrifice at Chichen Itza, many human skeletal remains were found, whereas, not many have been found in other areas. Clearly water was an important aspect of Maya ritual, and this has been brought to the attention of scholars mainly through the work of underwater archaeologists recovering artifacts from sacred water sources.

Cultural activity has also been discerned from looking at the underwater archaeological record. Paradoxically, artifacts recovered from the underwater environment are more fragile, but many things also preserve much better. This is because they are less exposed to environmental stresses. This is the case at Cerros, a salt production site and trade port on the Belize coast. We have also been able to show that people arrived on the Yucatan peninsula much earlier than previously expected, due to the discovery near Tulum of the hearth now submerged at a level of 27 meters.

More refined excavation techniques and a more focused eye on conservation and treatment will no doubt add to what we have already learned about the Maya through underwater archaeology. Rigorous research designs and more systematic methods that can produce more substantive anthropological results must accompany these new techniques. For the simple reason that much of the investigation to date was conducted by recreational divers or those who did not have proper certification, the scientific community is reluctant to accept much data from most of the previous underwater research. If archaeologists can learn from the mistakes of those who have come before us, especially Thompson's excavation of the Cenote of Sacrifice, the future of underwater archaeology in the Maya area will be an illustrious one indeed.

Preservation of Artifacts

In general, we can expect to find artifacts that are in a good state of preservation if they have survived inundation and have adapted to the higher pressure environment. We also have an advantage working in pools because artifacts are much more likely to preserve in freshwater than in saltwater (Marx 1975:66). Salt water adds insoluble and soluble salts that can eat away at objects until they are destroyed, or cannot be brought to the surface for fear of damage (Ballard 1987). Singley states, "Unlike salt water, freshwater has a much lower concentration of chlorides, so that damage resulting from salt contamination, like intensive corrosion and crystallization on the surface is much less" (1988:8). In her work at Cerros, Belize, McKillop (1995) found that larger ceramic sherds were present in the salt production areas than she would have found if the site had been on land. This was attributed to the fact that when a site is in an area where access to is limited, as is the case with submerged sites, less disruption or ‘stamping’ of the artifacts will appear. In general, we are interested in the probable preservation of all materials, including inorganics and organics, from lithics to ceramics. The following summaries are offered as possible preservation scenarios, presented by various researchers as summaries of their experiments and observations in the field.

Ceramics

Ceramics typically are the most abundant type of artifact found in underwater contexts throughout the Maya lowlands. Low-fired ceramics, terracottas (below 1000°C) and earthenwares (1000-1200°C), have a much higher chance of deterioration. Pearson (1988), who worked in salt water conditions, found that many of these wares had crazed and flaking glazes with partial dissolution of the clay body. However, Singley (1988), who works in freshwater, simply found a softening of the fabric. Seemingly, these differences in preservation can be attributed to the chemical makeup of the water in contact with ceramics. One point of agreement between researchers who work in salt water and those who work in fresh water is that glazes are very fragile. The main component of any glaze is a type of silica, which is modified to lower the melting point. These glazes are applied during the firing process, which melts into the fabric of the ceramic, both providing a finish and a seal to the clay body. Water current movement and the movement of sediment can cause the deterioration of these glazes by the constant abrading of the sediment against the ceramic. The equivalent to this process would be stripping wood with sandpaper to remove a layer of paint. With the removal of the glaze, which had added a protective layer over the more vulnerable clay, the porous body of these earthenwares and terracottas is much more susceptible to deterioration (Pearson 1988).

With the absence of a protective layer, stone-boring organisms can penetrate terracottas and earthenwares. In addition to the danger of these stone-borers, the water chemistry of the water may have an affect. As was shown through a National Reservoir Inundation Study, the more acidic the water solution is, the more likely the dissolution of the clay body is (Ware and Rayle 1981). In addition to the acidity of the water, the materials submerged with the ceramic may affect its preservation. Both organic and inorganic material can stain ceramics (Pearson 1988; Singley 1988). In the case of the Maya area, we do not expect to find metals, since the preliminary ceramics data shows no post-classic sherds on the surface surrounding the pools (Osterholtz n.d.). However, iron stains may be derived from clays in the sediment, and we must be careful in our recovery and conclusions (Pearson 1988).

High-fired wares, stonewares (1200°-1300°C) survive submergence much better. Because they are fired at such a high temperature, they become a form of stone, making them virtually impregnable to most things that disintegrate ceramics (Pearson 1988). It is for this reason that these are much more likely to appear in an underwater archaeological record than terracottas or earthenwares.

Wood

When Thompson in 1904 began dredging the Cenote of Sacrifice at Chichen Itza, he found several carved wooden idols. There was very little preservation of these pieces, not only during Thompson's expedition but also in successive ones, because, "the climate quickly rots and insects devour them [wooden artifacts]" (Coggins 1992:26). Water makes cellulose and hemicelullose soluble, breaking down networks by acid hydrolysis (Singley 1988). Ware and Rayle's (1981) experiments showed cracking and flaking of the wood surface. In addition to the damage that water itself can cause, bacteria and fungi can also be a problem.

Bone

During Thompson's investigations, he also discovered numerous human remains, including one human skull incensario. Keeping in mind the romantic notion of virgin maidens being thrown into the turgid water below has been debunked, Saul and Saul (1989) found that about half of the skeletons found in the Cenote were children between the ages of four and twelve, one fourth were adult males and the other fourth were adult females. At least one of these women had had a child, and wore the pelvic scars to prove it.

As is evident with the categories of artifacts discussed above, water chemistry and floral components heavily influence the preservation of bone. If quickly buried in sediment rich in phosphate (or some other protective agent such as peat), the bone has a much better chance for survival. This is because the porosity of bone allows the absorption of water soluble humates and metallic salts that can be leached from the clays in the sediment (Pearson 1988).

Underwater Archaeology: Methods

Although underwater excavation was not a goal in the 1998 VOPA season, in case the situation arose, we needed to be prepared to excavate. Consequently, I am including a description of a potential excavation strategy.

Green (1990) explains basic excavation procedures. Green is a marine archaeologist, and his methods are based on the problems encountered in a marine environment. Before excavating it is wise to check and make sure that the grid lines established when mapping are aligned precisely with the cardinal directions. The site is then further divided into one meter sections, defined by grid lines or a hard one meter frame, which can be constructed from one meter stick tapes fastened together.

Tools for excavation are fairly simple. Many of the excavation tools used for land archaeology are also used for underwater archaeology, including trowels and picks. In addition to elementary land tools, a diver's knife is indispensable. A diver's knife can be used as a scraper, a digging tool, and it is always a good idea that a diver carry a knife for emergencies. This piece of equipment should be with a diver anyway, but also makes a valuable excavation tool. Based on current evidence of the site of Cara Blanca, silty clay bottoms are present. This makes tools for encrustation removal unnecessary. For larger, more prolonged excavation, if one is called for after further investigation, certain tools will be very important.

Proper excavation techniques are exceedingly important, for the same reason that proper excavation techniques are important for land archaeology. We destroy as we excavate. It is for this reason that much of Thompson’s work in the Cenote of Sacrifice at Chichen Itza, conducted in 1904, is sorely lamented (Coggins 1992). Thompson, like other archaeologists of the area, had heard tales of human sacrifice and treasures thrown in by the Maya. Thompson lowered a bucket from a boom positioned along the rim of the cenote and dredged the floor. This technique destroyed all semblance of context or provenience. Admittedly, he brought up a number of beautiful objects, but we have no idea how they fit together as sequential ritual depositions, or how these ritual objects fit into the greater scheme of life at Chichen Itza.

As on land, not every object will be large enough to be recovered by the archaeologist at first glance. On land, this problem is solved by screening. In water, this problem is solved by the evacuation of sediment surrounding and covering an artifact by means of a vacuum tube attached to an air pump on the surface. This air pump draws up water, sediment and small artifacts (most vacuums have a maximum diameter of four inches). The material is shot out of the water onto a screen, usually of fine dimensions (1/4" mesh). Operators can then remove these artifacts and tag them according to the provenience of the grid below. Communication is key. Normally, level sizes are predetermined, simply to limit confusion. The vacuum also solves the problem of removing sediment to see the layer below.

An important part of excavation is the collection of sediment samples. Sediment is an excellent agent for the preservation of pollen and seeds. Once encased in the sediment, the seeds and pollen are safe from becoming dinner to scavengers or fish. If found in association with artifacts, these seeds and/or pollen can give us a clue as to the season in which the artifacts were deposited. This is particularly useful inside ceramic vessels, whose protection will further shield these particles. These sediment samples can be taken by simply digging a small hole into the sediment, and collecting it in an olefin bag. These bags allow for the escape of moisture, but do not allow the loss of sediment.

Recovery of Artifacts

To remove artifacts from the aquatic environment, there are several methods that cause little damage to the objects themselves. Before discussing methodology, however, it should be noted that these artifacts have been under a higher amount of pressure than the surface for hundreds of years. Roughly, the surface is defined as being one atmosphere of pressure (1 ATM). The deeper it is, the more pressure is exerted on artifacts. Every 33 feet (approximately 11 meters) is defined as being one ATM. Therefore, at a depth of 33 feet, 2 ATM is exerted on the human body (PADI 1994). This makes breathing twice as hard for the diver, since the air in the body is condensed. This is also true of artifacts. The air enclosed in the pores of low-fired ceramics or bone will condense, possibly causing the object to break or warp. Once an object is safely encased in sediment, it adjusts to the new amount of pressure. It will need to be discerned whether or not it is advisable to remove the object from this environment. Exposure to less pressure can force apart pores that have for so long been compacted to the point that the object may disintegrate. This was one major obstacle in the recovery of objects from the Titanic (Ballard 1987), researchers recovering the material simply took it up very slowly in a submersible pressure tank.

Very fragile artifacts must be left in situ if there is a remote chance that the artifact could fracture or break. For artifacts in this condition, photographic documentation will have to be sufficient. If it is determined that the artifact is indeed fragile, but its investigation will be of particular value, it can be removed encased in sediment at a very slow rate of ascension. Removal in sediment calls for plastic trays to transport the artifact; these trays catch sediment which supports the artifact more than the diver can. Organics, which have a fairly good chance of preservation if buried in sediment, must be removed very carefully. Generally, they must be removed using support from planking or plywood sheets. The contact points between the artifact and the support must be padded. This method requires two divers to swim the platform with the support and padding to the surface, and again, care must be taken to ascent slowly, to avoid warping and breaking

(Singley 1988). Fast ascension or inadequate protection in transit of the artifact can cause fractures and breakage that could be misinterpreted by a future researcher.

Another consideration, other than pressure, in the removal of artifacts is the difference in temperature at the bottom of the pool and at the surface. The deeper the water is, the cooler the temperature will be (PADI 1994). Colder temperatures cause materials to compact. If a quick ascension is done, this can result in a breakage or fracture of the artifact, especially if it is organic. This change in temperature is combated quite simply by a slow ascent. This allows for the artifact to adjust to the current temperature as the diver goes upward.

The simplest and most reliable way to remove artifacts from an underwater environment is with a mesh bag (Singley 1988). This is particularly useful in the recovery of mass objects or objects that do not require special protection, such as lithics. These can be used to transport items down to the floor, such as mapping and excavation tools, and for the recovery of artifacts. For large objects several other methods are available. One way to remove large objects from the pool floors is to employ lifting bags (Marx 1975). These bags range in size from those designed to lift individual ceramics to those designed to lift up to 200 pounds of weight. These are little more than lightweight plastic bags that have attachments that can be tied to an artifact or placed around the artifact, almost like a net. These bags are then inflated by the diver by placing his regulator into it and purging it, sending out a rush of air, which fills the balloon and it rises to the surface. These bags must be used carefully so as not to harm the artifact. The diver must be careful not to over-inflate the balloon, sending it too quickly to the surface and causing damage to the artifact. These are very useful when large objects must be lifted, and more than one can be combined to lift very heavy. They do require supervision, and this must be stressed above all else, the ascent must be carefully monitored for speed.

As mentioned earlier, vacuums are another tool used by many underwater archaeologists for the removal of sediment and small artifacts. This vacuum is operated by a pump located on the surface of a buoy with a mesh net to catch sediment and small artifacts. This is, in affect, screening the sediment. This is also a way that excess sediment can be removed from the site without it just settling in another place, as it does when the diver waves a fin or a hand to remove excess sediment. It has been discussed by Green (1990) that this is a decent way to take sediment samples; still, there are a few objections to this method. First, there is no way to communicate to the divers where the sample is coming from, therefore no provenience can be designated for the sediment samples. The other problem with this method is that small artifacts can be displaced or even broken by this action. These vacuums are very powerful; some can run at a depth of 50 feet, which translates as a lot of suction, and it pulls the artifacts up very quickly, further causing damage. The objects are then propelled into the air to land on a mesh net, where they are to be collected by an archaeologist running the pump. Also, the same problem of provenience is present with respect to artifacts. There is no way to ask the divers in which section they are holding the vacuum.

Also used on large-scale projects are lifts lowered from the surface to safely lift objects too heavy to be lifted by lifting bags or divers. Green (1990) goes into some detail about this. Most examples he provides are for the removal of large metal objects such as canons, anchors and other large features.

Conservation of Artifacts

Conservation should not only make the object aesthetically acceptable to further researchers but also structurally sound (Hamilton 1998a). Conservation should begin the minute the artifacts are removed from the aquatic environment. Freshwater conservation is generally simpler and more reliable than salt water conservation simply because freshwater does not have the chlorides that salt water does. Generally speaking, it is acceptable to allow inorganics to dry slowly once taken out of the aquatic environment. This must be done carefully, however. A representative sample should be allowed to dry out of direct sunlight; if cracking or frosting occurs, specimens should then be stored in filtered water with a neutral pH. Organics should be kept in water at all times until conservation procedures can begin (Singley 1988). Large objects, such as features, should be brought up intact, and no encrustation should be removed.

It is very important to keep the lab environment safe. For this reason, there should always be a minimum of two people in the lab at any one time. Also, no smoking, drinking or eating should be allowed in the lab. Protective clothing should also be worn when appropriate. In addition to these basic rules, any sort of treatment using large amounts of solvent or a long exposure time should be done outside and the technician performing the treatment should be dressed appropriately. All equipment should be turned off when the lab is not in use; the lab should be locked and the dispersal of its keys should be limited. Chemicals should be stored and disposed of properly.

Each of the categories of artifacts will be discussed separately. Throughout the descriptions of treatment methods, many references are made to various adhesives and consolidants. For a more thorough explanation of the various chemicals used, one should consult Singley (1988:90-97). This guide includes a list and description of all regents, solvents and resins that were used in the conservation of freshwater materials. This is a particularly useful guide because there are no references to the numerous solutions designed to remove chlorides that build up in artifacts from exposure to salt water. Also useful is Hamilton's 'Adhesives and Consolidants' (1998b). This is a list of all of the regents used for removal of stains and encrustation. The important thing to remember about this source is that it was written for salt water use. For this purpose, it is an excellent comparative model for salt and freshwater methods.

In general, laboratory conservation has four main steps. The first is storage prior to treatment. All artifacts should be kept in their aquatic environment, changed only to a filtered, fresh water. This water is tested daily for pH and chloride contamination. Only after there is no sign of contamination is treatment to begin. This is the second step, an evaluation of the conservation processes that should be used. Before treatment, every artifact should be photographed and described by the technician performing the conservation. This pre-treatment evaluation helps to decide which methods should be used, and which should not. The third step is cleaning. This must be done very carefully so as not to wash off paints or other remains that may be left intact on the object. Part of this is encrustation removal. All of this stain and encrustation removal must be done with an eye toward the preservation of the artifact. The final step is treatment to stabilize the object. During cleaning, some objects lose a large amount of internal integrity. For example, bone, if it is not consolidated after cleaning, will eventually crack and warp because all of the water has been removed from the cells, and has not been replaced by anything else. We use synthetic resins to strengthen and protect these artifacts for future researchers.

Ceramics

The first step in the consolidation of ceramics is washing. Sherds should be rinsed with tap water, then placed in distilled water overnight as a precaution against salt corrosion. After 24 hours, the water should be tested with a conductivity meter and a silver nitrate test to determine the amount of chloride contamination. If there is no contamination, the sherds may be removed and allowed to dry naturally out of direct sunlight and in a relative high humidity environment. If tests are positive for chloride contamination, the technician should continue soaking in deionized water that is changed daily until the results are negative (Singley 1988).

Ceramics should be washed in accordance to their firing temperatures. Terracottas and earthenwares should be placed in a five percent solution of tetrasodium of EDTA in distilled water. This should be followed by a washing in distilled water. This process will remove calcite which inevitably forms (Pearson 1988). Stonewares can be washed in a mild detergent, scrubbing the edges with the surface of a soft brush (Hamilton 1998c). Although this type of ceramic may be much better preserved, the technician must take care not to remove traces of food, paint pigments or soot left on the vessel.

An interesting new technique has developed in the past ten years as a reliable and non-time consuming technique of washing large amounts of organics. Neumann and Sanford (1998) have conducted a number of experiments with sodium (hexa)metaphosphate, available commercially in the name of Calgon. This method was found to be time efficient when 21 or more sherds are washed simultaneously. The process is very simple: it starts with a solution of 40 g of Calgon liter per liter of distilled water. The artifacts are then allowed to soak in the solution for up to 12 hours. One of the benefits of this cleaning method is that Neumann and Sanford may have developed a way to counteract that effect of submergence (1998). Ware and Rayle (1981) found that the clay body of the ceramic was markedly softened by exposure to water. Since this method not only safely cleans artifacts, but also increases their structural integrity as well, this will be an invaluable method. This is an ionic detergent, and therefore, when non-ionic detergent need to be used, this method will not work.

The next step is to remove stains without endangering the integrity of the ceramic. Some of the agents used to remove stains can chemically change the fabric or glaze of the ceramic, causing misinterpretations. However, these regents are also highly effective in stain removal, so only some sherds are cleaned in order to leave a large enough sample to keep information that could be lost through exposure to these chemicals. These agents are oxalic acid, which will attack iron in earthenwares, and EDTA, which will dissolve carbonate tempers. Oxalic acid is used to remove iron stains; to do this, a five to ten percent solution of oxalic acid is applied using cotton wool packs, after which sherds are tented under plastic to allow slow evaporative drying. A ten to fifteen percent solution of hydrogen peroxide applied in the same manner will also remove inorganic stains. Organic stains will turn a ceramic black; these can be removed with a ten to fifteen percent solution of hydrogen peroxide applied in the manner described above. If extensive organic or inorganic staining is present, the ceramic can be treated by total immersion in the above mentioned solutions for up to three days. During immersion, it is important to watch for hydrogen peroxide bubbling, that can cause already loose glaze to come free. After all treatment, ceramics should be rinsed for two days in baths of distilled water changed daily. On-site storage is not difficult. The ceramics should remain in distilled water baths that are changed daily until they can be properly dried. This drying procedure is simple. The ceramics are placed in a bath of distilled water with a relatively low percentage of alcohol in it; this percentage is increased daily to a point where the majority of the solution is alcohol. The ceramics are then allowed to dry. The use of the alcohol allows for a chemical drying of the interior pores, which prevents warping.

Wood

The goal in the conservation of wooden artifacts is to replace the water in the wood with a bulking agent. After rinsing in the distilled water, the wood is treated with polyethylene glycol (PEG), a water soluble agent applied by soaking, spraying or brushing. They are then rinsed yet again, and allowed to slowly dry.

Lithics

Because when fired, ceramics become a form of stone, the same conservation procedures are used for both.

Bone

Bone is a very porous and fragile substance and must be handled accordingly. From the moment of removal from the archaeological record, the bone should be kept saturated, and only in a laboratory environment should stabilization procedures be undertaken. If bone is in good condition, it can be washed with a soft brush and a drop or two of non-ionic detergent. Aside from washing with soap and water, alcohol can be used to facilitate drying. When washing bone in water, the amount of time the bone actually spends submerged should be limited. Any encrustation can be removed by brushing lightly with a brush and/or lightly scraping with wooden, plastic or metal tools.

Because bone is porous, it has a tendency to stain. These stains fall into organic and inorganic categories. Organic stains may be removed with a five to ten percent solution of hydrogen peroxide applied by cotton wool packs. Inorganic or metallic stains may be removed by applying a five to ten percent solution of EDTA. After this application, the material should be rinsed in deionized water for two to three days (Singley 1988).

Drying methods vary by researcher. Stone et al. (1990) allowed bone samples to slowly dry, in a high relative humidity environment. However, bones experienced warping, splitting, cracking, and exfoliation of outer layers with this method. Singley (1988) prefers a slow drying method of sequential baths of deionized water and acetone. The method takes four hours: the first hour the bone is in a solution that is 75 percent water and 25 percent acetone. The second hour is spent in a 50 percent water, 50 percent acetone solution. For the third hour, the solution changes to 25 percent water, 75 percent acetone. Finally, the fourth hour is spent in a 100% acetone solution. The acetone simply evaporates, allowing for later consolidation.

One way to replace the now empty cells in the bone with a substance to stabilize it is to apply polyvinyl acetate resin. For this method to be effective, the bone must be completely dry. With polyvinyl acetate emulsions, the effects become irreversible in a short time (Stone et al. 1990; Brown 1974; Joukowsky 1980; Snow and Weisser 1984).

These emulsions have also been shown to be susceptible to mold growth. They can also penetrate very poorly, protecting only the outer layers, allowing for the deterioration of the inner layers (Stone et al. 1990; Brown 1974; Koob 1984; Storch 1983).

Another stabilizing agent is polyethylene glycol (PEG). Long term effects on structural stability are not known at this time, thus this method should be used with the backup of a selective sample treated, and one not treated. Total immersion into a PEG solution is more desirable than simple application by brush or cotton wool pack. Acrylic Emulsions can be added to the bone when wet, or not completely dry (Stone et al. 1990; Brown 1974). This may be useful, since, splitting and warping occur when the bone is allowed to dry without treatment. A 30-50% solution should be applied either by brushing or immulsion to the bone.

Consolidation is one of the last steps before storage. Resin solutions must be diluted to decrease the viscosity, thus increasing the ability of the resin to penetrate material being treated (Hamilton 1998d). An excellent resin for use on faunal bone is Elmer's Glue All (Hamilton 1998b). It is applied by brush. The application process is such that one coat is applied, then the bone is allowed to dry. When dry, another coat of the resin is applied, and this is allowed to dry, and so on. This version works well, but total immersion works better. Whatever resin or method of application is used, for reconstruction or gluing the same resin should be used. The mixture is less diluted when used as a glue. Again, Elmer's Glue All is acceptable for this purpose.

Cara Blanca: Results from the 1998 VOPA season

The site of Cara Blanca was a major focus of the 1998 VOPA field season. The site was further mapped and investigated both terrestrially and underwater. The purpose of this research was to ascertain if cosmological factors were of an important influence in the choice to build the settlement in an agriculturally deficient area. According to Fedick (1996), the area in question is inadequate for farming unless reclamation and conservation techniques are employed (see also Lucero 1997). The site has certain elements that are known to have ideological significance: 1) the presence of a structure at the edge of the pool; 2) numerous possible cave openings; and 3) the presence of waterlilies in adjoining pools, indicating shallow, clean water; waterlilies are also found in Maya iconography associated with standing bodies of water, as well as Maya rulership.

Mapping techniques tested in the indoor pool at the NMSU Natatorium were used to determine the presence or absence of ritual objects, and to help retrieve and conserve them if present. Equipment used included Seaquest brand SCUBA equipment (including fins and masks), a Pelican Flashlight (this flashlight was too small to be of much use), a Reefmaster underwater camera that required no special film, basic plastic clipboards with graphite pencils tied to them, and DURAPAPER (water-safe paper that can be printed with a grid to facilitate underwater mapping). One of John Carr's employees, Antonio Martinez, was floating in the pool on an inner tube, holding a guide rope for us on our first dive. This rope had a length of 30 meters, knotted every three meters. This proved to be more of an impediment than an asset, and was not used on the second dive. More specific information about these dives can be found in the following table:

Diving at Cara Blanca: 9 June 98

	Dive 1	**Dive 2**
Beginning Time	12:28 p.m.	3:46 p.m.
Total Bottom	20 minutes	25 minutes
Time	60 ft (20 m)	40 ft (13.3m)
Maximum Depth	Kinkella* 1400	Kinkella* 1650
PSI Used	Osterholtz* 1000	Osterholtz* 1150
	12:46 p.m.	4:14 p.m.
End Time		

* tanks switched between dives since Osterholtz used less PSI than Kinkella during the first dive

Exploration at the pool we labeled as Pool 1 was a two-stage process. Due to bad roads and the near absence of trails, any exploration needed to be planned ahead of time. The first of our visits to Cara Blanca was an exploratory and planning mission. Pool 2 was discovered to the west of Pool 1. Pool 1 was also investigated further. Andrew Kinkella took depth measurements from different points in Pool 1 by tying a large plumb bob to the end of a 50 meter nylon tape and swimming out to various points in the pool. Depths ranged from 17.4 meters approximately 20 meters from the edge of Structure 1 to 39.3 meters at roughly the center of the pool to 26.9 meters about 75 meters from Structure 1.

We had decided to limit the dives to 20 minutes each, with a maximum depth of 60 feet. This meant that according to the depth readings by Kinkella done on the first excursion, we would need to stay along the shelf which we felt lay around the pool before dropping to the pools maximum depth in the center. Cara Blanca measures approximately 100 meters in length (east-west) and approximately 61 meters wide (north-south). We located our best dive 'platform' on the south side and began the first dive at approximately 12:30 p.m. (Figure 1). A guideline had been cut for us to make descent easier, and we followed this down to our predetermined maximum depth of 60 feet. Visibility was very poor, less than 10 feet, and the water was a cloudy yellow-orange color. From our dive platform, we headed roughly southwest until finding the shelf that runs along the pool. Staying close to this shelf we began to slowly ascend following a white path that was very distinctive from the rest of the rock face underwater. As we neared the surface, we discovered that this white path led from a looter's trench, and probably marked their method of removing the soil and superfluous artifacts from the trench. Two sherds were collected from this path, although they probably do not represent ritual disposal into the pool; they were probably just discarded from the looter's trench. We were able to tentatively date one of the sherds to the Middle Preclassic (900-250 B.C.) (Figure 2). Our total bottom time for Dive 1 was 20 minutes.

Dive two began at 3:46 p.m., when we began from the dive platform and headed west then north toward the cliff, which appears on the north side of the pool. The purpose of this dive was to determine the extent of the shelf that we discovered on Dive 1 to be about 40 feet in depth. However, in attempting to follow this shelf, we got tangled up in a clump of trees, on which the algae made poor visibility even worse. Upon finding these trees, we doubled back and followed the shelf the other way. As pointed out earlier, everything was covered in a thick layer of dark algae, which with the flip of a fin detached from the rock to show the surface. The surface of this rock was weathered, suggesting that water levels have in the past been significantly different. Total bottom time for Dive 2 was 25 minutes. Nothing was collected from this dive.

The conclusion that I draw from this summer's research is that a lack of evidence does not indicate a lack of information. There are several reasons for coming to this conclusion: 1) the pool was much deeper than first thought, it is entirely possible for cultural objects to have fallen down the inwardly sloping walls of the pool to a reserve in the center; 2) due to the extreme depth of the pool, we could not investigate this using standard SCUBA equipment (A special type of SCUBA is required for depths this deep, and special certification and equipment is necessary for NITROX diving, where the diver breathes enriched Nitrogen as a way of staying down longer); and 3) we were very limited in the scope of our investigation due to the remoteness of the location; if there had been any kind of diving accident, we had a two mile hike and then a three hour tractor ride to the nearest village, we knew that we had to be careful. For this reason, we padded the PADI dive table times and had longer intervals between dives, just to be on the safe side.

In the future, for further underwater research to be conducted, NITROX divers need to be brought in to probe the depths near the center. Also, the water will need to be tested to determine its chemical makeup in order to facilitate conservation if any artifacts are recovered. I suspect that there is something interesting about the water chemistry, due to the little aquatic life in the pool. Only near the surface did we see any fish, and they were very small. At the depth of approximately five to ten feet, the fish disappeared. There is much to be learned from this pool and others like it about Maya settlement patterns. The Maya, like all civilizations, were dependent upon the quality of the soil around them. So why did they build in places like this one, with little appeal for agriculture? The common denominator in settlements such as these is the presence of a water source. Investigating these water sources will help us to understand the Maya reasons for settlement in such areas.

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