

Results of the 2017 Valley of Peace Archaeology Project: Exploring Cara Blanca Pools 22, 23 and 25

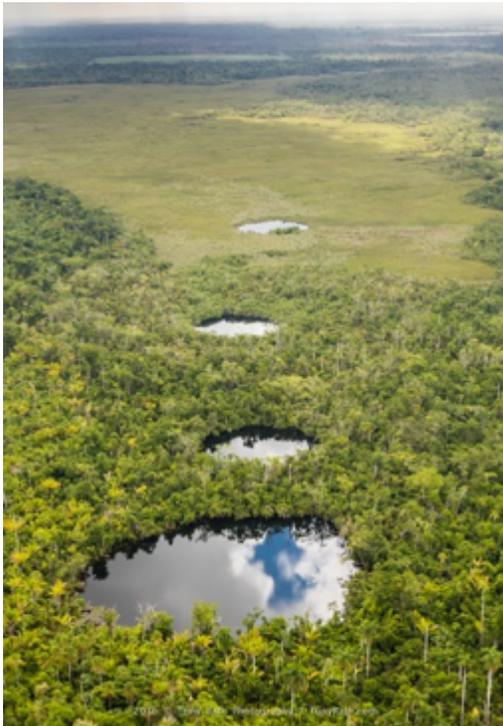
Report submitted to the Institute of Archaeology
National Institute of Culture and History
Government of Belize

Permit IA/H/2/1/17(06)
Accession no. 10392

Jean T. Larmon and Aimée E. Carbaugh
University of Illinois at Urbana-Champaign

Introductory Remarks, by Lisa J. Lucero (PI)

Permission was granted to the Valley of Peace Archaeology (VOPA) by the Belize Institute of Archaeology to survey the final three unexplored Cara Blanca pools, Pools 22, 23 and 25. The short 2017 season was funded by a University of Illinois at Urbana-Champaign (UIUC) Center for Latin American and Caribbean Studies grant to Lucero, a UIUC Anthropology Department Travel Grant to Larmon, and a donation from Forestland, who own Yalbac Ranch. Crew included UIUC PhD students Jean T. Larmon and Aimée E. Carbaugh, as well as foreman Cleofo Choc and field assistants from the Valley of Peace Village, Stanley Choc, Antonio Luna, Carlos Vasquez, and Marcial Arteaga. Photographer Tony Rath also played a major role in our explorations, and his assistance was invaluable. Yalbac Ranch, as always, supported this project and provided permission and logistical support.



2017 Season

During the brief 2017 summer field season (June 15-June 26), the VOPA project, led by Dr. Lisa Lucero (UIUC), explored the final three pools of Cara Blanca, Belize (Figure 1). Prior to the 2017 season, the final three pools—Pools 22, 23, and 25 (Table 1)—had not yet been visited by a VOPA team member, mostly due to the difficult terrain surrounding the pools. Between 1999-2014, Andrew Kinkella surveyed 22 of the 25 pools, but was unable to reach the final three because the surrounding areas were completely inundated. Yet, they represent the eastern extent of Cara Blanca and their exploration was essential for broader VOPA goals of exploring Cara Blanca as a pilgrimage destination. Armed with a compass, map, GPS unit, and DJI Phantom 3D Professional drone, we set off into the jungle of Cara Blanca.

Figure 1. Pools 21, 22, 23, and 25, looking east. Photo by Tony Rath.

Table 1. Final three pools (22, 23, 25) and Pool 21 dimensions

Pool	Diameter (m)	Depth (m)
21	c. 60 x 60	c. 13
22	c. 30 x 30	c. 6
23	c. 30 x 30	c. 11.3
25	c. 25 x 25	c. 9-10

Cara Blanca in central Belize is a system of 25 pools, both shallow lakes and *cenotes*, steep sided water filled sinkholes (Figure 2). These pools line the base of a steep limestone cliff, which rises up 100 m above the pools. The blue, sometimes muddied waters stand in stark contrast to the white limestone cliff and the dense primary and secondary jungle vegetation. Each pool is unique, with the *cenotes* ranging from 5-60 meters deep and the lakes from 2-18 meters. The western-most pools, 7, 8, and 9, are lakes and have settlement on their south sides. The central pools, 1-5, which are all *cenotes*, have a noticeable dearth of residential settlement and instead are associated with hypothesized ceremonial structures. The clear juxtaposition of pool use, particularly the lack of residential structures near the *cenotes*, which would have retained water regardless of drought conditions, suggests a specialized use of the *cenotes*. It was only when the Maya experienced several prolonged droughts c. 800-900 CE (Medina-Elizalde et al. 2010) that they built anything of a substantial nature in these previously ‘untouched’ areas near the central pools, constructing what we argue might be pilgrimage destinations (Lucero et al. 2016).

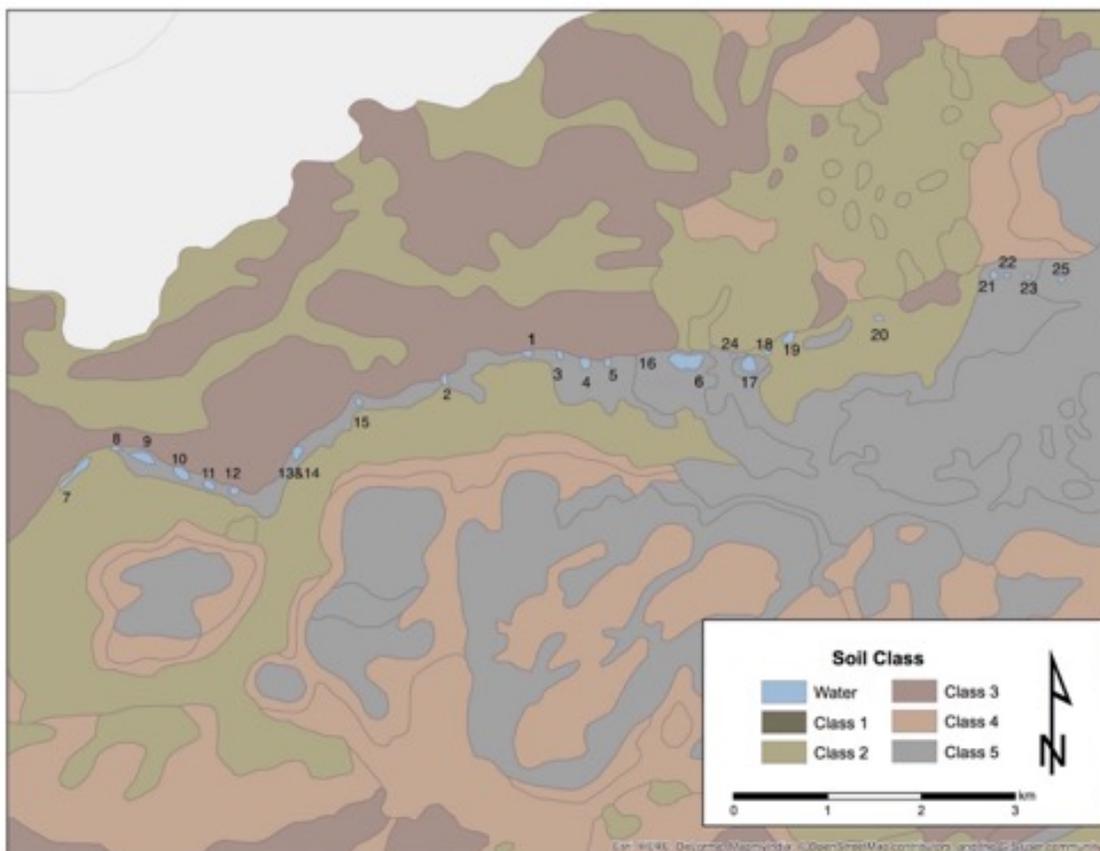


Figure 2. The 25 pools of Cara Blanca.

Lucero and colleagues have hypothesized that these pools were part of a ceremonial circuit, accessed by Maya during the late Late (700-800 CE) and Terminal Classic (800-950 CE) periods (Lucero and Kinkella 2015). The importance of surveying the final three Cara Blanca pools lies in both completing

the survey of the Cara Blanca area, as well as collecting further data to inform our hypothesis. Here, we present the results of the 2017 survey, offering insight into the significance of the Cara Blanca space.

The possibility of Cara Blanca having been part of a ceremonial circuit is indicated by the synchronic distinction of residential and ceremonial spaces by their isolation from residential areas (Lucero et al. 2016). In this case, both the built and unbuilt spaces are essential – the affect of the spaces between pools and the paths walked served to connect the constructed spaces, tying together “anthropogenic” and “natural” spaces in a way that deconstructs the dichotomy between the two. Traditionally, the Maya walk ceremonial circuits to reaffirm their relationship with and to sacred, forested places (e.g. Vogt 1969:144, 149, 390). As community members, or perhaps members of multiple residential communities, processed through the Cara Blanca space, they might have followed the path of the sun, from east-to-west (Ashmore 2009; Astor-Aguilera 2010:131-143). Based upon ceramic chronologies from structures, the Cara Blanca space was visited most formally during the late Late and Terminal Classic period (Kosakowsky 2017). As several, prolonged and severe droughts struck the region and political turmoil encouraged people to migrate out of centers to the hinterlands, the Cara Blanca circuit was formalized, with the construction of ritual structures (Larmon and Nissen 2015; Lucero and Kinkella 2015, Lucero et al. 2016; Larmon 2017; Larmon and Amin 2017). The eastern pools might have served a pivotal role in the Cara Blanca circuit, perhaps acting as a point of fruition for those taking part in the processions.

2017 Survey: The Final Three Pools

If Cara Blanca served as a ceremonial circuit, each *cenote* along its path could have served as the focal point for the performance of water related and other ceremonies (see Figure 1). From 1998 through 2014, Andrew Kinkella (2008; 2009; 2015) conducted an extensive and thorough survey of the Cara Blanca area, identifying the 25 pools and areas that were in need of further study. Though Kinkella had been able to reach 22 of the Cara Blanca pools, time constraints and survey conditions to the final three were particularly strenuous because of the swampy conditions, a prevalence of Black Poisonwood trees, and various hazards that accompany swampy jungle conditions. Pool 21, the last pool reached by Kinkella, lies at the western-most edge of the swamp. He had attempted the survey from the east (Figure 3), choosing the shortest path from the Yalbac road. In order to avoid some of the issues that he ran into, he suggested that we try to approach the pools from the north. Oriented using a GPS point taken by Kinkella on the western edge of Pool 21, the last known point of his 2014 survey, our team began the trek to Pool 21.

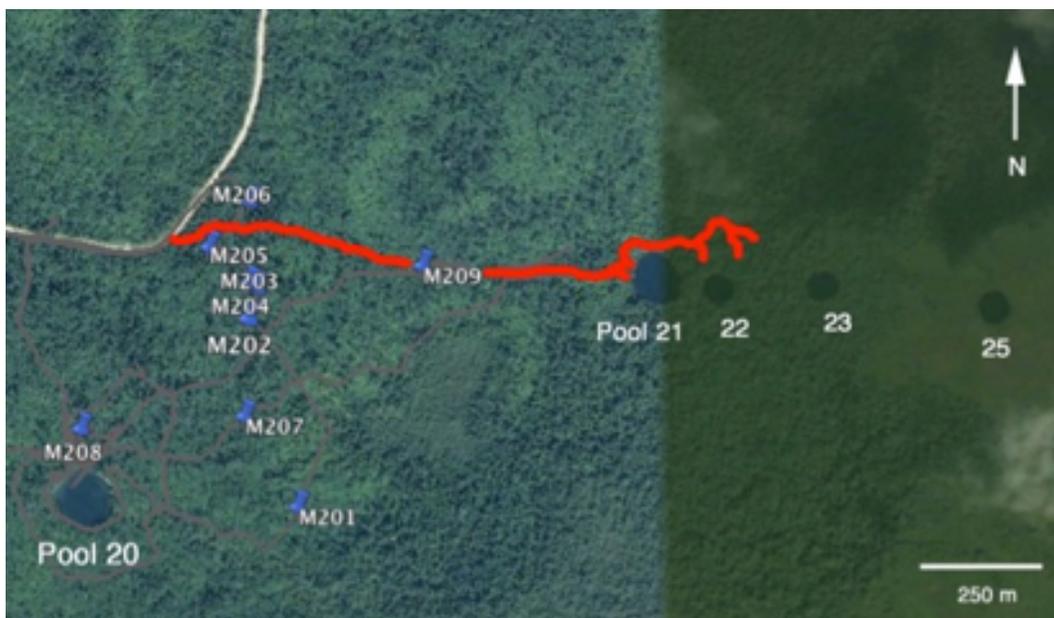


Figure 3. Andrew Kinkella’s 2014 survey route (Kinkella 2014:150)

From there, we would move east-ward to Pools 22, 23, and 25 (Table 2). Our exploration began by cutting our way south from an overgrown side road off of the main Yalbac road, oriented just west of south (Figure 4). Figure 5 shows our attempted path to each pool; we marked our path and entry points with pink flagging tape (Figure 6).

Table 2. All GPS points taken during the 2017 field season. * All points taken in NAD27 CONUS.

Point Title	GPS Data	Description
NORTHWEST CORNER POOL 21	16Q 0305890 E 1928694 N	NW side of Pool 21
ORANGE TAPE	16Q 0306079 E 1928307 N	Orange flagging tape on route to Pool 21
POOL 23 WEST	16Q 0306299 E 1927775 N	On the W edge of Pool 23
PATH N OF POOL 22	16Q 0306270 E 1927807 N	Entrance of path taken to get N of Pool 22 to Pool 23
E SIDE OF POOL 22	16Q 0306140 E 1927806 N	East side of Pool 22
WEST SIDE OF POOL 22	16Q 0306076 E 1927787 N	West side of Pool 22, marked with pink flagging tape
EDGE OF WETLAND	16Q 0306249 E 1927877 N	Where we hit dry land NW of Pool 23
PATH TO POOL 22	16Q 0305950 E 1927876 N	Entrance to path from Pool 21 to Pool 22
PATH INTERSECTION	16Q 0306112 E 1928189 N	Where our path from Pool 23 and to Pool 21 intersect/merge
POOL 25 NW CORNER	16Q 0306685 E 1927767 N	NW corner of Pool 25
POOL 15 PATH ENTRY	16Q 0299301 E 1926981 N	Where the path we took (that failed) to Pool 15 left the side road
PATH TO SINKHOLE	16Q 0306061 E 1928349 N	Where path to sinkhole (Pool 26) diverges from path to Pool 21
POOL 26 NE CORNER	16Q 0305905 E 1928402 N	NE side of Pool 26 (also called "sinkhole" in notes)



Figure 4. The Yalbac road from which we began the survey.



Figure 5. Entrance point to survey, marked with pink tape.

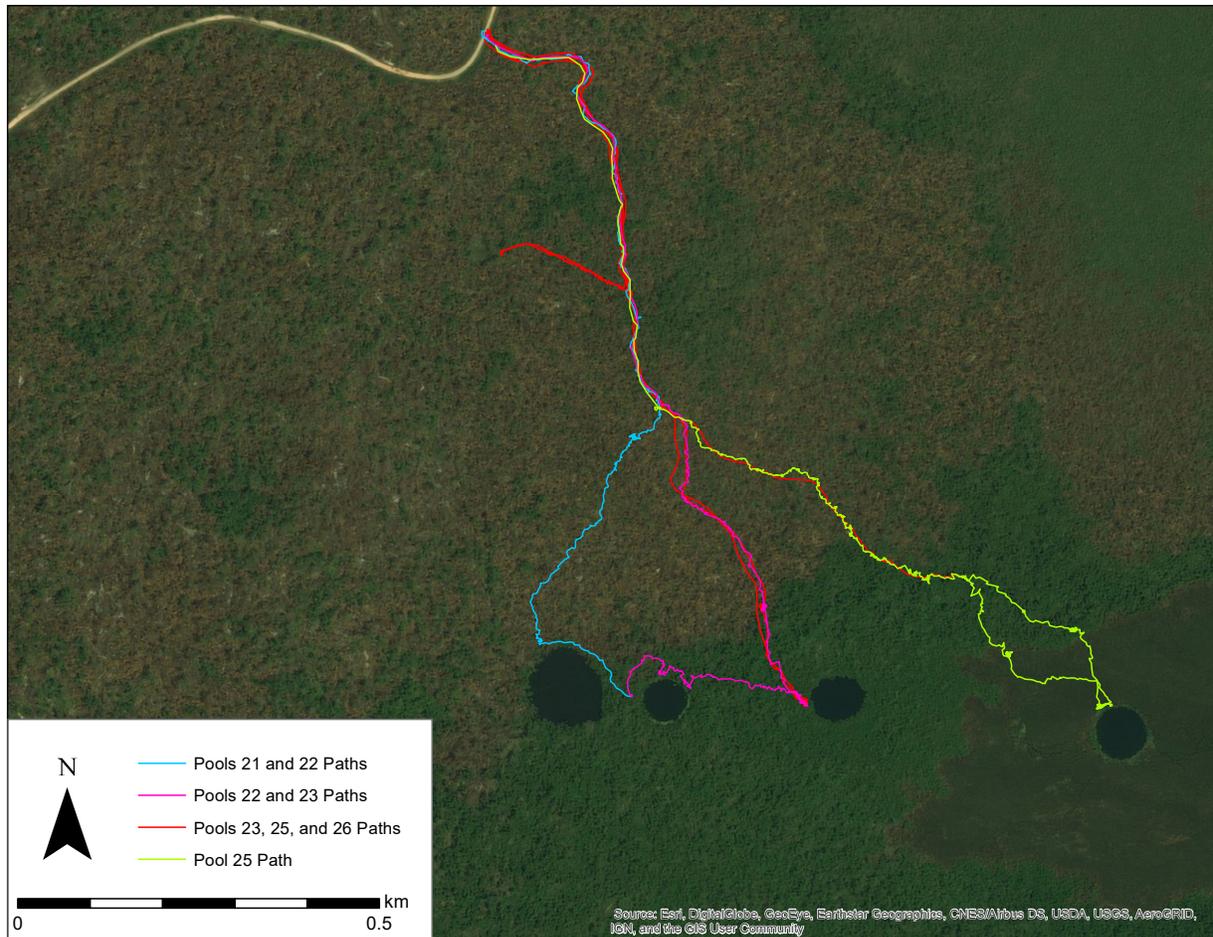


Figure 6. 2017 survey routes.

Pool 21 (Figure 7) is approximately 0.8 km from our starting point. We made it to our first destination in about 4 hours. Though Andrew had made it here in 2014, an underwater survey had not yet been conducted. Tony, Stanley and Jeannie hopped in the pool to do an informal survey with snorkel gear and obtain a depth. Pool 21 is approximately 60x60 m and 13 meters deep, measured with a diving weight tied to the end of a 50 m measuring tape (Figure 8). The pool was muddied by the recent rains, but swimming around the edge of the pool we noted an outflow on the east side. It was clear that this led to Pool 22 (Figure 9), which is just c. 100 m to the east. There was a strong current in the output and Unionidae clams lined the bottom. We noted large, c. 2 foot-long Tilapia and Tony saw a large turtle, as well as water lilies and a number of other unidentified fish, all indicating that the pool is biologically diverse.

Our next goal was to cut paths to Pools 22 and 23 to make later access much easier. Our original hope was to survey around each of the pools to identify any possible structures. Unfortunately, just east of Pool 21, the area was completely inundated (Figure 10), making both survey and access to the eastern pools very difficult. Though both pools were relatively close (Pool 22 just c. 100 m from Pool 21 and Pool 23 c. 200 m beyond Pool 22) it took us a full day to reach them. The pools are surrounded by swampy conditions and, interestingly, there is a thick red mangrove forest surrounding Pool 23 (Figure 11). We were wading through waist deep waters for the majority of the day, making it impossible to identify any additional structures.



Figure 7. Pool 21



Figure 8. Jeannie Larmon entering the pool with her measuring tape.



Figure 9. Pools 21 and 22



Figure 10. Carlos Vasquez in the jungle swamp. Photo by Tony Rath.



Figure 11. Pool 23

Another full day of survey was spent returning to Pools 22 and 23 to conduct preliminary informal underwater survey. Because of the conditions surrounding the pools, it was difficult to get adequate photos. Instead, we sent up the drone to get some aerial images (Figure 12). We used a Phantom 3D Professional drone often during survey to orient ourselves to the pools for which we had no GPS points. Using a rough compass orientation and the drone, we took off for Pool 22. Pool 22 is smaller than Pool 21, at approximately 30x30 m in diameter. Using a diving weight tied to a tape measure, we recorded a depth of just 6 m. We found the input from Pool 21 on the west side of Pool 22 and, again, found that the bottom was lined with clams. The presence of these clams in this abundance is unique to this area, though some were noted in other pools to a lesser extent. Amazingly, the current of this input was so strong that it was nearly impossible to swim against.



Figure 12. Aimée Carabaugh and Jeannie Larmon using the drone. Photo by Tony Rath.

Accessing Pool 23 presented additional challenges. As we approached the pool, for perhaps the last 100 m, we were in a red mangrove forest. Getting ready to swim the pools could only be done by finding any bit of dry land on which to change and crawling over the mangroves. Pool 23 is 11.2 m deep and, again, c. 30x30 m. Visibility in both pools was poor.

The last pool that we intended to visit was Pool 25 (Figure 13), the eastern most in the Cara Blanca system. This pool, c. 400 m east of Pool 23, ended up being the most difficult to access. We started our survey from the same place on the Yalbac road and branched off from the trail we had cut to Pool 21 in a roughly southeasterly direction. Based on aerial images, we planned to hit an “open” area c. 200 m from Pool 25. Our drone flights the previous days had shown us that the expansive grasslands that encompass Pool 25 had been recently burned, except for a strip along the edge of the forest. The burning around Pool 25 was caused by arson—poachers coming into the area at night and advertently or inadvertently setting fire to the property.



Figure 13. Pool 25 looking southeast

We expected to hit this “open” grassland and burned landscape and be able to see the pool. Instead, the “opening” that we had seen in the aerial images was cutting grass that rose well over our heads, the densest vegetation that we had encountered yet (Figure 14). In addition, the ground was completely inundated and deep unseen watery holes often caught us unawares, making traversing the area difficult. Unable to see the pool through the tall cutting grass, we again used the drone to reorient ourselves, cutting small clearings and sending it up above the grass line. Finally, we reached Pool 25, nearly walking right past it as we focused on navigating the burnt cutting grass and thigh deep waters. This pool is smaller, c. 25x25 m and 9-10 m deep. Our changing station for the snorkeling was constructed out of a bed of reeds and leaves on top of the dense, swampy waters (Figure 15). The biodiversity here is similar to the other pools. There was an input on the west side of the pool, likely connecting Pool 25 and 23. But, again, the area in between these two pools was completely inundated. There are pockets of incredibly cold water in Pool 25, which we did note in Pool 23 but to a much lesser extent. The cold water might suggest that there are springs or upwellings in the bottom of the pool funneling in ground water.



Figure 14. Aimée Carbaugh standing in the cutting grass surrounding Pool 25.



Figure 15. Carlos Vasquez helping Jeannie Larmon get ready to swim Pool 25

Ultimately, we did not note any additional Maya settlement with this survey, but this would have been near impossible given the field conditions. In order to better understand how these pools are interwoven in Cara Blanca's history, we need to assess their condition in the dry season. We can, however, attest to their resource richness and their magnetic qualities, the perfectly round pools that might have been tucked away in dense and harsh vegetation—a sort of haven.

Diversity

Dr. Ed Boles, an Aquatic ecologist and environmental consultant for various Belizean institutions (Belize Center for Environmental Studies, Belize Audubon Society, Belize Electric Company, Belize Department of the Environment, United Nations Development Programme, The Nature Conservancy, University of Belize, CATIE), accompanied us for the Pool 22 and 23 surveys and he was able to provide us with an assessment of the biodiversity within the pools. As he mentioned in a personal communication (email, 6/23/3017, these pools are particularly interesting for a number of reasons. The presence of red mangroves inland suggests that these pools could be remnants of a time when the sea level was much higher—mangroves are tolerant to salt and mineral-rich water. The fact that these stands survived in isolation suggests that the pools are heavily fed by groundwater that is rich in minerals, further evidenced by the presence of tufa in Pools 22 and 23, and iron oxide coatings on clam shells, tufa, etc. Both pools had water lilies, which act as ecosystem engineers, providing habitat quality control and funnel oxygen from the atmosphere into the sediments. He also noted that the pools had abundant amounts of wood (often as whole trees) that have likely been deposited by hurricanes over the years. The trees had “a thick, dense layer of periphyton (algae, fungi, bacteria, cyanobacteria, protozoans, microinvertebrates) that represent a production system.” In his preliminary survey of these two pools, Ed noted a number of species of fish, crabs, and clams (Table 3). We also noted turtles and crocodiles. His survey highlights the resource richness of these pools.

While Ed was visiting, we also revisited Pool 6 so the he and Tony Rath could get a sense of its biodiversity for comparison. His notes on the diversity are in the table below. It is important to note that

when we reached Pool 6, the “put-in” area was almost unrecognizable, due to the rainy season having started. Vegetation was significantly higher than the previous year (1-2 meters above my head) and the area leading up to the dock was completely inundated. The dock was submerged but still accessible and functional.

Pool 26

We noted an additional pool while flying our drone over the eastern pools. At first we believed it to be a sinkhole, but the presence of water indicated otherwise. This new pool is nearly directly in-between the Yalbac road and Pool 21 (Figure 16). On 23 June, we started down the path to Pool 21, using the drone intermittently to fix our positioning along the route. When we were parallel with the unidentified pool, we cut west c. 200 m, which brought us to the potential Pool 26 (Figure 17). It looked quite shallow, but could be perennial. Upon arrival we immediately noted two large crocodiles in the very muddy water, so did not do any snorkeling or circumnavigate the pool. This pool will be worth visiting in drier conditions to determine its seasonality.

Also on 23 June, we attempted to revisit Pool 16 (Figure 18) and Pool 1 (Figure 19). The path to Pool 16 was too obscured to reach the pool, but we were able to send the drone up to get images. We did reach and check on Pool 1. Though the road was not in good condition and there were trees down the entire way, we reached the pool and structures. The area was relatively unchanged from when we were there during the dry season in 2016 and less inundated than expected.

Table 3. Biodiversity table constructed by Dr. Ed Boles.

Taxa	Pool 6	Pool 22	Pool 23
Pesudothalpusidae (Crab)		X	X
Charicidae			
Central Tetra (<i>Astyanax aeneux</i>)	X	X	X
Mayan Tetra (<i>Hyphessobrycon compressus</i>)			X
Poeciliidae			
Mosquito fishes (<i>Gambusia</i> sp?)	X		X
Mollies (<i>Poecilia</i> sp.)			X
Cichlidae			
Northern Checkmark Cichlid (<i>Cichlasoma intermedium</i>)			X
Redhead Cichlid (<i>Cichlasoma synspilum</i>)		X	X
Mayan Cichlid (<i>Cichlasoma urophthalmus</i>)			X
Bay Snook (red phase) (<i>Pentenia splendida</i>)			X
PLANTS			
Cabombaceae			
Fish Weed (<i>Cabomba palaeformis?</i>)	X	X	X
Nymphaeaceae			
White Lily (<i>Nymphaea ampla</i>)	X	X	X
Lentibulariaceae			
Bladderwort (<i>Utricularia</i> sp.)	X	X	X
Cyperaceae			
Jointed Flatsedge (<i>Cyperus articulatus</i>)	X		



Figure 16. Pool 26 with the eastern-most pools in the background looking southeast



Figure 17. Pool 26



Figure 18. Pool 16



Figure 19. Pool 1

Pool 15

On our final day in the field (26 June), we attempted to revisit Pool 15 and associated caves. Kinkella had previously identified three caves just 500 m northwest of Pool 15. These caves are small and were used for rituals indicated by the Terminal Classic (c. 800-900 CE) jar sherds recovered. In addition, Kinkella noted on the escarpment above Pools 14 and 15 that the Maya built seven structures, a possible water shrine (Kinkella 2009:138-142). During a 2016 fly over, Tony Rath noted an additional, large cave that sits just below the lookout with the water shrine and above Pool 15 (Figure 20). There is a chance that the large cave extends down into the pool, though this is speculative. Unfortunately, we choose the wrong route to access the cave (Figure 21). Though we were able to access a road that brought us south to just 0.6 km from the cave, we ended up traversing the escarpment to the east of the cave and about 200 m out hit the escarpment's steep edge which we could not descend safely and had to turn back. While we did not reach the cave, but we did come up with a better access point for future exploration.



Figure 20. Pool 15, the cliff face, and the cave above the pool.

The Pool 15 area could provide important insights regarding the presence and use of ceremonial circuits in the Cara Blanca region. As Reese-Taylor (2002:159-163) mentions, one of the most common ethnographic ritual circulations is from the base to the summit of a mountain, through which participants are considered to be uniting the three worlds: the underworld (from the cenote), the human world (from the surface of the water up the cliff, perhaps through the cave), and the heavens (on the hill-top shrine). Pool 15 might represent an ancient example of this contemporary ritual.

In a future field season, it would be worth following the drainage ditch down to Pool 15 or walking over from Pool 2. From there, it might be possible to explore the large cave and move up to the hilltop shrine. Otherwise, it will be easiest to approach the water shrine from the west, the path of least resistance.



Figure 21. Survey route to try to access Pool 15.

Note on Poachers

On two occasions during this field season, we ran into Mike Green, a security official for Yalbac Ranch. In a personal communication (email, 25 June 2017), Green emphasized the increasing impact of the development and clearing of the Yalbac land for agriculture; he has conducted impact assessments of erosion and chemical runoff. Though our focus has primarily been on environmental concerns, it is incredibly important to note that the continued clearing of the land makes access for trespassers, wildlife poachers, and looters much easier. Though they have been able to keep trespassers away from the pools up to this point, there is a continued threat. Green noted that on nearly a nightly basis, he confronts groups of “spotlighters” attempting to enter the property. He notes that both he and Yalbac Ranch are “committed to protecting the cultural and natural resources of the Cara Blanca Valley and we will continue to do so” and hopes that there can be future collaboration with the government of Belize to that end.

Collection Registration

From August 12 through August 26, 2017, Jean Larmon returned to Belize and Banana Bank Lodge in order to begin the registration of the artifact collection being housed at the lodge. With the help of the Institute of Archaeology (IA) and in collaboration with John, Carolyn, and Leisa Carr, Larmon registered 162 artifacts at Banana Bank. Her registration process consisted of photographing each artifact from different angles, measuring relevant attributes, and describing each artifact. In addition, she photographed all of the artifacts from the Smith collection that have been housed at Banana Bank Lodge for a number of years. All photographs and description cards were turned over to the IA. Though much progress was made, there is still much to be done. In the coming years, VOPA will hopefully continue to work towards registering the entire Banana Bank Collection.

Conclusions

Though we did not come upon additional Maya structures that can inform us directly of how Maya were interacting with the final three pools at Cara Blanca, the material recovered from other pools, particularly from Pool 1 and the potential for ambulatory use at Pool 15, suggest that Cara Blanca served

as an active circuit. If this is the case, and visitors to the space followed ethnographic examples (from east-to-west), then the three most easterly pools would likely have been the beginning of a ceremonial journey, with the trials of traversing the spaces between constructed features contributing to the significance of the experience. Whether the space served as a cohesive circuit, each pool impacting the way another is experienced, or each pool and path was accessed separately and for distinct reasons, the weight of the journey resided in the process and nature of the mutually experienced human and environment interaction.

References Cited

Ashmore, Wendy

2009 Mesoamerican Landscape Archaeologies. *Ancient Mesoamerica* 20:183-187.

Astor-Aguilera, Miguel Angel

2010 *The Maya World of Communicating Objects: Quadripartite Crosses, Trees, and Stones*. University of New Mexico Press, Albuquerque.

Carbaugh, Aimée E.

2017 Analysis of Human Skeletal Remains from Cara Blanca Pool 1 and the Yalbac Salvage Program. In *Results of the 2016 Valley of Peace Archaeology Project: Cara Blanca Pool 1 Excavations and the Yalbac Salvage Archaeology Program*, edited by L. J. Lucero, J.T. Larmon and E. M. Benson, pp. 107-157. Report submitted to the Institute of Archaeology, National Institute of Culture and History, Belize.

Kosakowsky, Laura

2017 VOPA Ceramics 2016 General Summary. In *Results of the 2016 Valley of Peace Archaeology Project: Cara Blanca Pool 1 Excavations and the Yalbac Salvage Archaeology Program*, edited by L. J. Lucero, J.T. Larmon and E. M. Benson, pp. 11-14. Report submitted to the Institute of Archaeology, National Institute of Culture and History, Belize.

Kinkella, Andrew

2008 Over the Bajo and Through the Pools: The 2007 Settlement Survey Transect from Yalbac to the Cara Blanca Pools. In *Results of the 2007 Valley of Peace Archaeology Project: Yalbac's Settlement*, edited by L. J. Lucero, pp. 19-114. Report submitted to the Institute of Archaeology, National Institute of Culture and History, Belize.

2009 *Draw of the Sacred Water: An Archaeological Survey of the Ancient Maya Settlement at the Cara Blanca Pools, Belize*. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.

2015 Chechem at the End of the Road: The 2014 Cara Blanca Settlement Survey (CBSS). In *Results of the 2014 Valley of Peace Archaeology Project: Underwater and Surface Explorations at Cara Blanca*, edited by L. J. Lucero, pp. p. 146-151. Report submitted to the Institute of Archaeology, National Institute of Culture and History, Belize.

Larmon, Jean T.

2017 Cara Blanca Explorations: Pool 1 Structure 3 and Related Investigations. In *Results of the 2016 Valley of Peace Archaeology Project: Cara Blanca Pool 1 Excavations and the Yalbac Salvage Archaeology Program*, edited by L. J. Lucero, J.T. Larmon and E. M. Benson, pp. 86-106. Report submitted to the Institute of Archaeology, National Institute of Culture and History, Belize.

Larmon, Jean T., and Zach Nissen

2015 Exploratory Excavations at Pool 1: Structure 3 and the Plaza Test Pit. In *Results of the 2014 Valley of Peace Archaeology Project: Underwater and Surface Explorations at Cara Blanca*, edited by L. J. Lucero, pp. 60-75. Report Submitted to the Institute of Archaeology, National Institute of Culture and History, Belize.

Lucero, Lisa J., and Andrew Kinkella

2015 Pilgrimage to the Edge of the Watery Underworld: An Ancient Maya Water Temple at Cara Blanca, Belize. *Cambridge Archaeological Journal* 25:163-185.

Lucero, Lisa J., Jessica Harrison, Jean Larmon, and Zachary Nissen, and Erin Benson

2016 Prolonged Droughts, Short-Term Responses and Diaspora: The Power of Water and Pilgrimage at the Sacred Cenotes of Cara Blanca, Belize. *WIREs Water*. doi:10.1002/wat2.1148

Lucero, Lisa J., Jean T. Larmon, and Aimée E. Carbaugh

- 2017 The Ancient Maya Ceremonial Circuit of Cara Blanca, Belize. *Research Reports in Belizean Archaeology* 14: 249-259.
- Medina-Elizalde, Martín, Stephen J. Burns, David W. Lea, Yemane Asmerom, Lucien von Gunten, Victor Polyak, Mathias Vuille, and Ambarish Karmalkar
2010 High Resolution Stalagmite Climate Record from the Yucatán Peninsula Spanning the Maya Terminal Classic Period. *Earth and Planetary Science Letters* 298:255-262.
- Reese-Taylor, Kathryn
2002 Ritual Circuits as Key Elements in Maya Civic Center Designs. In *Heart of Creation: The Mesoamerican World and the Legacy of Linda Schele*, edited by A. Stone, pp.143-165. University of Alabama Press, Tuscaloosa.
- Vogt, Evon Z.
1969 *Zinacantan: A Maya Community in the Highlands of Chiapas*. The Belknap Press of Harvard University Press, Cambridge.