

VOPA 2011: Exploring Cara Blanca Pool 1 and Assessing Yalbac

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

Permit No. IA/H/2/1/11(08)
Accession No. 10256

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The VOPA project was granted permission by the Belize Institute of Archaeology to continue exploring Cara Blanca pools for ancient Maya offerings May 5-9, 2011 (Figure 1). Given their importance in Maya belief systems as portals to the underworld, the proposed investigation seeks to provide a glimpse into this watery realm. While the original goals were to assess the feasibility of conducting archaeology underwater at depths over 35 m at two pools (1 and 20) and conduct lab analysis, we spent four days diving at Pool 1 (Figure 2).

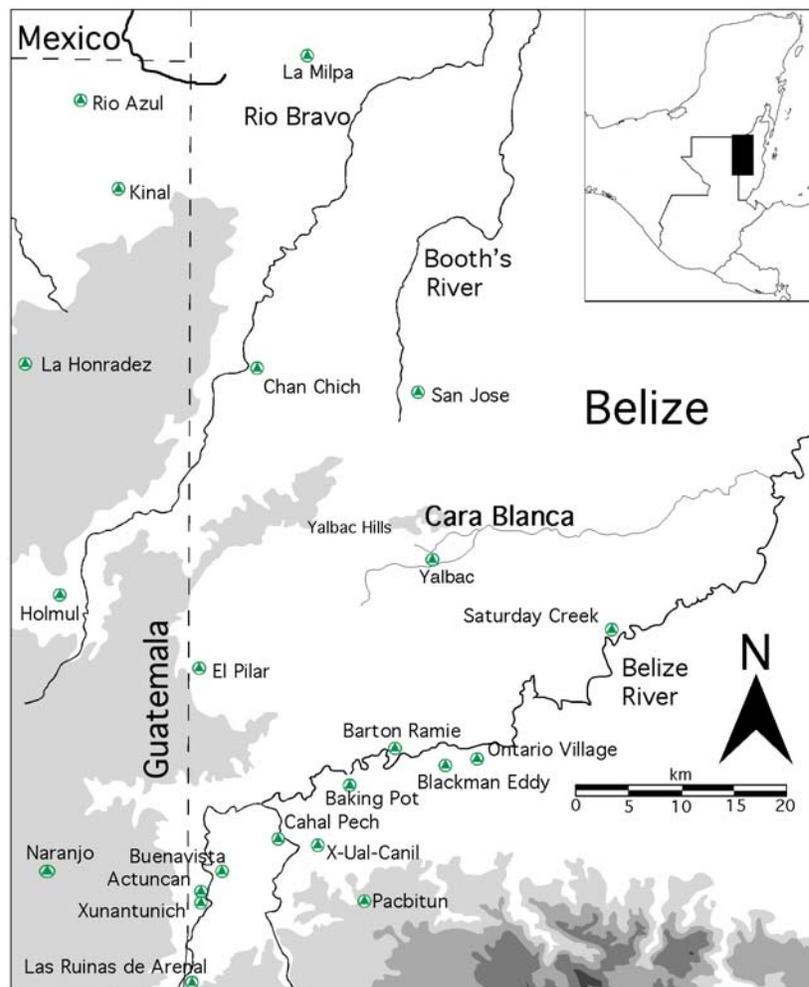


Figure 1 Research area

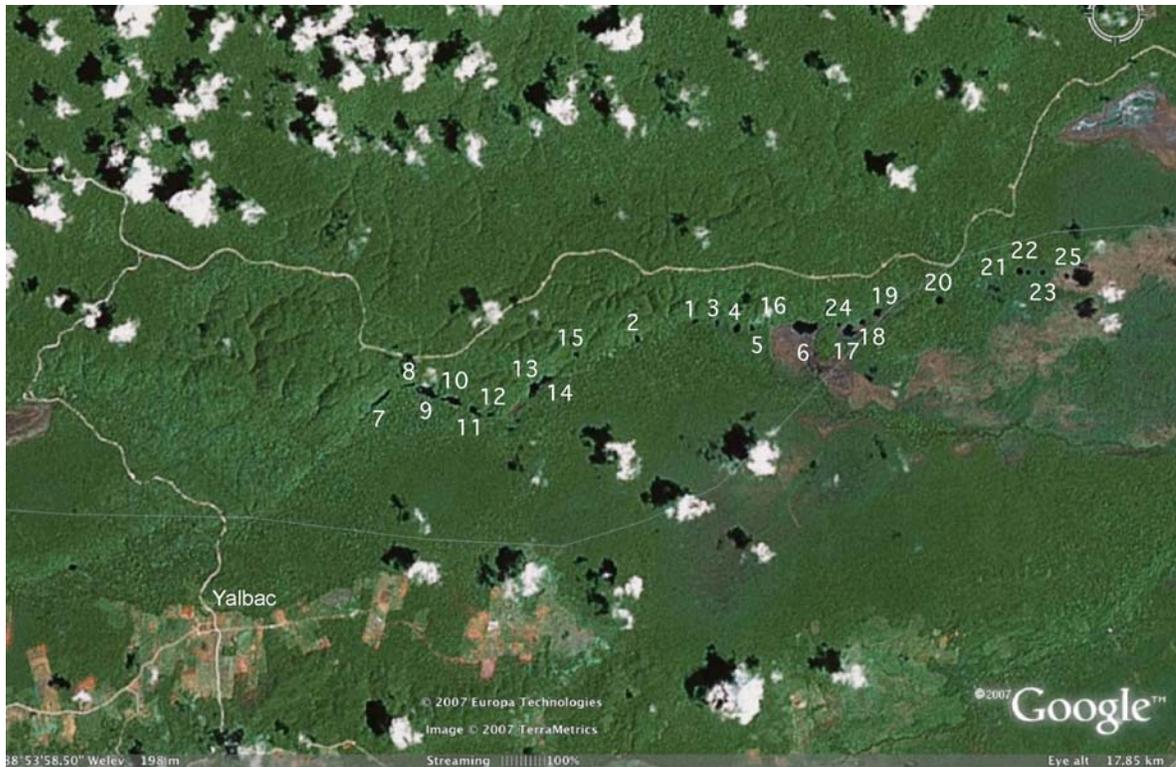


Figure 2 Google Map with Cara Blanca pool numbers

Funding was provided by a National Science Foundation High-Risk Research in Physical Anthropology and Archaeology Grant (#1110005) (\$17,576). Of the total, \$1544.70 was for round-trip airfare for PI and Kinkella; \$822.50 was paid to the Institute of Archaeology for the permit application fee and administrative and consolidation fees; \$935 for labor costs (including social security); \$847.26 for vehicle insurance, maintenance, and registration; \$779.07 for fuel (including roundtrip from Tulum for divers); \$1432.67 for oxygen, nitrogen, and helium gases; \$2751.67 for lodging and food at Banana Bank for PI and dive team; \$2415.70 for supplies including phone cards, field equipment, copying, etc.; \$235 for transportation costs; \$2000 for honorariums for divers; \$475.96 for hotel, food, etc. for delayed flights in Dallas and Chicago; and \$2500 for five AMS radiocarbon dates. Total expenses for the 2011 season were \$14,739.53.

A brief description of the field season can be found at: <http://scientistatwork.blogs.nytimes.com/2011/05/25/an-ancient-watery-underworld/#more-10403>. We also wanted to assess any damage to Cara Blanca and Yalbac caused by the April wild fires. We assessed the October 24 Hurricane Richard damage to Yalbac in February (see appendix for assessment). The landowners of Cara Blanca, Yalbac Ranch, provided permission for this expedition.

The landscape had totally changed since June, 2010; between the October 24, 2010 Hurricane Richard and the subsequent wildfires that swept through the 160,000 acre Yalbac Ranch property in April, 2011, things looked rather bleak. Everything was different; the pool that had once been surrounded by a beautiful green jungle was now surrounded by one of dead and burned trees and vegetation. The diving 'platform' used in 2010 was no longer accessible due to the maze of fallen and burned trees. The underwater landscape was also transformed, as I detail below. That said, there was surprisingly minimal damage to the ancient Maya structures.

Interestingly, Scott Fedick informed me in January 2011 that when Hurricane Wilma hit (Oct. 2005), that it destroyed huge stands of trees. Subsequently, wild fires struck during the dry season, and edible plants (e.g., manioc) soon grew in the newly open areas—and the area has not been settled since the 1600s. It will be interesting to what kinds of plants and trees that grow back on the Yalbac property.

Cara Blanca

Since our first visit to the Cara Blanca pools in the jungles of central Belize in 1997, our research has uncovered fascinating aspects on sacred landscape and ritual behavior (Kinkella 2009; Lucero and Kinkella in press). The ancient Maya had left this area and its natural sacred features, including lineage mountains and portals to the underworld, relatively untouched. Growing evidence from exploratory dives and excavations indicate, however, that the Maya began to intensify their ceremonial visits at the end of the Late Classic (Lucero 2011). Why was this the case? One major reason likely had to do with a series of multiyear droughts that struck the Maya area between c. A.D. 800 and 900 (Medina-Elizalde et al. 2010; see also Hodell et al. 2007). The most recent season in 2011 at Pool 1 has added even more details to the story, albeit in a novel fashion in the form of extinct megafauna, submerged forests, and freshwater shells—each embedded with climate and landscape histories. For example, pool sidewalls and bottoms are littered with trees that have been falling into the pool for centuries if not millennia; in future we should be able to assess landscape change via radiocarbon dating and species identification (e.g., Stahle et al. 2011).

The 2011 team included myself, exploration divers Kim Davidsson, Marty O'Farrell, (videographer), Chip Petersen and Patrick Widmann, archaeologist Andrew Kinkella, and field assistants Clefo Choc, Jose Ernesto Vasquez, Stanley Choc, Don Luna (Isabel Ascencio), and Juan Antonio Lopes. Unfortunately, Don Luna passed away August 6, 2011. He will be sorely missed, as will his sage advice and smile.



Don Luna (Isabel Ascencio)

A new diving platform was cleared by field assistants on the west side of the pool, just north of Str. 1. Field assistants built a ladder so divers could access the water more efficiently.

Divers used nitrox (oxygen and nitrogen) or trimix gases (oxygen, nitrogen, and helium) and open-air or closed-circuit rebreathers, which allowed them to dive deeper for longer periods of time and explore the *cenote* bottom for offerings, as well as to nearly complete the mapping of the large cave on the north side, Actun Ek Nen. The cave was a challenge to map because it is pitch black, penetrates over 50 m into the cliff face and bottoms out at over 70 m—the largest of its kind in Belize according to IOA records. Divers still need to check out one more area to rule out any cave passages or tunnels.

One benefit of the cleared vegetation is better GPS readings, which we could not get last year:

GPS readings taken by A. Kinkella

WGS 84 datum (All points begin with 16Q):

At ladder bottom (where the ladder touched the water): N1927166, E0300948

Unit 1 Center (on top of Str. 1, to align the new points to older readings): N1927143, E0300933

Fossil Line (where line went down to original fossil bed): N1927161, E0300937

Deep Line (where the deep line went down on the North side of Pool 1 - the descent point for the deep dives): N1927187, E0300970

CB Datum Line (right next to the deep line, where the tree was marked at the surface at the North side of Pool 1): N1927186, E0300975

Pool 1 Center (an estimate by Kinkella of where the center of the pool was as he swam): N1927170, E0300998

Below Structure 4 Tree (right below the large tree on Structure 4 - approximately where Marty found the other fossil bed): N1927142, E0301030

Based on Chip's computer logs, the temperature was pretty flat throughout the dive. At <10' it was 84°F; at <20' it was 83°F; at <120' it was 82°F; and past 130' or so it was 81°F. On the first day of diving, Kim also noted that much of the string they laid last year for mapping purposes has been dislodged, likely due to hurricane damage (trees falling in, not to mention all the sediment). There also were lots of overhanging trees.

Marty noted that visibility was about 25% of it was last season. Marty also filmed a catfish and noted the smell of hydrogen sulfide (divers did not smell it in 2010). In the process of filming and exploring, Marty found several more fossil beds, especially on the east side; one was about .6 x .46 m in size, and could be a pelvis bone. The beds range from c. 20 to 30 m in depth. I am sure they are the same fossil bed; the differences in depths from last season of the same beds indicate that slumping has occurred. He also noted smaller fossils on the northwest side at c. 33.5 m deep (rib bone, etc.), as well as large bones. Marty filmed Kim at 60 m deep, the bottom, where he inserted his arm as far as he could. He later told me that he felt more trees at bottom.

Divers discovered that the fossil bed rings the entire pool at c. 20 to 25 m below surface. A multitude of fossils were visible, especially on the east side; one was about .6 x .46 m in size, perhaps a pelvis bone of a large animal, such as a giant sloth or a mammoth. Several fossil fragments were collected, including a ball joint (Figure 3), as well as pieces of wood (Figure 4) and the matrix (Figure 5) from which fossils were extracted. The ball joint is actually 'Robbie's pot,' which I mistakenly thought they had collected last year (the giant sloth humerus bone). Marty could not locate the other bones that Andrew Kinkella mapped last year due to slumping in the interim (see Lucero 2011:Figure 2.5).

The soil matrix latter contained a high density of gastropods, including *Ammicola coronata* and *Cochliopina infundibulum* (David Grimley, Kevin Cummings, pers. comm., 2011). Mollusks are excellent indicators of rainfall patterns (Bowens 2009:20; Covich 1976) because it is possible to track changes in the ratio of evaporation to precipitation (E/P) "by measuring stratigraphic variations in the oxygen isotope composition ($\delta^{18}\text{O}$) of gastropod shells. Lower values reflect moister conditions and greater values reflect drier condition" (Mueller et al. 2009:136). While oxygen isotope analysis of lake sediment cores show periods of drought throughout Maya history, scholars are not sure of their extent beyond their respective study areas (e.g., Lake Petén Itzá, lakes in the Yucatán peninsula) and call for more studies of this kind (e.g., Brenner et al. 2010).

According to Greg McDonald, a Senior Curator of Natural History with the National Park Service, "The large "ball joint" looks like it is the medial condyle of a femur of *Eremotherium*. While the preliminary work has only identified this single taxon from Cara Blanca, the extent of the bone bed suggests that numerous other species could be recovered during systematic excavations (McDonald 2011). The recovery of multiple taxa will greatly increase our understanding of the nature of the ecological change that took place at the Pleistocene-Holocene transition and the pattern of extinction of the Pleistocene megafauna. The pattern of disappearance of the late Pleistocene megafauna is critical to answer the question as to whether the extinction was driven by climate change, the appearance of humans in the region, or some combination of both (Barnosky and Lindsey 2010).



Figure 3 Ball joint fossil



Figure 4 Wood from 25 m below surface, east wall



Figure 5 soil matrix from where fossil extracted

On the last day of diving (May 8), Patrick went below Str. 1 to search for the fossil bed noted there last season; he ended up bringing three large fragments and a few smaller ones (Figure 6).



Figure 6 Fossil fragments from below Str. 1, Pool 1

After the divers left, we returned to Cara Blanca to explore the cliff face since fire has cleared it. Also, Marty and Kim thought it looked interesting/artificial from the water. About 10 m up on the west side and c. 6 m from the pool's edge, Cleofo found two small body sherds near/from an upturned tree root. Just east of approximate center, we came upon a ravine, which has not been explored, according to Cleofo; I tried to take photos, but I do not think it will show (Figure 7). We went about two-thirds across the steep face north of Pool 1; nothing cultural as far as we could tell.



Figure 7 Ravine in steep incline north of Pool 1

In the end, Dr. Wang decided that it was not feasible to date the possible tooth/tusk/claw (#1, east wall, 25 m depth) (Figure 8), and we soon realized why. According to McDonald (email correspondence, August 8, 2011), “the "claw" was most likely a mineral deposit of some sort and not bone.” And in the process of attempting to extract collagen from the ball joint fragment (#2, east wall, 25 m depth), Wang found that the entire bone has been silicified, which means that silica would have been in the environment for replacement of bone with silica, as well as the crystallization that is visible with a magnifying glass in the form of small quartz crystals. Wang proposed attempting OSL, or optically stimulated luminescence dating. Other specimens could be dated.

Wood fragments, soil, and gastropods from the same geological bed in Pool 1 were submitted for AMS radiocarbon dating to the Radiocarbon Dating Laboratory, Illinois State Geological Survey under the direction of Dr. Hong Wang (<http://www.isgs.illinois.edu/>) (Table 1).



Figure 8 Mineral deposit we originally thought was either a tooth, claw, or tusk fragment

Table 1. AMS radiocarbon dates from Pool 1 samples

Sample No., description	Material	$\delta^{13}\text{C}$	Fraction of MC	\pm	D^{14}C	\pm	^{14}C yr BP	\pm
#3, east wall, 25 m depth	Wood	-25.6	0.3290	0.000 8	- 671.0	0.8	8930	20
#6, matrix, large knee joint (not collected), east wall, 25 m depth	Soil	-28.8	0.0387	0.000 8	- 961.3	0.8	26130	170
#4, matrix, ball joint, east wall, 25 m depth	Soil	-26.7	0.0079	0.000 8	- 992.1	0.8	38870	820
#7, matrix, large knee joint (not collected), east wall, 25 m depth	Shell	-4.7	0.0038	0.000 7	- 996.2	0.7	44700	1410
#5, matrix, ball joint, east wall, 25 m depth	Snail shell	-7.1	0.0048	0.000 7	- 995.2	0.7	42850	1120

The half-life of 5568 is used for the age calculation. It is reported as BP (before 1950). MC-Modern Carbon.

Dave Grimley, a Quaternary geologist at the Illinois State Geological Survey, suggests that the shells may incorporate “some old carbon into their shell—making their age a bit too old” (email correspondence, July 21, 2011). If this is the case, then the fossils date

anywhere between c. 9000 and 39,000 years BP, the more recent end which would fall in the realm of human occupation, which has interesting implications for addressing the issue of early humans in Belize.

Regarding the ball joint, “The bone dissolves 100% and leaves only a clear, yellowish brown to reddish brown solution. The bone was hard during cutting because all voids were filled entirely with clear, colorless calcite (Figure 9)...It’s been in the water a long time” (email correspondence, Thomas W. Stafford, Jr., Ph.D., Stafford Research, Inc., <http://www.stafford-research.com/>).



Figure 9 Photo of the ball joint bone wetted with alcohol to make the colors and infilling calcite show better. It is natural bone.

Yalbac and Beyond

On May 10, after the divers had departed (on May 9), the guys and I headed to Yalbac to assess the fire damage—which in the end turned out to be relatively minimal. The jungle immediately to the north of Yalbac was burned, and the fire had crept up over Str. 2D from the north and the north side of Str. 2A (Figures 10, 11). There are still lots of tree fall from the hurricane (see appendix). Also, the fire did spread to Plaza 2 (Figure 12).

Interestingly, on the north end of Str. 2C, part of the ballcourt, Stanley found a large thick body sherd and a large mammal bone fragment (Figure 13). He thought it was too small for a deer; it could perhaps be from a tapir.

Most of Plaza 3 was untouched other than the north side of Str. 3D (Figure 14). No fire damage was seen in Plaza 1, including the acropolis (1A). Less burning means lots more dead vegetation lying around from the hurricane.

On the way to the Gorgeous Gorge turn-off, we were able to see M104 quite well, the small cluster of buildings including a ballcourt (see Kinkella 2009:Figure 5.8).

We stopped along the northeast shortcut road a few places, include what we are calling for now, ‘Big hole’ (no GPS reading), which is on the north side of the road before the lookout. This hole is large and steep-sided—could it be artificial? It is about 60 m across west to east, and about 35-40 m wide. The north side is about 35 m deep (a total guess); near the road on its south side it is about 15 m deep.



Figure 10 Yalbac, Str. 2D, looking northeast



Figure 11 North side of Str. 2A, Yalbac, showing obvious burning



Figure 12 Yalbac Plaza 2; more open than ever



Figure 13 Burned bone fragment and sherd found southside of ballcourt near Str. 2C



Figure 14 North side of Str. 3D (looking east)

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Appendix: Yalbac Site Post-Hurricane Assessment

10 February 2011

With the assistance of Cleofo Choc and Ernesto Vasquez, we went to the medium-sized center of Yalbac on February 10, 2011 to assess the October 24 2010 Hurricane Richard damage. What follows is a description of each plaza and building; a photographic record was also kept. Figure 1 is a map of Yalbac that shows the location of hurricane damage. Even though we mostly focused on describing the large tree fall, every surface is covered with branches and trees of all sizes. It is like an obstacle course. Previous paths are now covered with vegetation, and much more sunlight is coming through; in the past, Yalbac offered a shady respite from the sun.

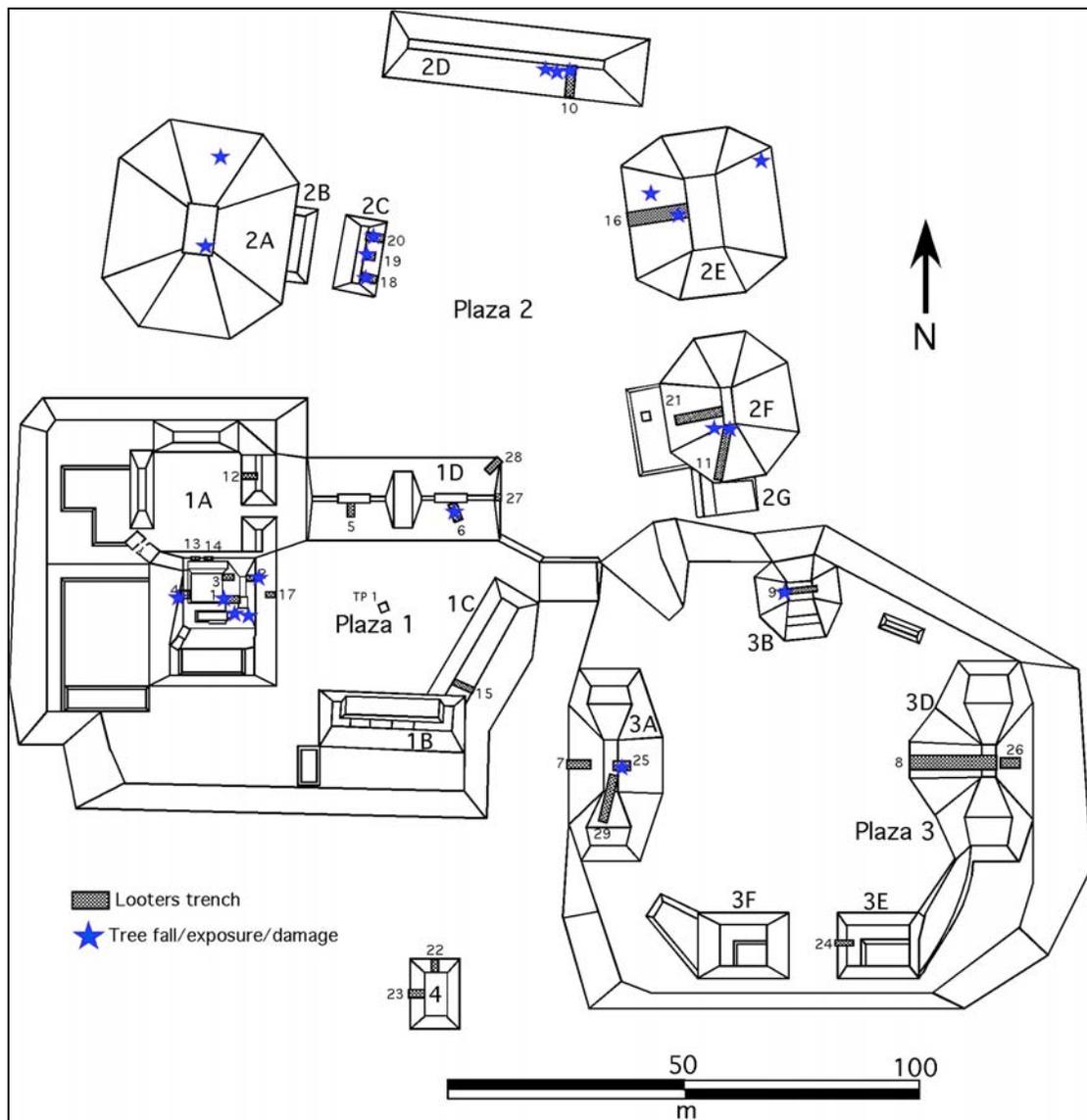


Figure 1. Map of Yalbac showing hurricane damage.

We parked and went into the site from the usual point between Strs. 1A and 2A. At first site, it is obvious that the hurricane left its mark; there were trees everywhere, especially smaller ones. And with the dry season coming, the concern now is for wild fires. This is

what happened after the 2005 Hurricane Wilma in the Yucatan. Scott Fedick (an archaeologist specializing in ancient Maya agriculture) also informed me that with the all trees down that smaller bushes and plants grew—interestingly, non-local ones, like manioc, spurt up. Several other edible plants popped up, even though the area had not been occupied since the 1600's. It will be interesting to see what grows in the Yalbac areas without much tree cover.

Future plans should focus on consolidating the most exposed architecture, specifically the south side of the acropolis (see below).

Str. 2A: lots of fallen vegetation, mostly small trees and c. two large trees snapped; we did not note any newly exposed architecture. I took 73 photos, described throughout this assessment. I am not including all of them; only ones with asterisks (*).

1. Path between Strs. 2A and 1A looking west
2. From top of Str. 2A looking down to ballcourt alley; Clefo for scale, 3. ditto
4. Top of Str. 2A, looking west; Ernesto for scale

Str. 2C: definitely fewer trees and less vegetation

5. From alley look east to top of Str. 2C (ballcourt structure), 6. ditto

The fallen tree on the north side of 2A, about half way up, exposed c. 1 x 1.5 m of fill; in the roots I noted an everted jar rim (not collected).

7. Fallen tree stump, north side of Str. 2A, 8. Ditto, 9. ditto, close-up, 10. ditto, 11. ditto

Str. 2C looters' trenches (LT) (on its east side):

LT 20; northern most LT; it appears that the less vegetation cover led to more obvious erosion during rainfall. There are rivulets of loose soil and collapse in the west/back wall of the LT. LT 19 (middle Str. 2C LT); also has a rivulet, but instead of topsoil is plaster and/or mortar. LT 18, southern most LT on Str. 2C, did not show much damage; it looks like collapsed branches and small trees helped to project the LT. Immediately underneath LT 18 overhang, I see white mortared fill, which likely is not the result of the hurricane, but due to the overhang that existed before it was extended by the hurricane.

12. LT 20, pink glove on top of rivulet for scale, 13. ditto, close-up
14. Looking west onto Plaza 2 from LT 20
15. LT 19, 16. ditto
17. LT 18, 18. ditto
19. ditto, close-up

Str. 2D (range building): a large tree uprooted c. a third west of the east side on the top and exposed a mortared fill. There is a smaller uprooted tree immediately to the east of the previous one and c. 2 m west of west edge of LT 10. About 70 cm of the west wall of LT 10 collapse in the northwest wall of the LT.

20. Large tree uprooted, top Str. 2D, 21. ditto, 22. * ditto
23. 2nd tree fall, top Str. 2D, 24. ditto
- 25*. LT 10 wall collapse, 26. ditto



Photo 22: Large tree uprooted, top Str. 2D



Photo 25: LT 10 wall collapse

Str. 2E; a medium size tree fell from the top and basically rolled down the northern front (west) and cleared the area of vegetation. Str. 2E LT 16 shows some collapse from around large roots that before the hurricane provided support and protection. It does not seem that the roots collapsed or broke, but rather that the weight of the waterlogged soils that did it. Lots of overhang still is in place.

27. tree-cleared area of Str. 2E, 28. ditto, more north

29. Str. 2E, LT 16, looking east/south of east from inside LT, 30. ditto

31.* ditto, from the north edge



Photo 31: Str. 2E, LT 16, looking east, south of east from inside LT

From the northeast top of Str. 2E looking down east side, northern section—there was a massive tree fall from a lower terrace (near northeast corner of Str. 2E).

32. Massive tree fall, northeast bottom, Str. 2E, 33. ditto, Cleofo for scale, 34. ditto, 35. ditto, 36.* ditto,

37.* Massive tree fall, looking south at bottom of Str. 2E, 38. ditto



Photos 36 and 37: on left—massive tree fall, northeast bottom, Str. 2E; on right—massive tree fall, looking south at bottom of Str. 2E

Str. 2F; smaller tree collapse between LT 21 and LT 11 c. ½ to 1/3rd up the structure. A medium sized tree at the top of LT 11 fell and exposed/extended it to the north. Ernesto checked it out north of the fallen tree to see what it exposed—a little fill (no photo taken).

39. smaller tree collapse between LT 21 and LT 11

40. LT 11 from west wall, northern half collapsed tree, 41. ditto

42. from bottom of Str. 2F (south side) looking north up LT 11—both fallen trees

43. LT 11, 44.* LT 11



Photo 44: LT 11, Str. 2F, looking north

Plaza 3: we noted a simple lean-to—one that Ellie and her crew built a few weeks ago? Hope so. Again, lots of fallen, dead trees.

45. Plaza 3, from near traverse point YF looking southeast

Str. 3B, LT 9, west side

46.* Str. 3B looking northeast at southwest corner entrance of LT 9

47. Str. 3B, west side, LT 9, west section of LT tunnel with collapse fill and tree

48.* LT 9, west section of LT tunnel with collapse fill and tree, 49. Ditto



Photos 46 and 48: on left—Str. 3B looking northeast at southwest corner entrance of LT 9;
on right—LT 9, west section of LT tunnel with collapse fill and tree

Str. 3D from mid-Plaza 3 looking east—it has never been so visible before! LT 8 appeared to be free from tree fall so we did not go up top.

50. Str. 3D from mid-Plaza 3 looking east, 51. ditto

Str. 3A, LT 25, some collapse of south LT wall. LT 29 looks okay: LT 7, not surprisingly, is fine; its entrance, of course is covered with debris (no photographs of either.

52. LT 25 collapse, looking southwest to south wall

Plaza 1: completely covered in debris!
53.* Plaza 1 looking west from top of Str. 1C



Photo 53: Plaza 1 looking west from top of Str. 1C

Str. 1D, LT 6 (one with the exposed, cut stone architecture), tree on northwest edge fell over, completely obscuring LT. May be even more protected. LT 5, Str. 1D; looks ok (no photograph)—covered with lots of branches.

54. looking north to LT 6, 55.* ditto



Photo 55: looking north to LT 6

Str. 1A, LT 2: a tree collapsed from the top southwest corner; did a little damage when it stuck the north wall of the trench. More disheartening is the recent looting behind/west of the bench. There had been a hole before, but not so deep; I suppose there could have been some collapse, but I think it is due to looting.

56.* LT 2, recent looting, 57.* ditto, 58. Ditto, 59. ditto, Cleofo for scale



Photos 56 and 57: LT 2, recent looting, St. 1A

Str. 1A, LT 1: The corbel wall on the south side of the first chamber (western most) collapsed; everything inside, though, looks fine.

60.* LT 1, first chamber, 61. ditto



Top: photo of LT1, first chamber, taken 19 April 2010 by C. Pottier
 Bottom, Photo 60: LT1, collapse roof, first chamber

There is massive exposure on the top of the acropolis to the south and immediately below (lower) than LT 1. Two large trees, when fell, took with it major architecture, including corbel blocks and stuccoed blocks.

- 62. Eastern tree fall with exposed architecture, 63. ditto
- 64. Western tree fall without obvious architecture, 65. ditto
- 66. corbel block from eastern tree fall, 67. Ditto, 68. ditto
- 69. stuccoed block from western tree fall debris, 70. ditto



Photos 63 and 66: Eastern tree fall with exposed architecture and corbel block



Photos 65 and 69: Western tree fall and stuccoed block

Clefo noted a large tree that fell from immediately below LT 4 on the east side of the acropolis plaza. I bet we would find lots more stucco decorative fragments as we have in the past.

71. Tree fall immediately below LT 4, Str. 1A, 72. Ditto, 73. ditto