

FAMSI © 2008:
Tomás Barrientos

Hydraulic Systems in Central Cancuén: Ritual, Reservoir, and/or Drainage?

Translation of the Spanish by Eduardo Williams

Research Year: 2005

Culture: Maya

Chronology: Late Classic

Location: Sayaxché, Petén, Guatemala

Site: Cancuén

Table of Contents

[Abstract](#)

[Introduction: Cancuén and the Alto Pasión Region](#)

[Background: Previous Research at Cancuén](#)

[The Discovery of the site](#)

[The Petexbatun Project](#)

[The Cancuén Project: 1999-2004](#)

[Research in 2005: Northeast Aguada, North Drain and North Aguada](#)

[Background](#)

[Excavations in the Northeast Aguada and the Main Causeway](#)

[Excavations in the North Drain](#)

[Excavations in the North Aguada](#)

[Research in 2005: South Drain and Royal Pool \(South Aguada\)](#)

[Background](#)

[Excavations in the South Drain](#)

[Excavations in the Royal Pool \(South Aguada\)](#)

[Interpretation of Hydraulic Systems in Cancuén](#)

[Conclusions and general implications](#)

[The role of water in Maya cities](#)

[The Royal Pool and Cancuén's collapse](#)

[List of Figures](#)

[Sources Cited](#)

Submitted 07/18/2006 by:

Tomás Barrientos, Director

Departamento de Arqueología

Universidad del Valle de Guatemala

tbarrientos@uvg.edu.gt

Abstract

The Cancuén Archaeological Project's 2005 field season included research of several hydraulic systems, thanks to funds provided by FAMSI. These features are important not just for the interpretation of water management at the site, but also to revise and criticize several theories and general models on this subject.

Hydraulic systems in Cancuén consist of small-scale canals and water reservoirs, which had different functions, such as supplying water for domestic use, the drainage of plazas, and performing ritual activities. Among these features stands out the discovery of a pool located at the Royal Palace's main entrance which has unique characteristics for the whole Maya area. Its function was linked with ritual, political, and diplomatic activities, which could have been performed in the palace. Excavation of the royal pool also included an important discovery, consisting in the skeletal remains of over 30 people, as well as a great amount of flint points and personal ornaments of shell and green stone. Archaeological analysis of these artifacts and of the deposit's context, as well as the assistance provided by forensic analysis, indicate that this was a massacre that took place at the end of Cancuén's occupation, probably the violent murder of the royal family.

The data gathered in Cancuén during the 2005 season show that the use and meaning given to water among the Prehispanic Maya were varied, therefore they must be interpreted according to the conditions pertaining to each settlement. We have to take into account the scale of hydraulic features, their context within the site and their possible function according to water availability for the inhabitants.

Introduction: Cancuén and the Alto Pasión Region

The region of the upper basin of the La Pasión River is in the south of the Petén department and in the north of Alta Verapaz, Guatemala, between the following sites: Tres Islas, Cancuén, and Raxruha (Figure 1). This region was of great importance, since it was located in a key position for controlling the La Pasión and Usumacinta route, the main route for communication and exchange in the Maya Lowlands during the Classic period (Figure 2).

Research carried out by the Cancuén Project in the Pasión River's Upper Basin has given continuity to a series of studies about ancient Maya trade routes (Thompson 1964; Hammond 1972; Tourtellot and Sabloff 1972; Adams 1978; Andrews 1984; Arnauld 1990), including revisions and critiques of older theoretical models, in particular the ones proposed by Rathje, who defines trade as the main cause for the rise of Maya states (Rathje 1971, 1973), as well as for their collapse (Rathje 1972; Webb 1975; Lowe 1985).

The main site in the area is Cancuén, which served as regional capital during the Late Classic. This city is located precisely at the start of the navigable course of the La Pasión River, and to the south are the beginning of the Highlands (the Sierra de Chinajá and the Candelaria cave system) where rivers are not navigable because they have small currents and rapids (Figure 3). This border zone between both regions was the place where products from the Highlands could arrive through land routes for their further distribution via the river toward the northwest, where sites like Seibal, Altar de Sacrificios, Yaxchilán, Piedras Negras, and Palenque were located.

Background: Previous research at Cancuén

The discovery of the site

During the 20th century Cancuén was the only site identified in the Upper Pasión region, but it was regarded as an unimportant site. Explorer Teobert Maler was the first person to make a report of it (Maler 1908), and Sylvanus Morley visited the site ten years later, publishing it in his important work *Inscriptions of Peten* (Morley 1937).

The explorations carried out by Maler and Morley focused on the search for monuments with inscriptions, so their maps show Cancuén as a site of very modest dimensions. This site remained virtually unknown until 1967, when archaeologists from the Seibal Project made a short visit, which included the elaboration of a more complete map, as well as the excavation of several exploratory pits. These data were included as an annex to the Seibal Project publications (Tourtellot III, Sabloff y Sharick, 1978).

The Petexbatun Project

Cancuén's importance began to be appreciated from work and discoveries at Dos Pilas, performed by the Petexbatun Regional Project of Vanderbilt University (Demarest 1997), including the discovery of the Palace (*el Palacio*), the Funeral Throne (*el Trono Funerario*) and the grave of Cancuén's Lady (*la Mujer de Cancuén*), wife of Ruler 3, *Toh K'in K'awil* (Wolley and Wright 1990). The marriage and alliance between Cancuén and Dos Pilas was also seen in Panel 19, which is a portrait of Ruler 3 and Cancuén's queen, witnessing the first self-sacrifice ritual performed by their heir *K'inich Chan K'awil*, or Ruler 4 (Houston and Stuart 1990; Martin and Grube 2000: 60-1).

The Cancuén Project: 1999-2004

The multidisciplinary studies of the Archaeological Cancuén Project were started in 1999, including the elaboration of a new map, exploratory excavations, and regional surveys. Ceramic information was very important, since it defined a new region in the Maya area (Demarest and Barrientos 1999, 2000). In the following seasons (Demarest and Barrientos 2001, 2002; Demarest *et al.* 2003, 2004; Barrientos *et al.* 2006a) a formal sampling and intensive excavations program was carried out throughout the site's residential area, where clear evidence was found of areas of artisan production, especially lithic materials. Excavations in the monumental Palace and the site's Epicenter have also given important data for the interpretation of Cancuén's political role, especially its control of the La Pasión River region between A.D. 761 and 800. On a regional level, work performed in the area of Tres Islas, Raxruhá, and the Candelaria cave system has been of the utmost importance.

During the seven years of work in the Alto Pasión, the Cancuén Archaeological Project has also been involved in several social aspects, defining new alternatives for interaction between the government, the communities and the scientists in

matters dealing with conservation, sustainable tourism and research of Guatemalan cultural heritage.

The site of Cancuén is located in a peninsula formed by the La Pasión River, therefore it was in a good position to function as port and to control the flow of products through this important route (Figure 4). Its ceremonial center is dominated by the Acropolis or Royal Palace, where most buildings were concentrated and which surely functioned as political-administrative centers. To the palace's north and east there are three plazas: the East Plaza contains several uncarved monuments and shrines or small temples, as well as the only monumental pyramid (L7-38) and the East Ball Court, dedicated by ruler *Taj Chan Ahk*. The North Plaza includes the ball court of the palace and a series of residential and ceremonial buildings of sub-monumental size. To the east the Northeast Plaza is bounded by a causeway in its eastern end, which links the epicenter with the residential areas and artisans' workshops located to the north (M9 and M10 groups) (Figure 5).

Previous research in Cancuén had provided us with very important data regarding the economy, trade and political relations of this ancient city (Kovacevich *et al.* 2001, 2002, 2003), but no specialized studies had been carried out dealing with ritual aspects, such as water use and symbolism. However, since the start of the project in 1999 we had noted a settlement pattern strongly linked with water management, since this is one of the main factors that defined the location of the structures. The residential groups are generally found in elevated and well-drained areas, surrounded by water springs, streams, and areas prone to flooding or *bajos* formed by the rise of the river's level during the eight months of the rainy season (Figure 6).

Initial surveys by O'Mansky and Barrientos identified the zone of *bajos* to the north, west, and south of the peninsula where the site is located, as well as two main streams which drain the epicenter toward the south and the west (O'Mansky 2001; Woodfill *et al.* 2002). Among the features associated with floods caused by the La Pasión River, it was very important to identify five natural bays which may have been utilized in ancient times as docks. Outstanding among these is the area known as "El Puerto" (the port), whose association with Palace M9-1 and the site's main causeway indicates its possible function for transport of goods and for other commercial activities (Alvarado *et al.* 2003; Alvarado 2004).

As part of the residential sampling program, in the 2002 season John Tomasic investigated a group of residential structures in the site's K9 quadrant, known as "Grupo Los Patos" (Tomasic 2003). This group is located 460 m to the northwest of the epicenter, and is characterized by having a small round *aguada* (i.e. a water source in a small depression in the landscape) 10 m in diameter, located in its northeast end, and fed by a small drainage canal (Figure 7). The following year Arik Ohnstad carried on with the excavations in this group, revealing another small water reservoir in the center of the main patio (Ohnstad *et al.* 2004). The excavations conducted by Tomasic and Ohnstad in the Los Patos group revealed the first data on water use in Cancuén, indicating that the small *aguada* was an intentional modification with a domestic use. However, inside the *aguada* we found evidence of some ritual activities, especially an offering containing an inverted bowl and a human mandible (Figure 8).

Research in 2005: Northeast Aguada, North Drain and North Aguada

Background

The elaboration of the detailed map of Cancuen's epicenter was started in 2004 by Marc Wolf, and resulted in the discovery of three important hydraulic features (Wolf 2006). The first feature was identified initially by the existence of a water spring under the west structure of the Palace's Ball Game. The spring is connected with a series of streams and stone canals which were called North Drain. The second feature is a water reservoir called North Aguada, which is directly linked with the north drain. Lastly, the third feature was the presence of a *bajo* in the Northeast Plaza, which fills up with water during the rainy season. However, it was seen that this bajo, initially called Northeast Aguada, is not located in a very convenient place, since it blocked the course of the site's main causeway. This called into doubt the existence of an aguada, as well as the causeway's function (Figure 9).

Excavations in the Northeast Aguada and the Main Causeway

Because of the doubtful definition of the Northeast Aguada, as well as its relation with the site's main causeway, we decided to investigate both areas through Operation 48, performed by Tomás Barrientos and Silvia Alvarado. Methodology was based mainly in 1 x 1 m exploratory pits, although some trenches and extensions were excavated as well. Altogether 64 excavation units were carried out (Figure 10).

The 1 x 1 m test units located in the causeway were distributed according to a north-south axis, with a distance of 5, 10 or 20 m between them (Figure 11). Apart from the test pits, we dug trenches in the causeway's eastern and western limits, as well as in the southern limit of the defensive wall located at the start of the causeway. Each pit and trench was taken as an excavation unit.

The following units were located within the causeway: CAN 48-1 to CAN 48-6, CAN 48-17, and CAN 48-21 to CAN 48-28. The upper humus stratum was removed to an approximate depth of 20 cm, exposing the causeway's surface. This consisted of a floor or stone pavement with small yellow and orange sandstones, small limestones and river cobbles (Figure 12). In some cases the cobblestone paving was not found, because of perturbation by tree roots. Units CAN 48-49 to 48-52 were located in the south end of the causeway, where the same pavement was revealed as in the previous units. This showed that the causeway runs without interruption from the M9 group to the north limit of the East Plaza.

CAN 48-7 and CAN 48-8 units exposed the southern end of a defensive wall running parallel to the causeway's northern limit. This wall had already been investigated in previous seasons. We confirmed its width of approximately 1 m (Figure 13). Units CAN 48-9 to CAN 48-12 exposed a possible side entrance precisely where the defensive wall ends and in the starting point of the terrace bordering the causeway on its eastern side. It is important to point out that the causeway is not elevated, but rather of the sunken kind, since it is bordered by a terrace on each side.

Units CAN 48-13 to CAN 48-16 and CAN 48-18 to CAN 48-19 were trenches to define the sides of the causeway, formed by terraces that modified the natural landscape (Figure 14). We found some features of informal architecture which may have formed retention walls for the terraces, although we did find the remains of a formal wall in CAN 48-18 unit (Figure 15).

Units CAN 48-29 to CAN 48-37 were located on an east-west axis, directly above the possible location of the Northeast Aguada (Figure 16). Upon removing the humus layer of around 20 cm we discovered a stone floor of similar characteristics as the floor of the causeway, but with bigger stones, a greater percentage of limestone and sandstone, and very little river cobbles (Figure 17). In the CAN 48-32 unit and its four extensions we went under the floor, finding clay-like soil but no other evidence of construction. CAN 48-34 unit was located in the west end of the plaza, near the L8-5 Structure. Toward the west, in the extension CAN 48-34B, the paving showed limestones of greater size and near the structure we exposed several slabs forming a banquette. Toward the north, in the CAN 48-34A extension, we located a small canal which led to a small hole exposed in the CAN 48-34E unit, which could have functioned as water drain (Figure 18). Units CAN 48-34F and CAN 48-34G showed how the plaza floor descends toward the drain on its east and west sides.

To the north of the former units another series of 1 x 1 m pits was laid down on an east-west axis, including the following units: CAN 48-38 to CAN 48-42, CAN 48-47 to CAN 48-48. Upon removing the humus layer we found a cobblestone pavement with the same characteristics, although dominated by small sandstones (Figure 19). This floor was also exposed in units CAN 48-45 and CAN 48-46.

In the southwest end of the Northeast Plaza we located units CAN 48-45 to CAN 48-55, each one measuring 2 x 2 m. Humus was removed from them, exposing the start of a canal that functioned as drain for the plaza, in the spot where the canal system of the site's North Drain started. The canal was bordered by L8-6 Structure, which is a low platform, and its surface showed a cobblestone pavement similar to the causeway, although with the presence of some slabs (see below, under [Excavations in the North Drain](#)).

Except for the areas with perturbations caused by roots or trees, each one of the laid-down pits showed the presence of a pavement, which corresponds to the floor of the causeway and the Northeast Plaza. We could also see that the plaza has a slight depression toward the west, showing that the water used to run in that direction to a small canal marking the start of the canal system called North Drain.

This system prevented the plaza from being flooded, so it was also shown that the so-called Northeast Aguada did not exist. Therefore, the current flooding of the Northeast Plaza is due to the fact that the humus layer prevents it from having a proper drainage (Figure 20).

Excavations in the North Drain

The North Drain consists of a series of canals located in the site's North Plaza, which served to drain the whole area to the north and west of the Palace, as well as the Northeast Plaza. Likewise, they served to channel the water spring under L7-33 Structure of the Palace's Ball Court. Excavations consisted of 13 units, and were carried out by Tomás Barrientos and Silvia Alvarado. Most of the units were trenches located perpendicular to the canals, with the objective of exposing their surface and obtaining transects (Figure 21). We have to point out that these canals are still functioning, so the water has completely uncovered their surface in some parts (Figure 22). Because of this it was not necessary to perform many excavations to define their shape and construction features.

The west end of the main canal was excavated with the unit CAN 48-65, located in the meeting point with the North Aguada. A series of big slabs were exposed with north-south orientation, just like in units CAN 48-66 and CAN 48-67 (Figure 23). The canal's sides also showed small slabs laid down as a possible contention wall.

The east side of the canal was exposed initially with units CAN 48-69, CAN 48-69A and CAN 48-70, where we found at a small depth a series of finely worked faced stones, laid down as a slab floor which surely was the surface of the bottom of the canal where the water used to run (Figure 24). This feature was also exposed in the following units: CAN 48-79, CAN 48-80 and CAN 48-81 (Figure 25).

The canal's east end is found between structures L8-6 and L7-31, and was excavated through units CAN 48-71 and CAN 48-72. The bottom of the canal was exposed, which is made up of slabs and of part of the stepped bodies of both structures (Figure 26).

Excavations in the main canal of the North Drain disclosed a construction based on stone slabs, in parts showing a very fine finish, especially in the canal's central part. This canal seems to have small dikes which could have kept the water free of trash. Toward the west it is joined by another small stream until it reaches the North Aguada. The quality of the work in laying down the canal's slabs suggests that considerable labor was invested in its construction, supporting the idea of a function that went beyond the drainage of the plazas, possibly with a ritual association.

Excavations in the North Aguada

Within the system known as North Drain there is a small reservoir that fills up with clean water during the rainy season (Figure 27). This aguada is fed from its east side by two canals (one of which functioned as drain for the Northeast Plaza). Starting from a dike another canal of bigger proportions is originated, which meets up with other three canals to form a stream that follows in that direction until reaching the La Pasión River. Excavations in this aguada were carried out using a grid of 2 x 2 m pits, 15 of which were excavated under the direction of Tomás Barrientos and Silvia Alvarado (Figure 28).

The CAN 48-56, 48-57, 48-58, and 48-61 units were located in the north end of the aguada, and units CAN 48-62, 48-73 and 48-77 in the east end. The western end was investigated in units CAN 48-58, 48-59 and 48-74, with units CAN 48-60 and 48-63 in its southern end. In the center of the aguada three units were laid down: CAN 48-64, 48-75 and 48-76. These excavations went through a fill of dark brown clay-like earth, almost black and of a soft texture. The sides of the aguada showed evidence of alignments or walls of coarsely worked limestone and sandstone, with east-west and north-south orientation. These walls do not seem to have been vertical, but descended toward the center (Figure 29). As we excavated toward the center, water started to flow at a depth of 0.80 m, which prevented us from finding the bottom of the aguada (Figure 30). However, this indicated the presence of a water spring, which is important because it constitutes a source of fresh water that could have been used by the inhabitants of the North Plaza for domestic or ritual use. This also explains why the residences located in this zone are among the oldest in the site (Arriaza and Barrientos 2006).

In the aguada's southwest corner a stone wall was partially defined which functioned as a dike or small dam, since to the west a canal starts on a level lower than the aguada. We tried to investigate the water flow toward the canal (CAN 48-74 unit), but the water level prevented us from discovering the relationship between the canal and the bottom of the aguada. The CAN 48-78 unit was located on the canal to the west, where a great amount of stones were exposed, suggesting that the water may have flowed underground.

Although the North Aguada superficially resembles a natural bajo or depression, we found plenty of evidence of modification, and it is likely that all its surface was covered with stone. The architecture of this aguada shows a rough construction with little-worked sandstone, something very different from the South Aguada or Royal Pool (see below).

Although the North Aguada was not excavated in its entirety, we could define a rectangular shape of 7 x 10 m, with its longest part on an east-west axis (Figure 31). Its sides show an inclination towards the center, creating a truncated conical shape, where the bottom appeared to measure 3 x 5 m. Although this may be due to the collapse of vertical walls, this is not likely the case.

Research in 2005: South Drain and Royal Pool (South Aguada)

Background

Apart from the North Drain, the Palace and the epicenter of the site featured another canal system which has been called the South Drain (Figure 32). The investigation methodology used here was similar, consisting of trenches and ditches perpendicular to the canals and a grid of 2 x 2 m pits in the aguada's area. Excavations in the hydraulic systems south of the epicenter were carried out as part of Operation 42, defined directly to the south of Operation 4, located on structure L7-9, which functioned as access to the Palace. This operation had already been defined in 2003, when a record was made in the far south end of the acropolis

terrace to install the drain pipes which come from Structure L7-9 (Barrientos, Larios y Luin, 2004).

Excavations in the South Drain

The area south of the L7- 38, L7-27, and L7-9 structures has a small stream which currently fills up during the rainy season, and runs toward the west, ending in the La Pasión River. However, its location in the southern end of the leveling terrace which makes up the East and South plazas of Cancuen's epicenter made it possible for this stream to function as a canal. In order to investigate this feature we dug four trenches to verify the shape and building material of the canal's sides and therefore to verify whether the stream was modified (Figure 33).

CAN 42-9 unit was located near the eastern end of the canal; in its north side we found a small wall made of faced stone, which was a little collapsed. Toward the west we set up units CAN 42-10, CAN 42-11, and CAN 42-12, which exposed clusters of big stones, but showing no order or formal alignment (Figure 34).

In general, excavations in this small canal showed the absence of containment walls on the sides, except for unit 42-9, where we could define the presence of a wall which was almost on the point of collapse.

This means that the stream's eastern end did show modifications, likely to avoid erosion of the terrace near L7-38 and L7-27 structures. The canal moves away from the epicenter, and it did not need more than a few piled-up stones in its sides and center. The presence of cultural material in all units suggests that trash accumulated because of erosion.

Excavations in the Royal Pool (South Aguada)

At the start of investigations in Cancuén we had already noticed the presence of a small aguada or water reservoir at the foot of the Palace's south entrance (Figure 35). However, this aguada superficially had a round shape, and when it dried up we could see the presence of lots of faced stone, therefore we thought its sides had been covered with stone steps. After removing the vegetation we were not able to better define its shape, since the surrounding stones had fallen down forming a large collapsed pile inside the aguada. Some local finca growers stated that cattle used to drink water in this reservoir, which explains the great amount of moved stones, especially in its south side. Since the aguada remained with water for several months, we thought it was fed by the canal and stream conforming the South Drain.

Since this aguada had not been studied before, we did several test pits, which revealed the existence of wall lines. Therefore we decided to excavate it horizontally with a grid of 2 x 2 m pits (Figure 36). These initial excavations were carried out by Tomás Barrientos and Silvia Alvarado, having a total of six units (CAN 42-3 to 42-9). Because of the great amount of bone remains found here (both human and animal) the excavation work was continued by a team from the Guatemalan Forensic

Anthropology Foundation (José Suasnívar, Heidi Quezada, and Guillermo Martínez) and by archaeologist Horacio Martínez, who performed a total of 10 pits, in order to remove the third and last stratum in the center and eastern side of the aguada. Excavations by the FAFG team included units CAN 42-13 to 42-22.

In all units a first lot was defined by the general cleaning of rubble rocks, which consisted mainly of worked stones, especially in the north and south of the aguada.

In the east and west sides the stones were of a softer yellow material, possibly as part of the building fill. Besides, in this part the perimeter wall was a little lower, indicating a greater percentage of collapsed stones toward the center of the aguada. The second lot from these units consisted of soil from under the rubble, which was a gray-colored clay with great amounts of cultural material and human and animal bones.

From the start of the excavation we noticed that the aguada did not have a round shape, as we had originally thought, but a quadrilateral shape defined by masonry walls and a slab floor. During the excavations water started to flow at a depth of approximately half a meter, indicating the presence of a water spring (Figure 37). In this way it was shown that this water reservoir functioned independently from the palace's south drain, with which it had no connection. It was also shown that this feature did not function as deposit or reservoir (aguada or cistern), but rather like a true pool that was fed by a clean water spring.

Excavations started with units CAN 42-3 and 42-8, located on the outside of the west limit of the pool. Only one superficial lot was excavated, revealing a surface (possibly a floor) formed by a mixture of mid-sized limestones and sandstones.

Units CAN 42-4 and 42-5 revealed the west side of the pool. After cleaning the rubble, the west wall was defined and the northeast and southeast corners, as well as part of the north and south walls. In this area the pool is narrower, because the north and south walls have inset corners, giving the pool a stepped or "half-cross" shape. The floor consisting of big-sized slabs was also defined, although in the eastern limit of 42-5 unit we saw that this floor was interrupted by a 0.5 m-high step or banquette. The start of this banquette coincides with the inset corners of the north and south walls (Figure 38). Under the rubble we also found a great amount of utilitarian pottery (water jugs) and fragments of polychrome dishes. There was a striking amount of human bone, among which we could identify a mandible and several skull fragments, apart from long limb bones from and some ribs (Figure 39). Many fragments of white stucco and a few of red stucco were recovered, which likely covered the walls and floor. Under the rubble in the southwest corner we found a cluster of small shell and greenstone beads, apart from tubular pieces and a possible stalactite. We also found several thin beads made of red and purple *Spondylus* shell. Likewise, in this same area we found an *in situ* necklace with greenstone and shell beads. The necklace's central part consisted of a horseshoe-shaped bead made of shell and a greenstone bead in the center (Figure 40). In the northwest corner we also found a fragment of vessel rim made of alabaster with incised glyphs and a ceramic figurine fragment with blue paint. Other artifacts included a kind of small shell mask, apart from an artifact of the same material shaped like a flower.

CAN 42-6 and 42-7 units excavated part of the pool's center, where we kept finding great amounts of human bone. Likewise the quantities of *Spondylus* shell and greenstone artifacts increased, including the inside part of a *Strombus* conch shell. Among these artifacts several flint projectile points stand out.

The excavations in the pool's center were finished by personnel from the Guatemalan Foundation of Forensic Anthropology, including the following units: CAN 42-13, 42-14, 42-15, 42-16, 42-17, 42-18, 42-19, and 42-20. In this part of the pool the gray clay fill reached a depth of 0.23 m, which was removed in order to expose the slab floor. The north wall had a height of 0.60-1 m, although it was quite bent toward the south.

The pool's northeastern end was exposed through units CAN 42-21 and 42-22, where there was plenty of rubble reaching a depth of 1.30 m. The second lot consisted of 0.23 m of gray clay over the slab floor. The east wall had a height of between 1 and 1.20 m.

Excavations in the pool revealed the presence of architecture around a water spring, consisting of masonry walls of faced limestone with a fill of yellowish sandstone (Figure 41). We were able to show that this feature did not function as an aguada, because the water does not come from any canal. Likewise, the presence of stone walls and slab floors covered with stucco gave it a pool or pond-like appearance (Figure 42). Its closeness to the Palace also indicates that its use could have been restricted to elite members; therefore it received the name of Royal Pool.

As much as 90% of the Royal Pool was excavated during the 2005 season. It presented a series of features which undoubtedly make it a unique discovery and make it necessary to redefine it conceptually as an exceptional architectural element. Its type of construction resembles the buildings constructed during the times of the greatest ruler of Cancuén, *Taj Chan Ahk* (760-780 d.C.). Its general dimensions are 7.76 m from north to south and 9.29 m from east to west. The average height is 0.60 m on the west side and 1.20 m on the rest, although it could easily have reached 2 m in the deepest part.

The limestone blocks forming this feature are of variable size and characteristics: 0.7 x 0.29 m, 0.16 x 0.22 m, and 0.19 x 0.37 m. The pool's layout was not rectangular, since on its west side the corners are inset forming a step or half-cross shape, resembling the shape seen in most stelae from Cancuén (Figure 43). The thin end on the west side was also characterized by having a bench, where the pool is less deep. The slab floor in this banquette includes slabs of up to 2 m long.

Excavations in the pool showed evidence of a possible massacre, since great quantities of human bones were found, including skulls, limb bones, mandibles, vertebrae and ribs. Up to now we have evidence of at least 32 people, including two infants and two fetuses (Figure 44). The individuals studied so far present several evidences of trauma caused by sharp cutting instruments, including a skull fragment directly associated with a flint point. However, it has not been possible to establish with certainty whether the bodies were deposited right after being murdered or whether they correspond to a secondary deposit. In any case, the whole or

dismembered bodies were thrown into the pool and later the collapsed walls fell on top of the human remains, burying them.

It is very important to point out that this pool shows the greatest amount of shell and greenstone ornaments so far recorded in Cancuén. The unusual amount of ornaments and other luxury items, including a necklace found *in situ* associated with several ribs, suggest that the bodies were thrown in still wearing their costumes (Figure 45). Another evidence of the massacre are 11 flint points found in the excavations of the collapse and the pit in the center of the aguada, which lends weight to the idea of a massacre and possibly of the pool's final role. The pottery associated with the human remains belongs primarily to the Late Classic, with utilitarian types such as *La Isla*, *Zapote Impreso* and *Encanto Estriado*, as well as several *Saxché-Palmar* dishes and a *Gris Fino Chablekal* imitation. However, the presence of at least two dish fragments with concave bases could indicate the beginnings of the Terminal Classic (AD 800).

The cleanliness and purity of the pool water suggest a ritual-ceremonial use, which could have been part of cleansing and purification rituals performed by the visitors to the palace, who came in through Structure L7-9, or Palace of the Portraits. The idea of a ritual function for the pool is supported by its shape of a half quatrefoil, which may be linked with several sacred contexts, such as the "Witz Monster's" forehead symbolizing an entrance to the underworld. It is also linked with the water lily, one of the most important symbols linked with water, which appears in the shape of the "Water Lily Monster". In some monuments, especially in Machaquilá, the half-quatrefoil symbol appears as a place name representing a place or mountain with water, because of the *ha* glyph inside it (Figure 46). Finally, the fact that the pool had clean water throughout the year, or at least most of the year, indicates that it was a source of sacred water or *Suhuy Ha'*, which may have been used in rituals performed inside the palace. It is possible that the use given to this water could have been analogous to the use given to water from caves, since it originated inside the Earth and at the foot of the palace, Cancuén's holy mountain.

Although almost the whole pool has been excavated in its entirety, we still have some questions about its function, since it could have functioned as water source for the nobility's domestic services. However, the most important question has to do with the identity of the people deposited inside the pool, especially to know if they belong to the royal family. Likewise, we still have to clarify the individuals' cause of death, and whether they were deposited in primary context or after being dismembered. In order to answer this we will have to wait for the finalization of the osteological, forensic, and genetic studies.

However, it has been possible to watch the pool's function after the onset of the rainy season, since it was full of water just two days after ending the excavation. The pool has remained like this since then, keeping the same level, which proves that it functions independently from the palace's drain system.

Interpretation of hydraulic systems in Cancuén

After describing the different ways in which water was used in Cancuén, it is noteworthy that these features are of a small scale compared with monumental works like the ones in Edzná, Calakmul, or Tikal. Cancuén's canals and reservoirs show drainage, domestic consumption, and ritual functions. To the north of the palace and the ceremonial center, the presence of a water spring in the North Aguada is directly associated with early residences in the site, which means that the availability of fresh water was important for the first settlers of Cancuén. On the other hand, the construction of the North and Northeast Plazas, as well as the Main Causeway, included a drainage system using changes in the plaza levels, cesspools or drains, stone canals and modified natural streams.

Likewise, to the south of the Palace and the East Plaza, a stream was used as drain canal involving a few minimal modifications.

What is most interesting about Cancuén's aquatic features is their association with ceremonial spaces. In the case of canals located in the north, apart from their function as drains they are also associated with places of a ritual nature, as suggested by the presence of the Palace's Ball Court over a water spring. The great quality of the stonework seen in these canals might indicate that the water being collected in the North Aguada could have been used for other than domestic purposes, especially if the structures of the North Plaza and the Palace's Ball Court constitute one of the site's most important ceremonial spaces.

However, the ritual function of Cancuén's hydraulic systems is best exemplified by the existence of a pool directly to the south of the Palace's main entrance (Figure 47). The function of this pool could have been analogous to the purification rites seen in other cultures and civilizations, since it was a permanent source of sacred water. The creation of the pool with stone masonry was simultaneous with the palace's construction. Because of the style of the worked stone in its walls, the pool can be dated as part of the building program of ruler *Taj Chan Ahk*, between AD 760 and 780. This building program was directed to creating a space for diplomatic and ritual events which were vital for maintaining the city's political stability.

The ritual use of water in Cancuén appears in important iconographic contexts, such as Panel 3, possibly *Taj Chan Ahk's* most representative sculpture (Figure 48). In this monument the ruler is seated on a throne with the water lily monster's image, from which two of these plants sprout. The scene's framework is a quatrefoil element with water lilies in its corners, which in this case represents the main plaza of Machaquilá and is the same shape of the royal pool. Besides, *Taj Chan Ahk's* headdress includes an aquatic lily being eaten by a fish, a symbol frequently used by Maya rulers. Since the pool had a half-quatrefoil shape, this clearly shows its association with rituals of communication with the underworld and the sacred character of its waters.

If the pool had an important role in maintaining *Taj Chan Ahk's* power, it also had a leading role in Cancuén's collapse; since it was there that the remains of his descendents were deposited. The discovery of a possible royal massacre inside the

pool shows its importance, since whoever perpetrated this violent act chose this specific place to lay down the bodies.

The association of the human bones with great amounts of pottery vessels and other objects points to the celebration of a termination ritual during or after the massacre. If this was the case, putting the bodies inside the site's sacred water reservoir was a way of polluting it, and therefore of ending its use.

Conclusions and general implications

The role of water in Maya cities

The importance of hydraulic systems for ancient Maya societies has been dealt with in other regions of the Maya area, including several studies that have defined the use of water in several subsistence, political, and ritual activities. These studies have also recorded a great diversity in location, scale, and building characteristics of the water management systems. The attention paid to the role played by water in the ancient Maya cities is due in great part to the studies of Vernon Scarborough about Tikal's water retention and storage systems (Scarborough and Gallopin 1991; Scarborough 1998). Scarborough has repeatedly referred to the need for collecting water in great artificial reservoirs or aguadas, with the primary aim of the centralization of power in major Maya cities such as Tikal, Calakmul, and Caracol. In this model the lack of permanent water sources made it necessary to create a state apparatus for the construction of hydraulic systems, which were located near the main temples and palaces. The widespread use of aguadas and canals started during the Late Preclassic, in sites like Mirador, Cerros, Edzná, and Becán (Scarborough 1984).

This model has been supported by Adams (1991), Dunning (1995), and recently by Lisa Lucero (2003), who not only explains the origins of Classic Maya civilization through water control, but also its downfall (Lucero 2002). Although it has been denied that the Maya reached the characteristics of hydraulic societies as proposed by Wittfogel, this study is based to a large extent on the cities located in the northeast Petén, defined by Lucero as "regional centers". However, in the so-called "secondary centers" and "minor centers" there are small-scale hydraulic systems, or none at all. Based on her study of water reservoirs in Copán, Davis-Salazar (2003) points out that the management of water sources did not necessarily have to depend on a centralized government, since it could have been controlled by sub-elites and other sectors of society. Besides, a great part of Maya society did not depend on water management for its organization.

Several investigations of Lucero's "secondary sites" have shown that there was a great amount of decentralized hydraulic systems, such as Quiriguá's wells for domestic use (Ashmore 1984) or the system of *chultunes* and *cenotes* in the Puuc area of Yucatán (McAnany 1990). In sites like Copán (Davis-Salazar 2003), La Milpa (Weiss-Krejci and Sabbas 2002), and Kinal (Scarborough *et al.* 1994), water-harnessing systems of a much smaller scale than those of Tikal and Calakmul have been discovered, that did not necessitate a state apparatus for their creation and

maintenance, and more importantly, were created during the sites' apogee, not before.

Regarding water's function for "secondary centers", Lucero claims this was not vital, since many of these were located near rivers, lakes and other permanent water sources (Lucero 2002). This means that water's role was not as important in relation to other activities like trade or political interaction if we want to explain how these centers rose as political entities. We have to consider that most Maya cities would be classified among these secondary centers, so their rise would be very different from the case of El Mirador, Tikal, and Calakmul, especially because they are not linked with hydraulic systems on a great scale.

Up to now we have taken into account the function of water-management systems to satisfy subsistence needs and for the ecological adaptation to the lowland tropical forest and to the karst area of Yucatán. In many Maya cities the availability of permanent water sources suggests a function beyond water supply for canals and reservoirs, which may have been linked with other needs, particularly of an ideological nature.

In this case there is ample evidence for water symbolism, especially its association with the underworld. Barbara Fash (n.d.) and Vernon Scarborough (1998) have identified several elements associated with water in Maya iconography, whose context is closely linked with the power of rulers. One of the most often used symbols was the water lily, which according to Fash indicates the existence of clean water reservoirs. Another symbol is the "water mountain", the mythical place of creation which is associated with the hills that contain caves and underground rivers.

Rather than being the source of power for Maya cities, water management was one of many ritual instruments that helped to maintain the political position and sacred character of the ruler or *Kujul Ajaw*. This situation was not just of the Maya cities, since numerous cases have been recorded around the world in which water was used ritually and was very important for keeping the political control.

For instance, in the Merina society of Madagascar rulers had to perform a series of sacred baths at the start of each year, while in Bali temples were located in each one of the water sources, although it was thought that all water came from the lake in the crater, the source of the most sacred water and where the main temple was located (Scarborough 1998). Among other examples, we can mention the use of purification pools in Jerusalem's temple, as well as the ritual importance of water canals in Angkor, Tiwanaku, and the Inca Empire.

Cancuén clearly illustrates the symbolic and ritual importance of water for Prehispanic Lowland Maya societies. However, we have to point out that water management in Cancuén, besides having a ritual aspect, was also planned in order to satisfy more mundane needs, such as the proper drainage of plazas and buildings in the site's epicenter, and its possible use for domestic consumption and for irrigating agricultural fields.

The study of hydraulic systems at Cancuén has helped to understand the management of water as a means of reinforcing the ideology of power through symbols and rituals. This functioned as support of the economic system, which was based on political and trade alliances that assured the procurement and redistribution of exotic raw materials and finished products by Cancuén's artisans.

The ritual and symbolic nature of Cancuén's hydraulic systems, as well as their small scale, provide us with clear data on the role of water in the rise and downfall of Maya cities. In spite of its obvious importance in several aspects of society, we cannot explain the development of Lowland Maya civilization simply as a product of the need to manage the procurement and consumption of water. Therefore, hydraulic systems of "secondary centers" such as Cancuén show that the use of water was varied and responded to different needs in each region. It is important that Maya hydraulic models should not be based solely on monumental sites such as Tikal and Calakmul. They should also include data from "atypical" sites like Cancuén, if we want to have a complete vision of Classic-period Lowland Maya society.

The Royal Pool and Cancuén's collapse

In previous seasons we had already defined evidence for a violent end in Cancuén, based on the excavation of defensive walls around the Palace and on the presence of human bones in the area of the "port".

However, it was not until the discovery of the Royal Pool and the human remains inside it, that it was shown that the end of Cancuén's history could have been quite dramatic, possibly including the demise of the ruling family.

The archaeological record has shown scenes of war throughout the Maya area, especially in stelae and vessels, as well as such evidence as spear points. However, no direct evidence had been found of the victims of these wars. The only massive burials found in the Maya area appeared in the Salamá valley (Sharer and Sedat 1987) and in Chalchuapa (Fowler 1984), but these are early and are linked with ritual sacrifices. Therefore, there was no direct evidence of violence for the Terminal Classic which could be linked with the war processes that took place during the collapse of Lowland Maya cities. Therefore, the massacre discovered in Cancuén has very important implications for the interpretation of this city's final moment and for the whole southwestern Maya Lowlands.

Up to now forensic analysis has identified 32 individuals of both sexes and all age groups, including two children and two pregnant women. Although these analyses are still in progress, it has been shown that all individuals show signs of violence and trauma, in the form of cuts or blows. According with the pottery found in direct association, this event can be dated to the beginning of Tepeu 3 phase, around AD 800, coinciding with the abandonment of the city. This is very important, since in 2004 we found the remains of Cancuén's last ruler, *Kan Ma'x* (Barrientos *et al.* 2006b), whose offerings included ceramic types like the ones found in the pool (Figure 49). Although *Kan Ma'x's* bones were in a very bad state of preservation, his grave was very close to the surface and without a cist or formal crypt, indicating a

hurried burial possibly associated with the event of the individuals deposited in the pool. In order to link both events we are conducting ADN analysis of the 33 individuals, but we are still waiting for the results.

Finally, it is important to state that epigraphy also supports the hypothesis of the massacre of the ruling family, since the last date recorded by *Kan Ma'x* (on an incised shell in a private collection in Brussels) is May 12th, AD 800 (Fahsen and Barrientos 2006; Barrientos and Fahsen 2006), which is precisely the moment of the massacre. We also have to add that on 19th August of the same year the first event is recorded in Machaquilá for almost 40 years, since this city was dominated by Cancuén (Stela 2, dedicated by ruler *Ochk'in Kalamte'*) (Kovacevich and Barrientos 2000).

If the political entity of Machaquilá was involved in the conquest and destruction of Cancuén, it is possible to date the incident of the massacre between May 12th and August 19th AD 800.

The evidence found in the Royal Pool constitutes one of the most important discoveries at Cancuén, and represents a unique context in the Maya area. The human bones, pottery and other artifacts show that the end of this city --and probably of many more-- was of a violent nature and included the demise of the ruling family by the conquering group. This shows that many war scenes depicted in monuments, artifacts and murals are real and that the level of violence during the end of the Classic period reached heights never seen before. We hope that research in the Royal Pool will continue, so that we will be able to obtain more information about this important event. Likewise, laboratory analysis will help us to understand other aspects of the massacre that extinguished Cancuén's rulers.

List of Figures

- Figure 1. Map of the Rio La Pasión, showing the Cancuén site (Luis F. Luin).
- Figure 2. Map of the main communication and trade routes in the Maya area (Luis F. Luin).
- Figure 3. Map of the main sites in the Upper La Pasión River Basin (Tomás Barrientos and Arik Ohnstad).
- Figure 4. Map of Cancuén (Tomás Barrientos, Luis F. Luin and Marc Wolf).
- Figure 5. Map of Cancuén's epicenter (Tomás Barrientos, Luis F. Luin and Marc Wolf).
- Figure 6. Map of Cancuén showing flooded areas and docks (Tomás Barrientos, Luis F. Luin and Marc Wolf).
- Figure 7. Map of K9 Group, "Los Patos" (Marc Wolf).

- Figure 8. Side view of Group K9's aguada and plan of associated offering (Luis F. Luin and Arik Ohnstad).
- Figure 9. Map of the hydraulic systems located to the north of the epicenter (Tomás Barrientos, Luis F. Luin and Marc Wolf).
- Figure 10. Location of the excavation units of Operation 48 (Tomás Barrientos, Luis F. Luin and Marc Wolf).
- Figure 11. Drawing of the excavation units in the causeway (Tomás Barrientos).
- Figure 12. East profile and plan of some test pits that discovered the causeway's floor (Oswaldo Cuc).
- Figure 13. Plan of CAN 48-7 and CAN 48-8 units, showing the southern end of the causeway's defensive wall (Oswaldo Cuc and Tomás Barrientos).
- Figure 14. North profile of CAN 48-14 and CAN 48-15 units, showing the stepped terraces defining the causeway's sides (Oswaldo Cuc).
- Figure 15. North profile of CAN 48-18 unit, showing the wall forming the terrace that defines the eastern side of the causeway (Oswaldo Cuc).
- Figure 16. Drawing of the excavation units in the Northeast Plaza (Tomás Barrientos).
- Figure 17. Plan of CAN 48-34 and CAN 48-35 units, showing the floor of the Northeast Plaza (Oswaldo Cuc).
- Figure 18. East profile of CAN 48-34A unit and west profile of CAN 48-34E, CAN 48-34F, and CAN 48-34G units, showing the canal and drain of the Northeast Plaza (Oswaldo Cuc).
- Figure 19. Plan and south profile of CAN 48-40 and CAN 48-48 units, showing the floor of the Northeast Plaza (Oswaldo Cuc).
- Figure 20. Photo of the flooded Northeast Plaza, which initially was considered as the "Northeast Aguada" (Tomás Barrientos).
- Figure 21. Drawing (not to scale) of the excavation units located in the canals forming the North Drain (Tomás Barrientos).
- Figure 22. Photo of the main canal of the North Drain, before its excavation (Tomás Barrientos).
- Figure 23. Plan of CAN 48-65 and CAN 48-67 units, showing the slabs that form the main canal of the North Drain (Oswaldo Cuc and Tomás Barrientos).

- Figure 24. Plan of CAN 48-69 and CAN 48-70 units, showing the slabs that form the main canal of the North Drain (Oswaldo Cuc and Tomás Barrientos).
- Figure 25. Photo of CAN 48-69, CAN 48-70, CAN 48-80, and CAN 48-81 units, showing the slabs that form the main canal of the North Drain (Tomás Barrientos).
- Figure 26. Plan and east profile of the CAN 48-71 and CAN 48-72 units, showing the main canal of the North Drain (Oswaldo Cuc and Tomás Barrientos).
- Figure 27. Photo of the North Aguada before its excavation (Tomás Barrientos).
- Figure 28. Drawing of excavation units in the North Aguada (Tomás Barrientos).
- Figure 29. Photo of the southwest corner of the North Aguada during its excavation (Tomás Barrientos).
- Figure 30. Photo of the excavation of the south wall of the North Aguada (Tomás Barrientos).
- Figure 31. Plan and profile of the exposed portion of the North Aguada (Luis F. Luin).
- Figure 32. Map of the hydraulic systems located to the south of the epicenter (Tomás Barrientos, Luis F. Luin and Marc Wolf).
- Figure 33. Location of excavation units in the South Drain (Tomás Barrientos, Luis F. Luin and Marc Wolf).
- Figure 34. Plan and west profile of CAN 42-9 and CAN 42-11 units (Oswaldo Cuc).
- Figure 35. Photo of the South Aguada or Royal Pool, before excavation (Tomás Barrientos).
- Figure 36. Drawing of the excavation units in the Royal Pool (Tomás Barrientos).
- Figure 37. Photo of the excavation of the south wall of the Royal Pool (Tomás Barrientos).
- Figure 38. Photo of the excavation of the banquette of the Royal Pool (Tomás Barrientos).
- Figure 39. Plan of the Royal Pool, showing pottery, bones and other artifacts found on the bottom floor (Luis F. Luin).

- Figure 40. Photo of a necklace found *in situ* in the banquette of the Royal Pool (Tomás Barrientos).
- Figure 41. Profile of the west and south walls of the Royal Pool (Luis F. Luin).
- Figure 42. Photo of the Royal Pool, during the end of the 2005 excavations (Tomás Barrientos).
- Figure 43. Plan of the Royal Pool, showing the slabs that form the bottom floor (Luis F. Luin).
- Figure 44. Photo of the human bones found in the Royal Pool, as they are being analyzed in the Foundation of Forensic Anthropology of Guatemala (Alan Robinson, FAFG).
- Figure 45. Photo of some shell artifacts found at the bottom of the Royal Pool (Andrew Demarest).
- Figure 46. Stelae number 4 and 8 of Machaquilá, showing the half-quatrefoil toponym with the *ha* glyph (taken from Graham 1967).
- Figure 47. Reconstruction of the Royal Pool and south entrance of Cancuén's Palace (Luis F. Luin and Tomás Barrientos).
- Figure 48. Cancuén's Panel 3, showing aquatic symbols (Luis F. Luin and Tomás Barrientos).
- Figure 49. Burial 77 of Cancuén, the ruler *Kan Ma'x* (Luis F. Luin and Tomás Barrientos).

Sources Cited

Adams, Richard

1978 "Routes of Communication in Mesoamerica: The Northern Guatemala Highlands and the Petén Mesoamerican communication routes and cultural contacts". En, *Papers of the New World Archaeological Foundation* 40, T. Lee y C. Navarrete, eds. pp. 27-35. Provo, Utah.

1991 "Nucleation of Population and Water Storage among the Ancient Maya". *Science* 251: 632.

Alvarado, Carlos

2004 "Excavaciones en el Puerto Principal de Cancuén: Temporada 2003". En *Proyecto Arqueológico Cancuén, Informe Temporada 2003*. A. Demarest, T. Barrientos, B. Kovacevich, M. Callaghan, B. Woodfill y L. Luin, editores. Informe entregado al Instituto de Antropología e Historia, Pp. 345-364.

- Alvarado, Carlos, Jeremy Bauer y Karen Pereira
2003 "Investigaciones en el Puerto Principal de Cancuén". En *Proyecto Arqueológico Cancuen, Informe Temporada 2002*. A. Demarest, T. Barrientos, B. Kovacevich, M. Callaghan y L. Luin, editores. Informe entregado al Instituto de Antropología e Historia, Pp. 207-222.
- Andrews, Anthony
1983 *Maya Salt Production and Trade*. Tucson: University of Arizona Press.
- Arnauld, Marie Charlotte
1990 El Comercio Clásico de Obsidiana: Rutas entre Tierras Altas y Tierras Bajas en el Área Maya. *Latin American Antiquity* 1 (4): 347-367.
- Arriaza, Claudia y Tomás Barrientos
2006 "Excavaciones en la Plaza Norte de Cancuén". En *Proyecto Arqueológico Cancuen, Informe Temporada 2004-2005*, T. Barrientos, A. Demarest, B. Woodfill y C. Quintanilla, editores.. Informe entregado al Instituto de Antropología e Historia. Pp. 315-376.
- Ashmore, Wendy
1984 "Classic Maya Wells at Quirigua, Guatemala: Household Facilities in a Water-rich Setting". *American Antiquity* 49 (1): 147-153.
- Barrientos, Tomás
2000 "Kaminaljuyu: Una Sociedad Hidráulica?". XIII Simposio de Investigaciones Arqueológicas en Guatemala, 1999.
- 1999 "Interpretación para una Sociedad Hidráulica en Kaminaljuyu Miraflores". *Utz'ib* 2 (6):16-23.
- 1997 "Evolución Tecnológica del Sistema de Canales Hidráulicos en Kaminaljuyu y sus Implicaciones Sociopolíticas". *X Simposio de Investigaciones Arqueológicas en Guatemala, 1996*. pp. 61-70.
- Barrientos, Tomás y Federico Fahsen
2006 "Nuevos Monumentos e Inscripciones de Cancuén". En *Proyecto Arqueológico Cancuen, Informe Temporada 2004-2005*, T. Barrientos, A. Demarest, B. Woodfill y C. Quintanilla, editores.. Informe entregado al Instituto de Antropología e Historia. Pp. 57-71.
- Barrientos, Tomás, Rudy Larios y Luis F Luin
2004 "Excavaciones en la Acrópolis de Cancuén: Patio Sur". En *Proyecto Arqueológico Cancuen, Informe Temporada 2003*. A. Demarest, T. Barrientos, B. Kovacevich, M. Callaghan, B. Woodfill y L. Luin, editores. Informe entregado al Instituto de Antropología e Historia, Pp. 43-84.
- Barrientos, Tomás, Arthur Demarest, Brent Woodfill y Claudia Quintanilla

- 2006a *Proyecto Arqueológico Cancuen, Informe Temporada 2004-2005.* Informe entregado al Instituto de Antropología e Historia.
- Barrientos, Tomás, Moisés Arriaza, Adriana Linares, Blanca Mijangos, Silvia Alvarado y Claudia Quintanilla
2006b “Excavaciones en la Estructura L7-27 de Cancuén”. En *Proyecto Arqueológico Cancuen, Informe Temporada 2004-2005*, T. Barrientos, A. Demarest, B. Woodfill y C. Quintanilla, editores.. Informe entregado al Instituto de Antropología e Historia. Pp. 259-314.
- Davis-Salazar, Karla
2003 “Late Classic Maya Water Management and Community Organization at Copan, Honduras”. *Latin American Antiquity* 14 (3): 275-299.
- Demarest, Arthur
1997 “The Vanderbilt Petexbatun Regional Archaeological Project 1989-1994: Overview, History and Major Results of a Multi-disciplinary Study of the Classic Maya Collapse”. *Ancient Mesoamerica* 8(2): 209-227.
- Demarest, Arthur y Tomás Barrientos
1999 *Proyecto Arqueológico Cancuen, Informe Preliminar No. 1 Temporada 1999.* Informe entregado al Instituto de Antropología e Historia.
- 2000 “Investigaciones Arqueológicas y reconocimiento en la zona del sitio Cancuen”, en *XIII Simposio de Investigaciones Arqueológicas en Guatemala, 1999.* editado por J.P. Laporte, H. Escobedo, C. Suasnavar, y B. Arroyo, pp. 1013-1032.
- 2001 *Proyecto Arqueológico Cancuen, Informe Temporada 2000.* Informe entregado al Instituto de Antropología e Historia.
- 2002 *Proyecto Arqueológico Cancuen, Informe Temporada 2001.* Informe entregado al Instituto de Antropología e Historia.
- Demarest, Arthur, Tomás Barrientos, Brigitte Kovacevich, Michael Callaghan y Luis Luin
2003 *Proyecto Arqueológico Cancuen, Informe Temporada 2002.* Informe entregado al Instituto de Antropología e Historia.
- Demarest, Arthur, Tomás Barrientos, Brigitte Kovacevich, Michael Callaghan, Brent Woodfill y Luis Luin
2004 *Proyecto Arqueológico Cancuen, Informe Temporada 2003.* Informe entregado al Instituto de Antropología e Historia.
- Dunning, Nicholas
1995 “Coming Together at the Temple Mountain: Environment, Subsistence and the Emergence of Lowland Maya”. En *The Emergence of Lowland Maya Civilization, The Transition from Preclassic to the Early Classic,*

Editado por Nikolai Grube. Acta Mesoamericana Vol. 8. Mockmuhl:
Verlag Anton Saurwein. Pp. 61-70.

Fahsen, Federico y Tomás Barrientos

2006 "Los Monumentos de Taj Chan Ahk y Kan Ma'x". En *Proyecto Arqueológico Cancuen, Informe Temporada 2004-2005*, T. Barrientos, A. Demarest, B. Woodfill y C. Quintanilla, editores.. Informe entregado al Instituto de Antropología e Historia. Pp. 35-55.

Fash, Barbara W.

s.f. "Iconographic evidence for water management and social organization at Copán" En *Copán: The rise and fall of a Classic Maya kingdom*. W. Fash, ed. Santa Fe: School of American Research.

Fowler, William

1984 "Late Preclassic Mortuary Patterns and Evidence for Human Sacrifice at Chalchuapa, El Salvador". *American Antiquity* 49: 603-618.

Hammond, Norman

1972 Obsidian Trade Routes in the Mayan Area. *Science* 178:1092-1093.

Houston, Stephen y David Stuart

1990 "Resultados Generales de los Estudios Epigráficos del Proyecto Petexbatún". En *Proyecto Arqueológico Petexbatún: Informe Preliminar # 2, Segunda Temporada, 1990*. A. Demarest y S. Houston, eds. pp. 568-77. Instituto de Antropología e Historia, Guatemala y Departamento de Antropología, Vanderbilt University, Nashville, TN.

Kovacevich, Brigitte y Tomás Barrientos

2000 The Chak Lords: The Dynastic Sequence of Machaquila. Manuscrito, Vanderbilt University.

Kovacevich, Brigitte, Tomas Barrientos, Michael Callaghan, y Karen Pereira

2002 La Economía en el Reino Clásico de Cancuén: Evidencia de Producción, Especialización e Intercambio. En *XV Simposio de Investigaciones Arqueológicas en Guatemala*, pp. 365-382. Guatemala: Ministerio de Cultura y Deportes, IDAEH, Asociación Tikal.

Kovacevich, Brigitte, Ronald Bishop, Hector Neff y Karen Pereira

2003 "Sistemas Económicos y de Producción Mayas: Nuevos Datos y Retos en Cancuén". En *XVI Simposio de Investigaciones Arqueológicas en Guatemala, 2002*.

Kovacevich, Brigitte, Tomas Barrientos, Arthur Demarest, Michael Callaghan, Cassandra Bill, Erin Sears, y Lucia Moran

2001 Producción e Intercambio en el Reinado de Cancuen. En *XIV Simposio de Investigaciones Arqueológicas en Guatemala*. Laporte, Suasnavar y Arroyo, eds. Guatemala: Ministerio de Cultura y Deportes, IDAEH, Asociación Tikal.

- Lowe, John
1985 *The Dynamics of Apocalypse: A Systems Simulation of the Classic Maya Collapse*. Albuquerque: University of New Mexico Press.
- Lucero, Lisa J.
2002 "Collapse of the Classic Maya: A Case for the Role of Water Control". *American Anthropologist* 104 (3): 814-826
- 2003 "The Politics of Ritual: The Emergency of Classic Maya Rulers". *Current Anthropology* 44 (4): 523.
- Maler, Teobert
1908 Explorations of the Upper Usumatsintla and Adjacent Region: Altar de Sacrificios; Seibal; Itsimté-Sácluk; Cankuen. Peabody Museum of Archaeology and Ethnology, Harvard University Memoirs 4(2).
- Martin, Simon y Nikolai Grube
2000 *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*. Londres: Thames and Hudson.
- McAnany, Patricia
1990 "Water Storage in the Puuc Region of the Northern Maya Lowlands: A Key to Population Estimates and Architectural Variability", En *Pre-Columbian Population History in the Maya Lowlands*, P. Culbert y D. Rice, eds. Albuquerque: University of New Mexico Press, pp. 263-284.
- Morley, Sylvanus
1937 *The Inscriptions of the Peten*. 5 vols. Carnegie Institute of Washington Publication 437.
- Ohnstad, Arik, Walter Burgos, and Claudia Arriaza
2004 "Operación 39A: Excavaciones en el Cuadrante K9 "Los Patos". En *Proyecto Arqueológico Cancuen: Informe Temporada 2003*. A. Demarest, T. Barrientos, B. Kovacevich, M. Callaghan, B. Woodfill y L. Luin, editores. Informe entregado al Instituto de Antropología e Historia, Pp. 211-250.
- O'Mansky, Matt
2001 "Mapeo y Reconocimientos en Cancuén, Temporada 2000". En *Proyecto Arqueológico Cancuen, Informe Temporada 2000*, A. Demarest y T. Barrientos, editores. Informe entregado al Instituto de Antropología e Historia. Pp. 11-28.
- Popenoe de Hatch, Marion, Erick Ponciano, Tomás Barrientos, Mark Brenner y Charles Ortloff
2002 "Climate and Technological Innovation at Kaminaljuyu, Guatemala" *Ancient Mesoamerica* 13: 103-114.

- Rathje, William
 1971 The Origin and Development of Lowland Classic Maya Civilization. *American Antiquity* 36: 275-285.
- 1972 Classic Maya Development and Denouement: A Research Design. In *The Classic Maya Collapse*, P. Culbert, ed. Albuquerque: University of New Mexico Press, pp. 405-56.
- 1973 Praise the Gods and Pass the Metates: A Tentative Trajectory of Production – Distribution Systems. In *Ancient Civilization and Trade*, editado por J. Sabloff y C. Lamberg Karlovsky, pp. 409-448. Albuquerque: University of New Mexico Press.
- Scarborough, Vernon L.
 1984 “A Preclassic Maya Water System”. *American Antiquity* 48 (4): 720-744.
- 1998 “Ecology and ritual: Water management and the Maya”. *Latin American Antiquity* 9 (2):135-59.
- Scarborough, Vernon y Gary Gallopín
 1991 “A Water Storage Adaptation in the Maya Lowlands”. *Science* 251: 658-662.
- Scarborough, Vernon y Steven Ross
 1994 “The Pre-Hispanic Maya Reservoir at Kinal, Peten, Guatemala”. *Ancient Mesoamerica* 5 (1): 97-106.
- Sharer, Robert y David Sedat
 1987 Archaeological Investigations in the Northern Maya Highlands, Guatemala: Interaction and the Development of Maya Civilization. University Museum Monograph 59. Philadelphia: University of Pennsylvania.
- Tomasic, John
 2003 “Operación 39: Excavaciones en El Sector K9, Grupo “Los Patos”. En *Proyecto Arqueológico Cancuen Informe Preliminar No. 4, Temporada 2002*, A. Demarest, T. Barrientos, B. Kovacevich, M. Callaghan y L. Luin, editores. Informe entregado al Instituto de Antropología e Historia, Pp.339–360.
- Thompson, J. Eric
 1964 “Trade Relations between the Maya Highlands and Lowlands”. *Estudios de Cultura Maya* 4, pp. 13-50.
- Tourtellot, Gair y Jeremy Sabloff
 1972 “Exchange Systems Among the Ancient Maya”. *American Antiquity* 37: 126-135.

- Tourtellot, Gair, Jeremy Sabloff y Robert Sharick
1978 "A Reconnaissance of Cancuen". En *Excavations at Seibal, Department of Peten, Guatemala*. G. Willey, ed. Memoirs of the Peabody Museum of Anthropology and Ethnology 14 (2). Pp.191-240.
- Webb, M.
1973 The Peten Maya Decline Viewed in the Perspective of State Formation. In *The Classic Maya Collapse*, P. Culbert, ed. . Albuquerque: University of New Mexico Press, pp. 367-404.
- Weiss-Krejci y Thomas Sabbas
2002 "The Potential Role of Small Depressions as Water Storage Features in the Central Maya Lowlands". *Latin American Antiquity* 13 (2): 343-358.
- Wolf, Marc
2006 "Actividades de Mapeo". En *Proyecto Arqueológico Cancuen, Informe Temporada 2004-2005*, T. Barrientos, A. Demarest, B. Woodfill y C. Quintanilla, editores.. Informe entregado al Instituto de Antropología e Historia. Pp. 19-34.
- Wolley, Claudia y Lori Wright
1990 "Operación DP7: Investigaciones en el Grupo L4-4". En *Proyecto Arqueológico Petexbatún: Informe Preliminar # 2, Segunda Temporada, 1990*. A. Demarest y S. Houston, eds. Pp. 44-65. Instituto de Antropología e Historia, Guatemala y Departamento de Antropología, Vanderbilt University.
- Woodfill, Brent, John Spenard, Tomás Barrientos y Brigitte Kovacevich
2002 "Mapeo y Estudio de Patrón de Asentamiento en Cancuén: Temporada 2001". En *Proyecto Arqueológico Cancuen, Informe Temporada 2001*. A. Demarest y T. Barrientos, editores.. Informe entregado al Instituto de Antropología e Historia. Pp. 9-20.