ACTA MESOAMERICANA
Volume 10

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(editors)

The Sacred and the Profane
Architecture and Identity in the Maya Lowlands

3rd European Maya Conference
University of Hamburg
November 1998
The Cave as a Cosmogram: Function and Meaning of Maya Speleothem Use

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Recent cave research has noted that there is a ubiquitous pattern of speleothem breakage and movement in caves utilized by the ancient Maya. Unfortunately, no systematic study has been undertaken to provide data on the extent of speleothem exploitation or on the variability in the contexts and uses of the material. Without such data there is little hope for understanding the meaning of the practice. The Western Belize Regional Cave Project (WBRCP) conducted a formal spatial analysis at the site of Actun Tunichil Muknal which involved piecely plotting artifacts (including speleothems), and recording distributions and associations using Geographical Information Systems (GIS). The analysis found that speleothems not only functioned as architectural components of such features as bridges and supports, but commonly accompanied offerings as well. Despite contextual differences, there exists a pervasive association of speleothem use with a “special” or “sacred” meaning. By examining groups of artifacts associated with individual speleothem clusters, comparisons were made with iconographic representations in order to determine specific meanings. This method of analysis has revealed that the Main Chamber of the cave was likely to have represented a physical manifestation of the Maya creation myth and that a ritual event conducted within the chamber was related to the iconographic representations of the creation of the world.

Introduction

The term speleothem is formally defined as “any secondary mineral deposit that is formed by water” (Gary et al. 1972:679), and is a commonly used generic term for stalagmites, stalactites or other similar cave formations. Although speleothem usage by the ancient Maya appears to be ubiquitous, it has only been given sporadic attention by archaeologists (Andrews 1970; Awe et al. 1997; Brady 1989; Bonor and Martinez 1995; MacLeod and Pulston 1978; McNatt 1996; Pendergast 1970; Reents 1980; Rissolo 1998). Recently, Brady has reported on the distribution and context of speleothems throughout the Maya area in both caves and surface sites, and has demonstrated their possible utility in linking surface finds to specific cave locations (Brady et al. 1997). However, to date no formal analysis has been undertaken to investigate their specific function and meaning.

The Yucatec term for speleothems is *xiix ha tunich* or “drip-water stone” (Barrera Vasquez et al. 1980: 946). This lexical evidence suggests that the Maya were cognizant, at least empirically, of the process of speleothem formation. Water found in caves, called *Zuhuy Ha* or “virgin water,” was considered sacred and used in ritual throughout Mesoamerica during pre-hispanic times (A.J.O. Anderson 1982: 82; Duran 1971: 131; Sahagun 1981: 141; Thompson 1959: 124–127.) It would be expected that the element of transformation embodied in the
process of creating stone from dripping water would imbue speleothems with special meaning as Brady suggests (1997:725).

A fundamental idea concerning the interpretation the archaeological data from caves, is that artifact assemblages are an expression of ancient Maya ritual and reflect religious symbolism. In discussing the use of the Direct Historical Approach in the analysis of Preclassic iconography, H.B. Nicholson suggests that rather than to simply consider isolated elements as symbolically meaningful, we may reach better understandings by evaluating clusters of elements (1976: 173). Cave archaeologists in the past have had a tendency to focus on particular objects in their search for the symbolism and meaning of data. A more fruitful approach to the interpretation of the archaeological record would be to evaluate interrelationships of groups of elements. Clearly, this approach is highly dependent on careful provenience allowing artifacts to be evaluated at a variety of levels of distribution on a continuum from global to local.

The present study is an analysis of speleothem use at Actun Tunichil Muknal, a Late Classic Maya ceremonial cave in Belize. By examining speleothem distribution and function within a single site, nuances of meaning may be established by viewing these artifacts from both global and local perspectives. Overall global trend of speleothem deposition will be analyzed as well as localized usage of unique deposits.

To facilitate the storage and analysis of these large amounts of specific data, the use of complex computer programs has increasingly become a necessity (Renfrew & Zubrow 1994). Geographical Information Systems (GIS) offer the flexibility needed for the display, storage, and analysis of the archaeological data, and are useful in the identification of patterning as demonstrated by Zubrow (1994: 107-18). Data display becomes a powerful tool in the analysis and the recognition of patterning within large areas and complex contextual features since global patterning becomes more easily recognizable and observations that were not obvious in the field become quite obvious on the screen.
Actun Tunichil Muknal, (Cave of the Stone Sepulcher), is a Maya cave in the Cayo district of Western Belize, Central America. Located near Teakettle village, it is situated on a tributary of Roaring Creek (Fig. 1). It was discovered by a geomorphologist, Dr. Thomas Miller (Miller 1989, 1990) and a map of the cave system was produced in 1989. Subsequently, the cave was visited by a British speleological expedition (Marochov & Williams 1989, 1991). It is currently under investigation by the Western Belize Cave Project (WBRC) under the direction of Dr. Jaime Awe.

Actun Tunichil Muknal is a large cave system and may be described as a “wet,” since flowing through the approximately 5 km. of cave passage is a perennial stream that culminates in a deep blue pool. Cultural remains in Actun Tunichil Muknal are found in four major loci: the Main Entrance, the Sinkhole Entrance, the “Stelae” Chamber and the Main Chamber (Fig. 2). Speleothem usage occurs in both the “Stelae” Chamber and the Main Chamber.

The area that we refer to as the “Stelae” Chamber is located approximately midway between the cave entrance and the Main Chamber. It is a large ledge approximately 10 meters above the stream measuring 5x15 meters that can accommodate 10-12 people in close conditions. Ceramics in this area date to the Late Classic - Spanish Lookout phase (A.D. 700-900), based on cross dating with Gifford’s Barton Ramie collection (Gifford 1976).

The Main Chamber was the most extensive and intensively utilized area of Maya ritual, and its secluded location left it undisturbed by looters. Located 500 meters from the cave entrance where a high level passage splits off from the main passage-way, it measures approximately 183 meters in length, 35 meters at its widest point and 5 meters at its narrowest. The total area of the chamber is approximately 4,450 square meters. Much of the chamber’s floor consists of a series of travertine dams formed by the precipitation of calcium carbonate during water evaporation. These dams, 10-40 cm. deep, create a honeycomb of gaur pools that descend gradually toward the eastern entrance of the chamber. Although no flooding was witnessed during investigations of the chamber in 1993 or 1996, a torrential rain in 1997 caused the chamber to flood. Natural drainage began almost immediately.
immediately, but standing pools persisted for up to three weeks. It is highly likely that the chamber has been flooded on and off since ancient times, which would account for the thick calcite buildup.

For purposes of description and field use, the Main Chamber was divided into the following areas: 1) the Creek, 2) Boot Hill, 3) the Burial Chamber, 4) the Ransom Chamber, 5) the Cathedral, 7) the Angel’s Room, 6) the West Wall, and 8) the Crystal Sepulcher. The highest artifact concentrations occurred in three areas, Boot Hill, the Burial Chamber, and the West Wall. (Fig. 3) Ceramics represent about 76% of the entire artifact assemblage and date to the same Late Classic time period as those located in the “Stela” Chamber.

**Methodology**

Artifacts in the Main Chamber were individually point-plotted and maps were later digitized onto a Geographic Information System (GIS). A total of 1408 items were recorded of which 116 or 12% were speleothems. Although this overall artifact count is inflated by ritual breakage, by combining fragments into discreet identifiable objects, the count can be reduced to 438. This data set, used for the statistical global analyses, includes the 116 speleothem artifacts. Speleothem use at Actun Tunichil Muknal is striking in the variety of functions noted and the extent of their use. Within this single site, speleothems were used as architectural elements, raw material for worked artifacts, hearthstones and frequently, as accompaniments to other offerings.

To evaluate the spatial relationship of speleothems to the artifact assemblage, preliminary analyses were undertaken using GIS. By directing the program to surround each speleothem by a radius

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>Artifacts</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>183</td>
<td>41%</td>
</tr>
<tr>
<td>1.0</td>
<td>233</td>
<td>53%</td>
</tr>
<tr>
<td>1.5</td>
<td>260</td>
<td>59%</td>
</tr>
<tr>
<td>2.0</td>
<td>297</td>
<td>68%</td>
</tr>
</tbody>
</table>
of a specified size, the total number of artifacts occurring within those radii were determined (Table 1). The data set representing the entire assemblage of 1408 artifacts was used in this test. There was a dramatic increase in the percentage of the total artifact assemblage accounted for as the radius was increased incrementally. At the 1.5 meter radius, over half of the data set was associated with speleothems. This indicates a high association of speleothems with other artifacts.

By grouping 723 artifacts present within that radius by class, it was possible to determine percentages of artifact classes represented (Table 2). At the .5 meter radius, indicating close association, results show a percentage increase of speleothems with each other, faunal remains, ornaments, and obsidian blades. In order to test these preliminary results, a statistical analysis was carried out using a Local Density analysis (LDEN).

LDEN produces a global measure of artifact class associations by computing interpoint distances at specified radii and comparing them to expected values (Kintigh 1990: 177–178). Results of LDEN at the .5 meter radius produced the highest statistical correlations of speleothems with obsidian, faunal remains and other speleothems (Table 3). These findings were quite similar to the GIS preliminary analysis.

Table 3. Local density coefficients of speleothems and other artifact classes with neighborhood radius of .5 m.

<table>
<thead>
<tr>
<th>Artifact Class</th>
<th>N=438</th>
<th>LDEN Coefficient for .5 meter Neighborhood Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jas</td>
<td>17.81</td>
<td>304.24</td>
</tr>
<tr>
<td>Bowls</td>
<td>25.97</td>
<td></td>
</tr>
<tr>
<td>Dishes</td>
<td>28.17</td>
<td></td>
</tr>
<tr>
<td>Shoe-shaped pots</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Vases</td>
<td>25.35</td>
<td></td>
</tr>
<tr>
<td>Whistles</td>
<td>20.28</td>
<td></td>
</tr>
<tr>
<td>Manos &amp; Metates</td>
<td>50.71</td>
<td></td>
</tr>
<tr>
<td>Celts</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Quartzite</td>
<td>50.71</td>
<td></td>
</tr>
<tr>
<td>Pyrite</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Monument</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Slate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ornaments</td>
<td>50.71</td>
<td></td>
</tr>
<tr>
<td>Obsidian</td>
<td>304.24</td>
<td></td>
</tr>
<tr>
<td>Faunal Remains</td>
<td>170.56</td>
<td></td>
</tr>
<tr>
<td>Speleothems</td>
<td>115.65</td>
<td></td>
</tr>
</tbody>
</table>
Of the 11 faunal remains located by the GIS program within a .5 meter radius of speleothems, 9 were bat bone. LDEN analysis also showed a high correlation between obsidian and faunal remains suggesting a three-way correlation between bat bone, obsidian, and speleothems. In order to explain this very high correlation, a closer examination was made of the data using GIS. Located in the Burial Chamber was a small floor-level niche measuring no more than 50 cm. in height, containing a cluster of artifacts that included 6 scatters of bat bone, 9 speleothems, 2 obsidian flakes, a small claw of unknown species, a shell bead, 4 potsherds, and a carbon scatter. The obsidian flakes associated with this niche represent the majority of obsidian found within the Main Chamber. Statistical analysis showed that the association between faunal remains, obsidian, and speleothems was not accidental.

Although bats are a common denizen of caves, it should be noted that, in the three-month field season of 1997, only twice were bats observed in the Main Chamber. There were no large guano deposits and no nesting areas, which tend to be located high on ceilings, were located. All bat bone was mapped, and it was unlikely that 6 of the 14 bat bone scatters recorded would have naturally occurred in the same small floor niche.

Although obsidian flakes and blades found in ritual context are commonly associated with blood letting, little information has been compiled on bat sacrifice. Brady (1989: 125-126) reported that at Naj Tunich, two bat skeletons, one of which was lacking the skull, were found associated with stalagmitic altars. He suggests that the context at Naj Tunich offers conclusive evidence of bat sacrifice (personal communication 1999).

In the Popol Vuh (Tedlock 1985:256-257) the Hero Twins were forced by the Lords of Xibalba to undergo a trial in the House of Bats, during which, Hunapu was decapitated by a demon bat. Illustrations on Maya vases depict some bats with crossed bones in-fixed on spread wings (Kerr 1992:452), and others with large testicles (Kerr 1997:835). Blaffer (1972:55–73) provides a lengthy discussion of Mesoamerican bat symbolism and meaning, and although much of this is quite speculative, she does point out that in the Codex Fejervary-Mayer, the Codex Vaticanus, and the Codex Borgia, the bat demon is illustrated holding severed human heads or extracted hearts. She concludes that bats were associated with sacrifice, darkness, blood, eroticism, termination of a time periods, and fertility.

**Architectural Elements**

There are two instances in which speleothems are used as architectural elements. The first is found in the 'Stelae' Chamber. Directly in the center of this high level alcove is a conglomeration of a number broken speleothems used as supports for two vertically erected slate shafts. These stelae-like shafts are both modified. The first has a series of nine scallops carved into its edges resembling a stingray spine and the second is hewn to a point resembling an obsidian blood-letter (Awe et al. 1996:2).

It is noteworthy that no drip formations naturally occur in the chamber so that the speleothem supports were necessarily brought from another area. Since there are few accessible speleothems in the tunnel system, it is likely that these were removed from the Main Chamber where formations are numerous. This suggests that speleothems were a construction material of choice not convenience, since it would have been easier to use rock from the nearby stream bed or brought from the entrance. It seems likely that the utilization of speleothems, in this case, has imbued the construction with special meaning.

The second example also suggests that speleothems served more than just a utilitarian function in architectural contexts. This construction, located in the deepest area of the Main Chamber is referred to as the Speleothem “Bridge.” At least 48 broken speleothems (these were not included with the 116 speleothems used in previous analyses), are placed

**Fig. 4.** Spatial distribution of pottery sherds, hearth, and breakage in area C. Inset: speleothem hearth which is surrounded by obsidian flakes.
in a crevice between boulders at the edge of a large area of breakdown. It is referred to it as a “bridge” because it must be crossed to gain access to the easiest, and indeed only route over the breakdown. However, the function appears to have been mainly to demarcate the route, since the crevice only measures 30 cm. wide and provides no real obstacle.

Carved Speleothems

In two instances speleothems were used as raw material to create ornaments. The first is a bead, found cached in a crevice in a remote area of breakdown. The second is a carved object found on a small flat altar-like feature along with a fragment of polished pyrite, a sherd and some small pieces of charcoal. Reents-Budet suggests (personal communication, 1997) that the artifact may be a fractured labret, worn on the lower lip. Speleothem artifacts appear to be somewhat rare and Brady et al. were able to produce only one example of a tubular speleothem bead and that is from Northern Honduras (1997: 731).

Hearths

Speleothems were also used in the construction of hearths. In one example, a concentration of charcoal is surrounded in a circular fashion by two speleothems, a large sherd and a rock. Although these types of configurations have functional value, in certain instances their meaning becomes an expression of cosmological ideals.

Recent work by Friedel et al. (1993: 68–93) has suggested hearths are salient features in Maya cosmology, particularly the 3-Stone-Hearth in the 4 Ahau 8 Kunk’u creation event of 3114 B.C. More recently, Taube (1998) draws an analogy between Maya household architecture and the configuration of temples as “god houses” whose roofs are supported by four posts and whose center is the 3-stone hearth that represents both a place of creation (Taube 1998: 464), and axis mundi connecting the sky, earth, and underworld (Taube 1998: 430). Taube’s proposes that this hearth symbolism is replicated in radial stairway pyramids, cache vessels,ensors, and three-legged altars (Taube 1998: 439–440). He associates a cluster of iconographic elements with this symbolism: centrality, jaguars, fire, and water (1998: 431–440).


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Fig. 4. Left: Photograph of the 3 speleothem cluster located in the Burial Chamber. – Right: Epigraphic depictions of the 3-Stone Hearth: a) the green hearthstone place, Quirigua; b) the Seibal emblem glyph, Tablet 4 of hieroglyphic stairway, Seibal; c) three smoking hearthstones, Monument 74, Tonina; d) one of a series of smoking hearthstones on headdress of ruler, detail of recently excavated stela, Tonina; e) three stones with burning wood, Naranjo Stela 30; f) smoking sky hearthstones with glyphs for Tikal Paddlers, Stela 16, Copan; g) smoking hearthstones with sky ahau glyph, Stela 1, Salinas de los Nueve Carros (Taube 1998:433).
Hoey (1995:35-36) argues that caves are thought to be the house of gods based on linguistic evidence where the native term for cave translates as stone house. This evidence suggests that Taube’s cosmological model for the concept of the temple as “God House” may apply to cave space as well. It also agrees well with Las Casas who noted centuries ago that the Maya word for temple was also used for cave (cited in Thompson 1959: 122). Based on the presence of the iconographic elements delineated by Taube, I propose that a cluster of three speleothems in the Main Chamber represents a 3-Stone-Hearth.

This cluster was particularly notable due to its odd configuration (Fig. 4). The three speleothems are stacked one on top of the other two. It is the only instance within the Main Chamber that this configuration occurs. This particular type of clustering is noted by Taube in epigraphic representations of the 3-Stone Hearth (1998: 433). Perhaps the most important of Taube’s elements is centrality. The cluster of three speleothems was found in the Burial Chamber, large cathedral-like room located within the Main Chamber. Not only is the cluster central to the smaller chamber in which it is located, but also to the entire Main Chamber (see Fig. 3). There is a high degree of confidence that the stones are in their original context because they have been firmly cemented to the floor with calcite caused by water evaporation.

If the stacked speleothems were indeed intended to represent a 3-Stone-Hearth, one would expect to find, according to Taube’s model, a number of other associated elements. One of these is the jaguar. A close-up of the immediate area illustrates the provenience of two felid bones, an innominate and a metatarsal, located in the Burial Chamber, within five meters of the speleothem cluster (Fig. 5). These bones have been identified as closely following Panthera onca or jaguar (Norbert Stanchly, personal communication 1999).

Evidence of burning would be expected in relationship to the 3-Stone-Hearth symbolism. Although large areas of charcoal scatter are present along the walls of the chamber any carbonized material located among the rimstone dams in the center would have been either washed away or covered with flowstone. There is however, some evidence of previous burning. The speleothem from the top of the stack exhibits charring.

The evidence presented from the Burial Chamber at Actun Tunichil Muknal has suggested that hearths may have frequently carried significance far beyond their simple function as fire pits. This is suggested by the very importance of fire within Maya ritual. Cook (1983: 139) notes that the Quiche frequently refer to rituals as burnings and Bunsell (1959: 431) reports that Maya altars are called “burning places.” Data from Actun Tunichil Muknal suggests a ritual, which on one level involved the re-enactment of the Maya creation myth. The wet, dark cave provided an analogous environmental counterpart to the world at the be-

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Fig. 5. Detail map of the Burial Chamber showing jaguar bones and 3 speleothem cluster.
ginning of creation when the sky was "lying down," resting on the primordial sea and all was dark. Artifactual evidence suggests a ritual event that is related to the iconographic representations of the creation of the world. The artifact distribution within the Burial Chamber represents a physical manifestation of that ancient cosmogram.

Conclusion

From global analyses it can be concluded that, from the quantity of their use and frequent associations with other artifacts, speleothems served an important function in the rituals. It was found that they were often deposited with other offerings in groups of two or more. In one instance, a three-way association of bat bone, obsidian, and speleothems suggests a ritual significance between these objects relating to sacrifice, possibly that of bats.

Speleothem use as construction material suggests that these particular artifacts were selected because of specific properties associated with a special meaning. Although other materials were available to the Maya, speleothems were used for constructions such as the bridge, and as supporting structures for stelae-like vertically erected stones. Again, in the "Stelae" Chamber containing the erected slates carved as bloodletting implements, the association can be drawn between speleothems and blood sacrifice.

Although they may have been used in a variety of contexts, their association with water and transformation made them in and of themselves objects of power. Thus, I would argue that their use as primordial hearthstones was hardly accidental. The obvious association with the cave reinforces the all-important concept of centrality, for as Eliade (1958: 380-382) notes, the great acts of creation in all parts of the world occur at the cosmic center. Evidence suggests that at Actun Tunichil Muknal, speleothems were highly sacred ritual objects associated with two basic themes of Maya religion, blood sacrifice and creation.

Acknowledgements

I would first like to thank the Social Science and Humanities Research Council of Canada, whose grant has funded the Western Belize Regional Cave Project. The project is under the direction of Dr. Jaime Awe, to whom I am indebted for his contributions, suggestions, and generous support. Thanks also to the members of the WBRCP and the many students who assisted us. The permit for the project was provided by the Belize Department of Archaeology and I would like to thank John Morris, Allen Moore, and Brian Woodley. I would also like to express my thanks to Dr. Karl Taube and Dr. David Friedel for their valuable input and to Dr. Keith Kinigh for his assistance. Finally, I would like to express my gratitude to Dr. James Brady for his suggestions and comments in the preparation of this manuscript.

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