



**Night
and
Darkness
in
Ancient
Mesoamerica**

Edited by Nancy Gonlin
and David M. Reed

CHAPTER 5

ILLUMINATING DARKNESS IN THE LATE CLASSIC MAYA WORLD:

NOCTURNAL CASE STUDIES FROM COPAN, HONDURAS AND LA JOYA DE CERÉN, EL SALVADOR

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Introduction to Light, Darkness, and Luminosity

The ancient Maya peoples of Mexico and Central America lived in a Neotropical environment where bright moonlight, the stars, and the Milky Way were part of the nightscape and their mythology and perception of time (Vail and Hernández 2013; Vail 2017). We can begin to understand how the Late Classic (600-900 CE) Maya navigated the night in terms of illumination, and what the roles of darkness and light were in Late Classic society by considering an historical ecology of this natural environment with the advantages and challenges of living in it (Chapter 1, this volume). This chapter focuses on material evidence for the sources of lighting during Classic times and the metaphorical role that some lighting sources, such as hearths and torches, played in Classic Maya culture (Scherer and Tiesler 2018).

The explicit study of light and lighting in anthropology is recent, but has already enhanced our understanding of the lives of humans. An anthropology of luminosity as put forth by Mikkel Bille and Tim Flohr Sørensen (2007, 265) presents this type of anthropological study as,

“an examination of how light is used socially to illuminate places, people and things, and hence affect the experiences and materiality of these, in culturally specific ways. ... how light, as matter in itself, may be manipulated and used in social and material practices.”

Luminosity, in their words, refers to “luminous qualities of the relationship between light and sight” (Bille and Sørensen 2007, 266). Cross cultural linguistic expressions demonstrate how the fundamental concepts of light and dark are interwoven through metaphors, idioms, myths, and experiences into the consciousness of humanity through time and space. “Light is more than just a medium: it evokes agency” (Bille and Sørensen 2007, 264). The myriad of socio-cultural dimensions to ideas and experiences of light and darkness make for fertile anthropological ground of inter- and intra-cultural comparisons. For example, consider who has access to lighting, how lighting and shadow are used to highlight or obscure, the role of lighting in safety, mischief, or resistance, or the way lighting can be used in displays of power and politics or entertainment. Understanding the cultural implications underlying and agencies involved in these examples, among others, can add dimensions for comprehending anthropological practices and interactions in both the present and the past. Examinations of lighting and its role in the built environment further our understanding of the variation of human experiences (e.g., Griffiths 2016; Moyes and Papadopoulos 2017) and conceptions of nighttime and darkness, as well as broaden our

consideration of the diversity of such perspectives, including how nocturnal illumination varied from house to house along the social spectrum, and along the rural-urban continuum.

We all are familiar with, make sense of, and experience night and darkness; however, we do not all share the same perspectives and embodiments of these phenomena through time, space, or social position. Lychnologists, scholars who formally study luminosity, have advanced our understanding of nocturnal and dark experiences through their study of lighting in the ancient world (e.g., Micheli and Santucci 2015; Popkin n.d.; Strong 2018). Archaeological researchers have begun to direct intentional focus on understanding darkness (Dowd and Hensey 2016; Moyes 2012; Chapter 1, this volume) and ancient nights (Gonlin and Nowell 2018), and in particular, ancient Maya nights (Aveni 2018; Coltman 2018; Gonlin and Dixon 2018; see chapters by Coltman; Reed et al.; Sheets and Thomason, this volume). As our inquiry expands, so too must our archaeological imaginings of the types of material culture employed in the dark and at night.

One ubiquitous component of night is darkness, varying globally by latitude but none-the-less experienced by humans the world over. We humans created various lighting mechanisms to overcome darkness or to emphasize it. This chapter explores the potential evidence in the archaeological record of the ancient Maya for tools of illumination, both materially and symbolically, by focusing on two different sites (Copan, Honduras and La Joya de Cerén, El Salvador). In the tropical region where the ancient Maya thrived, nights are relatively consistent in length throughout the calendar year. Fortunately, many lighting practices and evidence for the use of fire leave material traces in the archaeological record, as is the case for torches, hearths, and lamps the world over. (e.g., Micheli and Santucci 2015; Torrell 2016). The study of lighting encompasses much more than such material items; it includes phenomenological experiences of light and darkness in space and of metaphorical expressions, phrases, and idioms woven into language and expressed in other symbolic media.

While ancient light has long since faded, information about the methods and tools used to illuminate darkness can be detected from several sources, including evidence contained in realia such as artifacts and features, the remains of writing and other symbols, the use of ethnohistoric documents, historical recordings, and the critical use of ethnographies. Thus, archaeologists must draw inferences from varied sources to extract the material dimension of lighting, rather than measuring the materiality of light itself — the lumen (Bille and Sørensen 2007, 269). Among the array of Classic Period Maya cultures (Beyyette 2017), a range of sources are available to provide information about the light and illumination mechanisms of the past. Beyond the simple documentation that lighting was used, the study of light can inspire new questions and dimensions of understanding, creating a pseudolanguage that we can decipher and interpret. The varied historical uses to which lighting was put raises many research questions not directly considered before. Jeremy Coltman (2018; this volume) has explicitly considered what the role of light and darkness was in Late Classic society. We can examine how light was used as an agent in socio-political interactions. In a complex society, we would expect to find status differences in illumination, as Randolph Widmer has found to be the case at Teotihuacan, Mexico (this volume). There very well may have been age, class, and gender dimensions to producing lighting. How lighting was used for safety, craft production, navigation, ritual, politics, and other symbolically-laden activities should be investigated as one aspect of these habits. How vital was illumination to the nightly practices of the ancient Maya, given our current situation of nocturnal life? If ancient cities, or outlying areas, were lit at night, how was this illumination accomplished, whose efforts and labor went into creating and tending lighting throughout the night? And what protections or vulnerabilities might such lighting afford? While many of the complexities of ancient uses of

lighting might elude the archaeological gaze, like other aspects of archaeological research we can examine and interrogate various lines of evidence to better understand these practices. We can investigate to what degree the ancient Maya engineered their structures with the aspect of lighting in mind. Such a bounty of new research avenues leads to productive and exciting new considerations of the Classic Period Maya, but such interpretations must be grounded in archaeological data. One avenue of such data is to begin by considering the types of lighting technology employed and how to identify this evidence in the archaeological record.

Luminosity is addressed for the Late Classic Period Maya with the majority of evidence from two World Heritage sites, Copan, Honduras (Figure 5.1) and La Joya de Cerén, El Salvador (Figure 5.2). These two sites were chosen for a number of reasons. The first author (Gonlin) has conducted research at both locales, and the second author (Dixon) excavated at Cerén for several field seasons (Dixon 2013). Second, excavations at Copan and Cerén have taken place over decades, creating a rich database for both sites. Third, these two sites provide contrasting degrees of preservation (Webster, Gonlin, and Sheets 1997), with Copan exhibiting remains typical of the tropics, while Cerén was a farming community with extraordinary preservation of organic materials and in situ remains. The sudden burial of Cerén beneath meters of volcanic ash in 660 CE has preserved remarkable aspects of the past, such as thatch roofs, the hollows where agricultural plants had existed, a painted gourd, a sweat bath (see Sheets and Thomason, this volume) and incredibly, even rolled-up woven sleeping mats in the rafters of the roofs. Such preservation was made possible by the nature of the volcanic phases of the Loma Caldera eruption that buried the site. Examination of these two different ancient Maya locations in the context of the archaeology of darkness and the night affords a range of evidence of lighting as we initiate focused consideration of ancient Maya lighting practices. We begin this exploration by briefly considering ecological dimensions of lighting before turning to cultural innovations in an array of illumination sources. We then address the relationship of lighting to the built environment before concluding with suggestions for future research.

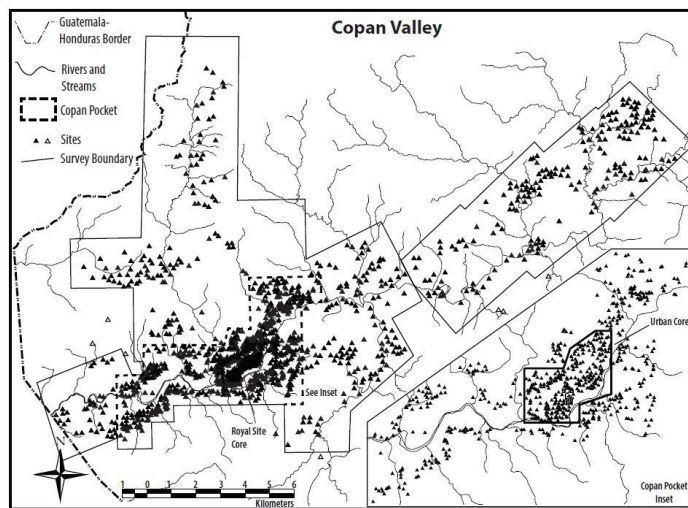


Figure 5.1. Plan map of the Classic Maya site of Copan, Honduras and the Copan Valley settlement. The Main Group and urban neighborhoods are shown in detail in the inset. (Courtesy of David M. Reed)

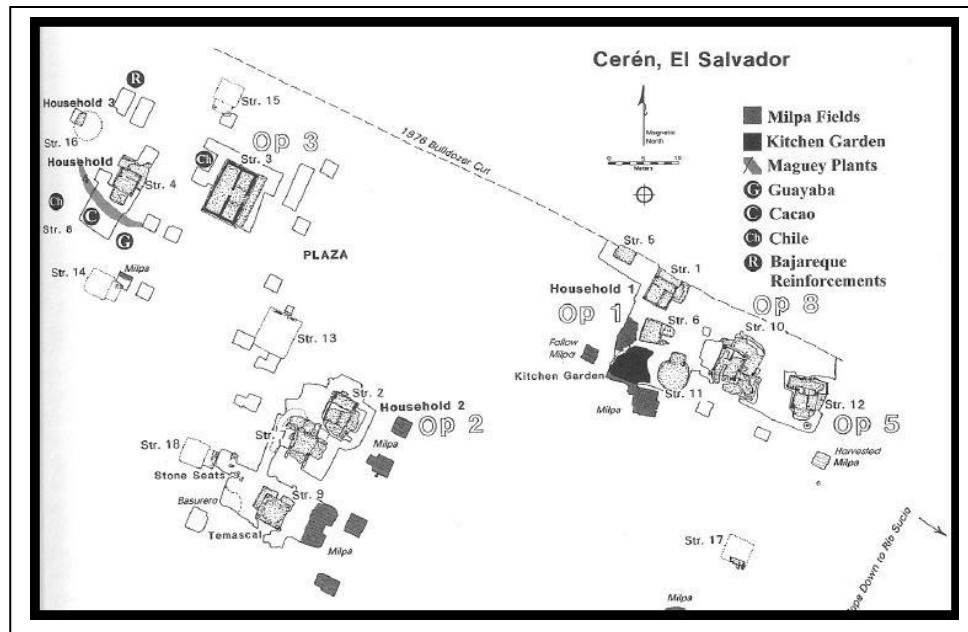


Figure 5.2. Plan map of La Joya de Cerén, El Salvador illustrating excavated structures at this seventh-century CE agricultural community. (Courtesy of Payson Sheets)

Lightscares of the Tropics – Landscape Considerations

“Light is important because it is the only natural tool that allows us to visually perceive space; only through the contrast between light and shadow can we read a space and understand it correctly” (Cesario et al. 2016:1). Sunlight and moonlight are two obvious natural sources of lighting experienced by humans the world over and through time (Alley 2017) and can be manipulated in various ways. The Central American countries and much of Mexico lie within the Neotropics where the average strength of the sun per day will be greater due to nearly equal nighttime and daylight lengths year-round than in more northern or southern latitudes. The sun is literally more intense the nearer one gets to the equator (Harris 2017). These observations have well-known effects on the lightscares of the tropics. While the intensity of the sun nearer the equator is often readily recognized, less often considered is that the amount of light that the moon gives off is similarly affected by several factors¹. The sun and the orbit of the moon taken together determine the brightness of the moon, but the difference is not perceptible to the human eye. Pollutants dim the brightness of all astronomical objects, as do clouds. During the agricultural season when fields are prepared and burning commences, or other cultural practices, such as lime production (Hansen et al. 2002; Seligson, Ruiz, and Pingarrón 2019), the moon’s visibility would be greatly diminished by smoky skies. Likewise, rainy season weather obscures the day sky with its greyness and the nighttime with its cloud cover. So, like our own night skies, the darkness of night would have varied from evening to evening for the ancient occupants of the Maya region. Thus, both natural phenomena and cultural practices were influences for the varied observance of the moon and the night sky of past, as they are in the present. “Creating *lightscares* are about recognizing the luminosity and materiality of the light source, and in the extended agency it offers to its surroundings” (Bille and Sørensen 2007, 274).

Beyond the larger geographical influences on the experiences of night, we must also consider the localized variation of individual perception of darkness and light. One aspect of light perception involves both the biological and cultural influences of individual human eyesight. Biologically, photoreceptors, the cones and rods in our eyes, will affect perception of light (Buser and Imbert [1992] and McIlwain [1996] as quoted in Kamp and Whittaker 2018). Because the number of photoreceptors varies from individual to individual, each of us has, in effect, his or her own unique lightscape. Color perception is as much a matter of culture as it is of cones and rods, as linguists well attest (Rowe and Levine 2012). Furthermore, suitable and preferred lighting are highly culturally-patterned. In the archaeological record, it is difficult for us to see the degree of cultural considerations of how darkness is quantified. While we may not know the differences of individual's photoreceptors or the specific cultural logic related to the categorization and appraisal of light perception, we can begin to think of how different social positions of members of Classic Maya society might have influenced various personal nightscapes and experiences.

The nighttime sky of the Classic Maya would have been immensely dark (darker than the nights witnessed by the majority of humans alive today) whether one lived in rural or urban areas of the Lowlands. There is no comparison of the past to the tremendous amount of light that pollutes the skies today. Most modern humans do not appreciate the brightness of the moonlight, as the ancient Maya did (Christenson 2007, 79) because we often cannot detect it among the artificial sources of nocturnal lighting. In the context of examining ancient lighting practices, it is helpful to adopt a relativistic perspective and to recognize the lumicentric culture of the 21st century. However, in the context of darker nights, in a world less populated, and before the advent of electricity, the ancient Maya people, like other societies on earth at that time, would have been acclimated to dark nights and perhaps have been more sensitive to forms of light that modern humans might find rather dull in comparison to contemporary lighting techniques. Sensitivity to different phases of the moon, planning around these phases, and imbuing them with cultural meanings existed in Classic times (Landau, Hernandez, and Gonlin n.d.). The creation of solar and lunar deities in innumerable cultural mythologies attests to the extreme significance afforded these astronomical bodies. The ancient Maya used the nocturnal lightscape of the tropics to great effect.

Contemporary Maya peoples are known to adhere to a lunar cycle in planting and harvesting and modern Maya farmers have relayed observations on how moonfall and rainfall correlate (Landau, Hernandez, and Gonlin, n.d.). In a study that combines Classic Mayan inscriptions for accession dates at eleven major cities with the lunar cycle, Kristin Landau, Christopher Hernandez, and Nancy Gonlin (n.d.) detected a statistically significant pattern where it was more likely for a king to come to power during either a full moon or a new moon, both of which are auspicious calendrical times. Given the immense astronomical knowledge of the Maya and that divine rulership and agricultural productivity were intricately intertwined, it is no surprise that this correspondence has been found.

Another example of a royal event and the phase of the moon comes from a Classic Maya city along the Usumacinta River in Guatemala, Yaxchilan. Structure 23 sported numerous lintels and one of them shows the queen, Lady Xoc, engaging in a bloodletting ceremony with her husband, King Shield Jaguar (Miller and Martin 2004; Schele and Miller 1986). The large torch used to illuminate the scene and the blue background may indicate that this ritual took place at night (Gonlin and Dixon 2018, 62). On the date of this performance, on October 24, 709 CE, the waxing gibbous moon could have supplied additional lighting since this celestial body was 89.94% illuminated at that time (*ibid.*). How one uses light can have great social, political, and economic influence and "light and shadows can be a way of permeating the boundary between public and

private” (Bille and Sørensen 2007, 273). Below we consider the experiences and effects of lighting in a review of the material evidence for how the ancient Maya illuminated their world and symbolic meanings attributed to such lighting sources.

Technologies and Symbolism of Artificial Lighting

Apart from natural sources of light (sun and moon) briefly considered above, there are many technologies to illuminate the dark that ancient people invented and utilized to great effect. Some of these technologies are portable, such as torches, lamps (Moullou 2015), a variety of ceramic forms that held fire, candlefish (Hough 1926, 199-201), or kukui (Van Gilder 2018), while others are not (e.g., hearths, wall sconces, etc.). The lighting of fires has particular significance in Maya religion (Stuart 1998). Given the numerous hieroglyphic Classic Mayan passages that pertain to burning events, David Stuart (1998, 403) concludes that “...burning and bloodletting went hand-in-hand as modes of spiritual and ritual expression.” So, while our main focus in this section is the archaeological evidence for lighting practices, the symbolism of such technology should be simultaneously considered as they are conflated. Anthropologists have long challenged Western society’s tendencies to prioritize binary divisions of secular and sacred domains by noting the inappropriateness for many cultures of the world to mark any distinction between the two. Given such a predisposition in our own culture, we are aware that as we discuss the more mundane, utilitarian ideas of illumination technology, that such tools would have been potentially employed and interwoven with significant symbolic meaning by the ancient Maya (Hamann 2002) and other cultures (Bille and Sørensen 2017).

It is essential to acknowledge the limitations of archaeological preservation for many types of illumination that would have relied heavily on perishable materials. Despite this constraint, much evidence remains from the Maya area regarding lighting technologies. Below we consider the role that hearths, torches, candles, ceramic forms, mirrors, and even fireflies, played in the dark. While most of these sources of illumination are artifacts and by definition are portable, the hearth, as a feature, is not. Once we explicitly look for the tools and contexts of ancient light, only then do they become highly visible, in many cases having already been waiting in plain archaeological sight.

Hearths

Hearths have been the center of life for ancient peoples for eons (Nowell 2018) and comprise a substantial category of the cross-cultural archaeological record. Two of the best-known and most readily archaeologically visible forms of ancient Maya lighting were hearths and torches, one used in situ, while the other readily transportable. “As in many Maya homes today, the fire and hearth, generally surrounded by the three stones for cooking are the center of life’s activities. In the cosmic sense as well, the three stones are the center of the universe” as reported by Mark Pitts (2011, 12). Iconographically, the hearth is represented by three stones, as at Ceibal, Guatemala (Josserand and Hopkins 2011, 85). Karl Taube (1998, 436) reports that “large, worked stone spheres have been found over much of the Maya area...” so we can surmise that these objects may be indicative of hearths. The three-stone hearth for the Maya goes back centuries. At the Preclassic site of Yaxnohcah in the Yucatan, Kathryn Reese-Taylor² (pers. com. July 23, 2019) and colleagues recovered in the plaza of the Grazia complex a hearth associated with a three stone arrangement under an altar. Both Joya de Cerén and Copan provide evidence for the significance

of hearths. At Joya de Cerén, a number of hearths have been documented within their wider community context. The hearth found at Cerén in the kitchen (Structure 11) of Household 1 is a rarity because it was intact, with three large stones used to support vessels with remains of ash from the fires of cooking below. At Cerén, many such features are found outdoors, such as the one along the western wall of a domicile, Structure 2, and two other hearths located in an area utilized for food preparation along the north exterior corridor of Structure 10, a religious community center. It is likely that feasts occurred at this building, according to Linda Brown's work (2001). Likewise, in rural Copan, from a small sample of completely excavated farmsteads (Gonlin 1993), the only indoor hearth was associated with a kitchen (Structure 3 at 7D-6-2), whereas others were found along exterior wall lines (e.g., 7D-3-1). Cooking and food preparation were part of every household's production. In summarizing both urban and rural Copan neighborhoods, Julia Hendon (2009, 119) remarks that "These quintessential activities of daily life took place in outdoor locations in the patio, on the terraces, or in roofed areas that were not fully enclosed rooms." We can envision nocturnal activities centered around the heat of the hearth easily taking place outdoors in the refreshing cool of the tropical night.

The demands for wood would have been substantial during Classic Maya times (Lentz et al. 2014; Robinson and McKillop 2013), perhaps enough to cause anthropogenic changes in the environment. Charcoal from pine and oak are very frequently recovered in archaeological contexts (see Slotten, this volume). Hearths are often associated with the heat of cooking activities, yet undoubtedly some hearths were lit to produce light itself in a set location.

While some fires were used for lighting of nocturnal activities, others were lit for manufacturing purposes. Hearths were employed in a range of applications including heat, cooking, protection, manufacture of plaster and ceramics, among others. In the Maya world, a great deal of lime was produced for nixtamalization of maize, and hence lime and maize tie in with hearths where maize was cooked in various forms. Other types of lime production were necessary for plaster manufacture for construction (Abrams 1994, 116-117; Hansen et al. 2002; Russell and Dahlin 2007; Seligson 2016; Seligson, Ruiz, and Pingarrón, 2019; Villaseñor 2010). As a result, numerous fires for burning limestone were necessary. It is worthwhile to consider whether lime manufacture was a nocturnal activity (see Widmer, this volume, for lime production at Teotihuacan), due to the high heat required to produce the end product. Hearths were a localized and fixed source of light and heat. Much more evidence for lighting techniques of the Maya world is found from mobile lighting sources, as described below. Portable hearths were created in ceramic vessels.

Torches

The Late Classic Maya portrayed the torch or "burning spear" (in reference to the torch held by King Shield Jaguar on Lintel 24, Structure 23 at Yaxchilan, Mexico [Miller and Martin 2004, 100]) in many different art forms. Evidence that torches were devices commonly employed by all in society include media, such as the lintel representation and elite Classic Maya cylindrical vessels (Figure 5.3), ethnographic observations and the wide range of uses of torches from quotidian to ceremonial contexts, and torch remains in domestic, ritual, and even cave locations. Epigraphic evidence reinforces the widespread usage of torches through the existence of the Classic Mayan glyphs for fire (K'AHK'), spark (TOK), and torch (TAAJ) (Stone and Zender 2011). Torches were employed in other Mesoamerican societies as well, such as Teotihuacan (Nielsen and Helmke 2018; Widmer, this volume).

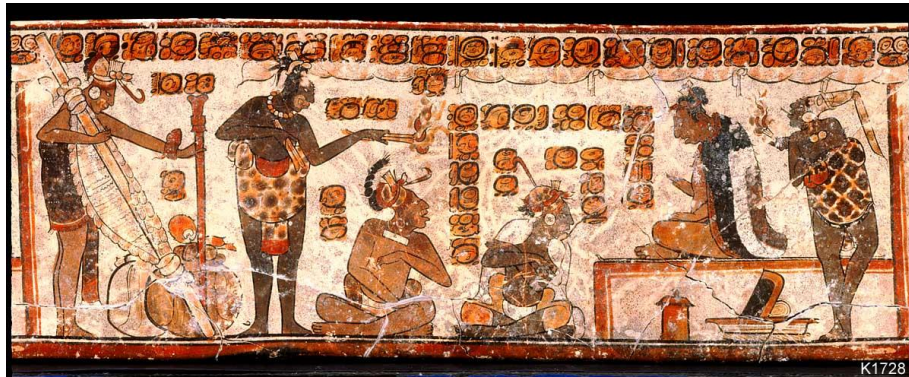


Figure 5.3. Classic Maya ceramic cylinder vessel (K1278). Note the torches in the palace scene which indicate that the activities portrayed likely took place in the dark, and perhaps at night. Note also the mirror resting in a vessel on the floor. (Photograph Justin Kerr file no. K1278; Image in Public Domain)

Ethnohistoric records provide insights into potential analogous practices throughout the Maya area. Charles Wisdom (1940, 21) reports many instances of torch use among the indigenous groups of Guatemala: “The Tunuco Indians, who live in the middle highlands ... produce nearly all the pine torches sold in the markets, since the best pines for this purpose grow only in the middle highlands.” Chorti guests routinely received a provision of pine torches (Wisdom 1940, 25), along with food and a bed, and in fact Wisdom recorded that “Every family keeps a supply of torches in its kitchen to give to travelers to light their trail when caught by nightfall before getting home” (*ibid.*). The documentation of torches provided for guests indicates the degree of widespread use for this material type, and illustrates cultural patterns of hospitality. Besides providing safe passage, torches were also essential to night hunting of deer. Torches were used to blind the deer (Wisdom 1940, 71), making a deer in the torchlight an easier target (see Loofer 2019 for a full treatment of deer by the Classic Maya). Torches also serve an essential role in the preparation of planting (Stone and Zender 2011, Figure 66.4). Historically, John Lloyd Stephens (1843) and Frederick Catherwood, in their travels through Mexico and Central America in the mid-1800s, made note of the use of torches by their guides. Torches were clearly embedded in symbolism as relayed by Andrea Stone and Marc Zender (2011, 161): “Given that fire played a pivotal role in Maya thought, the torch had complex symbolic dimensions. A torch could stand for solar heat and drought or the light of a firefly.” Torches, especially those made of pine, had great utilitarian uses but were often essential elements of rituals (Morehart, Lentz, and Prufer 2005).

It has proven difficult to find remains of torches in residential contexts because of their perishable nature, and since the more one uses a torch, the less of it remains, and when spent, a torch may be simply dropped in its location of disuse. Noted by Keith Prufer and Peter Dunham (2009, 305) is that “Poor preservation of organic materials at surface sites has likely masked evidence of an important relationship between the Maya ritual and pine in a variety of contexts, though remains of these materials are preserved in caves.” Protected venues throughout the Maya Lowlands have produced remains of torches through careful excavations (Prufer and Dunham 2009, 297, 304; Stone and Brady 2012, 487) or the ceramic handles used in some cases to support the torch material (Brady 1989, 257-258).

Evidence on ceramic vessels portray the ancient Maya using torches to light up palaces (Figure 5.3) and perhaps large courtyards where nocturnal rituals were performed (Miller and Martin 2004, 21-22), and just as likely, torches could have illuminated late night gatherings of

common folk outside of their banausic architecture. The perishable nature of torches makes preservation unlikely, unless in atypical situations. The Cerén site in El Salvador affords a rare opportunity to investigate ancient Maya life in a farming community and just such atypical preservation. The first phase of the Loma Caldera eruption coated the site with a fine ash that prevented initial burning of some perishable materials, such as thatch roofs; thus, if the inhabitants had used torches at Cerén, these items potentially would have been preserved. To date no torches have been identified in the inventory of the community's possessions (Sheets 2002). Despite the remarkable preservation of this site, there is actually minimal evidence for lighting practices. Perhaps torches were less important at Cerén, perhaps they were used in contexts or locations not yet identified in this community, maybe their flammable nature resulted in their ignition and burning during the eruption, or the inhabitants (who have not yet been found) ran away from the eruption, with torches in hand. No torch holders were found built into, or fastened to, the walls of Cerén's structures, further suggesting that perhaps torches were used in other contexts, more limitedly, or not at all. However, we may consider anew the "cord holders" constructed from loop handles that have broken off from their vessels. Such loop handles were implanted in Cerén's architecture (Gonlin and Dixon 2018, 55; Sheets 2006) and may very well have been strong enough to support a small torch. Without charcoal marks in evidence, however, this scenario may not be plausible. Despite the current lack of direct evidence for torches at Cerén, other forms of lighting technologies have left a mark, and one of the most significant is the hearth, as described above.

Candles

Another type of material culture useful in lighting is wax, a substance that has many uses, one of the most common of which is for candle-making (Widmer, this volume), though remains of the actual substance are rare. Stone and Zender (2011, 161) and many others concur that wax candles and oil lamps were not found among the ancient Maya, a conclusion based on the lack of evidence. Apiaries, though difficult to detect archaeologically, recently have been recovered (Žračka et al. 2018). Interestingly, an assemblage of artifacts from Cerén might suggest that some communities of the ancient Maya had the potential to manufacture and use wax candles. At Cerén, in Structure 4, a storehouse/workshop for Household 4, excavations revealed a ball of beeswax about the size of a baseball (Payson Sheets, pers. com., March 31, 2017). Inhabitants placed the wax on a high shelf that paralleled the building's partition wall and it was kept safe there along with many other items, including a censer decorated with an animal head (Gerstle and Sheets 2002, 78). Cotton, grown at Cerén (Lentz and Ramírez-Sosa 2002, 35-37), was a "vital crop" and one that could have been used for the manufacture of candle wicks (Wisdom 1940, 64). These components of the archaeological assemblage – beeswax³, a ceramic vessel, and cotton – all could have been combined to form candle lighting for the Cerén community, or they may have each had very different separate functions.

Beyond the Classic Maya, there is no evidence for candle use within Mesoamerica pre-hispanically. Later in time, Franciscan friar Bernardino de Sahagún documented in the *Florentine Codex* an Aztec man making candles (Sahagún 1963, bk. 10, 91) (Figure 5.4). This figure is wearing a costume of Nahuatl and Spanish elements, and the process portrayed is that of tallow dipping⁴ Such candle-makers and candle sellers were noted in the marketplace of the Aztec society (Nichols 2013); *candelanamacac* is the hybrid term from the Spanish *candela* with a Nahuatl ending⁵. It is most likely, then, that candle-making and candle-using did not take place in Mesoamerica before the arrival of the Spaniards, pending further evidence and interpretations (Peterson 2003).



Figure 5.4. Aztec man making candles. Depiction from the *Florentine Codex*, book 10, page 91. (Image in the Public Domain)

Ceramic Forms

Evidence for lighting practices are also visible through ceramic remains, a type of material abundant in the archaeological record. Ceramics are ideal vessels for retaining heat and containing fire, whether they are censers (*incensarios*), braziers, or shallow open dishes (Stone and Zender 2011, 63). While we typically think about dishes in terms of food consumption, these receptacles served to warm up, smoke up, and perhaps light up the night. One type of ceramic vessel, the censer, is connected to hearths in the Maya area. Taube (1998, 434-435) reminds us that “Aside from actual hearths, three-pronged *incensarios* probably also indicate the widespread occurrence of three-stone hearths by at least Late Formative times...these censers function much like portable three-stone hearths.” Some of these vessels are quite fancy and ornate while others are plain. Their distribution varies, but they are found at most households in the Maya region distributed across the social spectrum. At Cerén, every household had at least one censer (Beaudry-Corbett and Bishop 2002, 121-122), as did rural Copan households (Gonlin 1993, 377-378). From this wide distribution of censers in non-elite settings, we can infer that censers were a part of ancient Maya life — day and night. The amount of light emanating from these incense-holding vessels, however, would have been minimal to our modern eye.

The practice of incense burning was widespread across the ancient Maya world, and indeed, all of Mesoamerica. The Mayan glyph for incense was written as either “POM” or “CH’AAJ” (Scherer and Houston 2018). For Cerén, Payson Sheets (2006, 104) reports that “Not only did every household possess an *incensario*, but every household *building* had one. Every domicile, storehouse, and kitchen had one, and each tested positive for copal.” Copal, or *pom* in numerous Mayan languages (e.g., Laughlin 1975, 282), is a natural resin produced from a number of different trees, primarily of the *Bursera* and *Protium* genera (Case et al. 2003, 191) but this substance may also come from *Pinus* spp. (Case et al. 2003, 194). A recent test of *Protium copal* incense by Merali and colleagues (2018) examined this substance for its anxiolytic properties using animal models (rats) who were exposed to the incense for 5 minutes. It appears that even in that short exposure, a few minutes is enough to increase social interactions and has a calming effect. The burning of copal, as recorded in ethnographic contexts (Case et al. 2003, 190, 191), drives away insects and is used as a remedy for numerous maladies (Case et al, 2003; Merali et al. 2018). Copal is symbolically tied to creation and is a prime offering for the gods. Smoke is intimately tied into ritual practices for numerous ancient Mesoamerican cultures (Scherer and Tiesler 2018). The

nocturnal uses of copal could be many. Apart from the calming effect the inhalation of the smoke would have, its insect-scattering properties would be most welcome in the tropics. In an everyday sense, one must wonder whether the burning of copal in storehouses and kitchens was a routine practice to make offerings to the deities while simultaneously keeping away pests. Perhaps other resins were used for more mundane purposes, though the censers from Cerén may indicate otherwise.

Candeleros (Figure 5.5A) have been recovered in small numbers in rural Copan (Gonlin 1993) and areas just outside of its urban core (Landau 2016), but were more numerous in urban zones (Willey et al. 1994, 308). These little pottery vessels are not typically found in high numbers in the Maya Lowlands (Landau 2016, 266), but were manufactured in abundance by people who lived in Copan, in areas east of Copan (Douglass 2007; Hendon et al. 2014; Urban and Smith 1987), and in the great Classic city of Teotihuacan in the Basin of Mexico (Carballo et al. 2019; Cowgill 2015; Foley 2017; Kolb 1988; Richey 2018). Though these enigmatic mini containers elude functional classification, it is a misnomer to call them “candeleros,” a Spanish word for “candle-holder” or “candlestick.” Per the discussion on candles above, it may be unlikely that candeleros were used to hold candles, though many sport burn marks and we know that beeswax was available to Mesoamericans. Another reason that their use eludes us is that residue analysis has not been routinely performed on them (sic Richey 2018). Jennifer Foley (2017, 272) notes that “There are reports of the Aztecs using *candeleros* to hold blood, which was then absorbed by strips of paper and burned with copal incense on the altars of temples (Linné 2003:113-114).” Candeleros come in a wide variety of shapes and quality of manufacture, from the simplest pinch pots to elaborately incised and punctated specimens, some have one hole while other types have several, though most are small in size. Given this diversity, it is unlikely that all of them were used in similar fashion.



Figure 5.5. (A) A Classic Maya candelero from San Lucas, Copan, Honduras. (Photo courtesy of and with permission from Kristin V. Landau); (B) Miniature pot (Specimen 295-5-18) from Cerén, El Salvador. (Photo courtesy of and with permission from Payson Sheets). Note the similarity in size (~2.5 cm) and shape of the aperture. Such small ceramics could have functioned as candle holders, for burning incense, for holding pigments or other substances.

Though none have been recovered from Cerén, a small number of miniature pots have been found that are about the same size as Copan’s fancy candeleros from the urban neighborhood of Las Sepulturas (Figure 5.5B). Marilyn Beaudry-Corbett (1990, 157), who analyzed numerous Cerén ceramics, refers to these diminutive vessels as “miniature pigment pots” with good reason, observing that each contains the remains of powdered red pigment. Interestingly, she notes that “The rim diameters were extremely consistent in size (2.5 cm) and finish (a flattened lip), suggesting a stand[ard]ized production procedure such as fashioning them around a cylindrical

form” (Beaudry-Corbett 1990, 157). Longyear (1952, 101-102) noted a similar manufacturing process for the Copan candeleros by forming the clay around a stick. The Cerén miniature pot illustrated in Figure 5.5B sports appliqued elements that perhaps form the shape of a turtle. This specimen resembles items recovered at Copan that are called bottle-shaped candeleros (Figures 155-158 in Willey et al. 1994). No pigment or wax has been recovered from the Copan candeleros; however, it is unknown whether they were tested for residue.

While these types of small ceramics were not likely instrumental in lighting technology, as with censers, archaeologists associate candeleros with ritual activities (Hendon 1987; Hendon et al. 2014, 132), and smoke was a significant aspect of such behaviors. Patricia Urban and colleagues (2015) have hypothesized that candeleros from the Naco Valley, Honduras were all about producing smoke. The distribution of candeleros at Naco sites is such that both residences and storehouses contained the greatest numbers. Fumigation of structures holding perishable materials could be accomplished with candeleros. Whether candeleros were used in nocturnal rituals or cleansing (fumigation) remains to be seen, though these two activities are not mutually exclusive, conceptually or otherwise.

Jennifer Loughmiller-Cardinal⁶ (pers. com. July 22, 2019) notes that most candeleros are not tested for residues, and when washed, any traces of wax could be washed away. For the sample of candeleros that Loughmiller-Cardinal examined, she determined the remains of Carbon, which indicates something was burned inside of them, but those remains do not tell us exactly what was burned. Her future research involves testing candeleros and flasks for cross-over residues of hallucinogens, perhaps those from *Bufo marinus* and copal (see Loughmiller-Cardinal and Zagorevski 2016). Clearly, the catch-all category of “candeleros” encompasses a multi-use category that residue analysis can help to refine. Whether the uses correlate with form is of interest and an avenue to be further explored, as Loughmiller-Cardinal (2019) has done for cylindrical Classic Maya vessels. Archaeologists are becoming increasingly sophisticated in distinguishing between use, purpose, and function (Loughmiller-Newman 2012; Loughmiller-Cardinal 2019, 22-25) with the analytical tool of residue analysis and the consideration of context.

Mirrors

A form of reflectivity could have been employed in illumination practices in the past to enhance the potential of lighting. A mirror might not be the first object that comes to mind when considering illumination technology for the Late Classic Maya, but for eons, mirrors have been used “to enhance the effects of candlelight” (Brox 2010, 14) or light from any source. Mirrors are abundant in Mesoamerica and have been well-studied (Gallaga and Blainey 2016). The Classic Maya recorded this object with the glyph *nehn* (Stone and Zender 2011, 73). Their distribution at Copan is found in different contexts and in the remains of houses of all social statuses, from elite residences (Willey et al. 1994, 251-252) to the humblest abodes (Gonlin 1993, 406). To date, though, none have been recovered from Cerén (Payson Sheets, pers. com. August 21, 2017). Inferring from pictures on various media, such as highly decorated ceramic vessels, and from mirrors found in archaeological contexts, their size ranged from small to large (Figure 5.3).

Given the wide distribution of mirrors in Mesoamerica, it should be considered whether these mirrors were used in illumination. They are not made of glass, as modern mirrors are, but most are manufactured from polished pyrite, obsidian, or hematite (Gallaga 2016, 4). Referencing the research of Emiliano Gallaga (2016, Figure 1.1), the reflection that one sees of oneself in a pyrite mirror looks smoky and is unclear. Such mirrors have been found primarily in a number of specific contexts: divination (Taube 1992), ornamentation on dress (Joyce 2002), or in “elite burial

and cache contexts” (Blainey 2016, 180). For example, at Copan two Teotihuacan-style mirrors (Nielsen 2006) were interred with the burial of a royal woman in the Margarita tomb in the central Acropolis (Bell 2002). It may be that mirrors relate to “how light is used in relation to social identity” (Bille and Sørensen 2007, 269). Indeed, Marc Blainey (2016, 184) maintains that iron-ore mirrors, like other shiny objects, could be interpreted as linking humans to the spirit world (Taube 2016, 302) and were “a classic component of the shaman’s tool kit within the ancient Maya royal court” (Blainey 2016, 197). The ability to manipulate light and shadow is powerful, so it comes as no surprise that mirrors are often portrayed on ceramic vessels depicting royal court scenes (Figure 5.3) (see Coltman [this volume] who discusses the symbolism of the spiral eye mirror motif and its connection to darkness).

Fireflies

The use of insects has a long history in Mesoamerica that extends from the earliest to contemporary times (Vela 2019). Various species, including bees, grasshoppers, scorpions, and butterflies, among others, have figured in the mythology and subsistence practices of Mesoamericans. Thus, we consider another potential lighting source for the ancient world that comes from the realm of insects. Bioluminescent beetles might have played a role in lighting the dark and, to our knowledge, have not been previously considered as a source of lighting among the ancient Maya. Their ability to pierce the darkness, as recorded in the Popol Vuh, is well known (Schuettler 2006). The substance that glows, luciferin, is also found in algae, bacteria, fungi, and other types of animals, such as jelly fish (Grimaldi and Engel 2005, 383-386). The *Lampyridae* taxonomic family includes many species of fireflies, some of which are referred to as lightning bugs, glow-worms, and dark fireflies (Lewis 2016, 8). For fireflies, light is vital for communication, much more so than pheromones. “The duration of the flash, interval of the flash, and the location from where the beetle flashes are species dependent” (Grimaldi and Engel 2005, 384-385) (see also Lloyd 1997; Stanger-Hall et al. 2007). These small insects produce an extraordinary amount of light for their size, and perhaps one reason is that, according to entomologists, “[t]he light emitted by these insects is unique in being cold. Nearly 100% of the energy given off appears as light” (Borror, Triplehorn, and Johnson 1989, 432-433).

Walter Hough, as Head Curator during the 1920s and 1930s of the Department of Anthropology for the United States National Museum (later to become the Smithsonian Institution), wrote a lengthy bulletin titled *Fire as an Agent in Human Culture* (1926). Among the many topics he included in this treatise was a section on fireflies. Fireflies as sources of light were common in both the Americas and the Far East (Hough 1926, 196). Hough described the American genus *Pyrophorus* at length, and mention is made of ethnohistorians and their encounter with fireflies (e.g., Herrera). Bernal Diaz is recorded as stating that “in his first experience with the *Pyrophorus* thought them to be the matchlocks of numerous enemies in the forests and ordered his soldiers to prepare for action” (Hough 1926, 196). The light of these insects was apparently bright enough to serve as a sort of flashlight, guiding people through the bush. They were also employed for reading in the dark, lighting up a room, to illuminate hunting expeditions (by securing the beetles on one’s feet), and as a type of glowing jewelry worn by women.

Though Hough reports on many travelers’ observations through Mexico, details are lacking for this part of the world on exactly how fireflies were collected and in what type of container they were stored. He did report on other areas, however (Hough 1926, 198):

“Necessarily in the employment of fireflies as light for various purposes there would arise the need of apparatus for confining the insects. In the West Indies this has taken the form of a lantern with a grating of small rods, like the cages in which the Chinese keep fighting crickets. Another form closer to nature is the calabash perforated with many small holes and furnished with a door. Humboldt describes the latter form used under remarkable circumstances during a voyage from Cumana [Venezuela]”.

Another type of container was noted “from Java a curious firefly lamp consisting of a small oval wooded box with pivoted lid. The interior is lined with pitch, upon which fireflies are stuck. Reserve fireflies are kept in a cane tube. The apparatus is described as a burglar's dark lantern” (Hough 1926, 198). He provides other provocative ideas for the containment of fireflies. Hough states that “a Chinese student ... inclosed fireflies in a paper lantern,” and in Japan, they were kept in a cage (Hough 1926, 197). Only the lightest of materials would have been necessary to confine these little non-aggressive insects and of note, is that all of the materials are perishable.

The Classic Maya created a glyph for firefly (Lopes 2004; Stone and Zender 2011, 80) (Figure 5.6). The iconography of the firefly or lightning bug (KUH-KAY?) has been studied by Luís Lopes (2004, 6), who states that there is “evidence indicating their association with the underworld, with both Classic and Postclassic deities, and with several important Maya myths. In particular, fireflies seem to be equated with stars in some of these myths.” In the *Popol Vuh*, fireflies are mentioned in the section describing the descent of the Hero Twins, Hunahpu and Xbalanque, into the Underworld, Xibalba. They are given a torch and two cigars which they are to return to the Xibalbans. “As for the cigars, they just put fireflies on their tips. All night they would glow brilliantly because of them” (Christenson 2007, 153). Clearly the prominent characteristic and potential of this bioluminescent beetle were realized by the Classic Maya, though we admittedly lack direct evidence for the beetle’s utilization as a light source of any significance. Much of the lighting technology that may have been employed by them involves a reconsideration of the evidence already available to archaeologists. Our task is to evaluate anew the potential of various technologies and consider the possibilities, even those from unexpected sources like fireflies. Today, fireflies are experiencing a decline in numbers and species due to diminishing habitats and light pollution (firefly.org). Perhaps due to few encounters with fireflies and readily available brighter light sources, modern humans are not likely to consider the firefly a source for illumination, but records show that fireflies have been used for a long time by peoples throughout the world to light up dark spaces.

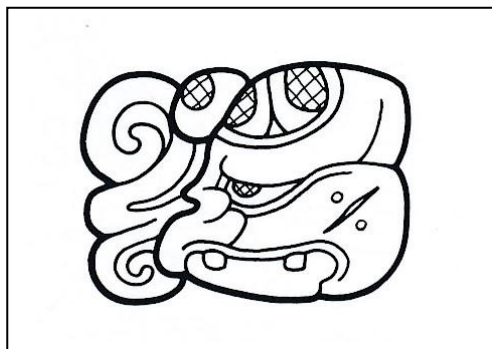


Figure 5.6. The Classic Maya firefly glyph KUH-KAY? (Drawing courtesy of Jeremy Coltman)

Lighting and the Built Environment

Maya building design and layout afford insight into ancient considerations of lighting. Bille and Sørensen (2007, 270-272; 2017) study luminosity through the combined effect of light, architecture, and space, all of which are aspects frequently considered in architectural studies of built environments. Archaeologists have categorized architectural differences of the built Maya world based on perceived functions into temples, residences, ball courts, roads (*sacbeob*), plazas, sweat baths (*temazcales*), ancillary structures such as kitchens and warehouses, and special purpose buildings, such as the community structures at Cerén (Gerstle and Sheets 2002) and the *popol na* at Copan (Fash 2011; Stomper 2001). We can examine different lighting choices in a variety of architectural settings to evaluate the mental templates of architecture and lighting. Of special relevance are structures typically categorized as residential buildings because of their domiciliary role in nightly activities and their association with artificial light (Moullou 2015).

At Copan, numerous residences have been completely excavated that run the gamut from the spectacular to the humble. Located outside of the main ceremonial core but within the urban neighborhood of Las Sepulturas, is the “House of the Bacabs” or 9N-8 (Webster 1989). Residents lived in several patio groups in 9N-8, the central and largest of which is Patio A, encompassing several structures (Structures 80-84) where the scribe himself lived. Inhabiting a house constructed entirely of stone had its advantages, to be sure, but it would have been naturally dark inside during the day and even more so at night. As has been noted for residential architecture in other cultures (e.g., Isbell 2009, 212; Jameson 1990, 98), illumination would have been essential in such dark spaces. Copan affords hints of elite lighting practices from burn marks visible on the floor of Structure 83. It is quite possible that such marks were made by braziers that provided warmth in the night. These ceramics have openings that would have allowed small amounts of light to escape and just might have been enough to enhance one’s night vision, perhaps functioning as an early take on the night light. Alternatively, the use of shallow open dishes for lighting (per above) may have made their mark on the white plastered surface of the floor (see chapter by Widmer for the use of such vessels at Teotihuacan). Such functional aspects of their use should not be separated, but viewed in conjunction with their ritual use. Undoubtedly, there was a strong connection between ritual use and fire. While there was sanctity to a fire’s light, fire was also functionally an essential part of lighting the dark and the night. According to Stone and Zender (2011, 64), “Because of the transformative and cleansing aspects of fire, the act of fire-drilling came to be seen as a divine one, akin to the creation of the sun and the world.” Thus, whatever the container for flames, the light, smoke, and shadows may have held supernatural significance.

In Patio H of 9N-8 (Structures 64, 110, and 76), residents performed craft activities indoors, quite possibly by day and night, as impending deadlines loomed for these artists. Among the many remains that Widmer (2009) recorded in Room 110B was Vessel 3, a censer that contained only charcoal, and lots of it. Widmer (2009, 182) surmised that “[t]his censer functioned as either a light source for the room, as a container for a torch, or else for burning incense as part of the ritual prescription for artifact manufacture, perhaps both.” Window slots in this structure would have allowed the penetration of natural light, whether from the sun or the moon. Such windows are not large but exist in other stone buildings in the Maya region. Hirth (2009, 53) notes for the highland Mexico site of Xochicalco that evidence for where lithic specialists conducted their craft was found “in the doorways of rooms that opened onto lighted areas.” Given the sharpness of lithic debris, one would be able to see the glistening shards much easier in bright light, and hopefully retrieve as much as possible for safety’s sake. Thus, it appears that in addition to lighting choices, ancient Mesoamericans sensibly utilized areas of natural lighting such as doorways that allow natural light

into spaces (for comparison, see Shepperson [2017] for a study of doorway light in ancient Mesopotamian domestic spaces). At Cerén, evidence for obsidian blade manufacture has not been found, but scrapers were re-sharpened by members of Household 1 by the ramada structure (Structure 5; Figure 5.2) (Payson Sheets, pers. com. September 1, 2019). This provenience further associates lighted areas and activities involving sharp tools.

Given the outdoor tropical lifestyles of ancient Mesoamericans, courtyards were fashioned as open areas for work, but were essential for letting in light to the structures placed around them. Courtyards were also built to serve as marketplaces or focal nodes (Hutson 2016, 115) and for public events, among other functions (Inomata and Tsukamoto 2014), and could also serve as unrestricted areas where star gazing could take place (see Lopiparo, this volume). For structures that did not have windows, or those with small ones (Healan 2009, 74), as noted above for 9N-8, open spaces were essential to interiors of structures. Hendon's (2009, 120) comments on Room 110B of Patio H are instructive:

“The shell working in Copan's Structure 9N-110B Room 2 takes place in the most enclosed and least visible location considered here. It is the most private location, in the sense of being the most controllable by the participants and the least subject to intrusion by others. This privacy, which suggests a desire to keep hidden what was being produced or the process of production itself, comes at a cost: the only natural light comes from the doorway into Room 1, which in turn has only one doorway onto the terrace. Artificial light may have been provided by burning material in the two pots, but the amount of illumination would not be great. Thus, this was not an easy place to cut, scrape, and shape brittle shells into complicated shapes and objects. The other rooms, with their direct access to the outside, would have been better lit and still fairly private if the workers stayed inside and did not take advantage of the large terrace, but not nearly as conducive to secrecy.”

Moving away from Copan's stone structures and away from elite contexts, thousands of urban and rural dwellers built their small abodes with cobble foundations and topped them with perishable materials of wattle and daub or thatch, materials⁷ that are well-suited to the tropics. Unlike the dark, dank stone interiors of elite housing, these residences breathed, and exterior light sources, such as the sun and moon, or the light produced from an outdoor hearth, could penetrate them. One consideration of internal lighting in perishable structures that are not solidly built is that at night, as Kristin Landau (pers. com.) has highlighted, any light inside would showcase interior activities and people's figures would be visible to those who are outside the house. Thus, while easier to light up these perishable structures than their stone counterparts, such lighting would come at the cost of some internal privacy. Hendon (2009, 116) sums up these architectural differences by stating that:

“Stone walls are less permeable to sound and light, confining what is said or done inside them more effectively than walls of wood or clay. At the same time, stone walls limit the occupants' observation of people's comings and goings to what can be seen through the doorway (if not closed off by a mat or curtain). The more permeable wood and clay walls change the experience of inside and outside and afford greater opportunity for continued interaction between people working outside and inside the house (Robin 2002). People inside the wattle-and-daub houses in rural and urban Copan, such as those found at practically all groups

considered here, would have been able to note what was happening outside more readily than their neighbors in stone buildings.”

At the farming community of Cerén, residents chose a range of building materials with different implications for lighting: wattle and daub (e.g., Structure 2), pole and thatch (e.g., Structure 11), and adobe (e.g., Structure 3). Adobe would have functioned similarly to stone architecture in that both materials would keep out light and sound, yet retain interior coolness through the hot hours of the day. Structure 3 at Cerén is the largest known structure in the community and was a public building, likely used for political and community meetings. The use of adobe for such a building would have allowed for additional privacy and coolness during the days and evenings. Inhabitants wisely built their kitchen (Structure 11) from pole and thatch materials that allowed for the flow of air when cooking. Storehouses, located close to domiciles, were necessary for keeping safe the family’s possessions during the night (Hendon, 2000, 2010; Isbell 2009, 212), and at Cerén, these structures were typically built with wattle and daub. Domiciles were likewise constructed of wattle and daub, allowing for some privacy and some natural lighting during bright moonlit nights. Thus, the construction materials of buildings in the ancient Maya world were partly selected with a consideration of lighting needs and were likely varied based on the structural function and social context of the building.

From indoor lighting and workspaces, we next consider outdoor work areas, many of which have been commonly recorded throughout other Neotropical areas. In Peru, William Isbell (2009, 12) has found Huari architectural engineering at Moraduchayuq, where

“patio group courtyards had plaster floors, with drains connected to canals beneath them. Each floor was raised along its edges, about 15 to 25 cm, forming a stone-faced bench usually a little more than a meter wide. This kept rainwater out of the lateral rooms, and I suspect that the elevated benches were covered by long eaves projecting from roofs over lateral rooms. Consequently, these benches were securely sheltered, but well lighted, making them excellent work and living space.”

Another cross-cultural example hails from Europe. At the Classical (5th and 4th centuries BC) Greek town of Olynthos, Michael Jameson (1990, 97-98) considers environmental factors, the use of the courtyard, and the orientation of domestic structures:

“In the Mediterranean climate, where most of the known Greek houses are located, the court was in fact one of the chief living areas of the house. The rooms opening directly off the court, as most did, were extensions of the court’s living area. Porches shading one or more sides of the court increased the utility of the court as living space; they might extend into the court area or be a recessed space off the court. (Porches supported by pillars on all four sides of the court, forming a peristyle, were rare before the Hellenistic period.) A porch was most useful on the north side of the court. Ancient writers recommended south-facing living rooms to gain sun in the winter while being shaded from the higher sun of summer; where the site permitted, as on the north hill of Olynthos, south-facing living rooms do in fact predominate (Xenophon, *Memorabilia* 3.8.8-9; Pseudo-Aristotle, *Oeconomica* 1.6.7, 1345A).”

These two examples afford cross-cultural insights into the ways that architecture, including both indoor and outdoor spaces, was constructed to facilitate lighting, heating, and household activities during the day and the night.

Navigating the Night with the Color White

There are other lighting technologies that might have been used in the ancient Maya world. The color white (*saq*) reflects well and materials with this color were often chosen by the ancient Maya for construction. In a number of Mayan languages, “the term often means something ‘artificial’ or something devised by human arrangement or skill” (Houston et al. 2009, 33). It is no surprise then, that a constructed road is called a *sacbe* (meaning “white way”), one of which was built at Cerén and many were built at Copan and other Maya cities, such as Chunchucmil (Hutson 2016). A less typically preserved aspect of illumination present at Cerén is the ground surface itself. Cerén is constructed on, and with, the very light tephra of the previous Ilopango eruption, called *Tierra Blanca Joven* (TBJ), named for the young white nature of the soil that formed from Ilopango ash. Cerénians would have recognized that the fine granules of the TBJ ash made for excellent construction material that could be compacted to form a surface with a cement-like hardness. Pozzolanic plasters (which incorporate volcanic ash and glass), similar to TBJ, are known from other areas of the Maya Lowlands, namely Calakmul, Mexico and Lamanai, Belize (Villaseñor 2010; Villaseñor and Graham 2010). Such plasters may have increased glimmer to catch the moonlight (Meghan Strong, personal communication, Dec 12, 2017). At Cerén this TBJ ash was used as the living surface, for construction of buildings and agricultural beds, and also for the creation and maintenance of the *sacbe* at the site. In construction of the *sacbe*, the whitest of the TBJ ash was selected for its uppermost layer. Inhabitants would have appreciated the reflective nature of such light-colored ash and perhaps that characteristic was one motivation for using the lightest ash to coat the top layer of the *sacbe*, apart from its pozzolanic properties. This white coating would have allowed light from the moon and stars to reflect off its surface. While not totally illuminating the way, a lighter path through agricultural fields and into the community center would have been resulted. After evening gatherings near Structure 10, this same path might have been used by those living further from the core of the community to safely navigate their way home. The lighter ash used throughout the construction of Cerén would have contributed to greater reflectivity of the entire landscape of the built environment, further aiding nightly navigation of the dark. Similarly, throughout the Maya area plaster was a common substance used to coat plaza floors, benches, buildings, and *sacbeob* throughout the region. While much of this plaster was often painted in bright blue and red, white plaster would have had a similar effect as the TBJ surface at Cerén, providing a reflective surface that would create better visibility in the very dark ancient Maya nights.

At the ancient city of Chunchucmil in Mexico’s Yucatan Peninsula, Scott Hutson and Jacob Welch (2016, 120-122) discuss the dozens of *chichbes* that were built by urban inhabitants. These features were slightly elevated pathways lined with parallel stone walls. Their predominance throughout the city may have been vital for nighttime navigation. The glimmering limestone of the Yucatan Peninsula provided raw material for construction but by default, an enhanced pathway for those who were out and about in the darkness. Consider that such pathways would have been able to easily guide nighttime celebrants who were safely returning back home from observance of royal rituals in the city center. This type of infrastructure would have enabled you to go where you wanted to go even in the dark of night by guiding you home (M. L. Smith 2019, 140).

Conclusions

In this chapter, we have provided an initial exploration of the evidence for luminosity in the ancient Maya world and brought together a variety of sources of potential lighting that would have been available in the past. It is unknown whether the ancient Maya purposely lit their cities continuously through dark nights, or periodically as needed for special activities that took place in the dark or at night, but populated areas undoubtedly sparkled from the light given off by the dying embers of outdoor fires, or the shimmering reflections of moonlit off white plastered *sacbeob* and buildings.

We have touched upon the ways in which the Maya lit the night and how they managed their built environment to better utilize low, natural lighting sources. Among the artificial lighting sources, fire was by far the most ubiquitous, but also rarely did it leave obvious archaeological evidence, leaving us to wonder about its potential manipulation and economic requirements. We should consider whether niches in monumental buildings were receptacles for lighting devices and whether receptacles that could hold torches or other sources of light were placed at intervals to light pathways. The round of activities involved in sustaining the multitudes of fires requires us to look at how the fires were fed, who collected resources, and from where. Lychnologists look at evidence for lamps and the production of vegetable oils or animal fats that could be used as illuminants (Meghan E. Strong, personal communication, Dec. 12, 2017). The cost of firewood and producing charcoal would have been phenomenal, as Widmer (this volume) reveals for Teotihuacan. In the Maya area firewood, collected by children and adults, was an essential part of daily and nightly life, critical for cooking, making plaster, craft activities, ceramic production, heat, safety, deer hunting, and many more pursuits. Some have suggested potential environmental impacts of massive fire practices, such as those required for production of the limestone plaster that covered the cities of the ancient Maya landscape. As archaeologists increasingly tease apart evidence for ancient nightly practices from the material record, it is essential to carefully consider the vast array of artifacts, features, epigraphy, iconography, and historical records that potentially hold information for connecting the night, darkness, and illumination. However the ancient Maya lit up the dark, the symbolism of doing so was inescapable and likely provided as much comfort as the light itself.

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² Many thanks to Kathryn Reese-Taylor who generously shared unpublished data with us (July 23, 2019) on the striking ritual assemblage which included the hearth, three stone arrangement, and altar at Yaxnohcah, dated to the Middle Preclassic.

³ Kevin Terraciano kindly conveyed to us, via Cecelia Klein (July 23, 2019), that there is a "distinction between wax made from bees and tallow in the Mixteca, and different entries in the Mixtec Vocabulario for both." Furthermore, "Molina gives *xicocuitlatl* for *cera*, combining *xicotli* (bee) and *cuitlatl* (excrement) (f. 34 1st num.) Molina gives both the indigenous term and the loanword under *candela de cera* and *candela de sebo*." See Terraciano 2001.

⁴ This observation came from Jeannette Peterson, via Cecelia Klein (personal communication, July 18, 2019), and is very much appreciated.

⁵ I am indebted to Jeannette Peterson who conveyed to Cecelia Klein that "Two other bits of evidence that candle making was primarily colonial come from language and image in the Florentine. The text calls candles by their Spanish, not Nahuatl, name: a candle seller is *candelanamacac* -a hybrid term from the Spanish which is *candela* - used in the parallel translation of the Florentine. This suggests there was no Nahuatl term." (personal communication, July 18, 2019) In this same communique, Lisa Sousa observed that in colonial documents "people [were] "getting fire" from their neighbors to start a hearth fire for cooking, heat, and light. Seems candles were used mainly in churches, or Spanish homes."

⁶ Jennifer Cardinal-Loughmiller very kindly responded to our query regarding residue analysis of candeleros and allowed us to report preliminary findings. While some of these vessels have been examined, much work remains to be done (personal communication to Gonlin, July 22, 2019).

⁷ Observations of wattle and daub housing in modern Copan (Gonlin during the 1980s and Kristin Landau during the 2000s) reveal that such residences are constructed in such a fashion that walls are not uniform and gaps exist between the chunks or blocks of daub. Solid uniform walls are not the norm for this type of construction. It is assumed that the Classic Maya may have had similar building practices.