

# Organization of Masonry Technology in the Eastern Puuc: Evidence from Escalera al Cielo, Yucatán

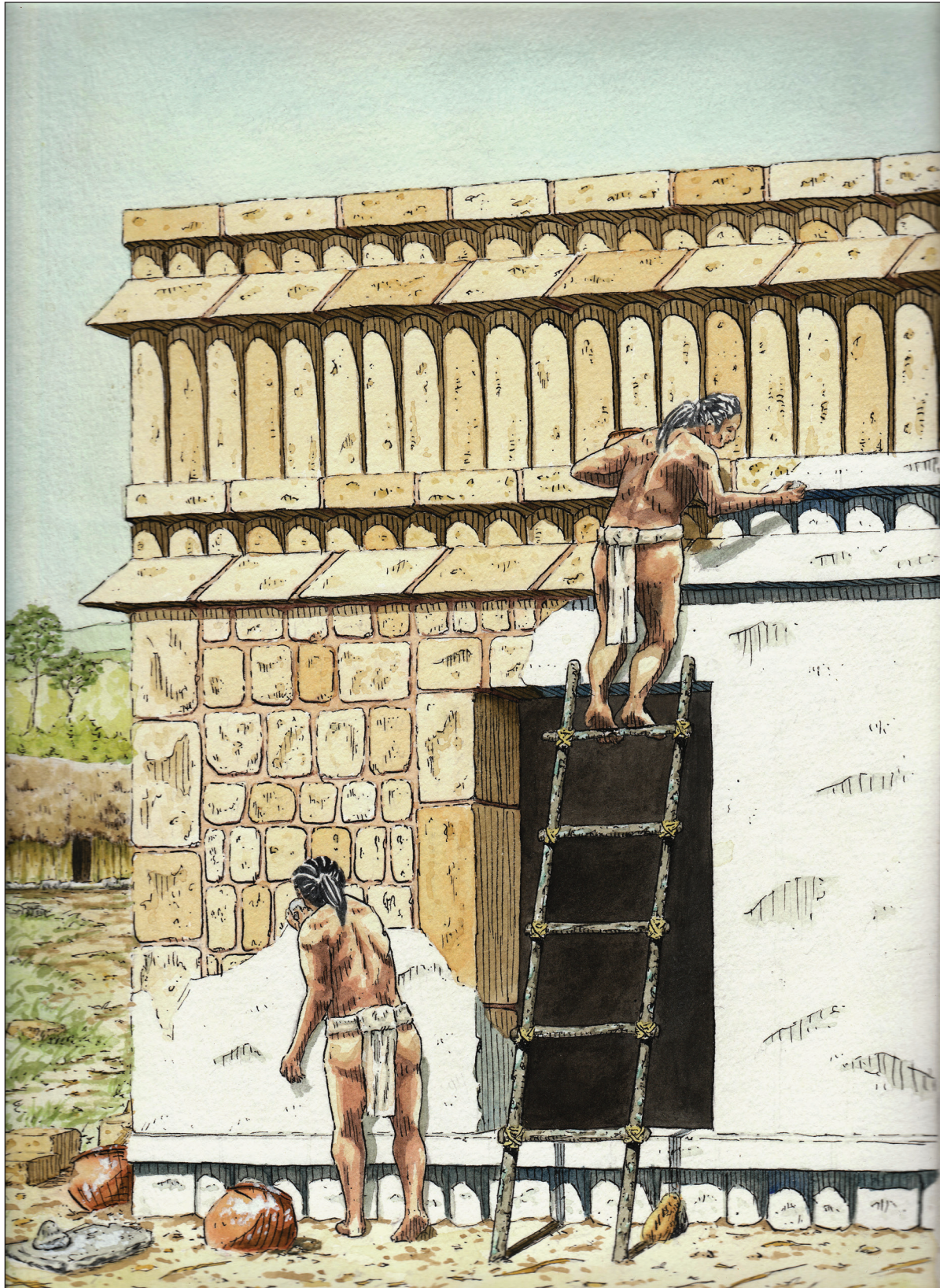
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*Vaulted masonry buildings in the Puuc region of Yucatán have been studied from technological perspectives and from their socio-economic organization. They functioned not only as palaces, residences, and council houses, but were the principal material repositories for wealth in the Puuc, leading to their proliferation across the landscape. While it is crucial to understand the significance of these buildings for the Maya of the Puuc, it is also important to consider the methods of construction and maintenance of these buildings along with the technological organization of masonry activities. In this article, we explore the organization of masonry technology via the analysis of a set of masons' tools from a suburban hilltop complex on the periphery of the Eastern Puuc site of Kiuic. The masons residing at this hilltop complex were attached specialists who produced goods and performed services for high status elites. This suggests that elites actively managed and controlled sources of building materials, but more importantly, they exerted considerable influence over the labor force that built these monumental constructions. The persistent construction of masonry buildings over several centuries suggests elite kin groups maintained affiliative ties with masonry craft specialists across generations, and these affiliative ties played a prominent role in the major expansion of Puuc economies and populations during the Terminal Classic period.*

*Keywords: Lithic technology, Puuc region, craft specialization, intermediate elites, Terminal Classic period*



Many of the most elaborate and well-constructed stone buildings in the ancient Maya world are in the Puuc region of Yucatán, México. Abundant sources of limestone, proper ingredients for manufacturing high-strength cements, and a mode of socio-economic organization that incentivized the deposition of wealth into stone buildings led to the proliferation of vaulted masonry architecture across Puuc landscapes. In lieu of interring wealth into sizeable jade assemblages, complex hieroglyphic inscriptions on stone, or the production of polychrome pottery, the Maya of the Puuc region instead channeled their wealth into constructing vaulted masonry buildings that served multiple functions. These included palaces, council houses (*popol nahs*), temples, and residential buildings.

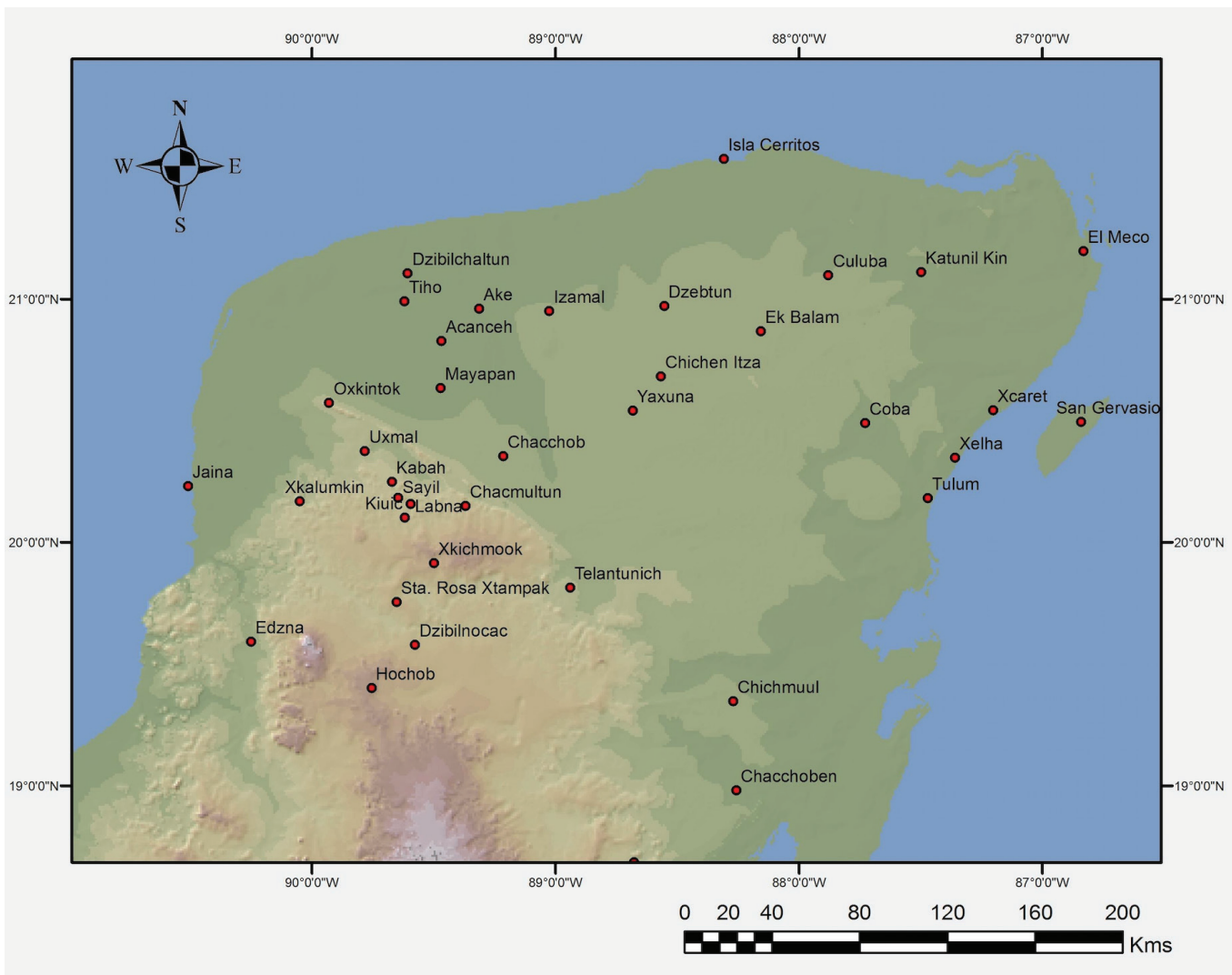
Vaulted masonry buildings in the Puuc have been studied from multiple thematic, methodological, and theoretical perspectives. The most common approaches are focused on the organization of technology, such as examining methods of construction and material composition (e.g. Abrams 1994). Thousands of pit-kilns used to produce hydrated lime as a base for creating mortar for masonry construction and plaster for surfacing buildings and floors have been documented across the Eastern Puuc region (Ringle et al. in press; Seligson et al. 2018). Elite households galvanized power via control of preferred sources of stone, and the quality of limestone utilized in building materials was a direct reflection of social hierarchy and accumulated capital (Carman et al. 2011:155).

These buildings were also the most important and recognizable repositories of wealth in the Puuc region. Due to constraints on the accumulation of surplus staples, a lack of evidence for non-perishable commodities, and a much higher ratio of masonry-to-perishable architecture than elsewhere in the Maya lowlands (Ringle 2019), the Maya of the Puuc began to find new, visible, and permanent expressions of accumulated wealth. Vaulted masonry architecture fulfills that need, and also facilitates the intergenerational transmission of wealth, as older buildings can be inherited, and new buildings can be constructed for branching kin lines (Gallareta Negrón and Bey III 2012; Gallareta Negrón 2013:339).

While it is crucial to understand the significance of these buildings for the Maya of the Puuc, it is also important to consider the methods of construction and maintenance of these buildings along with the technological organization of masonry activities. In this article, we explore the organization of masonry technology via the analysis of a set of masons' tools from a suburban hilltop complex on the periphery of the Eastern Puuc site of Kiuic (Figure 1). The masons residing at this hilltop complex were attached specialists who produced goods and performed services for high status non-royal elites. This suggests that elites actively managed and controlled sources of building materials, but more importantly, they controlled the labor involved in the construction of masonry architecture (Brumfiel and Earle 1987; Costin 1991:7, 1998:5, 2016; Horowitz 2017; Janusek 1999:109). The increasing investiture of power and wealth into stone buildings in the Puuc also necessitated the attachment of these specialists to elite households.

### **Masonry Tool-Kits and Residences among the Lowland Maya**

Despite the prevalence of masonry buildings across the Maya Lowlands, few mason toolkits have been identified or published. What types of tools actually characterized a toolkit for an ancient Maya mason? Eaton (1991) offers a summary of the full range of tools in masons' kits, but it is worth examining those non-perishable tools made of stone that are typically found in



**Figure 1.** Archaeological sites of the Northern Maya Lowlands.

archaeological contexts. First, it is important to note that not all pestles recovered from Maya sites were utilized for masonry. For example, Inomata (1997:122) recovered numerous stone pestles with mortars that were utilized for pigment preparation. The pestles, smoothers, and buffers used for masonry differ from these quite substantially. First, they are considerably larger, both in length, width, and circumference of the pounding or buffering surface. Mortar and stucco smoothers are made of ground limestone and are often banana shaped, with longitudinal concave faces bearing an oval, flat working facet (Andrews IV and Rovner 1975:93-94). Other smoothers are bell or shoe-shaped with flat bases (Andrews IV and Rovner 1975:95). Bell and shoe shaped pestles often have tapering dorsal elements that narrow substantially. These functioned either to facilitate grip, or to facilitate hafting to long poles. These smoothers would then be utilized to apply plaster to the sides of buildings and then smooth it to a fine finish. The faces of these smoothers also appear to have been functional, with some being entirely circular and others rectangular, most likely to efficiently reach into the corners of rooms or architectural

junctions. Smaller hand-held ground-stone tools utilized for polishing have also been recovered (Rovner and Lewenstein 1997:58).

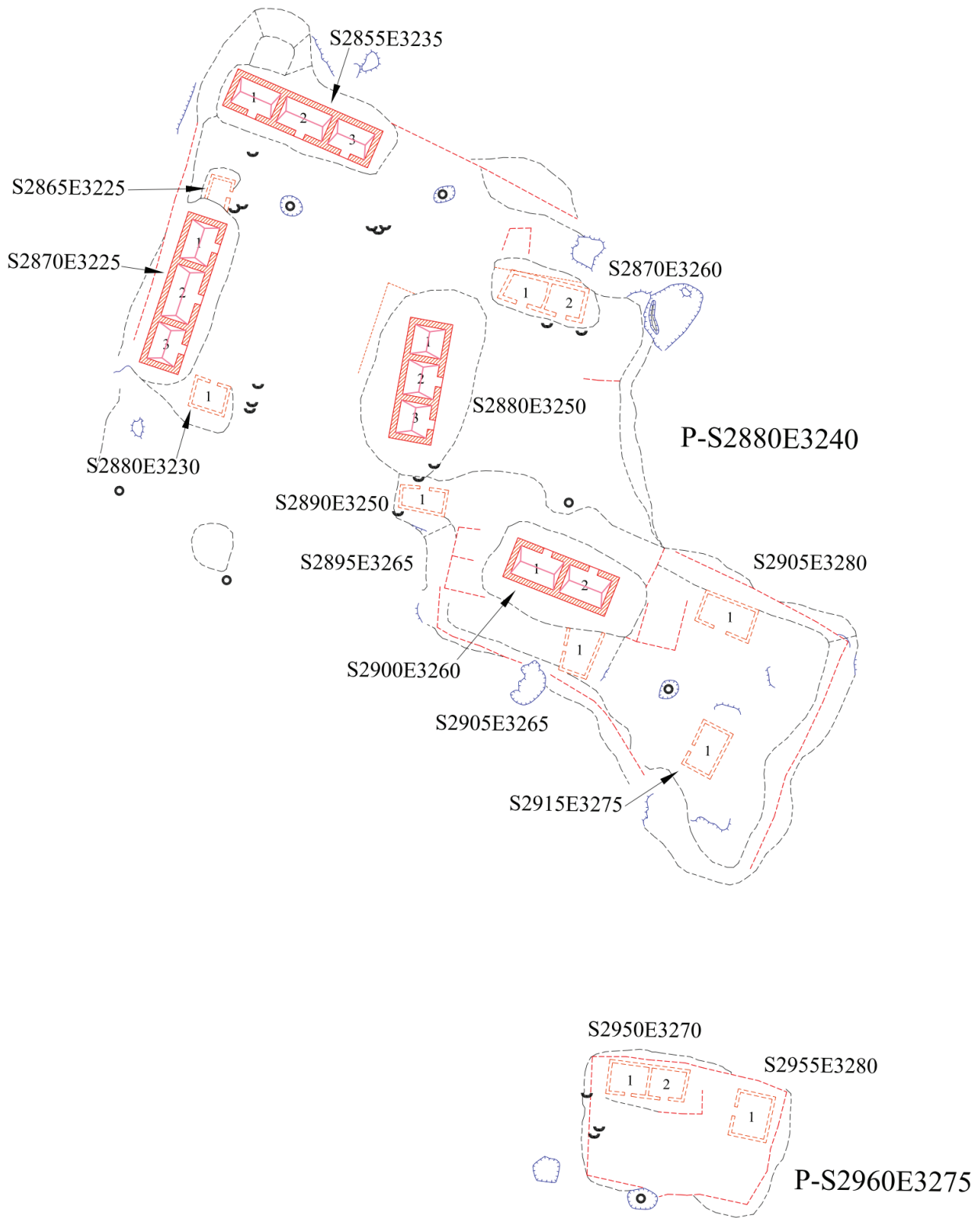
Andrews IV and Rovner (1975) reported on the discovery of two caches of masonry tools from Dzibilchaltún and Muná in the Northern Lowlands. These were specialized instruments used to cut stones and apply stucco to the façades of masonry residences. The assemblage from Muná was looted in the 1960s, but locals noted that they were cached beneath the floor surface of a masonry vaulted building. The assemblage included nine limestone smoothers and pestles and four chert adzes (Andrews IV and Rovner 1975:84–85). The cache of masons’ tools from Dzibilchaltún were found beneath the floor of a two-room unvaulted stone-walled rectangular building (Structure 742) that dated to the “Late Early period”, which in modern chronologies corresponds to around 600 AD (Andrews IV 1980:273). This structure was then covered by a new platform construction around 800 AD. It is unclear whether the cached masonry tools date to this construction event or were placed in a later intrusive cut through the floor of the platform. The assemblage consisted of four limestone smoothers, five chert chisels, a graver, and an abrading stone. Four additional limestone smoothers of unknown date and provenience were also described in their study (Andrews IV and Rovner 1975:86–87). The limestone smoothers bore surface encrustations of plaster, and the tapering ends suggest they were intended to be hafted to wooden implements. The masonry tools from Dzibilchaltún were found in a sealed context, suggesting they were indeed meant to be part of a complete toolkit, though any perishable wooden elements such as haftings have certainly decayed.

Chert tools were also common components of these masons’ tool kits, though determining whether a flaked stone tool is used for masonry is hampered by their multi-functionality. Chert adzes, thinned bifaces, and stemmed/unstemmed chisels were all found in association with various groundstone buffers and smoothers from the masons’ caches at Muná and Dzibilchaltún (Andrews IV and Rovner 1975:86–87). Tear-drop shaped and abrasive chert tools were also part of these assemblages. Based on microscopic use-wear analyses, chert bifaces also appear to have been used to cut stone masonry blocks at Aguateca (Aoyama 2009).

Elsewhere, Proskouriakoff (1962:339) describes a “pear-shaped pestle” with a polished surface from “an early deposit” from Mayapán, though no additional description or context for the artifact was offered. Excavations conducted by Carlos Peraza Lope beneath the plaza floor associated with Hall Q-72 at Mayapán uncovered two conical chert pestles, two chert polishers, and a chert knife, most likely another ritually cached mason’s tool kit (Peraza Lope and Masson 2014:125–126). Outside of the Northern Lowlands, a limestone pestle was found from the site of Tajumulco in Guatemala (Dutton and Hobbs 1943:48). Peraza Lope and Masson (2014:125–126) dubbed a bedrock cavity in front of Hall Q-72 at Mayapán “La Casa del Albañil” due to the discovery of a cache of masons’ tools that consisted of a mano, two conical chert pestles, two chert polishers, a conch shell trumpet, two jade beads, and a chert knife. Such a ritual cache most likely commemorated either the construction of the elaborate colonnaded Hall Q-72 or the surfacing of the main plaza at the site.

At Aguateca, excavations of Structure L8-8, a temple that was abandoned during construction,





**Figure 2.** Northern and central groups of Escalera al Cielo, Yucatán. Map by William M. Ringle.



**Figure 3.** Mason's house from central group of Escalera al Cielo. Note the finely cut stone wall braces and high quality of the door jambs.

revealed large quantities of chipped and ground stone artifacts that were integral to the construction process (Aoyama 2006:20–21). These stone tools were concentrated behind the structure, and included 1,339 pebble smoothers, a polished chert celt, and 11 stucco smoothers. Seven of the stucco smoothers were made of limestone, three of chert, and one of basalt.

Identifying the houses of masons has proven more difficult. At the Bolonchén site of Huntichmúl, several domestic basal platforms on the slopes of hills surrounding the site core have been identified as being associated with the stone-working industry (Ringle et al. in press). These platforms contain standard perishable residential structures, but are associated with other vacant platforms that may contain debitage from stone working. Ringle et al. (in press) posit that these households were the direct clients of the high-status individuals living in the palatial compounds on hilltops. Becker (1973:402) argues that the residents of Gr. 4G-1 at Tikal were masonry specialists due to twice as many “plaster-smoothing” tools being found in excavations there versus other groups at the site, though he offers no descriptions of these tools nor does he offer additional information regarding their context.

### **Masonry Tool Kits of Escalera al Cielo, Yucatán**

The Bolonchén Regional Archaeological Project (BRAP) conducted survey and excavations at a small hilltop settlement on the suburban edge of the Terminal Classic center of Kiuc from 2008 to 2014. The settlement, Escalera al Cielo (EAC) is circumscribed and isolated due to being

located on the cusp of a 60 m tall hill (Figure 2). Spatially, the site is composed of five residential patio groups. A group of five vaulted buildings surrounding a central patio is located on the southern edge of the hill, and most likely functioned as a civic-ceremonial center or even a palatial compound (Bey III et al. 2009). A monumental staircase was the main access point for this group. Two elite residential groups are in the northern sector of the hill. The western group consisted of two collapsed vaulted masonry buildings constructed in the Puuc Colonette style, though the buildings in the western group lacked the same amount of decorative façade stones that the eastern group possessed. Due to an increase in either population and/or wealth, a new patio group in a later variant of the Puuc Colonette style was constructed just to the east (Bey III et al. 2015). It consisted of two vaulted masonry buildings in addition to six ancillary perishable structures that functioned as kitchens, storage units, and activity areas. Chronologically, ceramics recovered from excavations fall into the Late Classic and Terminal Classic Cehpech ceramic sphere. Bracketing the abandonment of the site has been difficult, though the prevalence of Late Terminal Classic ceramics, the paucity of Early Postclassic pottery, and the presence of some Puuc Colonette style architecture lead us to place the abandonment of the hilltop between 950 and 1150 A.D. Radiocarbon dates from wood charcoal from the floor surface in the south room of the westernmost vaulted structure suggest an abandonment before 1020 A.D (Beta-286658; CAL 980–1060 AD and 1080–1150 at 2 $\sigma$ , Simms et al. 2012:274).

Simms et al. (2012) excavated two of the ancillary structures and one of the vaulted buildings in the western patio group and uncovered extensive on-floor assemblages. These assemblages consisted of reconstructible pottery vessels and stone tools placed along the walls of the interiors of buildings. Assemblages were uncovered on the floors of masonry vaulted buildings as well as perishable structures and are present in all three patio groups that have been excavated. This patterning of *de facto* refuse suggests that EAC was rapidly abandoned, yet what remained did not constitute the full material inventory of its inhabitants, indicating that they most likely planned to return (Lamoureux-St-Hilaire et al. 2015; Simms et al. 2012). Because so many objects were left in storage contexts at EAC, the material from excavations offers a stronger means of interpreting where, how, and by whom certain objects such as masons' toolkits were utilized. Excavations conducted in two patio groups at EAC indicate that attached masonry specialists resided at the settlement and were engaged in the construction and maintenance of vaulted masonry buildings on the hilltop. A small platform (Platform S2960E3275, 19 x 12 m) located to the south of the elite households served as the residence for these masons (Figure 3). The platform included two fully excavated perishable structures, both of which contained extensive on-floor assemblages. Several lines of evidence suggest masons inhabited the platform. First, it was located adjacent to two marl quarries. These were utilized for the mining of *sascab*, a chalky limestone-based powder that was an essential ingredient for the manufacture of mortar and stucco. Second, the architecture of the principal residential structure (Structure S2955E3280, 3.4 x 2.55 m) of the platform was of higher quality than any other perishable structure on the hilltop. Typically, these types of structures consist of four walls composed of parallel stone braces. These braces are generally roughly hewn and advantageously drawn from any nearby source of stone, provided it was roughly rectangular in shape. However, the wall braces for this structure were of exceptional quality. They were finely cut with smoothly modelled faces, and the corner stones were substantially larger than necessary for a perishable structure. Often door jambs for these types of buildings are no more than 20 cm tall, yet the jambs for this structure were finely



carved on all four sides and measured 60 cm in height. Third, this is the only platform group other than the major vaulted patio groups that possesses its own *chultun*, typically a key marker of permanent residence for an architectural group in the Puuc region. Finally, two chert chisels were found along the side-wall of the western two-room structure of the group (Figure 4). These chert tools bear close resemblance to those recovered from the masons' toolkits from Muná and Dzibilchaltún, and their placement is indicative of either a primary or storage context.

This household also possessed several high value objects that were not removed upon abandonment. Two worked shell pendants and a small ceramic figurine were recovered from the floor surface in addition to five reconstructible vessels. Two Yokat Striated jars, a Muna Slate basin, and an Akil Impressed dish were ritually cached under the floor. The adjacent structure (Structure S2950E3270) contained substantial on-floor assemblages, including at least four large Yokat Striated storage jars and a Muna Slate bowl. A "Fat God" ceramic pendant was found along the back side of the building (Figure 4). The Fat God deity is related to material wealth and excess, and is depicted as a fattened older male individual with swollen eyes and a rounded pot belly (Miller and Taube 1997:86). It is the most prevalent iconographic subject at EAC, most likely because the source of power for the wealthy residents of vaulted buildings at EAC was not necessarily divine, but economic. Sub-floor offerings included a secondary burial covered by an inverted dish placed next to a bowl. A large complete storage jar was the final offering uncovered.

The evidence from one housing compound is not enough to establish the presence of attached masonry craft specialists at EAC; excavations of one of the elite patio groups cements this link. As mentioned above, the eastern elite compound is composed of two collapsed masonry vaulted buildings and six ancillary perishable structures that functioned as kitchens and store-rooms. Excavation and consolidation of one of the largest vaulted masonry structures (Structure 2900E3260) in 2012 and 2013 revealed that it is the only structure in the northern complex with decorative features on the facades, specifically colonnettes on the basal, medial, and upper moldings. The west exterior wall of the two-room structure did not feature basal moldings or cut stones for the upper façade (Figure 5). Such a feature suggests that the building had yet to be fully constructed, and that when completed, would have eventually stood as a three-room vaulted structure. Such uncompleted buildings are quite common in the Puuc and suggests that either 1) construction of masonry buildings was still occurring just up to the moment of a precipitous demographic collapse or 2) buildings were purposefully constructed in a manner to easily facilitate expansion upon the accrual of wealth later in time.

To the northwest of the principal vaulted structure, we uncovered remains of a single course of stones that delimited an activity area under a *palapa* (Structure S2895E3250). On the floor of the *palapa*, a square masonry limestone buffer was found directly adjacent to a finely cut piece of limestone that was a segment of molding for a vaulted structure (Figure 6). The close association of these two artifacts suggests that this stone was undergoing carving and burnishing just prior to abandonment.

To the south of the large vaulted masonry building is a single-room, westward-oriented pole-and-thatch structure (Structure S290E3265). Excavations uncovered an on-floor assemblage placed in the back corner of the structure that consisted of a tripodal dish with modeled legs in the image of the Fat God. Importantly, two limestone smoothers used for applying stucco and mortar were found on the floor as well (Figure 7). One smoother featured only a single, circular facet, which was worn exceptionally smooth and featured multidirectional scratches, suggesting



a



b

**Figure 4.** (a) Chert chisels found in storage context on side of masons' house; (b) Fat God ceramic pendant found cached along exterior of masons' house.



Figure 5. Western side of the principal vaulted masonry building in the northern group of Escalera Cielo. The lack of lower molding stones indicates that residents planned a future expansion of the structure but did not complete construction either due to lack of funds or because of the abandonment of the settlement.

that smoothing could have been achieved in both unidirectional and circular motions (Figure 8). The surface of the applicator contained calcite encrustations, most likely dried mortar that would be worn down over time. The dorsal side tapers sharply on one side, but hardly at all on the other. This would have allowed space for a pole to be easily attached if necessary, meaning ceilings and sides of masonry structures could be easily buffed without need for scaffolding,



**Figure 6.** Limestone polisher found on floor of perishable structure in association with a medial molding stone that was undergoing smoothing.

though it could just as likely have been held in one hand to buff while the other hand or another individual applied plaster. The other smoother features a facet that is more rectangular in shape, with the shorter ends rounded. It has the same types of striations, pitting, and calcite encrustations as the other smoother. No banana-shaped smoothers were recovered in the assemblage. Across the patio from the vaulted building, a two-room perishable structure (Structure S2870E3260) that functioned as a kitchen was excavated by Maggie Morgan-Smith in 2008. Two chert chisels were piled outside the eastern door of the structure, once again provisioned in storage context. These chisels would typically be classified as broken lanceolates, but given their placement in storage contexts, they were still being

utilized and therefore were most likely hafted as chisels possibly utilized for cutting stone blocks. Of course, one of the benefits of bifacial chert technology is its flexible nature; chisels could be used for wood-working, stone-carving, or fulfill any type of splitting function. Microscopic use-wear analysis could determine what purposes these stone tools fulfilled (Aoyama 2007).

Given the large number of vaulted residences at EAC, frequent maintenance and ongoing construction necessitated keeping the proper tools on-hand. A lime pit-kiln excavated by Kenneth Seligson on the northern cusp of the hill indicates that lime was not being imported from the urban core and that consumption of lime used for mortar and plaster was high enough to invest in the construction of a large pit-kiln (Seligson 2016:178). The demands of ongoing construction and the need to resurface buildings and floors with new layers of plaster every ten years or so necessitated the presence of skilled artisans in addition to the infrastructure needed for these tasks. The construction of masonry buildings most likely took place during the dry season, when wet plaster and cement could more thoroughly set, though the quarrying of stone, construction of water cisterns, and plastering of the interiors of masonry structures could occur year-round.

### Discussion and Conclusion

The abandonment of EAC was relatively rapid, but its inhabitants planned to return based on their placement of many objects in storage contexts. Given the amount of wealth left at the settlement and the fact that its most ornate masonry residence was still being constructed, the socio-economic lifeways of its inhabitants remained relatively unchanged up until the very



**Figure 7.** Fat God platter and limestone polishers found in storage context in corner of a perishable structure behind masonry vaulted structure undergoing construction.

moment of the abandonment. More importantly, it suggests that masons maintained close affiliative ties with elites until the abandonment, and that both the elites and their attached specialists left at roughly the same time. Although masonry tools have been recovered from other sites in the Northern Lowlands, those contexts are confined to ritual caches. While such caching preserves the entirety of the toolkit, it does diminish opportunities for understanding how, where, and when masonry specialists utilized their tools, and how they organized their technological knowledge. By recovering masonry tools in storage contexts and excavating the housing compounds of masons, it is possible to elucidate the model of technological organization employed in the Eastern Puuc for the construction and maintenance of stone buildings. Because these buildings were crucial for the creation, maintenance, and transmission of wealth among elites, it is imperative to understand how it impacted the craft specialists engaged in this labor.

It is disingenuous to argue that the masons of EAC are either simply attached or independent specialists. More likely this technology was organized on a continuum between the two. The finely cut stones and amount of wealth left in the masons' compound suggest that their skills and knowledge paid dividends. Their craft skills were likely transmitted intergenerationally, as suggested by the presence of Batres Red and Qunital Unslipped in the construction fill of the masons' house, both Early Classic types. Furthermore, the proximity of marl and stone quarries denotes knowledge not just of how to construct stone buildings, but also how to properly identify source materials and maintain some control over them. At least sixteen pit and ledge quarries of variable size are located adjacent to the northern elite residential group of Escalera al Cielo, used for quarrying *sascab* as well as limestone for architectural fill, veneer stones, and material for producing plasters and cements.

However, the bulk of the masons' tools, primarily smoothers and chisels, were not found associated directly with their house platform. Instead, they were found stored in ancillary buildings owned and operated by elites. Given the proximity of the masons' house to these elite compounds and the possession of masonry tools by these elites, it appears that attached specialization was the dominant mode of organizing this technology. This study confirms Carmean et al.'s (2011:156) observation that "high ranking persons did not quarry, shape, and haul stone to build stone houses and monuments; rather, much like land and water, people of high-rank controlled stone resources and distributed quarry labor and cut stone through long strands of patron-client networks." Given the long history of construction of vaulted buildings at EAC, elites were not only investing wealth into the stone buildings themselves, but they were also investing

in affiliative ties with masonry specialists both synchronically and diachronically.

Ringle et al. (in press) assert that stone workers were the clients of the highest ranking elites who directed labor toward the construction of vaulted masonry buildings toward engendering binding ties with lower-level elites. The constant labor demands constituted a form of non-material tribute that these craft specialists could offer. Furthermore, they argue that the persistent construction of new buildings



Figure 8. Limestone polishers.

and the addition of rooms to existing buildings fueled the Puuc economy; these were not only repositories of wealth but operated to some extent outside a system of traditional economic exchange due to the inalienability of stone buildings. As such, demand could never truly be satiated for the construction of these buildings, leading to continual construction projects.

In a holistic examination of Maya construction practices at Copán, Abrams (1994:111) notes that most building activity would have been organized via reciprocal labor exchange which required common knowledge of general construction practices among wide swathes of the population. The monumental vaulted constructions of the Classic era required specialized and skilled laborers, yet Abrams estimates that most stone buildings could have easily been built with a combination of just a few masonry specialists and a greater number of unskilled laborers. Such a perspective is supported at Aguateca, where Aoyama (2006:30) notes a close association between masonry and scribal tools around an unfinished temple, such that scribes may have supervised masons or even have served as chief architects. Abrams also notes that painters would have employed a lime-based whitewash as the foundation for later pigments applied to the exterior of buildings, and that specialized knowledge was needed for the application of plasters and paints (Abrams 1994:117).

To add to Ringle et al.'s conclusions, wealth is not simply measured in terms of material possessions, but also relationally in terms of the accumulation of social capital, in this case the attachment of masonry specialists to non-royal elites. Regardless, environmental processes, warfare, and macroeconomic trends spared neither the non-royal elites nor their attached masonry specialists around 1000 AD, resulting in both groups rapidly departing the hilltop together.



### Acknowledgements

We would like to thank the Consejo de Arqueología of Mexico's Instituto Nacional de Antropología e Historia for granting us permits to conduct this research. Excavations at EAC were funded with support from Millsaps College, the Chisholm Foundation, and Maurice and Kathy Hall. Special thanks go to Rossana May Ciau, Betsy Kohut, Amanda Strickland, Kenneth E. Seligson, and Maggie Morgan-Smith for their assistance in years of excavations and analysis at EAC. Thanks go to William M. Ringle for the map of EAC. We would also like to thank Mat Saunders and Maxime Lamoureux St-Hilaire for their hard work in organizing the annual Maya at the Lago conference. This manuscript was greatly improved by the helpful comments of Maxime Lamoureux St-Hilaire, William M. Ringle, and one anonymous reviewer.

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