




## Research Article


# Stone on stone: elite involvement in stoneworking at the ancestral Maya site of El Perú-Waka'

Rachel A. Horowitz<sup>1,\*</sup> , Damien B. Marken<sup>2</sup> & Juan Carlos Meléndez<sup>3</sup>

<sup>1</sup> Department of Anthropology, Washington State University, Pullman, USA

<sup>2</sup> Department of Anthropology, Sociology, Criminal Justice, and Social Work, Commonwealth University of Pennsylvania-Bloomsburg, USA

<sup>3</sup> Archéologie des Amériques, UMR 8096 – CNRS, Université Paris 1 – Panthéon-Sorbonne, France

\* Author for correspondence  [rachel.horowitz@wsu.edu](mailto:rachel.horowitz@wsu.edu)



Crafting is often assumed to have been a 'dirty' and hence low-status activity: elites managed the supply of materials or distribution of the products, lower-status workers undertook the hard graft. Here, the authors present an *in situ* stoneworking toolkit from El Perú-Waka' in the central Maya lowlands of Guatemala. Recovered from a high-status neighbourhood, the tools indicate the involvement of elite crafters in the working of various types of stone and greenstone. The assemblage is discussed with reference to ontological understandings of raw materials in the Maya world and the importance of specialised and ritual knowledge. The results encourage greater consideration of the involvement of elites in craft production across Mesoamerica and beyond.

Keywords: Mesoamerica, central Maya lowlands, Maya, lithic technology, crafting, greenstone

## Introduction

The role of elite individuals in craft production is key to understanding economic organisation in the past. Most discussions of elite involvement in craft production focus on the relationship between actors of differing sociopolitical statuses, such as elite management of lower-status craftworkers (e.g. Costin 1991, 2001, 2004; Domínguez Carrasco & Folan 1999; Inomata 2001; Clark 2007; Flad & Hruby 2007; Shimada 2007; Hirth 2009). The identification of elite management of craft activities involves evaluations of access to and the formal organisation of production areas, proximity to political elite structures and standardisation of processes and products (Costin 1991, 2001, 2004; Ames 1995). Archaeological studies have assessed the role of elites in the organisation of crafting in many parts of the world, including the Americas (Ames 1995; Hruby 2007; Swenson & Warner 2012; Davenport 2020), Asia (Sun 2008; Campbell *et al.* 2011; Yee *et al.* 2021), Africa (Chirikure

Received: 6 November 2023; Revised: 14 March 2024; Accepted: 6 April 2024

© The Author(s), 2024. Published by Cambridge University Press on behalf of Antiquity Publications Ltd

2020; Moffett *et al.* 2020) and elsewhere (Barrowclough & Lister 2004; Olausson 2017; Amesbury *et al.* 2022). However, elites not only managed crafting, sometimes they were also craftworkers. Here, we focus on Maya elites as crafters (see Ames 1995; Inomata 2001; Inomata *et al.* 2002; Aoyama 2007; Hruby 2007), to evaluate the role of elite crafting in the wider economic organisation in the Maya region.

Elite crafting in the Maya world is associated with the production of objects that are either used in ritual activities or which require specialised knowledge for their production (O'Neil 2009; Houston 2014, 2021; see also Helms 1993). During the Classic period (AD 250–800), stone was seen as animate and thus stoneworking was a ritual activity (Houston 2014: 91; Houston *et al.* 2021a). Through stone crafting, power was ritually transferred to a modified object (Stuart 1996; O'Neil 2009; Houston 2014: 91).

While monumental architecture and stone monuments, such as stelae and sculptures, were important to ancestral Maya lifeways, little is known about people who produced them. While individuals of different statuses participated in the creation of monuments (Inomata 2001), establishing the identities of these individuals is difficult. Identification of crafters has been attempted through the consideration of archaeological assemblages, including caches (Andrews & Rovner 1973; Inomata 2001; Inomata *et al.* 2002; Aoyama 2007; Clarke 2020; Clarke *et al.* in press) and through glyphic/iconographic studies (Stuart 1989; O'Neil 2009; Houston 2021). However, it is unusual to find clear archaeological evidence of such crafters due to the nature of the contexts in which crafting toolkits were disposed. Tools were typically discarded when exhausted and such broken or worn artefacts are difficult to identify. Furthermore, tools used for carving could also be used for other purposes and can therefore only be identified through assemblage-level comparisons. Sculptors occasionally signed their work, making it possible to distinguish the hand of an individual craftworker, but linking known stoneworking sites to specific sculptors is currently impossible (Houston *et al.* 2021b).

Greenstone held particular cultural and economic significance for the ancestral Maya (e.g. Freidel 1993; Taube 2005; Kovacevich & Callaghan 2018). Evidence for greenstone working areas indicates the involvement of elite actors in the crafting process (Kovacevich 2011; Andrieu *et al.* 2014; Kovacevich & Callaghan 2018). The segmented production identified at Cancuen, in Guatemala, points to the range of specialised knowledge integral to the production process, as that specialised knowledge was required more in some stages of production than others, and hence production at those stages was restricted to certain individuals (Kovacevich 2006, 2011).

In this article, we present an assemblage of stoneworking objects, or modifiers, from El Perú-Waka' (hereafter Waka'), an ancestral Maya site in the central Maya lowlands (Figure 1) in modern-day Petén, Guatemala. We use 'stone modifiers' to refer to objects used to work stone during the manufacture of stone artefacts, including monuments and greenstone production. We prefer the term 'modifier' as not all of the objects discussed in this piece have yet been subject to use-wear analysis to distinguish, for example, those used for grinding versus polishing. Excavations at an elite residential group at Waka' identified materials that had likely been used for modifying stone items, specifically for masonry/monument production and greenstone working. This assemblage provides an opportunity to address the role of elite individuals in crafting and contributes to the global literature on craft specialisation. We

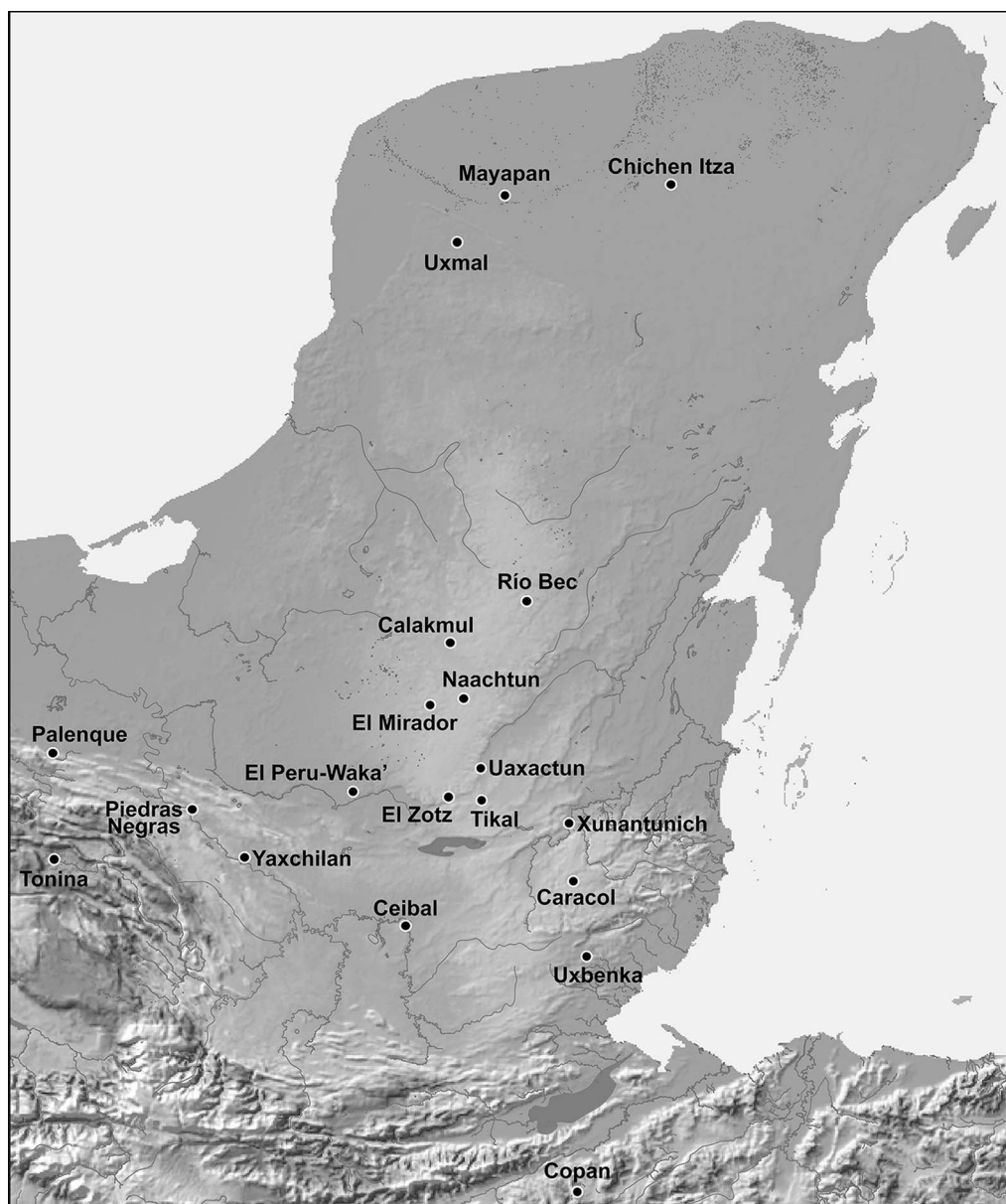


Figure 1. Location of Waka' (figure by D. Marken).

propose that the crafters who occupied Waka's residential group were elite actors who participated in multiple artisanal activities, including stone carving and greenstone working. These finds support the identification of elite participation in 'dirty' crafting (Inomata 2001) and suggest that elite possession of specialised knowledge facilitated their participation in these stoneworking activities (Helms 1993; Ames 1995; Stuart 1996; O'Neil 2009; Houston 2014).

## Identifying stoneworking assemblages

The successful identification of stoneworking assemblages is rare in the Maya region, as they are difficult to discern without the sorts of contextual evidence that does not preserve well archaeologically (Clarke *et al.* [in press](#)). Several studies do, however, provide insights into the types of tools, which are discussed below, linked with stone and greenstone working (Kidder *et al.* 1946; Mirambell 1968; Digby 1972).

Most stoneworking assemblages have been identified in unique depositional contexts, for example, at the site of Aguateca, Guatemala, which was rapidly abandoned, leaving objects in the locations in which they were last used (Inomata & Triadan 2000; Inomata *et al.* 2002). Assemblages at Aguateca indicate that polished greenstone axes formed part of toolkits for carving stelae (Inomata 2001; Inomata *et al.* 2002; Aoyama 2007). The differently sized axes were related to specific carving or incising tasks (Inomata 2001; Inomata *et al.* 2002; Aoyama 2007). Aoyama (2007) used use-wear analyses to illustrate that greenstone axes were used to work stone for masonry blocks or carving stone monuments (see also Haviland 1974; Houston 2000; Clarke *et al.* [in press](#)) but traceological studies, which examine the microscopic wear on objects to determine the function of those objects, demonstrate that greenstone was also used to polish greenstone ornaments (Melgar & Andrieu 2016; Meléndez 2019; Melgar 2023). Greenstone items found in stoneworking assemblages could therefore have been used as polishers for greenstone ornaments.

Polishers, including polished limestone objects, ‘banana-shaped’ polishers, and polished bifaces are also associated with stoneworking assemblages (Andrews & Rovner 1973; Rovner & Lewenstein 1997). Polished bifaces were worked/rounded on one side but retain traces of bifacial working on the other (see Andrews & Rovner 1973). When assemblages of such polishers are found, they are interpreted as residences of masons or areas of masonry work (Parker *et al.* 2019; see also Clarke 2020; Clarke *et al.* [in press](#)). Other objects associated with polishing include manos, a particular form of groundstone tool, and pumice, the volcanic rock (Clarke 2020; Clarke *et al.* [in press](#)).

Overall, stoneworking assemblages contain a mix of greenstone axes, polishers (including limestone pieces, polished bifaces and ‘banana’ polishers) and whetstones, which are used for sharpening tools. Yet the identification of all of these objects together in a single context is unusual (Andrews & Rovner 1973; Rovner & Lewenstein 1997), and the identification of stoneworking assemblages is often dependent on contextual information rather than a complete toolkit (Clarke 2020).

Greenstone working assemblages are most often identified by the presence of debitage from the production process and associated toolkits that include hammerstones of various sizes, string saw anchors, chert blades and drills, abraders or polishers, and materials used as abrasives, including broken greenstone and quartz (Kidder *et al.* 1946; Kovacevich 2006, 2011; del Águila Flores 2009; Rochette 2009, 2014; Andrieu *et al.* 2014). One such assemblage was identified at Cancuen, in the southern Maya lowlands (AD 760–800), with tools including chert, greenstone and quartzite hammerstones, and chert drills (Kovacevich 2006: 181, 2011; Andrieu & Forné 2010: 947; Andrieu *et al.* 2014). Similarly, excavations in the Motagua region in the northern Maya highlands—close to the only known sources of jadeite in Mesoamerica—have uncovered tool assemblages and debitage

linked to bead and preform production including greenstone cobbles, flakes and hammerstones and chert drills (Rochette 2009, 2014).

## **El Perú-Waka'**

Located at the south-west of the Petén Karst Plateau, in modern-day Guatemala, the Maya city of Waka' was occupied from the Late Preclassic to the Terminal Classic periods (400 BC–AD 1000, Freidel & Escobedo 2014; Navarro-Farr & Rich 2014; Eppich *et al.* 2023; Figure 1). Excavations within the city core and in the surrounding region indicate that Waka' figured prominently in Classic period Maya political dynamics (Guenter 2014; Martin & Velásquez 2016; Martin 2020). The activities of Waka's elites mirror those of other major Maya centres, including the erection of carved stone monuments (Stuart 1996; O'Neil 2009; Houston 2014, 2021).

Waka' was one of the most densely populated settlements in the Maya region (Marken 2015; Canuto *et al.* 2018; Marken *et al.* 2019; Marken & Ricker 2024). Multiple types of economic activities were practised across the city and its hinterlands, in which individuals of all statuses participated. Eppich and Freidel (2015; see also Eppich 2020) suggest marketplace exchange of utilitarian goods but that prestige goods likely circulated through different mechanisms.

Here, we focus on materials from the Payes group within the Ical neighbourhood, the north-western residential sector of the city's urban core (Figure 2; Marken & Cooper 2018). The Ical neighbourhood consists of 133 structures dominated by an acropolis (Marken *et al.* 2023). Located near the centre of the neighbourhood, adjacent to the acropolis, is the Payes group, which consists of 30 structures around seven patios. Excavations consisted of test units across the neighbourhood (Menéndez & Cuyan 2016; Marken *et al.* 2023), slot trenches on the edges of particular land-use features (a reservoir and a causeway) and horizontal excavation of two residences (Marken & Cooper 2018). All excavations were conducted using natural and cultural stratigraphic layers and sediment was screened through a one-quarter inch (6.35mm) mesh. The objects and architecture revealed, and their proximity to a large residential complex (the acropolis), point to the presence of high-status individuals within the neighbourhood. Structures K10-11 and K10-12B, where the stoneworking assemblage was identified, are both located in the northernmost part of the Payes group, due east of the acropolis on the north-east edge of the Ical tank (a large water storage reservoir), flanking the tank's outlet (Figure 3).

## **Materials and methods**

Lithic artefacts (including flaked and ground stone items) recovered from excavations in the Payes group were analysed using a detailed attribute analysis. Analysis of flaked stone artefacts followed conventions of lithic analysis (Whittaker 1994; Odell 2003; Andrefsky 2005) and collected information on 23 attributes including metric data, technological and typological attributions, production stage and mechanism, raw material and the presence of cortex and heat treatment, among others. Cores and formal tools, such as bifaces, were subject to additional analyses, including morphological and technological analyses, to provide fuller

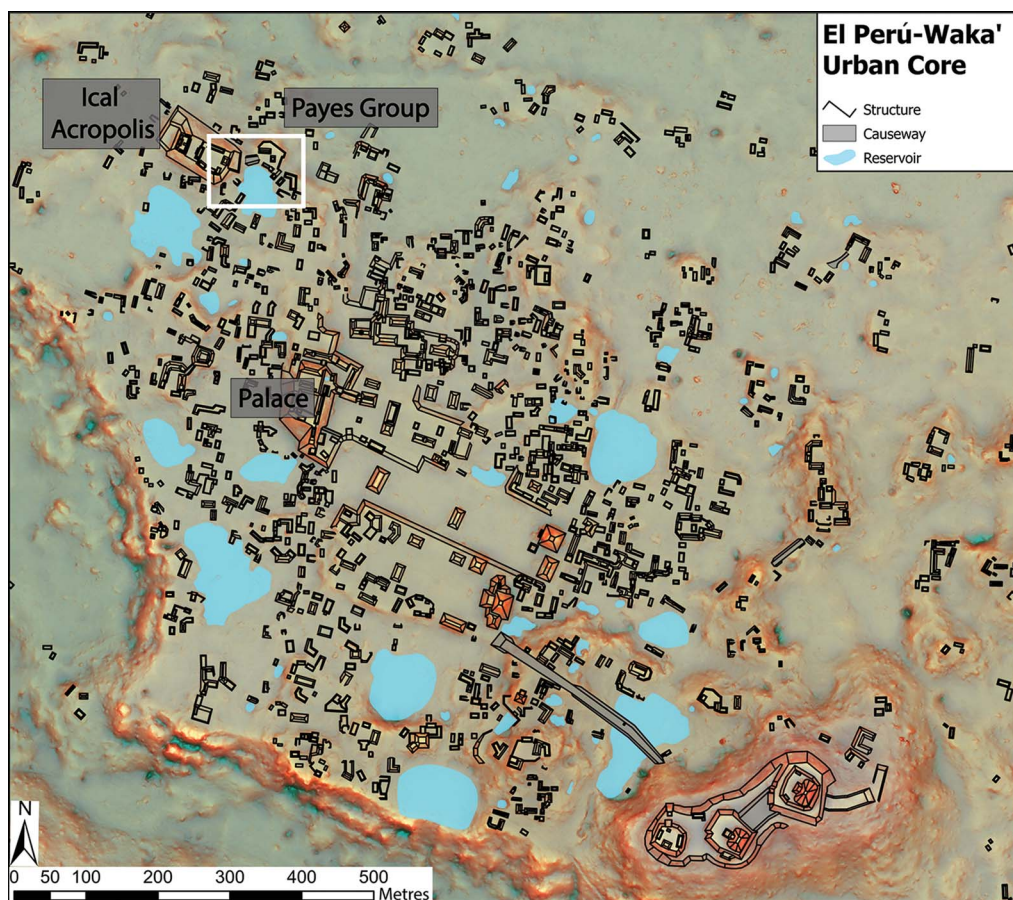


Figure 2. Map of Waka' overlaid on the lidar image for the site (figure by D. Marken, with permission of Proyecto Arqueológico Waka').

characterisation. Analysis of the groundstone assemblage followed conventions of such analyses (Adams 2002) including metric measurements, raw material and form designations. The results of the flaked stone lithic analysis are summarised in Table 1, and the results of the ground stone analysis are discussed in the following section.

## Evidence for carving and polishing at Waka'

An assemblage of stone modifiers was recovered during removal of collapsed masonry from structure K10-11 (Marken & Cooper 2018). This cluster of artefacts was identified as embedded within and on top of the masonry of the southern portion of the structure's east wall. Other materials from structure K10-11 and the adjacent structure K10-12B, described further below, indicate stone and greenstone working.

Structure K10-11 was a small, vaulted, stone-built residential structure consisting of two rooms with east facing doorways. Room 1 contained a masonry bench with a single step along

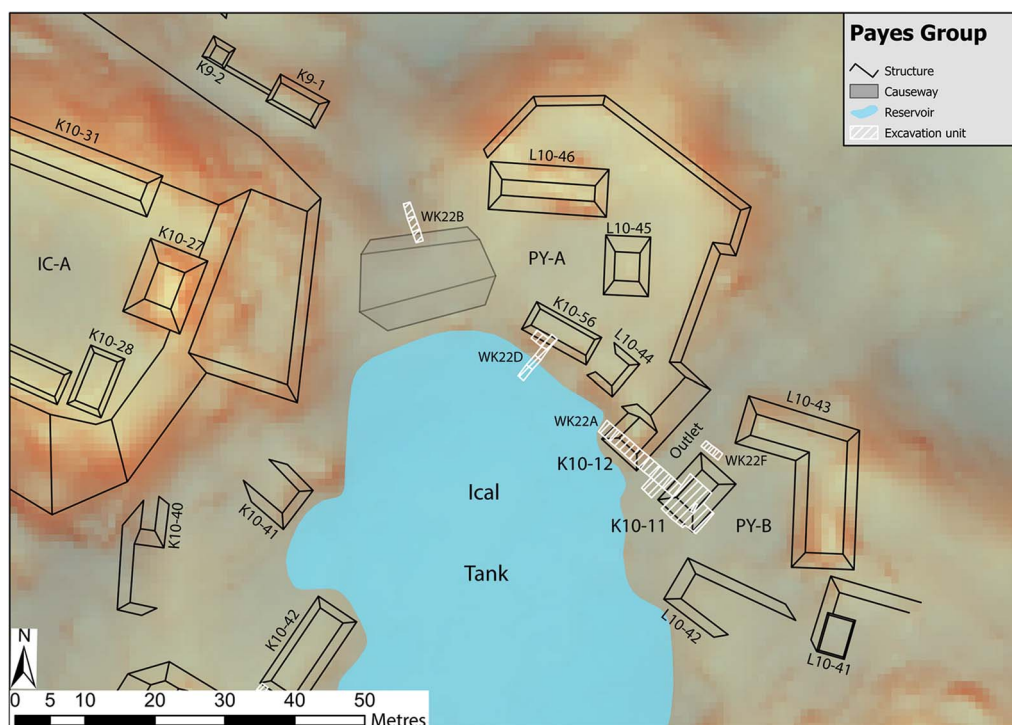


Figure 3. Payes group (figure by D. Marken, with permission of Proyecto Arqueológico Waka).

the northern side (Figure 4). Prior to the roof collapse, the body of a middle-aged woman (Burial 76) had been placed on the bench (Patterson 2018) and the structure was likely abandoned shortly thereafter, as some of the bones were knocked to the floor during the collapse. Several artefacts, including a small bead modifier, two manos, two large shell bivalves, a

Table 1. Chert lithics from structures K10-11 and K10-12B.

Material	Count
Debitage	63
Soft hammer	20 (31.7%)
Hard hammer	28 (44.4%)
Other	15 (23.8%)
Biface	26
Uniface	2
Core	2
Scraper	1
Drill	2
Blades	3
Total	99*

\*Not including the stone modifier assemblage.

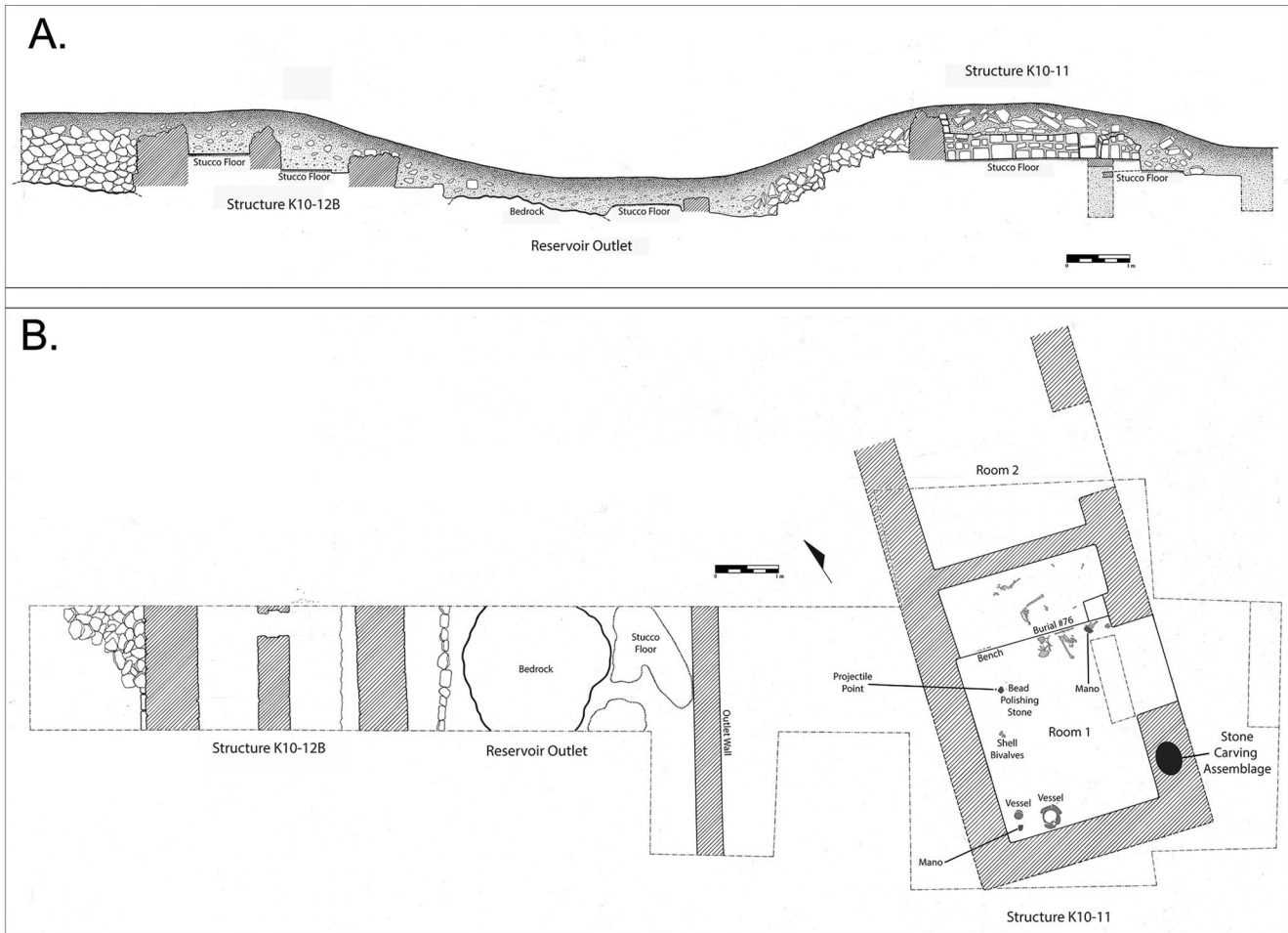


Figure 4. North profile (A) and plan (B) of structures K10-11 and K10-12B (drawings by R. Ozaeta (A & B) and D. Marken (B), with permission of Proyecto Arqueológico Waka).





Figure 5. Photograph of the stone working assemblage in situ in room 1 of structure K10-11 (photograph by D. Marken).

projectile point and two partial ceramic vessels, were recovered from the floor of room 1 (Marken & Cooper 2018; Figures 4 & 5).

The assemblage of stone modifiers (Figure 6) consists of two polished stones with greenstone flecks, three greenstone axes, two polished limestone pieces, two greenstone pieces polished on one side only and one polished chert biface. All were recovered from the same area, along with a general utility biface, a common tool type from the Maya lowlands that was also associated with stoneworking.

The assemblage includes objects typically used for the working of stone and greenstone (see Andrews & Rovner 1973; Rovner & Lewenstein 1997; Inomata & Triadan 2000; Aoyama 2007; Clarke *et al.* in press). In particular, the three greenstone axes (Figure 6) resemble those axes from Aguateca, which represent the tools of a stela carver, with different sizes for different stages of work. The polished chert biface and the shaped limestone pieces are comparable with objects identified by Andrews and Rovner (1973) from a mason's toolkit from Dzibichaltun (Andrews & Rovner 1973; Rovner & Lewenstein 1997; Parker *et al.* 2019). Those bifaces were polished on one side, with the other side illustrating their bifacial production. The shaped limestone pieces also resemble those identified by Andrews and Rovner (1973; Rovner & Lewenstein 1997; Parker *et al.* 2019).

The two greenstone pieces that are polished on one side, one of the polished stones with greenstone flecks and one of the two polished limestone pieces show evidence of sawing, which probably relates to greenstone working. Based on the straightness of the marks, it is



Figure 6. Stone working assemblage. Top row) two polished limestone pieces, materials with greenstone flecks, and cut greenstone; bottom row) three greenstone axes and polished biface (photograph by R. Horowitz).

probable that planks, possibly made of wood, or stone slabs were used to rub abrasives (e.g. sand) acting as a saw. As both greenstone and limestone pieces show saw marks, we propose that they were in the process of being made into preforms for the manufacture of greenstone ornaments or limestone tools (e.g. abraders). Traceological studies identified limestone as the preferred modifier of Classic-period Maya artisans for abrading greenstone ornaments in the central Maya lowlands (Melgar & Andrieu 2016; Meléndez 2019). We propose hypothetical scenarios for the polished surfaces of the two greenstone pieces: either these pieces were fragments of finished goods that were in the process of modification for reuse or were used as greenstone polishers themselves. Their glossy sections are the result of friction exerted over their surface by another agent, such as abrasives.

In addition to the stone modifier assemblage, other finds likely indicative of stoneworking were recovered from structures K10-11 and K10-12B, with most concentrated in structure K10-11. These include pumice ( $n = 4$ ), greenstone ( $n = 2$ ) and mano ( $n = 3$ ) fragments, a stone with nine hemispherical holes on one side (likely for modifying beads), a bark beater (in 2 pieces) and a potential abrading stone. The pumice, which was imported from the volcanic area to the south of Waka', could have been used as an abrasive, while manos were used for a variety of stoneworking activities, including polishing (Clarke 2020; Clarke *et al.* in press).



Figure 7. Stone modifier from Structure K10-11. The hemispherical holes were possibly used for modifying beads (photograph by R. Horowitz).

The stone with the hemispherical holes (Figure 7) is similar to those used in bead production (Chase & Chase 2011: 116; Kovacevich 2011; Landry 2013; Kovacevich & Callaghan 2018). This stone modifier is broken; the fragment contains nine depressions ranging from 10–12mm in diameter, though more may originally have been present. It differs slightly in form from other known stone modifiers and the flat interior surface of the depressions suggests that it was used to work relatively small, flat objects. The presence of this stone modifier alongside the partially sawn greenstone pieces indicates that multicrafting activities (Shimada 2007; Hirth 2009) were undertaken within these structures, as they relate to greenstone production.

In addition to the stoneworking assemblage, other lithic materials recovered during the excavations include a mix of formal and informal chert tools and debitage (Table 1). Bifaces were the most common flaked stone tool and include general utility bifaces (n = 10), projectile points (n = 5), unidentifiable fragments (n = 10) and a polished biface similar to that described above (Figure 8; Andrews & Rovner 1973). Both the general utility bifaces and the polished biface are typically associated with stoneworking activities (see Clarke 2020; Clarke *et al.* in press).

While the remaining chert materials are not directly related to either stelae carving or greenstone working, chert tools were used in both tasks. Traceological studies indicate that chert was the preferred raw material for perforating greenstone ornaments (Melgar & Andrieu 2016; Meléndez 2019; Melgar *et al.* 2021) and, at Teotihuacan, Mexico, was used for polishing both monuments and greenstone ornaments (Cabrera *et al.* 2018; Melgar & Solís 2018).



Figure 8. 'Banana-shaped', polished chert biface showing polished (left) and unpolished (right) sides (photographs by R. Horowitz).

## Discussion

The lithic assemblage from the Payes group is indicative of stone and greenstone working. The presence of distinctive tools, including polished and ‘banana-shaped’ bifaces, stone objects for abrading/polishing and greenstone axes point to stoneworking, while greenstone and abrading/polishing implements point to the working of greenstone. While it is impossible to determine exactly what was produced here, comparisons with assemblages from other sites suggest the tools may have been used for carving stelae and greenstone working, possibly of greenstone ornaments. The lack of greenstone debitage suggests that greenstone production was segmented and most reduction occurred elsewhere.

The location of the stoneworking assemblage within the Payes group indicates crafting conducted by the high-status residents of Waka’. Similarly, at Cancuen, some greenstone working areas were located near the royal palace, and the presence of greenstone and limestone sawing, abrading and polishing at structure K10-11 at Waka’ corresponds with the activities performed at high-status groups at Cancuen (Kovacevich 2006: 36). Given the evidence for stone and greenstone working, the location of the artefacts within the Payes group and the symbolic nature of the activities themselves (see Stuart 1996; Inomata 2001; Aoyama 2007; O’Neil 2009; Houston 2014), we argue that high-status producers were involved in stelae carving and the production of greenstone objects at Waka’. These high-status crafters participated in ‘dirty crafts’ (Inomata 2001), including sawing greenstone and limestone cobbles to manufacture preforms.

The animate nature of stone in the Maya region meant that stoneworking was a ritual activity and physical objects were imbued with power (Stuart 1996; O’Neil 2009; Houston 2014: 91; Houston *et al.* 2021a; Horowitz *et al.* 2024). The esoteric nature of stoneworking, and the symbolic importance of stone monuments and greenstone objects, therefore point to the involvement of high-status producers. Production by high-status crafters also added to the economic and social value of such monuments and objects (Helms 1993; Kovacevich 2017) and it is likely that the ritual and esoteric knowledge involved in their crafting was limited to select (high-status) individuals (Stuart 1996; Houston 2014; Clarke 2020; but see Weedman Arthur 2018 for a discussion of animate stone and specialist knowledge in stone tool production by non-elite Gamo hide scrapers in Ethiopia). In turn, the use and exchange of stone objects was mediated through knowledge about the producer.

The identification of stoneworking toolkits outside caches or special abandonment contexts is unusual and the Waka’ stone modifier assemblage therefore provides a unique opportunity to explore crafting locations. Structures K10-11 and K10-12B lie on the outskirts of the residential group, near a water source (Figures 3 & 4), suggesting that the latter was important for stone working. The burial of a female within structure K10-11 could indicate the involvement of individuals of multiple genders in these activities.

Finally, the assemblage provides evidence for multicrafting (Shimada 2007), with the crafters involved in stone and greenstone working, and in the production of their own tools. The location of the finds supports the hypothesis of elite participation in crafting, adding weight to previous assertions based on the symbolic and ritual significance of the raw materials and the finished products, and on the specialised knowledge required for production.

## Conclusion

Consideration of a stone modifier assemblage from the ancestral Maya city of Waka', and its location within a high-status area of the site, provides evidence that elite individuals participated in difficult to perform, labour-intensive and 'dirty' craft production activities (Inomata 2001). Although Inomata (2001) highlighted elite participation in crafts that are difficult work, often scholars have continued to assume that difficult tasks were performed by non-elite individuals. We suspect that elite participation in similar crafting activities is more common globally than documented thus far. Furthermore, the ontological understanding of stone, or other materials, may shape who can undertake such crafting, despite the difficulties of working with these materials.

Hence, elite involvement in crafting may result from the possession of the ritual or specialised knowledge necessary for certain types of production.

The Waka' assemblage suggests that elites participated in a variety of crafts, and that their participation in craft production was almost certainly shaped by the ontological understanding of the raw materials and the knowledge necessary to produce such goods. We suggest that elite crafting is probably under-recognised archaeologically, and we hope that this case study provides a framework for the identification of such crafting at other sites and in other parts of the world.

## Acknowledgements

Investigations were conducted by the Proyecto Arqueológico Waka' (PAW), directed at the time of excavations by David Freidel and Juan Carlos Pérez, with support and permission from the Ministerio de Cultura y Deportes de Guatemala, which includes the Dirección General del Patrimonio Cultural y Natural, the Instituto de Antropología e Historia (IDEAH), and the Departamento de Monumentos Prehispánicos y Coloniales. Thanks to Rene Ozaeta, Zachary Cooper and the people of Paso Caballos, La Cebita and Dolores for their assistance.

## Funding statement

Research was funded by the GeoOntological Development Society and the Bergen Excellence in Archaeology Fund, Washington State University.

## Data availability

All relevant data are contained within the manuscript and archaeological materials are stored by the Proyecto Arqueológico Waka' and IDEAH. The site of El Perú-Waka' and the residential Payes Group are part of Guatemala's cultural patrimony. Researchers interested in pursuing these data for scholarly purposes may contact IDEAH for permissions ([direcciongeneraldepatririmonio@mcd.gob.gt](mailto:direcciongeneraldepatririmonio@mcd.gob.gt)).

## References

- ADAMS, J.L. 2002. *Ground stone analysis: a technological approach*. Salt Lake City: University of Utah Press.
- AMES, K. 1995. Chiefly power and household production of the Northwest Coast, in T. Price & G. Feinman (ed.) *Foundations of social inequality*: 155–87. New York: Plenum.
- AMESBURY, J.R., C.K. WALTH & J.M. BAYMAN. 2022. Marine shell ornaments and the political

- economy of gendered power in the Mariana Islands. *Journal of Island and Coastal Archaeology* 17: 537–56.  
<https://doi.org/10.1080/15564894.2020.1838972>
- ANDREFSKY, W. JR. 2005. *Lithics: macroscopic approaches to analysis*. Cambridge: Cambridge University Press.
- ANDREWS IV, E.W. & I. ROVNER. 1973. Archaeological evidence on social stratification and commerce in northern Yucatan: two mason's toolkits from Muna and Dzibilchaltun, Yucatan, in M.A.L. Harrison & R. Wauchope (ed.) *Archaeological investigations on the Yucatan Peninsula*: 81–102. New Orleans (LA): Middle American Research Institute.
- ANDRIEU, C. & M. FORNE. 2010. Producción y distribución del jade en el Mundo Maya: talleres, fuentes y rutas del intercambio en su contexto interregional: vista desde Cancuén, in B. Arroyo, A. Linares & L. Paiz (ed.) *XXIV Simposio de Investigaciones Arqueológicas en Guatemala*: 946–55. Guatemala City: Museo Nacional de Arqueología y Etnología.
- ANDRIEU, C., E. RODAS & L. LUIN. 2014. The value of Classic Maya jade: a reanalysis of Cancuén's jade workshop. *Ancient Mesoamerica* 25: 141–64.  
<https://doi.org/10.1017/S0956536114000108>
- AOYAMA, K. 2007. Elite artisans and craft producers in Classic Maya society: lithic evidence from Aguateca, Guatemala. *Latin American Antiquity* 18: 3–26. <https://doi.org/10.2307/25063083>
- BARROWCLOUGH, D.A. & A.R. LISTER. 2004. The secrets of the craft production of Scandinavian Late Neolithic flint daggers. *Lithic Technology* 29: 75–86.  
<https://doi.org/10.1080/01977261.2004.11721013>
- CABRERA, V., V. GUZMÁN, E.R. MELGAR & S. SÁNCHEZ. 2018. Análisis tecnológico de los monolitos de Piedra Verde Hallados en la Plaza de La Pirámide de La Luna, Teotihuacán. *Boletín de Arqueología Experimental* 13: 37–53.  
<https://doi.org/10.15366/baexuam2018-19.13.003>
- CAMPBELL, R.B., ZHIPENG LI, YULING HE & YUAN JING. 2011. Consumption, exchange and production at the great settlement Shang: bone-working at Tieshanlu, Anyang. *Antiquity* 85: 1279–97.  
<https://doi.org/10.1017/S0003598X00062050>
- CANUTO, M.A. et al. 2018. Ancient Lowland Maya complexity as revealed by airborne laser scanning of northern Guatemala. *Science* 361.  
<https://doi.org/10.1126/science.aau0137>
- CHASE, A.F. & D.Z. CHASE. 2011. Heterogeneity in residential group composition: continued investigation in and near Caracol's epicenter: Caracol Archaeological Project Investigations for 2011. Report prepared for the Belize Institute of Archaeology. Available at:  
<https://caracol.org/wp-content/uploads/2016/05/Season-Report-2011.pdf> (accessed March 2023).
- CHIRIKURE, S. 2020. New perspectives on the political economy of Great Zimbabwe. *Journal of Archaeological Research* 28: 139–86.  
<https://doi.org/10.1007/s10814-019-09133-w>
- CLARK, J.E. 2007. In craft specialization's penumbra: things, persons, action, value, and surplus. *Archaeological Papers of the American Anthropological Association* 17(1): 20–35.  
<https://doi.org/10.1525/ap3a.2007.17.1.20>
- CLARKE, M.E. 2020. Producing stone and slate: the intersection of domestic and institutional economies in Classic Maya society. Unpublished PhD dissertation, Boston University.
- CLARKE, M.E., R.A. HOROWITZ & J.S.R. PALING. In press. Tools of the trade: a review of the lithic technologies associated with ancient Maya quarries. *Ancient Mesoamerica*.
- COSTIN, C.L. 1991. Craft specialization: issues in defining, documenting, and explaining the organization of production. *Archaeological Method and Theory* 3: 1–56.
- 2001. Craft production systems, in G.M. Feinman & T.D. Price (ed.) *Archaeology at the millennium: a sourcebook*: 273–314. New York: Plenum.
- 2004. Craft economies of ancient Andean states, in G.M. Feinman & L.M. Nichols (ed.) *Archaeological perspectives on political economy*: 189–221. Salt Lake City: University of Utah Press.
- DAVENPORT, J.A. 2020. The organization of production for Inka polychrome pottery from Pachacamac, Peru. *Journal of Anthropological Archaeology* 60.  
<https://doi.org/10.1016/j.jaa.2020.101235>
- DEL ÁGUILA FLORES, P. 2009. *Manufactura de piedras de moler contemporáneas: una aproximación al estudio en las regiones de Nabualá, Sololá, San Luis Jilotepeque, Jalapa y Malacatancito*,

- Huehuetenango, Guatemala* (Serie de Estudios Arqueológicos 6). Guatemala: Ministerio de Culturas y Deportes.
- DIGBY, A. 1972. *Maya jades*. Oxford: Oxford University Press.
- DOMÍNGUEZ CARRASCO, M. DEL R. & W.J. FOLAN. 1999. Hilado, confección y lapidación: los quehaceres cotidianos de los artesanos de Calakmul, Campeche, México, in J.P. Laporte, B. Arroyo & H. Escobedo (ed.) *XII simposio de investigaciones arqueológicas en Guatemala, 1998*: 628–46. Guatemala City: Museo Nacional de Arqueología y Etnología.
- EPPICH, K. 2020. Commerce, redistribution, autarky, and barter: the multitiered urban economy of El Perú-Waka', Guatemala, in M.A. Masson, D.A. Friedel & A.A. Demarest (ed.) *The real business of ancient Maya economies: from farmers' fields to rulers' realms*: 149–71. Tallahassee: University of Florida Press.  
<https://doi.org/10.5744/florida/9780813066295.003.0009>
- EPPICH, K. & D. FREIDEL. 2015. Markets and marketing in the Classic Maya Lowlands: a case study from El Perú-Waka', in E.M. King (ed.) *The ancient Maya marketplace: the archaeology of transient space*: 195–225. Tucson: University of Arizona Press.
- EPPICH, K., D.B. MARKEN & E.D. MENÉNDEZ. 2023. A city in flux: the dynamic urban form and function of El Perú-Waka', in D.B. Marken & M.C. Arnauld (ed.) *Building an archaeology of Maya urbanism: planning and flexibility in the American tropics*: 105–47. Denver: University of Colorado Press.
- FLAD, R.K. & Z.X. HRUBY. 2007. "Specialized" production in archaeological contexts: rethinking specialization, the social value of products, and the practice of production. *Archaeological Papers of the American Anthropological Association* 17(1): 1–19. <https://doi.org/10.1525/ap3a.2007.17.1.1>
- FREIDEL, D. 1993. The jade ahau: towards a theory of commodity value in Maya civilization, in F.W. Lange (ed.) *Pre-Columbian jade: new geological and cultural interpretations*: 149–65. Salt Lake City: University of Utah Press.
- FREIDEL, D.A. & H.L. ESCOBEDO. 2014. Stelae, buildings, and people: reflections on ritual in the archaeological record of El Perú-Waka', in O.C. Navarro-Farr & M. Rich (ed.) *Archaeology at El Perú-Waka': ancient Maya performance of ritual, memory, and power*: 18–33. Tucson: University of Arizona Press.
- GUENTER, S. 2014. The epigraphy of El Perú-Waka', in O.C. Navarro-Farr & M. Rich (ed.) *Archaeology at El Perú-Waka': ancient Maya performances of ritual, memory, and power*: 147–66. Tucson: University of Arizona Press.
- HAVILAND, W.A. 1974. Occupational specialization at Tikal, Guatemala: stoneworking-monument carving. *American Antiquity* 39: 494–96.  
<https://doi.org/10.2307/279445>
- HELMS, M.W. 1993. *Craft and the kingly ideal: art, trade, and power*. Austin: University of Texas.
- HIRTH, K.E. 2009. Craft production, household diversification, and domestic economy in prehispanic Mesoamerica. *Archaeological Papers of the American Anthropological Association* 19(1): 13–32.  
<https://doi.org/10.1111/j.1551-8248.2009.01010.x>
- HOROWITZ, R.A., M.K. BROWN, J. YAEGER & B. CAP. 2024. Animate stone: Maya chert 'debitage' and ontological perspectives. *Archaeologies* 20: 177–213.  
<https://doi.org/10.1007/s11759-024-09497-6>
- HOUSTON, S. 2000. Into the minds of ancients: advances in Maya glyph studies. *Journal of World Prehistory* 14: 121–201.  
<https://doi.org/10.1023/A:1007883024875>
- 2014. *The life within: Classic Maya and the matter of permanence*. New Haven (CT): Yale University Press.
- HOUSTON, S. (ed.) 2021. *A Maya universe in stone*. Los Angeles (CA): Getty Research Institute.
- HOUSTON, S., D. STUART & K. TAUBE. 2021a. Seasonal gods and cosmic rulers, in S. Houston (ed.) *A Maya universe in stone*: 93–151. Los Angeles (CA): Getty Research Institute.
- HOUSTON, S., A. SCHERER & K. TAUBE. 2021b. A sculptor at work, in S. Houston (ed.) *A Maya universe in stone*: 37–92. Los Angeles (CA): Getty Research Institute.
- HRUBY, Z.X. 2007. Ritualized chipped-stone production at Piedras Negras, Guatemala. *Archaeological Papers of the American Anthropological Association* 17(1): 68–87.  
<https://doi.org/10.1525/ap3a.2007.17.1.68>
- INOMATA, T. 2001. The power and ideology of artistic creation: elite craft specialists in Classic Maya society. *Current Anthropology* 42: 321–49.  
<https://doi.org/10.1086/320475>
- INOMATA, T. & D. TRIADAN. 2000. Craft production by Classic Maya elites in domestic settings: data from rapidly abandoned structures at Aguateca, Guatemala. *Mayab* 13: 57–66.

- INOMATA, T., D. TRIADAN, E. PONCIANO, E. PINTO, R.E. TERRY & M. EBERL 2002. Domestic and political lives of Classic Maya elites: the excavation of rapidly abandoned structures at Aguateca, Guatemala. *Latin American Antiquity* 13: 305–30. <https://doi.org/10.2307/972113>
- KIDDER, A., J. JENNINGS & E. SHOOK. 1946. *Excavations at Kaminaljuyu, Guatemala*. Vol. 561. Washington, D.C.: Carnegie Institution of Washington.
- KOVACEVICH, B. 2006. Reconstructing Classic Maya Economic systems: production and exchange at Cancuen, Guatemala. Unpublished PhD dissertation, Vanderbilt University.
- 2011. The organization of jade production at Cancuen, Guatemala, in Z.X. Hruby, G.E. Braswell & O. Chinchilla Mazariegos (ed.) *The technology of Maya civilization: political economy and beyond in lithic studies*: 151–63. Sheffield: Equinox.
- 2017. The value of labor: how the production process added value to pre-Columbian Maya jade, in J.P. Mathews & T.H. Guderjan (ed.) *The value of things: prehistoric to contemporary commodities in the Maya region*: 7–29. Tucson: University of Arizona Press.
- KOVACEVICH, B. & M.G. CALLAGHAN. 2018. Fifty shades of green: interpreting Maya jade production, circulation, consumption, and value. *Ancient Mesoamerica* 30: 457–72. <https://doi.org/10.1017/S0956536118000184>
- LANDRY, R. 2013. Ancient Maya stone polishers and issues with the terminology for the artifacts polished with these tools. Unpublished MA dissertation, University of Central Florida.
- MARKEN, D.B. 2015. Conceptualizing the spatial dimensions of Classic Maya states: polity and urbanism of El Perú-Waka', Peten, in D.B. Marken & J.L. Fitzsimmons (ed.) *Classic Maya polities of the Southern Lowlands*: 123–66. Boulder: University of Colorado Press.
- MARKEN, D.B. & Z.J. COOPER. 2018. WK22: excavaciones en estructuras residenciales asociadas con rasgos de manejo del agua en el Barrio Ical, in J.C. Pérez, G. Pérez & D. Friedel (ed.) *Proyecto Arqueológico Waka' Informe 15, Temporada 2017*: 196–254. Report on file with the Instituto de Antropología e Historia.
- MARKEN, D.B. & M.C. RICKER. 2024. Fire, earth, and water: settlement, soils and hydrology at El Perú-Waka', in K. Eppich, D.B. Marken & D. Freidel (ed.) *El Perú-Waka': new archaeological perspectives on the kingdom of the centipede*: 57–89. Gainesville: University of Florida Press.
- MARKEN, D.B., J.C. PÉREZ, O. NAVARRO-FARR & K. EPPICH. 2019. Ciudad de los ciempies: urbanismo, fronteras, y comunidad en el Perú-Waka', Peten, Guatemala, in B. Arroyo, L. Méndez Salinas & G. Ajú Álvarez (ed.) *XXXII simposio de investigaciones arqueológicas en Guatemala*: 531–36. Guatemala City: Museo Nacional de Arqueología y Etnología.
- MARKEN, D.B., E.D. MENÉNDEZ, M. CUYÁN, H. PÉREZ, M. PLUNKETT, S. VAN OSS & S. CANTÉ. 2023. ES: excavaciones en grupos residenciales urbanos: grupos Ical, Pepem, Caída, Batz, y Jabalí, in G. Pérez Robles, O. Navarro-Farr & D. Marken (ed.) *Proyecto Arqueológico Waka' Informe No. 20 Temporada 2022*: 92–209. Report submitted to the Instituto de Antropología e Historia.
- MARTIN, S. 2020. *Ancient Maya politics: a political anthropology of the Classic Period 150–900 CE*. Cambridge: Cambridge University Press.
- MARTIN, S. & E. VELÁSQUEZ. 2016. Politics and places: tracing the toponyms of the snake dynasty. *The PARI Journal* 17(2): 23–33.
- MELGAR, E.R. 2023. *La Lapidaria del Templo Mayor, estilos y tradiciones tecnológicas*. Mexico City: Secretaría de Cultura, Instituto Nacional de Antropología e Historia.
- MELGAR, E.R. & C. ANDRIEU. 2016. El intercambio del jade en las Tierras Bajas Mayas, desde una perspectiva tecnológica, in B. Arroyo, L. Méndez & G. Ajú (ed.) *XXIX simposio de investigaciones arqueológicas en Guatemala 2015*: 1065–76. Guatemala City: Museo Nacional de Arqueología y Etnología.
- MELGAR, E.R. & R. SOLÍS. 2018. Caracterización mineralógica y tecnológica de la lapidaria de Teopanaczo, in L. Manzanilla (ed.) *Teopanaczo como Centro de Barrio Multiétnico de Teotihuacan. Los sectores funcionales y el intercambio a larga distancia*: 621–72. Mexico City: Universidad Nacional Autónoma de México.
- MELGAR, E.R., R. SOLÍS, H. MONTERROSA, M.J. PUY & J.C. MELÉNDEZ. 2021. Presencia de lapidaria de estilo Maya fuera de la región Maya. *Revista Española de Antropología Americana* 51: 11–32.
- MELÉNDEZ, J.C. 2019. *A contextual and technological study of ancient Maya greenstone mosaic masks*. Unpublished PhD dissertation, Washington University in St. Louis.



- MENÉNDEZ, D. & M. CUYÁN. 2016. Excavaciones de Sondeo, in J.C. Pérez & G. Pérez (ed.) *Proyecto Arqueológico Regional Waka' Informe 13 Temporada 2015*: 131–74. Report submitted to the Instituto de Antropología e Historia.
- MIRAMBELL, L. 1968. *Técnicas Lapidarias Prehispánicas*. Mexico City: Instituto Nacional de Antropología e Historia.
- MOFFETT, A.J., S. HALL & S. CHIRIKURE. 2020. Crafting power: new perspectives on the political economy of southern Africa, AD 900–1300. *Journal of Archaeological Method and Theory* 59. <https://doi.org/10.1016/j.jaa.2020.101180>
- NAVARRO-FARR, O.C. & M. RICH (ed.). 2014. *Archaeology at El Perú-Waka': ancient Maya performance of ritual, memory, and power*. Tucson: University of Arizona Press.
- ODELL, G.H. 2003. *Lithic analysis*. New York: Springer.
- OLAUSSON, D. 2017. Knapping skill and craft specialization in Late Neolithic flint daggers. *Lithic Technology* 42: 127–39. <https://doi.org/10.1080/01977261.2017.1364328>
- O'NEIL, M.E. 2009. Ancient Maya sculptures of Tikal, seen and unseen. *Res: Anthropology and Aesthetics* 55/56: 119–34. <https://doi.org/10.1086/RESvn1ms25608839>
- PARKER, E., G.J. BEY III & T. GALLARETA NEGRÓN. 2019. Organization of masonry technology in the eastern Puuc: evidence from Escalera al Cielo, Yucatán. *The Mayanist* 1(1): 21–36.
- PATTERSON, E. 2018. Análisis preliminar de los restos óseos esqueléticos humanos, Temporada 2017, in J.C. Pérez, G. Pérez & D. Friedel (ed.) *Proyecto Arqueológico Waka' Informe 15, Temporada 2017*: 345–49. Report on File with the Instituto de Antropología e Historia.
- ROCHETTE, E. 2009. The Late Classic organization of jade artifact production in the middle Motagua Valley, Zacapa, Guatemala. Unpublished PhD dissertation, Pennsylvania State University.
- 2014. Out of control? Rethinking assumptions about wealth goods production and the Classic Maya. *Ancient Mesoamerica* 25: 165–85. <https://doi.org/10.1017/S095653611400011X>
- ROVNER, I. & S.M. LEWENSTEIN. 1997. *Maya stone tools of Dzibichaltun, Yucatan and Becan and Chicanna, Campeche* (Middle American Research Institute Publication 65). New Orleans (LA): Middle American Research Institute.
- SHIMADA, I. 2007. Introduction, in I. Shimada (ed.) *Craft production in complex societies: multicraft and producer perspectives*: 1–25. Salt Lake City: University of Utah Press.
- STUART, D. 1989. Hieroglyphs on Maya vessels, in J. Kerr (ed.) *The Maya vase book, a corpus of rollout photographs of Maya vases, vol. 1*: 149–60. New York: Kerr Associates.
- 1996. Kings of stone: a consideration of stelae in ancient Maya ritual and representation. *Res: Anthropology and Aesthetics* 29/30: 148–71. <https://doi.org/10.1086/RESvn1ms20166947>
- SUN, Z. 2008. *Craft production in the Western Zhou Dynasty (1046–771 BC): a case study of a jue-earrings workshop at the predynastic capital site, Zhouyuan, China* (British Archaeological Reports International Series 1777). Oxford: Archaeopress.
- SWENSON, E.R. & J.P. WARNER. 2012. Crucibles of power: forging copper and forging subjects at the Moche ceremonial center of Huaca Colorada, Peru. *Journal of Anthropological Archaeology* 31: 314–33. <https://doi.org/10.1016/j.jaa.2012.01.010>
- TAUBE, K. 2005. The symbolism of jade in Classic Maya religion. *Ancient Mesoamerica* 16: 23–50. <https://doi.org/10.1017/S0956536105050017>
- WEEDMAN ARTHUR, K. 2018. *The lives of stone tools: crafting the status, skill, and identity of tool makers*. Tucson: The University of Arizona Press.
- WHITTAKER, J.C. 1994. *Flintknapping: making and understanding stone tools*. Austin: University of Texas Press.
- YEE, WONG WAI, EA DARITH, CHHAY RACHNA & TAN BOUN SUY. 2021. Two traditions: a comparison of roof tile manufacture and usage in Angkor and China. *Asian Perspectives* 60: 128–56. <https://doi.org/10.1353/asi.2020.0039>