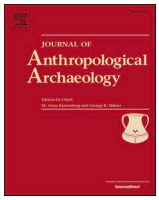
Journal of Anthropological Archaeology 66 (2022) 101408

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

journal homepage: www.elsevier.com/locate/jaa



Chronology and the evidence for war in the ancient Maya kingdom of Piedras Negras

Andrew K. Scherer [a,*], Charles Golden [b], Stephen Houston [c], Mallory E. Matsumoto [d], Omar A. Alcover Firpi [k], Whittaker Schroder [e], Alejandra Roche Recinos [f], Socorro Jiménez Álvarez [g], Mónica Urquizú [h], Griselda Pérez Robles [i], Joshua T. Schnell [j], Zachary X. Hruby [l]

[a] Department of Anthropology, Brown University, Box 1921, Providence, RI 02912, United States
[b] Department of Anthropology, MS006, Brandeis University, 415 South Street, Waltham, MA 02454, United States
[c] Department of Anthropology, Brown University, United States
[d] Department of Religious Studies, University of Texas at Austin, United States
[e] Center for Latin American Studies, University of Florida, Gainesville, FL 32611, United States
[f] Department of Anthropology, Reed College, United States
[g] Facultad de Ciencias Antropológicas, Universidad Autónoma de Yucatán, Carretera Mérida-Tizimín, Cholul, 97305 Mérida, Yuc., Mexico
[h] Instituto de Antropología e Historia de Guatemala, 6 calle y 6 avenida zona 1 Palacio Nacional, Ciudad de Guatemala, Guatemala
[i] Proyecto Paisaje Piedras Negras-Yaxchilan, Guatemala
[j] Department of Anthropology, Brown University, Box 1921, Providence, RI 02912, United States
[k] Informing Change, United States
[l] Department of Anthropology, Northern Kentucky University, 217 Landrum Academic Center, Highland Heights, KY 41099, United States

ARTICLE INFO

Keywords:
Classic Maya
Warfare
Violence
Fortification
Weapons
Bioarchaeology
State formation
Collapse

ABSTRACT

Through a case study of the Classic period (A.D. 350–900) kingdom of Piedras Negras, this paper addresses a number of debates in the archaeology of war among the ancient Maya. These findings have broader comparative use in ongoing attempts to understand war in the precolonial Americas, including the frequency of war, its role in processes of polity formation and collapse, the involvement of non-elites in combat, and the cause and effect of captive-taking. This paper provides the first synthesis of a number of datasets pertaining to war and violence in the region of Piedras Negras while presenting new settlement data gleaned from recent lidar survey of the area. Focus is especially on tracing the material, iconographic, and epigraphic evidence for war in diachronic perspective. Material evidence includes the spatial distribution of settlement, presence of fortifications, weaponry, and human skeletal remains demonstrating evidence of traumatic injury. Additional data are drawn from epigraphy and iconography. As with all archaeological contexts, there are crucial gaps in the record. Nevertheless, by combining these datasets it is possible to reconstruct a history of warfare within this precolonial indigenous polity of the first millennium.

1. Introduction

Within and beyond anthropology, there has been sustained academic interest in whether humans have, on average, become more or less violent with the passage of time, especially following landmark shifts to agriculture, complex society (including states), and modernity (e.g., Gat, 2006; Keeley, 1996; Leblanc and Register, 2003; Morris, 2014; Pinker, 2011; Scherer, 2021). Of particular interest has been the role violence has played in the formation, maintenance, and collapse of states and other complex political formations. Within the North American tradition of anthropology, archaeology is uniquely tasked with providing the long view on the history of violent conflict. (e.g., Arkush and Allen, 2006;

* Corresponding author.
E-mail addresses: andrew_scherer@brown.edu (A.K. Scherer), cgolden@brandeis.edu (C. Golden), Stephen_houston@brown.edu (S. Houston), mematsumoto@austin.utexas.edu (M.E. Matsumoto), omar_alcover@alumni.brown.edu (O.A. Alcover Firpi), wschroder@latam.ufl.edu (W. Schroder), arocherecinos@reed.edu (A.R. Recinos), sdpjimenez@yahoo.com.mx (S.J. Álvarez), grisroble11@gmail.com (M. Urquizú), grisroble11@gmail.com (G. Pérez Robles), joshua_schnell@brown.edu (J.T. Schnell), hrubyz1@nku.edu (Z.X. Hruby).

https://doi.org/10.1016/j.jaa.2022.101408
Received 21 June 2021; Received in revised form 21 February 2022;
Available online 4 April 2022

Arkush and Tung, 2013; Chacon and Mendoza, 2007; Nielsen and Walker, 2009; Redmond and Spencer, 2012; Roscoe, 2013; Spencer, 2010; Stanish and Levine, 2011; VanDerwarker and Wilson, 2016).

Yet with all the potential strengths of archaeology for such research, there are also pitfalls. Considering the breadth of methodological approaches and research foci around the globe, data are not always directly comparable even when discussing discrete types of data, like evidence for trauma from human remains or defensive systems. Further, such broad analyses tend to emphasize sites with abundant evidence of violence and downplay data from archaeological sites with little to no evidence for violence (Ferguson, 2013). Metaphorically speaking, the shout of warfare and violence overwhelms the quieter evidence for peace. In that regard, regional and temporally focused analyses of the archaeological evidence for warfare are fruitful, with their more limited scope permitting nuanced considerations of site-specific data within broader cultural-historical contexts (e.g., Lambert, 2002; Martin, 2016; Milner, 1999; Milner et al., 2013; Robbins Schug et al., 2012).

Elizabeth Arkush and Tiffiny Tung's (2013) survey of Andean warfare is an excellent example of what can be gained from a robust regionally focused review. They compare the results of bioarchaeological studies of human cranial trauma with research on settlement patterns, demonstrating that frequency of violence fluctuated over time within the Andes. They report overall congruity in the datasets, though find in the cases of the Wari and Inka empires that settlement patterns fail to fully capture the record of violence that was otherwise evident from cranial trauma. The general trend in the Andes was not towards a general increase (or decrease) in violence but instead oscillations that corresponded to what they call "crisis times," including environmental stress and socio-political transformation, particularly the breakdown of earlier forms of political integration and periods of imperial expansion. Overall, the Andean synthesis presented by Arkush and Tung highlights the utility of archaeological data in reconstructing patterns of warfare, and underscores the value of integrating multiple datasets, where possible, since certain episodes and types of violence may be hidden in some contexts.

Such a regionally specific study offers great value for better understanding the political and cultural impact of violence and warfare in the Maya world of southeastern Mexico and northern Central America. In the past few decades, there has been no shortage of scholarship on the subject of violence among the precolonial Maya (and in Mesoamerica in general); this results from their rich epigraphic and iconographic records, which provide abundant data regarding the history of war and ritual violence, as well as the growing evidence that fortifications, contrary to earlier assumptions, were widespread (e.g., Alcover Firpi and Golden, 2020; Brown and Stanton, 2003; Chacon and Mendoza, 2007; Morton and Peuramaki-Brown, 2019; Scherer and Verano, 2014; Webster, 2000). While David Webster (2000) provided the last major synthesis of Maya warfare to consider multiple lines of evidence, his review did not include a systematic chronological consideration of patterns of violence. The lack of chronological analysis is all the more notable in light of the fact that the Maya provide us with one of the only textual records for war in the precolonial Americas, albeit one that, like any historical record, is biased towards the elites, the victors, and eras of vigorous textual production, in their case the seventh and eighth centuries A.D. (Martin, 2020). Seeking insights from as many distinct data sets as possible, this paper does not take a pan-Maya perspective but instead focuses on a single Classic period kingdom, Piedras Negras, where the history of warfare can be approached from numerous lines of evidence.

Over the course of this paper we highlight a number of persistent challenges in the archaeological reconstruction of war over the longue durée, both within the Maya area and beyond. One is the age-old adage that absence of evidence is not necessarily evidence of absence. This especially holds for time periods that are not well represented in the archaeological record. In the southern Maya lowlands, the Early Classic period (A.D. 250–600, in most of the Maya area; A.D. 350–600 in the area of Piedras Negras) is underrepresented relative to the Late Classic period (A.D. 600–800) due to two factors: Late Classic period populations were much larger than those of the Early Classic period and much Early Classic period construction was buried by later architecture. As a result, violence is generally much easier to detect for the Late Classic period. That increased visibility relative to earlier periods is often treated as real diachronic change in practice, as opposed to a side effect of the nature of the material record. Another persistent issue in the archaeology of war is that we often lack the chronological precision necessary to detect less than decadal-level changes in practice, and thus relatively brief episodes of violence (or peace) may go undetected.

For the purpose of this paper, we see war as a collective effort involving two or more self-identified groups where at least one group seeks to advance its own interests at the expense of the others through the use of physical, psychological, or emotional trauma. In other words, war is collective conflict involving bodily harm. In the Maya area, war fundamentally involved communities (or alliances thereof) attacking other communities (or alliances thereof) to acquire immediate spoils and, as best can be discerned for the Classic period, establish tributary relationships. Epigraphy clearly indicates that captives were one such spoil and, while the evidence is murky, other gains likely involved transportable material wealth and religious effigies. Tribute likely took the form of not only precious materials but also commodities such as food, cotton mantles, and perhaps even labor. The hieroglyphic record provides cases of political subordination of defeated communities, whereas there is no textual or archaeological evidence for lasting territorial conquest and colonization of defeated places. Ongoing points of debate not only in the study of war among the Maya but in the precolonial Americas in general are the frequency and intensity of war, the role of war in processes of polity formation and collapse, the involvement of non-elites in combat, and the cause and effect of captive-taking, all matters that we address in the Discussion. Moreover, we make the case that what has recently been described as "total war" for the Maya can be applied from at least Late Preclassic period (B.C. 300–A.D. 350 in the Piedras Negras area) forward (Wahl et al., 2019). For more detail, the interested reader may consult a number of recent discussions of war and the Maya (Alcover Firpi and Golden, 2020; Hernandez and Palka, 2019; Martin, 2020:196-236; Tokovinine, 2019; Webster, 2000)

Within the Maya region, Piedras Negras provides an especially useful case study because of its abundant history of archaeological research (e.g., Coe, 1959; Golden et al., 2016; Houston et al., 2003a; Houston et al., 2000a; Houston et al., 1998; Houston et al., 1999; Houston et al., 2000b; Houston et al., 2000c; Houston et al., 2001; Weeks et al., 2005), including lithic studies (Golden et al., 2020; Hruby, 2006, 2007; Hruby and Ware, 2009; Roche Recinos, 2021; Roche Recinos et al., 2021), bioarchaeology (Scherer, 2015; Scherer et al., 2007), settlement survey (Golden and Scherer, 2013; Golden et al., 2008; Nelson, 2006), and, most recently, remote sensing survey (Golden et al., 2021) as well as its abundance of sculptural monuments with epigraphic texts (Clancy, 2009; O'Neil, 2012). After a brief summary of the kingdom of Piedras Negras, we present a systematic overview of the different lines of evidence pertaining to war within the polity: settlement location, fortifications, weapons, human remains, and epigraphy. The paper concludes with a synthesis and discussion of the findings. Although the authors of this paper have published extensively on the archaeology of warfare in the kingdom of Yaxchilan (e.g., Golden, et al. 2008; Golden and Scherer 2013; Scherer and Golden 2009, 2014a), this is the first paper to present data for settlement distribution, fortifications, and human osteology as they pertain to violence in the area of Piedras Negras, and here we also offer new lithic data from smaller communities in the region.

2. Piedras Negras: A brief summary

Piedras Negras is located on the Usumacinta River along the modern-day border between Peten, Guatemala and Chiapas, Mexico. The earliest known occupation at the site of Piedras Negras dates to the Middle

Preclassic period (ca. 600–300 BCE) and the greatest concentration of early ceramics has been found in the South Group Court and adjacent areas, identifying the zone as the likely center of the community in its earliest years (Fig. 1; Houston et al., 2003a:219). As urban centers emerged elsewhere in the Maya area during the Late Preclassic period, the site continued as a relatively small village with very modest public ceremonial architecture (Houston et al., 2000c). Beyond Piedras Negras, the area was dotted by a number of small, village-sized communities, of which only a few demonstrated minor public architecture in the form of small pyramidal temples, E-groups, and ballcourts (Fig. 2; Golden and Scherer, 2013; Kingsley et al., 2012; Schroder, 2019). Prior to the fifth century AD, Piedras Negras was no larger a community than any of these other centers, and there is no evidence that any one community had authority over other settlements of the region (Houston et al., 2000c).

Piedras Negras' subsequent demographic boom corresponds with the establishment of a royal dynasty (*yokib*) at the site center sometime in the mid-fifth century of the Early Classic period (Houston et al., 2003a). The dynasty itself was likely founded around a century earlier but seems to have been located elsewhere, perhaps at another site in the area (Martin, 2020:130). The evidence for rapid demographic growth is especially pronounced for the late fifth and sixth centuries A.D. and likely was triggered by an influx of people, coeval with the abandonment of most of the region's Late Preclassic period villages. Only a few communities, including El Cayo and perhaps La Mar, maintained continuous populations from the Late Preclassic through the Late Classic periods. Many of the abandoned villages were later re-occupied in the Late Classic period. At that same time, new settlements were founded throughout the region, presumably by migrants from Piedras Negras, which itself reached its maximum size at this time (Fig. 3).

By the late eighth century, the height of the Classic period, a 10–15 km radius around Piedras Negras was occupied by a mix of small hamlets and towns, some of which were governed by non-royal lords known as *sajal*, who epigraphic texts suggest were ostensibly loyal to the Piedras Negras royal court (Chinchilla and Houston, 1993; Martin and

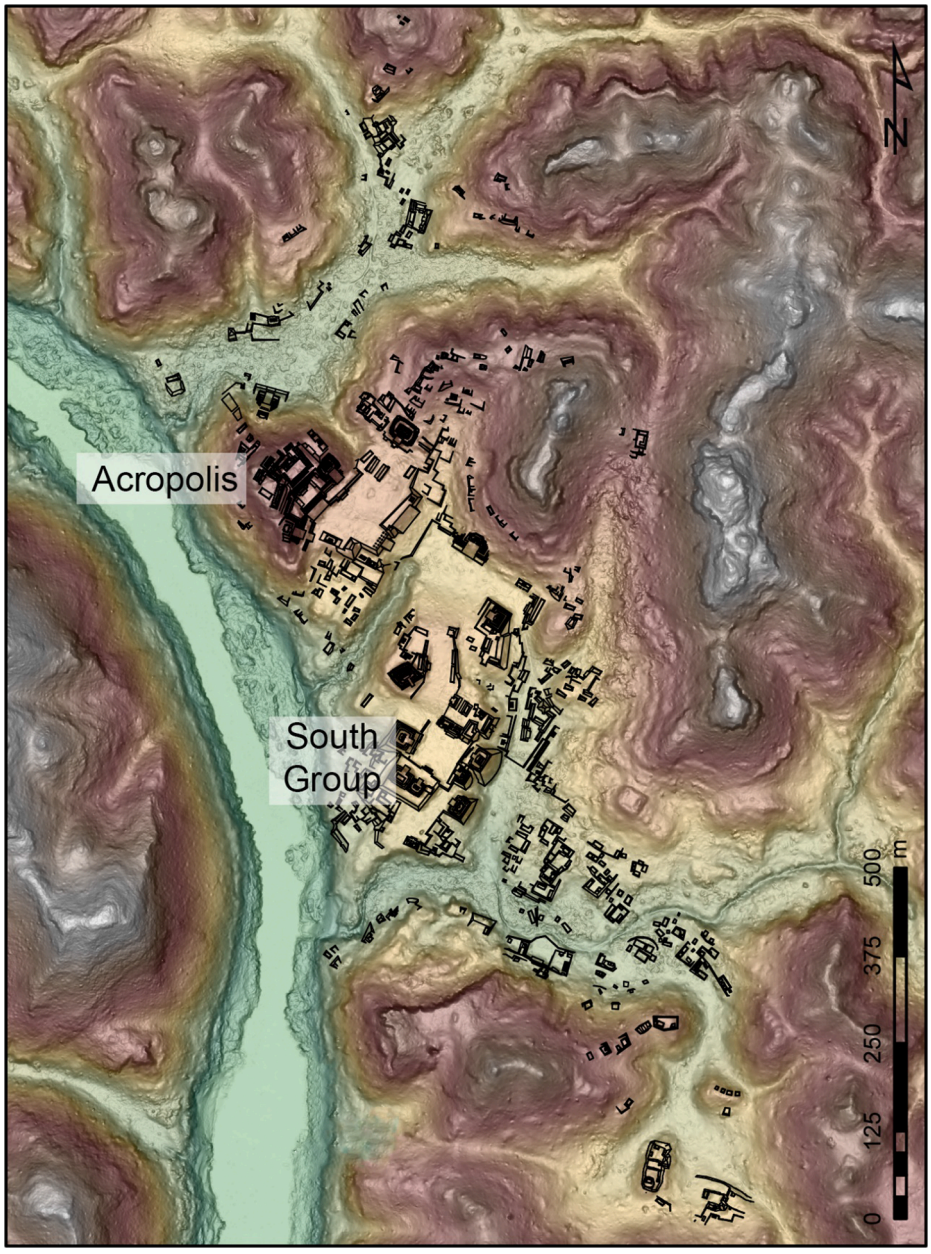


Fig. 1. Piedras Negras site map overlain on lidar visualization illustrating the rugged topography of the site (image by A. Scherer based on the site map by F. Parris and T. Proskouriakoff with modifications by Z. Nelson, N. Curritt, and T. Murtha).

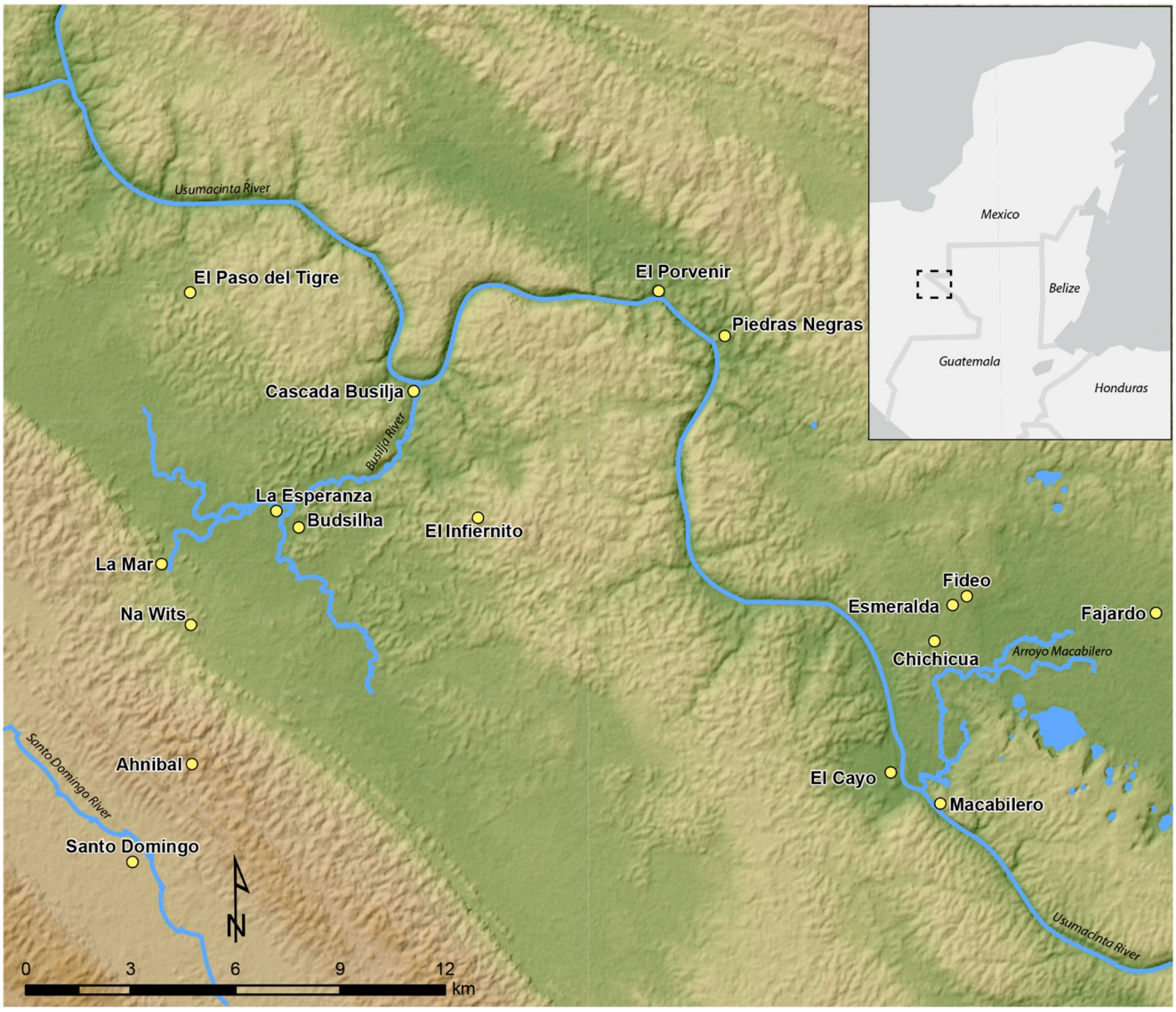


Fig. 2. Map of sites with known Preclassic period occupation in the area that became the Classic period kingdom of Piedras Negras (image by C. Golden).

Grube, 2008:150; Zender, 2002). It is this approximately 71,000-hectare region that roughly delineates the zone under most direct influence of the Late Classic period lords of Piedras Negras, and that henceforth will be called the Piedras Negras region or area. It is important to keep in mind that the lords of Piedras Negras did not exert authority over this region during the Late Preclassic period (there likely were no lords at that time) and that the extent of political authority in the Early Classic period is murky. At the edge of this Late Classic sphere of influence is La Mar, governed by an *ajaw* (royal lord) that never claimed the *k'uhul* ("sacred") epithet in his title but nevertheless appears to have maintained a degree of political independence. While Piedras Negras is by far the largest and most densely settled community discussed in this paper, La Mar boasted its own sprawling settlement, including expansive agricultural fields that were lacking around Piedras Negras itself (Golden et al., 2021).

The regional influence of Piedras Negras came to an end in the early ninth century. The penultimate ruler of Piedras Negras was captured and perhaps executed by the royal court at Yaxchilan, its longtime nemesis located 42 km to the southeast, in the year 808 (Stuart, 1998). Although another ruler appears to have taken the throne at Piedras Negras, the court was abandoned not long thereafter and the city itself experienced a gradual decline in population over the course of the ninth century A.D (Golden et al., 2016; Houston et al., 2001). That same demographic decline appears to have occurred throughout the region, where there is very limited evidence for occupation beyond the ninth century.

One challenge in interpreting the settlement history of Piedras Negras is the chronological imbalance of available data. Archaeologically speaking, the volume of Late Classic period contexts excavated within the area of Piedras Negras dwarfs those from all other time periods. This can be measured, in part, by the volume of Yaxche (A.D. 630–750) and Chacalhaaz phase (A.D. 750–850) ceramics that have been excavated at Piedras Negras and the surrounding communities (Jiménez Alvarez et al., 2014; Muñoz, 2006). After the dynastic collapse in the early ninth century, the Terminal Classic period (A.D. 810–900) represents a period of gradual abandonment and is also significantly underrepresented in the material record. The Late Preclassic period is the second-best represented context because a number of sites such as Macabilero saw significant construction and subsequent abandonment during the Late Preclassic period with little later occupation or construction over-burden. Early Classic period contexts, in contrast, are underrepresented because much regional settlement was abandoned around AD 350–450.

Further complicating our ability to fully resolve the regional settlement history is the record of research in the region. Of the three sites

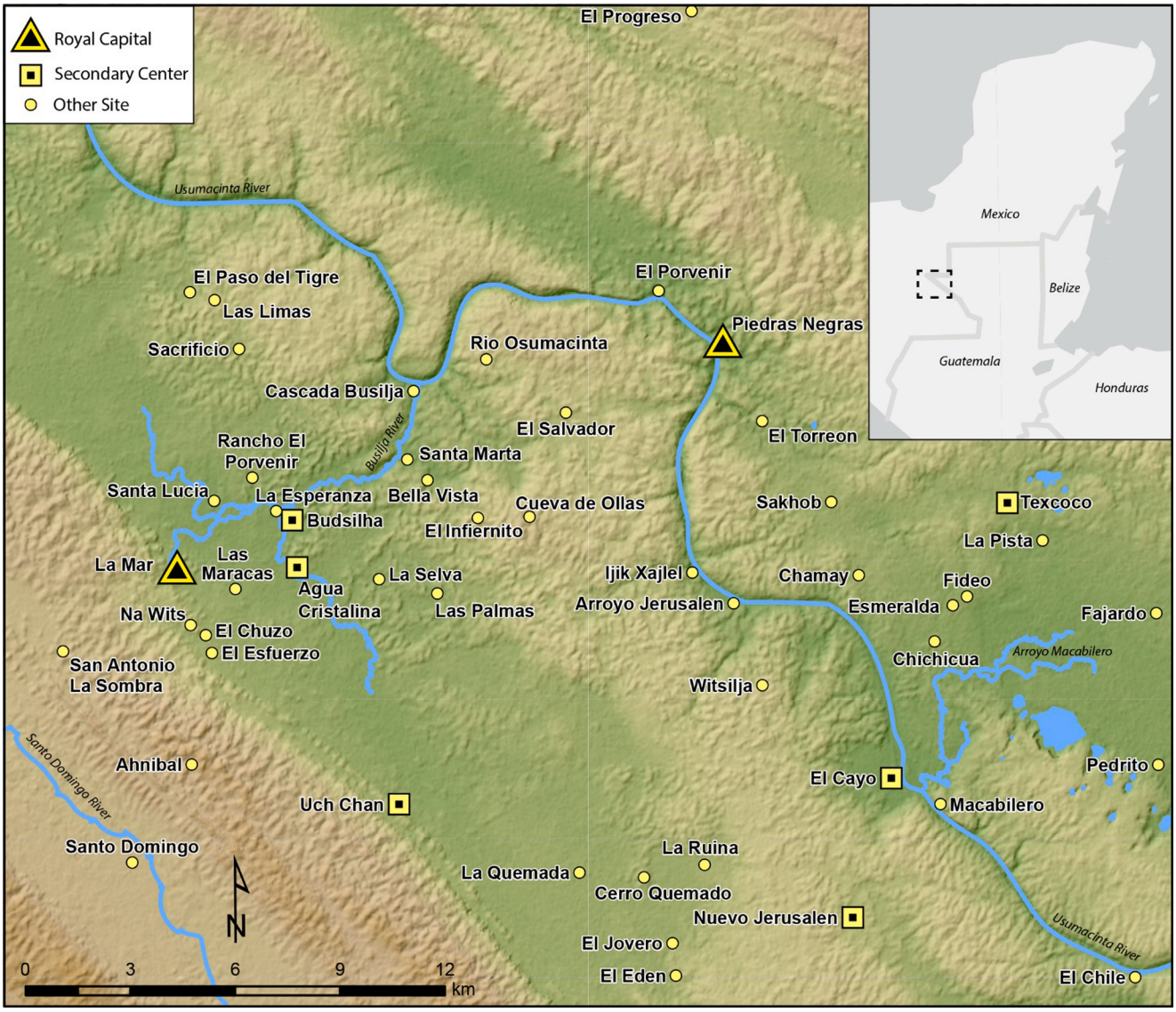


Fig. 3. Map of the Late Classic period region of Piedras Negras, including communities that were allied with if not under the direct dominion of the *yokib* dynasty during the eighth century A.D. (image by C. Golden). Many of these sites are unexcavated and could contain earlier occupation.

with Early Classic period contexts, Piedras Negras, El Cayo, and possibly La Mar, we only have access to data from Piedras Negras itself. El Cayo was not studied by our research team, and we have not had the opportunity to study its excavated material in any detail. Research there has also not been reported in a manner that can be incorporated here, in no small part because of modern violence that interrupted archaeological research at El Cayo (Lee and Hayden, 1988; Mathews and Aliphat Fernández, 1997; Mathews and Aliphat, 1992). While Scherer, Golden, and Schroder did lead preliminary excavations at La Mar, our work was on the periphery of the site where no Early Classic period materials were found. Thus, the presence of an Early Classic period occupation at La Mar remains hypothetical, based on the supposition that its large size during the Late Classic period indicates that it also had a previous, Early Classic period occupation.

3. Settlement location

Settlement location is widely used by archaeologists to infer the degree to which the conduct of war and the threat of violence shaped community organization and emplacement (e.g., Arkush, 2006; Arkush and Tung, 2013; Lambert, 2002; Leblanc, 1999). While early scholars suggested that most precolonial Maya settlements were unfortified and that defense was not much of a concern, these assumptions were disproved decades ago by systematic settlement surveys that revealed strategic shifts in settlement location (Rice, 1986) and identified the presence of fortifications (Kurjack and Andrews, 1976; Puleston and Callendar, 1967; Puleston, 1983; Rice and Rice, 1981; Webster, 1974, 1976, 1978). In the relatively flat and monotonous northern lowlands, there has been little comment on chronological differences in settlement location. By contrast, diachronic changes in settlement strategies have been observed for the southern lowlands, which are more topographically varied in terms of relief and surface water, both of which create natural defensive barriers. For example, in the Peten Lakes region of Guatemala, the Classic to Postclassic period transition was marked by a shift from sprawling communities in low-lying areas to more nucleated settlements on defensible islands and peninsulas within the lakes (Rice and Rice, 2004:130).

Lidar remote sensing has dramatically improved our capacity to visualize Maya settlement, though chronology remains a challenge and most reports do not directly engage the issue of diachronic changes in settlement strategy (e.g., Canuto et al., 2018; Chase et al., 2014; Chase et al., 2012; Chase et al., 2011; Ebert et al., 2017; Hutson, 2015; Inomata

et al., 2018; Prufer and Thompson, 2017; Ringle et al., 2021). One exception is Garrison and colleagues' (2019) analysis of settlement in the Buenavista Valley in the Peten where they distinguish between Preclassic and Classic period architectural groups based on differences in mound form. During the Preclassic period, settlement was densely clustered around the civic ceremonial center of El Palmar that was located on the banks of an expansive *bajo* (swamp) on the valley floor, whereas settlement in the Classic period dispersed and included significant occupation of the uplands, which suggests a greater concern with defense (see the next section for further discussion on war in the Buenavista Valley).

The topography of the Piedras Negras area is among the most rugged in all of the Maya lowlands (Golden et al., 2021). There, hilltop settlement is best understood as first and foremost a defensive strategy. Hilltop locations privileged those fighting from the higher ground and allowed inhabitants to monitor movement of people on the landscape. Such elevated terrain offered other benefits as well, including the capacity to easily signal other nearby settlements and access to breezes that provided some respite from the humidity and mosquitos of low-lying areas. Yet life atop the rugged karst hills of the region was also a burden, involving regular hikes up and down the steep slopes to reach agricultural fields on the valley floors and hunting grounds that were presumably located at some distance from human occupation. Moreover, all supplies had to be hauled up from lower elevations and water had to be captured in cisterns, which required dependable precipitation. In contrast, the area's valleys and bajos have an abundance of creeks, lagunas, and cenotes that would have provided easy sources of water (Scherer and Golden, 2014b). Without the motivation of defense, it is unlikely that beautiful vistas and cool breezes were sufficient rewards to warrant the inconvenience of hilltop settlement, especially during the Late Preclassic period when population density was low throughout the region.

Recent lidar survey over an expansive region (346 km^2) in the Upper Usumacinta River region has revealed what are likely the earliest settlements in the region, dating to the Middle Preclassic period if not earlier based on their site form (Golden et al., 2021). These settlements are located in lowland areas, suggesting that defense was not a primary concern in positioning the region's earliest settlements. By the Late Preclassic period, however, there are at least a dozen hilltop centers that, depending on their scale, can be described as hillforts or fortresses (Fig. 4). Of the few that have been reconnoitered, all have produced both Late Preclassic and Late Classic period ceramics, from either excavation or surface recovery. The presence of these settlements prior to the founding of the royal dynasty at Piedras Negras indicates that warfare was a concern for at least some part of the Late Preclassic period as well as the Late Classic period. The architectural layouts of these hilltop settlements generally do not follow the Classic era norms of site orientation (typically 30 or 120 degrees azimuth), and most do not have structures arrayed around formal plazas. Instead, these elevated settlements consist of ramparts and platforms strewn along ridgetops. In the Pasión River region of Guatemala, where the Preclassic period is generally better studied, Takeshi Inomata (2014) notes a similar trend

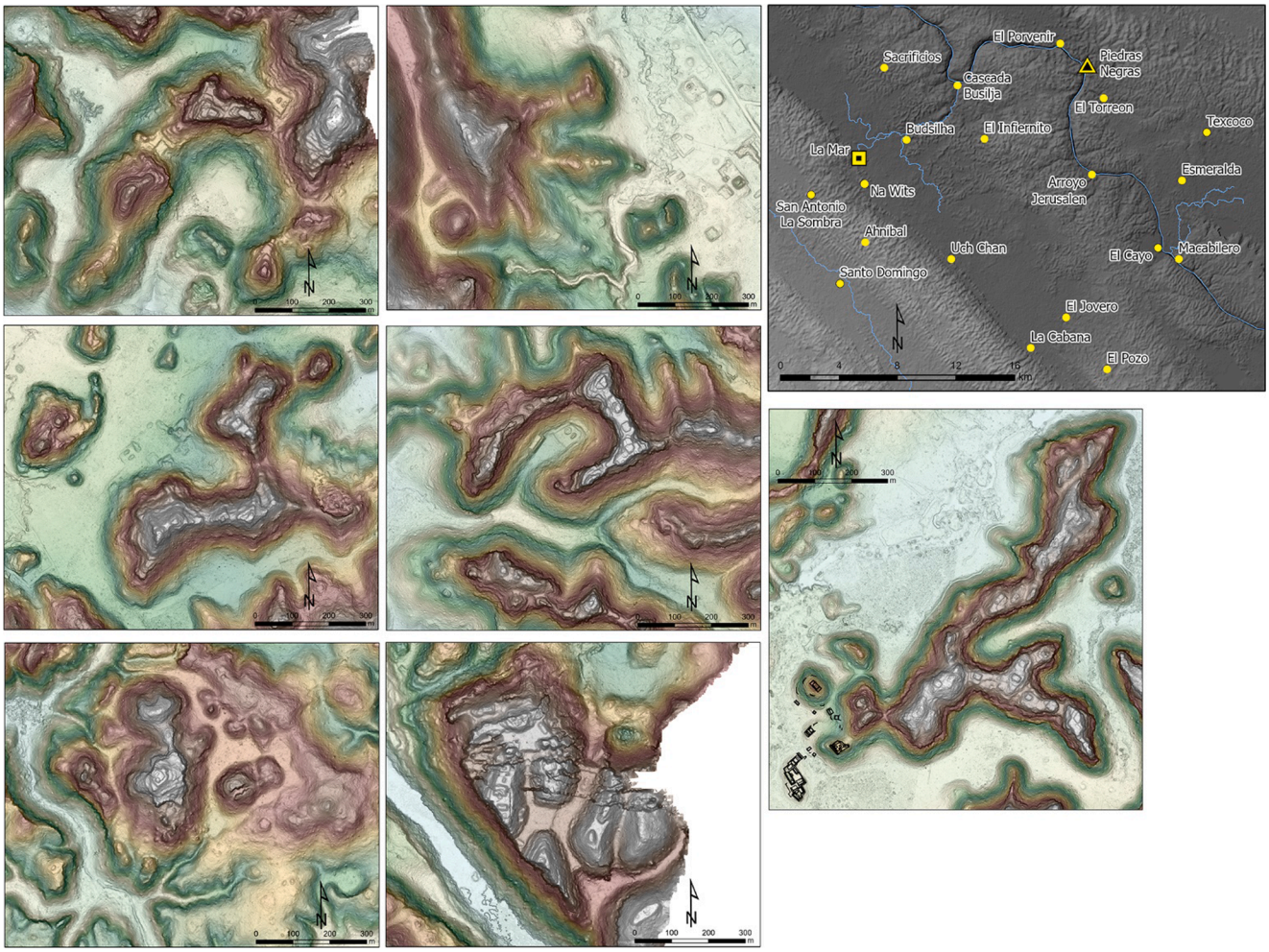


Fig. 4. Fortified hilltop sites. Ahnibal (top left); San Antonio La Sombra (center left); El Torreon (bottom left); La Mar (top center); El Infiernito (center); Macabilero (bottom center); Budsilha (bottom right) (images by C. Golden).

with Middle Preclassic settlements located in relatively open terrain, followed by a shift in the Late Preclassic period towards settlement on hilltops and in other defensive locations.

The fortress site of Macabilero is the largest and most significant Late Preclassic period hilltop site in the region, covering no fewer than 20 ha, with masonry architecture, stucco floors, and facades of a quality surpassing that of Piedras Negras during the Late Preclassic period. Research was undertaken there in 2017 and 2018 by Omar Alcover Firpi, Monica Urquizú, and Ricardo Rodas and detailed publication of those results are forthcoming by that team (Alcover Firpi, 2020), but its basic location and layout are important for understanding the region's settlement history. Macabilero is located at a key crossing point along the Usumacinta River, at an area that has been known since the mid-twentieth century as Desempeño, meaning "unburdening," likely in reference to its function as a place of portage (Canter, 2007:10). A 19th century logging road, which itself was likely built over a precolonial travel artery, met the Usumacinta River just above Macabilero and a canoe port is visible on lidar imagery at this juncture. Thus, it is likely that Macabilero was built not just for simple defense but also to monitor and control movement at this critical location during the Late Preclassic period.

Macabilero, unlike most other hilltop centers, features sizable patio spaces, presumably for public gatherings. This arrangement suggests that a large number of people, more than actually lived there, were able to gather at Macabilero, presumably for public festivities but also for defense. At least one large water storage feature is known at Macabilero, measuring ~75 m^2 and currently 5–7 m deep, sufficiently large to keep occupants well provisioned for a period of time, even during episodes of violent conflict when they could not easily reach the streams and lakes below. The entire ridgetop occupied by Macabilero was fully modified and one possible reason for its abandonment is that the community's elites had nowhere left to build. That is, Macabilero was ultimately unsuitable as a Classic period monumental center because it lacked sufficient space for constructing pyramids and palaces that became the hallmark of that era.

More typical in form, layout, and scale to other hilltop centers identified in the Upper Usumacinta region is El Infiernito, Chiapas. Located 8.6 km to the southwest of Piedras Negras, El Infiernito was investigated by Whittaker Schroder from 2015 to 2017 (Schroder et al., 2017; Schroder, 2019). El Infiernito was built during the Late Preclassic period as a series of platforms arrayed along a ridgeline, and like most other hilltop sites, lacked large public gathering spaces. It was abandoned at the end of the Preclassic period and later re-occupied during the Late Classic through Early Postclassic (A.D. 900–1100) periods, when earlier architecture was covered and modified by small formal patios and residential structures (Schroder, Golden, Scherer, et al. 2017: Fig. 9). The fact that a hilltop center like El Infiernito has produced some of the region's latest Postclassic period ceramics points to the persistence of inter-community violence long after the collapse of the region's dynastic courts.

It is unclear to what degree these hilltop settlements were socially, politically, or functionally integrated with one another during the Late Preclassic period. That is, we simply do not know who were allies and who were enemies at this time, or how defense may have overlapped to create broader patterns of security. Did potential attackers live a mere 15 km away – the distance between Macabilero and El Infiernito? Or were enemies located further away, such as the fortified Late Preclassic period center of Zancudero, located 40 km to the south (Golden and Scherer, 2006)? That distance is similar to those separating Piedras Negras from two of its Late Classic period rivals, Yaxchilan (43 km) and Pomona (48 km). According to epigraphic records, most Classic period attacks were made against communities within 100 km, and long-distance forays were highly unusual. If warfare during the Classic period is a reasonable analogy for the Late Preclassic period, it is unlikely that the villagers of the Preclassic period were defending themselves from attackers who originated beyond the Usumacinta River region itself.

At Piedras Negras, it is possible that the hilltop Acropolis served a defensive function in the Late Preclassic period. Deep probing did produce some Late Preclassic period materials, but whatever modest early settlement was located there was later destroyed and buried by the construction of the Classic period palace. While the majority of Piedras Negras' Classic period settlement is located on the site's valley floors, it is perhaps no coincidence that the royal dynasty chose an elevated, defensible position to build their palatial complex. Moreover, the site itself is highly defensible due to its natural topography (Scherer and Golden, 2014a). Analysis using the Vector Ruggedness Measurement (VRM) tool in ESRI's ArcGIS Pro 2.9 based on 30 m resolution NASA-DEM (JPL, 2020) shows clearly that the architectural heart of Piedras Negras is tucked into a small valley at the confluence of two systems of folded hills, where the terrain is especially rugged (Bosworth-Ahmet, 2020; Hobson, 1972; Sappington et al., 2007a). VRM, which considers slope and aspect to model the roughness of the terrain,can technically vary from 0 to 1, with anything over 0.02 considered "rugged." Natural terrains, even in highly mountainous areas rarely exceed 0.5 (Sappington et al., 2007b:1422–1423), and the Piedras Negras area is well within this uppermost range (Fig. 5).

There is little about the location to explain the settlement choice other than defense. The hilly landscape lacks expansive areas of low slopes and valleys that are more ideal for agriculture. Such terrain was available for settlement just to the northwest and southeast, yet the emergent royal court chose not to settle those areas. The rugged terrain also impedes transportation. The only easy access to the heart of the city is via the Usumacinta River or via singular overland paths to the north and to the south that could be easily monitored. In fact, situated just at the outlets of these paths are the hilltop fortifications of El Torreon in the southeast and the minor center of El Porvenir, also overlooked by a hilltop settlement, in the northwest. As evidenced by lidar survey, no other site in our study region is positioned in such a rugged location other than the fortified centers of El Infiernito, Macabilero, and Ahnibal, none of which is surrounded by such an extensive stretch of rugged terrain.

The other Early Classic period centers were not without their own defenses, though they were nevertheless more exposed than Piedras Negras. While El Cayo is located on a relatively flat, open expanse adjacent to the Usumacinta River, the site's acropolis, like the one at Piedras Negras, was built onto a hill. Moreover, rugged hills to the west of El Cayo provide some protection. La Mar is similarly situated against rugged hills but overlooks an expansive valley to the east, leaving the community's epicenter relatively exposed. That susceptibility to attack may explain why La Mar never achieved the size or political significance of Piedras Negras. Yet, there was clearly an interest in defense here too: rings of concentric ramparts encircle hilltop platforms overlooking the city's epicenter, while the hills to the south of the epicenter are topped by plazas protected by walls.

4. Fortifications

While a detailed, up-to-date chronological review of Maya fortifications remains to be published, an abundant body of work puts to rest an older view that walled fortifications were primarily a late and aberrant phenomenon in the Maya world (Thompson, 1954:105-106), restricted to Postclassic period Yucatecan sites of the north, such as Mayapan or Tulum (Lothrop, 1927; Shook, 1952). Rather, it is clear that the Maya built defensive walls and barricades throughout the lowlands as early as the Late Preclassic period (Golden and Scherer, 2006; Johnston, 2007; Rice and Rice, 1981; Webster, 1974) and continued to make use of such features into the Classic (Demarest et al., 1997; Garrison et al., 2019; Puleston and Callendar, 1967; Scherer and Golden, 2009) and Postclassic periods (Lothrop, 1927; Russell, 2013; Sanders, 1960:203; Shook, 1952). Despite widely published data from across the lowlands, research at Dos Pilas and Aguateca of the Pasión River region,

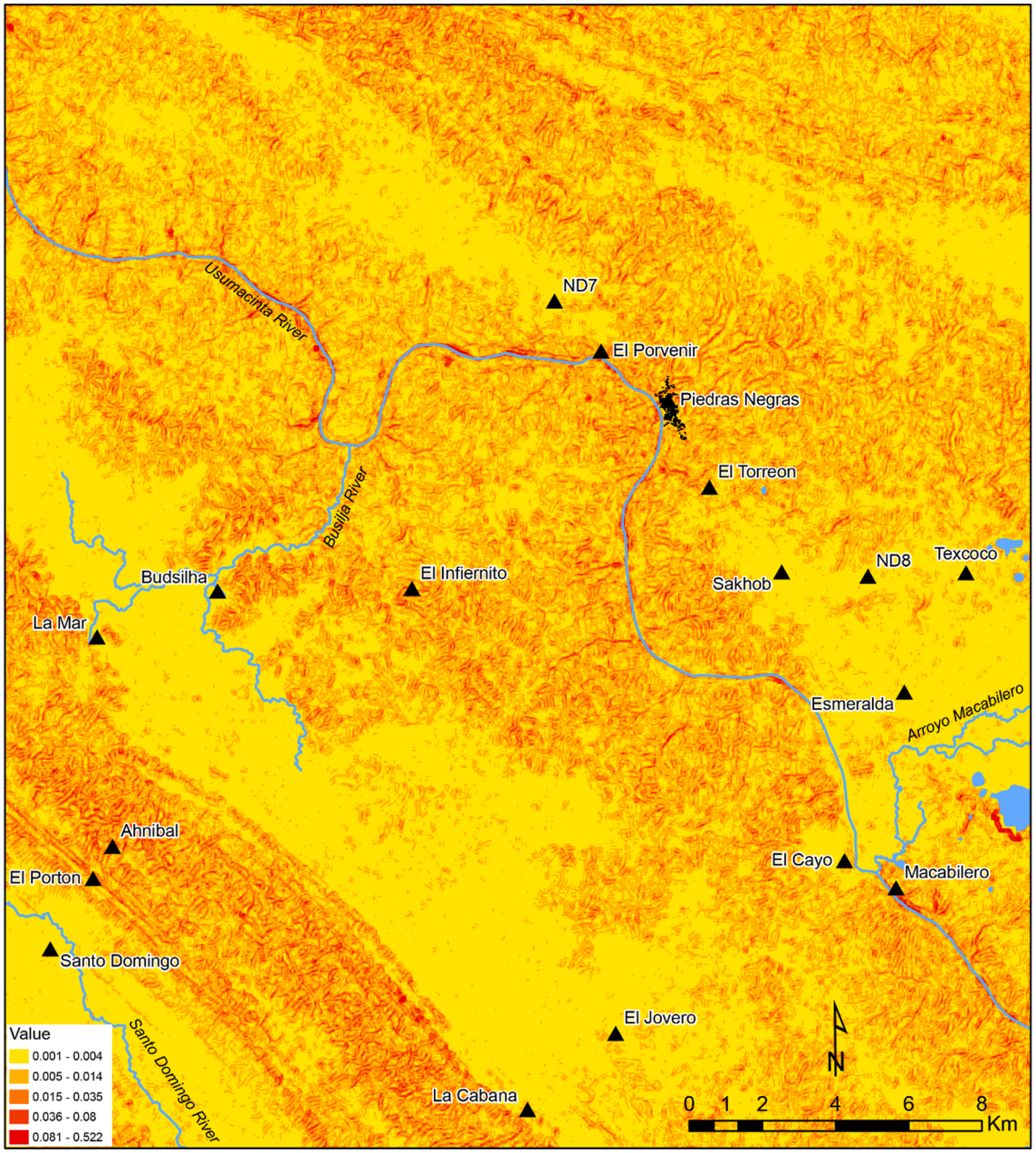


Fig. 5. Vector Ruggedness Measurement (VRM) showing relative ruggedness of terrain (0 is flat, 1 is most rugged) based on 30 m resolution NASADEM (image by C. Golden using data from NASA JPL).

both fortified and the latter with clear evidence of violent destruction around A.D. 800 (Demarest et al., 1997; Inomata, 1997), have overshadowed interpretations of Maya warfare in the past few decades. In particular, they have driven a narrative – one that has gained traction particularly in popular media - that the scope and scale of violence abruptly shifted at the end of the Classic period (e.g., Carleton et al., 2017; Collard et al., 2021; Kennett et al., 2012).

In the area of Piedras Negras, however, the earliest known fortifications date to the Late Preclassic period and include the defenses built at hilltop sites such as El Infiernito and Macabilero. The largest structures at Macabilero are its massive masonry ramparts that were built with huge cut blocks (Fig. 6). The stone ramparts operated in concert with stone walls and perilous natural chasms to significantly restrict access to the summit of the hill upon which the site was built (Alcover Firpi, 2020; Alcover Firpi and Golden, 2020). While the ramparts and walls of El Infiernito are more modest than those of Macabilero, at least some of their construction dates to the Late Preclassic period, further underscoring the early use of human-made defenses in the Piedras Negras area (Schroder, 2021; Schroder, 2019).

Other defensive features are more difficult to date, as is the case of the barricades that blocked routes of travel to Piedras Negras itself. Published here for the first time, Scherer, Alcover Firpi, and Matsumoto identified 12 linear stone features that we interpret as foundations for wooden barricades that obstructed access to the ceremonial center from the north, east, and south (Scherer and Alcover Firpi, 2016; Scherer and Matsumoto, 2017). The barricade foundations at Piedras Negras are similar in construction and placement to those that we have reported previously for the kingdom of Yaxchilan (Fig. 7; Scherer and Golden, 2009; Scherer and Golden, 2014a; Scherer et al., 2019). The Piedras Negras barricade foundations consist of large, uncut stone, loosely piled in a line and typically bisecting routes of travel across a saddle between two hills (Fig. 8). The barricades that they supported were likely built of

Fig. 6. Monumental stone rampart at Macabilero (photo by O. Alcover Firpi).

wooden poles and other perishable materials lashed together. Their function was presumably not to protect the polity capital against sustained attack but instead to slow or re-direct travel, controlling entry into the center and reducing the efficacy of raids against the polity capital. Similar barricades are shown on the Lienzo de Quauhquecholllan, a conquest-era document produced by Nahua allies of the Spaniards who invaded Guatemala (Fig. 9; Asselbergs, 2008). Despite the eight-century gap separating the barricades found in our research and those depicted on the lienzo, we argue that the latter document provides an informative analog for understanding the form and function of Classic period fortifications.

Unfortunately, none of our excavations in the fortifications surrounding Piedras Negras produced datable materials. Yet, considering that these barricade foundations more closely resemble in masonry form, placement, and apparent function those dated to the Late Classic period at La Mar (see below) and in the Yaxchilan polity, rather than the more formal system of walls protecting hilltop centers such as Preclassic Macabilero, we presume they too were built during the Late Classic period. This deduction of a Late Classic date for these defensive constructions is further supported by their proximity to house groups that we have been able to date to that period through excavation and analysis of ceramics found therein.

The site of La Mar is the second largest urban center in the study region and was likewise fortified with valley barricades and hilltop redoubts (Golden et al., 2021). We identified 13 barricade walls and ramparts that block access to La Mar from the west, southwest, and southeast (Fig. 7). La Mar's barricades are primarily oriented to obstruct travel from the Santo Domingo Valley, located to the east. The highland kingdom of Tonina is known to have taken captives from La Mar (Martin and Grube, 2008:182) and the least cost route between Tonina and Piedras Negras crosses through the Santo Domingo Valley and into La Mar, directly along the route across which the barricades are located (Fig. 10). The site of Lacanja Tzeltal, also located in the Santo Domingo Valley, was the seat of the Sak Tz'i' dynasty, another ancient antagonist of La Mar. The general construction of the La Mar barricade foundations is similar to those we have identified elsewhere as typically associated with Classic period settlement: linear piles of rough-cut stone located within the saddles between two hills.

The form of one of La Mar's barricades, which was investigated as Operation 6A, suggests that it likely functioned as a gate, with its center bisected by a passageway (Fig. 11). A similar gate feature was documented near Tecolote, part of Yaxchilan's northern defenses (compare with Scherer and Golden, 2009: Fig. 8). The stonework of the La Mar feature was more formalized than is typical of other barricades and the gap was lined with facing stones, something not observed in similar defensive features that have been documented elsewhere. A series of post holes were identified within the feature where wooden poles that formed the barricade were presumably inset. Removal of the humus layer during excavation immediately exposed a series of chert weapons shown in Fig. 11 and described in the following section. Ceramic analysis by Socorro Jiménez and her research team confirms that this feature was built at some point during the Yaxche phase, likely in the seventh century A.D. and thus long before La Mar's collapse and abandonment. The barricade's likely construction date corresponds to a time when Palenque, Tonina, and Piedras Negras vied for influence or control over large stretches of Chiapas and Tabasco and epigraphic inscriptions indicate that La Mar was subject to multiple attacks during this interval (Fig. 10; Martin and Grube, 2008:146, 182).

The evidence from texts, discussed in more detail below, suggest that La Mar's barricades were not sufficient defense for the city center and that it suffered a series of military defeats. In such times, a series of redoubts surrounding the site may have offered refuge for some. Lidar data reveal stone ramparts that encircle hilltop platforms in the uplands just west of the architectural core, while the fortified hilltop center of Na

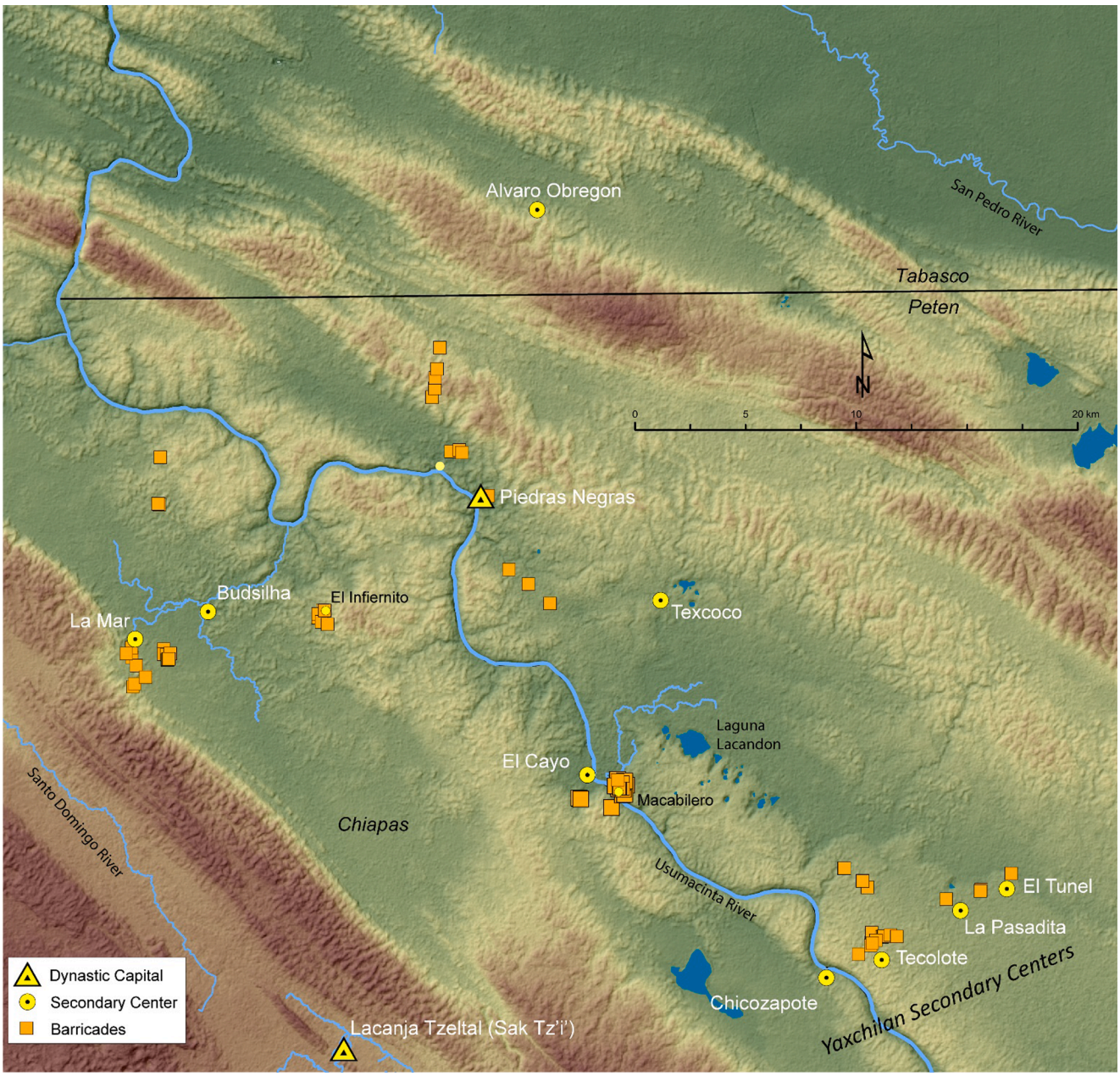


Fig. 7. Map illustrating the location of barricades relative to secondary political centers associated with the kingdoms of Piedras Negras and Yaxchilan (image by C. Golden).

Wits is located just over a kilometer to the south (Golden et al., 2021). Perched atop a hill with wide vistas of the valley below, Na Wits is reached today by clambering over the remains of ramparts that cross the hill's slopes. Mapping and excavation of Na Wits show a complex of buildings, perhaps initiated in the Preclassic but with most surface visible architecture dating to the Late Classic period, provisioned with a vaulted cistern that would have been a critical resource for besieged defenders (Golden et al., 2013). Elsewhere in the polity, fortifications have been identified for El Infiernito and at other communities located 15 km due west of Piedras Negras (Fig. 7). Excavations at El Infiernito confirm initial construction of its walls and ramparts in the Late Preclassic period and their re-use following El Infiernito's reoccupation in the Late Classic period (Schroder, 2021; Schroder, 2019).

In our prior work in the Yaxchilan polity, we highlighted that the spatial distribution of that kingdoms defenses indicates a formalized and planned approach to the protection of the greater kingdom (Scherer and Golden, 2009, 2014a; Scherer et al., 2019). Evidence includes the association of barricades with evenly positioned, *sajal*-governed secondary centers across the kingdom's northern border, all with line of sight to the polity capital, and containing carved monuments with the *sajal* shown in deference to the Yaxchilan *k'uhul ajaw* during his periodic visits (Fig. 7; Scherer and Golden, 2009, 2014a; Scherer et al., 2019). The situation at the margins of the Piedras Negras kingdom, in contrast, is quite different. We have found no evidence for systematic placement of noble-governed centers with fortifications that are oriented to protect the kingdom at large. Rather, defensive construction seems largely to have been intended to protect the respective communities with which they are spatially proximate. In fact, the La Mar defenses were likely built when that center was more directly under the influence of the court at Palenque, located 80 km to the northwest (Martin and Grube, 2008:170), rather than the Piedras Negras dynasty.

In contrast with the Yaxchilan polity, defense of the polity capital of

Fig. 8. Barricade foundation located in the saddle between two hills north of Piedras Negras (photograph by O. Alcover Firpi).

Fig. 9. Lienzo de Quahquechollan showing three barricades of lattice beams blocking routes of travel (early 16th century Nahua document, scan of the original available on Wikimedia Commons).

Piedras Negras seems to have been more immediate, a product of its natural defensiveness coupled with the barricades that blocked the easiest routes of travel to the site center. Although barricades are associated with the Yaxchilan site center (Scherer et al., 2019), its first line of defense were the barricades associated with the secondary centers located at 15–20 km from the polity capital along its northern

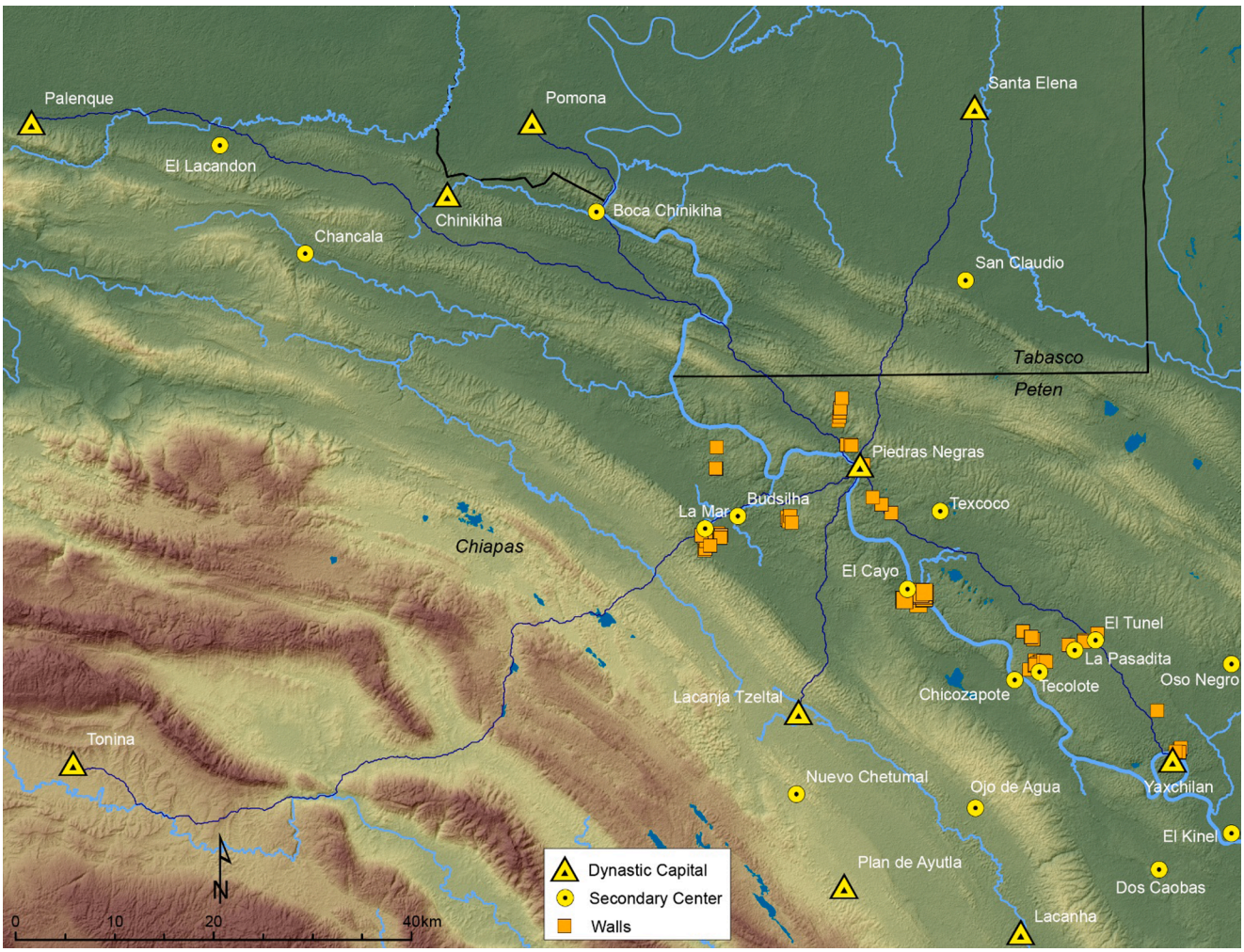


Fig. 10. Map showing route of cost path analysis to Piedras Negras from other polity capitals, highlighting the vulnerability of La Mar's location along with the location of its defenses (see also Fig. 7, image by C. Golden). The Santo Domingo Valley is located west of La Mar and runs from southeast to northwest across the center of the map. Routes modeled using ASTER Global Digital Elevation Model (GDEM) Version 3, 30 m resolution; https://lpdaac.usgs.gov/products/astgtmv003/).

border. Defense of Piedras Negras, by contrast, was largely dependent on barricades and associated hillforts that were located at 5 km or less from the center, coupled with the ruggedness of the immediate terrain. The general picture is that the organization of defense and perhaps military affairs in general, was distinct between the two kingdoms (Golden et al., 2008; Scherer and Golden, 2014a).

In sum, while many fortifications in the Piedras Negras area have yet to be securely dated, it is clear that the Maya had constructed formalized defenses in the region by at least the third century A.D. (if not sooner) at Macabilero and El Infiernito. During the Classic period, the one securely dated fortification at La Mar was built in the seventh century, and we presume that most of the other fortifications we have identified were used throughout the seventh and eighth centuries. In other words, we find no evidence for a pulse of defensive constructions coeval with the final decades of the Classic period in the late eighth and early ninth centuries.

5. Weapons

While there has yet to be a systematic study of chronological change in Maya weaponry, Kazuo Aoyama and Elizabeth Graham (2015) report on chronological trends in projectile point use at Copan, Honduras, and the Pasión River sites of Aguateca, and Ceibal in Guatemala (see also Aoyama, 2005). They note an increased production in dart and arrow points at Copan during the Terminal Classic period, which they connect to warfare (Aoyama and Graham, 2015:10). Although Aguateca lacks the chronological depth necessary to consider diachronic change in weapon use, they report that at Ceibal, 63 of 116 chert points date to the Late Classic period, which they interpret as evidence for "the intensification of warfare at Ceibal during this period" (Aoyama and Graham, 2015:13). They also note, however, that chert points were found for all time periods at Ceibal. The Late Classic to Terminal Classic period also corresponds to Ceibal's maximum population size (Inomata et al., 2018:25), and thus period of greatest material culture production and discard.

At Piedras Negras, archaeologically recovered weapons include chert and obsidian artifacts that are functionally interpreted as dart points (small laurel leaf, tear drop, stemmed, and tanged points) and spearheads or knives (medium sized laurel leaf and stemmed points), as well as axes/choppers (i.e., celtiforms) and blades (Coe, 1959; Hruby, 2006; Roche Recinos, 2021). Knives, celtiforms, and blades were equally used for a range of non-violent utilitarian activities and so they are "weapons" in the same sense that a modern machete or Swiss army knife is potentially a weapon. Dart points and spearheads, in contrast, provide stronger evidence for violent practices, although both tool types were also used by the Classic period Maya to hunt animals. We also include celtiforms in the discussion below in light of their association with the barricade at La Mar and known use in decapitation as shown in Classic period imagery. The vast majority of stone tools at Piedras Negras date to the Late Classic period, corresponding to the site's maximum

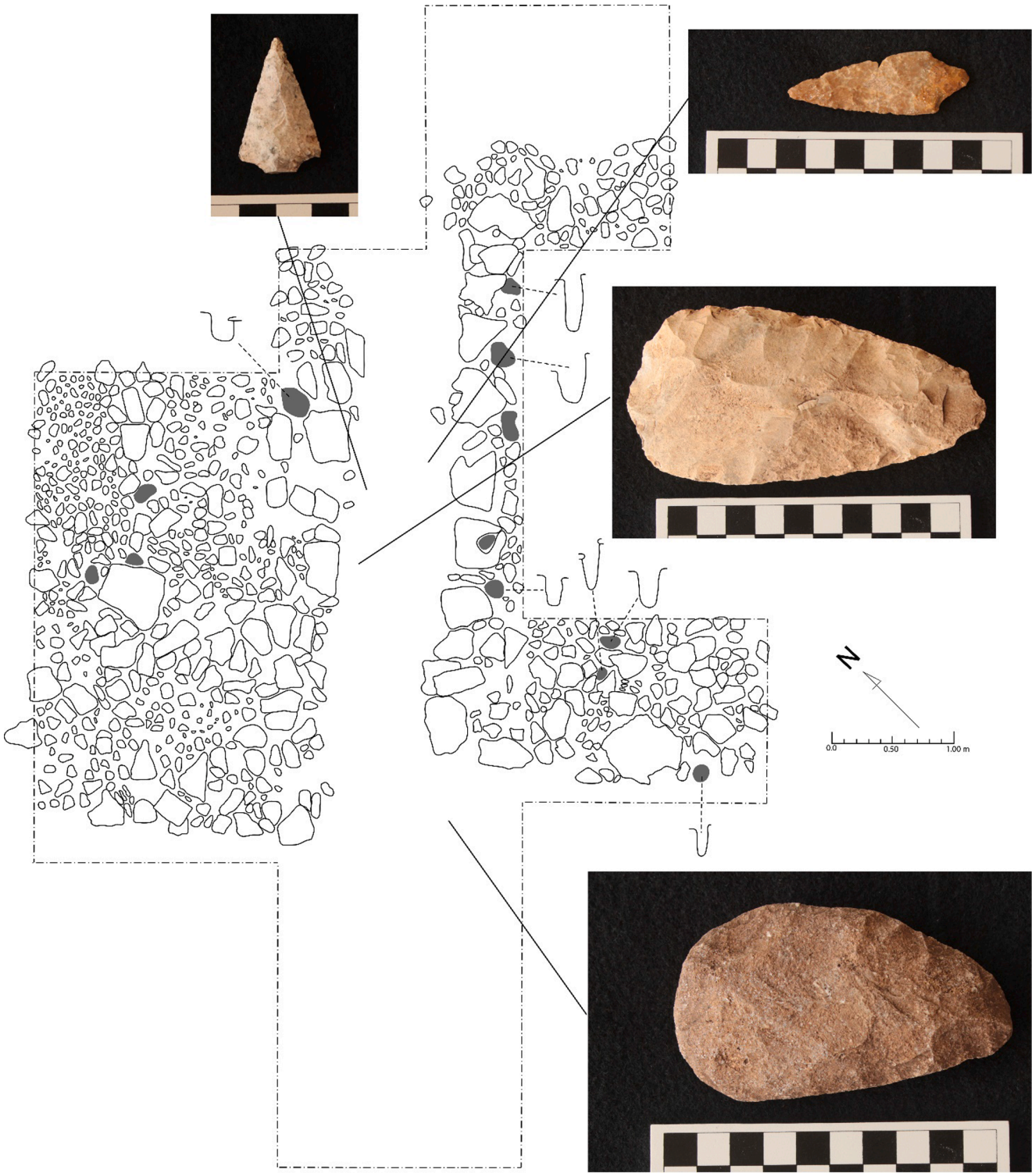


Fig. 11. Plan of La Mar Operation 6A barricade gate, including detail of postholes (grey, with profile), the location of select chert artifacts (drawing and photos by A. Scherer).

population extent (Hruby, 2006:78). Thus, it is only possible to comment on diachronic trends within the sample in very broad terms. While celtiforms are found across all time periods at Piedras Negras, dart points are notably absent for the Preclassic period. Without further probing of Piedras Negras' Late Preclassic contexts, it is difficult to say if the absence of points is merely due to underrepresentation of that time period or truly indicates their lack of use during the Preclassic period. While dart points are found throughout the Classic period, arrow points (i.e., chert or obsidian projectiles shot by bow) were used relatively late in the region. In our excavations, we have only found arrow points in Postclassic or Historic period deposits at El Porvenir, Guatemala (Kingsley et al., 2012).

Here, we report in further detail on a combined Classic period sample that includes the results of Zachary Hruby's (2006) analysis of chert from the joint late 1990s Brigham Young-del Valle project and Alejandra Roche Recino's (2021) study of the lithic materials recovered from the

2016 and 2017 excavations that focused largely on the marketplace. The combined sample includes a total of 9,426 chert artificats, of which are 213 points (or fragments thereof), representing 2.3% of the total assemblage. the These data can be contrasted to the lithic sample recovered fromexcavations of households in the periphery of Piedras Negras by the Pennsylvania State team in the late 1990s (analyzed by Hruby) and the 2017 investigations of a peripheral housegroup north of Piedras Negras (Operation 74). Combined, excavations of these peripheral households yielded a total of 988 chert artifacts of which 67 were points, 6.8% of the total assemblage. These findings suggest greater use of weaponry by inhabitants of peripheral households than those dwelling in the urban center. While these results might signal that the commoners living in these peripheral households were more likely to hunt than the higher status occupants of the urban center, they also suggest these commoners were also armed for war, undermining the argument that Maya warfare was primarily the domain of elites.

The recovery of weaponry in the greater Piedras Negras region is largely limited to places where we have conducted excavations (as opposed to places subject to surface collection only) and include Budsilha, El Infiernito, Macabilero, La Mar, and Na Wits, listed in the order of decreasing numbers of operations. Budsilha dates largely to the Late Classic period, with some evidence for an earlier, thin occupation in the Late Preclassic period (Golden et al., 2020; Jiménez Alvarez et al., 2014). Based on the presence of a palatial structure at the center of the site, Budsilha was likely the seat of a *sajal* (noble) that, based on the proximity of the two sites, was immediately subordinate to the *ajaw* (royal lord) of La Mar (Maler, 1903:89-92; Scherer and Golden, 2012:39-48).

As analyzed by Alejandra Roche Recinos, excavations at Budsilha in 2018 produced 53 chert bifaces, which came from the two plazas that comprise the epicenter of Budsilha. Of those that were categorizable, 28% are stemmed dart points and 3.7% are celtiform bifaces. Bifacial dart points make up 3.7% of the total chert assemblage, slightly more than the percentage observed from the center of Piedras Negras, but below that of the peripheral households. Given the absence of other finished types at Budsilha, it seems then that much of the chert industry there was directed towards bifacial tools, especially dart points. Chronologically, the Budsilha points date to both the Yaxche and Chacalhaaz phases of the Late Classic period. The 3.7% representation of bifacial dart points at Budsilha is nearly identical to the frequency at Aguateca, where bifacial points represent 3.8% of the chert sample, which Aoyama (2005:298) notes to be "considerably higher than for any reported Maya Lowland center." He interprets this proportion as evidence for the intensification of warfare at Aguateca. The comparably high percentages of projectile points at Piedras Negras, especially in peripheral households, and Budsilha could indeed point towards a focus on warfare (and/or hunting).

At La Mar, excavations focused largely on the Late Classic period barricade feature described in the previous section and a nearby structure that may have operated as a lookout. 471 chert artifacts were recovered, of which nine were celtiforms (1.9%), four were dart points (0.8%), and one was a fragment of a knife or spearhead. While the ratios of tools to production debris in the La Mar assemblage is not particularly notable, the spatial distribution is distinct in that all but one of the finished objects (a celtiform) were found on the surface of the barricade passageway. The La Mar assemblage dates no earlier than the Yaxche phase, when the barricade was built, though, considering their recovery on the floor of the gate passageway, the chert weapons may have been deposited in an event that post-dated the barricade's construction (Fig. 11).

The total chert assemblage at El Infiernito includes 2,062 objects. Of these objects, 123 are tools, including 42 dart points (34.1%), similar to the percentage of the assemblage at Budsilha. Compared to the total chert assemblage, dart points represent 2% of the sample, intermediate in their prevalence between Piedras Negras and Budsilha. Of the projectile points, nearly all were recovered from Late Classic to Terminal Classic period contexts, primarily in above floor contexts and burials or caches, except for a possible fragmentary projectile point from a Late Preclassic period context. Notably, the majority of the projectile points (n = 30) were found above the last-built floors, suggesting their active use at the site at the time of its abandonment.

At Macabilero, chert analysis has only been completed for excavations at Grupo Sereque, located just north of the base of the escarpment and across the river from El Cayo. The residential group is largely Late Classic period in construction but seems to have overlain an earlier, Late Preclassic period occupation. The majority of the chert is likely from the Late Classic period, though some mixing of periods was evident at the base of the units. A total of 468 chert artifacts were recovered, including 22 celtiforms (4.7% of the sample) and one dart point (0.2% of the sample), notably lower than the percentage of points observed at other sites. As a final note on bifacial projectile points, arrow points (i.e., chert or obsidian projectiles shot by bow) were used relatively late in the region. In our excavations, we have only found arrow points in Postclassic or Historic period deposits at El Porvenir, Guatemala (Kingsley et al., 2012).

Largely overlooked by Mayanists until recently has been evidence for the use of slingstones and hand thrown stones. While any stone is a potential weapon, caches of limestone reshaped into spheres provide unequivocal evidence for storing of weapons for defense as has been recently documented at Macabilero and Budsilha (Roche Recinos et al., 2021). While these stones might have been hurled by either hand or sling, we will henceforth refer to them as slingstones to distinguish them from bifacial projectile points. The practice of caching slingstones is well documented at Andean hillforts and provides a useful analog for interpreting the practice in the Maya area (Arkush, 2011:93; 2017:247). The general prevalence of slingstones at Piedras Negras itself is uncertain since they were not systematically recorded by earlier projects at the site. Two examples are shown in William Coe's (1959:Fig. 2g,h) artifact report, one from the summit of the R-11 pyramid and the other from the floor of Structure S-18. Schroder and Talavera (2017:32) identified one at El Infiernito, located on the surface of their excavations and likely dating to the Terminal Classic period. At Macabilero slingstones were recovered from the fill of the main patio, adjacent structures, and as part of a cache in one of the caves located just below the hilltop summit. The slingstones found in excavation contexts at Macabilero all date to the Late Preclassic period and considering that the size and shape of the slingstones from the cave cache is consistent, we assume those projectiles also date to the same time. The slingstones found at Budsilha, which come from Late Classic period excavations contexts, are less well shaped than those from Macabilero.

In the case of Macabilero, with its dramatic location on an escarpment overlooking the Usumacinta River, the slingstones would have been a highly formidable weapon, hurled at would-be attackers attempting to summit the hill or launched at canoes passing on the Usumacinta River, more than 120 m below. While dart points and other chert bifaces may have been used in both war and hunting, the slingstones represent the one class of weapon that was likely used primarily in defensive battle. This is especially true of the relatively large, intentionally worked slingstones cached at Late Preclassic period Macabilero. The average weight of those slingstones is 133.22 g and the average diameter is 4.35 cm, making them unwieldy to carry in any sizable quantity if one was traveling to attack a foe.

6. Human remains

Reconstructing patterns of violence from human remains is notoriously difficult in the Maya area owing to poor preservation coupled with a sample size bias that heavily favors the Late Classic period. Tiesler and Cucina (2012) provide the only major diachronic study of violence by focusing on the frontal bones of 1,103 individuals from across 63 lowland Maya sites. When the adult sample is pooled, they found the lowest frequencies of trauma among their combined Preclassic-Early Classic

period sample (13.3%), an increase in Late Classic period times (18.18%) and a subsequent plateau from Terminal Classic (18.2%) through Postclassic period times (18.39%). The patterns are different for males and females, with females having their highest incidence of trauma in the Preclassic-Early Classic period (18.8%) and males in the Late Classic period (24.2%). Evidence for trauma among males drops in the Terminal Classic period (16.1%). Their review thus provides no evidence for a rise in violence in the Late to Terminal Classic periods.

In a similar bioarchaeological synthesis, Serafin et al. (2014) examined 116 skeletons from 14 archaeological sites in the northwest Yucatan and use the same temporal periods as Cucina and Tiesler. They found a somewhat different pattern, however, whereby the highest incidence of trauma was observed for a combined Preclassic-Early Classic period sample (20.0%) followed by a decline in the combined Late-Terminal Classic period (6.5%), and another increase again in the Postclassic period (15.7%). The discrepancy might indicate differences in chronological patterns of violence across the region or may again relate to issues of small sample sizes, as the early sample in their study includes only 15 individuals.

To date, approximately 151 burials have been excavated from the greater Piedras Negras area, including from Piedras Negras itself (n = 128), Macabilero (n = 3), Budsilha (n = 12), El Infiernito (n = 5), and Paso del Tigre, Chiapas (n = 2). Aside from a few burials excavated by the University Museum project at Piedras Negras in the 1930s that are curated in Guatemala City, Scherer has analyzed all of these, some in collaboration with Schnell. This total does not include human remains from non-burial contexts. From the burial sample, frontal bones are sufficiently preserved (more than 60% of the bone present) to observe for evidence of antemortem or perimortem trauma from 14 adult burials at Piedras Negras, one from Budsilha, one Macabilero, and one from El Infiernito. In none of these cases was trauma observed.

The lack of evidence for cranial trauma can in part be attributed to low sample size, itself a product of the characteristically poor skeletal preservation in the Maya lowlands. However, the lack of trauma could also be taken as reflective of the low levels of interpersonal violence experienced at Piedras Negras itself (the sample sizes for the other sites are too small to be meaningful). Other skeletal evidence for violence at Piedras Negras includes retainers placed in tombs at Piedras Negras (Burials 5, 13, and 110; Coe, 1959:124-125; Escobedo, 2004; Houston et al., 2003b). In all cases, the accompanying dead were adolescents and it is impossible to know if these victims were captives taken in war. None of the skeletons demonstrate evidence of traumatic injury, though preservation was poor in all contexts and violence is assumed based on the specific age profiles of the retainers.

While frontal bone trauma provides little evidence for violence in the Piedras Negras area, there nonetheless exist cases of traumatic injury in the local skeletal record, even if in many cases it is difficult to discriminate between interpersonal violence and accidental injury (Table 1). At Piedras Negras itself, likely cases of interpersonal violence include a skeleton with cutmarks excavated from below the playing alley of the West Group ballcourt (Burial 4; Coe, 1959:123-124; Coe did not report on the cutmarks, which were instead noted by Scherer during his analysis), a partial cranium with cutmarks that was found in the patio in front of the small pyramid associated with the marketplace (Burial 78; Houston and Scherer, 2010:Fig. 11), and a mandible with cutmarks and a perimortem fracture found below the floor of one of the Acropolis patios (46F-23-6; Scherer, 2015:fig. 2.63). All perhaps represent captives taken during war and date to the Classic period, with the partial cranium and mandible securely dated to the Yaxche phase (AD 620–750).

Outside of Piedras Negras, the only other secure cases of interpersonal violence come from remains recovered from the caves located below the main architectural group of Macabilero, designated MC 6A-0 and MC 6B-0. The MC 6A-0 context includes cranial vault fragments with evidence of perimortem fractures that were found in the same area as the cache of spherical projectile stones described above. Nearby ceramics were both Late Preclassic and Classic period in date. The MC 6B-0 context includes a mandible that was found near the entrance of a cave with both cutmarks and fracture patterns consistent with decapitation (Alcover Firpi and Golden, 2020:fig. 26.3). The mandible produced a radiocarbon age of 1870 +/- 30 BP (Beta-486141; tooth collagen; $\delta^{13}C = -12.3‰$) with a calibrated date range of 73–226 cal AD (calibrated with BetaCal3.21 with the INTCAL13 calibration curve), a date that puts the violent death well before the establishment of royal courts in the region. The only possible case of interpersonal violence documented for the Chacalhaaz phase (A.D. 750–850), which straddles the collapse of the Piedras Negras dynasty, comes from Burial 3 of Macabilero, located in the Grupo Sereque. The burial itself likely dates to around A.D. 830–850, and the skeleton demonstrates numerous cases of healed antemortem fractures sustained decades prior to this person's death in his sixties or later.

In sum, bioarchaeology provides unambiguous evidence for interpersonal violence in the area of Piedras Negras, though poor skeletal preservation makes it difficult to discern any clear diachronic patterns of either escalated violence or relative peace. The few cases of clear interpersonal violence data to the centuries prior to the establishment of the royal court or to the era when the court was at the height of its power. The unambiguous case of decapitation at Macabilero in the Late Preclassic period likely signals the practice of captive-taking at this early date. It is notable that the one skeleton that provides our best case of someone who experienced repeated violent confrontations, Macabilero Burial 3, comes from the same residential complex (Grupo Sereque) that produced little evidence for weapon production or use. It should also be noted, however, that the injuries were sustained decades prior to his

Table 1
Summary of Human Remains Demonstrating Evidence for Trauma in the Piedras Negras Area.

Site	Provenance	Date	Sex/Age	Accident or Interpersonal Violence (IV)?	Trauma
P. Negras	Burial 4	Classic	?/Adult	IV	Cutmarks on radius, ulna, cranial fragment
P. Negras	Burial 37	Yaxche	Male?/Adult	Accident or IV	Antemortem fracture to right radius
P. Negras	Burial 72A	Yaxche	?/Adult	Accident or IV	Antemortem rib fracture
P. Negras	Burial 78	Yaxche	Male?/Adult	IV	Cutmarks on cranium
P. Negras	Burial 98A	Chacalhaaz	Male/Adult	Accident	Antemortem fracture to foot phalanx
P. Negras	Burial 100	Yaxche	Female/Old Adult	Accident	Antemortem fracture of left fifth metatarsal and associated phalanges
P. Negras	Burial 102	Yaxche	Female/Adult	Accident	Antemortem fracture of distal left fibula
P. Negras	Burial 103	Yaxche	Male/Adult	Accident	Myositis ossificans traumatica of the left femur
P. Negras	PN 46F-23-6	Yaxche	Male/Adult	IV	Cutmarks and perimortem fracture of the mandible
Macabilero	Burial 3	Chacalhaaz	Male/Old Adult	Accident or IV	Numerous cases of antemortem fractures throughout the skeleton
Macabilero	MC 6A-0	Late Preclassic/ Classic	?/Adult	IV	Perimortem fractures of a cranial vault fragment and maxilla
Macabilero	MC 6B-0	AD 73226	Male/Adult	IV	Mandible with injuries consistent with decapitation

death, which occurred decades after the collapse of the royal dynasty at Piedras Negras.

7. Epigraphy

Simon Martin (2020:215-233) has recently synthesized the corpus of inscriptions that make reference to war for the Classic period, including a detailed discussion of the terminology and discourse surrounding war. Taking careful consideration of the many problems inherent in the dataset, he finds that frequency of war-related inscriptions rises abruptly in the early seventh century A.D. and then remains consistent over the course of the Late and Terminal Classic periods. He attributes the rapid rise in war-related inscriptions to a shift in the rhetoric of war, not an overall increase in war events during the Late Classic period relative to earlier periods. Moreover, the inscriptions do not provide evidence for a general rise in war-related events having caused the collapse of Maya polities over the course of the ninth century. While a change in the scope and scale of warfare during that timeframe is plausible, the epigraphic record does not provide evidence for such since the majority of texts were produced over just a few generations (Tokovinine, 2019:87).

For Piedras Negras, the earliest and latest recorded references to the royal court pertain to warfare. The earliest mention of a likely Piedras Negras ruler occurs at Yaxchilan at about A.D. 460, when Itzam K'an Ahk (Ruler A) is named as a captive on a monument at that site (Martin and Grube, 2008:140). The tables were turned on the earliest inscription found at Piedras Negras, Panel 12, which dates to around A.D. 514 and shows Ruler C of Piedras Negras dominating kneeling lords from Santa Elena (located 40 km to the north-northeast) and Lakamtuun (identified by David Stuart [2007] with the modern archaeological site of El Palma, 103 km to the southeast), as well as Knot-eye Jaguar I, king of Yaxchilan (Fig. 12). It is unclear whether these lords were taken captive or if their depiction as kneeling and bound was intended as a metaphor for subordination. Less ambiguous is the anonymous figure to the right, whose lack of headdress, clothing, and arms bound behind his back all suggest he represents a captive taken in war. The text itself does not mention war or capture, however, and it is unclear how the kneeling lords came to appear before the Piedras Negras king.

As Stuart (2007) points out, Panel 12 is essentially a statement of Ruler C's dominance over the region's three major waterways – the mainstream of the Usumacinta itself, the Lacantun to the south, and the San Pedro to the north. Importantly, evidence from Yaxchilan indicates that the lords from Yaxchilan and Lakamtuun depicted on Panel 12 were not killed, but were re-established on their thrones, presumably as clients or tributaries of the Piedras Negras ruler (Martin and Grube, 2008:120-121; Stuart, 2007). We can then surmise that this monument is a celebration of the early Piedras Negras king's acumen in regional politics and his prowess at war. Monuments like Panel 12 and the thematically similar Panels 2 and 3 do not explicitly state the causes and consequence of war. The general presumption is that the victors gained immediate spoils and subsequent tribute from the vanquished. However, there is very little evidence for lasting domination and later battles involving the same protagonists are common.

When we consider the Piedras Negras corpus in detail, there is little evidence for an increase in war-related historical events over the course of the Late Classic period. Fig. 13 shows the distribution of dated historical events of the types of events reported in Piedras Negras' recorded hieroglyphic record in fifty-year intervals. **Calendric Rites** include period-endings (of five year intervals or greater), stone-wrapping, and monument or building dedication. **Dynastic History** contains dates pertaining to birth, accession, arrival, head-wrapping, abdication, death, and anniversaries of those events. **Ritual (non-war)** encompasses events involving adorning, covering, shaping, dancing, fire-entering, and censing. Not all events easily fall into one category; for example, fire-entering rites (Ritual) were performed on anniversaries of death (Dynastic History). However, for distinguishing war from non-war related events these categories suitably make the distinction from **War-Related** events that pertain specifically to reported captures of nobles from enemy polities or battles recorded using the "star-over" sign. This hieroglyph's precise meaning remains ambiguous, but based on context it clearly denotes a violent clash and seems to refer to the most momentous of violent engagements (Martin, 2020:208-209; Zender, 2020).

The dates in Fig. 13 are those of historical events recorded on the monuments, which themselves may have been carved sometime later. For example, Altar 1 at Piedras Negras features eight dates spanning 4710BCE (a mythological date) through A.D. 692, the year it was dedicated. Aside from three mythological dates on that altar and two other dates that look forward into the ninth century, all other dates in Fig. 13 represent historical events. Fig. 13 also accounts for each dated event recorded, even if the same event was documented multiple times

Fig. 12. Piedras Negras Panel 12 (photo by C. Golden).

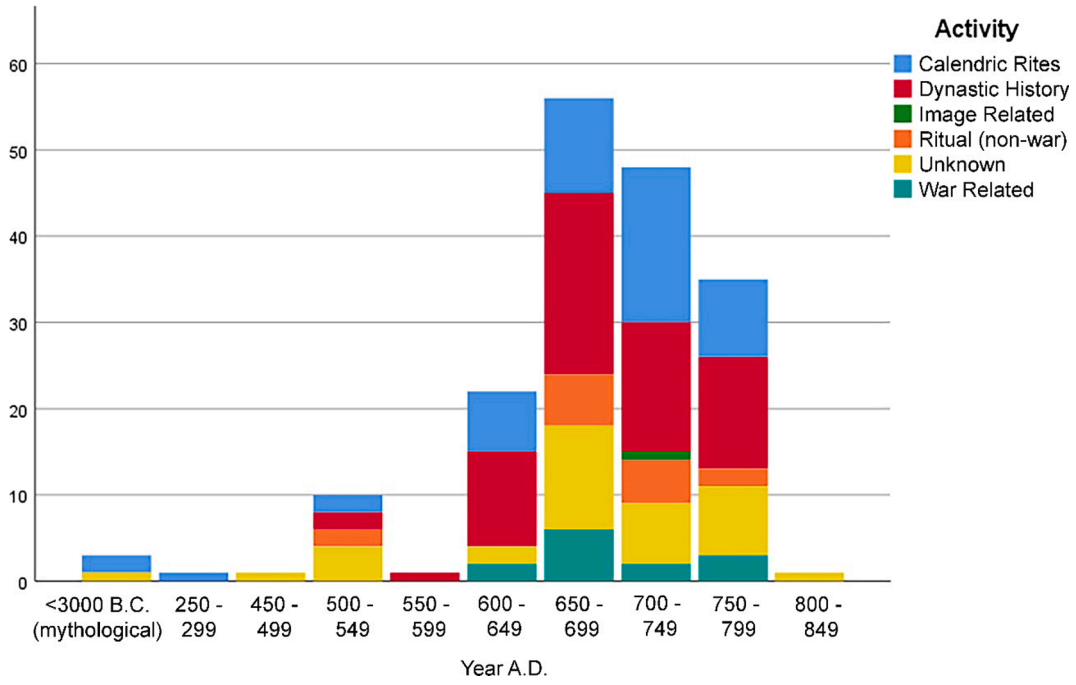


Fig. 13. Frequency of recorded dates by fifty-year categories, grouped by the type of activity reported. The earliest column represents mythological dates referenced in the inscriptions.

in the Piedras Negras corpus. For example, the birth of K'inich Yo'nal Ahk II is reported six times (on Stelae 3, 6, 8, Altar 4, and twice on Stela 7) and thus accounts for six dates in Fig. 13.

The vast majority of dates recorded in Piedras Negras' extant sculptural corpus, like those of most Maya centers, cluster between A.D. 650–800. Thus, in terms of absolute number of recorded war events, it is obvious that the highest number are reported for the Late Classic period. At Piedras Negras, the greatest number of war-related events fall between A.D. 650–700, which also happens to be the span of time when the greatest number of inscriptions are recorded overall.

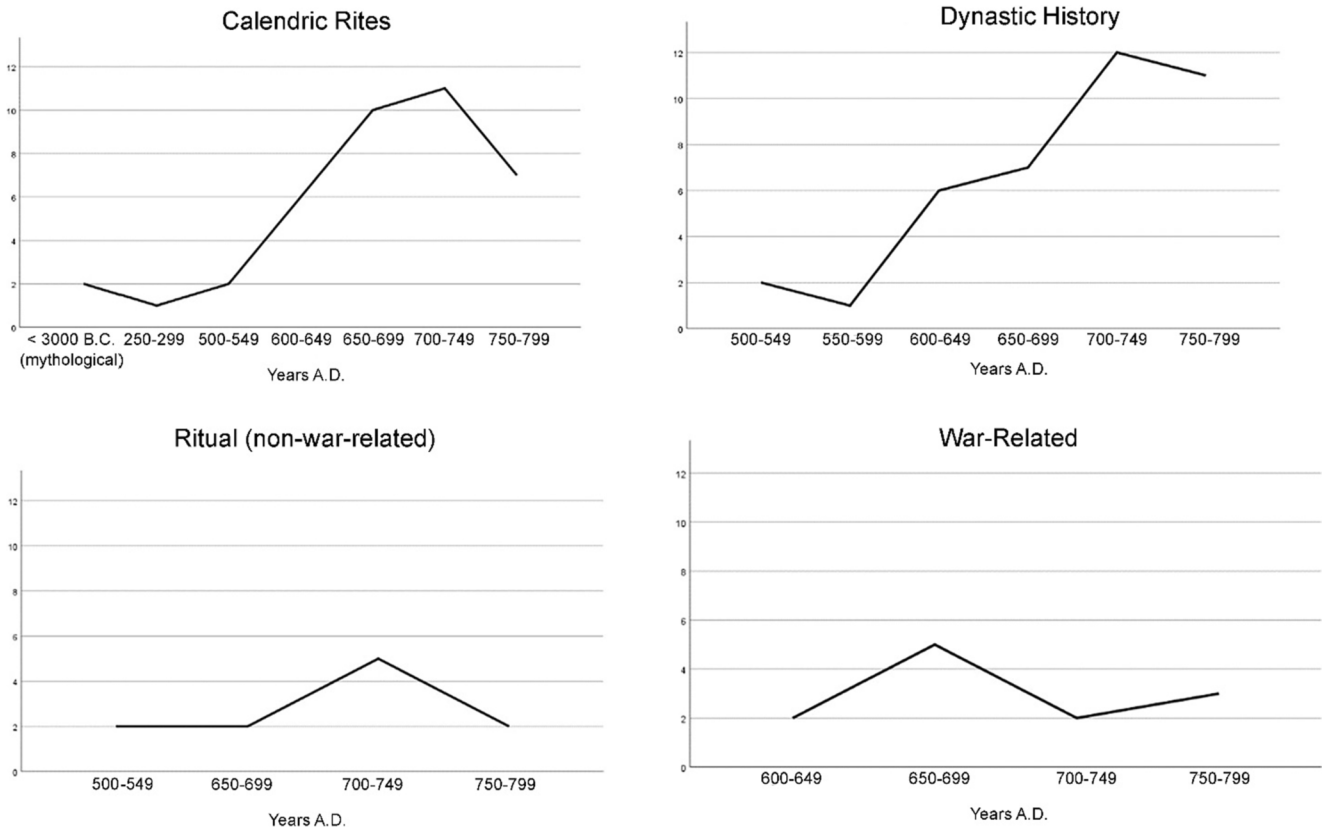


Fig. 14. Frequency of recorded dates by fifty-year categories separated by category and with duplicate dates and dates of unknown activities removed.

In order to better make sense of the pattern of war-related events, they must be considered relative to the frequency of non-war-related events (Fig. 14). For these comparisons, we exclude dates that record events of unknown nature, and, unlike Fig. 13, each historical event is only reported once, even if it was inscribed multiple times. As Fig. 14 shows, not all types of events increase in frequency over the course of the Classic period; instead, they wax and wane across the intervals of fifty years. Most, relevant to this study are recorded events related to Calendric Rites and Dynastic History, which gradually rise to a peak in A.D. 700–750 whereas War-Related events peak in A.D. 650–700 and actually dip between A.D. 700–750, with a slight rebound in A.D. 750–799.

Combined, Figs. 13 and 14 illustrate that there was no increase in reported war-related events over the Classic period at Piedras Negras. Rather, war-related historical events are reported with relative consistency throughout the Classic period. A subtle decline in the first half of the eighth century could reflect an actual decline in the frequency of war or, more likely, a decline in war events that the lords of Piedras Negras deemed worth celebrating in their monumental record, an issue we will explore in greater detail in the next section. These data are nonetheless largely opaque concerning the relevance of war in the immediate years preceding the dissolution of the royal court (A.D. 800–810). As Martin (2020:219) observes for the Maya region overall, if there was an explosion of violent conflict shortly before the political collapse of Classic period dynasties, those events are unrecorded in the historical record. While some polities continued to erect monuments into the ninth century, their dedication was sporadic and their content focused on other matters. The last textual reference to war in all of the southern lowlands is dated to 808, when K'inich Yat Ahk of Piedras Negras was captured by warriors from Yaxchilan.

If war was both endemic throughout the Classic period and essential to the conduct of regional geopolitics, why did historical references to war at Piedras Negras diminish in the eighth century relative to other events? We suggest, based on consideration of the local sculptural corpus, that this decline reflects general turmoil within the royal court, coupled with a diminishing ability to effectively wage war, if not actual military defeats that are unrecorded at Piedras Negras and prompted a shift in royal, rhetoric in the mid-eighth century. Most depictions of the Piedras Negras kings can be classified as one of three categories: warrior (shown holding a lance or a staff capped with a stylized obsidian eccentric), ritual specialist (involved in non-violent acts, most often shown scattering), or seated at accession or period-ending ceremony (Fig. 15; see Clancy, 2009; O'Neil, 2012; Stone, 1989 for a full discussion of the iconography of Piedras Negras' sculptures). Table 2 lists the

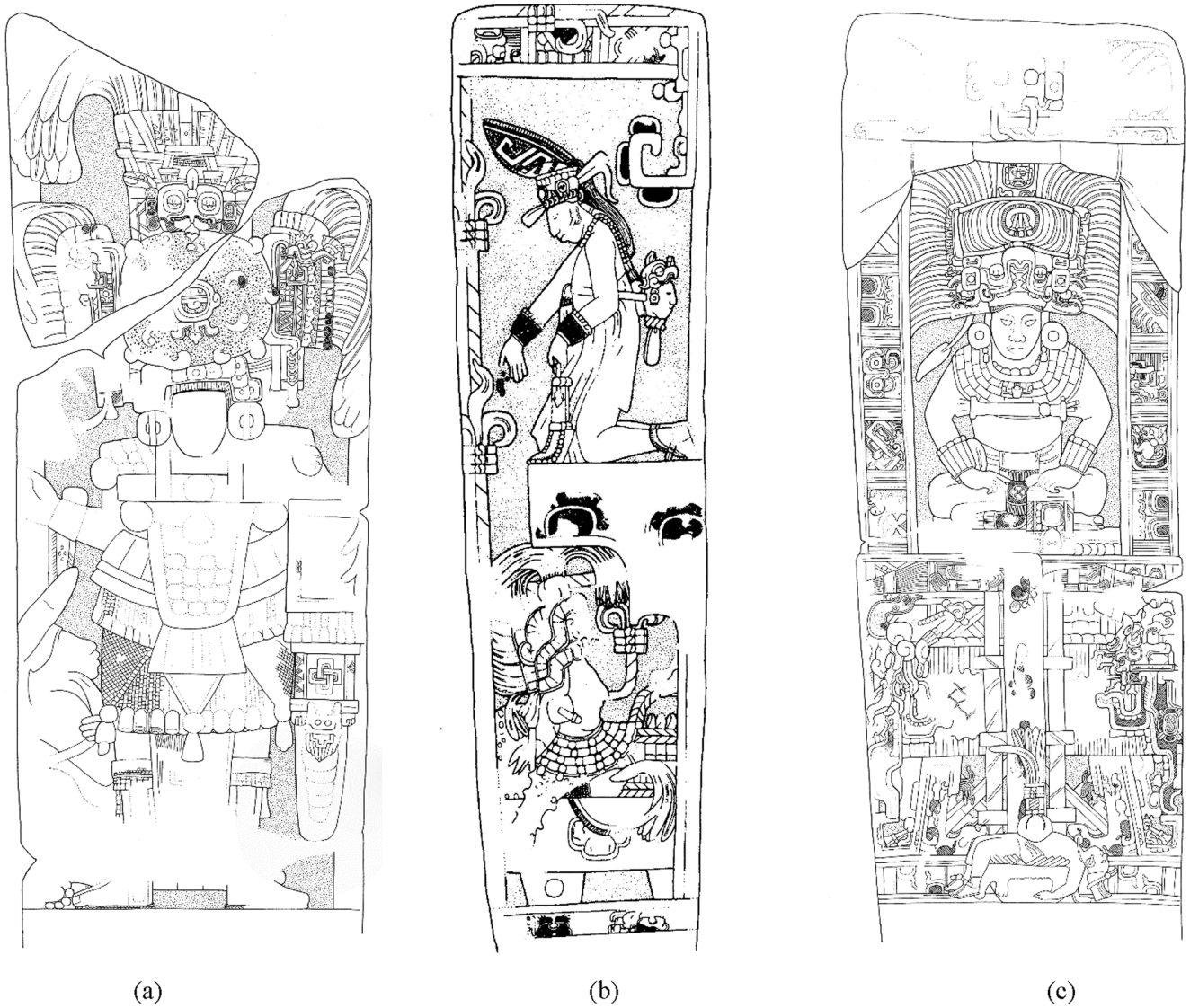


Fig. 15. Depictions of Piedras Negras Ruler 4 as (a) a warrior on Stela 9 (drawing by D. Stuart), (b) ritual performer on Stela 40 (drawing by J. Montgomery), and (c) overseeing a period-ending celebration on Stela 11 (drawing by D. Stuart).

Table 2
Distribution of King-As-Warrior Images by Reigning King who Commissioned the Sculpture.

Ruler	Reign	Images of King-As-Warrior
Early rulers	<A.D. 603	1/1 (100%)
K'inich Yo'nal Ahk I (Ruler 1)	603–639	2/3 (66.6%)
Itzam K'an Ahk III (Ruler 2)	639–686	4/8 (50.0%)
K'inich Yo'nal Ahk II (Ruler 3)	687–729	4/7 (57.1%)
Itzam K'an Ahk IV (Ruler 4)	729–757	1/4 (25.0%
K'inich Yo'anl Ahk III (Ruler 5)	758–767	0/1 (0.0%)
Ha' K'in Xook (Ruler 6)	767–781	0/1 (0.0%)
K'inich Yat Ahk (Ruler 7)	781–808	1/4 (25.0%)

Piedras Negras kings, the number of monuments that depict them, and the fraction thereof that show the king either garbed as a warrior or receiving captives. The table includes the king who commissioned the respective monument, not the king that is depicted in its imagery. For example, Piedras Negras Panel 2 is a monument that shows an unknown Early Classic period king but was commissioned by Itzam K'an Ahk III (Ruler 2) as part of his own narrative on warfare, where his martial prowess was likened to that of a predecessor; Table 2 thus associates Panel 2 with Itzam K'an Ahk III.

Table 2 illustrates that war-related imagery diminished among monuments commissioned by the later kings of Piedras Negras who reigned after A.D. 729. Although the sample size of monuments from later kings is limited (particularly for Rulers 5 and 6) there was a greater tendency for sculptures commissioned during the sixth and seventh centuries to depict war motifs. One could argue that this trend was simply an evolution in artistic convention. Yet the shift also corresponds to an absence of war-related inscriptions. Stela 8 describes a war event associated with K'inich Yo'nal Ahk II (Ruler 3) in 714 and another, a capture, in 718. Then there is silence, at least on martial affairs, until K'inich Yat Ahk III (Ruler 7) celebrates his campaign against Pomona, that began in 787 and culminated in victory in 795.

The intervening period was not, however, a peaceful time for Piedras Negras. Lintel 1 of La Pasadita describes and depicts the capture of a Piedras Negras prince in A.D. 759 by allies of Piedras Negras' arch-rival, Yaxchilan, a little over a year after the start of the short-lived reign of Yo'nal Ahk (Ruler 5; Martin and Grube 2008:131). The same event is also reported on Yaxchilan Hieroglyphic Stairway 1 (Nahm, 1997, 2006). The captured Piedras Negras prince is again shown in a retrospective scene on Panel 3, a monument that depicts Itzam K'an Ahk II (Ruler 4) court but commissioned by K'inich Yat Ahk III (Ruler 7). This combination—a decrease in war-related inscriptions, a decline in war-related imagery, and the capture of an important member of the royal family by Yaxchilan warriors—points to a kingdom faltering at war during the middle of the eighth century. The monumental program from this interval thus contrasts with the general rhetoric produced from earlier times that celebrates the military prowess of the Piedras Negras kings during the seventh century. Again, we do not believe these changes in monumental representation reflect a period of either increased or decreased aggression in the region, but instead one in which the outcomes of warfare were worsening for the kingdom of Piedras Negras.

While the factors that led to the rapid turnover in kings at Piedras Negras during the mid- to late eighth century remains unknown, these events were likely a factor in the polity's declining martial effectiveness and accompanying decrease in monumental references in warfare. The average length of reign for Rulers 4, 5, and 6 was 17 years, a stark contrast to the mean reign of 42 years that the previous three kings had enjoyed. Moreover, Piedras Negras' long-reigning sovereigns were the very ones who celebrated their military prowess in text and image. K'inich Yat Ahk III (Ruler 7) appears to have righted the ship, at least briefly. His best-known monument, Stela 12, dates to A.D. 795 and commemorates victories over Pomona in the years prior to its commission (Houston, Escobedo, Child, Golden, Terry, et al. 2000: 101; Houston et al. 2001: 76-77; Martin and Grube 2008: 152-153; Schele and Grube 1994). The monument once again displays the king as a warrior, spear held in his right hand. The monument also features two subordinate lords, including the La Mar *ajaw*, who served as the military captains responsible for at least some of the captures. In 808, Yat Ahk's good fortune ran out and he was captured by warriors from Yaxchilan, though it is not clear whether he was taken while on campaign or during an attack on Piedras Negras itself (Martin and Grube 2008: 153; Stuart, 1998).

8. Discussion

Overall, there is general agreement in the material evidence pertaining to the chronology of war in the area of Piedras Negras. During the Late Preclassic period, settlement strategies, the presence of fortifications, and evidence from human remains showing evidence of trauma all indicate that not only did the Maya of the region engage in warfare, but that violence specifically involved attacks against community centers (as opposed to battles waged in rural spaces). While the relative paucity of dart points from the Late Preclassic period could be taken as a contradictory line of evidence, their low frequency may relate to the relative lack of excavation in Late Preclassic contexts relative to those of the Late Classic period. The lack of Late Preclassic points might also signal the relatively infrequent use of *atlatls* and darts during that time relative to the Classic period. In contrast, the Late Preclassic period caching of slingstones at Macabilero provides unambiguous evidence that the community was in fact defending itself from violent attack at this time.

This material evidence finds striking parallel to an image conveyed on an unprovenanced vase of the Late Classic period showing the hurling of stones from a hilltop place at attackers below (Fig. 16). The vase also shows what appears to be the taking of women and children as captives, a poignant reminder that the stakes of Maya warfare were high. Early colonial era texts from the Yucatan, such as Gaspar Antonio Chi's *Relación*, make clear that prior to the conquest the Yucatec Maya kept slaves, some of whom were acquired as captives in war (Tozzer, 1941:231). Moreover, captive-taking is known in many other parts of the Americas, where the captives' final fate ranged from execution or enslavement to full incorporation into the captive-taking community (Brooks, 2002; Ibarra Rojas, 2013; MacLeod, 1928). Considering that the evidence for attacks on communities extends back into the Preclassic period, we must also consider that captive-taking may have had a similar antiquity.

Epigraphic texts and pictorial images are nonexistent for the Piedras Negras area during the Late Preclassic period. For the Classic period, however, these records provide abundant evidence for war and stone sculptural monuments are among our only secure evidence for war during the Early Classic period in particular. Many of the earliest historical inscriptions from the region reference war and, importantly, memorialize captives or submissive lords and the settlements from which they originate. The persistent focus on naming the captives' place of origins throughout the Classic period underscores the geo-political dimension of Classic period Maya war. By contrast, aside from tomb sacrifices, there is no secure case of violence in the bioarchaeological record for the Early Classic period. This time interval is also underrepresented in the data on weaponry, and no fortification is known to have been built during the Early Classic period. Nevertheless, the emergence of Piedras Negras as a royal center was in no small part related to its natural defensibility as underscored in the lidar analysis. Clearly, defense against attack was a concern for the founders of the Piedras Negras dynasty.

In contrast to the Early Classic period, there is evidence for violent confrontation in all material records for the Late Classic period. However, no dataset provides evidence for an escalation of violence across the two Late Classic period ceramic phases, from the Yaxche phase into the Chacalhaaz phase, the latter being the temporal period that straddles

Fig. 16. Armed warriors face off against a defender hurling stones from a hilltop that is marked by the image of an animate mountain to his immediate left (Unprovenanced vase; K454 © Justin Kerr). The women and child are perhaps being taken captive. The bodies of the attacking warriors are painted black and they carry backpacks, perhaps laden with supplies for their journey or loot taken from the defended place.

the collapse of the royal court circa A.D. 810. In fact, the epigraphic and iconographic records of war are strongest for the earlier Yaxche phase, which also corresponds to the time of unambiguous evidence for interpersonal violence in the bioarchaeological record at Piedras Negras. The one Classic period fortification whose age could be determined with further precision, the barricade at La Mar, was also built during Yaxche times. The Late Classic period was also when the hillforts of the Late Preclassic period were reoccupied and, potentially, new ones were built (all hillforts we have tested to date have a Late Preclassic period component).

In terms of spatial distribution on the landscape, the evidence for warfare clusters around a few key places. The hilltop fortress of Macabilero is the best documented of these, with its monumental ramparts, defensive walls, bioarchaeological evidence for interpersonal violence, and of the caching of defensive weapons. The site only lacks epigraphic and iconographic evidence for war, which, is unsurprising since it was not the seat of a royal court or noble house during the Classic period. Most of the sites sampled show a relatively high percentage of dart points among their Classic period chert assemblages. Particularly notable was the greater prevelance of points in excavations at outlying households at Piedras Negras, relative to archaeological contexts from the site center. This could signal those households involvement in warfare, hunting, or more likely both.

8.1. Meaning of walls

In a recent synthesis on the history of walls (that largely overlooks the precolonial Americas), historian David Frye (2018) suggests walls were, in a sense, the "midwife to civilization" in that they were built by early complex societies around the world to protect their builders from people they perceived as barbarian others. According to Frye, walls were a double-edged sword for the early societies that built them. On one hand, border and city walls provided ancient people—specifically men—the security and time to pursue other professions and activities beyond being a warrior and waging battle. On the other hand, that lack of experience in war cultivated fear of those non-civilized others who were more adept at waging war than the wall-builders. In that sense, the barricades and other modest fortifications built during the Classic period in the Piedras Negras region are perhaps a reflection of two factors: (1) the Maya largely did not go to war against people perceived as cultural others and (2) most Maya men (and perhaps women) were, if not trained in the art of war, at least anticipating the possibility that they might need to fight to defend themselves.

The lack of monumental fortifications at Piedras Negras implies that the king, his noble subordinates, and commoner subjects were sufficiently adept warriors such that there was no need to build what Frye (2018:246) calls "monuments to fear," instead carving sculptures that celebrated their military prowess, at least during the Yaxche phase. It is tempting to suggest that the barricades that block access to Piedras Negras correspond to the very period when such monuments stopped being raised in the eighth century, during the tumultuous reigns of Rulers 4, 5, and 6, though without secure dates on the barricades, that suggestion is impossible to substantiate.

Frye's model nonetheless does not explain the monumental fortifications of Late Preclassic period Macabilero, built prior to the rise of royal courts. Alternatively, we might follow Alcover Firpi's (2020) interpretation of Macabilero as a refuge with its massive ramparts and finely constructed defensive walls as monuments not to fear but to the

collective efforts of the local community in a time that precedes any clear evidence for political hierarchy and social inequality. Elizabeth Arkush and Hugo Ikehara (2019) make a similar argument regarding defensive monumentality at the Andean hillfort site of Pucarani which, despite having the largest defensive walls in the Lake Titicaca Basin, lacks evidence for social differentiation and formal hierarchy. They interpret Pucarani as the collective efforts of the relatively equal social groups that occupied the community and that its defenses "were not just barriers, but monuments that deterred enemies and augmented regional political leverage by making statements about group strength and cohesion" (Arkush and Ikehara, 2019:79). Adding leverage to this argument is the fact that many of the most impressive walls of the southern Maya lowlands were built at Late Preclassic centers with little evidence for significant social hierarchy, including Zancudero (Golden and Scherer, 2006) and Muralla de Leon (Rice and Rice, 1981). On the other hand, the impressive system of walls and ramparts at La Cuernavilla may well have been the product of Early Classic period kings vying for control of the Buenavista Valley, perhaps with support from Teotihuacan (Garrison et al., 2019). In that sense, monumental defenses in the Buenavista Valley served as highly visible symbols of emergent authoritarian power. So it might well be that we need to be open to multiple interpretations for monumental fortifications in the Maya area, contingent on the local socio-political situation.

8.2. Polity formation

Scholars interested in the formation of ancient states and other complex political formations have long recognized the relevance of war in those processes, although they are of mixed opinion regarding its importance and precise role in explaining the evolution of complex political formations. Perhaps most influential is Robert Carneiro's (1970, 1978, 2011, 2012, 2018) model for the interconnection between war and the emergence of states among early agriculturalists, a process which he sees as triggered by resource competition among people living in a geographically circumscribed region such that there was no longer any space to which growing populations could move in order to escape violence. Other models equally see the absorption and subjugation of the defeated as critical to the emergence of states. For example, Stephen Leblanc (2006) suggests that the maintenance of buffer zones to diminish violent conflict was a widespread strategy among relatively non-complex societies and that the coalescence of formerly competing polities led to larger, more complex social institutions with equally complex forms of governance. In Leblanc's model, polities coalesced through a combination of alliance building and conquest, with warfare more crucial for the emergence of complexity than it was for its maintenance. Ian Morris (2014) makes a similar argument: complex political formations arose as conquest generated larger societies that in turn required more complex political apparatuses to govern them. For Morris, one of the principal aims of government is to keep the peace internally. Elements of Leblanc's and Morris' models appear widely in other approaches that link state formation to war, including: (1) acquisition of territory, resources, and subordinate classes through conquest and (2) expansion of an elite class that served as military leaders and administrators of conquered territory (e.g., Ferguson 2006; Haas 2001; Redmond and Spencer 2006; Spencer 2007).

Yet the history of war and polity in the Piedras Negras area does not resonate well with these models. There is no evidence for territorial conquest and the subjugation of defeated enemies, at neither the birth of the kingdom nor its death. We do see the expansion of an elite class, including individuals necessary to wage war throughout the realm, but this appears to occur largely in the seventh and especially the eighth centuries, long after the polity's foundation (Golden and Scherer, 2013, 2020; Golden et al., 2008). This is not to discount the utility of these models; Leblanc's framework especially has value for thinking through the evolution of Maya polities during the Classic period. It simply indicates that they do not universally explain the emergence of all complex polities.

The rapid coalescence of regional populations at Piedras Negras during the Early Classic period echoes observations made elsewhere that see larger, more complex communities emerging out of the interest for common defense (Arkush, 2018; Birch and Williamson, 2013; Kowalewski, 2006; Kowalewski, 2007, 2013). As Paul Roscoe (2013:59) observes: "polities as political communities are and were almost everywhere defensive organizations, aimed at securing the collective benefits of mutual protection against enemy attack. In contrast, polities as political apparatuses are hierarchies of power relations created, reproduced, and extended to advance elite agendas." Here, Roscoe is making a distinction between a polity as describing the people within a shared political community versus the polity as the elites charged with the governance of said political community. The distinction for Roscoe is that when polities go on the offensive and wage war, they do so largely for the benefit of the elites. For Piedras Negras during the Early Classic period, the distance between the ruler and the ruled was relatively small in that the polity would have largely consisted of perhaps no more than a thousand people (if that) who lived in less than an hour's walk from the monumental center of the site. The presumption is that any spoils gained in war, whether booty taken in the aftermath of a battle or subsequent tribute from sustained subordination, benefited much of the small body politic of the Early Classic period. Beyond the material benefits of war, however, going to battle was also a mechanism to foster trust among allied combatants, particularly if the fighting force involved a large segment of the adult, presumably male, population, as it surely did during the Early Classic period (Golden and Scherer, 2013).

Understanding emergent royal courts of the Early Classic period as entities that provided military defense and organized communities for war also explains the seeming disparity in settlement strategy noted between the Piedras Negras area and the Buenavista Valley in the Peten (Garrison et al., 2019). In the latter case, the resettlement from the largely undefended Late Preclassic period settlement of El Palmar to the heavily fortified upland regions in the Early Classic period reflects a necessary shift to accommodate the higher population densities of the region and the relatively close spacing of emergent Early Classic polities at El Zotz, Tikal, and Uaxactun, among others. In contrast, the demographic situation was different in the western lowlands, with emergent royal courts more dispersed at distances of 43 km (Yaxchilan), 48 km (Pomona), and 90 km (Palenque) from Piedras Negras. Rather, the Early Classic period pressure in the region of Piedras Negras was to bring populations together at a place that provided space for larger communities to settle, and yet was highly defensible. In other words, we suspect that all southern lowland Maya royal courts of the Early Classic period had the common cause of both providing defense and waging successful war, but that the evidence for those practices will vary based on local topography, population densities, and geo-political histories.

8.3. The long view of Maya war

While scholars have long accepted that war was a regular occurrence among the Classic period Maya, there remains a persistent tendency to downplay its scope, scale, and significance. Until recently, mention of warfare was largely absent from broader discussions of the Late Preclassic period despite the fact that numerous walled settlements are known for that time period (e.g., Golden and Scherer, 2006; Rice and Rice, 1981; Webster, 1975, 1976). Inomata's (2014) paper on the Late Preclassic period roots of war at Ceibal is a notable exception. He sees a direct connection between the emergence of centralized authority and rituals of violence at Ceibal as overseen by the early leaders of the community. A persistent issue in the study of Late Preclassic warfare is the precision of dating. For example, the ramparts and walls of Macabilero may have been built anytime between 300 B.C. and A.D. 200. The radiocarbon-dated-mandible came from someone decapitated sometime in the first two centuries of the first millennium, which only narrows the window for violence slightly. Thus, while it is fair to speak

of elevated warfare in Late Preclassic period relative to the Middle Preclassic period, it is difficult to say whether the incidence of violence increased over the course of the Late Preclassic period or was simply endemic to the time period.

The end of the Late Preclassic period in the area of Piedras Negras, like much of the Maya area, remains poorly understood. Some scholars speak of this transition as a "collapse" with warfare cited as potential cause (Estrada-Belli, 2011:128-129). In the area of Piedras Negras, "collapse" is perhaps not the best term; instead the Late Preclassic to Early Classic period transition is better described as a major social and political re-organization, one that appears inspired in part by changes in military strategy. Considering the evidence for warfare into the Early Classic period, we are reluctant to hypothesize that an escalation or de-escalation in violence triggered that transition. More likely, the demographic shift reflects a growing willingness for greater social cooperation among non-kin groups coupled with a willingness to resettle to participate in emergent urban life and the spectacle of the dynastic court (Houston et al., 2003a). Surely strategic advantages in strength in numbers and organized defense were among the factors that fueled rapid growth at Piedras Negras during the Early Classic period, despite the loss to socio-political autonomy that was incurred by abandonment of village life.

To that end, we are also skeptical of claims that "Classic Maya warfare was fought mainly by elites" (Aoyama and Graham, 2015:14), that most fighting happened in fields or forests between urban centers, or that warfare can be reduced to rules of engagement whereby elites went to war to capture one another in battle so that "tribute or tax payments, including access to land, through the act of capture were accorded the victor" (Graham, 2019:228). Rather, at least since Late Preclassic period times, war regularly (though not necessarily frequently) involved direct attacks on communities where any member of society was a potential combatant who may have had something to gain (a share of booty or tribute, honor, prestige, social solidarity, etc.) or lose (their life, their freedom if taken captive and enslaved, their food, their homes, their personal possessions, etc.). As text and imagery pertaining to warfare were written by elites, it should come as no surprise that those media focus on the particular exploits of those individuals (namely, subduing other elites) but we should not assume that elites fighting elites was the totality of Maya warfare (see Stanton, 2019:216-218 for a recent discussion on Maya commoners at war).

Finally, there is a persistent tendency to see warfare as escalating during the decades leading into the Classic period collapse. On one hand, something as dramatic as the demise in divine kingship in the southern lowlands was certainly caused by both significant and complex factors. And yet unambiguous evidence that violence escalated across the lowlands in the years prior to the collapse is still forthcoming and, as noted earlier, is not supported by the epigraphic corpus (Martin, 2020:215-233). For the past two decades, the archaeological evidence for the destruction of place at Aguateca around A.D. 800 and the construction of walls at Late Classic period centers throughout the Petexbatun has loomed large in interpretations of the collapse throughout the Maya area (Demarest et al., 1997; Inomata, 1997, 2008). While the evidence for the violent end of Aguateca is unequivocal, the case that Dos Pilas's walls were hastily built to protect the royal court is open for debate (Houston, 2020). The broader question is whether those late eighth century events truly represent warfare at an unheralded scale for the Maya area, or instead reflect the particularities of the geo-politics of the Pasión River region whereby the successful defeat of Aguateca, a nascent courtly capital, was sufficient to trigger its abandonment. That is, Aguateca's sacking was certainly not the first direct attack on a courtly center but what marks it as distinct is that it was subsequently abandoned, not cleaned and rebuilt, and thus affording one of the few opportunities to directly excavate a battle's aftermath in the Maya area, particularly thanks to the skilled team that undertook those investigations.

Destruction of the throne at Piedras Negras and the defacement of many of its stone sculptures has long been taken as potential evidence of a violent attack on Piedras Negras (Golden et al. 2016:115-116; Houston, 2014; Satterthwaite 2005 [1935]:68–72). However, that is unlikely the first time the Acropolis of Piedras Negras was attacked and subject to violent destruction. Rather, over two hundred years earlier during the sixth century A.D., Piedras Negras appears to have been defeated in war and its acropolis burnt around the time that the lords of Piedras Negras paid tribute to Pomona (Golden, 2002:358-363; Houston et al., 2000a:101). A century later, La Mar braced for a violent attack on its center when it built its barricades during the Yaxche phase (A.D. 630–750), long before its abandonment sometime in the eighth century. Equally, the great fortifications of Macabilero coupled with its caches of slingstones indicate that the Maya were attacking settlements as early as the Late Preclassic period. The chronology of Maya fortifications should be interpreted at face value: Maya communities were directly attacked, and in some cases their centers burned and destroyed, from the Late Preclassic period onwards. Many however, were rebuilt.

Again, our point is not to claim that violence had no part to play in the abandonment of Classic period settlements. Rather, it is to illustrate that the evidence for escalating violence in the eighth and ninth centuries is not as clear as it is often assumed, certainly not for the area of Piedras Negras. The abundance of fortifications dating to the Late Preclassic period would seem to suggest that such violent attacks likely date back many centuries earlier. David Wahl and colleagues (2019) make a similar argument for the site of Witzna in eastern Peten where archaeology and epigraphic evidence both provide suggestions of a devastating attack on the community in A.D. 697. The data presented here supports their view that "total war" was not restricted to the Terminal Classic period, not limited to capturing only elites, and potentially involved serious infrastructural damage to defeated communities.

9. Conclusions

The paradox of the archaeology of war is that the material record is spotty, incomplete, and potentially contradictory, and yet only archaeology is equipped to explore the evidence for intergroup violence deep into humanity's past. The record for the precolonial Maya is no exception. In this paper we have presented data pertaining to ancient warfare in the area of Piedras Negras, to both demonstrate the utility of a detailed case study that incorporates multiple lines of evidence and to address some basic questions pertinent to the study of precolonial violence in the Maya area and beyond. Settlement strategies indicate a persistent concern with defense in all time periods, though hilltop settlement was given up for population nucleation during the Early Classic period. Evolution in weaponry is often overlooked in reconstructions of violence in antiquity and the evidence for cached slingstones in Late Preclassic and Late Classic period times indicates that defense of place was a persistent concern. Fortifications dating to the Late Preclassic period further confirm that violent attack was directed at communities during those early years. While human remains are undoubtedly one of our best means for accessing evidence for violence in antiquity, poor preservation continues to limit their utility in the Maya area, as was the case here. And yet the admittedly thin data accorded well with patterns observed in more robust datasets considered in this study. Epigraphy is the one line of evidence virtually unique in the Maya area relative to other parts of the ancient Americas and in the case of Piedras Negras provides clear evidence for war in the Early Classic period where most other lines of evidence are silent.

This review demonstrates the presence of war long before the formation of the Piedras Negras polity. We see the foundation of the royal court as intimately linked to the emergent dynasty's ability to organize elites and non-elites alike for both effective defense and offense and that the success of the Piedras Negras kingdom from the fourth through eighth centuries was, in part, due to its capacity to wage succesful offensive and defensive war. However, unlike other models for complex polity formation, we do not see lasting conquest as part of this process, rather organization for defense and attacks on neighboring polities were

more likely factors. While precision in dating remains a problem, as does the overrepresentation of a single time period (the Late Classic), there is no evidence for an escalation in violence or a change in the nature of war in the decades before the collapse of the Piedras Negras polity in the early ninth century. This is not to say the violence was not a causative factor, but that the evidence for its role is not as obvious as is often assumed. In the case of Piedras Negras, the data are more consistent with endemic war during all time periods. What appears to have changed is how people organized themselves around the conduct of war and how success (or failure) at war helped sustain the kingdom (or not) over the course of the Classic period.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Archaeological investigations in Chiapas were permitted by the Instituto Nacional de Antropologia e Historia, Mexico and in the Petén by the Instituto de Antropología e Historia de Guatemala. We are grateful for the permission and local knowledge of the people and communities who were involved in the research presented here. In Guatemala this includes La Cooperativa Técnica Agropecuaria, Santa Rita, and La Cooperativa Nuevo Horizonte, and, in Chiapas, Nueva Esperanza. The Defensores de la Naturaleza provided key infrastructural support for fieldwork in Peten, Guatemala, as did the Fonseca family in Chiapas, Mexico. Institutional and financial support was awarded through Brown University (including Joukowsky Summer Research Awards and Tinker Foundation Field Research Grants), Brandeis University (the Jane Fund of the Latin American and Latino Studies Program), University of Pennsylvania (the Penn Museum, Department of Anthropology, and Latin American and Latino Studies), the Universidad Autónoma de Yucatan, Merida, the Universidad de Ciencias y Artes de Chiapas, the National Science Foundation (SBE-BCS 0406472, 0715463, 1115818, 1505399, 1505483, 1733551, 1917671), the Alphawood Foundation, the National Geographic Society (Grant #9054-12), Fulbright IIE/ U.S. State Department (awarded to Omar Alcover Firpi), the Wenner Grenner Foundation (awarded to Whittaker Schroder and Alejandra Roche Recinos), the Foundation for the Advancement of Mesoamerican Studies, H. John Heinz III Charitable Trust, the Rust Foundation, and Sigma Xi. We thank two anonymous reviewers whose suggestions have greatly improved this manuscript. All errors and omissions are ours.

References

Alcover Firpi, O., 2020. Conflict, Defense, and Cooperation at Macabilero, Peten, Guatemala. Unpublished Ph.D. dissertation, Department of Anthropology, Brown University, Providence.

Alcover Firpi, O.A., Golden, C., 2020. The Politics of Conflict: War before and Beyond the State in Maya Society, in: Hutson, S.R., Arden, T. (Eds.), The Maya World. Routledge, 2020, pp. 477-495.

Aoyama, K., 2005. Classic Maya Warfare and Weapons: Spear, Dart, and Arrow Points from Aguateca and Copan. Ancient Mesoamerica 16, 291–304.

Aoyama, K., Graham, E., 2015. Ancient Maya Warfare: Exploring the Significance of Lithic Variation in Maya weaponry. Lithics: the Journal of the Lithic Studies Society 36, 5–17.

Arkush, E., 2006. Collapse, Conflict, Conquest: The Transformation of Warfare in the Late Prehispanic Andean Highlands. In: Arkush, E., Allen, M.W. (Eds.), The Archaeology of Warfare: Prehistories of Raiding and Conquest. University Press of Florida, Gainesville, pp. 286–335.

Arkush, E., 2011. Hillforts of the Ancient Andes: Colla Warfare, Society, and Landscape. University Press of Florida, Gainesville.

Arkush, E., 2017. The End of Ayawiri: Abandonment at an Andean Hillfort Town of the Late Intermediate Period. J. Field Archaeol. 42, 241–257.

Arkush, E., 2018. Coalescence and Defensive Communities: Insights from an Andean Hillfort Town. Cambridge Archaeol. J. 28, 1–22.

Arkush, E., Allen, M.W., 2006. The Archaeology of Warfare: Prehistories of Raiding and Conquest. University Press of Florida, Gainesville.

Arkush, E., Ikehara, H.C., 2019. Pucarani: Defensive Monumentality and Political Leadership in the Late Pre-Columbian Andes. J. Anthropol. Archaeol. 53, 66–81.

Arkush, E., Tung, T.A., 2013. Patterns of War in the Andes from the Archaic to the Late Horizon: Insights from Settlement Patterns and Cranial Trauma. J. Archaeol. Res. 21, 307–369.

Asselbergs, F., 2008. Conquered Conquistadors: The Lienzo de Quauhquechollan. University of Colorado Press, Boulder, A Nahua Vision of the Conquest of Guatemala.

Birch, J., Williamson, R.F., 2013. Organizational Complexity in Ancestral Wendat Communities. In: Birch, J. (Ed.), From Prehistoric Villages to Cities: Settlement Aggregation and Community Transformation. Routledge, New York, pp. 153–178.

Bosworth-Ahmet, E., 2020. Terrain Ruggedness Index (TRI) and Vector Ruggedness Measurement (VRM) - Two new Arc Hydro functions that quantify ruggedness on a DEM. Esri Community Blog https://community.esri.com/t5/water-resources-blog/terrain-ruggedness-index-tri-and-vector-ruggedness/ba-p/884340, Accessed January 10, 2022.

Brooks, J.F., 2002. Captives and Cousins: Slavery, Kinship, and Community in the Southwest Borderlands. University of North Carolina Press, Chapel Hill.

Brown, M.K., Stanton, T.W., 2003. Ancient Mesoamerican Warfare. AltaMira Press, Walnut Creek, CA.

Canter, R.L., 2007. Rivers Among the Ruins: The Usumacinta. The PARI Journal 7, 1–24.

Canuto, M.A., Estrada-Belli, F., Garrison, T.G., Houston, S.D., Acuña, M.J., Kováč, M., Marken, D., Nondédéo, P., Auld-Thomas, L., Castanet, C., Chatelain, D., Chiriboga, C. R., Drápela, T., Lieskovský, T., Tokovinine, A., Velasquez, A., Fernández-Díaz, J.C., Shrestha, R., 2018. Ancient Lowland Maya Complexity as Revealed by Airborne Laser Scanning of Northern Guatemala. Science 361.

Carleton, W.C., Campbell, D., Collard, M., 2017. Increasing Temperature Exacerbated Classic Maya Conflict Over the Long Term. Quat. Sci. Rev. 163, 209–218.

Carneiro, R.L., 1970. A Theory of the Origin of the State. Science 169, 733–738.

Carneiro, R.L., 1978. Political Expansion as an Expression of the Principle of Competitive Exclusion. In: Cohen, R., Service, E.R. (Eds.), Origins of the State: The Anthropology of Political Evolution. Institute for the Study of Human Issues, Philadelphia, pp. 205–223.

Carneiro, R.L., 2011. The Studied Avoidance of War as an Instrument of Political Evolution. In: Chacon, R., Mendoza, R.G. (Eds.), The Ethics of Anthropology and Amerindian Research: Reporting on Environmental Degradation and Warfare. Springer, New York, pp. 360–366.

Carneiro, R.L., 2012. The Circumscription Theory: A Clarification, Amplification, and Reformulation. Social Evolution and History 11, 5–30.

Carneiro, R.L., 2018. The Checkered History of the Circumscription Theory. AuthorHouse, Bloomington, IN.

Chacon, R.J., Mendoza, R.G., 2007. Latin American Indigenous Warfare and Ritual Violence. The University of Arizona Press, Tucson.

Chase, A., Chase, D., Awe, J., Weishampel, J., Iannone, G., Moyes, H., Yaeger, J., Brown, M., Shrestha, R., Carter, W., Fernandez Diaz, J., 2014. Ancient Maya Regional Settlement and Inter-Site Analysis: The 2013 West-Central Belize LiDAR Survey. Remote Sensing 6, 8671.

Chase, A.F., Chase, D.Z., Fisher, C.T., Leisz, S.J., Weishampel, J.F., 2012. Geospatial revolution and remote sensing LiDAR in Mesoamerican archaeology. Proc. Natl. Acad. Sci. 109, 12916–12921.

Chase, A.F., Chase, D.Z., Weishampel, J.F., Drake, J.B., Shrestha, R.L., Slatton, K.C., Awe, J.J., Carter, W.E., 2011. Airborne LiDAR, Archaeology, and the Ancient Maya Landscape at Caracol, Belize. J. Archaeol. Sci. 38, 387–398.

Chinchilla, O.M., Houston, S.D., 1993. Historia Politica de la Zona de Piedras Negras: Las Inscripciones de El Cayo. In: Laporte, J.P., Escobedo, H., de Brady, S.V. (Eds.), VI Simposio de Investigaciones Arqueológicas en Guatemala. Museo Nacional de Arqueología y Etnología, Guatemala, Guatemala City, Guatemala, pp. 63–70.

Clancy, F.S., 2009. The Monuments of Piedras Negras, an Ancient Maya City. University of New Mexico Press, Albuquerque.

Coe, W.R., 1959. Piedras Negras Archaeology: Artifacts, Caches, and Burials. University Museum, University of Pennsylvania, Philadelphia.

Collard, M., Carleton, W.C., Campbell, D.A., 2021. Rainfall, Temperature, and Classic Maya Conflict: A Comparison of Hypotheses using Bayesian Time-Series Analysis. PLoS ONE 16, e0253043.

Demarest, A.A., O'Mansky, M., Wolley, C., Van Turenhout, D., Inomata, T., Palka, J., Escobedo, H., 1997. Classic Maya Defensive Systems and Warfare in the Petexbatun Region: Archaeological Evidence and Interpretations. Ancient Mesoamerica 8, 229–253.

Ebert, C.E., Hoggarth, J.A., Awe, J.J., 2017. Integrating Quantitative Lidar Analysis and Settlement Survey in the Belize River Valley. Advances in Archaeological Practice 4, 284–300.

Escobedo, H.L., 2004. Tales from the Crypt: The Burial Place of Ruler 4, Piedras Negras. In: Miller, M., Martin, S. (Eds.), Courtly Art of the Ancient Maya. Thames and Hudson, New York, pp. 277–280.

Estrada-Belli, F., 2011. The First Maya Civilization: Ritual and Power before the Classic Period. Routledge, New York.

Ferguson, R.B., 2013. Pinker's List: Exaggerating Prehistoric War Mortality. In: Fry, D.P. (Ed.), War, Peace, and Human Nature: The Convergence of Evolutionary and Cultural Views. Oxford University Press, Oxford, pp. 112–131.

Frye, D., 2018. Walls: A History of Civilization in Blood and Brick. Simon and Schuster, New York.

Garrison, T.G., Houston, S., Alcover Firpi, O., 2019. Recentering the Rural: Lidar and Articulated Landscapes among the Maya. J. Anthropol. Archaeol. 53, 133–146.

Gat, A., 2006. War in Human Civilization. Oxford University Press, Oxford.

Golden, C., 2002. Disentangling Culture Change from Chronology: The Early Classic/Later Classic Divide at Piedras Negras, Guatemala. Unpublished Ph.D. Dissertation, Department of Anthropology. University of Pennsylvania, Philadelphia.
Golden, C., Guzmán López, P., Schroder, W., 2013. Na Wits. In: Scherer, A.K., Golden, C. (Eds.), Proyecto Arqueológico Busilja-Chocolja: Informe de la Cuarta Temporada de Investigación. Informe entregado al Consejo de Arqueología del Instituto Nacional de Antropología e Historia, Mexico, pp. 89–104.
Golden, C., Scherer, A.K., 2006. Border Problems: Recent Archaeological Research along the Usumacinta River. PARI Journal 7, 1–16.
Golden, C., Scherer, A.K., 2013. Territory, Trust, Growth and Collapse in Classic Period Maya Kingdoms. Current Anthropology 54, 397–417.
Golden, C., Scherer, A.K., 2020. Landscapes of Warfare, Détente, and Trade in the Maya West. In: Houk, B.A., Arroyo, B., Powis, T.G. (Eds.), Approaches to Monumental Landscapes of the Ancient Maya. University Press of Florida, Tallahasee, pp. 218–241.
Golden, C., Scherer, A.K., Kingsley, M., Houston, S., Escobedo, H., 2016. The Life and Afterlife of the Classic Period Piedras Negras Kingdom. In: Iannone, G., Houk, B.A., Schwake, S.A. (Eds.), Ritual, Violence, and the Fall of the Classic Maya Kings. University Press of Florida, Gainesville, pp. 108–133.
Golden, C., Scherer, A.K., Muñoz, A.R., Vásquez, R., 2008. Piedras Negras and Yaxchilan: Divergent Political Trajectories in Adjacent Maya Polities. Latin American Antiquity 19, 249–274.
Golden, C., Scherer, A.K., Schroder, W., Murtha, T., Morell-Hart, S., Fernandez Diaz, J., Jiménez Alvarez, S., Alcover Firpi, O., Agostini, M., Bazarsky, A., Clark, M., Kollias III, G.V., Matsumoto, M., Roche Recinos, A., Schnell, J., Whitlock, B., 2021. Airborne Lidar Survey, Density-Based Clustering, and Ancient Maya Settlement in the Upper Usumacinta River Region of Mexico and Guatemala. Remote Sensing 13, 4109.
Golden, C., Scherer, A.K., Schroder, W., Vella, C., Roche Recinos, A., 2020. Decentralizing the Economies of the Maya West. In: Masson, M.A., Freidel, D.A., Demarest, A.A. (Eds.), The Real Business of Ancient Maya Economies: From Farmers' Fields to Rulers' Realms. University Press of Florida, Talahasee, pp. 403–417.
Graham, E., 2019. This Means War! In: Morton, S.G., Peuramaki-Brown, M.M. (Eds.), Seeking Conflict in Mesoamerica: Operational, Cognitive, and Experiential Approaches. University Press of Colorado, Louisville, pp. 220–247.
Hernandez, C.L., Palka, J.W., 2019. Maya Warfare, Symbols, and Ritual Landscapes. In: Morton, S.G., Peuramaki-Brown, M.M. (Eds.), Seeking Conflict in Mesoamerica: Operational, Cognitive, and Experiential Approaches. University Press of Colorado, Louisville, pp. 30–46.
Hobson, R.D., 1972. Surface Roughness in Topography: Quantitative Approach. In: Chorley, R.J. (Ed.), Spatial Analysis in Geomorphology. Harper and Row, New York, pp. 221–245.
Houston, S., 2020. Canonical Space and Maya Markets. Maya Decipherment: Ideas on Ancient Maya Writing and Iconography https://mayadecipherment.com/; accessed September 12, 2020.
Houston, S.D., Escobedo, H., Child, M., Golden, C., Muñoz, R., 2003. The Moral Community: Maya Settlement Transformation at Piedras Negras, Guatemala. In: Smith, M.L. (Ed.), The Social Construction of Ancient Cities. Smithsonian Institution Press, Washington, D.C., pp. 212–253
Houston, S.D., Escobedo, H., Child, M., Golden, C., Terry, R., Webster, D.L., 2000a. In the Land of the Turtle Lords: Archaeological Investigations at Piedras Negras, Guatemala, 2000. Mexicon XXII, 97-110.
Houston, S.D., Escobedo, H., Forsyth, D., Hardin, P., Webster, D.L., Wright, L.E., 1998. On the River of Ruins: Explorations at Piedras Negras, Guatemala, 1997. Mexicon XX, 16-21.
Houston, S.D., Escobedo, H., Hardin, P., Terry, R., Webster, D.L., Child, M., Golden, C., Emery, K., Stuart, D., 1999. Between Mountains and Sea: Investigations at Piedras Negras, Guatemala, 1998. Mexicon 21, 10–17.
Houston, S.D., Escobedo, H., Scherer, A.K., Fitzsimmons, J., L., Child, M., 2003b. Classic Maya Death at Piedras Negras, Guatemala, in: Ciudad Ruiz, A., Humberto Ruz Sosa, M., Iglesias Ponce de León, M.J. (Eds.), Antropología de la Eternidad: La Muerte en La Cultura Maya. Sociedad Española de Estudios Mayas, Madrid, pp. 113-144.
Houston, S.D., Escobedo, H., Terry, R., Webster, D.L., Veni, G., Emery, K.F., 2000b. Among the River Kings: Archaeological Research at Piedras Negras, Guatemala, 1999. Mexicon XX, 16-22.
Houston, S.D., Escobedo, H.L., Child, M., Golden, C., Muñoz, A.R., 2000c. El inicio de una ciudad Maya: Una perspectiva desde Piedras Negras, Guatemala, Los Investigadores de la Cultura Maya 8. Universidad Autónoma de Campeche, Campeche, Mexico, pp. 9–27.
Houston, S.D., Escobedo, H.L., Child, M., Golden, C., Muñoz, A.R., 2001. Crónica de una Muerte Anunciada: Los Años Finales de Piedras Negras, in: Ruiz, A.C., Ponce de León, J.I., del Carmen Martínez Martínez, M. (Eds.), Reconstruyendo La Ciudad Maya: El Urbanismo en Las Sociedades Antiguas. Sociedad Española de Estudios Mayas, Madrid, pp. 65-93.
Houston, S.D., Scherer, A.K., 2010. La ofrenda máxima: el sacrificio humano en la parte central del área Maya. In: López Luján, L., Olivier, G. (Eds.), El sacrificio humano en la tradición religiosa mesoamericana. Instituto Nacional de Antropología e Historia and Universidad Nacional Autónoma de México, Instituto de Investigaciones Históricas, Mexico City, pp. 169–194.
Hruby, Z.X., 2006. The Organization of Chipped-Stone Economies at Piedras Negras, Guatemala. University of California at Riverside, Riverside.
Hruby, Z.X., 2007. Ritualized Chipped-Stone Production at Piedras Negras, Guatemala. Archaeological Papers of the American Anthropological Association 17, 68–87.
Hruby, Z.X., Ware, G., 2009. Painted Lithic Artifacts from Piedras Negras, Guatemala. In: Golden, C., Houston, S., Skidmore, J. (Eds.), Maya Archaeology I. Precolumbia Mesoweb Press, San Francisco, pp. 77–85.
Hutson, S.R., 2015. Adapting LiDAR Data for Regional Variation in the Tropics: A Case Study from the Northern Maya Lowlands. J. Archaeolog. Sci.: Rep. 4, 252–263.
Ibarra Rojas, E., 2013. Pueblos que capturan. Esclavitud indígena al sur de américa central del siglo XVI al XIX. Editorial de la Universidad de Costa Rica, San José.
Inomata, T., 1997. The Last Day of a Fortified Classic Maya Center: Archaeological Investigations at Aguateca, Guatemala. Ancient Mesoamerica 8, 337–351.
Inomata, T., 2008. Warfare and the Fall of a Fortified Center: Archaeological Investigations at Aguateca. Vanderbilt Institute of Mesoamerican Archaeology, Vanderbilt University Press, Nashville.
Inomata, T., 2014. War, Violence, and Society in the Maya Lowlands. In: Scherer, A.K., Verano, J.W. (Eds.), Embattled Places, Embattled Bodies: War In Pre-Columbian Mesoamerica and the Andes. Dumbarton Oaks Research Library and Collection, Washington, DC, pp. 25–56.
Inomata, T., Triadan, D., Pinzón, F., Burham, M., Ranchos, J.L., Aoyama, K., Haraguchi, T., 2018. Archaeological Application of Airborne LiDAR to Examine Social Changes in the Ceibal region of the Maya Lowlands. PLoS ONE 13, e0191619.
Jiménez Alvarez, S., Méndez Cab, A., Golden, C., Scherer, A.K., 2014. La Cerámica del Período Clásico Tardio Procedente de la Region entre los Ríos Chocolja y Busilja, en el Río Usumacinta Medio de Chiapas, Mexico, Los Investigadores de la Cultura Maya 22. Tomo II, 181–199.
Johnston, K., 2007. Preclassic Maya Occupation of the Itzan Escaprment, Lower Río de la Pasión Petén, Guatemala. Ancient Mesoamerica 17, 177–201.
JPL, N., 2020. NASADEM Merged DEM Global 1 arc second V001. 2020. NASA EOSDIS Land Processes DAAC.
Keeley, L.H., 1996. War Before Civilization: The Myth of the Peaceful Savage. Oxford University Press, Oxford.
Kennett, D.J., Breitenbach, S.F.M., Aquino, V.V., Asmerom, Y., Awe, J., Baldini, J.U.L., Bartlein, P., Culleton, B.J., Ebert, C., Jazwa, C., Macri, M.J., Marwan, N., Polyak, V., Prufer, K.M., Ridley, H.E., Sodemann, H., Winterhalder, B., Haug, G.H., 2012. Development and Disintegration of Maya Political Systems in Response to Climate Change. Science 338, 788–791.
Kingsley, M.J., Golden, C.W., Scherer, A.K., Marroquín Franco, L.M., 2012. Parallelism in Occupation: Tracking the Pre- and Post-Dynastic Evolution of Piedras Negras, Guatemala through its Secondary Site. El Porvenir. Mexicon XXXIV 109–117.
Kowalewski, S.A., 2006. Coalescent Societies. In: Pluckhahn, T.J., Ethridge, R. (Eds.), Light on the Path: The Anthropology and History of the Southeastern Indians. University of Alabama Press, Tuscaloosa, pp. 94–122.
Kowalewski, S.A., 2007. From Out of the Southwest, A New Kind of Past. In: Gregory, D. A., Wilcox, D.R. (Eds.), Zuni Origins: Toward a New Synthesis of Southwestern Archaeology. University of Arizona Press, Tucson, pp. 434–445.
Kowalewski, S.A., 2013. The Work of Making Community. In: Birch, J. (Ed.), From Prehistoric Villages to Cities: Settlement Aggregation and Community Transformation. Routledge, New York, pp. 201–218.
Kurjack, E.B., Andrews, E.W.V., 1976. Early Boundary Maintenance in Northwest Yucatan, Mexico. Am. Antiq. 41, 318–325.
Lambert, P.M., 2002. The Archaeology of War: A North American Perspective. J. Archaeol. Res. 10, 207–241.
Leblanc, S.A., 1999. Prehistoric Warfare in the American Southwest. The University of Utah Press, Salt Lake City.
Leblanc, S.A.w., Register, K.E., 2003. Constant Battles: Why We Fight. St. Martin's Griffin, New York.
Lee Jr., T.A., Hayden, B., 1988. San Pablo Cave and El Cayo on the Usumacinta River, Chiapas, Mexico. New World Archaeological Foundatoin, Provo.
Lothrop, S.K., 1927. Tulum: An Archaeological Study of the East Coast of Yucatan. Carnegie Institute of Washington Publication 335, Washington, DC.
MacLeod, W.C., 1928. Economic Aspects of Indigenous American Slavery. American Anthropologist 30, 632–650.
Maler, T., 1903. Researches in the Central Portion of the Usumatsintla Valley: Report of Explorations for the Museum - Part Second. Harvard University, Cambridge.
Martin, D.L., 2016. Hard Times in Dry Lands: Making Meaning of Violence in the Ancient Southwest. J. Anthropol. Res. 72, 1–23.
Martin, S., 2020. Ancient Maya Politics: A Political Anthropology of the Classic Period 150–900 CE. Cambridge University Press, Cambridge.
Martin, S., Grube, N., 2008. Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya, second ed. Thames and Hudson, New York.
Mathews, P., Aliphat Fernández, M., 1997. Informe de la Temporada de Campo 1993, Proyecto El Cayo. Informe Presentado ante el Consejo de Arqueología del Instituto Nacional de Antropología e Historia Mexico City.
Mathews, P., Aliphat, M.M., 1992. Proyecto Arqueologico El Cayo. Report of the Second Field Season. University of Calgary.
Milner, G.R., 1999. Warfare in prehistoric and early historic eastern North America. J. Archaeol. Res. 7, 105–151.
Milner, G.R., Chaplin, G., Zavodny, E., 2013. Conflict and Societal Change in Late Prehistoric Eastern North America. Evolutionary Anthropology: Issues, News, and Reviews 22, 96–102.
Morris, I., 2014. War! What Is It Good For?: Conflict and the Progress of Civilization from Primates to Robots Farrar. Straus and Giroux, New York.
Morton, S.G., Peuramaki-Brown, M.M., 2019. Seeking Conflict in Mesoamerica: Operational, Cognitive, and Experiential Approaches. University of Colorado Press, Boulder.
Muñoz, A.R., 2006. Power, Practice, and Production: Technological Change in the Late Classic Ceramics of Piedras Negras, Guatemala, Department of Anthropology. University of Arizona, Tucson.
Nahm, W., 1997. Hieroglyhic Stairway 1 at Yaxchilan. Mexicon XIX 65–69.
Nahm, W., 2006. New Readings on Hieroglyphic Stairway 1 of Yaxchilan. Mexicon XXVIII 28–39.

Nelson, Z., 2006. Urban Development at Piedras Negras, Guatemala: Agriculture, Population, and Settlement. VDM Verlag Dr. Müller, Saarbrücken, Germany.
Nielsen, A.E., Walker, W., 2009. Warfare in Cultural Context: Practice, Agency, and The Archaeology of Violence. The University of Arizona Press, Tucson.
O'Neil, M.E., 2012. Engaging Ancient Maya Sculpture at Piedras Negras, Guatemala. University of Oklahoma Press, Norman.
Pinker, S., 2011. The Better Angels of Our Nature: Why Violence has Declined. Penguin, New York.
Prufer, K., Thompson, A.E., 2017. Lidar-Based Analyses of Anthropogenic Landscape Alterations as a Component of the Built Environment. Adv. Archaeol. Practice 4, 393–409.
Puleston, D., Callendar Jr., D.W., 1967. Defensive Earthworks at Tikal. Expedition 9, 40–48.
Puleston, D.E., 1983. The Settlement Survey of Tikal. University Museum Publications, University of Pennsylvania, Philadelphia.
Redmond, E.M., Spencer, C.S., 2012. Chiefdoms at the Threshold: The Competitive Origins of the Primary State. J. Anthropol. Archaeol. 31, 22–37.
Rice, D.S., 1986. The Peten Postclassic: A Settlement Perspective, in: Sabloff, J.A., Andrews V, E.W. (Eds.), Late Lowland Maya Civilization: Classic to Postclassic. University of New Mexico Press, Albuquerque, pp. 301-344.
Rice, D.S., Rice, P.M., 1981. Muralla de Leon: A Lowland Maya Fortification. Journal of Field Archaeology 8, 271–288.
Rice, P.M., Rice, D.S., 2004. Late Classic to Postclassic Transformations in the Petén Lakes Region, Guatemala. In: Demarest, A.A., Rice, P.M., Rice, D.S. (Eds.), The Terminal Classic in the Maya Lowlands: Collapse, Transition, and Transformation. University of Press of Colorado, Boulder, pp. 125–139.
Ringle, W.M., Gallareta Negrón, T., May Ciau, R., Seligson, K.E., Fernandez-Diaz, J.C., Ortegón Zapata, D., 2021. Lidar Survey of Ancient Maya Settlement in the Puuc Region of Yucatan. Mexico. PLOS ONE 16, e0249314.
Robbins Schug, G., Gray, K., Mushrif-Tripathy, V., Sankhyan, A.R., 2012. A Peaceful Realm? Trauma and Social Differentiation at Harappa. Int. J. Paleopathol. 2, 136–147.
Roche Recinos, A., 2021. Regional Production and Exchange of Stone Tools in the Maya Polity of Piedras Negras, Guatemala. Department of Anthropology, Brown University, Providence. Unpublished Ph.D. dissertation.
Roche Recinos, A., Alcover Firpi, O., Rodas, R., 2021. Evidence for Slingstones and Related Projectile Stone Use by the Ancient Maya of the Usumacinta River Region. Ancient Mesoamerica.
Roscoe, P., 2013. War, Collective Action, and the "Evolution" of Human Polities. In: Carballo, D.M. (Ed.), Cooperation and Collective Action: Archaeological Perspectives. University of Colorado Press, Boulder, pp. 57–82.
Russell, B.W., 2013. Fortress Mayapan: Defensive Features and Secondary Functions of a Postclassic Maya Fortification. Ancient Mesoamerica 24, 275–294.
Sanders, W.T., 1960. Prehistoric Ceramics and Settlement Patterns in Quintana Roo, Mexico. Publication 606. Carnegie Institution of Washington.
Sappington, J.M., Longshore, K.M., Thompson, D.B., 2007. Quantifying Landscape Ruggedness for Animal Habitat Analysis: A Case Study Using Bighorn Sheep in the Mojave Desert. J. Wildl. Manag. 71, 1419–1426.
Scherer, A.K., 2015. Mortuary Landscapes of the Classic Maya: Rituals of Body and Soul. University of Texas Press, Austin.
Scherer, A.K., 2021. Recent Research on the Archaeology of War and Violence. Annual Review of Anthropology 50, 403–421.
Scherer, A.K., Alcover Firpi, O., 2016. Reconocimiento de Piedras Negras. In: Pérez Robles, G., Scherer, A.K., Golden, C. (Eds.), Proyecto Paisaje Piedras Negras-Yaxchilan: Informe de la Primera Temporada de Investigación. Informe presented to the Instituto de Antropología e Historia de Guatemala (IDAEH), Guatemala City, pp. 97–104.
Scherer, A.K., Golden, C., 2009. Tecolote, Guatemala: Archaeological Evidence for a Fortified Late Classic Maya Political Border. Journal of Field Archaeology 34, 285–304.
Scherer, A.K., Golden, C., 2012. Revisiting Maler's Usumacinta: Recent Archaeological Investigation in Chiapas, Mexico. The Pre-Columbian Art Research Institute, San Francisco.
Scherer, A.K., Golden, C., 2014a. War in the West: History, Landscape, and Classic Maya Conflict. In: Scherer, A.K., Verano, J.W. (Eds.), Embattled Places, Embattled Bodies: War In Pre-Columbian Mesoamerica and the Andes. Dumbarton Oaks Research Library and Collection, Washington, DC, pp. 57–92.
Scherer, A.K., Golden, C., 2014b. Water in the West: Chronology and Collapse of the Classic Maya River Kingdoms. In: Iannone, G. (Ed.), The Great Maya Droughts in Cultural Context: : Case Studies in Resilience and Vulnerability. University of Colorado Press, Boulder, pp. 207–230.
Scherer, A.K., Golden, C., Alcover Firpi, O., Schroder, W., Urquizú, M., Román, E.R., 2019. Yaxchilan from the Perspective of Guatemala: New Data on Settlement, Fortifications, and Sculptural Monuments. The PARI Journal XX 1–14.
Scherer, A.K., Matsumoto, M., 2017. Reconocimiento de Piedras Negras. In: Urquizú, M., Scherer, A.K., Golden, C. (Eds.), Proyecto Paisaje Piedras Negras-Yaxchilan: Informe de la Segunda Temporada de Investigación. Informe presented to the Instituto de Antropología e Historia de Guatemala (IDAEH), Guatemala City, pp. 164–167.
Scherer, A.K., Verano, J.W., 2014. Embattled Bodies, Embattled Places: War In Pre-Columbian Mesoamerica and the Andes. Dumbarton Oaks Research Library and Collection, Washington, DC.
Scherer, A.K., Wright, L.E., Yoder, C.J., 2007. Bioarchaeological Evidence for Social and Temporal Differences in Subsistence at Piedras Negras, Guatemala. Latin American Antiquity 18, 85–104.
Schroder, W., 2021. Cycles of Defence on the Piedras Negras Kingdom Periphery: Landscape Patrimony at the Fortified Hilltop Community of El Infiernito, Chiapas. Landscape Res. 46, 793–810.
Schroder, W., Golden, C., Scherer, A.K., Jiménez Alvarez, S., Dobereiner, J., Méndez Cab, A., 2017. At the Crossroads of Kingdoms: Recent Investigations on the Periphery of Piedras Negras and its Neighbors. The PARI Journal XVII 1–15.
Schroder, W., Talavera, M.R., 2017. El Infiernito: Excavaciones y Reconocimiento. In: Schroder, W., Golden, C., Scherer, A.K. (Eds.), Proyecto Arqueológico Busilja-Chocolja: Informe de la Cuarta Temporada de Investigación. Informe entregado al Consejo de Arqueología del Instituto Nacional de Antropología e Historia, México, pp. 11–129.
Schroder, W.C., 2019. Community Resilience Through Crisis At El Infiernito, Chiapas, A Fortified Refuge In The Upper Usumacinta Valley. Department of Anthropology, University of Pennsylvania, Philadelphia. Unpublished Ph.D. dissertation.
Serafin, S., Lope, C.P., Uc González, E., 2014. Bioarchaeological Investigation of Ancient Maya Violence and Warfare in Inland Northwest Yucatan, Mexico. Am. J. Phys. Anthropol. 154, 140–151.
Shook, E., 1952. The Great Wall of Mayapán. Current Report Number 2. Carnegie Institution of Washington, Washington, DC.
Spencer, C.S., 2010. Territorial Expansion and Primary State Formation. Proc. Natl. Acad. Sci. 107, 7119–7126.
Stanish, C., Levine, A., 2011. War and Early State Formation in the Northern Titicaca Basin, Peru. Proceedings of the National Academy of Sciences, 13901-13906.
Stanton, T.W., 2019. Organized Violence in Ancient Mesoamerica. In: Morton, S.G. (Ed.), Seeking Conflict in Mesoamerica: Operational, Cognitive, and Experiential Approaches. University Press of Colorado, Boulder, pp. 207–219.
Stone, A., 1989. Disconnection, Foreign Insignia, and Political Expansion: Teotihuacan and The Warrior Stelae of Piedras Negras. In: Diehl, R.A., Berlo, J.C. (Eds.), Mesoamerica after the Decline of Teotihuacan. Trustees for Harvard University, Washington, DC, Dumbarton Oaks, pp. 153–172.
Stuart, D., 1998. Una Guerra Entre Yaxchilan y Piedras Negras?, in: Escobedo, H., Houston, S.D. (Eds.), Proyecto Arqueológico Piedras Negras: Informe Preliminar No. 2, Segunda Temporada, 1998. Informe Entregado al Instituto de Antropología e Historia de Guatemala, Guatemala City, Guatemala, pp. 389-392.
Stuart, D., 2007. The Captive on Piedras Negras, Panel 12. Maya Decipherment - A Weblog on the Ancient Maya Script http://decipherment.wordpress.com/2007/08/18/the-captives-on-piedras-negras-panel-12/, accessed 4/28/2011.
Thompson, J.E.S., 1954. The Rise and Fall of Maya Civilization. University of Oklahoma Press, Norman.
Tiesler, V., Cucina, A., 2012. Where Are the Warriors? Cranial Trauma Patterns and Conflict among the Ancient Maya, in: Martin, D.L., Harrod, R.P., R., P.V. (Eds.), The Bioarchaeology of Violence. University Press of Florida, Gainesville, pp. 160-179.
Tokovinine, A., 2019. Fire in the Land: Landscapes of War in Classic Maya Narratives. In: Morton, S.G., Peuramaki-Brown, M.M. (Eds.), Seeking Conflict in Mesoamerica: Operational, Cognitive, and Experiential Approaches. University Press of Colorado, Louisville, pp. 77–100.
Tozzer, A.M., 1941. Landa's Relación de las Cosas de Yucatan: A Translation. Harvard University Press, Cambridge.
VanDerwarker, A.M., Wilson, G.D., 2016. The Archaeology of Food and Warfare : Food Insecurity in Prehistory. Springer, Cham, Switzerland.
Wahl, D., Anderson, L., Estrada-Belli, F., Tokovinine, A., 2019. Palaeoenvironmental, Epigraphic and Archaeological Evidence of Total Warfare among the Classic Maya. Nat. Hum. Behav. 3, 1049–1054.
Webster, D., 1974. The Fortification of Becan, Campeche, Mexico, in: Adams, R.E.W. (Ed.), Preliminary Reports on Archaeological Investigations in the Rio Bec Area, Campeche, Mexico. Middle American Research Institute Publications 31, New Orleans, pp. 123-127.
Webster, D., 1975. Warfare and the Evolution of the State: A Reconsideration. Am. Antiq. 40, 464–470.
Webster, D., 1976. Lowland Maya Fortifications. Proc. Am. Philos. Soc. 120, 361–371.
Webster, D., 1978. Three Walled Sites of the Northern Maya Lowlands. J. Field Archaeol. 5, 375–390.
Webster, D., 2000. The Not So Peaceful Civilization: A Review of Maya War. J. World Prehistory 14, 65–119.
Weeks, J.M., Hill, J.A., Golden, C.W., 2005. Piedras Negras Archaeology: 1931–1939. The University of Pennsylvania Museum Press, Philadelphia.
Zender, M., 2002. The Toponyms of El Cayo, Piedras Negras, and La Mar. In: Stone, A. (Ed.), Heart of Creation: The Mesoamerican World and the Legacy of Linda Schele. University of Alabama Press, Tuscaloosa, pp. 166–185.
Zender, M., 2020. Disaster, Deluge, and Destruction on the Star War Vase. The Mayanist 2, 53–86.