Middle Preclassic Nixtun-Ch'ich': A lowland Maya primate/ritual city

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ARTICLE INFO	ABSTRACT
	It is argued that the southern lowland Maya city of Nixtun-Ch'ich' (Petén, Guatemala) centered a Middle Preclassic (ca. 900/800–400 BCE) primate settlement distribution and was the capital of an archaic state. This highly atypical, gridded site provides a new view of Maya socio-political development, contrasting with traditional rejection of the existence of true cities and early state-level organization. The city's roughly orthogonal urban grid of paved streets, mimicking the dorsal surface of a mythological creation crocodile while more pragmatically draining it of excess rainwater, defined 50+ sectors of dense construction with "E-Group" ritual architectural complexes at the monumental core. Six satellites of the city can be identified by similar complexes with shared orientations toward solar phenomena. The grid, drainage system, and creation landscape are evidence of massive labor mobilization for construction of public goods, and we argue a collective politico-ritual organization for early Nixtun-Ch'ich'.

The cosmovision approach to Mesoamerican cities emphasizes the symbolic role of cities and human replications of the cosmos. From this perspective, buildings were built and cities laid out to embody key Mesoamerican concepts of time and space. Cities were sacred places where myth and ritual were acted out, and their organization and nature cannot be explained without reference to cosmological ideas. Cities were also key nodes in a regional setting where cosmological concepts integrated agriculture, landscape, human society, and the supernatural into a coherent cultural model (Smith 2001, pp. 291–292).

1. Introduction

Historically, the Maya lowlands of eastern Mesoamerica, occupying the tropical-forested limestone shelf of the Yucatán Peninsula in southern Mexico, northern Guatemala (Petén), Belize, and adjacent areas (Fig. 1), were long considered backward developmentally. Compared with the volcanic highlands, especially central Mexico, the lowlands were seen as resource-poor, lacking true cities and states, and representing chiefdom-level socio-political organization. The sprawl of Classic-period (AD 200–800) sites fed early narratives that they were "vacant ceremonial centers," Eric Thompson (1966[1954], p. 66) reasoning that the damp, dark, interiors of stone buildings were not conducive to permanent habitation and harbored only a small priestly class of residents. Later archaeological and related research in the lowlands overturned these impressions, revealing that large Classic sites such as Tikal had early permanent resident populations (Coe 1965) and the region displayed greater societal complexity than previously understood. Such complexity can now be recognized a millennium earlier in the Middle Preclassic period (ca. 900/800–400 BCE).

The site of Nixtun-Ch'ich', (re-)discovered in 1995, occupies a pivotal position in this new view of the lowland Preclassic. We argue that Nixtun-Ch'ich', a large, atypically structured, and long-lived city in the southern Maya lowlands of Petén, centered a Middle Preclassic primate settlement distribution, and was the capital of an early or incipient primary state. Our purpose is not to inflate the vast literature defining "city," "urban," and "state" compiled by archaeologists, anthropologists, historians, sociologists, and others. Rather, we situate Nixtun-Ch'ich' within that context. We contend that it was an early, collectively governed city at the core of an archaic state, with satellite centers in its settlement hierarchy, all informed by the presence of "E-Group" ritual architectural complexes.

We loosely situate our arguments about the urban nature of Nixtun-Ch'ich' in a recent analysis of "dimensions" for defining cities and urbanism (Smith 2020). The primary dimensions include size, functions (political and economic), and life and society. Our focus is on the

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secondary dimensions: form (architecture, layout, planning), "meaning" (cosmic and religious symbolism, and ideological functions), and growth.

2. Cities, States, and Nixtun-Ch'ich'

Old debates about cities and urbanism in ancient Mesoamerica often focused on comparisons with those of the Old World and questions about primary dimensions, such as demographics, spatial extent, construction density, and diversity and organization of institutions and functions (for reviews, see, e.g., Chase, Chase, and Haviland 1990; Marcus 1983; Sanders and Webster 1988). The lowland Maya usually emerged from such hoary deliberations judged as lacking true cities (Sanders and Price 1968) and urban character, with dispersed rather than centralized commoner residency, low population sizes and densities, and little to no evidence of planning other than possibly cosmogrammatic.[1] Today, however, archaeologists acknowledge that large lowland Maya population centers are cities, just of a different sort: cities with low residential densities as part of "sustainable agrarian urbanism" (Isendahl and Smith 2013); "green" cities rather than "stone" cities (Graham 1999).

The same is true of understandings about state-level political organization. What is a "state"? Much of the literature about early or archaic states or state-level organization eschews precise definition of the terms, likely in tacit acknowledgment of their diversity through time and over space, and in recognition of distinctions vis-a-vis modern nation-states. Perhaps it is more informative to describe, rather than define, them. Descriptions focus not only on states' large populations and areal sizes and densities, but also on what they do and how they do it: institutions of power, divine rulers, specialized bureaucratic hierarchies of administration and decision-making (Wright 1977), complex political economies (Claessen and van de Velde 1991; Smith 2004), and territorial expansion (Spencer 2010). Participants in a conference comparing archaic states—those known only through archaeological investigations (plus indigenous writings where present)—agreed that these polities exhibit considerable variation but generally possess the following: minimally two socioeconomic classes; highly centralized and internally specialized government; standardized architecture implying a state religion; and full-time "priests" or religious personnel (Marcus and Feinman 1998, pp. 4–5).

With respect to the lowland Maya, studies of the early state and of ancient Maya cultural development displayed "almost mutual ignorance" of each other (Ploeg 1991, p. 215). This disregard is partly explained by a common belief that states simply did not develop or exist in a humid, tropical forest setting, such as that of the Maya, because of relatively poor soils and few resources (Ploeg 1991, pp. 216–217). Maya states were deemed late developments of the Classic period: "We can date the evolution of Lowland Maya society from chiefdom to state within rather precise limits; it apparently had taken place by A.D. 534" (Marcus 1993, p. 461). An ongoing dispute was whether Maya states had evolved without contact with pre-existing states, that is, as a "first generation," "pristine," or primary state (e.g., Late Preclassic El Mirador; Spencer and Redmond 2004, pp. 188–189), or were the product of such contact, or even takeover or conquest (secondary state). Now, scholars are examining the independent genesis of Maya states in the Middle Preclassic period (e.g., Traxler and Sharer 2016).

Here, in accepting that ancient lowland Maya cities are "different," we propose that lowland Maya archaic primary states and their circumstances and processes of nascence also might be "different," although still within the parameters of variability noted comparatively. We concur with those who emphasize large populations, the presence of standardized architecture, centralized decision-making or government, and internal complexity manifest as two (or more) classes, a state religion, and the presence of occupational specialists. We differ, however, in placing greater emphasis on ritual, ideology, and "religion" or belief systems writ large (Rice 2020b), rather than on secular or prosaic concerns, as they inform public architecture and occupational specialization.

The nineteenth-century French historian Numa Denis Fustel de Coulanges discussed the role of "religion"—for him, a belief system centering on ancestry and gods or supernaturals unique to each family—in the formation of ancient Greek cities and Rome. He also saw religion in a more corporate sense, as the foundation of social life, the city, and its institutions: The founding of an early city, analogous to a family, was a "religious" act, performed by a man who established "the sacred fire, … called the gods, and fixed them forever" there (Fustel de Coulanges 1877, pp. 177, 188). That founder became an important ancestor. Complementary perspectives come from Paul Wheatley's (1971, p. 418) thoughts on the role of belief systems in the layout of
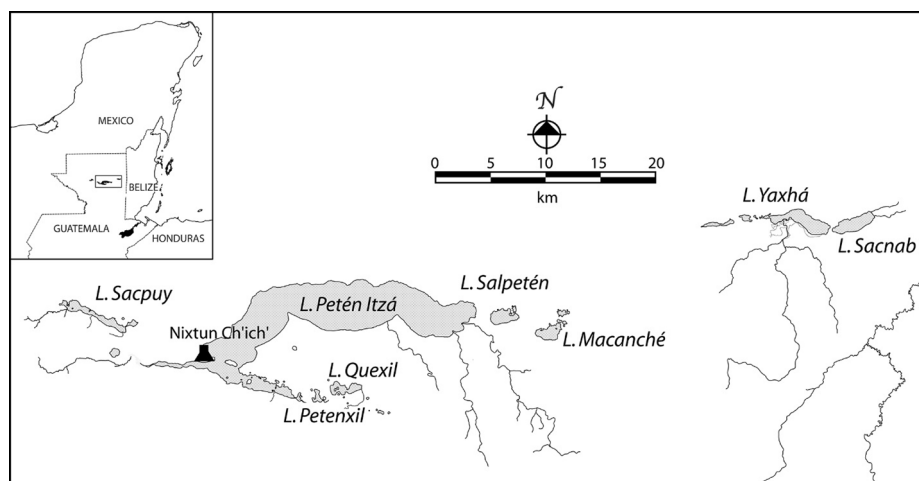

Fig. 1. The central Petén lakes area of the southern Maya lowlands of Mesoamerica, showing the location of Nixtun-Ch'ich'.

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[1] See epigram. The concept of cosmograms—models of the cosmos in site and architecture plans—is contentious in Maya archaeology (Ashmore 1989; Ashmore and Sabloff 2002; Smith 2003, 2005).

ancient Chinese "cosmo-magical" cities: an *axis mundi* permits communication among the cosmic planes, and the four cardinal directions delimit a sacred landscape for conducting rituals to ensure harmony between "macrocosmos and microcosmos."

2.1. City planning and planners

Nixtun-Ch'ich' is an early city that is atypical for the lowland Maya and in some ways more comparable to Old World urban centers. It lies on the western shore of Lake Petén Itzá, the largest (30 km east–west) and deepest lake in the Maya lowlands (Fig. 2). Lake Petén is the second-westernmost of eight bodies of water in a 76 km-long east–west chain of fault basins at ca. 17°–17.5° North latitude in the karstic geology of central Petén. A striking feature of Nixtun-Ch'ich' is its plan or layout: a modular grid of seven north–south "avenues" (alphabetically identified) intersecting six east–west "streets" (numbered) over an area of 2.5 km^2 (Pugh 2018; Pugh and Rice 2017). These roughly orthogonal corridors delineate 50 + alphabetically designated, quadrilateral sectors centered by an *axis urbis* oriented 94° 40', including an urban core of 1.1 km^2.

The uniqueness of the Nixtun-Ch'ich' gridded cityscape is accentuated by what we have proposed is its modeling of a mythical crocodilian creature or "earth monster," head to the east, on the Candelaria Peninsula (Fig. 3; Rice 2018, 2020a). According to a long-lived Maya creation myth, the reptile was sacrificed by gods who slit its throat (or decapitated it), then it rose from the primordial waters to form the earth's surface. This sacrifice established ordered space and was, therefore, the first cosmic planning. The city's layout reproduced this spatial order, with a crocodile emerging from Lake Petén Itzá (or perhaps entering it, its earth-forming work completed). The regular rectangular array of scutes on its dorsal surface was mimicked by the grid of raised platforms/mounds, and the sacrificial cut by the ditch of a wall-and-ditch complex at the base of the Peninsula. A "hole" in the mythical creature's back (Stuart 2005) is represented by a deep *fosa* or depression in Sector Y in the monumental core of the site (Rice and Pugh 2017).

Clearly this mammoth construction project at Nixtun-Ch'ich' required centralized planning and massive labor mobilization on the part of the city's early leaders. Most lowland Maya sites, Preclassic through Postclassic, grew by accretion, with successive rulers building new civic-ceremonial-palatial complexes to honor themselves or their ancestors. Nixtun-Ch'ich', however, was conceived and built "of a piece," apparently by devotees of whatever belief system the crocodilian creature materialized. The planning itself was a reenactment of the primeval establishment of cosmic order out of chaos. We argue that at early Nixtun-Ch'ich', decision-making specialization and authority rested on cosmo-political principles and was exercised by individuals or groups of ritual practitioners.

To date, unfortunately, we know nothing of those leaders or of the early governance structure in the region. The city's principals must have commanded profound respect and/or fear, as well as obeisance, but they were uncelebrated in sculptural or other art programs: the city is "faceless" (Pugh, Chan Nieto, and Zygadło 2020). Clearly, Middle Preclassic Maya leadership differed significantly from "divine kingship" of the Classic period (Pugh, n.d.). This latter form was likely imported from the Olmec region at the end of the Middle Preclassic period (Freidel 2018, p. 372).

2.2. Pre-Existing occupation

The Nixtun-Ch'ich' grid was imposed in the Middle Preclassic period over an area with light earlier occupation, much of which was cleared away to leave a clean bedrock foundation for new construction (Obrist-Farner and Rice 2019; Pugh and Rice 2017). Unfortunately, because of this removal and later overbuilding, little is known of the earlier occupation, but it can be recognized from two lines of evidence.

One line of evidence consists of pottery, which reveals early occupation around large, two-tiered Mound ZZ1 on the tip of the ~1 km-long Candelaria Peninsula (Rice 2009; South 2019; South and Rice 2021). There, pottery can be categorized into two "Pre-Mamom" ceramic complexes, the relatively uncommon and poorly known material dating before the more abundant Middle Preclassic pottery of the Mamom ceramic sphere. One complex, K'as, is represented by meager quantities of small fragments of rather poor-quality pottery, dated 1300–1100 and 1100–900 cal BC (the Late and Terminal Early Preclassic periods). It is mixed with pottery of the subsequent Chich ceramic complex, also Pre-Mamom, which dates (from interpolation between radiometrically dated deposits) to approximately 1100–900 cal BC. Excavations in the large, mainland part of Nixtun-Ch'ich', particularly above bedrock in Sectors Y, Z, AA, and BB, the monumental nucleus of the city, recovered only a few sherds of K'as pottery. These lowest construction levels, however, yielded a transitional mix of Chich and Middle Preclassic Nix Mamom pottery predating construction of the grid (Rice 2019b).

A second dataset pertaining to very early settlement at Nixtun-Ch'ich' comes from the north–south orientation. Such alignments are characteristic of what has been called the Middle Formative Chiapas (MFC) pattern in early communities in the Gulf Coast and Chiapas (Clark 2016; Clark and Hansen 2001). Two diagnostic components of the MFC pattern are a large pyramid in the north and an E-Group structural arrangement in the south, creating a plaza. In general, early north–south plans and axes are not common in the lakes area (Yaxhá in the east and Cerro Ortiz in the Lake Macanché basin are exceptions), replaced during the Middle Preclassic period by east–west orientations and heavily overbuilt in the Classic period. At Nixtun-Ch'ich', broad north–south Avenues G and H were likely early ceremonial entrances from the peripheries into the eastern end of the city's monumental core (Sectors AA and BB), where there was an E-Group and possibly an early plaza (Pugh 2018).

In the Middle Preclassic, southern Avenue G2 was paved to function not only as a point of entry for pedestrians approaching by canoe via the southwestern finger of Lake Petén Itzá, but also as a channel for discharging heavy seasonal rainwater into the lake (Pugh, Rice, Chan Nieto, Meranda, and Milley n.d.). The Nixtun-Ch'ich' urban grid does not tend to privilege particular locations (Pugh 2018)—that is, it is largely "non-focal"—but Avenues G and H are exceptions. These
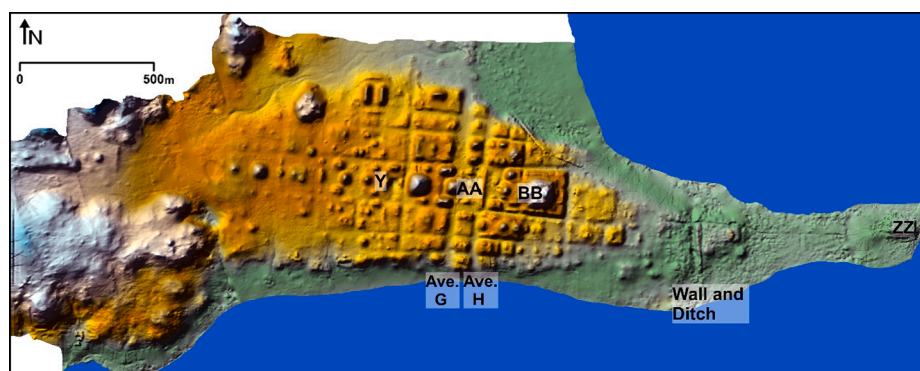

Fig. 2. The site of Nixtun-Ch'ich', showing the grid of streets and avenues, Sector Y and AA E-Groups, and other features mentioned in the text.
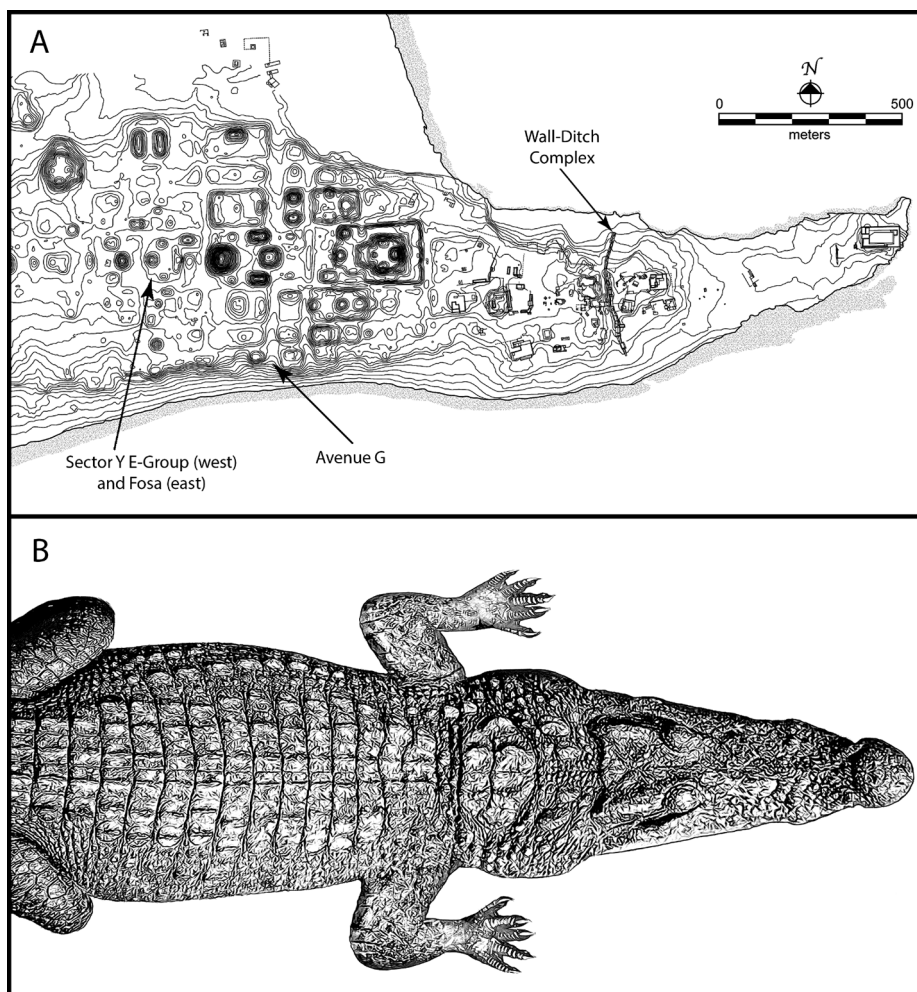
Fig. 3. The gridded layout of Nixtun-Ch'ich' as a crocodile (Rice 1920: Fig. 2).

entryways emphasized the Sector AA E-Group by heading directly to its two main buildings, producing a space of intensive focus (Pugh, Chan Nieto, and Zygadło 2020).

3. E-Groups, ideology, and power: Nixtun-Ch'ich' as a primate city

As mentioned, we contend that the chief functions of Nixtun-Ch'ich' were ideological. The power and influence of Nixtun-Ch'ich' lay in the cosmo-political and astro-calendrical realms, manifest in the city's gridded, crocodilian layout and in early civic-ceremonial architectural assemblages known as E-Groups. Seventeen E-Groups or possible E-Groups are found around the central Petén lakes (Rice and South 2022), 10 of which lie in the watershed of Lake Petén Itzá and one at Lake Sacpuy farther west (Fig. 4). Their presence provides a basis for proposing a Preclassic settlement system in the western lakes area, with these sites constituting satellites of Nixtun-Ch'ich'.
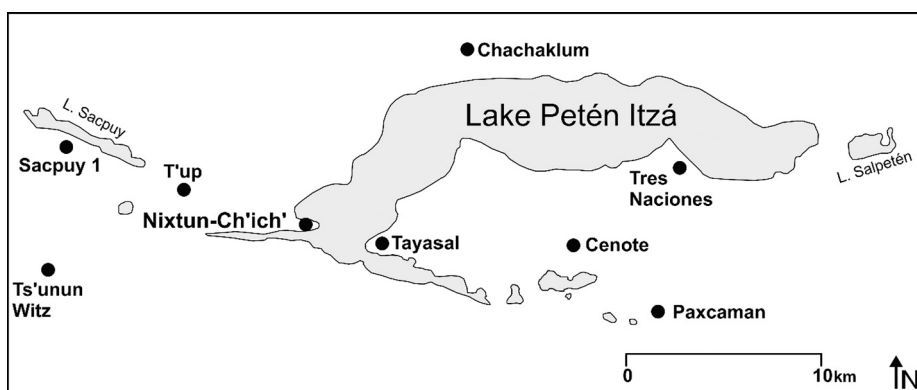

Fig. 4. Preclassic sites around Lake Petén Itzá and Lake Sacpuy with E-Groups (Pugh, Chan Nieto, and Zygadło 2020, Fig. 2).

3.1. E-Groups

The structural complexes known as E-Groups are widespread in Preclassic Mesoamerica, and were named for the first-identified (but relatively late-dating) arrangement at the southern Maya lowland site of Uaxactun in Petén. In idealized form, an E-Group consists of two edifices facing each other across a plaza. On the east is a low, north–south platform with three aligned buildings on the ends and center, here called a "tri-part structure" (similar to "eastern triadic structures" but distinct from later triangular arrangements known as "Triadic Groups"). Across the plaza in the west, a radial (square footprint, four stairways) pyramid lies centered on the eastern platform. Many Maya E-Groups were constructed in ways that recall mythical landscapes of creation: clearing soil to expose clean, white bedrock which was then carved into the cores of the two structures, later built out with rock and earth.

Deliberations about these groups emphasize their early dates and public usage: "a stage for communal ritual performances … .… The emergence of standardized ceremonial complexes exemplified by the E-Group assemblage and the MFC pattern were possibly associated with increasingly prescribed forms of interactions and shared notions of new social order" (Inomata, Triadan, Aoyama, Castillo, and Yonenobu 2013, p. 470). They are considered the earliest example of "a civic requirement for sociopolitical units . . . necessary for settlers to interact" (Doyle 2012, p. 369), and representative of a shared and unified belief system (Chase and Chase 2017, p. 32). The earliest excavated E-Group known thus far in Petén dates to 1000 BCE at Ceibal (Inomata, Triadan, Aoyama, Castillo, and Yonenobu 2013; Inomata et al., 2015), but it is not unlikely that others, perhaps including some still unexcavated, have similar dates. At Tikal's Mundo Perdido E-Group, thousands of fragments of Pre-Mamom pottery (Laporte and Fialko 1995, pp. 45–46) were deposited in *chultuns* with remains of feasts and similar events. As discussed below, two E-Groups at Nixtun-Ch'ich' were constructed about that same time.

These architectural arrangements exhibit some degree of standardization in that they have two buildings, linear east and pyramidal west, and this general resemblance is typically stressed. But they are also markedly variable. In Petén, two temporal and constructional variants of the tri-part eastern structure have been distinguished by their visible features (Fig. 5): "Cenote style" and "Uaxactun style" (Chase 1983; Chase and Chase 1995, 2017). The elongated Cenote variant has a large, central edifice offset to the back (east) of the north–south axis of its substructure, with two smaller platforms or buildings at the north and south ends of two extensions or wings. These lateral structures were accessed from behind the platform. In the Uaxactun style, all three buildings are superstructures aligned upon a single platform, with access from the plaza in front or west. Other variations exist, notably in the Belize Valley, where the three eastern structures were built independently and then conjoined (Awe, Hoggarth, and Aimers 2017).

E-Groups were built and rebuilt over many centuries, alignments changing and sometimes entire structures, especially the western pyramids, were leveled or overbuilt. Moreover, increasing awareness of spatial and temporal variations, not only in structural forms but also in alignments and azimuths throughout Mesoamerica (e.g., Šprajc 2015), reveals a more enigmatic reality. Although solar observation might have been the intent of the earliest versions of the assemblage—perhaps originally simply gnomons set upon a platform, as at La Venta's (Tabasco, Mexico) Group D—lunar and Venus positions also might have been marked (Šprajc 2015). In the Maya lowlands, functions doubtless changed over time, with apparent associations with trade (Laporte 1996; Stanton 2017), watersheds (Chase and Chase 2017, p. 34), and all manner of ritual: general agricultural (Cohodas 1980), maize-based (Rice 2017, p. 158; Stanton and Freidel 2003), and royal mortuary/ancestor veneration as, for example, at Cival (Estrada-Belli 2017, p. 297), Tikal (Laporte and Fialko, 1993), and in the Belize valley (Awe 2013; Awe, Hoggarth, and Aimers 2017, pp. 432–435).

Despite decades of study and consensus on E-Groups' early public, civic-ceremonial roles, archaeologists do not agree on more specific
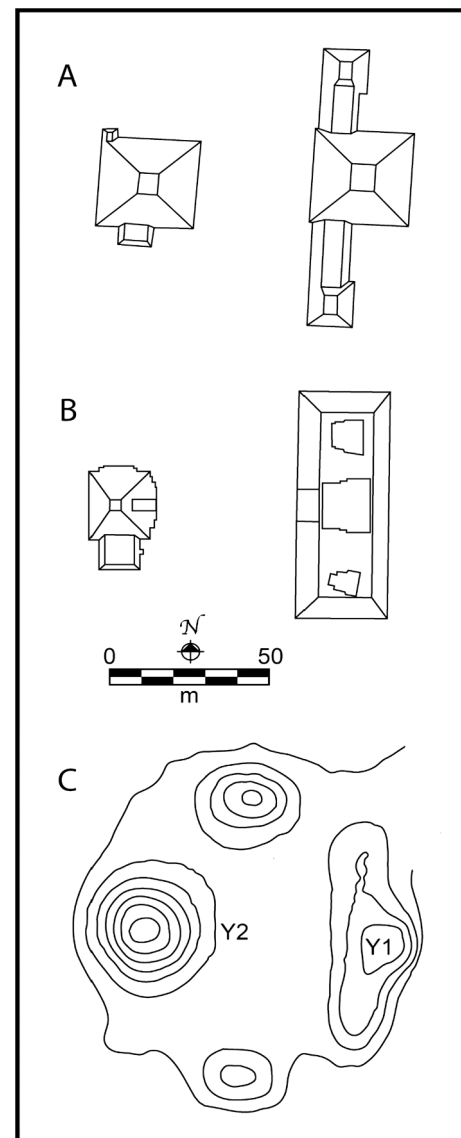

Fig. 5. E-Group structural variants: a, Cenote; b, Uaxactun; c, Nixtun-Ch'ich' Sector Y.

functions. The most enduring interpretation centers on naked-eye, horizon-based, solar-observational astronomy, particularly solstice stations. Nearly 100 years ago it was noted that, for an observer at the Uaxactun E-Group's western pyramid, sunrise points on the solstices and equinoxes appeared to coincide with architectural features (e.g., doorways; corners) of the three structures on the eastern platform (Blom 1924; Ricketson 1928. For more on E-Group hierophanies, see Dowd 2015). Why did some sites have multiple complexes? Perhaps they were "specialized" and dedicated to different cycles, solar and lunar, or cycles within cycles: Cival in northeast Petén, for example, had five groups, several of them visually "nested" and with alignments corresponding to equinoxes, solstices, zeniths, *haabs*, and so on (Estrada-Belli 2017, pp. 299–300, 430). In the central lakes, both Nixtun-Ch'ich' in the west and Yaxhá in the east had three E-Groups. At Yaxhá, two of those were in the site center and one was off to the southeast, perhaps representing the civic-ceremonial architecture of a certain social group associated with a distinct residential neighborhood or district. All three at Nixtun-Ch'ich' were constructed on the city's central axis, two in its monumental core. Eventually, E-Groups may have become largely commemorative places for public gatherings and ceremonies (Aveni and Hartung 1989; Fialko 1988; Laporte 1996), especially those associated with calendrical

cycling.

Moreover, any distinct "meanings," ritual or otherwise, of the two extant architectural styles of Maya tri-part eastern platforms, Cenote versus Uaxactun, are unclear. The Cenote style is considered primarily an early (Late Preclassic, 400 BCE–AD 200) form, whereas the Uaxactun variant, less common than Cenote, may date to the Early Classic. Both styles exhibit some internal variability, often have Middle Preclassic cores, and may represent significant remodeling and overbuilding. Superstructural differences may relate to changing emphases on the role of three beings, entities, or places—a mythical Three Stone Place, the three stones of the domestic hearth, three bright stars of the Orion constellation, three founding deities (e.g., Chase and Chase 2017, p. 63)—at the heart of cosmological order, or with growth in polity size and composition, or with different rituals and cycles being celebrated.

3.2. The Nixtun-Ch'ich' E-Groups

Nixtun-Ch'ich' has three E-Groups, all aligned on the city's central axis. Two are in Sectors Y and AA in the civic-ceremonial nucleus (Fig. 2); the third lies in Sector A in the far west and has not been excavated.

The city's Sector Y has two parts, eastern and western. The western half is an E-Group, its eastern tri-part structure (Structure Y1/1) 83.5 m long, oriented 3° east of North. Excavations on the west centerline revealed that construction began with about 50 cm of bedrock leveling topped by a Yum Transitional (mixed Pre-Mamom and early Nix Mamom Middle Preclassic) platform about 1.5 m high (Rice, Pugh, and Chan Nieto 2019). This was covered with 3 m of Nix construction and fills that included multiple walls, floors, and substructures. Excavation into Late Preclassic construction above uncovered two intrusive features on the centerline: an oval pit, probably from a stela placement, and a partial human cranium. The central building, also constructed (or reconstructed) during the Late Preclassic period, is set back, as in the Cenote style. Construction at the southern end of Structure Y1/1 may have been only a low platform, or perhaps an unfinished or partially dismantled superstructure. The tri-part structure was later damaged by Terminal Classic or subsequent activity.

The eastern half of Sector Y was built around a deep fosa—the "hole" in the back of the slain mythical creation crocodile. Likely a natural sinkhole and portal to the watery Underworld, this depression was the fulcrum of the city's central axis, anchoring the grid and the entire city in time and space (Rice and Pugh 2017). Surrounded by stone tiers of amphitheater-like seating, Fosa Y was a setting for community feasting and public performances. It is an example of Wheatley's (1971, p. 417) fixed point necessary to consecrate and "cosmicize" a sacred place. Sector Y was thus a sanctum sanctorum: a sacred landscape within a sacred landscape.

The Sector AA E-Group is represented by a low (ca. 2.5 m above bedrock) eastern platform, Structure AA1, approximately 136 m long and lacking surface evidence of tri-part architecture. Any western edifice that may have existed was overbuilt by the Structure Z2 pyramid. A test unit into the center of Structure AA1 suggested that it might have been Cenote-like in form, with its rear (east) facade having stairs and/or stepped. Earliest construction—30–35 cm of bedrock levelling—incorporated Yum Transitional pottery, covered by 70 cm of Nix fill (Rice, Cordell, Kidder, Harris, Pugh, and Chan Nieto 2018, p. 755, Fig. 2). Thus, earliest construction of the Sectors AA and Y E-Groups at Nixtun-Ch'ich' occurred coevally in "archaeological time."

The Sector A E-Group at the western end of the axis urbis has not been excavated. Its low eastern platform is 1–2 m high and 84 m long, similar to Structure Y1/1. The western pyramid has another smaller structure to its west (behind it), with two mounds bordering the northern and southern edges of the small plaza between them.

The three E-Groups help define the axis urbis of the city. Its western end is bounded by the Sector A E-Group; the eastern end is bounded by the large Structure ZZ1 platform, 3,050 m distant on the tip of the Candelaria Peninsula. These two endpoints coincide with geographic transitions: the lake to the east and karstic hills to the west. Such pronounced natural edges or "isolating boundaries" are strategic points and highly memorable (Lynch 1960, pp. 62–63). Significantly, similar E-Group/large platform bounding is also observed in the Middle Formative Chiapas (MFC) pattern (Clark 2016; Clark and Hansen 2001), including at Izapa (Rosenswig 2019, p. 97; Rosenswig and López-Torrijos 2018); however, these axes extend north–south. Thus, the termini of the Nixtun-Ch'ich' axis are composed as an architectural trope, incorporating E-Groups and representing orderly boundedness.

3.3. Nixtun-Ch'ich' and primacy

The singularity of early Nixtun-Ch'ich' is further underscored by what we propose is its position at the apex of a primate settlement hierarchy. Settlement hierarchies based on site-size variations provide one method for archaeologists to evaluate social, political, and economic complexity by inferred functions: the more levels, the more functions served. The lowest size/level comprises residential or domestic occupation and is undifferentiated; the presence of two levels of site and structure sizes typically indicates the existence of some degree of inequality and ranking (e.g., a chief's or big-man's house) above commoner dwellings. The existence of three- and four-levels of settlement sizes in a region—formalized in central place theory in economic (marketing) geography (e.g., Christaller 1966[1933])—bespeaks greater complexity in architectural, social, political, and economic differentiation and specialization within and between centers. In archaeology, site-size hierarchies and associated inferences of social inequality and political control have long contributed to discussions of the roles and relative importance of Classic lowland Maya centers vis-à-vis each other over a landscape. William R. Bullard (1960), for example, identified "major" and "minor" centers in his surveys of northeast Petén. Other similar schemes for ranking Maya settlement complexity have been based on numbers of courtyards (Adams and Jones 1981), construction volume (Turner, Turner, and Adams 1981), and display of Classic heraldic-like devices called emblem glyphs (Marcus 1973).

Primate systems are different from, and rarer than, other multi-level settlement hierarchies. In a primate settlement hierarchy, the top tier is occupied by a single central place or city, often a capital, that is many times larger in population and areal extent than the next lower center(s). A primate city proclaims "supereminence" (Jefferson 1979[1939]), its disproportionate size and centralized functions monopolizing control of regional socio-politico-economic relations, thereby retarding the developmental roles of smaller, lower-tier centers. In ancient Mesoamerica, the best-known primate city is the enormous and influential Classic highland Mexican city of Teotihuacan (see Nichols, 2016). Primate cities are not currently known in the Maya area, although they might have once existed but were heavily overbuilt.

The origins of primate cities are of no little interest. In some models of modern urbanization, primate cities are seen as lying at the heart of an early phase of development, beginning with "some degree of spatial dominance" followed by rapid population growth, largely through migration, to total domination (Geyer and Kontuly 1993, pp. 160–162). But their origins go back further, especially in Latin America and Southeast Asia, as legacies of colonialism and capitalism: they often began in coastal locations convenient for exporting goods, and/or as gateways for populating the interior (see Johnston 1977; also Linsky 1965). They are characterized by migration (below) and low economic and infrastructural development. The origins of ancient or pre-capitalist primate cities in lightly inhabited terrain, as was the setting of Middle Preclassic Nixtun-Ch'ich', may parallel these considerations: chiefly convenient access for early settlers (e.g., by water; and especially in times and places without wheeled vehicles) and proximity to valued resources, especially for subsistence.

3.4. Satellites of Nixtun-Ch'ich'

On the basis of our current understanding of the distribution of sites with E-Groups around western Lake Petén Itzá and Lake Sacpuy, we propose the existence of a primate settlement system with six satellite sites.[2]

One satellite is Tayasal, on the eponymous peninsula east of Nixtun-Ch'ich' (Pugh, Chan Nieto, and Zygadło 2020) (Fig. 4). Better known for its Classic and Postclassic occupations, Tayasal is a large site with a Cenote-style E-Group (see Chase 1983, Table 44), but its western building was apparently leveled and two structures on the eastern platform may be Postclassic (Chase 1983, Table 44; Chase and Chase 2017, p. 47; Pugh et al., 2012). Tayasal has a large, 8 m-high platform with its edges distinctively "stepped" and squared—like a grid with patterned truncations on all sides—in outline or plan view. This platform, which began to be constructed in the Middle Preclassic, covered 0.087 km² and was heavily modified by later construction, but maintained a general east–west axis oriented 99.5° east of North.

Two other satellites are T'up and Sacpuy 1. T'up (Fig. 6), a newly discovered, very small site west of Nixtun-Ch'ich', has a gridded plan like that city and a stepped footprint like the Tayasal platform (Pugh, Chan Nieto, and Zygadło 2020). T'up has suffered some recent destruction and has not yet been well mapped on the ground (or excavated), but drone mapping reveals that its grid covers 0.13 km² and is oriented to the southeast at ~108° east of North. Some version of an E-Group likely occupies its center. At Sacpuy 1, a small site on the south shore of Lake Sacpuy, the only significant architectural complex is an E-Group of indeterminate style (Martínez and Laporte 2010). This E-Group is oriented to the southeast rather than east and has a ceremonial core of approximately 0.086 km², the same size as the Tayasal platform. Other structures could be residential or administrative in function.

Sacpuy 1 lies approximately 13 km west-northwest of Nixtun-Ch'ich', with T'up midway between them, on a direct line oriented ~109°. Interestingly, Tayasal lies on an eastward extension of this alignment. Neither T'up nor Sacpuy 1 would have been directly visible from Nixtun-Ch'ich', however, given intervening low natural hills (Pugh, Chan Nieto, and Zygadło 2020).

Three other more distant sites with E-Groups in the Lake Petén Itzá basin were also likely secondary centers (Fig. 4). Chachakluum, on the north shore of the lake, has an E-Group thought to be Late Preclassic, but excavations have not been carried out to investigate initial construction. Farther east, Cenote and Paxcaman, on the south shore east of the small southern arm of the lake, are possible secondary centers (Pugh, Chan Nieto, and Zygadło 2020). Cenote is the type site of the Cenote-style E-Group (Chase 1983, pp. 298–301). Paxcaman, a sprawling site with multiple cores, was first mapped by Arlen Chase (1983, p. 1155), and recently partially re-mapped. One core, approximately 0.099 km² in area, has an MFC-like structural arrangement. Its Cenote-style E-Group (Fig. 7) has an eastern tri-part platform 96 m long and oriented 3°–3.5° off North, very close to that of Nixtun-Ch'ich'. This core plus that immediately to the south gives this portion of the site a strong north–south axis. A large (>100 m wide; 8–10 m deep) depression, resembling Fosa Y, lies to the east.

Motul de San José, an important Classic center on the north shore of the lake, lacks evidence of an E-Group as does Trinidad de Nosotros, its large satellite and port. This is odd given the complex's ubiquity at other lakes area sites, small and large. Perhaps their absence can be explained by scarce early occupation at Motul—"Middle Preclassic materials are rare" and it was probably "a relatively small site" (Moriarty 2004, pp. 37–38)—or maybe an E-Group once there was overbuilt.

4. Discussion

Why do some small population aggregations develop into large urban centers, and a proportion of them become primate cities or megalopolises? Myriad factors are at play, including resources, convenience, political organization, and serendipity. Most of these play into Smith's (2020) "dimensions" for defining cities and urbanism. The robusticity of our arguments for primacy is limited in several senses, chiefly by our inability, at this point in the excavation history of Nixtun-Ch'ich', to provide data on the polyvalent dimension of site size.

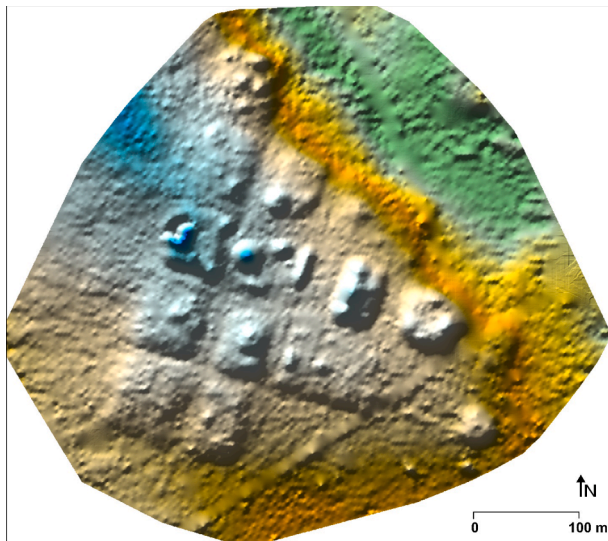One touchstone of site size is population size. In general, archaeology

Fig. 6. Drone-mapped plan of the small satellite of T'up, showing E-Group in the center.
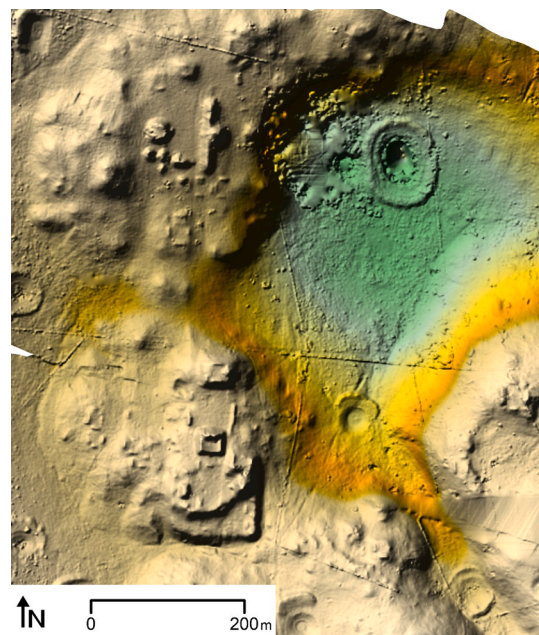

Fig. 7. Drone-mapped Cenote-style E-Group (upper left complex) at Paxcaman. Note the large natural sinkhole to the east.

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[2] In doing so, we follow Robert Rosenswig's (2019; Rosenswig and López-Torrijos 2018) reasoning in using the distribution of centers in the contemporaneous Middle and Late Preclassic Izapa (Chiapas) kingdom. There, lidar surveys revealed 41 centers exhibiting shared orientations and layouts (the Middle Formative Chiapas pattern, including E-Groups and ballcourts), that were used to reconstruct the region's settlement hierarchy.

does not permit accurate population estimates because of uncertainties about how many buildings were residential, were contemporaneously occupied, and by how many people (Rice and Culbert 1990, pp. 14–18). In the early central Maya lowlands, presumed Middle Preclassic domestic architecture tends to be ephemeral, resulting in seemingly "empty" platforms. Moreover, these problems are compounded by overbuilding: centuries of later remodeling, expansion, and reconstruction. Settlement area is a frequent proxy indicator of population size (Wright and Johnson 1975, p. 274; Rosenswig 2019, p. 99), but because Middle Preclassic Petén sites typically exhibit ceremonial cores surrounded by dispersed populations, we cannot readily draw boundaries around settlements. Thus, in comparing this center's size with that of its satellites having E-Groups, we argue primacy on the basis of areal extent of collectively constructed, public, ceremonial space—labor investment, in other words—rather than by numbers of people. The Nixtun-Ch'ich' urban core, defined as the area linked by the gridded corridors, occupies 1.1 km^2, whereas the satellites typically have cores of less than 0.1 km^2, or about 10 percent the size of the primate center.

4.1. Growth: Migration and monuments

As noted, our emphasis in characterizing Preclassic Nixtun-Ch'ich' as a primate city is on "secondary" dimensions of urban form, including its planned, gridded layout modeling a mythical, cosmic-creation crocodile, but also on the city's growth. Several causal phenomena seem to have played salient roles: migration, monuments (E-Groups), and "technology" (astro-calendrical observations).

Pottery and construction data indicate population growth well beyond that of natural reproduction rates (Rice 2019b, p. 487). Pottery of the Nix Mamom Middle Preclassic ceramic complex was recovered in virtually all excavations at the site, representing a significant areal expansion compared with the more limited occurrences of the preceding Late Chich complex. In addition, the varied shapes and decoration of slipped serving vessels, compared with earlier material, reveal the growing importance of prestige goods within a socially diversifying population, and their larger sizes indicate ostentatious displays of feeding larger groups of people, such as community-wide feasts like those around Fosa Y (Rice and Pugh 2017).

At this point we cannot precisely specify the proximate reasons or stimuli for the rapid growth of Nixtun-Ch'ich' from its barely visible Late Early Preclassic beginnings. Certainly, the setting was productive for early horticulture, with substantial areas of undated possible raised or ditched fields in the low terrain opposite the city on the other side of the narrow finger of the lake, as well as near T'up (Pugh, Chan Nieto, and Zygadło 2020). But migration is a critical factor in the growth of primate cities. All cities are magnets for in-migration because of their many and diverse opportunities for making a living and access to goods and services, and primate cities exert an especially compelling centripetal force. Early twentieth-century and later studies of such centers, particularly in developing countries, stress their "unifying effect": the people who migrate to them are mostly "pilgrims … born in the provinces, which unite in the composition of the capital … The primate city therefore expresses the national disposition more completely than any other city … and contributes much to the unification of the country" (Jefferson 1979[1939], pp. 229, 231). The wide distribution of Middle Preclassic ceramics, plus massive construction efforts, including establishment of the urban grid and monuments, are strong evidence of in-migration.

"Monuments"—here, E-Groups as examples of monumental public (or corporate) architecture—are intended to "accommodate the entire community and to be seen and used by all" (Stanish and Haley 2004, p. 53), and these also would have contributed to the city's growth. Several studies of the earliest lowland Maya E-Groups (e.g., Estrada-Belli 2011, 2017; Inomata et al., 2015; Rice 2017) have discussed the role of these architectural complexes in the transitions from mobile, hunting-gathering, subsistence-settlement patterns to sedentary horticulture, and the integration of peoples following either or mixed lifeways. Some

scholars working in different cultural contexts (Bradley 1998; Helms 1999) have proposed characteristics of belief systems that might have been transformed along with this transition: a restructuring of space-–time relations in the natural and social worlds, including the roles of humans and ancestors, and the legitimation of leaders in cosmologies and ontologies. Monuments and the corporate labor[3] mobilized for their construction symbolize continuities, demarcate sacred space, and signify a new order of time and place.

How do we get from temporary hunter-gatherer camps to early monumental constructions? One requirement is a reliable subsistence base (often framed as production of an economic surplus beyond household needs). Another is cooperative labor organized through "some kind of persuasive or coercive social mechanism" (Stanish and Haley 2004, p. 56), usually in the form of a leader or decision-maker. Such leaders might emerge out of the earliest permanent settlers in an area: kin groups that accrue prestige through their "first-comer" status (Kopytoff 1987, pp. 52–60) or by incentivizing cooperative activities on behalf of the larger collectivity, as with reciprocity and redistribution through feasts (Dietler and Hayden 2001). Their residential compounds may become appropriate settings for events of importance to the community as a whole, then develop into semi-public places invested with ancestral authority (Powis and Cheetham 2007), eventually commemorated by monuments. An example of this structural transformation is the paradigmatic E-Group at Uaxactun (Hendon 1999).

Through these and other mechanisms, monumental architecture contributes to the social fabric through creation and reinforcement of group identities (Jefferson's "national disposition"). Primate centers experience substantial in-migration from the hinterlands, which has the potential to pose significant threats to stability through growing social cleavages and inequalities (Anthony and Crenshaw 2014, pp. 13–14). In such difficult-to-manage circumstances, monuments play a critical role. They are typically public spaces where people interact face-to-face with both neighbors and others more socially or physically distant (Bradley 1998). Participation in rituals in these theater-like spaces enhances attendees' sense of place-based solidarity as they are immersed en masse in beliefs and practices uniting time, ancestors, and the cosmos. Shared rituals foster a sense of shared purpose, encouraging residents to favor the commons and act collectively for mutually beneficial outcomes. Ritual spaces, such as the monumental architecture of E-Groups—three of them at Nixtun-Ch'ich'—could have had strong unifying effects: centripetal forces to rein in spiraling heterogeneity resulting from emerging social inequalities (albeit not yet clearly discerned archaeologically) through social integration and group identity formation.

4.2. Ritual technology: Astro-Calendrics

E-Group architecture also points to the role of what we might call ritual technology—specifically, astro-calendrical observations and calculations—in the evolution of Nixtun-Ch'ich' as a primate center. With three E-Groups there and six at its satellites, that center would have had some kind of a religio-administrative role in the area.

An early astronomical function of E-Groups should not be too hastily discarded. Anthony Aveni (2002: 211; Aveni, Dowd, and Vining 2003) noted that around 17°N latitude, that of the central Petén lakes, the solar year can be "perfectly segmented into multiples of 20 days" or Maya calendrical units known as *winals*, roughly "months." Each segment ends on a solar solstice, equinox, or zenith/nadir passage. (It is of interest in this regard that E-Groups are scarce in the northern lowlands, the western Usumacinta drainage, and northeastern Belize.) This latitudinal zone, then, might have been fertile ground for elaboration of the Maya

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[3] The increasing labor devoted to monumental construction might have contributed to economic diversification and development of an occupational specialization in masonry, as in the Mirador Basin (Hansen 1998, pp. 71–105; Pugh and Rice 2017, p. 580).

sacred almanac of 260 days: 13 numerical prefixes times 20 named days in a *winal* (see also Estrada-Belli 2017, p. 320; Šprajc 2015, p. 26). That E-Groups had continuing astro-calendrical roles is evident into the Early Classic period, as some of the earliest-dated stelae in the southern lowlands were erected in front (west) of the eastern platform. These monuments typically celebrated completion of 20-year *k'atuns* (or *winikhaabs*) in Petén.

Rice (2017, 2019a) has proposed that the western Petén lakes area had a role in the observation and recording of these calendrical developments. Anthropomorphic fired-clay figurines were possible models for "head-variant" glyphs of the numbers associated with day names in Classic script referencing the almanac. Moreover, the aligned southeastern orientation of two satellite E-Groups with Nixtun-Ch'ich', one at Sacpuy 1 and another possible complex at T'up, suggests a local focus on the winter solstice. These two small sites, each consisting of little other than an E-Group, appear to have had astronomically functional specializations: sightings southeast to winter solstice sunrises at a ~108–110° azimuth (and perhaps back-sighting to summer solstice sunsets). According to an on-line calculator (www.suncalc.org), the 2019 winter solstice sunrise at the latitude of Nixtun-Ch'ich' was 112.9°N, approximately 3–5 degrees off this alignment.

Another, but much later, reference to winter solstice in the lakes area comes from Altar 1 at Zacpetén, a peninsular site in Lake Salpetén. This Terminal Classic (AD 849) monument was found broken in half with both pieces embedded into the façade of a structure in the Postclassic Group A temple assemblage. Its unusual text refers to historical personages, possibly a ruler of Zacpetén and his ancestry, but set in a mythological context of the winter solstice rebirth of the sun out of a "Mountain" and deep "maw" or hole (into the Underworld) (Stuart 2009). Although the rhetoric of a Maya king being (re)born from the Underworld is not uncommon (see Pacal's sarcophagus lid at Palenque, Chiapas), this cosmic imagery calls to mind the Nixtun-Ch'ich' Sector Y E-Group's ancient but timeless sacred landscape of *fosa* and mounds, especially the adjacent massive pyramid Z2 to the east (Pugh and Rice 2017; Rice and Pugh 2017).

4.3. Categorizing cities: collective organization and cooperation

A last point of discussion with respect to the Middle Preclassic role of Nixtun-Ch'ich' in the western Lake Petén Itzá basin concerns organizational institutions and power. Our understanding of these aspects of the city's early governance is limited not only by overbuilding of sites, but also by absence of the carved monuments, state art, and texts referencing polities or celebrating leaders that illuminate Classic centers' histories. Moreover, neither the grid nor the proposed urban primacy, alone or together, provide straightforward insights into, or models for, the social, economic, or political workings of this early city. Gridded cities have often been assumed to signify relatively democratic or quasi-egalitarian social structures, but historically they are found with varied politico-economic regimes, including monarchies and tyrannical concentrations of power (often military) and wealth (Grant 2001). Similarly, primate cities also have been associated with authoritarian, totalitarian, or despotic regimes and dictatorships (Ades and Glaeser 1995; Anthony and Crenshaw 2014).

Categorizations and typologies of pre-modern (and modern) cites, states, and approaches to power tend toward binaries or tripartite schemes. A recent categorization of cities identified two types, economic and political, the latter embracing most ancient cities and emphasizing administrative processes and powers (Smith and Lobo 2019). Earlier, Shmuel Eisenstadt and Ayelet Shachar (1987, pp. 68–74) identified two processes of urbanization, often overlapping, that led to the formation of cities and their different "internal ecological structures." One process is spatial concentration, especially of population, which produces an "economic city" with relatively high levels of internal divisions of labor and economic specialization. The second process is institutional centrality (centralization), especially of religious and political

administration, which produces hierarchically organized authority structures, priestly and administrative (and military). Cities formed by the forces of centrality tend to emphasize kinship and "tribal" ties, with order and legitimation based on religious sanctions. They are usually large—often primate cities and/or capitals—that dominate the small villages of their hinterlands through powerful politico-religious hierarchies; they are dependent on mobilizing continuously available surpluses, especially food products, thus contributing to stronger spatial integration. Thus far, excavations at Nixtun-Ch'ich' have revealed few signs of early specialized production: only figurines of white clay (Rice 2019a, p. 173) as possible early prestige goods (see Plourde, 2008). Otherwise, the site appears to exhibit the traits of a religious administrative city or state formed through forces of centrality.

An older three-part classification of urban centers categorized them by the kinds and loci of power they wielded—administrative, mercantile, and regal-ritual (Fox 1977). Nixtun-Ch'ich', like many later Mesoamerican cities, can be situated near the "regal-ritual" vertex of this functional triad. In such cities, the dominant components of power and influence are ideology and ritual display, rather than solely administrative or commercial activity.

In yet another characterization, "contractual/voluntaristic/benevolent" states lie at one end of a theoretical continuum, contrasted with "conflictive/coercive/predatory" states at the other (Blanton, Feinman, Kowalewski, and Peregrine 1996). Two politico-economic power strategies, a "dual processual theory," were identified in Mesoamerica: an individualized, centralized, "exclusionary" or network strategy and a more collective, corporate or group-oriented strategy of shared power. Late Preclassic Maya lowland polities were judged to represent corporate strategies in dual-processual theory and, given what is now better known about the Middle Preclassic lowlands, this is likely true of earlier times, too (Blanton, Feinman, Kowalewski, and Peregrine 1996, pp. 9, 13; see also Rice 2015). Socio-political structures in Melanesia are an analog, posited to fall on the "benevolent" end of the continuum, characterizable as knowledge- or wisdom-based, stressing reciprocity, and "supported by a ritual cycle emphasizing cosmological themes that transcend local belief systems" (Blanton, Feinman, Kowalewski, and Peregrine 1996, p. 3; Rice 2019a, pp. 19–20).

Gridded cities appear to pursue power through three societal strategies—diffusing, centralizing, and globalizing—and the large, Classic Mesoamerican primate center of Teotihuacan is an example of the "diffusing" or distributed (i.e., collective, cooperative) approach (Grant 2001, pp. 222, 225, Tables 1, 2). Teotihuacan's grid is characterized as non-hierarchical (and/or egalitarian), with blocks of approximately equal size and wide streets facilitating citizen movement throughout the city. The Nixtun-Ch'ich' grid also displays the wide streets and avenues that promote social interaction and access, but it is slightly hierarchical, having quadrilateral blocks of differing sizes and shapes. Neither city's grid is radial, which is highly focused and spatially efficient, especially in cities that are fundamentally politico-administrative (e.g., Washington, DC), but both are efficient with respect to their central monumental cores.

Nonetheless, one might question whether maximizing efficiency was even a goal at Nixtun-Ch'ich'. As at Teotihuacan, the sheer size and density of construction would have been impressive, especially to visitors, but awareness of treading upon a mythical creation earth monster could have inspired anything from reverence to terror. The city was a "cosmomagical symbol" like ancient Chinese cities and Inka Cusco (a puma) (Blanton and Fargher 2011, p. 515; see also Carl, Kemp, Laurence, Coningham, Higham, and Cowgill 2000). In commenting on the role of beliefs and religion in the foundation of cosmomagical Chinese cities, Paul Wheatley (1971, p. 417), noted that "Those religions which hold that human order was brought into being at the creation of the world tend to dramatize the cosmogony by reproducing on earth a reduced version of the cosmos." Inspiring awe (Yoffee 2015; Rice and Pugh 2017) is a more plausible aim.

The grids of both Nixtun-Ch'ich' and Teotihuacan were products of

collective community labor, and were public goods. The Nixtun-Ch'ich' grid served all members of society, enhancing their lives and livelihoods, as illustrated by four points. First, the corridors connected all parts of the city, thereby boosting social and economic opportunities. Second, they created impressive amounts of interconnected public space. Although in many societies streets and plazas have restricted uses and are heavily regulated by central government (Kostoff 1992, pp. 141–143), those at Nixtun-Ch'ich' did not focus exclusively on any particular area. Platform constructions in most sectors were surrounded by streets and avenues, so their use could not have been severely restricted. Two E-Groups were in the city center, not only visible to all but open for gatherings within their plazas, as opposed to being restricted, private spaces for elites. Third, the corridors were constructed to drain water from heavy seasonal rainfall out of the city, another public good (Pugh, Rice, Chan Nieto, Meranda, and Milley n.d.). Rather than leaving muddy paths for passage through the city, formal paved streets—which demanded huge commitments of corporate labor—were constructed to facilitate transit. Fourth, over and above these investments, the city's architecture highlighted an important creation myth and was faceless, displaying no evidence of a rulership cult, such as figural representations celebrating local leaders or sequestered living quarters ("palaces").

Finally, perspectives drawn from selectionist theory and evolutionary biology shed light on Middle Preclassic Nixtun-Ch'ich'. Religion and belief systems are mechanisms for institutionalizing prosocial behavior and cooperation, and costly signaling theory predicts that those systems imposing the greatest demands on believers compel the greatest levels of commitment and within-group cooperation (Irons 2001; Sosis 2004). For the Maya, such commitments translated to communal physical labor (e.g., installing the grid, paving public spaces, building E-Groups) and participation in rituals, such as those relating to beliefs about natural cycles, supernatural forces, and ancestors (Rice 2019a, pp. 18–21). Although the labor could have been commanded by tyrannical leaders, benign belief systems and ritual may have played a greater role. An "effective way to create and maintain cooperative labor organization … is to embed the production process in set schedules" associated with political ritual, feasting, and new behavioral norms and expectations: "ritual schedules labor" (Stanish 2013, p. 88). That scheduling is most effectively established through the cyclical rhythms of a calendar.

Here, we argue neither for egalitarianism nor against wealth/power concentration (a la Grant 2001) at Nixtun-Ch'ich'. Given the above review, we favor characterizing the city as a ritual/religio-administrative center with a "diffusing" or mildly "centralizing" power strategy. We propose that early social, economic, and political behaviors and institutions of Nixtun-Ch'ich' were embedded in an ethos variously described as collective, cooperative, collaborative, or corporate (see, e. g., Feinman and Carballo 2018).

5. Conclusions

Middle Preclassic Nixtun-Ch'ich' in central Petén is an intriguing anomaly. An early primate, (regal)-ritual city, Nixtun-Ch'ich' sat atop a two-tiered, cosmo-political, religio-administrative hierarchy and a three-tiered settlement hierarchy (Pugh, Chan Nieto, and Zygadło 2020). Its chief functions were not secular, neither strictly politico-administrative nor economic-commercial, but rather ideological and ritual. The existence of a large, dense center with a full, modular, urban grid in the Maya lowlands, especially so early, is unexpected. Compared with other contemporaneous (and later) cities, Nixtun-Ch'ich' is exceptional—a "city different" (to borrow the promotional characterization of Santa Fe, New Mexico)—in terms of strong evidence of planning and labor mobilization to build its orthogonal grid modeled on a mythical creation crocodile. Both unique features contribute to the city's primacy as a capital in the western Petén lakes area.

Available evidence points to the emergence of an early state at Nixtun-Ch'ich' in the Middle Preclassic period. The city was well planned and founded, suggesting the presence of unheralded individuals or groups with the knowledge as well as the ability to plan an entire city and successfully implement that plan. Its grid construction involved the leveling or erasure of earlier settlement(s), but we do not know if those settlements were occupied at the time, or had been abandoned; the degree of erosion and comminution of the pottery fragments argues for the latter. Structure ZZ1 at the tip of the Candelaria Peninsula had served as a ceremonial locus since the earliest use of pottery in the area (Rice 2009), but there is little settlement on the rest of the low-lying peninsula; perhaps ZZ1 was an early pilgrimage center (or even an early E-Group, later overbuilt).

We contend that the city amassed power and influence through astro-cosmo-calendrical beliefs and ritual, embodied in its E-Groups and those in its settlement hierarchy. E-Groups are widespread in the Maya lowlands (Freidel, Chase, Dowd, and Murdock 2017), but there is much we do not understand about their presence/absence and physical variability. Some communities built multiple E-Groups, but why did others, such as Motul de San José and Ixlú in the Lake Petén Itzá area, lack these early architectural assemblages? Was it a consequence of small populations, weak leadership, lack of resources, different beliefs, or something else?

We maintain that Middle Preclassic Nixtun-Ch'ich' likely operated via a cooperative or corporate (rather than coercive or competitive) system of government that emphasized the public good over celebrations of individual rulers or powerful leadership. Evidence is drawn primarily from its gridded layout, which, through its ready intelligibility, facilitated movement of the populace and access to all areas of the urban environment. The grid, which materialized an archetypal protagonist of an enduring cosmic-creation myth, also drained the city of excessive rainwater accumulation. Unfortunately, historical perspectives on gridded (and primate) cities show wide variations in social, economic, and political characteristics, with few if any strong correlates that would illuminate the management of Nixtun-Ch'ich' or activities and relations in its settlement hierarchy. Thus, not only do we currently not understand most of the city's functions and attributes, such as population size, social differentiation, political system and leaders, and economic pursuits (production, exchange; revenues and finance), we lack a comparative base of analogies for inferring these characteristics.

In deepest context, while natural and cosmic transitions and cycles—of plant growth, animal reproduction, seasons of weather, movement of celestial bodies—are everywhere, it is human calibration that gives them social meaning. Cycles establish the temporal parameters for both quotidian tasks and sacred rites, and these are formalized and administered through calendrical instruments. Central Petén E-Groups can be conceptualized in such terms: like calendars, they memorialize and celebrate earthly and celestial cycles; they articulate disparate temporal segments. They are "timescapes" (Rice 2017), and Nixtun-Ch'ich', a leviathan in the early Maya lowlands, played an enduring politico-ritual role in this eternal cycling.

6. Declarations

6.2. Availability of data and material

Artifacts and other data related to Nixtun-Ch'ich' are housed in the Proyecto Itza field headquarters in Flores, Petén.

6.3. Code availability

Not applicable.

6.4. Author contributions

Both authors contributed to the study conception and design. Field data collection and analysis were performed by Timothy Pugh; ceramic analysis by Prudence Rice. The first draft of the manuscript was written by Rice.

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.

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References

Adams, R.E.W., Jones, R.C., 1981. Spatial patterns and regional growth among Classic Maya cities. Am. Antiq. 46 (2), 301–322.

Ades, A.F., Glaeser, E.L., 1995. Trade and circuses: explaining urban giants. Q. J. Econ. 110 (1), 195–227.

Anthony, R.M., Crenshaw, E.M., 2014. City size and political contention: the role of primate cities in democratization. Int. J. Sociol. 44 (4), 7–33.

Ashmore, W., 1989. Construction and cosmology: Politics and ideology in lowland Maya settlement patterns. In: Hanks, W.E., Rice, D.S. (Eds.), Word and image in Maya culture: Explorations in language, writing, and representation. University of Utah Press, Salt Lake City, pp. 272–286.

Ashmore, W., Sabloff, J.A., 2002. Spatial orders in Maya civic plans. Latin Am. Antiq. 13, 201–215.

Aveni, A.F., 2002. Empires of time: Calendars, clocks, and cultures, rev. ed. University Press of Colorado, Boulder.

Aveni, A.F., Dowd, A.S., Vining, B., 2003. Maya calendar reform? Evidence from orientations of specialized architectural assemblages. Latin Am. Antiq. 14 (2), 159–178.

Aveni, A.F., Hartung, H., 1989. Uaxactun, Guatemala, Group E, and similar assemblages: An archaeoastronomical reconsideration. In: Aveni, A.F. (Ed.), World Archaeoastronomy. Cambridge University Press, Cambridge, UK, pp. 441–461.

Awe, J.J., 2013. Journey on the Cahal Pech time machine: an archaeological reconstruction of the dynastic sequence at a Belize Valley polity. Res. Rep. Belizean Archaeol. 10, 33–50.

Awe, J.J., Hoggarth, J.A., Aimers, J.J., 2017. Of apples and oranges: The case of E Groups and eastern triadic architectural assemblages in the Belize River valley. In: Freidel, D.A., Chase, A.F., Dowd, A.S., Murdock, J. (Eds.), Maya E Groups: Calendars, astronomy, and urbanism in the early lowlands. University Press of Florida, Gainesville, pp. 412–449.

Blanton, R.E., Fargher, L.F., 2011. The collective logic of pre-modern cities. World Archaeol. 43 (3), 505–522.

Blanton, R.E., Feinman, G.M., Kowalewski, S.A., Peregrine, P., 1996. A dual processual theory for the evolution of Mesoamerican civilization. Curr. Anthropol. 37, 1–14.

Blom, F., 1924. Report on the preliminary work at Uaxactún, Guatemala. Carnegie Inst. Washington Yearbook 23, 217–219.

Bradley, R., 1998. The significance of monuments: On the shaping of human experience in Neolithic and Bronze Age Europe. Routledge, London.

Bullard Jr., W.R., 1960. Maya settlement pattern in northeastern Petén, Guatemala. Am. Antiq. 25, 355–372.

Carl, P., Kemp, B., Laurence, R., Coningham, R., Higham, C., Cowgill, G.L., 2000. Viewpoint: Were cities built as images? Cambridge Archaeol. J. 10, 327–365.

Chase, A.F., 1983. A Contextual Consideration of the Tayasal-Paxcaman Zone, El Peten, Guatemala. Ph.D. dissertation. University of Pennsylvania, Philadelphia.

Chase, A.F., Chase, D.Z., 1995. External impetus, internal synthesis, and standardization: E Group assemblages and the crystallization of Classic Maya society in the southern lowlands. Acta Mesoamericana 8, 87–101.

Chase, A.F., Chase, D.Z., 2017. E Groups and the rise of complexity in the southeastern Maya lowlands. In: Freidel, D.A., Chase, A.F., Dowd, A.S., Murdock, J. (Eds.), Maya E

Groups: Calendars, astronomy, and urbanism in the early lowlands. University Press of Florida, Gainesville, pp. 31–71.

Chase, D.Z., Chase, A.F., Haviland, W.A., 1990. The Classic Maya city: reconsidering the "Mesoamerican urban tradition". Am. Anthropol. 92, 499–506.

Christaller, W., 1966[1933]. Central places in southern Germany. Prentice-Hall, Englewood Cliffs, NJ.

Clark, J.E., 2016. Western kingdoms of the Middle Preclassic. In: Traxler, L., Sharer, R.J. (Eds.), The origins of Maya states. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, pp. 123–224.

Clark, J.E., Hansen, R.D., 2001. The architecture of early kingship: comparative perspectives on the origins of the Maya royal court. In: Inomata, T., Houston, S.D., (Eds.), Royal courts of the ancient Maya: 2. Data and case studies. Westview, Boulder, CO, pp. 1–45.

Claessen, H.J.M., van de Velde, P. (Eds.), 1991. Early state economics (Political and Legal Anthropology Series, vol. 8. Transaction, New Brunswick, NJ.

Coe, W.R., 1965. Tikal, Guatemala, and emergent Maya civilization. Science 147, 1401–1419.

Cohodas, M., 1980. Radial pyramids and radial-associated assemblages of the central Maya area. J. Soc. Archit. Historians 39 (3), 208–223.

Dietler, M., Hayden, B., 2001. Feasts, archaeological and ethnographic perspectives on food, politics, and power. Smithsonian Institution Press, Washington, DC.

Dowd, A.S., 2015. Maya architectural hierophanies. In: Dowd, A.S., Milbrath, S. (Eds.), Cosmology, calendars, and horizon-based astronomy in ancient Mesoamerica. University Press of Colorado, Boulder, pp. 37–75.

Doyle, J.A., 2012. Regroup on E-Groups: monumentality and early centers in the Middle Preclassic Maya lowlands. Latin Am. Antiq. 34 (3), 355–379.

Estrada-Belli, F., 2011. The first Maya civilization, Ritual and power before the Classic period. Routledge, New York.

Estrada-Belli, F., 2017. The history, function, and meaning of Preclassic E Groups in the Cival region. In: Freidel, D.A., Chase, A.F., Dowd, A.S., Murdock, J. (Eds.), Maya E Groups: Calendars, astronomy, and urbanism in the early lowlands. University Press of Florida, Gainesville, pp. 293–327.

Feinman, G.M., Carballo, D.M., 2018. Collaborative and competitive strategies in the variability and resiliency of large-scale societies in Mesoamerica. Econ. Anthropol. 5, 7–19.

Fialko, V., 1988. Mundo Perdido, Tikal: un ejemplo de complejos de conmemoración astronómica. Mayab 4, 13–21.

Fox, R.G., 1977. Urban anthropology: Cities in their cultural settings. Prentice Hall, Englewood Cliffs, NJ.

Freidel, D.A., 2018. Maya and the idea of empire. In: Brown, M.K., Bey, G.J. (Eds.), Pathways to complexity: A view from the Maya lowlands. University Press of Florida, Gainesville, pp. 363–386.

Freidel, D.A., Chase, A.F., Dowd, A.S., Murdock, J. (Eds.), 2017. Maya E Groups: Calendars, astronomy, and urbanism in the early lowlands. University Press of Florida, Gainesville.

Geyer, H.S., Kontuly, T., 1993. A theoretical foundation for the concept of differential urbanization. Int. Reg. Sci. Rev. 15 (2), 157–177.

Graham, E., 1999. Stone cities, green cities. In: Bacus, E.A., Lucero, L.J. (Eds.), Complex polities in the ancient tropical world. Archeological Papers of the American Anthropological Association, Washington, DC, pp. 185–194.

Grant, J.L., 2001. The dark side of the grid: Power and urban design. Plan. Perspect. 16, 219–241.

Hansen, R.D., 1998. Continuity and disjunction: The Pre-Classic antecedents of Classic Maya architecture. In: Houston, S.D. (Ed.), Function and meaning in Classic Maya architecture. Dumbarton Oaks, Washington, DC, pp. 49–122.

Helms, M.W., 1999. Why Maya lords sat on jaguar thrones. In: Robb, J.E. (Ed.), Material symbols: Culture and economy in prehistory. Occasional Paper 26. Carbondale: Center for Archaeological Investigations, Southern Illinois University, pp. 56–69.

Hendon, J., 1999. The Pre-Classic Maya compound as the focus of social identity. In: Grove, D.C., Joyce, R.A. (Eds.), Social patterns in Pre-Classic Mesoamerica. Dumbarton Oaks, Washington, DC, pp. 97–125.

Inomata, T., MacLellan, J., Triadan, D., Munson, J., Burham, M., Aoyama, K., Nasu, H., Pinzon, F., Yonenobu, H., 2015. Development of sedentary communities in the Maya lowlands, coexisting mobile groups and public ceremonies at Ceibal, Guatemala. Proc. Natl. Acad. Sci. U.S.A., 112, 4268–4273.

Inomata, T., Triadan, D., Aoyama, K., Castillo, V., Yonenobu, H., 2013. Early ceremonial constructions at Ceibal, Guatemala, and the origins of lowland Maya civilization. Science 340, 467–471.

Irons, W., 2001. Religion as a hard-to-fake sign of commitment. In: Nesse, R. (Ed.), Evolution and the capacity for commitment. Russell Sage Foundation, New York, pp. 292–309.

Isendahl, C., Smith, M.E., 2013. Sustainable agrarian urbanism: The low-density cities of the Mayas and Aztecs. Cities 31, 132–143.

Jefferson, M., 1979[1939]. Why geography? The law of the primate city. Geogr. Rev. 79 (2), 226–232.

Johnston, R.J., 1977. Regarding urban origins, urbanization and urban patterns. Geography 62 (1), 1–8.

Kopytoff, I., 1987. The internal African frontier: The making of African political culture. In: Kopytoff, I. (Ed.), The African frontier: The reproduction of traditional African societies. Indiana University Press, Bloomington, pp. 3–84.

Kostoff, S., 1992. The city assembled: The elements of urban form through history. Bullfinch, London.

Laporte, J.P., 1996. La cuenca del Río Mopán-Belice: Una sub-región cultural de las tierras bajas maya central. In: Laporte, J.P., Escobedo, H. (Eds.), IX Simposio de Investigaciones Arqueológicas en Guatemala, 1995. Museo Nacional de Arqueología y Etnología and Asociación Tikal, Guatemala City, pp. 253–279.

Laporte, J.P., Fialko, V., 1993. El preclásico de Mundo Perdido: algunos aportes sobre los orígenes de Tikal. In: Laporte, J.P., Valdés, J.A. (Eds.), Tikal y Uaxactún en el preclásico. Instituto de Investigaciones Antropológicas, Universidad Nacional Autónoma de México, Mexico City, pp. 9–47.

Laporte, J.P., Fialko, V., 1995. Un reencuentro con Mundo Perdido, Tikal, Guatemala. Ancient Mesoamerica 6, 41–94.

Linsky, A.S., 1965. Some generalizations concerning primate cities. Ann. Assoc. Am. Geogr. 55 (3), 506–513.

Lynch, K., 1960. The image of the city. MIT, Cambridge, MA.

Marcus, J., 1973. Territorial organization of the lowland Maya. Science 180, 911–916.

Marcus, J., 1983. On the nature of the Mesoamerican city. In: Vogt, E.Z., Leventhal, R.M. (Eds.), Prehistoric settlement patterns. University of New Mexico Press, Albuquerque, pp. 195–242.

Marcus, J., 1993. Lowland Maya archaeology at the crossroads. Am. Antiq. 48 (3), 454–468.

Marcus, J., Feinman, G.M., 1998. Introduction. In: Feinman, G.M., Marcus, J. (Eds.), Archaic states. School of American Research, Santa Fe, NM, pp. 3–13.

Martínez, G.O., Laporte, J.P., 2010. Laguna Sacpuy en el centro de Petén y su asentamiento arqueológico. In: Arroyo, B., Linares, A., Paiz, L. (Eds.), XXIII Simposio de Investigaciones Arqueológicas en Guatemala, 2009. Museo Nacional de Arqueología y Etnología, Guatemala City, pp. 331–457.

Moriarty, M.D., 2004. Settlement archaeology at Motul de San José, Petén, Guatemala. Preliminary results from the 1998–2003 seasons. Mayab 17, 21–44.

Nichols, D.L., 2016. Teotihuacan. J. Archaeol. Res. 24, 1–74.

Obrist-Farner, J., Rice, P.M., 2019. Nixtun-Ch'ich' and its environmental impact: sedimentological and archaeological correlates in a core from Lake Petén Itzá in the Maya lowlands, Guatemala. J. Archaeol. Sci.: Rep. 26 https://doi.org/10.1016/j.jasrep.2019.05.033.

Ploeg, R., 1991. Divide and pool: Early state economics and the Classic Maya. In: Claessen, H.J.M., van de Velde, P., (Eds.), Early State Economics. Political and Legal Anthropology Series, vol. 8. Transaction, New Brunswick, NJ, pp. 215–230.

Plourde, Aimee, 2008. The origins of prestige goods as honest signals of skill and knowledge. Hum. Nat. 19, 374–388. https://doi.org/10.1007/s12110-008-9050-4.

Powis, T.G., Cheetham, D., 2007. From house to holy: Formative development of civic-ceremonial architecture in the Maya lowlands. Res. Rep. Belizean Archaeol. 4, 177–186.

Pugh, T.W., 2018. From the streets, public and private space in an early Maya city. J. Archaeol. Method Theory 26, 967–997.

Pugh, T.W., n.d. Social complexity and the Middle Preclassic lowland Maya. Accepted for publication in J. Archeol. Res.

Pugh, T.W., Chan Nieto, E.M., Zygadło, G.W., 2020. Faceless hierarchy at Nixtun-Ch'ich', Peten, Guatemala. Ancient Mesoamerica 31 (2), 248–260.

Pugh, T.W., Rice, P.M., 2017. Early urban planning, spatial strategies, and the Maya gridded city of Nixtun-Ch'ich', Petén, Guatemala. Curr. Anthropol. 58 (5), 576–603.

Pugh, T.W., Rice, P.M., Chan Nieto, E.M., Meranda, M.L., Milley, D.S., n.d. Middle Preclassic hydraulic planning at Nixtun-Ch'ich', Petén, Guatemala. In: Reese-Taylor, K., Vásquez López, V.A. (Eds.), Sociopolitical and economic transformations in the Maya lowlands during the Middle Preclassic Period (1000–300 BC). Special issue of Ancient Mesoamerica.

Pugh, T.W., Sánchez Polo, R., Shiratori, Y., 2012. Contact and missionization at Tayasal, Petén, Guatemala. J. Field Archaeol. 37, 3–19.

Rice, D.S., Culbert, T.P., 1990. Historical contexts for population reconstruction in the Maya lowlands. In: Culbert, T.P., Rice, D.S. (Eds.), Precolumbian population history in the Maya lowlands. University of New Mexico Press, Albuquerque, pp. 1–36.

Rice, P.M., 2009. Mound ZZ1, Nixtun-Ch'ich', Petén, Guatemala: Rescue operations at a long-lived structure in the Maya lowlands. J. Field Archaeol. 34 (4), 403–422.

Rice, P.M., 2015. Middle Preclassic interregional interaction and the Maya lowlands. J. Archaeol. Res. 23 (1), 1–47.

Rice, P.M., 2017. The E Group as timescape: Early E Groups, figurines, and the sacred almanac. In: Freidel, D.A., Chase, A.F., Dowd, A.S., Murdock, J. (Eds.), Maya E Groups: Calendars, astronomy, and urbanism in the early lowlands. University Press of Florida, Gainesville, pp. 135–176.

Rice, P.M., 2018. Maya crocodilians: Intersections of myth and the natural world at early Nixtun-Ch'ich', Petén, Guatemala. J. Archaeol. Method Theory 25 (3), 705–738.

Rice, P.M., 2019a. Anthropomorphizing the cosmos: Middle Preclassic lowland Maya figurines, ritual, and time. University of Colorado, Louisville.

Rice, P.M., 2019b. Early pottery and construction at Nixtun-Ch'ich', Petén, Guatemala: Preliminary observations. Latin Am. Antiq. 30 (3), 471–489.

Rice, P.M., 2020a. Crocodiles, sharks, and some speculations on central Petén Preclassic history. Ancient Mesoamerica 31 (2), 230–247.

Rice, P.M., 2020b. In search of Middle Preclassic lowland Maya ideologies. J. Archaeol. Res. https://doi.org/10.1007/s10814-020-09144-y.

Rice, P.M., Cordell, A.S., Kidder, G., Harris Jr., W.G., Pugh, T.W., Chan Nieto, E.M., 2018. Early construction at Nixtun-Ch'ich', Petén, Guatemala: an architectural footing and bonding sample. J. Archaeolog. Sci.: Rep. 17, 754–761.

Rice, P.M., Pugh, T.W., 2017. Water, centering, and the beginning of time at Middle Preclassic Nixtun-Ch'ich', Petén, Guatemala. J. Anthropol. Archaeol. 48 (5), 1–16.

Rice, P.M., Pugh, T.W., Chan Nieto, E.M., 2019. Early construction of a Maya sacred landscape: The Sector Y "E-Group" of Nixtun-Ch'ich' (Petén, Guatemala). J. Field Archaeol. 44 (8), 550–564.

Rice, P.M., South, K.E., 2022. The beginnings of complexity in the central Petén lakes area. In: deLance, L., Feinman, G.M. (Eds.), Framing complexity: Vantages from Formative Mesoamerica. University Press of Colorado, Louisville.

Ricketson Jr., O.G., 1928. Astronomical observatories in the Maya area. Geogr. Rev. 18, 215–225.

Rosenswig, R., 2019. The Izapa kingdom's capital: Formative period settlement patterns, population, and dating low-relief stelae. Latin Am. Antiq. 30 (1), 91–108.

Rosenswig, R., López-Torrijos, R., 2018. Lidar reveals the entire kingdom of Izapa during the first millennium BC. Antiquity 92 (365), 1292–1309.

Sanders, W.T., Price, B., 1968. Mesoamerica, the evolution of a civilization. Random House, New York.

Sanders, W.T., Webster, D., 1988. The Mesoamerican urban tradition. Am. Anthropol. 90, 521–546.

Smith, M.E., 2001. Urbanization. In: Carrasco, D. (Ed.), The Oxford Encyclopedia of Mesoamerican Cultures. Oxford University Press, Oxford, pp. 291–294.

Smith, M.E., 2003. Can we read cosmology in ancient maya city plans? Comment on Ashmore and Sabloff. Latin Am. Antiq. 14, 221–228.

Smith, M.E., 2004. The archaeology of ancient state economies. Ann. Rev. Anthropol. 33, 73–102.

Smith, M.E., 2005. Did the Maya build architectural cosmograms? Latin Am. Antiq. 16 (2), 217–224.

Smith, M.E., 2020. Definitions and comparisons in urban archaeology. J. Urban Archaeol. 1, 15–30.

Smith, M.E., Lobo, J., 2019. Cities through the ages: One thing or many? Front. Digital Human. https://doi.org/10.3389/fdigh.2019.00012.

Sosis, R., 2004. The adaptive value of religious ritual. Am. Sci. 92, 166–172.

South, K.E., 2019. Value and depositional history of early Maya pottery in the Petén lakes region of Guatemala. Ph.D. dissertation. Department of Anthropology, Southern Illinois University Carbondale.

South, K.E., Rice, P.M., 2021. Dynamics of early pottery from the Petén lakes area. In: Walker, D. (Ed.), Pre-Mamom pottery variation and the Preclassic origins of the lowland Maya. University Press of Colorado, Boulder.

Spencer, C.S., 2010. Territorial expansion and primary state formation. Proc. Natl. Acad. Sci. USA 107, 7119–7126.

Spencer, C.S., Redmond, E.M., 2004. Primary state formation in Mesoamerica. Ann. Rev. Anthropol. 33, 173–199.

Šprajc, I., 2015. Pyramids marking time: Anthony F. Aveni's contributions to the study of astronomical alignments in Mesoamerican architecture. In: Dowd, A.S., Milbrath, S. (Eds.), Cosmology, calendars, and horizon-based astronomy in ancient Mesoamerica. University Press of Colorado, Boulder, pp. 19–36.

Stanish, C., 2013. The ritualized economy and cooperative labor in intermediate societies. In: Carballo, D.M. (Ed.), Cooperation and collective action: archaeological perspectives. University Press of Colorado, Boulder, pp. 83–92.

Stanish, C., Haley, K.J., 2004. Power, fairness, and architecture: modeling early chiefdom development in the central Andes. Archeol. Papers Am. Anthropol. Assoc. 14, 53–70.

Stanton, T.W., 2017. The founding of Yaxuná: Place and trade in Preclassic Yucatán. In: Freidel, D.A., Chase, A.F., Dowd, A.S., Murdock, J. (Eds.), Maya E Groups: Calendars, astronomy, and urbanism in the early lowlands. University Press of Florida, Gainesville, pp. 450–479.

Stanton, T.W., Freidel, D.A., 2003. Ideological lock-in and the dynamics of Formative religion in Mesoamerica. Mayab 16, 5–14.

Stuart, D., 2005. The inscriptions from Temple XIX at Palenque. Pre-Columbian Art Research Institute, San Francisco.

Stuart, D., 2009. The symbolism of Zacpetén Altar 1. In: Rice, P.M., Rice, D.S. (Eds.), The Kowoj: Identity, migration, and geopolitics in Late Postclassic Petén, Guatemala. University Press of Colorado, Boulder, pp. 317–326.

Thompson, J.E.S., 1966[1954]. The rise and fall of Maya civilization, second ed. University of Oklahoma Press, Norman.

Traxler, L., Sharer, R.J. (Eds.), 2016. The origins of Maya states. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia.

Turner, E.S., Turner, N.I., Adams, R.E.W., 1981. Volumetric assessment, rank ordering, and Maya civic centers. In: Ashmore, W. (Ed.), Lowland Maya settlement patterns. School of American Research & University of New Mexico Press, Albuquerque, pp. 71–88.

Wheatley, P., 1971. The pivot of the four quarters. A preliminary enquiry into the origins and character of the ancient Chinese city. Aldine, Chicago.

Wright, H.T., 1977. Recent research on the origin of the state. Ann. Rev. Anthropol. 6, 379–397.

Wright, H.T., Johnson, G.A., 1975. Population, exchange, and early state formation in southwestern Iran. Am. Anthropol. 77, 267–289.

Yoffee, N., 2015. Conclusion: The meanings of early cities. In: Yoffee, N., (Ed.), Early cities in comparative perspective, 4000 BCE–1200 CE. The Cambridge World History, vol. III. Cambridge University Press, Cambridge, pp. 546–557.