Original Study

Michael E. Smith*

The Teotihuacan Anomaly: The Historical Trajectory of Urban Design in Ancient Central Mexico

https://doi.org/10.1515/opar-2017-0010
Received May 24, 2017; accepted August 9, 2017

Abstract: The ancient Mexican city of Teotihuacan had the most aberrant design of any city in ancient Mesoamerica. I examine similarities and differences between the design of Teotihuacan and other Mesoamerican cities. During the Preclassic period, a set of common Mesoamerican planning principles emerged. The designers of Teotihuacan rejected most of these principles in favor of a new and radical set of planning concepts. After the fall of Teotihuacan, subsequent urban planners ignored the Teotihuacan principles and returned to ancient Mesoamerican planning ideas. Elements of the Teotihuacan plan did not resurface until the Mexica of Tenochtitlan revived them for a specific goal. The historical sequence of central Mexican city layouts highlights the anomalous character of Teotihuacan's principles of urban design within the canons of ancient Mesoamerican urbanism.

Keywords: Urban planning; cities; Mesoamerica; Teotihuacan

1 Introduction

Where does the ancient city of Teotihuacan fit within the traditions of central Mexican urbanism and society? This question has elicited a diversity of answers from scholars. Some emphasize the continuities with earlier and later cities and states, while others stress the unique features of Teotihuacan. David Carballo (2016:213), for example, points out continuities between Teotihuacan and earlier central Mexican societies. The people of Teotihuacan used ritual objects similar to those of earlier peoples, and Carballo posits a "shared architectural grammar" (p. 213) before and during Teotihuacan times. Other archaeologists claim strong continuities in city form and economic organization between Teotihuacan and the later large central Mexican cities of Tula and Tenochtitlan (Mastache, Cobean, & Healan, 2002; Sanders & Santley, 1983). Art historian Esther Pasztory, on the other hand, has argued strongly for the uniqueness of Teotihuacan's society, government, and urban design within Mesoamerica. In her view, Teotihuacan was a utopian society based on an ideology of impersonal order and egalitarianism, and these produced a unique urban structure (Pasztory, 1992, 1997).

One of the most obvious ways that the city of Teotihuacan stands out is its planned orthogonal layout; very few other Mesoamerican cities employed orthogonal planning, and none used it as extensively as Teotihuacan. In this paper I focus on the planning and design of Teotihuacan to evaluate its degree of continuity versus disjunction with earlier and later cities in central Mexico. My conclusions are clear and strong: there were two episodes of major re-orientation of urban design in the central Mexican past: the innovative and radical layout of Teotihuacan itself, and then the later rejection of that layout by subsequent cities. Although urban design and urban planning are usually separated as distinct activities and fields of study in modern planning (Cuthbert, 2006), I use these terms interchangeably here.

***Corresponding author: Michael E. Smith,** Arizona State University, Tempe, United States, E-mail: mesmith9@asu.edu

A tradition of urban planning originated in Mesoamerica with the earlies towns and cities during the Preclassic epoch (2000–0 BC). By the Late Preclassic period (ca. 500 BC–0), cities with shared traits of urban form had emerged in various parts of Mesoamerica, including the central Mexican highlands. Teotihuacan most likely resembled other Late Preclassic Mesoamerican cities during its earliest manifestation, although the lack of information on buildings and layout in the earliest periods limits our understanding of the early city. Before long, the designers of the city created a series of innovations. In some cases these took the form of avoiding standard Mesomaerican urban traits (such as ballcourts or royal palaces), and in other cases these innovations were new features of urban layout (such as the use of a central avenue and apartment compounds as residences). By the time the city reached is maximal size, it was an utterly uniquely designed city within Mesoamerica.

After the collapse of Teotihuacan in the sixth century AD, cities in central Mexico returned to the planning principles of the ancient Mesoamerican tradition. They failed to adopt the new Teotihuacan traits, and this denial—or perhaps rejection—of Teotihuacan planning principles continued through the Aztec period. Then, in the Late Postclassic period, designers of the growing imperial capital Tenochtitlan broke with central Mexican tradition and reached back to the Teotihuacan past for architectural and planning inspiration, after a gap of many centuries.

My proposed historical outline is shown in Figure 1. I argue below that the changes in layout and planning before and after Teotihuacan were so radical that they can be interpreted as the deliberate rejection of the previous period's urban principles, at both the beginning and the end of Teotihuacan.

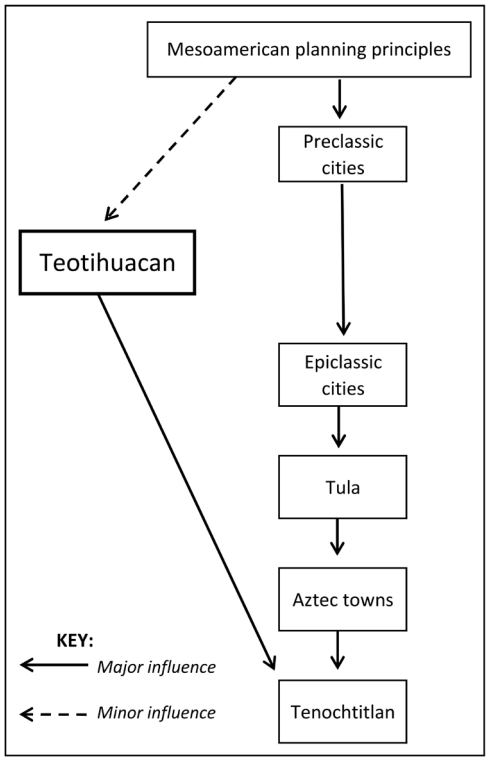

Figure 1. Historical trajectory of urban planning in central Mexico. Graphic by author.

2 Origin of the Mesoamerican Planning Principles

During the Early and Middle Preclassic periods a variety of separate social, economic and religious practices and concepts coalesced into the Mesoamerican cultural tradition (Guzmán V. & Martínez O., 1990; Joyce, 2000; Kirchhoff, 1943). This was the time when the first urban settlements were established. While the size

and social complexity of many of these were insufficient to label them "urban" according to the sociological definition of urbanism (Wirth, 1938), these settlements do conform to the functional and attribute-based definitions of urban settlements (Smith, 2016).

The cities and towns of Preclassic Mesoamerica adopted a common set of architectural and spatial features that I refer to as "the Mesoamerican planning principles." These include types of building (temple-pyramids, royal palaces, and ballcourts), formal open spaces (plazas), and a spatial dichotomy between a central area (the epicenter) that contains most of the civic architecture arranged with a planned configuration, and surrounding residential zones that exhibit little or no planning in their arrangement. These features characterized nearly all Mesoamerican urban centers from Preclassic times until the Spanish conquest, with one major exception: Teotihuacan.

Table 1. Preclassic Mesoamerican urban features.

	Urban feature
Buildings and spaces:	
*	Pyramids
	Temples
*	Royal compounds
*	Ballcourts
*	Formal, patterned plazas
	E-groups
	Acropoli measuring about 80 meteres square
Associated urban features:	
	Arrangements of 4 god masks on pyramid facades
	Stone sculptures (altars and stelae)
	Thrones
	Axial placement of offerings
	Royal tombs and crypts
Images and iconography:	
	Regal vestments and jewelry
	Jester-god crowns
	Snake scepters
	Special headdresses and capes
	Memorial monuments to kings
	Representations of gods

Note: Data from Clark & Hansen (2001: 33-34)

* Included in Mesoamerican planning principles

The first four Mesoamerican planning principles are included in John Clark and Richard Hansen's (2001:33-34) list of urban traits at Preclassic Maya and Olmec sites (Table 1). The *temple-pyramid*—a pyramidal structure with one or more temples at the top, reached by stairs—was the most widespread urban feature in ancient Mesoamerica. The Olmec site of La Venta, Tabasco (400–800 BC) had the earliest pyramid in Mesoamerica (González Lauck, 1996; Pool, 2007:156-175). Scholars are divided on whether this structure originally had the form of a fluted cone, or whether its round shape derives from erosion and weathering; also, it is not clear whether there was a temple on top (Figure 2A). By the Late Preclassic period, the standard

Mesoamerican rectangular temple-pyramid was being built in urban centers throughout the area. The site of Izapa, Chiapas (Ekholm, 1969; Lowe, Lee, & Martínez Espinosa, 1982; Rosenswig, López-Torrijos, Antonelli, & Mendelsohn, 2013) is a typical example of a Late Preclassic city with several temple-pyramids (Figure 2B).

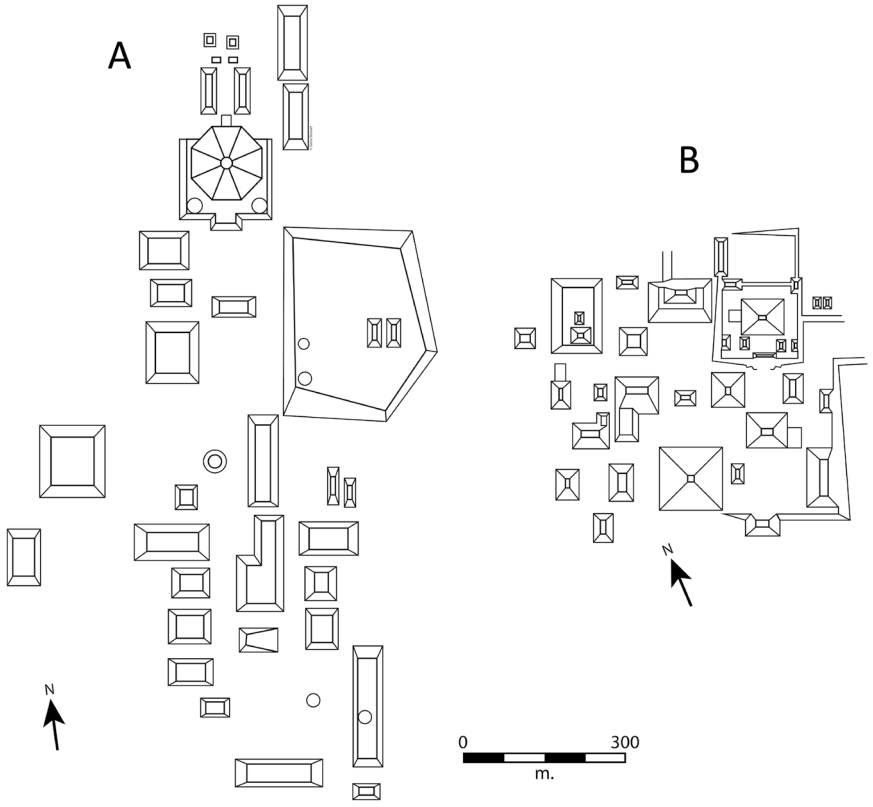

Figure 2. Preclassic urban centers. Plans by Sierra Stewart A: La Venta, redrawn from Diehl (2004:61). B: Izapa; redrawn from Coggins (1996:30).

Although *royal palaces* have been analyzed and compared for later periods in Mesoamerica (Evans, 2004; Inomata & Houston, 2000, 2001), there has been little attention to this architectural form in the Preclassic period. Clark and Hansen (2001) associate palaces (which they call "royal compounds"; see Table 1) with the spread of the institution of kingship in Preclassic Mesoamerica. Some archaeologists have interpreted the Stirling Acropolis at La Venta (the largest building in Figure 2A) as a palace (Spencer & Redmond, 2004:186). By the onset of the Classic period, royal palaces were prominent features in most Mesoamerican cities.

Ballcourts were another fundamental Mesoamerican urban feature. The earliest known ballcourt was constructed at Paso de la Amada on the Pacific coast, ca. 1400 BC (Hill, Blake, & Clark, 1998). Ballcourts were common features at sites throughout Mesoamerican during Preclassic times (Clark & Hansen, 2001; Hansen, 2000; Olko, 2003; Scarborough & Wilcox, 1991); see Figure 2A, top. They continued to be built in most cities up through the Spanish conquest. Finally, *formal public plazas* also became prevalent during the Preclassic period. Many sites, such as La Venta and Izapa, had several plazas (Figure 2), and smaller sites, such as Preclassic La Laguna (Figure 3) had a single central plaza. These features remained a basic components of Mesoamerican urban planning in all regions. Larger sites tend to have larger plazas, although the relationship between site population and plaza size is sublinear in several sets of measured cities, meaning that larger settlements had less plaza space per capita than did small settlements (Ossa, Smith, & Lobo, 2017).

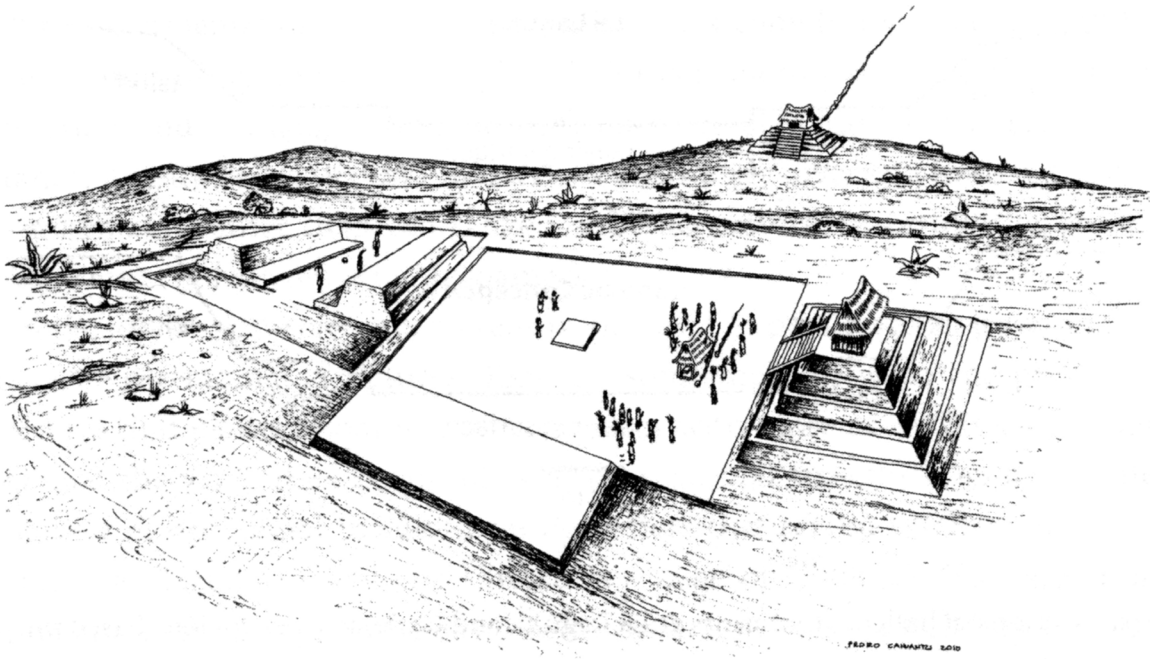

Figure 3. Reconstruction drawing of La Laguna. Reproduced with permission from Carballo (2016:147).

A *planned urban epicenter* was a widespread spatial planning principles in ancient Mesoamerica. Most civic architecture was concentrated in a central zone called the epicenter, and these zones exhibit planning in the sense described in Smith (2007). In brief, the civic buildings were arranged following clear spatial patterns, such as proximity, common orientations, formality, and symmetry. The settlements shown in Figures 2 and 3 have clearly planned epicenters. The planned epicenter was almost always surrounded by *unplanned residential zones*. The presence of central planning in residential neighborhoods ws rare in Mesomerican cities.

The widespread adoption of a suite of common architectural and spatial characteristics does not imply that Preclassic Mesoamerican cities and towns followed a standard plan. There is much variability among settlements, both within and among regions. But the extent of shared traits justifies assigning these cities to a single urban and cultural tradition, whose cities can be seen as local interpretations of a set of basic pan-Mesoamerican planning principles.

3 The Development of the Teotihuacan Plan

Teotihuacan was founded as a village in the *Cuanalan period*, ca. 500–200 BC. Almost nothing is known of the architecture of layout of the settlement at this time. The settlement grew rapidly in the *Patlatchique period* (100 BC–0), reaching a population of some 20,000 persons (Cowgill, 2015:53). The initial small prototypes of the Sun and Moon pyramids were built at this time (Figure 4). Although there is still no information on layout and planning, it seems likely that the early city resembled other Late Preclassic Mesoamerican cities and towns (Figures 2, 3). The growth of the city continued at a rapid pace in the *Tzacualli period* (0–AD 100). George Cowgill's artifact distribution studies show that city expanded almost to its maximal extent (Cowgill, 2015, 2017). The Sun Pyramid was rebuilt to almost its final size, and the Moon Pyramid was expanded with several construction stages. Major offerings were placed within each of these structures. Plaza One, a large three-temple group in the northwest part of the city (Figure 4), was probably built at this time (Cowgill, 2015:71; Millon & Bennyhoff, 1961). The key development in city layout was the creation of the Avenue of the Dead, beginning at the Moon Pyramid and extending south for several km. Construction of this prominent linear feature may have been the first clear signal of Teotihuacan's departure from the ancient Mesoamerican planning principles.

Figure 4. Plan of Teotihuacan. Numbers indicate important civic buildings discussed in the text. This plan was generated from the GIS model of Teotihuacan developed by the project "Service Access in Premodern Cities" (Stanley et al., 2016). The GIS model is based on a digitized version of the Teotihuacan Mapping Project map of the city (Millon, Drewitt, & Cowgill, 1973). Alexandra Norwood created the output for this plan.

During the *Miccaotli period* (AD 100–170), the city expanded to its maximal extent. The Moon Pyramid was rebuilt, and the Sun Pyramid reached its final size. The Ciudadela compound—with its central Feathered Serpent Pyramid—was constructed at this time, as was the Great Compound, a probable marketplace located across the Avenue of the Dead. The subsequent *Early Tlamimilolpa period* (AD 170–250) witnessed one of the most radical transformations of Teotihuacan. Earlier houses and structures were razed, and a new kind of residence—the apartment compound—was built throughout the entire area of the city. The apartment compound was a unique form of housing (see discussion below). The scale of this transformation was such that René Millon (1981:209) called it an early example of "urban renewal." This was the final step of the spatial transformation that changed a typical Late Preclassic Mesoamerican city into a unique urban place.

4 The Design of Teotihuacan: Rejection of the Mesoamerican Planning Principles

In this paper I emphasize features that differentiate the layout of Teotihuacan from earlier and later central Mexican cities. I do not mean to imply, however, that Teotihuacan's urban design was *sui generis*, with no connections at all to earlier cities. But compared to the very specific and spatially important traits that

show disjunction in planning, those indicating continuity with Preclassic cities tend to be generalized, pan-Mesoamerican principles. For example, Teotihuacan showed continuity in things like the presence of temple-pyramids and the arrangement of residences around patios, both nearly-universal urban features in ancient Mesoamerica. On a more specific level, several authors point out that the three-temple groups that were common in Teotihuacan may have originated in the area of the State of Puebla, as shown at the Preclassic site of Tetimpa (Angulo Villaseñor, 2007; Plunket & Uruñuela, 2002). While this may well be correct, the continuities between Teotihuacan and earlier cities seem less important than the disjunctions.

The designers of Classic-period Teotihuacan rejected four of the six Mesoamerican planning principles identified above, while instituting a series of planning innovations of their own. This was a true revolution in urban planning. Two observations signal its radical nature. First, other contemporaneous cities in Classic-period Mesoamerica—such as the lowland Maya cities or Monte Alban in Oaxaca—continued using the Mesoamerican planning principles, elaborating and expanding on them. Teotihuacan stood alone as the only city using a new and very different set of planning principles. Second, after the fall of Teotihuacan, its urban successors in central Mexico returned to the Mesoamerican planning principles, spurning the Teotihuacan innovations. These changes are illustrated schematically in Table 2.

Table 2. Trajectory of urban planning principles in central Mexico.

				Post-Teotihuacan:		
Planning principles & features	**Preclassic**	**Teotihuacan**	**Epiclassic**	**Tula**	**Aztec Towns**	**Tenochtitlan**
Mesoamerican Planning Principles:						
Temple pyramids	I	C	C	C	C	C
Royal palace	I	⦸	R	C	C	C
Ballcourts	I	⦸	R	C	C	C
Central public plaza	I	⦸	R	C	C	C
Planned urban epicenter	I	C	C	C	C	C
Unplanned residential zones	I	⦸	R	C	C	C
Teotihuacan Innovations:						
Huge size of the city		I	⦸			R
Massive scale of main temples		I	⦸			R
Orthogonal planning of entire city		I	⦸			R
Central avenue		I	⦸			
Apartment compounds		I	⦸			
Tula Innovations:						
Formalization of the epicenter				I	C	C
Circular Quetzalcoatl temples				I	C	C
Aztec Innovations:						
Twin-temple pyramids					I	C
Multiple small altars					I	C
Walled ceremonial precinct						I

Key:

I: Innovation R: Revival

C: Continuity ⦸ : Rejection

4.1 Mesoamerican Urban Features Absent at Teotihuacan

Two kinds of anomalous features can be identified at Teotihuacan: the *lack* of a series of typical Mesoamerican urban features and principles, and the creation of a group of planning innovations. Four of the six features in the former category described above are not present at Teotihuacan. The other two features—temple-pyramids and the presence of planning in the urban epicenter—do appear at Teotihuacan.

Royal palace. The possible identification of a royal palace has been a contentious issue in Teotihuacan studies for decades. One long-standing tradition starts with the assumption that a city as large and well-planned as Teotihuacan must have had powerful rulers, and these rulers must have needed a large elaborate royal palace compound. The task for archaeologists is then to identify which structure at Teotihuacan was the palace. Unfortunately, none of the big architectural compounds provides a close fit for a royal palace as known from other Mesoamerican urban centers (Christie & Sarro, 2006; Estrada-Belli et al., 2009; Evans & Pillsbury, 2004; Flannery & Varner, 2015; Inomata & Houston, 2001; Nehammer Knub, Helmke, & Nielsen, 2015; Redmond & Spencer, 2017; Sheehy, 1996; Smith, 2008). I limit discussion here to likely royal palaces, leaving aside the separate issue of elite but non-royal palaces such as the Palacio de Quetzalpapalotl (Acosta, 1964).

The sources listed above reveal that most of the clearly identified royal palaces in ancient Mesoamerica had the following traits:

- A walled compound.
- A very large compound, typically the largest in the city (in area).
- Presence of a large central courtyard, surrounded by rooms.
- Variation in the size, form, and configuration of rooms, signaling the presence of multiple activities within the palace, as discussed by Sheehy (1996) and Redmond and Spencer (2017).
- Presence of living quarters.

In addition, most Mesoamerican palaces—outside the Maya area—exhibit an integrated, unitary plan suggesting a pre-designed organization (Redmond & Spencer, 2017). Some Classic Maya palaces, by contrast, grew incrementally as successive kings enlarged and modified the structure (Schele & Mathews, 1998).

Three large architectural compounds have been suggested as possible royal palaces at Teotihuacan. The most frequently proposed royal palace are the two large room blocks north and south of the Feathered Serpent Pyramid, within the *Ciudadela compound* (Cabrera Castro, 1991; Sugiyama, 2005). These compounds, with their highly standardized room blocks, lack the large central courtyard and variation in room size and form found in other Mesoamerican palaces. The *Street of the Dead Complex* is a large walled complex of temples and residences that occupies both sides of the Avenue of the Dead (Morelos García, 1993). This area is not at all an integrated structure, and it lacks the central courtyard found in other Mesoamerican palaces.

The *Xalla Compound*, a smaller walled compound located between the Sun and Moon Pyramids (Manzanilla, 2002; Manzanilla & López Luján, 2001; Manzanilla, López Luján, & Fash, 2005; Nielsen, 2015), is closest to the general model of Mesoamerican palaces, although it is not the largest compound at Teotihuacan and it lacks a central large courtyard. Thus for each of these three compounds, several palace-like features can be identified, but other elements argue against interpretations as royal palaces. The data and arguments are reviewed by several authors (Cowgill, 2015:108-111; Nielsen, 2015; Sanders & Evans, 2006; Sugiyama, 2005), whose works can be consulted for the details. In my estimation, the Ciudadela compound and Street of the Dead Compound diverge sufficiently from the norms of Mesoamerican palaces to rule them out, and the Xalla compound needs more excavation and analysis before a judgment can be made about its possible status as a royal palace.

A second and currently expanding scholarly tradition holds that governance at Teotihuacan may have been more collective and less autocratic than other Mesoamerican states (Carballo, 2016; Froese, Gershenson, & Manzanilla, 2014; Manzanilla, 2011; Pasztory, 1997). If correct, a corollary may be that

a collective government would not need a single large, sumptuous royal palace. Regardless of how one classifies the system of governance at Teotihuacan or its possible changes through time, however, the lack of scholarly consensus on the identification of a central royal palace may, in itself, be significant. As pointed out by Nielsen (2015:9), scholars rarely have trouble identifying the royal palace at other Mesoamerican cities, such as those of the Classic Maya (Inomata & Houston, 2000, 2001), the Aztecs (Evans, 2004, 2006; Smith, 2008), or other large cities such as Xochicalco and Monte Alban. The logical conclusion is that—given current evidence—a Mesoamerican-style royal palace did not exist at Teotihuacan.

Ballcourt. For decades archaeologists have remarked on the absence of a ballcourt at Teotihuacan. Many scholars have interpreted evidence from art and iconography to suggest that some kind of ballgame may have been played at Teotihuacan (Cowgill, 2015:151; Gómez Chávez & Gazzola, 2015; Uriarte, 2006). For the study of urban planning, however, the relevant question is the presence of ballcourts, not whether a ball game might somehow have been played in the city. Excavations in the Ciudadela located a feature that could be an early ballcourt, but the feature was later buried as the Ciudadela compound reached its final form (Gómez Chávez & Gazzola, 2015). This possible ballcourt was built in the Tzacualli phase, when Teotihuacan likely resembled other Late Preclassic urban centers. But as the major structures of the Ciudadela compound were built, it was destroyed and buried. If Gómez and Gazzola are correct in their identification of the buried feature as a ballcourt, it would help refine our chronological understanding of Teotihuacan urban design: this feature was built during the period when Teotihuacan was just beginning its divergence in form from ancient Mesoamerican principles, and then destroyed soon after, as the divergence in design became pronounced.

Central public plaza. Although Teotihuacan does not lack a large plaza, the location and features of its biggest plaza differentiate it from most Mesoamerican central public plazas. Located in front of the Moon Pyramid, the Moon plaza differs from the central plazas of most Mesoamerican cities in three key respects. First, only one of the major civic buildings was located adjacent to the plaza; the others were positioned adjacent to the Avenue of the Dead instead. Second, the plaza is not located at the center of the site—the most common Mesoamerican pattern—but near its northern extreme. Third, this plaza connects directly to the Avenue of the Dead, and the two features are not clearly separated. Thus the plaza could be considered a segment of that street rather than as a discrete architectural feature of its own. These unusual features lead to the conclusion that Teotihuacan lacked the kind of central public plaza found in most Mesoamerican cities.

Unplanned residential zones. As the plan of Teotihuacan (Figure 4) clearly shows, virtually all structures in the city—residences and civic buildings—were oriented to the basic city grid. Thus all of the residential neighborhoods at Teotihuacan (Robertson, 2005, 2015) were carefully planned, unlike the situation at almost all other Mesoamerican cities (Smith, 2007).

4.2 Planning Innovations at Teotihuacan

The major planning innovations at Teotihuacan were the huge size of the city, the massive sale of the main pyramids, the orthogonal planning of the entire city, the use of a central avenue to structure the spatial layout of the city, and the use of apartment compounds as the dominant type of dwelling (Table 2).

Huge size of the city. With 80,000 to 100,000 inhabitants living in an area of some 20 square km (Cowgill, 2015), Teotihuacan was one of the two most populous cities in Classic-period Mesoamerica; Caracol may have had an equivalent number of resients (Chase & Chase, 2017). A millennium after the fall of Teotihuacan, the Aztec capital Tenochtitlan grew to be more than twice the size of Teotihuacan (Rojas, 2012). But for its time, the size and density of Teotihuacan were anomalous in central Mexican and perhaps in all of Mesoamerica.

Massive scale of the main temples. The main pyramids of Teotihuacan stand out as far larger than most pyramids at earlier or later cities. The massive pyramid of Cholula—the largest in Mesoamerica—was contemporaneous with Teotihuacan, however, making Teotihuacan less anomalous with respect to this feature.

Orthogonal planning of the entire city. Teotihuacan was not the only Mesoamerican city to exhibit orthogonal planning. During the Late Preclassic period, the Maya town of Nixtun-Ch'ich' exhibited orthogonal planning, with a series of straight streets aligned at angles within several degrees of 90 degrees (Pugh & Rice, 2017). Many of the residences at the Pacific Maya site of Ujuxte (Love, 2011) were built with a common orthogonal orientation. But Teotihuacan was the only large settlement in which almost all of the structures were orthogonally oriented. This trait is not the simple inverse of the feature, unplanned residential zones (Table 2); it is possible to have planned urban neighborhoods, without the entire city following a common orthogonal layout.

The orthogonal planning of an entire large city is one of the most striking anomalous features of Teotihuacan, differentiating it from other Mesoamerican cities prior to Tenochtitlan. The latter city, the Aztec imperial capital, also exhibited orthogonal planning, but the poor preservation of the Aztec plan makes it difficult to evaluate the nature and extent of the grid layout. I argue below that the orthogonal planning of Tenochtitlan may be due in part to the deliberate revival of Teotihuacan planning features.

Central avenue. Streets and avenues were not important features in most Mesoamerican cities. Some Classic Maya cities did have formal roads or causeways, called *sacbe*, that connected major architectural groups or settlements (Shaw, 2001, 2008), and causeways of various sorts were present in a number of cities in central Mexico, including Xochicalco and Tenochtitlan (Hirth, 1991; Lombardo de Ruiz, 1973). But Teotihuacan is the only Mesoamerican city that has a single straight central avenue that served as an axis to structure the layout of the entire city. This kind of linear feature that provides an order and structure to a city's form is called an "urban armature" by MacDonald (1986:3-18). None of the streets at other Mesoamerican cities serve as an armature. From a structural perspective, Teotihuacan's Avenue of the Dead served the same purpose as the central public plaza in other Mesoamerican cities—a central feature that provided a common orientation to anchor the layout of an entire city.

Apartment compounds. Prior to the urban renewal episode in the Tlamumilolpa period, when most apartment compounds were constructed, housing at Teotihuacan evidently consisted of small, one-room houses. Most of these were destroyed when the apartment compounds were built (Linné, 2003:108), but one partial early house was excavated by Darlena Blucher (1979); see Figure 5A. The large, complex apartment compounds (Figure 5B) not only differed greatly from earlier housing at the site; this was a unique form of urban residence not just in Mesoamerica but in world urban history (Smith, 2014). Although multi-room residential compounds were used at some central Mexican sites before Teotihuacan (Santley, 1989; Serra Puche, 1986), the size, complexity, and spatial configuration of the apartment compounds was clearly an innovation at Teotihuacan.

Multi-household structures with a single entrance were rare before the Industrial Revolution. Apartment buildings in other premodern urban traditions—such as the insulae of Classical Rome (Ellis, 2000; Storey, 2004) or the Rab of Ottoman Cairo (Raymond, 1980, 2002)—were cramped and crowded housing for the poor. The Teotihuacan apartment compounds, by contrast, were large and sumptuous dwellings. Open patios had drains leading to outside the compound. Rooms were large, with both floors and walls covered with lime plaster, often painted in colorful murals. While one of the key spatial principles of apartment compounds—rooms or dwellings arranged around a patio—is a widespread Mesomerican pattern, the configuration of multiple patio groups enclosed within a continuous outer wall was a Teotihuacan innovation, as was the high degree of symmetry and formality of individual patio-room blocks in the apartment compounds.

Yayahuala (Figure 5B) is a typical apartment compound. Many probable civic structures at Teotihuacan, located along the Avenue of the Dead, do not conform to the standard plan of the apartment compound. They typically lack a continuous outer wall, and they are often open to the Avenue of the Dead. They may be connected spatially to temples. But in spite of these differences, most civic structures share key spatial attributes with apartment compounds, such as the formal patio-room block. The so-called Viking Group (Figure 5C) is an example; this structure is adjacent to the Avenue of the Dead, which runs along its western edge.

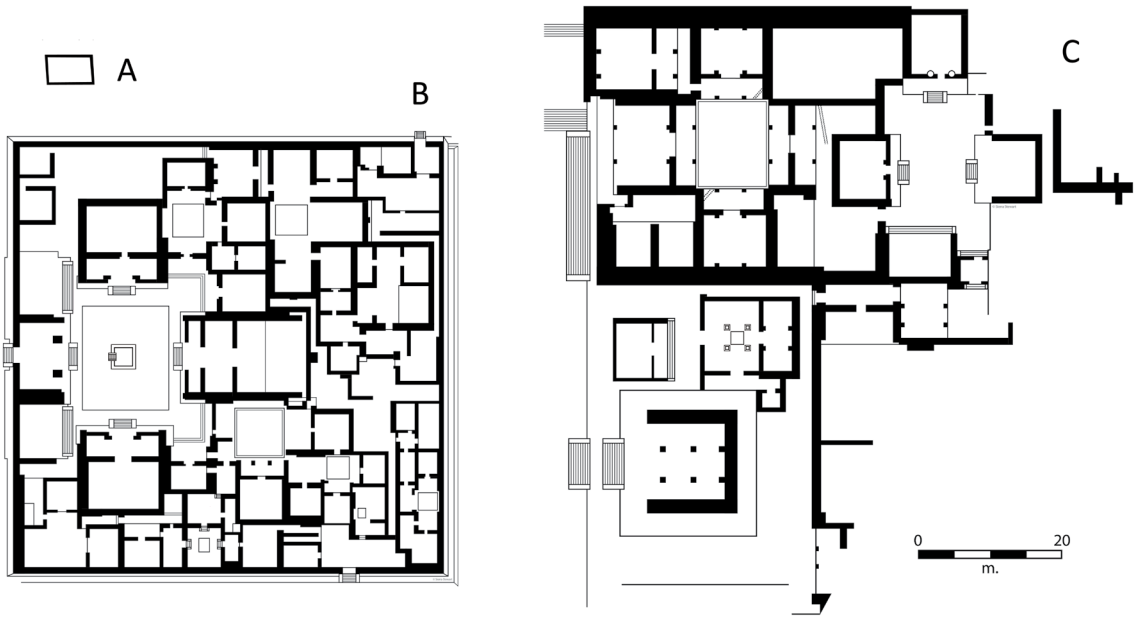

Figure 5. Teotihuacan housing. A: Early (Tzacualli period) one-room house. B: Yayahuala, a typical apartment compound. C: Viking Group, a civic structure with the kind of a patio-room block used in apartment compounds. A: Redrawn from Blucher (1979: Fig. 4) by the author. B, C: Plans by Sierra Stewart, redrawn from original unpublished plans by René Millon.

5 Rejection and Revival of Teotihuacan Planning Principles

The reversion of central Mexican cities to an older Mesoamerican spatial pattern after the fall of Teotihuacan is one of the strongest pieces of evidence for the anomalous character of the layout the latter city. Here I trace the course of urban design and layout after the fall of Teotihuacan.

5.1 Central Mexican Cities of the Epiclassic Period (AD 650–900)

The fall of Teotihuacan in the sixth or seventh century (Cowgill, 2013; Millon, 1988) was followed by the rapid growth of smaller defended hilltop cities throughout central Mexico. These cities include Xochicalco, Cacaxtla, Cantona, Teotenango, and the initial flourishing of Tula. Teotihuacan itself remained a major urban center with an estimated population of some 30,000 inhabitants (Diehl, 1989). The design of these other cities represented a rejection of the principles of Teotihuacan and a return to the more ancienet Mesoamerican planning principles.

Xochicalco is the most extensively-excavated and mapped of these Epiclassic central Mexican cities (González Crespo, Garza Tarazona, de Vega Nova, Mayer Guala, & Canto Aguilar, 1995; Hirth, 2000; Molina & Kowalski, 1999). The layout of Xochicalco shares very little with Teotihuacan; instead it exhibits all of the Mesoamerican planning principles (Table 2). Figure 6 shows the hilltop epicenter of Xochicalco, with two temple-pyramids, a royal palace, two ballcourts, and two public plazas. It is hard to identify any specific continuities with the layout of Teotihuacan, except for the rather general feature of structures arranged around plazas and patios. The other Epiclassic cities listed above each have a unique plan, but they parallel Xochicalco in having little in common with the layout of Teotihuacan. While the hilltop locations of these cities would have made it difficult to create a Teotihuacan-like plan, it seems clear that their designers made no effort to reproduce the Teotihuacan planning innovations, and instead reverted to elements of the Mesoamerican planning principles.

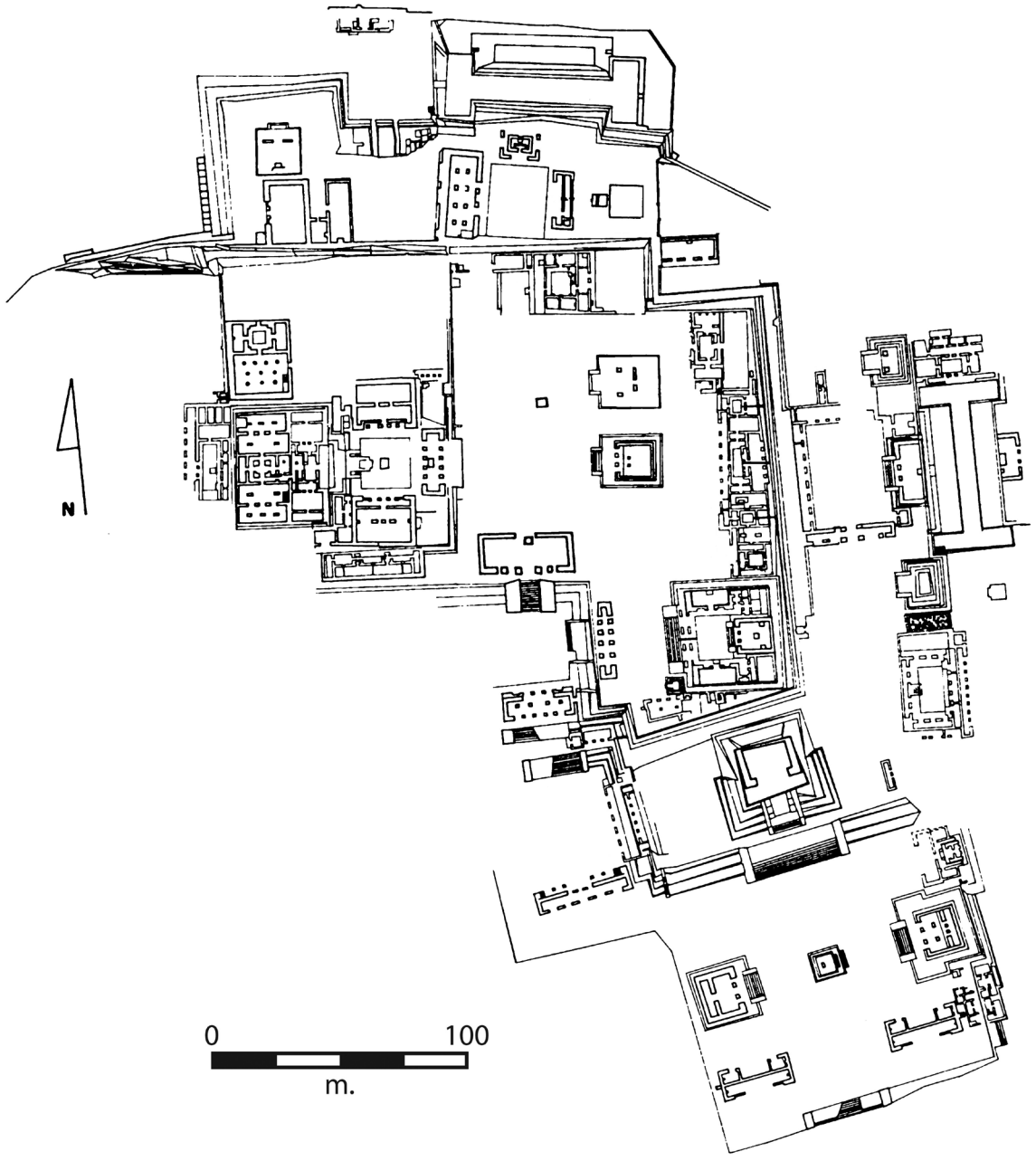

Figure 6. Xochicalco plan, showing features of the Mesoamerican planning principles. Modified after (Molina & Kowalski, 1999:143).

5.2 Tula (Early Postclassic Period, AD 900–1100)

The urban epicenter of the Early Postclassic city of Tula (Figure 7) clearly exhibits the Mesoamerican planning principles, with two large temple-pyramids, two central ballcourts, and a large public plaza. The identification of a royal palace is not completely secure however (Evans, 2006; Mastache et al., 2002). Beyond these basic features, Tula shows a highly formal and monumental Mesoamerican urban plan. Formality and monumentality are common attributes of urban planning in many ancient urban traditions (Smith, 2007). Compared to other Mesoamerican cities, the formality of Tula's epicenter is striking, with its strictly orthogonal square shape, large size, and the balancing of massive architectural features on all four sides. This highly formal layout qualifies as a planning innovation at Tula; another innovation was the use of circular temples.

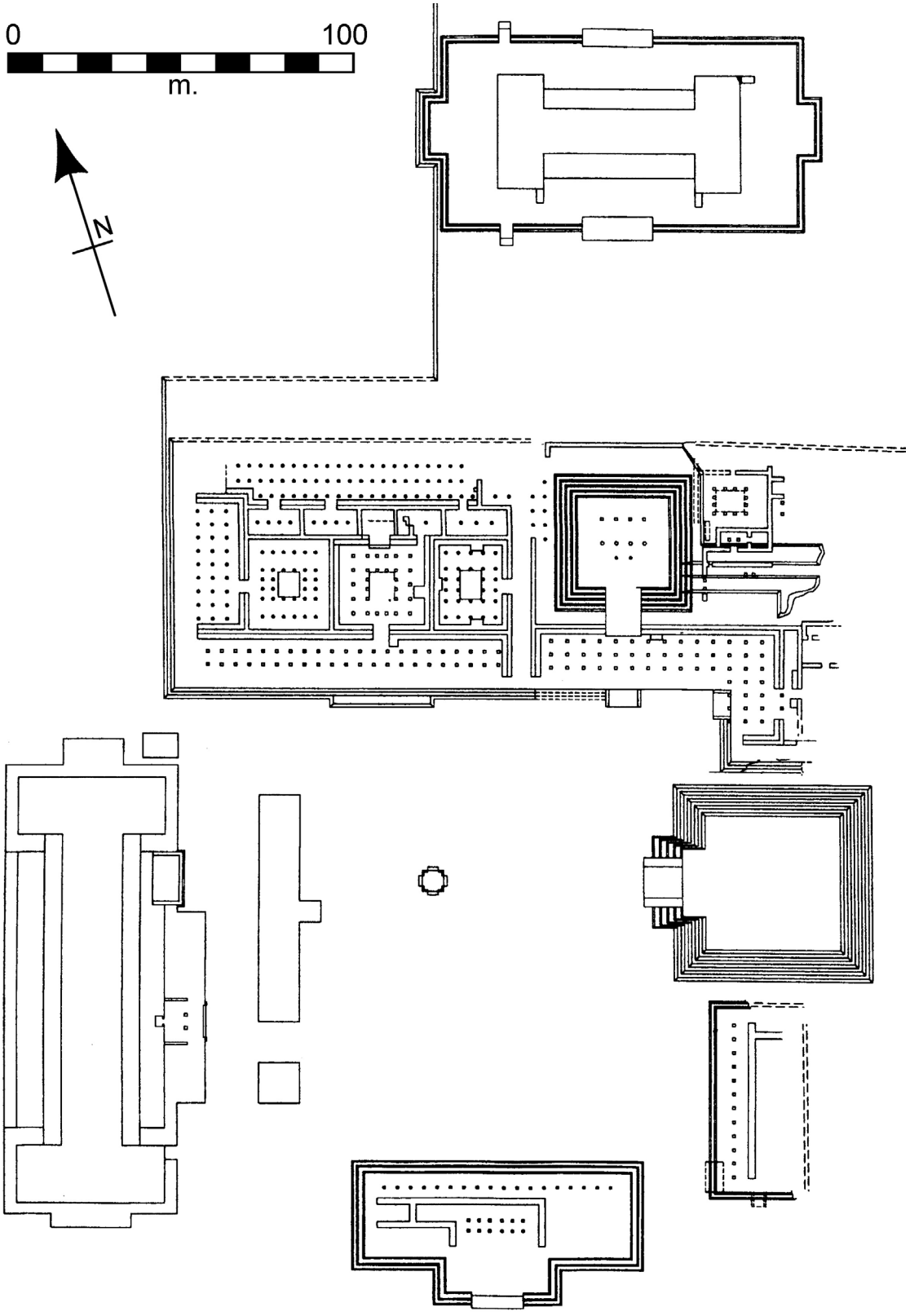

Figure 7. Plan of the epicenter of Tula. Modified after Mastache et al. (2002:92).

For cities laid out on relatively flat surfaces, Tula and Teotihuacan had radically different plans. One might conclude that the plan of Tula represents the strongest rejection of the Teotihuacan principles of any post-Teotihuacan city. Instead, the builders of Tula created a highly formal Mesoamerican plan. The strong formality of the Tula epicenter was later taken up by many Aztec city-state capitals (Smith, 2008: chapter 3). One complicating feature at Tula is the possible presence of architectural compounds that some archaeologists have labeled apartment compounds (Healan, 1993; Mastache et al., 2002:155-56). Healan (1993:116), however, notes that these are "considerably smaller and less complex than their Teotihuacan counterpart." I would add that their internal spatial configuration differs from the distinctive symmetric patio-based dwelling unit of the Teotihuacan apartment compounds. While the architects of Tula might have borrowed the concept of multi-household compounds from Teotihuacan, they did not borrow the specific configuration of the Teotihuacan apartment compound.

5.3 Aztec Towns (Middle Postclassic Period, AD 1100–1300)

Most Aztec city-state capitals were founded between AD 1100 and 1300. These cities exhibited the Mesoamerican planning principles (Smith, 2008), with little or no evidence of Teotihuacan-derived traits of urban design and architecture. Aztec urban designers drew rather heavily on the urban plan of Tula for the layout of their epicenters (Figure 1). The Tula innovations—formal epicenter and circular temples—became important parts of Aztec urban design. These Aztec towns in turn made at least two innovations of their own in urban planning: (1) the use of twin-temple pyramids (that is, two temples, each with its own stairway, built on top of a single pyramid platform); and, (2) the placement of groups of small altars or shrines in plazas and city centers (Table 2); see discussion in Smith (2008).

5.4 Tenochtitlan (Late Postclassic Period, AD 1300–1520)

The Mexica imperial capital Tenochtitlan, founded near the start of the Late Postclassic period, was the first central Mexican city to draw explicitly on Teotihuacan's principles of urban design. Tenochtitlan probably began as a typical city-state capital (Smith, 2008), but as its empire expanded the city grew rapidly in size, power, and wealth. The Mexica rulers were at pains to both anchor the legitimacy of their rule in the ancient dynasties of central Mexico and to distinguish themselves from other Aztec cities and polities. One result was the use of a broad and eclectic group of urban planning principles for the layout of their capital. All of the basic Mesoamerican planning principles were employed, along with the various innovations from Tula and the Aztec city-state capitals. But Tenochtitlan also drew on Teotihuacan's urban principles.

Tenochtitlan employed the first three of the five Teotihuacan innovations shown in Table 2. With a population of over 200,000, Tenochtitlan was the only Mesoamerican city larger than Teotihuacan, and its pyramids were particularly large. It was also the only other central Mexican city with orthogonal planning of the entire city area. These three traits, by themselves, would be insufficient to identify a clear and deliberate use of principles from Teotihuacan by the Mexica urban designers. After all, Tenochtitlan did *not* employ two of the more distinctive Teotihuacan innovations: orientation around a central avenue and housing in apartment compounds. But there is abundant evidence from other sources that the Mexica rulers paid close attention to the city and material remains of Teotihuacan.

We know that some Mexicas visited Teotihuacan, and the ruins formed the setting for a key Aztec creation myth. The Mexica built several shrines in clear Teotihuacan style near their central temple of Tenochtitlan, the Templo Mayor (Olmeda Vera, 2002). They excavated objects at Teotihuacan and buried them in offerings at their central temple-pyramid, the Templo Mayor (López Luján, Neff, & Sugiyama, 2000). The Mexica also made numerous explicit references to Teotihuacan styles and imagery in their own material culture (Umberger, 1987). The names of features at Teotihuacan (e.g., Avenue of the Dead, the Sun and Moon Pyramids) are those given by the Aztecs. Leonardo López Luján (1989) summarizes this and other evidence for deliberate references to Teotihuacan by the Mexica. Given this great interest in, and detailed knowledge of Teotihuacan by the Mexicas of Tenochtitlan, it is not unreasonable to infer that the use of Teotihuacan planning innovations at Tenochtitlan was a deliberate reference to the ancient city.

The Mexica also had a keen interest in the Toltecs of Tula (López Luján & López Austin, 2007; Smith, 2012), probably even greater than their level of interest in Teotihuacan. While the Tula-derived traits at Tenochtitlan may have been copied from the earlier site, it is more likely that they were transmitted to Tenochtitlan via the Aztec city-state capitals (see above). I depict the simpler latter model in Figure 1.

6 Results and Discussion

The data and arguments presented in this paper lead to a single conclusion about the position of Teotihuacan within the central Mexican urban tradition: with respect to urban design, Teotihuacan was so divergent that it can be said to have stood outside the regional historical trajectory. Figure 1 illustrates my historical reconstruction of that trajectory, and the evidence for that reconstruction is summarized in Table 2. This is a new interpretation that diverges from prior views that stressed continuity in urban design between earlier central Mexican cities and Teotihuacan. The earlier arguments, however, are based on generic traits that characterize virtually *all* Mesoamerican cities, calling into question their relevance for explaining the specifics of the central Mexican trajectory of urban design. David Carballo (2016:156-57), for example, talks of a "shared architectural grammar" at Teotihuacan and earlier sites, but this "grammar" consists of the practice of placing temples alongside plazas plus some unspecified similarities in temple decoration. Almost every Mesoamerican city had temples located next to plazas. Similarly, Murakami and Kabata (2017) point out several differences between Teotihuacan and the earlier city of Tlalancaleca (e.g., lack of a central avenue or three-temple groups at the earlier site), but propose that they shared "a multi-centric spatial organization." This similarity is then claimed to imply "a measure of organizational or ideational continuity from Tlalancaleca to Teotihuacan" (p. 471). But again, many or perhaps most Mesoamerican cities had a multi-centric spatial configuration (Marcus, 1983), making this a weak argument for specific historical continuity in form (not to mention ideological continuity, whose existence would require considerable additional evidence to establish).

While my model of disjunction in urban design at the beginning and end of Teotihuacan has strong empirical support, it is premature to extend that conclusion to broader domains of society, governance, or religion. To take just one example, consider current arguments about whether the government at Teotihuacan was more collective or autocratic in nature. This issue has been debated for many years (Cowgill, 1983; Pasztory, 1997). The publication of Blanton and Fargher's influential book, *Collective Action in the Formation of Pre-Modern States* (Blanton & Fargher, 2008) allows this debate to be expressed in more precise terms with a stronger comparative and theoretical framework than previously (see also, Blanton, 2016; Carballo, 2013; Carballo, Roscoe, & Feinman, 2014).

While the nature of urban design may very well be causally connected to processes of governance, we do not yet have sufficient understanding of these connections know whether it is possible to argue from city layout to patterns of government. This difficulty was pointed out some time ago by urban planning scholar Jill Grant. In a very useful paper titled, "The Dark Side of the Grid: Power and Urban Design" Grant (2001) argued that orthogonal planning has been used over history by both collective and autocratic regimes: "People choose to use the grid layout for a variety of reasons to serve a wide range of functions. The record offers no simple correlation between a particular physical form and social patterns or aspirations" (p. 221). While scholarly understanding of the social and political contexts of grid planning has increased in recent years (Blanton, 2016; Blanton & Fargher, 2011; Rose-Redwood, 2008; Smith, 2007), a method for inferring governance processes from urban layouts is still lacking. While the construction of a fully gridded city like Teotihuacan undoubtedly required a strong central government (Smith, 2007), such political power could have been wielded by either an autocratic or a collective regime.

Models of historical continuity and disjunction are most useful when they focus on specific domains instead of on broad city–or society–wide patterns. Thus my model of planning disjunction does not contradict arguments like Carballo's (2016) claims of continuity in ritual and urban processes between earlier cities and Teotihuacan. Rather, my model points to the need for more precise spatial and social models for such phenomena. A better understanding of key patterns of urban development at Teotihuacan

requires careful empirical analysis coupled with a relevant theoretical framework. When such tools are applied to the layout of Teotihuacan within its historical context, it is hard to avoid the conclusion that this was a unique and highly anomalous Mesoamerican city.

Acknowledgements: An initial version of some of the arguments of this paper were presented at the International Symposium on the Sociopolitical Organization of Teotihuacan, at Teotihuacan, in January 2017. I thank the conference organizers and participants for stimulating discussion of urban design and other features of Teotihuacan. I thank David Carballo for permission to use Figure 3, and Sierra Stewart for creating Figures 2 and 5. Alexandra Norwood helped produce the Teotihuacan map (Figure 4). The comments of two anonymous reviewers improved the paper by helping clarify and strengthen my argument.

References

Acosta, J. R. (1964). *El Palacio del Quetzalpapalotl*. Mexico City: Instituto Nacional de Antropología e Historia.

Angulo Villaseñor, J. (2007). Early Teotihuacan and its Government. In V. L. Scarborough & J. E. Clark (Eds.), *The Political Economy of Ancient Mesoamerica: Transformations During the Formative and Classic Periods* (pp. 83-100). Albuquerque: University of New Mexico Press.

Blanton, R. E. (2016). *How Humans Cooperate: Confronting the Challenges of Collective Action*. Boulder: University Press of Colorado.

Blanton, R. E., & Fargher, L. F. (2008). *Collective Action in the Formation of Pre-Modern States*. New York: Springer.

Blanton, R. E., & Fargher, L. F. (2011). The Collective Logic of Pre-Modern Cities. *World Archaeology, 43*(3), 505-522.

Blucher, D. K. (1979). *Late Preclassic Cultures in the Valley of Mexico: Pre-Urban Teotihuacan.* (Ph.D. dissertation), Brandeis University.

Cabrera Castro, R. (1991). Secuencia arquitectónica y cronológica de La Ciudadela. In R. Cabrera Castro, I. Rodrígez García & N. Morelos García (Eds.), *Teotihuacan 1980-1982: Nuevas interpretaciones* (pp. 31-60). Mexico City: Instituto Nacional de Antropología e Historia.

Carballo, D. M. (2016). *Urbanization and Religion in Ancient Central Mexico*. New York: Oxford University Press.

Carballo, D. M. (Ed.). (2013). *Cooperation and Collective Action: Archaeological Perspectives*. Boulder: University Press of Colorado.

Carballo, D. M., Roscoe, P., & Feinman, G. M. (2014). Cooperation and Collective Action in the Cultural Evolution of Complex Societies. *Journal of Archaeological Method and Theory, 21*, 98-133.

Chase, D. Z., & Chase, A. F. (2017). Caracol, Belize and Changing Perception of Ancient Maya Society. *Journal of Archaeological Research, 25*(3), 185-249.

Christie, J. J., & Sarro, P. J. (Eds.). (2006). *Palaces and Power in the Americas: From Peru to the Northwest Coast*. Austin: University of Texas Press.

Clark, J. E., & Hansen, R. D. (2001). The Architecture of Early Kingship: Comparative Perspectives on the Origins of the Maya Royal Court. In T. Inomata & S. Houston (Eds.), *Royal Courts of the Ancient Maya, Volume 2: Data and Case Studies* (pp. 1-45). Boulder: Westview Press.

Coggins, C. C. (1996). Creation Religion and the Numbers at Teotihuacan and Izapa. *RES: Anthropology and Aesthetics, 29/30*, 16-38.

Cowgill, G. L. (1983). Rulership and the Ciudadela: Political Inferences from Teotihuacan Architecture. In R. M. Leventhal & A. L. Kolata (Eds.), *Civilization in the Americas: Essays in Honor of Gordon R. Willey* (pp. 313-344). Albuquerque: University of New Mexico Press.

Cowgill, G. L. (2013). Possible Migrations and Shifting Identities in the Central Mexican Epiclassic. *Ancient Mesoamerica, 24*(1), 131-149.

Cowgill, G. L. (2015). *Ancient Teotihuacan: Early Urbanism in Central Mexico*. New York: Cambridge University Press.

Cowgill, G. L. (2017). A Speculative History of Teotihuacan. In M. H. Robb (Ed.), *Teotihuacan: City of Water, City of Fire* (pp. 20-27). San Francisco: Fine Arts Museums of San Francisco, De Young, and University of California Press.

Cuthbert, A. (2006). *The Form of Cities: Political Economy and Urban Design*. Oxford: Blackwell.

Diehl, R. A. (1989). A Shadow of its Former Self: Teotihuacan During the Coyotlatelco Period. In R. A. Diehl & J. C. Berlo (Eds.), *Mesoamerica After the Decline of Teotihuacan, AD 700-900* (pp. 9-18). Washington, DC: Dumbarton Oaks.

Diehl, R. A. (2004). *The Olmecs: America's First Civilization*. New York: Thames and Hudson.

Ekholm, S. M. (1969). *Mound 30A and the Early Preclassic Ceramic Sequence of Izapa, Chiapas, Mexico* (Vol. 25). Provo: New World Archaeological Foundation.

Ellis, S. P. (2000). *Roman Housing*. London: Duckworth.

Estrada-Belli, F., Tokovinine, A., Foley, J. M., Hurst, H., Ware, G. A., Stuart, D., & Grube, N. (2009). A Maya Palace at Holmul, Peten, Guatemala and the Teotihuacan "Entrada": Evidence from Murals 7 and 9. *Latin American Antiquity, 20*, 228-259.

Evans, S. T. (2004). Aztec Palaces and Other Elite Residential Architecture. In S. T. Evans & J. Pillsbury (Eds.), *Palaces of the Ancient New World* (pp. 7-58). Washington, DC: Dumbarton Oaks.

Evans, S. T. (2006). Antecedents of the Aztec Palace: Palaces and Political Power in Classic and Postclassic Mexico. In J. J. Christie & P. J. Sarro (Eds.), *Palaces and Power in the Americas: From Peru to the Northwest Coast* (pp. 285-310). Austin: Uniersity of Texas Press.

Evans, S. T., & Pillsbury, J. (Eds.). (2004). *Palaces of the Ancient New World*. Washington, DC: Dumbarton Oaks.

Flannery, K. V., & Varner, D. M. (2015). The Governmental Palace on Mound 8. In K. V. Flannery & J. Marcus (Eds.), *Excavations at San José Mogote 2: The Cognitive Archaeology* (pp. 339-350). Ann Arbor: Museum of Anthropology, University of Michigan.

Froese, T., Gershenson, C., & Manzanilla, L. R. (2014). Can Government Be Self-Organized? A Mathematical Model of the Collective Social Organization of Ancient Teotihuacan, Central Mexico. *PloS one, 9*(10), e109966.

Gómez Chávez, S., & Gazzola, J. (2015). Un posible cancha de juego de pelota en el área de la Ciudadela, Teotihuacan. *Anales de Antropología, 49*(1), 113-133.

González Crespo, N., Garza Tarazona, S., de Vega Nova, H., Mayer Guala, P., & Canto Aguilar, G. (1995). Archaeological Investigations at Xochicalco, Morelos: 1984 and 1986. *Ancient Mesoamerica, 6*, 223-236.

González Lauck, R. (1996). La Venta: An Olmec Capital. In E. P. Benson & B. de la Fuente (Eds.), *Olmec Art of Ancient Mexico* (pp. 72-81). Washington, DC: National Gallery of Art.

Grant, J. (2001). The Dark Side of the Grid: Power and Urban Design. *Planning Perspectives, 16*, 219-241.

Guzmán V. A., & Martínez O. L. (Eds.). (1990). *La validez teórica del concepto Mesoamérica. XIX Mesa Redonda de la Sociedad Mexicana de Antropología*. Mexico City: Instituto Nacional de Antropología e Historia.

Hansen, R. D. (2000). The First Cities: The Beginnings of Urbanization and State Formation in the Maya Lowlands. In N. Grube (Ed.), *Maya: Divine Kings of the Rain Forest* (pp. 50-65). Cologne: Könneman.

Healan, D. M. (1993). Urbanism at Tula from the Perspective of Residential Archaeology. In R. S. Santley & K. G. Hirth (Eds.), *Prehispanic Domestic Units in Western Mesoamerica: Studies of the Household, Compound, and Residence* (pp. 105-120). Boca Raton: CRC Press.

Hill, W. D., Blake, M., & Clark, J. E. (1998). Ball Court Design Dates Back 3,400 Years. *Nature, 392*, 878-879.

Hirth, K. G. (1991). Roads, Thoroughfares, and Avenues of Power at Xochicalco, Mexico. In C. Trombold (Ed.), *Ancient Road Networks and Settlement Hierarchies in the New World* (pp. 211-221). New York: Cambridge University Press.

Hirth, K. G. (Ed.). (2000). *Archaeological Research at Xochicalco. Volume 1, Ancient Urbanism at Xochicalco: The Evolution and Organization of a Pre-Hispanic Society. Volume 2, The Xochicalco Mapping Project*. Salt Lake City: University of Utah Press.

Inomata, T., & Houston, S. D. (Eds.). (2000). *Royal Courts of the Ancient Maya. Volume 1, Theories, Themes, and Comparisons*. Boulder, CO: Westview.

Inomata, T., & Houston, S. D. (Eds.). (2001). *Royal Courts of the Ancient Maya. Volume 2, Case Studies*. Boulder, CO: Westview.

Joyce, R. A. (2000). High Culture, Mesoamerican Civilization, and the Classic Maya Tradition. In J. Richards & M. van Buren (Eds.), *Order, Legitimacy, and Wealth in Ancient States* (pp. 64-76). New York: Cambridge University Press.

Kirchhoff, P. (1943). Mesoamérica: sus límites geográficas, composición étnica, y caracteres culturales. *Acta Americana, 1*, 92-107.

Linné, S. (2003). *Mexican Highland Cultures: Archaeological Researches at Teotihuacan, Calpulalpan and Chalchicomula in 1934-35* (Reprint of 1942 ed.). Tuscaloosa: University of Alabama Press.

Lombardo de Ruiz, S. (1973). *Desarrollo urbana de Mexico-Tenochtitlan segun las fuentes históricas*. Mexico City: Instituto Nacional de Anthropología e Historia.

López Luján, L. (1989). *La recuperación mexica del pasado teotihuacano*. Mexico City: Instituto Nacional de Antropología e Historia.

López Luján, L., & López Austin, A. (2007). Los mexicas en Tula y Tula en Mexico-Tenochtitlan. *Estudios de Cultura Náhuatl, 38*, 33-83.

López Luján, L, Neff, H., & Sugiyama, S. (2000). The 9-Xi Vase: A Classic Thin Orange Vessel Found at Tenochtitlan. In D. Carrasco, L. Jones & S. Sessions (Eds.), *Mesoamerica's Classic Heritage: From Teotihuacan to the Aztecs* (pp. 219-249). Boulder: University Press of Colorado.

Love, M. W. (2011). Cities, State and City-State Culture in the Late Preclassic Southern Maya Region. In M. E. Love & J. Kaplan (Eds.), *The Southern Maya in the Late Preclassic: The Rise and Fall of an Early Mesoamerican Civilization* (pp. 47-76). Boulder: University Press of Colorado.

Lowe, G. W., Lee, T. A., Jr., & Martínez Espinosa, E. (1982). *Izapa: An Introduction to the Ruins and Monuments* (Vol. 31). Provo: New World Archaeological Foundation.

MacDonald, William L. (1986). *Architecture of the Roman Empire, volume 2: An Urban Appraisal*. New Haven: Yale University Press.

Manzanilla, L. R. (2002). Gobierno corporativo en Teotihuacan: una revisión del concepto "palacio" aplicado a la gran urbe prehispánica. *Anales de Antropología, 35*, 157-190.

Manzanilla, L. R. (2011). Los grupos sociales de Teotihuacan: Perspectiva interdisciplinaria para su estudio. *Memoria, El Colegio Nacional, 2011*, 201-237.

Manzanilla, L. R., & López Luján, L. (2001). Exploraciones en un posible palacio de Teotihuacan: El Proyecto Xalla (2000-2001). *Mexicon, 23*, 58-61.

Manzanilla, L. R., López Luján, L., & Fash, W. L. Jr. (2005). Como definir el palacio en Teotihuacan. In M. E. Ruiz Gallut & J. Torres Peralta (Eds.), *Arquitectura y urbanismo: pasado y presente de los espacios en Teotihuacan (Memoria de la Tercera Mesa Redonda de Teotiihuacan)* (pp. 185-210). Mexico City: Instituto Nacional de Antropología e Historia.

Marcus, J. (1983). On the Nature of the Mesoamerican City. In E. Z. Vogt & R. M. Leventhal (Eds.), *Prehistoric Settlement Patterns: Essays in Honor of Gordon R. Willey* (pp. 195-242). Albuquerque: University of New Mexico Press.

Mastache, A. G., Cobean, R. H., & Healan, D. M. (2002). *Ancient Tollan: Tula and the Toltec Heartland*. Boulder: University Press of Colorado.

Millon, R. (1981). Teotihuacan: City, State, and Civilization. In J. Sabloff (Ed.), *Archaeology*(pp. 198-243). Austin: University of Texas Press.

Millon, R. (1988). The Last Years of Teotihuacan Dominance. In N. Yoffee & G. L. Cowgill (Eds.), *The Collapse of Ancient States and Civilizations* (pp. 102-164). Tucson: University of Arizona Press.

Millon, R., & Bennyhoff, J. A. (1961). A Long Architectural Sequence at Teotihuacan. *American Antiquity, 26*(4), 516-523.

Millon, R., Drewitt, R. B., & Cowgill, G. L. (1973). *Urbanization at Teotihuacan, Mexico, Volume 1: The Teotihuacan Map, Part 2: Maps*. Austin: University of Texas Press.

Molina, A., & Kowalski, J. K. (1999). Public Buildings and Civic Spaces at Xochicalco, Morelos. In J. K. Kowalski (Ed.), *Mesoamerican Architecture as a Cultural Symbol* (pp. 140-161). New York: Oxford University Press.

Morelos García, N. (1993). *Proceso de producción de espacios y estructuras en Teotihuacán: Conjunto plaza oeste y complejo calle de los muertos*. Mexico City: Instituto Nacional de Antropología e Historia.

Murakami, T., & Kabata, S. (2017). Development of an Early City in Central Mexico: The Tlalancaleca Archaeological Project. *Antiquity, 91*(356), 455-473.

Nehammer Knub, J., Helmke, C., & Nielsen, J. (2015). *Palaces and Courtly Culture in Ancient Mesoamerica*. Oxford: Archaeopress.

Nielsen, J. (2015). Where Kings Once Ruled? Consideration on Palaces and Rulership at Teotihuacan. In J. Nehammer Knub, C. Helmke & J. Nielsen (Eds.), *Palaces and Courtly Culture in Ancient Mesoamerica* (pp. 7-22). Oxford: Archaeopress.

Olko, J. (2003). Mesoamerican Ballcourts: Spatial Context and Regional Distribution. In M. S. Ziółkowski & A. Sołtysiak (Eds.), *Między Drzewem Życia a Drzewem Poznania*. Księga ku czci Profesora Andrzeja Wiercińskiego (pp. 159-183). Warsaw-Kielce.

Olmeda Vera, B. (2002). *Los templos rojos del recinto sagrado de Tenochtitlan*. Mexico City: Instituto Nacional de Antropología e Historia.

Ossa, A., Smith, M. E., & Lobo, J. (2017). The Size of Plazas in Mesoamerican Cities: A Quantitative Analysis and Social Interpretation. *Latin American Antiquity* (in press).

Pasztory, E. (1992). Abstraction and the Rise of a Utopian State at Teotihuacan. In J. C. Berlo (Ed.), *Art, Ideology, and the City of Teotihuacan* (pp. 281-320). Washington, DC: Dumbarton Oaks.

Pasztory, E. (1997). *Teotihuacan: An Experiment in Living*. Norman: University of Oklahoma Press.

Plunket, P., & Uruñuela, G. (2002). Antecedentes conceptuales de los conjuntos de tres templos. In M. E. Ruiz Gallut (Ed.), *Ideología y política a través de materiales, imágenes y símbolos (Memoria de la Primera Mesa Redonda de Teotihuacan)* (pp. 529-546). Mexico City: Instituto Nacional de Antropología e Historia.

Pool, C. A. (2007). *Olmec Archaeology and Early Mesoamerica*. New York: Cambridge University Press.

Pugh, T. W., & Rice, P. M. (2017). Early Urban Planning, Spatial Strategies, and the Maya Gridded City of Nixtun-Ch'ich', Peten, Guatemala. *Current Anthropolgoy* (in press).

Raymond, A. (1980). The Rab': A Type of Collective Housing in Cairo During the Ottoman Period. In J. G. Katz (Ed.), *Architecture as Symbol and Self-Identity* (pp. 55-62). Philadelphia: Aga Khan Award for Architecture.

Raymond, A. (2002). *Arab Cities in the Ottoman Period: Cairo, Syria and the Maghreb*. Burlington, Vt.: Ashgate.

Redmond, E. M., & Spencer, C. S. (2017). Ancient Palace Complex (300–100 BC) Discovered in the Valley of Oaxaca, Mexico. *Proceedings of the National Academy of Sciences, 114*, 3805-3814.

Robertson, I. G. (2005). Patrones diacrónicos en la constitución social de los vecindarios Teotihuacanos. In M. E. Ruiz Gallut & J. Torres Peralta (Eds.), *Arquitectura y urbanismo: pasado y presente de los espacios en Teotihuacan (Memoria de la Tercera Mesa Redonda de Teotihuacan)* (pp. 277-294). Mexico City: Instituto Nacional de Antropología e Historia.

Robertson, I. G. (2015). Investigating Teotihuacan through TMP Surface Collections and Observations. *Ancient Mesoamerica, 26*(1), 163-181.

Rojas, J. L. de (2012). *Tenochtitlan: Capital of the Aztec Empire*. Gainesville: University Press of Florida.

Rose-Redwood, R. S. (2008). Genealogies of the Grid: Revisiting Staniskawski's Search for the Origin of the Grid-Pattern Town. *Geographical Review, 98*, 42-58.

Rosenswig, R. M., López-Torrijos, R., Antonelli, C.E., & Mendelsohn, R. (2013). LiDAR Mapping and Surface Survey of the Izapa State in the Tropical Piedmont. *Journal of Archaeological Science, 40*, 1493-1507.

Sanders, W. T., & Evans, S. T. (2006). Rulership and Palaces at Teotihuacan. In J. J. Christie & P. J. Sarro (Eds.), *Palaces and Power in the Americas: From Peru to the Northwest Coast* (pp. 256-284). Austin: Uniersity of Texas Press.

Sanders, W. T., & Santley, R. S. (1983). A Tale of Three Cities: Energetics and Urbanization in Pre-Hispanic Central Mexico. In E. Z. Vogt & R. Leventhal (Eds.), *Prehistoric Settlement Patterns: Essays in Honor of Gordon R . Willey* (pp. 243-291). Albuquerque: University of New Mexico Press.

Santley, R. S. (1989). Residential Site Structure in the Basin of Mexico During the Formative and Classic Periods. In M. Scott, D. J. W. Archer & R. D. Garvin (Eds.), *Households and Communities: Proceedings of the 21st Annual Chacmool Conference* (pp. 398-406). Calgary: Archaeological Association of the University of Calgary.

Scarborough, V. L., & Wilcox, D. R. (Eds.). (1991). *The Mesoamerican Ballgame*. Tucson: University of Arizona Press.

Schele, L., & Mathews, P. (1998). *The Code of Kings: The Language of Seven Sacred Maya Temples and Tombs*. New York: Simon and Schuster.

Serra Puche, M. C. (1986). Unidades habitacionales del Formativo en la cuenca de México. In L. Manzanilla (Ed.), *Unidades habitacionales Mesoamericanas y sus areas de actividad* (pp. 161-192). Mexico City: Instituto de Investigaciones Antropológicas, Universidad Nacional Autónoma de México.

Shaw, J. M. (2001). Maya Sacbeob: Form and Function. *Ancient Mesoamerica, 12*, 261-272.

Shaw, J. M. (2008). *White Roads of the Yucatan: Changing Social Landscapes of the Yucatec Maya*. Tucson: University of Arizona Press.

Sheehy, J. J. (1996). Ethnographic Analogy and the Royal Household in 8th Century Copan. In A. G. Mastache, J. R. Parsons, R. S. Santley & M. C. Serra Puche (Eds.), *Arqueología Mesoamericana: Homenaje a William T. Sanders* (Vol. 2, pp. 253-276). Mexico City: Instituto Nacional de Antropología e Historia.

Smith, M. E. (2007). Form and Meaning in the Earliest Cities: A New Approach to Ancient Urban Planning. *Journal of Planning History, 6*(1), 3-47.

Smith, M. E. (2008). *Aztec City-State Capitals*. Gainesville: University Press of Florida.

Smith, M. E. (2012). *The Aztecs* (3rd ed.). Oxford: Blackwell Publishers.

Smith, M. E. (2014). Housing in Premodern Cities: Patterns of Social and Spatial Variation. *International Journal of Architectural Research, 8*(3), 207-222.

Smith, M. E. (2016). How Can Archaeologists Identify Early Cities: Definitions, Types, and Attributes. In M. Fernández-Götz & D. Krausse (Eds.), *Eurasia at the Dawn of History: Urbanization and Social Change* (pp. 153-168). New York: Cambridge University Press.

Spencer, C. S., & Redmond, E. M. (2004). Primary State Formation in Mesoamerica. *Annual Review of Anthropology, 33*, 173-199.

Stanley, B. W., Dennehy, T., Smith, M. E., Stark, B. L., York, A., Cowgill, G. L., Novic, J., & Ek, G. (2016). Service Access in Premodern Cities: An Exploratory Comparison of Spatial Equity. *Journal of Urban History, 42*(1), 121-144.

Storey, G. R. (2004). The Meaning of 'Insula' in Roman Residential Terminology. *Memoirs of the American Academy in Rome, 49*, 47-84.

Sugiyama, S. (2005). *Human Sacrifice, Militarism, and Rulership: The Symbolism of the Feathered Serpent Pyramid at Teotihuacan, Mexico*. New York: Cambridge University Press.

Umberger, E. (1987). Antiques, Revivals, and References to the Past in Aztec Art. *RES: Anthropology and Aesthetics, 13*, 62-105.

Uriarte, M. T. (2006). The Teotihuacan Ballgame and the Beginning of Time. *Ancient Mesoamerica, 17*(1), 17-38.

Wirth, L. (1938). Urbanism as a Way of Life. *American Journal of Sociology, 44*, 1-24.