Journal of Anthropological Archaeology 59 (2020) 101203

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

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

The collapse of Teotihuacan and the regeneration of Epiclassic societies: a Bayesian approach

Sarah C. Clayton

University of Wisconsin-Madison, 1180 Observatory Drive, Madison, WI 53706, United States

ARTICLE INFO

Keywords:
Teotihuacan
Chicoloapan
Epiclassic
Collapse
Regeneration
Bayesian

ABSTRACT

The collapse of premodern states is an enduring theme of archaeological research, and it is increasingly clear that understanding how states dissolve requires research at sites beyond regional capitals, as well as attention to subsequent developments. Recent literature reflects substantial interest in the ways in which people rebuild communities after states break down and in how the legacies of failed states influence processes of regeneration. Here, I examine the transformation of communities in the Basin of Mexico in response to the fragmentation of the Teotihuacan state system during the 500s CE. I focus on the development of Chicoloapan, a large settlement in the southern Basin that expanded as the state declined. Demographic growth, changes to the built environment, and shifting practices at Chicoloapan reflect decisions made by local residents amid severe regional instability and infrastructural disruption. A temporal framework for the reorganization of the Chicoloapan community is presented, based on the Bayesian modeling of 24 radiocarbon dates from residential contexts. These dates reveal a spate of local construction activity in the 600s CE. This research advances knowledge of the close relationship between the deterioration of a centralized state and the development of new communities, practices, and identities.

1. Introduction

The decline of early states is an enduring theme of archaeological research, and Teotihuacan, a powerful state that flourished for several centuries in central Mexico before collapsing by 600 CE, is no exception. Since at least the 1960s researchers have grappled with explaining the end of Teotihuacan in terms of the dissolution of political institutions, the decay of a vibrant metropolis, and the loss of longstanding and widespread practices. The study of state collapse requires identifying multiple, interrelated factors that contribute to sociopolitical instability in the span of time before governments unravel. It is increasingly apparent, however, that if we are to understand why states come apart, we must not limit our research to the circumstances that preceded their disintegration. It is also useful and necessary to consider what happened next. How did people regroup and reorganize? Which practices and institutions were discarded or abandoned, which were preserved or newly adopted, and why?

Recent literature reflects substantial interest in the ways in which people rebuild societies after governments and institutions dissolve, and in how the legacies of collapsed states influence processes of sociopolitical regeneration (e.g., Faulseit et al. 2015; Kim 2013; Sharratt 2016). In a volume examining the concept of *regeneration* and its applicability to diverse case studies, Schwartz (2006:7) defines it simply as the reappearance of societal complexity (e.g., the development of cities and polities) after periods of decentralization. Regeneration is often viewed as part of a pattern of cycling (Gavrilets et al. 2010; Marcus 1998) between centralized and decentralized politics, which broadly describes the long-term trajectories of many regions. Political regeneration is not necessarily synonymous with the centralization of authority, however, as it may also entail the development of collective forms of governance that are as complex as those in which power is concentrated (see Fargher et al. 2011). The notion of regeneration also need not be confined to totalizing narratives of regional political cycling. When detached from such abstract models, the concept is useful for examining processes of rebuilding that transpire at smaller space-time scales (Faulseit 2015:4) as the result of decision-making and strategic action within communities.

Here, I consider the emergence of post-collapse societies in the Basin of Mexico during the Epiclassic period (550–850 CE). This span of time encapsulates the fall of Teotihuacan, the growth of other settlements, and the nascent formation of the Toltec state (Anderson et al. 2015; Jiménez Moreno 1966). As a case study, I discuss the development of Chicoloapan, an urban settlement in the southern Basin that prospered in the wake of Teotihuacan's decline. I examine the timing and characteristics of Chicoloapan's growth and argue that this local process of regeneration was coterminous with and closely linked to the breakdown of the Teotihuacan state.

E-mail address: sclayton@wisc.edu.

https://doi.org/10.1016/j.jaa.2020.101203
Received 17 October 2019; Received in revised form 13 July 2020
Available online 28 July 2020

Chicoloapan's development illustrates that regeneration is not necessarily a gradual process of rebuilding that occurs long after states have unraveled. On the contrary, the relatively rapid expansion of its local population and built environment reflects decisions made in the context of major disruptions associated with the collapse of a government, displacement of people, and erosion of the previous social order. Responses to natural disasters in today's world show people to be incredibly resourceful, often taking quick initiative to reorganize and innovate in response to the loss of reliable safety nets and familiar social conditions (Solnit 2009). Post-collapse societies may reflect a similar kind of human resilience. They do not necessarily rise from the ashes of decline centuries afterward but take shape amid the problematic conditions that cause central governments and social institutions to crumble. In the past, as in the present, people made strategic decisions to meet their needs during critical times (McAnany and Yoffee 2010), including moving, reorienting social and economic networks, and innovating new forms of leadership.

In this article I present a high-resolution chronology for the growth of the Chicoloapan settlement, based on the Bayesian modeling of radiocarbon dates from residential contexts across the site. I then examine the shifting local practices and material culture that accompanied and contributed to Chicoloapan's reorganization as a thriving, autonomous community during the 600s CE. This work advances knowledge of the related processes of Teotihuacan's deterioration as a centralized state and the formation of new communities, institutions, and identities in the surrounding region—its former subject territory. As states are regional (or macroregional) phenomena, their decline is constituted in the loss of control over the populations and resources upon which they depend. Empirical research focused on surrounding settlements is, therefore, necessary for modeling the timing, contributing factors, and local impacts of state collapse. Evidence from Chicoloapan complements existing archaeological data relating to the breakdown of Teotihuacan, most of which has resulted from investigations focused on the capital city (e.g., Beramendi-Orosco et al. 2009; Manzanilla 2003).

In a previous publication (Clayton 2016), I presented a small sample (n = 6) of unmodelled radiocarbon dates from domestic contexts and provided a qualitative discussion of local domestic architecture and ceramics. The present analysis builds directly from this previous work by incorporating a significantly larger sample of dates from additional domestic contexts across the site, as well as more detailed discussion of the ceramic wares and forms present. This research considerably refines the chronology and improves our understanding of the local material culture at a time of significant social transformation.

2. Regional political dynamics and the concept of regeneration

In many parts of the world where early complex societies developed, archaeologists note a broadly cyclical pattern, in which the development of large, regional states is followed by the breakdown of these states and the decentralization of political power. By 'regional' states, I mean those that exercise political authority and influence over populations and resources across a geographically extensive, but not necessarily contiguous, subject territory. Marcus (1992, 1998), for example, offered a *dynamic model,* in which she described the alternating phases of state formation and fragmentation that mark the trajectories of different regions as peaks and valleys. Although such pendulum shifts may be observed as a general pattern in regional politics over the long-term, most would agree that cyclical models paint forms of sociopolitical organization and processes of change in exceedingly broad strokes. Regional states implement—with varying degrees of success—diverse and shifting strategies of political integration, and the forms of interaction between state apparatus and subject populations are known to vary considerably across space and to shift through time (Feinman 1998:106). Where complexity is observed to wax and wane, cyclical models are too abstract to elucidate variation in political forms or innovative shifts in modes and concepts of governance (Hutson et al. 2015). It is also becoming increasingly clear that the dynamic model does not fit all complex societies (Schwartz 2006:8).

In central Mexico, the successive emergence of regional states (Teotihuacan, Toltec, and Aztec), punctuated by periods of decentralization, generally aligns with Marcus' dynamic model (Anderson et al. 2015; Schwartz 2006:8). If this characterization is apt as a grand narrative, however, it falls short of advancing a fuller comprehension of everyday practices, politics, economics, and social variation—particularly during the decentralized periods. Within this framework, the Epiclassic period, and all of the changes that it entailed, stagnates in a valley between the 'peaks' of regional political integration. This conceptualization obscures the unique histories and sociopolitical characteristics of societies of the time.

Although Epiclassic polities in the Basin were smaller in scale than the major states that came before and after, they featured urban landscapes with monumental civic architecture, novel forms of leadership, reconfigured economies, new technologies, and significant social diversity. They contributed substantially, therefore, to the evolution of urban forms, religious institutions, complex economies, and political structures through time in central Mexico. Surprisingly, they are often neglected in research that examines these changes over the long term. Discussions of urbanism during the Epiclassic period in this region are absent from otherwise impressively thorough, diachronic treatments of this subject (e.g., Carballo 2016). Innovations in urban planning that occurred during this span of three centuries, and the changing social and political practices that they reflect, certainly contributed to subsequent developments. These changes warrant closer examination if we are to grasp the full spectrum of sociopolitical variability through time in this region, including patterns in land use, governance, and daily life.

Regeneration is a useful heuristic concept for examining the development of smaller scale, complex societies like those of the Epiclassic Basin of Mexico. The concept is of greatest utility when *a priori* notions about the nature of post-collapse societies considered to be "regenerated"—particularly unexamined thresholds of scale—are discarded. Studies of regeneration are an important counterpart to the large body of research preoccupied with the rise of primary states—that is, states without precedent in their region (Spencer and Redmond 2004). A focus on regeneration, which presupposes political collapse, emphasizes the significance of historical context and social memory in the formation of second (or third, etc.) generation complex societies. Societies do not emerge from sociopolitical *tabula rasa;* rather, the legacies of earlier states may profoundly influence later social developments, including strategies of polity building. Such legacies include concepts of governance and identity, memories of events, and enduring impacts of state-related activities. These may range from extensive water and land-management systems (Graffam 1992) to the physical marks of militarization and warfare on landscapes (Kim 2013).

Since post-collapse societies develop in historical context, research examining their social, economic, and political dimensions does not just illuminate the particular characteristics of these societies, but also advances knowledge of the structure and decline of antecedent states. The concept of regeneration presents fertile ground for research because it situates processes of polity formation within contexts of longer-term sociopolitical change; however, there are potential shortcomings of this framework that should be addressed. First, the term may be misleading, in that it implies a degree of cultural likeness between successive polities or societies that obscures potentially profound differences. Schwartz (2006:7) is careful to note, however, that regeneration refers to the reappearance of complexity, not the reappearance of *specific* complex societies. Likewise, Bronson (2006) distinguishes patterns of regeneration that strictly adhere to "fully understood, well-recorded" *templates*, offering Ming China as an example, from cases in which polity-building is loosely influenced by hazy memories of earlier states. The latter pattern, which he calls "stimulus" regeneration, likely describes a wider range of examples, as the degree to which historical pasts can be fully understood or faithfully replicated is debatable. In stimulus regeneration, new institutions are legitimated in part through reference to a glorious past but also require substantial alteration to succeed in their particular, dynamic social and environmental contexts (Anderson et al. 2015; Kim 2013).

A second, and more significant, issue is that definitions of regeneration tend to emphasize the *eventual* reorganization of subsequent, centralized states in a region following some undefined period of decentralization (e.g., Schwartz 2006:7). This perspective runs the risk of replicating abstract models of political cycling by failing to capture the simultaneity and interrelatedness of processes of decline and reorganization. New identities, ideologies, political strategies, and ways of life do not simply arise at some point after a state has collapsed but often develop as part of the same transformative trajectory. Novel practices and institutions evolve as existing ones are concurrently destabilized or dismantled, and such processes of erosion and innovation may be closely connected (Janusek 2005). Consequently, understanding how post-collapse societies take shape requires examining changes that occur at relatively small timescales, in the generations immediately surrounding the decline of states. Determining when key developments occurred, such as the growth of a settlement or the adoption of new ritual practices, technologies, or material culture, is a crucial step in this work, allowing us to relate changing patterns of behavior to broader, regional political shifts. Chicoloapan, which became a thriving urban town within a few generations of Teotihuacan's dissolution, presents an opportunity to examine the ways in which local practices diverged from earlier ways of living.

3. The collapse of Teotihuacan

There is no consensus concerning the specific changes that constitute the end of Teotihuacan as a society, but destructive violence focused on the city's central monuments is considered by many to correspond to the fall of its government. More than one hundred structures were burned, sculptures were smashed and scattered (Millon 1988), and the governing apparatus of the state ultimately did not recover. Manzanilla and colleagues date these events, which they refer to as the "Big Fire," to 550 ± 25 CE, based on limited archaeomagnetic data from central compounds (Beramendi-Orosco et al. 2009). If these violent events marked the end of the elite institutions of the state, then these dates challenge earlier interpretations of the timing of Teotihuacan's political demise. For example, Cowgill (2015) placed the collapse of the state in the 600s CE, corresponding to the Metepec phase (Table 1), which is considered to encompass Teotihuacan's final years as both macroregional regime and cohesive society. As he and others (e.g., Nichols 2015) note, further research and a larger sample of dates is needed to confirm the timing of the fires. Whenever they occurred, however, they are likely to have culminated from protracted conditions of sociopolitical instability, and they must be viewed as only one, tangible product of a multifaceted process of decline.

During its final century, Teotihuacan's population is estimated to have decreased by more than half (Cowgill 2013:133). These and other transformations, including shifts in regional settlement patterns and material culture, distinguish the Epiclassic period. Households adopted new forms and styles of pottery, the networks through which goods were exchanged were reorganized, and practices involving the acquisition of raw materials changed. For example, the use of green obsidian from Sierra de Pachuca, Hidalgo, which had been the most important source for Teotihuacan, declined during the Epiclassic period (Charlton and Spence 1983:66; Pastrana 1998:240–254). This shift was concomitant with an increased reliance on gray obsidian from the Otumba source—a pattern that is evident at Chicoloapan as well (Clayton and Cruz Jiménez 2017).

Table 1
General chronology of central Mexico and corresponding Teotihuacan phases.

Period (Central Mexico)	Approximate Years	Teotihuacan Ceramic Phases
Postclassic	1100-1500 CE	Early & Late Aztec
Early Postclassic	850–1100 CE	Mazapan
Epiclassic	600–850 CE	Coyotlatelco
	550–600/650 CE	Metepec
Early Classic	350-550 CE	Xolalpan
	200–350 CE	Tlamimilolpa
	100–200 CE	Miccaotli
Terminal Formative	1-100 CE	Tzacualli
	100–1 BCE	Patlachique

Perhaps the most striking, and certainly the most widely recognized, change in household material culture is the adoption of *Coyotlatelco* pottery (Rattray 1966; Solar Valverde 2006). This ceramic tradition is best known for distinctive red-on-natural and red-on-cream painted serving bowls (Fig. 1). Coyotlatelco is thought by many scholars to resemble Classic period pottery in regions to the north and west of the Basin (e.g., Healan 2012; Hernández and Healan 2019; Mastache et al. 2002; Moragas Segura 2013). These observations have prompted discussion about the role that migration played in the formation of communities and polities in the area (Beekman and Christensen 2003; Cowgill 2013; Hernández and Healan 2019). Empirical data from multiple Epiclassic settlements across the region, including newly founded and existing communities, are needed for resolving these questions. In addition to information about daily life and social organization during this transition, chronometric data are crucial for relating the adoption of new practices and materials to the breakdown of the state. The settlement of Chicoloapan, whose inhabitants experienced the local effects of these macroregional processes, represents one such source of direct chronometric and archaeological data.

4. Chicoloapan

When Teotihuacan was at its height, Chicoloapan was a small village of a few hundred people living in dispersed farmsteads along the southern margins of the Basin of Mexico (Parsons 1971). The area was settled by at least the first millennium BCE, long before a regional state existed, and was inhabited during the subsequent Epiclassic and Postclassic periods as well. Chicoloapan's long history of occupation, antedating the rise of the state, distinguishes it from settlements in the region that were newly established as part of the expansion of Teotihuacan and were abandoned as it declined (e.g., García Chávez et al. 2005). Distinct settlement histories surely contoured interactions between the capital and surrounding communities and may also have affected the relative resilience of communities as the state broke down (Clayton 2016).

Evidence from archaeological survey, mapping, surface collection and recent excavations indicates that Chicoloapan's population grew dramatically during the Epiclassic period (Clayton 2012; Parsons 1971). What had been a loose scattering of farmsteads became a sprawling, functionally urban community with monumental architecture, houses, and farmed fields stretching for about eight kilometers across the southern Texcoco region. At this time, Chicoloapan was spatially connected to a site called Cerro Portezuelo, which is located to the immediate west, in the neighboring municipality of Chimalhuacan[1].

[1] The site name "Cerro Portezuelo," which is common in archaeological literature in the U.S. from the 1950s onward, is rarely used or comprehended by people living in this area today and is largely an archaeological invention. Some older members of established families in the area recognize "Portezuelo" as an informal reference to a large hill on the Chimalhuacan-Chicoloapan municipal boundary, which is both officially named and commonly called *Xolcuango*. In addition to accurately identifying its municipal location, the name "Chicoloapan," which is a Nahuatl word, distinguishes the site of current research from that of fieldwork undertaken in the 1950s in adjacent Chimalhuacan (Hicks 2013). Most importantly, we use the name Chicoloapan out of respect for and in accordance with the wishes of members of the local descendant community, who refer to this heritage landscape and its cultural remains as Chicoloapan Viejo.

Fig. 1. Examples of *Coyotlatelco* red-on-cream (left three) and red-on-natural (right two) pottery from domestic contexts at Chicoloapan. Photo by author.

Cerro Portezuelo was partially excavated in the 1950s (Hicks 2013; Nichols et al. 2013) and has since been destroyed by modern development. Parsons (1971) estimated the Epiclassic population of Cerro Portezuelo to have been at least 6000, with Chicoloapan (TX-ET-17) as an eastern extension having a more dispersed character. Such demographic growth, from a few hundred to several thousand people, is attributable to the movement of people into the area from elsewhere, rather from internal processes alone.

Four houses inhabited during the Epiclassic period were extensively excavated between 2013 and 2018 (Structures 3, 7, 9, and 20), with additional, limited excavations in two poorly preserved dwellings (Structures 4 and 5) and two open spaces (Fig. 2). These represent the first detailed, horizontal excavations of Epiclassic period residences and areas of domestic activity in this part of the Basin of Mexico.[2] This work, therefore, contributes new information about household and community organization during the decline of Teotihuacan and the reorganization of post-collapse societies. Attention to material culture in stratigraphic context permits a diachronic view of everyday domestic practices, advancing knowledge of the cultural changes that took place during the Epiclassic period.

A program of absolute dating was applied in combination with analyses of artifact assemblages to examine the decline of Teotihuacan's influence over the southern Basin and the growth of autonomous Epiclassic communities there. A sample of 24 carbon specimens from secure contexts in Structure 3 (n = 3), Structure 7 (n = 10), and Structure 9 (n = 11) was submitted to the University of Arizona AMS Laboratory for dating by accelerator mass spectrometry. Bayesian modeling was applied to the dates from each of these structures to generate a fine-grained temporal framework for the trajectory of the Chicoloapan settlement. I concentrate this discussion primarily on Structures 7 and 9. These were more extensively excavated than Structure 3, and larger samples of dates were obtained from these structures, representing a greater variety of stratigraphic contexts. As a result, the chronological models from Structures 7 and 9 are more comprehensive and warrant more detailed discussion; the three dates from Structure 3 are presented as a useful point of comparison, however. Taken together, the dates from these structures demonstrate a degree of temporal overlap in the construction and habitation phases of houses in different areas of the settlement during the 600s CE. This pattern makes it possible to examine intracommunity variation in the architecture and artifact assemblages from contexts that were broadly contemporaneous. A complete list of carbon specimens, the materials and contexts that they represent, their respective uncalibrated radiocarbon ages BP, and both unmodelled and modelled calibrated dates CE, is provided in Table 2. Models were generated using OxCal v4.3.2, hosted by the Radiocarbon Accelerator Unit at Oxford University; original radiocarbon ages were calibrated using the IntCal13 atmospheric curve (Reimer et al. 2013).

Within each structure, we excavated a limited area to sterile *tepetate* (an indurated volcanic tuff substrate), with the objective of examining contexts representing the history of use, including construction, habitation, and the residues of post-abandonment activity, where present. For example, empty rooms in Structure 7 had been filled with trash soon after the structure was abandoned, probably by neighboring residents who remained in the area.

Although domestic structures at Chicoloapan share many characteristics, such as the combined use of stone and adobe as building materials, variation in the techniques and quality of their construction reflects substantial socioeconomic diversity among residents. Construction materials were primarily acquired locally, but some structures featured costly, durable materials imported from some distance away. For example, stucco made from a non-local, as yet unidentified source of lime (*cal*), was copiously applied to interior floors and the lower portions of exterior walls of some structures, where it served to prevent water damage to their bases.

Structure 9 (Fig. 3), which featured lime stucco, was built on a low platform with durable, sloping exterior walls made from a combination of creatively placed heavy basalt stones and smaller, unmodified *tezontles* (a porous volcanic rock that is abundant in the area). The tezontle rocks were uniformly sized and exclusively red in color, reflecting a preference for red over black tezontle, which is also locally available. We interpret Structure 9 as a domestic space based on the assemblage of artifacts recovered and the presence of internal rooms that are similar in size and configuration to nearby residential structures. However, its position on a platform suggests that its occupants may have been local elites, and it is possible that the space served as a

[2] Excavations at Cerro Portezuelo in the 1950s were restricted to test pits and the partial exposure of large ceremonial structures (Clayton 2013; Hicks 2013).

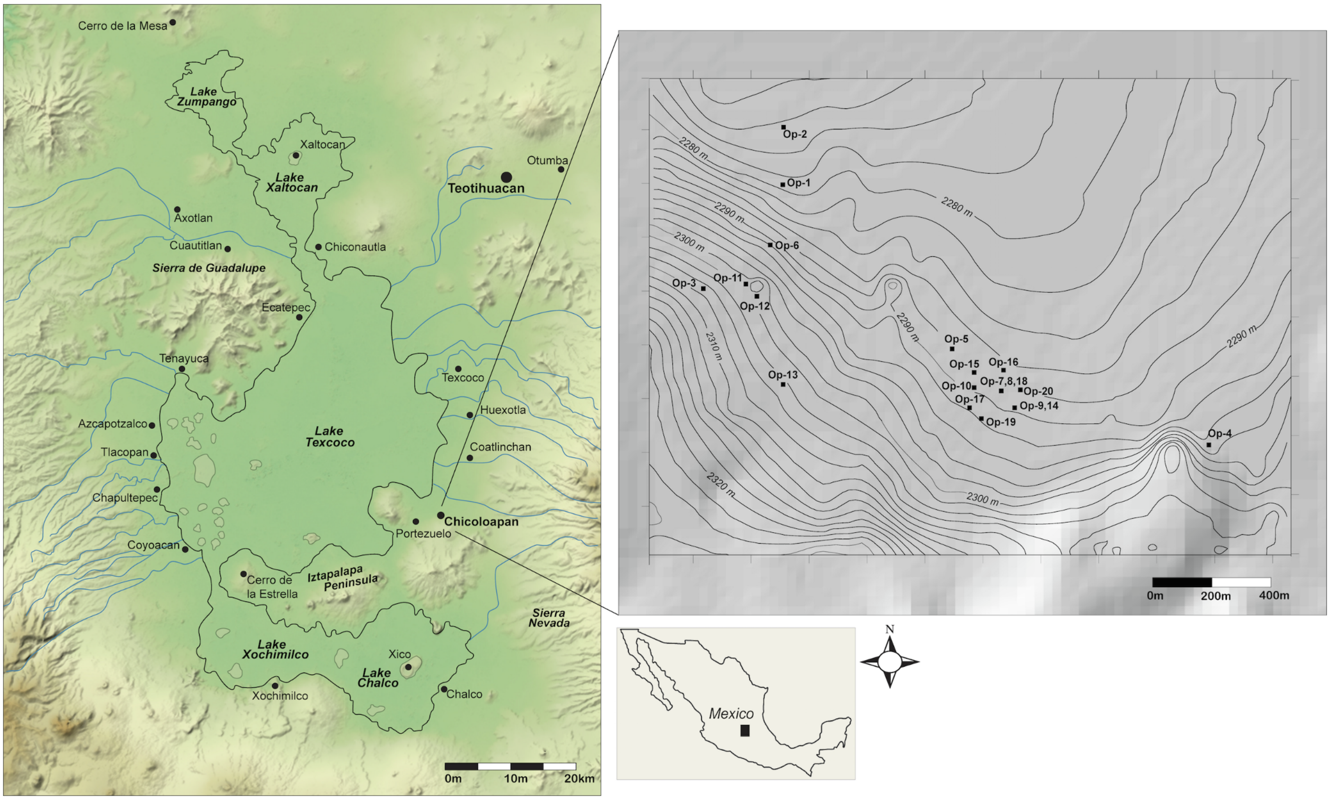

Fig. 2. The Basin of Mexico, showing the location of Chicoloapan, and a contour map indicating the location of excavations at the site. Unique Operation numbers (Op) were assigned to each excavation during each distinct field season; Structure numbers correspond to the Op. number assigned during the initial season of a structure's excavation.

context of domestic as well as administrative activities.

The high quality of construction of some houses (e.g., Structures 7, 9, and 20), has contributed to a remarkable state of preservation, considering that these structures were exposed within 50 cm of the current surface and exhibit scars of the plow on the stones used in their walls. Some houses, on the other hand, were more ephemeral and built using lower quality materials and simpler techniques. For example, Structure 5, which was poorly preserved and underwent only limited excavation, evidently had an earthen floor, with no evidence of the use of stucco. Most houses were not built on formal platforms, but were instead placed onto the *tepetate* substrate, which was sometimes filled in with stone and mud to create a level surface.

Central hearths were built into some of the patio floors at Chicoloapan, which is not typical of Teotihuacan architecture. Other distinctive local patterns include the prolific use of adobe and the construction of interior walls using a technique in which a wet mud mixture was poured into molds in place and allowed to dry, creating long, uniform slabs. This poured mud technique is an example of variation in the architecture at Chicoloapan (Clayton 2016), as it was evidently used in some structures (Structures 7, 9, and 20) and not others (Structures 3, 4, and 5). The inclusion of residual artifacts in the adobe matrix (e.g., fragmented ceramic and lithic artifacts from earlier structures) was remarkably rare in all excavated houses. This pattern is consistent with relatively rapid settlement expansion, in which houses were built on unoccupied land using primarily raw materials (e.g., mud and organic matter) rather than accumulated refuse.

5. Toward a high-resolution chronology for Chicoloapan's growth

The combined use of "prior information" with probabilistic modeling distinguishes Bayesian approaches from classical methods of statistical analysis (Buck et al. 1996:17; Bronk Ramsey 2009). Bayesian modeling is well suited to the analysis of archaeological contexts, and particularly for the examination of radiocarbon dates, because it makes effective use of existing knowledge about archaeological data, such as observations relating to stratigraphic sequences. Because *a priori* knowledge about archaeological contexts is incorporated into Bayesian models, improved estimates of dates may be generated (i.e., the intervals of calibrated date ranges may be reduced), resulting in higher-resolution chronologies.

Deep vertical excavations in Structures 7 and 9 each revealed contexts of their early phases of construction 70–80 cm beneath the level of the latest floors. In Structure 9, an early floor was discovered at this depth. In Structure 7, the earliest context of activity was a tight concentration of ash deposited in two sequential layers, which likely resulted from the repeated disposal of contents of a cooking hearth. This feature was found directly beneath a later, round pit-hearth, which was lined with clay and stone and built into the center of a sunken patio corresponding to the final habitation phase of Structure 7 (Fig. 4). The superpositioning of hearths points to the long-term use of this space for cooking and gathering. Such activities are crucial to the basic survival of the household, but they are also fundamentally social, and their repetition in the same space may have promoted social continuity across generations. That is, the hearth provided warmth, but also may have served as one kind of material reference to the memory and reproduction of a social group.

In the field, these early contexts of domestic activity—deposited substantially beneath the later levels of domestic construction—were initially thought to reflect habitation of the settlement during the Teotihuacan period. The recovery of characteristically Epiclassic-period ceramics from these contexts posed a challenge to this interpretation, suggesting that these structures were built and inhabited during the subsequent period. A critical point to bear in mind, however, is that aspects of material culture (e.g., pottery styles) are likely to have been

Table 2
Carbon samples from Chicoloapan, including uncalibrated radiocarbon ages BP, unmodelled calibrated dates CE, and modelled calibrated dates CE.

Sample	Material	Provenience	Uncalibrated Age BP	Unmodelled calibrated CE (1σ)	Unmodelled calibrated CE (2σ)	Modelled calibrated CE (2σ)	A index	Model 'phase'	Context
104	wood	Str 7, Op8	1315 ± 32	660–764	654–769	651–674	90.5	Str 7-Phase 5	refuse F801
80	wood	Str 7, Op8	1394 ± 21	637–661	610–665	650–670	64.3	Str 7-Phase 5	refuse F801
140	wood	Str 7, Op8	1352 ± 23	652–673	641–760	651–672	132.9	Str 7-Phase 5	hearth F811
128	wood	Str 7, Op8	1358 ± 15	654–666	647–674	651–670	114.6	Str 7-Phase 5	hearth F811
171	wood	Str 7, Op8	1332 ± 32	653–761	647–768	645–665	87	Str 7-Phase 4	bench F816
130	wood	Str 7, Op8	1488 ± 23	557–604	541–634	625–660	< 60	Str 7-Phase 3	floor F802 fill
186	wood	Str 7, Op8	1394 ± 16	641–658	618–664	541–634	110.6	Str 7-Phase 3	floor F802 fill
60	wood	Str 7, Op7	1506 ± 33	479–608	430–636	430–637	< 60	Str 7-Phase 3	floor F123 fill
52	wood	Str 7, Op7	1375 ± 22	645–665	624–675	626–676	< 60	Str 7-Phase 2	upper ash deposit
53	wood	Str 7, Op7	1482 ± 23	561–608	545–634	561–646	79	Str 7-Phase 1	lower ash deposit
120	wood	Str 9, Op9	1225 ± 35	720–870	688–887	690–780	87.3	Str 9- Phase 4	late ofrenda F909
318	bone (dog)	Str 9, Op14	1247 ± 25	689–775	680–868	693–774	115.7	Str 9- Phase 4	late ofrenda F909
132	wood	Str 9, Op9	1305 ± 18	666–763	662–767	692–769	62.6	Str 9- Phase 4	late ofrenda F909
154	wood	Str 9, Op9	1262 ± 19	691–769	682–773	687–754	108.8	Str 9- Phase 3	floor F903 fill
291	wood	Str 9, Op14	1268 ± 23	690–767	675–773	687–760	110.6	Str 9- Phase 3	adobe step F1465
202	wood	Str 9, Op9	1224 ± 23	723–866	695–883	697–883	< 60	Str 9- Phase 2	fill, early int floor
272	wood	Str 9, Op14	1261 ± 22	691–769	671–776	676–762	100.1	Str 9- Phase 2	early ofrenda F1470
305	bone (dog)	Str 9, Op9	1297 ± 25	671–764	663–769	672–762	103.8	Str 9- Phase 2	fill, early ext floor
270	wood	Str 9, Op14	1298 ± 23	670–764	663–769	672–762	101.1	Str 9- Phase 2	fill, early ext floor
302	wood	Str 9, Op9	1243 ± 23	690–776	685–868	676–762	81.6	Str 9- Phase 2	fill, early int floor
221	wood	Str 9, Op9	1330 ± 22	657–686	651–764	652–713	95.6	Str 9- Phase 1	stratum beneath first floor
17	wood	Str 3, Op3	1284 ± 22	680–766	669–770	665–766	95.4	Str 3- Phase 1	fill, early floor
26	wood	Str 3, Op3	1321 ± 22	659–760	655–766	653–763	109.1	Str 3- Phase 1	fill, early floor
33	wood	Str 3, Op3	1443 ± 23	603–641	575–650	584–655	102.3	Str 3- Phase 1	cist/fill, early floor

Fig. 3. Plan of the excavated portion of Structure 9 at Chicoloapan, a residential or mixed-use structure built on a low platform.

adopted by communities across the region at varying times. This underscores the importance of obtaining absolute dates as a complementary line of evidence for building specifically local chronologies. The program of AMS radiocarbon dating conducted at Chicoloapan, discussed below, shows that these early contexts were coterminous with the Teotihuacan state in its final generations. They also contain the material traces of transformations occurring at the time, including shifting aesthetic preferences, the adoption of new practices, and the reconfiguration of networks of exchange for obtaining household goods.

Structure 7. Ten radiocarbon dates from Structure 7 represent five temporally discrete contexts, including the two distinct layers of ash from the early occupation (n = 2), with one sample from each distinct ash deposit); the construction of the later floor (n = 3); the addition of a bench (n = 1); and the latest contexts of activity, which include a pit-hearth and refuse deposit spread across the surface of the patio floor around it (n = 4).[3] Multiple dates from single strata were grouped together into 'phases' for the purposes of the Bayesian model; these phases were then put into sequential order based on their relative stratigraphic positions. Analyzing groups of dates as successive 'phases,' rather than as individual dates in a sequence, is appropriate when there are sets of dates for which no internal order may be assumed. For example, dates grouped as phases may represent a single deposit or

[3] Carbon specimens from the latest hearth and the trash deposit were combined as one temporal context (or phase) due to their spatial proximity and because it is unknown whether the trash deposit, which included nearly complete vessels, was *de facto* or post-abandonment refuse.

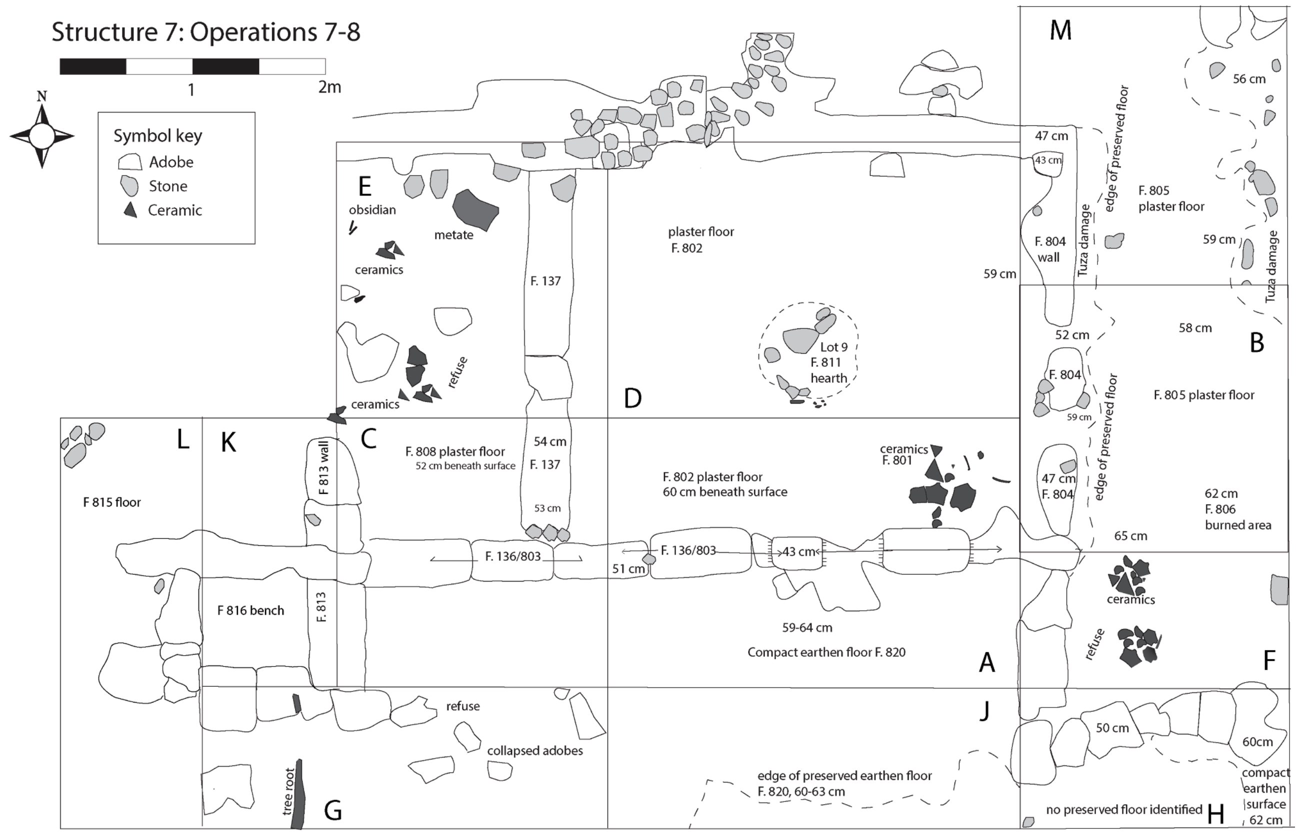

Fig. 4. Plan drawing of the excavated portion of Structure 7 at Chicoloapan, showing a small, interior courtyard with central hearth and surrounding features.

stratum (e.g., a burial), or features that are spatially and temporally associated, but not directly superimposed (e.g., from discrete features that are nonetheless determined to represent the same general period of habitation or use). All submitted dates were initially included in the model. Using this approach, outliers are identified based on the agreement index (A) calculated by OxCal; when this index is lower than 60, the date is considered an outlier and may be rejected.

A first run of the model identified three dates (#130, #60, and #52) as outliers; earlier dates for these contexts than are modelled based on the stratigraphic sequence may be a consequence of the old wood problem or the result of rodent burrowing. After rejecting these outliers, the resulting model has an overall agreement index of 86.2, which indicates a good fit with the data (i.e., that there is not a reason to reject the model).

Bayesian modeling (Fig. 5) produces a detailed chronology for the construction, use, and abandonment of Structure 7, which may be linked to cultural changes at both the local and regional scale, such as the adoption of Epiclassic period material culture by Basin communities. All of the two-sigma intervals for the unmodelled calibrated dates included in the model were reduced in length, by an average of 52.5%. Structure 7 appears to have been inhabited for a century or less—perhaps four generations—based on the median modelled dates for the earliest and latest phases of activity, which are 598 CE and 664 CE, respectively. At most, the structure was used for 150 years.

Structure 9. Eleven radiocarbon dates were obtained from stratigraphic contexts in Structure 9, which had undergone a complex history of renovation, including the periodic addition of superimposed, plastered floors. These dates represent: the stratum beneath the earliest floor (n = 1); the earliest contexts of construction and habitation, located at depths greater than 1 m (n = 5); later contexts of construction, located at depths of less than 1 m (n = 2); and a ritual deposit, Feature 909, in which offerings had been buried under the latest preserved floor (n = 3). As with the dates from Structure 7, multiple dates from Structure 9 were grouped together into 'phases' for the purpose of the Bayesian model, which were then put into sequential order based on their relative stratigraphic positions.

Following the same procedure used for Structure 7, all original dates from Structure 9 were included in the initial run of the model. One outlier was identified (#202); this specimen was collected from the matrix just above the earliest floor and may have been introduced into this context by gopher burrowing. After rejecting this outlier, the resulting model has an overall agreement index of 86.1, which indicates a good fit with the data. The median modelled dates for the earliest and latest probable phases of activity at Structure 9 are 669 CE and 748 CE, or perhaps a century from construction to abandonment. These modelled dates are similar to the original unmodelled calibrated ranges for the earliest and latest dates, the medians of which are 674 CE and 797 CE. The Bayesian model improves the estimates of each individual date in the series, however, by reducing the unmodelled two-sigma interval lengths by an average of 33.7%.

Bayesian modeling produces a high-resolution chronology of the use-life of Structure 9 (Fig. 6), which takes into account the observed stratigraphic sequence of deposits representing events and behaviors that were part of its history. This makes it possible to temporally relate the activities that took place at Structure 9 to those associated with surrounding contexts, such as Structure 7. Based on the unmodelled and modelled dates, Structure 7 was built earlier than Structure 9, but there is likely to have been some overlap in the structures' use. Archaeological and chronometric data both point to a slightly earlier abandonment of Structure 7 than Structure 9. Specifically, the interior spaces of the former contained large amounts of refuse on the floors, whereas the interior spaces of Structure 9, much of which was excavated simultaneously, were relatively empty.

Structure 3. Three radiocarbon dates were obtained from contexts within Structure 3, a house located in the western area of the settlement (see Clayton 2016:111). Whereas the dates from Structures 7 and 9

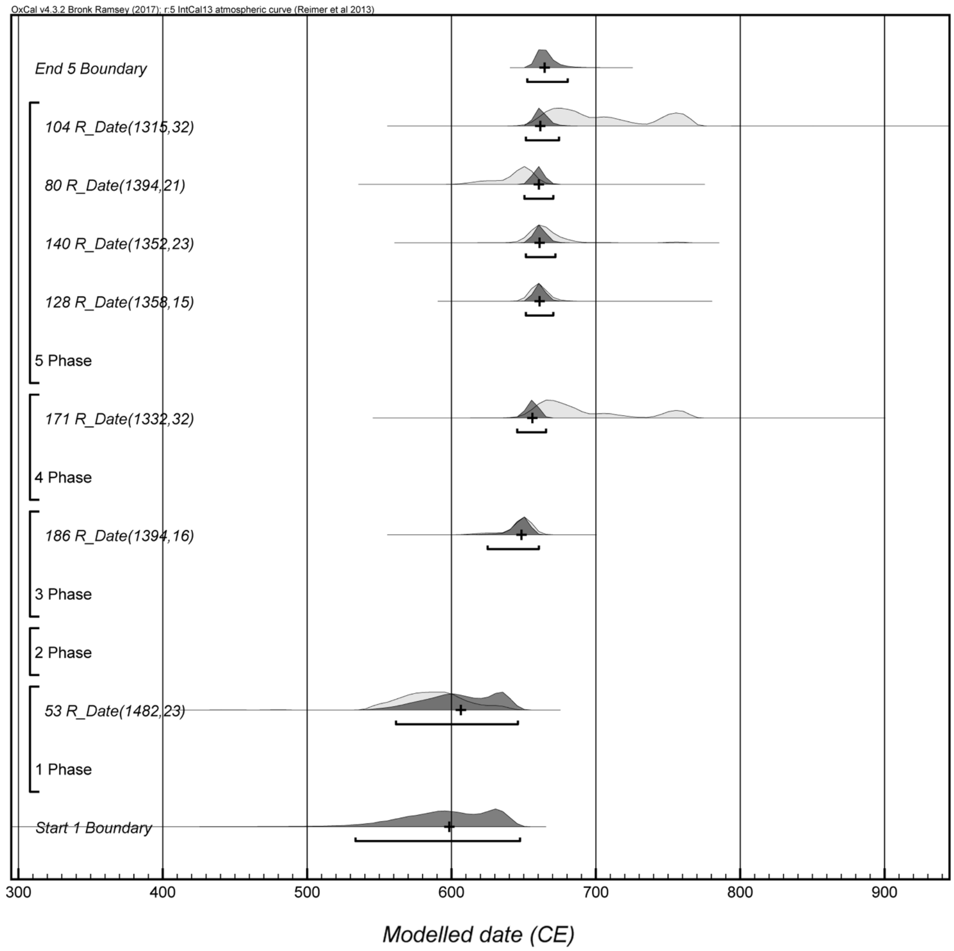

Fig. 5. Radiocarbon determinations from Structure 7, showing the probability distributions of modelled (dark gray) and unmodelled (light gray) calibrated dates. Bars indicate 2-sigma.

represent multiple stratigraphic contexts and temporally distinct deposits, the dates from Structure 3 all come from contexts associated with the initial phase of construction. These include two carbonized wood specimens from subfloor construction fill and one recovered from a stone-lined cavity, or cist, contained within the same subfloor fill matrix. The latter is considered to be incidental to the creation of the deposit and the disturbance of surrounding fill, rather than representative of materials placed inside, although it is possible that organic offerings were made in this context. Because dates from Structure 3 cannot be put into a temporal sequence, a simple, single-phase model (Bronk Ramsey 2009; Hamilton and Kenney 2015; Hamilton and Krus 2018) was used in this case. This model has an overall agreement index of 103.7 and places the resulting median dates in the 600s CE (Fig. 7).

The Bayesian modeling of radiocarbon dates from residential contexts at Chicoloapan improves our understanding of local patterns of house construction and modification, abandonment, and post-abandonment activity. Beyond the implications for local changes, these data make it possible to more precisely link the trajectory of an Epiclassic settlement in the Basin to larger processes and events that impacted the region. These include the destruction of Teotihuacan's monuments and the decrease in its population, the movement of people around the region, and the adoption of different practices and material culture, such as Coyotlatelco pottery.

6. Transforming practices and material culture: Ceramics at Chicoloapan

In addition to building houses, residents of Chicoloapan during the early Epiclassic period began to make, acquire, and use new kinds of material objects. Although some stylistic continuities exist, which are discussed below, the ceramic assemblage on the whole diverged markedly from that of Teotihuacan with respect to vessel forms, functions, and decorative styles. These striking differences signal major changes in foodways and domestic ritual, as well as shifting economic networks along which household goods were exchanged. The local trajectory of population growth, construction projects, and the adoption of new practices and material culture collectively represent a process of transformation. This concept has been applied in research concerning path-dependence, resilience, and change among societies in the U.S. Southwest and Mesoamerica (Hegmon et al. 2008; Nelson et al. 2014), and it is equally relevant here. In a comparative, systematic study of social transformations, Hegmon and Peeples (2018:2) define them as lasting, major changes in settlement, economy, or sociopolitical organization such that people's experiences before and afterward differ substantially. Transformations may occur quickly, within the life span of individuals, or over the course of several generations.

Modifications to the material culture at Chicoloapan were substantial, conspicuous, and occurred over the span of a few generations at most, based on the chronometric data generated by this research. These changes were socially meaningful; however, they must not be

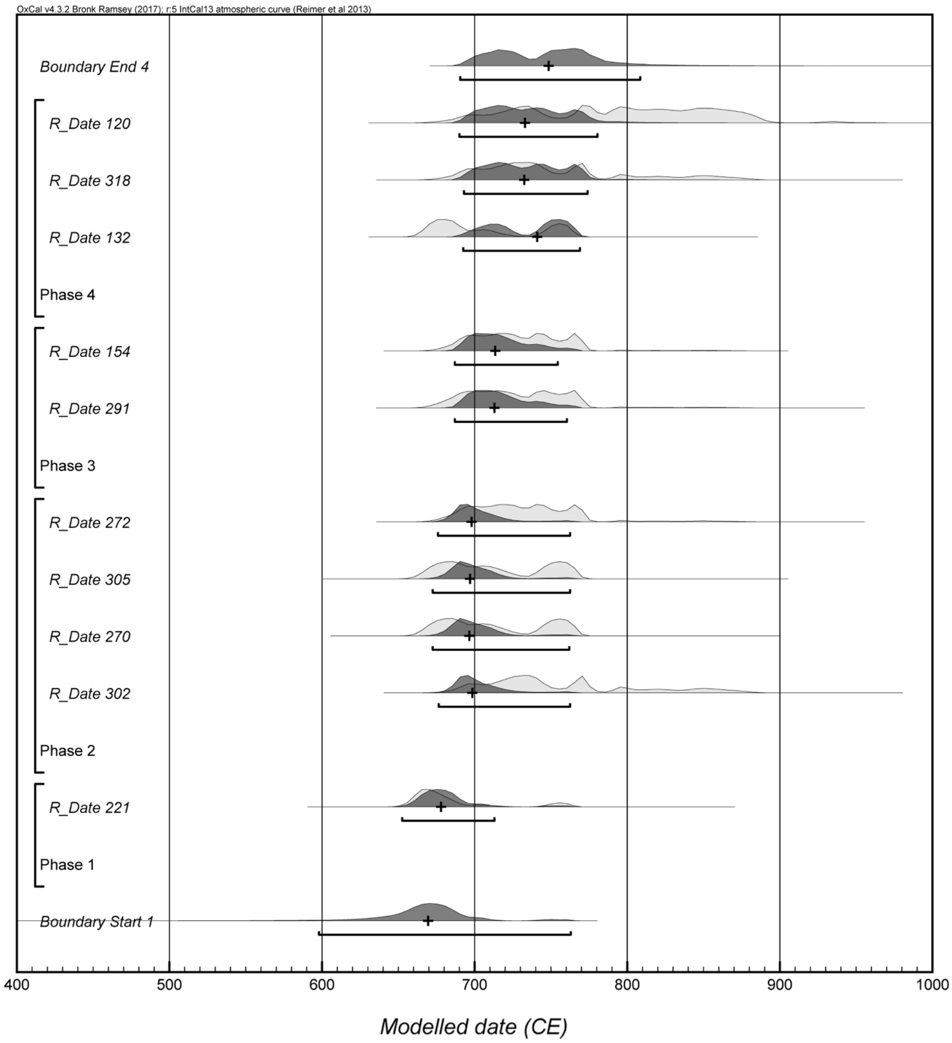

Fig. 6. Radiocarbon determinations from Structure 9, showing the probability distributions of modelled (dark gray) and unmodelled (light gray) calibrated dates. Bars indicate 2-sigma.

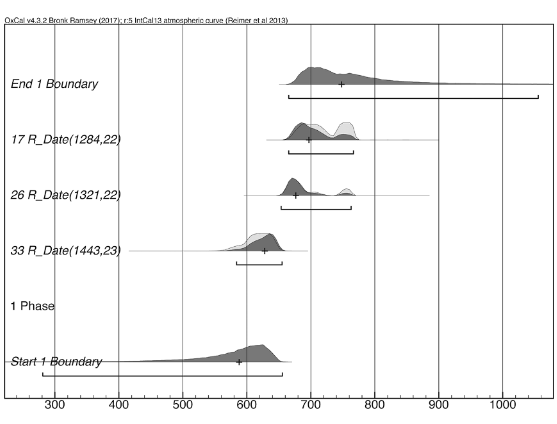

Fig. 7. Radiocarbon determinations from Structure 3, showing the probability distributions of modelled (dark gray) and unmodelled (light gray) calibrated dates. Bars indicate 2-sigma.

misinterpreted as reflecting a simplistic scenario of total population replacement (e.g., Rattray 1989), or sudden, comprehensive discontinuity in every aspect of everyday life. As I have suggested previously (Clayton 2016), the settlement experienced significant in-migration, but established households are also likely to have been present, given its long history of habitation. The changes that we observe must, therefore, be understood in the context of day-to-day practices and interactions among diverse residents who were navigating a variety of shifting, social, economic, and political circumstances.

An analysis of ceramics recovered from early contexts of activity in Structures 3, 7, and 9 permits a consideration of change and continuity in local material culture. In addition to the appearance of Coyotlatelco painted bowls, basic kitchen equipment for food preparation and storage was revised to accommodate shifting culinary practices. For example, griddles (*comales*) and large scoops (*cucharones*), neither of which were prominent in Classic period assemblages, became common in Chicoloapan households. Ritual paraphernalia changed as well; for example, *sahumadores,* or 'ladle censers' with long, hollow handles (e.g., Hicks 2013:81; Morehart et al. 2012:433), were significant in the local assemblage at this time. These objects were not a part of Teotihuacan material culture or the vernacular of ritual behaviors associated with Teotihuacan society. Their appearance at Chicoloapan reflects the adoption of new religious practices and concepts.

Table 3 shows ceramic wares and forms present in the early construction contexts of Structures 3, 7, and 9.[4] Plain olla sherds are the

[4] A comprehensive ceramic chronology representing all excavated contexts and phases of activity across the site is currently being developed (Huster 2019; Huster & Clayton 2019).

Table 3
Counts and relative proportions of ceramics present in the early construction phases of Structure 3, 7, and 9, organized by ware and type/form categories. Rim and body sherds are included; percentages greater than 5 are shown in bold. These data are drawn from typological/formal ceramic analysis conducted by Angela Huster.

Analyzed ceramics from initial construction strata		Structure 3		Structure 7		Structure 9	
	Type/form category	*count (n)*	*percent*	*count (n)*	*percent*	*count (n)*	*percent*
Utilitarian (food prep, storage)	Plain olla	138	**44.2**	216	**35.4**	205	**46.5**
	Double handle	2	0.6	15	2.5	4	0.9
	Plain basin	14	4.5	27	4.4	36	**8.2**
	Red-rim cazuela	4	1.3	4	0.7	5	1.1
	Comal (griddle)	11	3.5	7	1.1	5	1.1
	Cucharon (scoop)	3	1.0	7	1.1	5	1.1
Painted serving vessels	Coyotlatelco R/N	3	1.0	58	**9.5**	4	0.9
	Coyotlatelco R/C	0	0.0	20	3.3	0	0.0
	General R/N	6	1.9	31	**5.1**	6	1.4
	Specular mono red	2	0.6	6	1.0	1	0.2
	Zone-incised R/N	0	0.0	3	0.5	0	0.0
	Tezonchichilco	5	1.6	4	0.7	1	0.2
Polished serving vessels	Plain incised bowl	3	1.0	7	1.1	3	0.7
	Plain polished bowl	68	**21.8**	140	**23.0**	122	**27.7**
	Plain polished jar	6	1.9	11	1.8	3	0.7
Censers	Sahumador (handled)	36	**11.5**	40	**6.6**	18	4.1
	Brazier (upright)	5	1.6	3	0.5	11	2.5
Other	Hollow handle/support	3	1.0	0	0.0	3	0.7
	Figurine or adorno	2	0.6	3	0.5	0	0.0
	Orejera (earspool)	0	0.0	0	0.0	1	0.2
	Oaxaca gray ware	1	0.3	0	0.0	0	0.0
	White or cream slip	0	0.0	3	0.5	0	0.0
	Other/indeterminate	0	0.0	5	0.8	8	1.8
TOTALS		312	100.0	610	100.0	441	100.0

most abundant category, and this form is likely to be overrepresented in these data due to the high quantity of body sherds that result from the breakage of large vessels. Types and forms that are widely considered to distinguish Epiclassic pottery from that of Classic Teotihuacan dominate these assemblages. These categories include ollas with distinctive ‘double handles,’ formed by joining two parallel coils of clay; *cazuelas* (large, open cooking pots) with painted red rims; *comales; cucharones; sahumadores* with long, hollow handles, and Coyotlatelco red-on natural and red-on-cream painted bowls. Coyotlatelco pottery is present in the initial strata in all of these structures and is underrepresented in these data as a result of the mode of decoration itself; Coyotlatelco is characterized by red rims and curvilinear designs applied only to a portion of the vessel. Numerous sherds from the lower portions of the vessels are categorized as plain polished bowls (the second most abundant ceramic category in these assemblages) because they lack red paint. In addition, a “general red-on-natural” category serves as a catchall for sherds with red paint that either could not be confidently identified as Coyotlatelco or represent a distinct type altogether.

Some of the red-painted pottery present in these early contexts exhibits stylistic attributes similar to wares associated with Teotihuacan’s late phases, which suggests a degree of stylistic and technological continuity with earlier local ceramic traditions. These similarities seem to be limited to red-on-natural pottery, however, and most ceramic wares and forms considered typical of Classic Teotihuacan are absent the Chicoloapan assemblages. One likeness is the use of specular hematite in red paint, which imparts a metallic sparkle to the surface of painted vessels. This is a frequent feature of red-painted pottery at Chicoloapan (particularly in monochrome vessels) and occurs in later painted wares at Teotihuacan as well (Rattray 2001:197, 227, 257). Red-on-natural painted and zone-incised serving bowls in this assemblage also resemble some of the pottery present at Teotihuacan and other regional settlements during the later phases of the state’s dominance. However, these bowls at Chicoloapan are often further elaborated with a stamped decoration, which is applied to the lower exterior wall around the entire circumference of the vessel, resulting in a distinctive type called *Tezonchichilco*. A local example of this type, which is not characteristic of Teotihuacan pottery, is shown in Fig. 8 (see also

Fig. 8. Sherd from a *Tezonchicilco* serving bowl at Chicoloapan. Red paint with specular hematite inclusions was applied beneath the rim and directly above a stamped motif, which is visible in the lower half of the sherd. Other examples of this type are decorated with incised lines that delineate geometric zones of red paint applied beneath the rim. Photo by author.

Sejourné 1983: Figure 40). Its circulation and use may have been specific to settlements in the southern Basin (Crider 2013:113).

7. Discussion and conclusions

Combined chronometric and archaeological evidence suggest that the late 500s to mid 600s CE, which was a time of serious sociopolitical instability and decline for the Teotihuacan state, was simultaneously a dynamic time of growth for settlements forty kilometers to the south. The great conflagration that raged in the heart of the monumental capital, which is perhaps the most tangible marker of the demise of the state, is estimated to have occurred in the mid 500s CE (Beramendi-Orosco et al. 2009). The Metepec phase, which comprises the final generations of Teotihuacan's iconic material culture and political preeminence, is dated to circa 550–600/650 CE (Cowgill 2015). At Chicoloapan, absolute dates from the earliest levels of construction of a sample of houses reveal a spate of local activity at this time. New houses were built to accommodate an expanding and diverse population, which grew in step with the fragmentation of the Teotihuacan state and the depopulation of its capital. Residents of the settlement likely included established households as well as displaced, former residents of the capital and newcomers from other parts of the Basin or more distant places.

In this paper I have presented a temporal framework for the growth of Chicoloapan, based on the Bayesian modeling of dates from a sample of residential structures. These models may be refined in the future via the incorporation of additional dates from residential and civic architectural contexts across the settlement. The implications of these dates extend beyond the culture-historical exercise of chronology building for the sake of filling out regional timelines and typologies. Specifically, they allow us to view changing daily practices as part of the process of (re)making a community, undertaken by people who lived under the strain of political unrest and the loss of infrastructure at a regional scale.

Although the structures in this sample vary in terms of the timing of their initial construction, habitation, and abandonment, dates representing the earliest contexts of activity cluster around the 600s CE, and it is clear that several local transformations were underway. These include the growth of the settlement, indicated by the construction of new houses, and the adoption of foodways, domestic ritual practices, and forms of material culture that were distinct from those of Teotihuacan. Teotihuacan's influence over communities in the southern Basin significantly diminished during the 500s CE; it did not only experience violence in its capital city, but had collapsed as a regional state by the 600s CE.

The tumultuous events that culminated in the death of the state were part of the collective memory of residents of the southern Basin. From this perspective, activities such as house building may be understood not simply as the practical fulfillment of a basic human need for shelter, but as meaningful acts of regeneration. These houses are one among many tangible outcomes of the strategies that people implemented as they reformulated a thriving community. They are physical manifestations of ideas about the practices—including forms of social interaction and cooperation involved in planning and construction—that would constitute this new way of living. The case study at Chicoloapan demonstrates that regeneration is not subsequent to collapse, but is a linked, concurrent process that plays itself out in the dynamics of everyday life at settlements beyond the margins of monumental capitals.

Declaration of Competing Interest

The author affirms that no known conflicts of interest are associated with this publication.

Acknowledgements

Research by the Proyecto Arqueológico Chicoloapan Viejo has been supported by grants from the National Science Foundation (Awards 1219505 and 1724462), the Thomas Jefferson Fund of the French American Cultural Exchange Foundation, and the University of Wisconsin-Madison. Mexico's Consejo de Arqueología granted permission to conduct fieldwork at Chicoloapan.

This research would not be possible without the support of the communities of San Vicente Chicoloapan and Coatepec, Ixtapaluca, who extended a warm welcome and offered their support in many ways. I thank the Ejido de San Vicente Chicoloapan and the ejidatarios who have kindly granted permission to excavate on their land, and I particularly appreciate the assistance provided by Antonia Hernández and Manuel Zavala Diaz. This project has benefitted immensely from collaboration with exceptional colleagues: Ricardo Cruz Jiménez, Angela Huster, Michelle Elliott, Carolyn Freiwald, Luis Barba Pingarron, and Guillermo García Román. Many thanks also to Benito Martínez Cruz, Roberto Perez Santana, Humberto Isla Perez, Enrique Perez, Andres Perez, Sergio Lazo Soto, Rosario Hernández, Gabriela Rodríguez, Norma Salazar, Ivone Medrano, Reyna Gutierrez, Berenice Barrera, and Mónica Toledano for their friendship, generosity, and support. Finally, I am grateful to the many students who have devoted their time, energy, good humor, and enthusiasm to this project.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jaa.2020.101203.

References

Anderson, J.H., Healan, D.M., Cobean, R., 2015. Collapse, regeneration, and the origins of Tula and the Toltec state. In: Faulseit, R.K., Anderson, J.H., Conlee, C.A., Dunn, S., Ek, J., Emerson, T. (Eds.), Beyond Collapse: Archaeological Perspectives on Resilience, Revitalization, and Transformation in Complex Societies. Southern Illinois University Press, Carbondale, pp. 431–458.

Beekman, C.S., Christensen, A.F., 2003. Controlling for doubt and uncertainty through multiple lines of evidence: a new look at the Mesoamerican Nahua Migrations. J. Archaeol. Method Theory 19, 111–164.

Beramendi-Orosco, L.E., Gonzalez-Hernandez, G., Urrutia-Fucugauchi, J., Manzanilla, L.R., Soler-Arechalde, A.M., Goguitchaishvili, A., Jarboe, N., 2009. High-resolution chronology for the Mesoamerican urban center of Teotihuacan derived from Bayesian statistics of radiocarbon and archaeological data. Quat. Res. 71 (2), 99–107.

Bronson, B., 2006. Patterns of political regeneration in Southeast and East Asia. In: Schwartz, G., Nichols, J. (Eds.), After Collapse: The Regeneration of Complex Societies. University of Arizona Press, Tucson, pp. 137–143.

Bronk Ramsey, C., 2009. Bayesian analysis of radiocarbon dates. Radiocarbon 51, 337–360.

Buck, C.E., Cavanagh, W.G., Litton, C.D., 1996. Bayesian Approach to Interpreting Archaeological Data. Wiley.

Carballo, D.M., 2016. Urbanization and Religion in Ancient Central Mexico. Oxford University Press, USA.

Charlton, T.H., Spence, M.W., 1983. Obsidian Exploitation and Civilization in the Basin of Mexico. In Mining and Mining Techniques in Ancient Mesoamerica, edited by Weigand, P.C., and Gwynne, G. State University of New York-Stony Brook, 6:7–86.

Clayton, S.C., 2012. Investigaciones de campo en las cercanías de Cerro Portezuelo durante el 2011. Report for the Consejo de Arqueología, México.

Clayton, S.C., 2013. Measuring the Long Arm of the State: Teotihuacan's Relations in the Basin of Mexico. Ancient Mesoamerica 24 (1), 87–105.

Clayton, S.C., 2016. After Teotihuacan: a view of collapse and reorganization from the Southern Basin of Mexico. Am. Anthropol. 118, 104–120.

Clayton, S.C., Cruz Jiménez, R., 2017. El colapso de Teotihuacan y el crecimiento de ciudades epiclásicas: investigaciones recientes en Chicoloapan Viejo. Sixth Annual Mesa Redonda Teotihuacan, Mexico.

Cowgill, G.L., 2013. Possible migrations and shifting identities in the Central Mexican Epiclassic. Ancient Mesoamerica 24, 131–149.

Cowgill, G.L., 2015. Ancient Teotihuacan: Early Urbanism in Central Mexico. Cambridge University Press.

Crider, D.L., 2013. Shifting Alliances: Epiclassic and Early Postclassic Interactions at Cerro Portezuelo. Ancient Mesoamerica 24, 107–130.

Fargher, L.F., Heredia Espinoza, V.Y., Blanton, R.E., 2011. Alternative pathways to power in late Postclassic Highland Mesoamerica. J. Anthropol. Archaeol. 30(3), 306–326.

Faulseit, R.K., 2015. Collapse, resilience, and transformation in complex societies: modeling trends and understanding diversity. In: Faulseit, R.K., Anderson, J.H., Conlee, C.A., Dunn, S., Ek, J., Emerson, T. (Eds.), Beyond Collapse: Archaeological

Perspectives on Resilience, Revitalization, and Transformation in Complex Societies. Southern Illinois University Press, Carbondale, pp. 3–26.
Faulseit, R.K., Anderson, J.H., Conlee, C.A., Dunn, S., Ek, J., Emerson, T. (Eds.), 2015. Beyond Collapse: Archaeological Perspectives on Resilience, Revitalization, and Transformation in Complex Societies. Southern Illinois University Press, Carbondale.
Feinman, G.M., 1998. Scale and Social Organization: Perspectives on the Archaic State. In: Feinman, G.M., Marcus, J. (Eds.), Archaic States. School of American Research Press, Santa Fe, pp. 95–134.
García Chávez, R., Gamboa Cabezas, L.M., Vélez Saldaña, N., 2005. Excavaciones Recientes en un sitio de la fase Tlamimilolpa en Cuautitlán Izcalli, estado de México. In: Ruiz Gallut, M.E., Torres Peralta, J. (Eds.), Arquitectura y urbansismo: Pasado y presente de los espcacios en Teotihuacan. Memoria de la tercera mesa redonda de Teotihuacan, INAH, Mexico, pp. 487–505.
Gavrilets, S., Anderson, D.G., Turchin, P., 2010. Cycling in the complexity of early societies. Cliodynamics: J. Theoret. Math. History 1, 58–80.
Graffam, G., 1992. Beyond state collapse: rural history, raised fields, and pastoralism in the South Andes. Am. Anthropol. 94 (4), 882–904.
Hamilton, W.D., Kenney, J., 2015. Multiple Bayesian modelling approaches to a suite of radiocarbon dates from ovens excavated at Ysgol yr Hendre, Caernarfon, North Wales. Quat. Geochronol. 25, 72–82.
Hamilton, W., Krus, A., 2018. The myths and realities of bayesian chronological modeling revealed. Am. Antiq. 83 (2), 187–203.
Healan, D., 2012. The archaeology of Tula, Hidalgo, Mexico. J. Archaeol. Res. 20, 53–115.
Hegmon M., Peeples M.A, On behalf of the LTVTP-NABO collaboration, 2018. The human experience of social transformation: Insights from comparative archaeology. PLoS ONE 13(11): e0208060.
Hegmon, M., Peeples, M.A., Kinzig, A.P., Kulow, S., Meegan, C.M., Nelson, M.C., 2008. Social Transformation and Its Human Costs in the Prehispanic U.S Southwest. Am. Anthropol. 110, 313–324.
Hernández, C., Healan, D.M., 2019. Migration and the Coyotlatelco Ceramic Tradition: Evidence from El Bajío. In: Beekman, C.S. (Ed.), Migrations in Late Mesoamerica. University Press of Florida, pp. 88–108.
Hicks, F., 2013. The architectural features of Cerro Portezuelo. Ancient Mesoamerica 24 (1), 73–85.
Huster, A., 2019. Chronology and style of Chicoloapan ceramics in a regional perspective. Paper presented at the symposium “Early Urbanism, land use, and community life: archaeological and paleoenvironmental research at Chicoloapan, Mexico,” Université Paris 1, Pantheón-Sorbonne, organized by S.C. Clayton and M. Elliott.
Huster, A., Clayton, S.C., 2019. Social Diversity at Chicoloapan Viejo. Paper presented at the Southwest Mesoamerica Conference, Northern Arizona University, Flagstaff.
Hutson, S.R., Ancona Aragón, I., Covarrubias Reyna, M., Larsen, Z., Lukach, K., Plank, S.E., Terry, R.E., Vanessendelft, W., 2015. A historical processual approach to continuity and change in classic and Postclassic Yucatan. In: Faulseit, R.K. (Ed.), Beyond Collapse: Archaeological Perspectives in Resilience, Revitalization and Reorganization in Complex Societies. Southern Illinois University Press, Carbondale, pp. 124–146.
Janusek, J.W., 2005. Collapse as cultural revolution: power and identity in the Tiwanaku to Pacajes Transition. In: Vaughn, K.J., Ogburn, D., Conlee, C.A. (Eds.), Foundations of Power in the Prehispanic Andes. American Anthropological Association, Arlingon, VA, pp. 175–210.
Jiménez Moreno, W., 1966. Los imperios prehispánicos de Mesoamérica. Revista Mexicana de Estudios Antropológicos 20, 179–195.
Kim, N.C., 2013. Cultural landscapes of war and political regeneration. Asian Perspect. 52 (2), 244–267.
Manzanilla, L.R., 2003. The Abandonment of Teotihuacan. In: Inomata, T., Webb, R. (Eds.), The Archaeology of Settlement Abandonment in Middle America. University of Utah Press, Salt Lake City, pp. 91–102.
Marcus, J., 1992. Dynamic cycles of Mesoamerican states: political fluctuations in Mesoamerica. Natl Geogr. Res. Explor. 8, 392–411.
Marcus, 1998. The Peaks and Valleys of Ancient States: An Extension of the Dynamic Model. In: Feinman, G.M. and Marcus, J. (Eds.), Archaic States. School of American Research Press, Santa Fe, pp. 59-94.
Mastache, A.G., Cobean, R.H., Healan, D., 2002. Ancient Tollan: Tula and the Toltec Heartland. University Press of Colorado, Boulder.
McAnany, P.A., Yoffee, N., 2010. Why we Question Collapse and Study Human Resilience, Ecological Vulnerability, and the Aftermath of Empire. In: McAnany, P.A., Yoffee, N. (Eds.), Questioning Collapse: Human Resilience, Ecological Vulnerability, and the Aftermath of Empire. Cambridge University Press, pp. 1–20.
Millon, R., 1988. The Last Years of Teotihuacan Dominance. In: Yoffee, N., Cowgill, G.L. (Eds.), The Collapse of Ancient States and Civilizations. University of Arizona Press, Tucson, pp. 102–164.
Moragas Segura, N., 2013. Sociedades en colapso: La transición del clásico al epiclásico en Teotihuacan. Díalogo Andino 41, 185–197.
Morehart, C.T., Meza Peñaloza, A., Serrano Sánchez, C., McClung de Tapia, E., Ibarra Morales, E., 2012. Human sacrifice during the epiclassic period in the Northern Basin of Mexico. Latin American Antiquity 23, 426–448.
Nelson, B.A., Chase, A.S.Z., Hegmon, M., 2014. Transformative Relocation in the U.S. Southwest and Mesoamerica. Archaeol. Pap. Am. Anthropol. Assoc. 24 (1), 171–182.
Nichols, D.L., 2015. Teotihuacan. J. Archaeol. Res. 24, 1–74.
Nichols, D.L., Neff, H., Cowgill, G.L., 2013. Cerro Portezuelo: States and Hinterlands in the Pre-Hispanic Basin of Mexico. Ancient Mesoamerica 24 (1), 47–71.
Parsons, J.R., 1971. Prehistoric Settlement Patterns in the Texcoco Region, Mexico. Memoirs of the Museum of Anthropology, University of Michigan, Number 3.
Pastrana, A., 1998. La explotación Aztec de la obsidiana en la Sierra de las Navajas. Instituto Nacional de Antropología e Historia, Mexico City.
Rattray, E.C., 1966. An archaeological and stylistic study of coyotlatelco pottery. Mesoamerican Notes 7–8, 87–211.
Rattray, E.C., 1989. Un taller de bifaciales de obsidiana del período Coyotlatelco en la Hacienda Metepec, Teotihuacan. In: Gaxiola, M., Clark, J.E. (Eds.), La obsidiana en Mesoamerica. Instituto Nacional de Antropología e Historia, México City, pp. 243–253.
Rattray, E.C., 2001. Teotihuacan: Ceramics, Chronology, and Cultural Trends. Instituto Nacional de Antropología e Historia/University of Pittsburgh, Mexico City/Pittsburgh, PA.
Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Ramsey, C.B., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., 2013. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55 (4), 1869–1887.
Schwartz, G.M., 2006. From collapse to regeneration. In: Schwartz, G.M., Nichols, J.J. (Eds.), After Collapse: The Regeneration of Complex Societies. University of Arizona Press, Tucson, pp. 3–17.
Sejourné, L., 1983. Arqueología e historia del Valle de México de Xochimilco a Amecameca. Siglo veintiuno editores, Mexico City.
Sharratt, N., 2016. Collapse and cohesion: building community in the aftermath of Tiwanaku state breakdown. World Archaeol. 48 (1), 144–163.
Solar Valverde, L. (Ed.), 2006. El Fenómeno Coyotlatelco en el Centro de México: Tiempo, Espacio y Significado: Memoria del Primer Seminario-Taller Sobre Problemáticas Regionales. INAH, Coordinación Nacional de Arqueología, Mexico.
Solnit, R., 2009. A Paradise Built in Hell: The extraordinary communities that arise in disasters. Penguin Books, New York.
Spencer, C.S., Redmond, E.M., 2004. Primary State Formation in Mesoamerica. Ann. Rev. Anthropol. 33, 173–199.