

CHAPTER 18

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**COMPLEX SOCIETIES
IN THE SOUTHERN
MAYA LOWLANDS
THEIR DEVELOPMENT AND
FLORESCENCE IN
THE ARCHAEOLOGICAL
RECORD**

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THE evolution of sociopolitical complexity in the southern Maya lowlands is much discussed but as yet is incompletely resolved. Considerations are hampered by the fact that most early archaeological materials lie deeply buried beneath later human construction activity, making it difficult to locate remains that are directly relevant to questions bearing on the rise of complexity. Even should such remains be located, the overlying constructions usually make areal exposure of the earlier materials difficult. Nevertheless, sufficient evidence exists to posit a trajectory of complexity developing from Preclassic villages to Early Classic states to Late Classic attempts at creating hegemonic empires.

DIVERSE EARLY POPULATIONS

While there is some evidence for Archaic hunters in the coastal lowlands of Belize as early as 3400 BC, based primarily on archaeologically recovered lithic points (Lohse et al. 2006), the remains relevant to the earliest sedentary Maya appear in the southern lowlands (Figure 18.1) some three millennia ago at the onset of the Early Preclassic period (1200–900 BC). When encountered, these materials represent fully formed village societies. These early populations were familiar with raised-platform architecture and participated in broader Mesoamerican networks. Each of these early developments is associated with regional ceramic styles that are largely distinct. While the earliest dates may vary slightly from site to site, shortly after 900 BC complex regional developments can be found in the archaeological record of the southern Maya lowlands for northern Belize (Swasey), for west-central Belize (Cunil), for the central Petén (Eb), and for the Usumacinta area (Xe). Interments were simple compared to the later Classic period, but nevertheless they regularly contained pottery vessels and, in some cases, imported shell or jadeite adornments. No solid archaeological evidence has yet been encountered for in situ developmental precedents for these village groups, causing some researchers to argue for an influx of other Mesoamerican

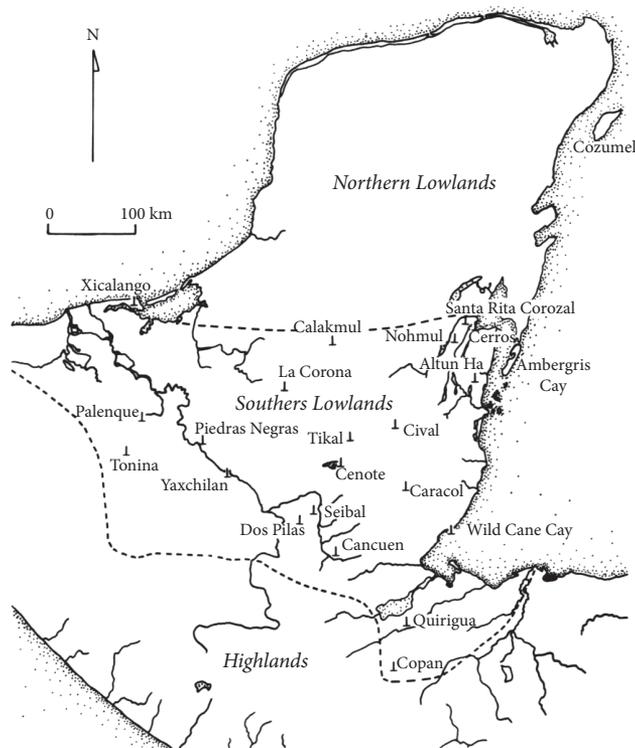


Figure 18.1 Map of the Maya area, showing the location of the southern lowlands and the major sites mentioned in the text.

populations, such as the Mixe-Zoque from Veracruz and Chiapas, into the Maya area at this early date (Ball and Taschek 2003). Whatever the case, a series of diverse village communities dotted the landscape of the Maya southern lowlands in the first half of the first millennium BC. Sometime after 600 BC, the cultural remains associated with these communities became more standardized, especially in terms of ceramics and architecture, becoming readily identifiable as “Maya.”

EARLY IDEOLOGY AND A PAN-MESOAMERICAN CONNECTION

Most researchers do not see any direct linkage between the contemporary Olmec ceramic complexes recovered at San Lorenzo and La Venta, Mexico, and those found in the Maya southern lowlands (Andrews V 1987). However, it is possible that both the Maya and the Olmec used the same conceptual base for their earliest public plazas, generally referred to either as “Astronomical Commemorative Assemblages” or as “E Groups” (A. Chase and D. Chase 2006). The importance of ideology to the founding of Maya sites may also be found in early deposits deeply buried in the sacred locations around which Maya sites were centered. Such deposits are difficult to find because early Maya earth-moving efforts resulted in the construction of massive horizontal platforms (Joyce 2004). While interments with offerings are found by at least 900 BC, the earliest elaborate Maya caches appear to date several hundred years later, dating to between 700 to 600 BC. Among the earliest of these ritual deposits to be found associated with monumental architecture are two cruciform cache pits, both associated with jadeite celts (Estrada-Belli 2006). One cache derives from Seibal, Guatemala, and the other is from Cival, Guatemala. Other early deposits of jadeite celts, horizontally arranged in rows, have been recovered more recently deep beneath the Seibal plazas. The material similarities in content between these Maya caches and those known from the Olmec area raise questions of interconnections between these two cultures, further suggesting that, even though ceramic complexes differ, ritual components of early Maya ideology may share some material aspects with those known from the Olmec area.

E-GROUP CRYSTALLIZATION

The Maya of the southern lowlands adopted the E Group configuration (consisting of a western pyramid and an eastern platform supporting three structures) as the basic plan for the public architecture of almost all major centers (Figure 18.2). This

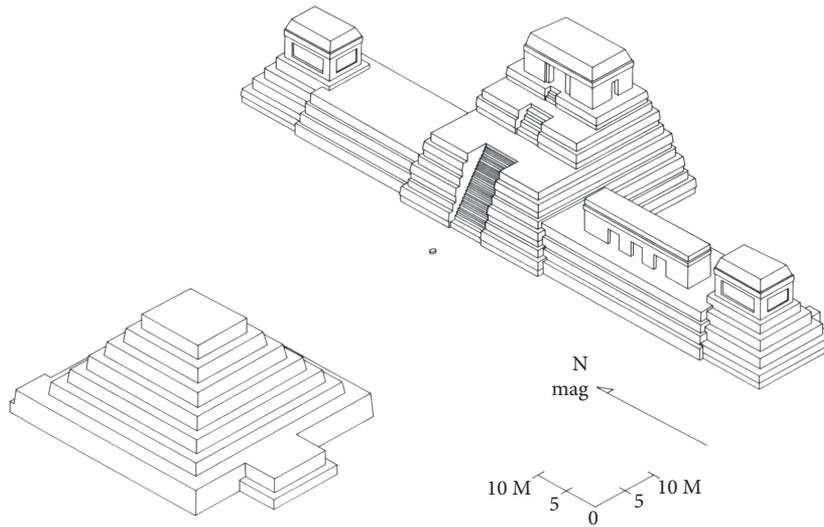


Figure 18.2 Isometric reconstruction of the Cenote E Group (after A. Chase and D. Chase 1995).

architectural complex differentiates the early Maya of the southern lowlands from their neighbors elsewhere in Mesoamerica (A. Chase and D. Chase 1995). E Groups have commonly been assumed to function as observatories useful for defining astronomical events such as solstices and equinoxes; however, the variation in their formal structural alignments (e.g. Aimers and Rice 2006) suggests that this was likely not the case. The architectural buildings that make up the grouping are more probably associated with a series of deities important to the founding of Maya social order. The western pyramid in the E Group has been correlated with maize iconography (Estrada-Belli 2006). Rather than representing the transition of the sun over the course of a year, the three buildings situated upon the eastern platforms in the various E Groups may represent the “triad”—sacred deities noted in epigraphic texts that were important in the formal founding of each Maya center (A. Chase and D. Chase 2006).

By 300 BC, many sites also exhibited large vertical architectural complexes—distinct from the original E Groups—that consisted of three pyramidal structures set atop a tall raised platform. In concert with the E Groups, these triadic platforms formed part of the architectural charter that provided legitimization for elite rule. The murals from San Bartolo, Guatemala, reflect this cosmological charter and explicitly show how Maya rulership was centered—in terms of five world trees or directions and based on an explicit association with the maize god; the human ruler was viewed as a representative of this deity (Saturno et al. 2005). This ideology and the triadic architectural complexes came into general use in the southern Maya lowlands during the Late Preclassic period (300 BC to 250 AD). The widespread popularity of this architectural charter is echoed in the ceramic uniformity that characterized the Maya lowlands at this time. The Maya may have been

the source of inspiration for both triadic groups and an E Group found in central Teotihuacan, Mexico (LaPorte and Fialko 1995), a suggestion consistent with the widespread economic and multidirectional sociopolitical interaction that characterized early Mesoamerica.

DIFFERENTIATION

For almost four hundred years of the Late Preclassic period (300 BC–250 AD), similar material culture characterized much of the Maya lowlands. Sometime around 100 AD, however, segments of the material culture began to change. After a long period that focused on the use of monochrome red slip in Maya ceramics, polychromy was introduced, as were new pottery forms that were reminiscent of other parts of Mesoamerica. The intensification of agriculture also increased the economic output for the Maya and provided the necessary resources for the elaboration of Maya society. During the Late Preclassic period, agricultural intensification was focused on raised-field architecture (Turner and Harrison 1981); in the Classic period (250–800 AD), agricultural intensification in several lowland areas focused on extensively terracing the landscape.

A florescence of Maya society occurred in the Late Preclassic in the northern Petén lowlands—as represented by the sites of Mirador and Nakbe (Hansen 2005). During this era, the inhabitants of Mirador constructed some of the largest pyramidal structures seen in the southern Maya lowlands. It has also been suggested that an elaborate causeway system tied together the first regional state to arise in the Maya area. Yet the archaeological remains have yet to confirm that Maya elites had fully differentiated themselves from other members of society.

Major changes occurred in the Maya area at the end of the Late Preclassic period, with some of the more precocious sites, like Mirador, being largely abandoned until the Late Classic period. During this same time frame (ca. 100 AD), however, some of the earliest archaeologically excavated Maya elite tombs were situated within public architecture (Coe 1990). The appearance of these tombs can be linked to the celebration of specific human ancestors who were beginning to change the ideological charter for rule away from the deity-based E Group complexes. By 250 AD—at the onset of the Early Classic period—both elite tombs and carved stone monuments with hieroglyphic texts became conjoined with E Groups, signifying that elite families were claiming specific ritual locations and control over established communities. Various aspects of this conjunction can be seen in the archaeology of the central Petén of Guatemala at the sites of Cenote, Tikal, and Cival. Once cosmologically centered and hieroglyphically sanctioned, however, Maya rulership became expressed and accessorized in different ways at the various sites of the southern lowlands.

Architectural complexes, referred to colloquially as “palaces” (Inomata and Houston 2001), became widespread throughout the lowlands and were paired with a concomitant florescence of the stela-altar cult (in which vertical stones portraying ruling individuals and containing hieroglyphic texts were paired with horizontal carved or plain altars). The written hieroglyphic records on these stone monuments served to position Maya leaders within cosmological time and to foster their political competitiveness. Many Maya centers used these texts to establish founding dates for their political dynasties, the bulk of which fell within the Early Classic time frame: 100 AD for Tikal; 320 AD for Yaxchilan; 330 AD for Caracol; and 426 AD for Copán. Other sites, however, like Naranjo and Palenque, claimed foundings in earlier mythological time.

It is clear from the burial data that minimally rank, and in some places stratified, societies were in place throughout the Maya lowlands at the beginning of the Early Classic period (250–550 AD) and that rulership was a prerogative of a small elite group at each site. This group differentiated itself in death through an ostentatious display of wealth (Figure 18.3). With this differentiation, the sites of the southern lowlands followed varied paths after 500 AD. Ostentatious display by the Maya elites continued at some sites, like Tikal, into the Late Classic period. At other sites, like Caracol, the elites utilized a different strategy for governing.

The Early Classic period (250–550 AD) in the southern Maya lowlands was characterized by the emergence of several primary centers—and presumably states—in the southern lowlands; these included Palenque to the west, Caracol to



Figure 18.3 Photograph of an elaborate Early Classic tomb from Santa Rita Corozal, Belize. Along with eight pottery vessels, the tomb contained a carved stone bowl, jadeite and pyrite earrings, a blue-jadeite pendent, a chert ceremonial bar, three chert spearpoints, three jadeite tinklers, three large seashells, three turtle shells, stuccoed artifacts, and a host of other artifactual remains (see D. Chase and A. Chase 2005).

the east, Copán to the southeast, Piedras Negras on the Usumacinta River, El Peru and Tikal in the central Petén, and Calakmul in south-central Yucatan. The elites at most of these sites coveted Teotihuacan-style material culture, which was originally utilized to emphasize their higher status. A rich cremation from Caracol suggests that at least one Teotihuacano may have married into that site's elite prior to 350 AD (A. Chase and D. Chase 2011). While some epigraphers suggest that actual Teotihuacanos controlled the political scene in the Maya lowlands during the Early Classic and were responsible for the Tikal dynasty, the archaeological data suggest otherwise (Braswell 2003). Stable isotope analyses show that only local inhabitants were present in the "Teotihuacanoid" elite tombs of Tikal, consistent with similar data from the Guatemalan highland site of Kaminaljuyú (Wright 2005).

The majority of these polities were relatively small city-states, whose interactions with neighboring groups are documented in hieroglyphic texts. However, Tikal emerged as the preeminent site of the Early Classic period and may have formed the first—although fleeting—hegemonic Maya empire.

THE INTERPRETIVE POLITICS OF THE LATE CLASSIC MAYA

The Late Classic period was characterized by a series of competing states. While Maya epigraphers have constructed a story of the Late Classic period as being characterized by conflict between two large hegemonic centers—Calakmul and Tikal (Martin and Grube 2000)—both the epigraphy and the archaeology can be interpreted as revealing something far more complicated. Hieroglyphic texts don't tell the whole story; they need to be contextualized. Besides political matters, these writings also deal extensively with cosmology (Stuart 2005). In some cases, multiple ideological interpretations can be generated from the same texts and, in other cases, the political texts themselves don't match the archaeological reality.

One key to our epigraphic understanding of the Late Classic period are widespread hieroglyphic references to the "snake emblem," also referred to as "Site Q," which is thought to be a prime mover and potential "super-state" (Martin and Grube 2000). Researchers have tended to assign Site Q to the center of Calakmul, largely because of that site's size and extensive stela count. However, contrary to the established epigraphic paradigm, the location of Site Q and the function of the emblem glyph itself remain open to interpretation. The emblem may be an arbitrarily grouped cacophony of animal heads (Harrison 2008), and textual reference to the enigmatic Site Q emblem may refer to ideology and cosmology rather than to political matters (A. Chase et al. 2009).

The Late Classic period (550–800 AD) in the southern lowlands represented the height of Maya artistic expression, particularly with regard to polychrome

figure vases and carved-stone monuments (Figure 18.4). This was also the time of the greatest population density in the southern lowlands; almost every residential group excavated there contains evidence of habitation during this time span (Culbert and Rice 1990). A multitude of sites flourished, and the evidence for extensive agricultural intensification in the form of terracing during the Early and Late Classic periods in the Maya Mountains of Belize and the southern Yucatan Peninsula has long been recognized (Donkin 1979). Although such agricultural intensification cannot be readily identified everywhere in the southern lowlands, it likely existed, given the evidence for substantial population numbers.

Our view of Classic Maya society is currently in flux. In the past it has been characterized on the basis of limited sampling, both of mapped areas of sites and of

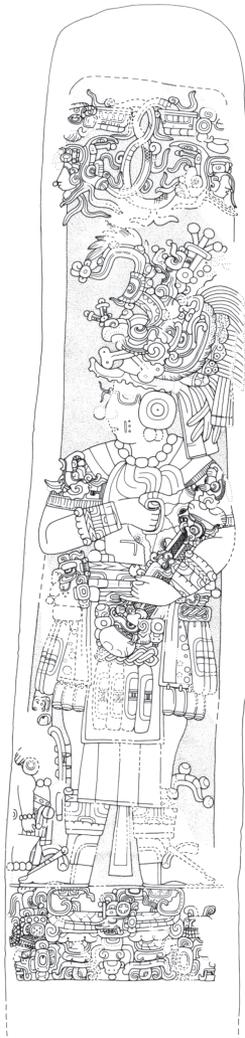


Figure 18.4 The back of Late Classic Caracol Stela 6, portraying a deceased ruler (after Beetz and Satterthwaite 1981).

excavation of architectural groups. Because of the limited nature of the data classes that were collected, contrasting models of ancient Maya society have arisen (e.g., Fox et al. 1996). However, new technologies, such as Light Detection and Ranging (LIDAR), are in the process of redefining how Maya landscape studies can be done (A. Chase et al. 2010). These technologies reveal that the Late Classic Maya lived in a heavily modified anthropogenic environment; they show that sites once considered to be discrete units are actually part of a unified whole; and, they suggest that the Maya were far more complex than some researchers believed.

Maya cities also gained their greatest areal extent in the Late Classic; some, like Caracol (Figure 18.5) and Tikal, had each occupied and completely utilized a landscape on the order of 200 square kilometers in size and contained upwards of 100,000 occupants. These Maya low-density cities are consistent with other tropical expressions of urbanism noted for Southeast Asia and Africa (Fletcher 2009). Many ancient Maya cities contain spatially distinct areas of public architecture separated by several kilometers. In some cases, these architectural complexes were linked together into a cohesive system through the use of causeways (Shaw 2008) and continuous residential settlements. The integrated siting of large plazas through a Maya landscape, conjoined with the widespread distribution of commodities and exotics like pottery and obsidian, suggest that the Late Classic Maya participated in a market economy (A. Chase and D. Chase 2007).



Figure 18.5 Photograph of Caracol's central architectural complex, "Caana." Rising 43.5 meters above its frontal plaza, this unique construction serves as the Late Classic palace for a 200-square-kilometer metropolis. It mimics triadic complexes of a much earlier era.

LATE CLASSIC MAYA CITIES, STATES, AND EMPIRES

As seen through archaeological evidence for the existence of stratification, the Maya surely achieved state-level societies by the beginning of the Early Classic period, if not before (A. Chase et al. 2009). In contrast to Early Classic states that were generally centered around one primary city, Late Classic states often incorporated other smaller centers into broader polities. In some cases, other larger centers were brought under direct political control for an extended period of time, forming what might be referred to as an “empire.” An example is Caracol, which appears to have controlled Naranjo, some 42 kilometers away, for approximately fifty years. In other cases, loose alliances were formed in which one center is viewed as having the upper hand, forming what have been termed as “hegemonic empires” in Mesoamerica; both Tikal and Calakmul are referred to in these terms.

Much of our interpretation about Maya states is predicated on the hieroglyphic inscriptions of the various rulers who occupied the cities of the southern lowlands. Without hieroglyphic texts (or with badly eroded records), sites like Altún Ha in Belize and Xultun in Guatemala tend to be excluded from political reconstructions even though they have evidence for extensive settlements and substantial external trade. Because the hieroglyphic texts focus on the individual within the institution of rulership, Maya states have often been framed as being controlled by “divine kings” (Freidel 2008). These divine kings are believed to have been situated in the main palaces of certain Maya cities (Inomata and Houston 2001)—but many Maya cities supported more than one palace, implying that others qualified for these quarters.

During the Late Classic period, there was further differentiation of political structures among sites. The spatial extent, population numbers, and public works present at many Maya cities and polities are apparent and must have required some sort administrative bureaucracy that would have functioned as a secondary elite. At sites like Caracol, administrative bureaucracy moved to the forefront and divine kingship moved to the background (D. Chase and A. Chase 2008). At Caracol, the attempt to return to divine kingship in the Terminal Classic period (800–900 AD) provides a key impetus to the collapse in providing an ill-advised dynastic intervention that broke with long-established economic patterns. While Maya states may have been fairly uniform in the Early Classic period, over the course of the Classic period different Maya polities came to focus on distinct governing strategies, which helped to create very diverse Late Classic polities. These differences determined the varied and protracted nature of the Maya collapse.

By the end of the Late Classic there were multiple kinds of states in existence in the southern lowlands. Some focused on divine kingship, but others had moved to more complex political orders. The largest Maya states were characterized by huge populations—between 50,000 and 115,000 people in the main center and between 300,000 to 600,000 people in the regional state. The various polities in the Maya

southern lowlands used diverse strategies to manage their inhabitants. Some states managed huge regional areas and effectively regulated their landscapes, while others may have been more cavalier in their treatment of the environment. Thus, a complicated set of polities existed throughout the southern lowlands at the end of the Late Classic period. While some, like Dos Pilas, Guatemala, were destroyed by war shortly after 760 AD (O'Mansky and Dunning 2004), other states continued to prosper for another 140 years before succumbing to the complex events that eventually caused Classic Maya civilization in the southern lowlands to essentially disappear shortly after 900 AD (D. Chase and A. Chase 2006).

CONCLUSION

While the archaeological data for the development of Maya civilization in the southern lowlands are difficult to synthesize, investigations over the last century have revealed a civilization with great complexity. The Maya filled the southern lowlands with people and created complex political systems, grounded in ancient cosmology, to manage their populations. Like peoples throughout the world, Maya elites fought and schemed to gain social and economic control not only of their own populations but also of their neighbors' societies. The Maya contribution to a general understanding of complex societies is only now coming to fruition as we gain better archaeological samples. Much of the current research is resulting in a completely new understanding of the place of the ancient Maya among the world's past civilizations.

REFERENCES

- Aimers, James J., and Prudence M. Rice. 2006. Astronomy, Ritual, and the Interpretation of Maya "E-Group" Architectural Assemblages, *Ancient Mesoamerica* 17:79–96.
- Andrews V, E. Wyllys. 1990. Early Ceramic History of the Lowland Maya. In *Vision and Revision in Maya Studies*, edited by F. Clancy and P. D. Harrison, pp. 1–19. University of New Mexico Press, Albuquerque.
- Ball, Joseph W., and Jennifer T. Taschek. 2003. Reconsidering the Belize Valley Preclassic: A Case for Multiethnic Interactions in the Development of a Regional Culture Tradition. *Ancient Mesoamerica* 14:179–217.
- Beetz, Carl P., and Linton Satterthwaite. 1981. *The Monuments and Inscriptions of Caracol, Belize*. Monograph 45, University of Pennsylvania Museum, Philadelphia.
- Braswell, Geoffrey E. 2003. *The Maya and Teotihuacan: Reinterpreting Early Classic Interaction*. University of Texas Press, Austin.
- Chase, Arlen F., and Diane Z. Chase. 1995. External Impetus, Internal Synthesis, and Standardization: E Group Assemblages and the Crystallization of Classic Maya Society in the Southern Lowlands. *Acta Mesoamericana* 8:87–101.

- Chase, Arlen F., and Diane Z. Chase. 2006. En medio de la nada, en el centro del universo: Perspectivas sobre el desarrollo de las ciudades mayas. In *Nuevas ciudades, nuevas patrias: Fundacion y relocalizacion de ciudades en Mesoamerica y el Mediterraneo Antiguo*, edited by M^a Josefa Iglesias Ponce de Leon, Rogelio Valencia Rivera, and Andrés Ciudad Ruiz, pp. 39–64. S.E.E.M., Madrid.
- Chase, Arlen F., and Diane Z. Chase. 2007. Ancient Maya Urban Development: Insights from the Archaeology of Caracol, Belize. *Belizean Studies* 29(2):60–72.
- Chase, Arlen F. and Diane Z. Chase. 2011. Status and Power: Caracol, Teotihuacan, and the Early Classic Maya World. *Research Reports in Belizean Archaeology* 8:3–18.
- Chase, Arlen F., Diane Z. Chase, and John F. Weishampel. 2010. Lasers in the Jungle: Airborne Sensors Reveal a Vast Maya Landscape. *Archaeology* 63(4):29–31.
- Chase, Arlen F., Diane Z. Chase, and Michael E. Smith. 2009. States and Empires in Ancient Mesoamerica. *Ancient Mesoamerica* 20:175–182.
- Chase, Diane Z., and Arlen F. Chase. 2005. The Early Classic Period at Santa Rita Corozal: Issues of Hierarchy, Heterarchy, and Stratification in Northern Belize. *Research Reports in Belizean Archaeology* 2:111–129.
- Chase, Diane Z., and Arlen F. Chase. 2006. Framing the Maya Collapse: Continuity, Discontinuity, Method, and Practice in the Classic to Postclassic Southern Maya Lowlands. In *After Collapse: The Regeneration of Complex Societies*, edited by Glenn Schwartz and John Nichols, pp. 168–187. University of Arizona Press, Tucson.
- Chase, Diane Z., and Arlen F. Chase. 2008. Que no nos cuentan los jeroglíficos? Arqueología e historia en Caracol, Belice. *Mayab* 20:93–108.
- Coe, William R. 1990. *Excavations in the Great Plaza, North Terrace, and North Acropolis of Tikal*. Tikal Report 4, University Museum, University of Pennsylvania, Philadelphia.
- Culbert, T. Patrick, and Don S. Rice. 1990. *Precolumbian Population History in the Maya Lowlands*. University of New Mexico Press, Albuquerque.
- Donkin, R. A. 1979. *Agricultural Terracing in the Aboriginal New World*. University of Arizona Press, Tucson.
- Estrada-Belli, Francisco. 2006. Lightning Sky, Rain, and the Maize God: The Ideology of Preclassic Maya Rulers at Cival, Peten, Guatemala. *Ancient Mesoamerica* 17:57–78.
- Fletcher, Roland. 2009. Low-Density, Agrarian-Based Urbanism: A Comparative View. *Insights* 2:2–19.
- Fox, John, Scott Cook, Arlen F. Chase, and Diane Z. Chase. 1996. Questions of Political and Economic Integration: Segmentary versus Centralized States among the Ancient Maya. *Current Anthropology* 37:795–801.
- Freidel, David. 2008. Maya Divine Kinship. In *Religion and Power: Divine Kingship in the Archaeological World and Beyond*, edited by Nicole Brisch, pp. 91–206. University of Chicago, Chicago.
- Hansen, Richard D. 2005. Perspectives on Olmec-Maya Interaction in the Middle Formative Period. In *New Perspectives on Formative Mesoamerican Cultures*, edited by Terry G. Powis, pp. 51–72. BAR International Series 1377, Archaeopress, Oxford.
- Harrison, Peter D. 2008. Animales como nombres de familias reales en Tikal y algunas consideraciones sobre Calakmul. *Mayab* 20:109–124.
- Inomata, Takeshi, and Stephen D. Houston. 2001. *Royal Courts of the Ancient Maya*. Westview Press, Boulder, Colorado.
- Joyce, Rosemary A. 2004. Unintended Consequences? Monumentality as a Novel Experience in Formative Mesoamerica. *Journal of Archaeological Method and Theory* 11(1):5–21.

- Laporte, Juan Pedro, and Vilma Fialko. 1995. Un reencuentro con undo Perdido, Tikal, Guatemala. *Ancient Mesoamerica* 6:41–94.
- Lohse, Jon C., Jaime Awe, Cameron Griffith, Robert M. Rosenwig, and Fred Valdez Jr. 2006. Preceramic Occupations in Belize: Updating the Paleoindian and Archaic Record. *Latin American Antiquity* 17:209–226.
- Martin, Simon, and Nikolai Grube. 2000. *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*. Thames and Hudson, New York.
- O'Mansky, Matt, and Nicholas P. Dunning. 2004. Settlement and Late Classic Political Disintegration in the Petexbatun Region, Guatemala. In *The Terminal Classic in the Maya Lowlands*, edited by Arthur A. Demarest, Prudence M. Rice, and Don S. Rice, pp. 83–101. University of Colorado Press, Boulder.
- Saturno, William A., Karl A. Taube, David Stuart, and Heather Hurst. 2005. The Murals of San Bartolo, El Peten, Guatemala: Part 1: The North Wall. *Ancient Mesoamerica* 7, Center for Ancient American Studies, Barnardsville, North Carolina.
- Shaw, Justine M. 2008. *White Roads of the Yucatan: Changing Social Landscapes of the Yucatec Maya*. University of Arizona Press, Tucson.
- Stuart, David. 2005. *The Inscriptions from Temple XIX at Palenque: A Commentary*. Pre-Columbian Art Research Institute, San Francisco.
- Turner, Billie L., and Peter D. Harrison. 1981. Prehistoric Raised-Field Agriculture in the Maya Lowlands. *Science* 213:399–405.
- Wright, Lori E. 2005. Identifying Immigrants to Tikal, Guatemala: Defining Local Variability in Strontium Isotope Ratios of Human Tooth Enamel. *Journal of Archaeological Science* 32:555–566.