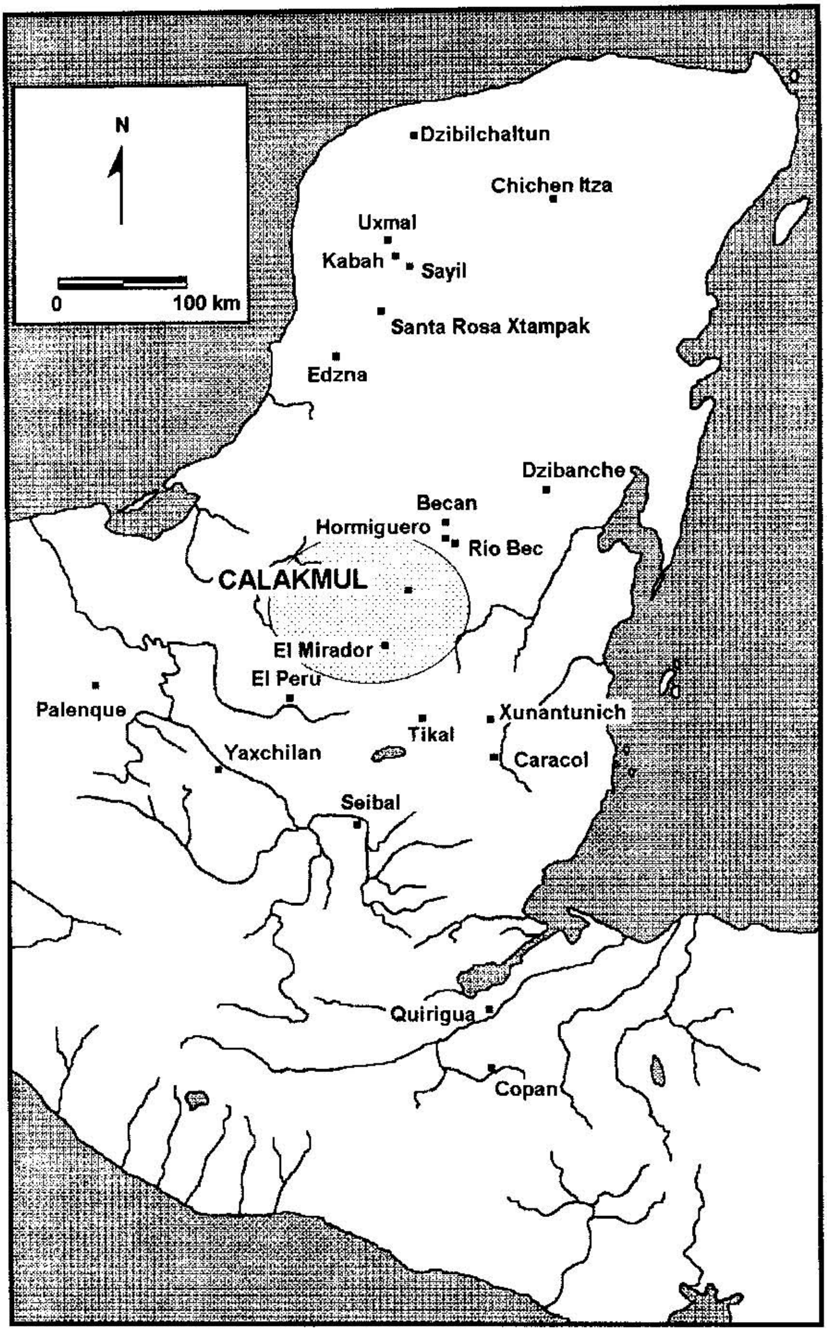
9

Defining the Terminal Classic at Calakmul, Campeche

Geoffrey E. Braswell, Joel D. Gunn, María del Rosario Domínguez Carrasco, William J. Folan, Laraine A. Fletcher, Abel Morales López, and Michael D. Glascock

For more than one thousand years, Calakmul, located in southeastern Campeche, Mexico, was the capital of one of the largest and most powerful regional states in the Maya lowlands (Folan, Marcus, Pincemin et al. 1995; May Hau et al. 1990). At its peak during the Classic period, the territory under the direct control of the *k'uhul kan ajawob,* as the kings of the Calakmul polity were known, extended over an area of approximately 13,000 square kilometers (Figure 9.1; Domínguez Carrasco et al. 1997; Folan 1988; Marcus 1973, 1976). In fact, the kingdom of Calakmul was at least as large in area and population as any other Late Classic state of the central Maya lowlands, including Tikal (Fletcher and Gann 1992; Folan 1988).

The importance of Calakmul in the Classic Maya world also is reflected in the architecture and hieroglyphic texts of sites far beyond its direct control. The architectural program of central Calakmul, already established by the Late Preclassic period, may have been the model for the central precincts of Classic-period Naranjo and Xunantunich (Ashmore 1998: 174–175). The Calakmul Emblem Glyph appears more often in ancient Maya texts and its spatial distribution is greater than that of any other Classic Maya site, including Tikal (Folan, Marcus, Pincemin et al. 1995). The political and military prowess of the Calakmul polity is recorded at sites like Palenque (which was sacked at least twice by Calakmul in the late sixth and early seventh centuries); Dos Pilas and Caracol (both lesser allies of Calakmul who, in concert with their stronger partner, claim to have killed two important kings of Tikal); El Perú, Naranjo, Piedras Negras, and Yaxchilán



9.1 Approximate extent of the Calakmul regional state during the Late Classic period.

(all subordinate allies of Calakmul); Quiriguá (whose king, K'ahk' Tiliw Chan Yopaat, captured and sacrificed the important Copán king Waxaklajuun U B'aah K'awiil in A.D. 738, apparently with the blessing of a k'uhul kan ajaw); Copán (where Stela A mentions Calakmul as one of four important Maya cities in A.D. 731); and Seibal (where the last explicit mention of Calakmul, still considered one of the four great Maya polities, appeared on Stela 10 in A.D. 849) (Marcus 1973, 1976; Schele and Mathews 1998; Looper 1995).

The central role played by Calakmul in so many battles, marriages, accessions, and commemoration events has led Martin and Grube (1995) to call the polity a "superpower." Although we are unsure that the term can be applied legitimately to any Maya kingdom, it is clear that no model of Classic Maya political process that ignores the fundamental importance of Calakmul is viable (Marcus and Folan 1994; Pincemin et al. 1998). If warfare or other aspects of political intrigue were factors in the complex processes leading to the collapse of state-level society in the central Maya lowlands (see Demarest 1997 and Chapter 6, this volume), there can be no doubt that the k'uhul kan ajawob were pivotal actors at the center of this drama. We argue, therefore, that an understanding of the events and conditions of the Terminal Classic at Calakmul is central to any discussion of the Classic Maya collapse.

In this chapter we characterize the changes that took place at Calakmul during the ninth and early tenth centuries. Like many other large Maya centers, Calakmul suffered a dramatic decline of population during this period. We have evidence, however, in the form of continued elite residence and the erection of dedicatory monuments at least as late as A.D. 899, that the political structure of the Calakmul kingdom continued to function into the period of demographic crisis. The changing fortunes of the ninth century also are reflected in the establishment of new trading alliances outside the central Maya lowlands, specifically with emerging polities in the northern Maya lowlands and the Gulf Coast. There was, then, an economic response to the collapse, an adaptation that was successful for a time despite adverse environmental and political conditions. A third point we stress is that during the Terminal Classic, the use of space in the epicenter of Calakmul changed; formerly sacred structures were modified to serve as loci for more quotidian activities. This shift should not be described simply as a process of secularization: the sacred role of temples was not abandoned but combined with residential, administrative, and economic functions in a new way characteristic of sites in the northern Maya lowlands. Finally, we present evidence that one of the catalysts in the changing fortunes of Calakmul was climatic deterioration. We think that a prolonged drought was a contributing factor to the decline of the largest, and arguably most important, Classic Maya polity.

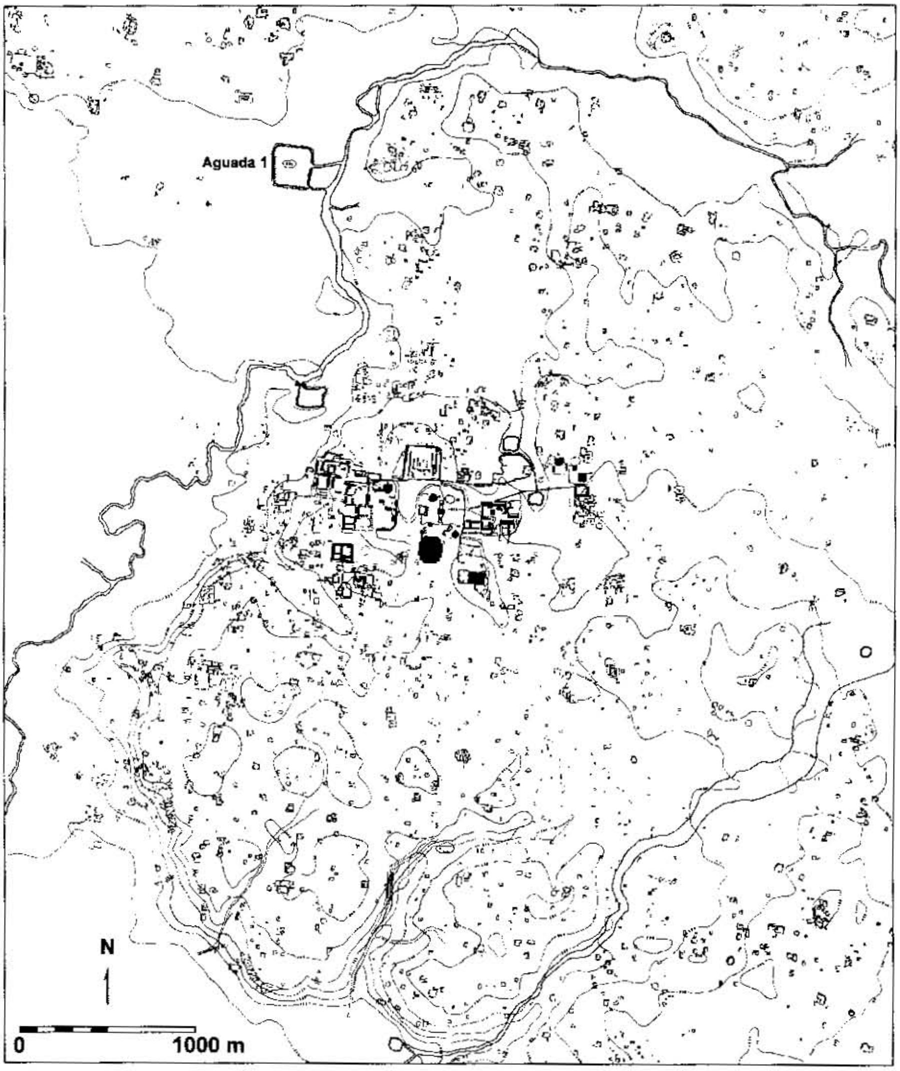
INVESTIGATIONS AT CALAKMUL

The data and interpretations presented in this chapter are the result of ongoing archaeological research that began more than two decades ago. Field investigations conducted by the Proyecto Calakmul of the Universidad Autónoma de Campeche include the detailed survey and mapping of the thirty square kilometers that form the inner core of Calakmul, the excavation and consolidation of several monumental structures in the site epicenter, limited excavations in other sectors of the city and its environs, study of the hydraulic system surrounding the city center, environmental studies of the site and its sustaining area, and a wide variety of survey and mapping operations conducted within the Calakmul kingdom. In the laboratory we have conducted analyses of ceramics, stone tools and debitage, figurines, and other artifacts recovered from excavated contexts, and also have analyzed settlement and demographic data derived from our surveys. Because much of this work—particularly aspects of our settlement and demographic studies—continues, the results presented here should be considered preliminary.

Much of our discussion of the Terminal Classic occupation of Calakmul is derived from excavations in Structures I, II, III, and VII in the site epicenter. Survey and mapping operations in less imposing portions of the site and in its sustaining area have not revealed the existence of Terminal Classic and Early Postclassic structures similar to those described at other sites in the central Maya lowlands. Moreover, Terminal Classic ceramics are uncommon outside the site center. For these reasons, it seems likely that the Terminal Classic occupation of Calakmul was concentrated in the epicenter of the city. Although many of the ninth- and early-tenth-century inhabitants probably were commoners who moved into the elite architecture of the site center, there are strong indications of the persistence of a privileged class until A.D. 900 or later. A wide variety of imported goods—including pottery, obsidian, shell, jade, and metal—were recovered from Terminal Classic contexts in Structures I, II, III, and VII. These types of goods, though more broadly distributed in the Maya area during the Terminal Classic than in earlier periods, suggest the presence of an economic elite. Significantly, the erection until at least A.D. 899 of stelae with both hieroglyphic inscriptions and depictions of divine kings demonstrates the continued existence of royalty until a time that cannot be distinguished from the abandonment of Calakmul.

ENVIRONMENTAL AND CULTURAL SETTING OF LATE CLASSIC CALAKMUL

Calakmul is located in the northern Petén region of the central Maya lowlands in an area that today is heavily forested. Recent analyses indicate that the millennium in which Calakmul thrived was characterized by moderate but dependable rainfall (Gunn et al. 1994, 1995). Compared to the rainforest of Guatemala, however, little surface water is available in the region. For this reason, the ancient Maya of Calakmul built and relied on thirteen public reservoirs to supply water throughout the dry season. The largest of these reservoirs, Aguada 1, encompasses an area of five hectares (Figure 9.2). We estimate that the minimum total capacity of these reservoirs was 200 million liters (Domínguez Carrasco and Folan 1996;



9.2 Inner core of Calakmul, showing reservoirs, canals, and structures (after May Hau et al. 1990).

Gates and Folan 1993; Zapata Castorena 1985). Thus, if filled to capacity each rainy season, the hydraulic system of Calakmul easily could have supplied enough water to support 50,000–100,000 individuals. We could find no evidence that the reservoirs of Calakmul were used to irrigate crops (Domínguez Carrasco and Folan 1996).

The urban center of the city was called Ox Te' Tuun ('Place of Three Stones'), perhaps a reference to the massive triadic pyramid Structure II as the place of the fourth creation (Marcus 1987; Martin 1996; Pincemin et al. 1998). The many triadic structures built throughout the site center served as constant reminders of the identity of the city. Calakmul is organized in a strongly concentric fashion on the margin of the large seasonal swamp called El Laberinto. The initial Middle and Late Preclassic occupation was situated along the perimeter of the bajo, and the majority of large Classic structures were built in the ecotone up to twenty or thirty meters above its edge (Fletcher et al. 1987; Folan, Marcus, and Miller 1995). The rich and moist soils of the bajo margin were heavily planted and chert deposits in the heart of the swamp were exploited as the source of lithic material for stone tool production (Domínguez Carrasco and Folan 1996). The inner thirty-square-kilometer core of Calakmul, much of which sits on an artificially leveled limestone dome, has been mapped. A total of 6,250 structures and other stone constructions have been identified. The most striking architectural features within the urban core are a central plaza containing an astronomical commemorative group similar to Uaxactún Group E (Figure 9.3: Structures IV and VI), two of the largest pyramidal structures ever built in Mesoamerica—each more than fifty meters high (Figure 9.3: Structures I and II)—and the Great Acropolis, a complex of buildings currently under investigation by Ramón Carrasco Vargas of INAH (Carrasco Vargas 1998).

Late Classic Ceramics

We have identified twenty ceramic types characteristic of the Late Classic Ku–phase occupation of Calakmul (Domínguez Carrasco 1994a: 122–181; 1994b: 52). The high percentage of ceramics from this phase (36.4 percent of all analyzed sherds) and the great variability in utilitarian types reflect the maximum economic extension of the kingdom. As in earlier times, the strongest ceramic ties were with sites to the south, particularly those in the El Mirador basin. The Late Classic ceramics of Calakmul and El Mirador share a considerable number of formal attributes that distinguish them from pottery produced in other parts of the central Maya lowlands (Domínguez Carrasco 1994a: 301–315; 1994b: 51).

In our analysis of 22,639 Late Classic sherds from excavations into Structures I, II, III, and VII, only 151 (0.67 percent of the Ku phase total) pertain to types and varieties produced outside the Petén Tepeu II sphere.[1] Three of these (Traino Brown: Traino variety [Traino Group], Moro Orange Polychrome: Moro variety [Chimbote Group], and Pelota Modeled: Pelota variety [Corona Group]) are known principally from the Río Bec zone, located sixty kilometers northeast of Calakmul (Ball 1977a). An additional twelve sherds, all from Structure VII, are Cui Orange Polychrome: Cui variety, a funerary ware known primarily from the Chenes region and Jaina, but also found at Edzná, Acanceh, and Dzibilchaltún (Ball 1975; Ball and Andrews 1975: 232–233; Forsyth 1983: 90).

9.3 Central Plaza and Great Acropolis of Calakmul. Area shown measures 1000 x 1500 meters (after May Hau et al. 1990).

Boucher and Dzul (1998: Cuadro 1), who have analyzed an additional 64,629 Late Classic sherds recovered during recent INAH consolidation excavations at Calakmul, have noted the presence of eight more ceramic groups and thirteen types produced in the Río Bec and Chenes regions. Two additional ceramic groups, Petkanché and Azcorra, each with two types represented at Calakmul, seem to suggest economic relations with northwest Belize. Since these types also are found in the Río Bec zone (Ball 1977a), their presence may indicate only indirect contact with that region. Boucher and Dzul (1998) also identified the type Egoísta Resist (which has a wide distribution in the northern lowlands, Belize, and Petén [Ball 1977a: 82]), and found one sherd of a type that might come from the Río Motagua zone or Baja Verapáz, Guatemala. Still, all these types account for only 2.1 percent of the Ku-complex sherds analyzed by Boucher and Dzul (1998). Thus, both of our analyses support only weak ceramic similarities with Late Classic sites outside the Tepeu sphere, with the strongest external ties linking Calakmul with both the Río Bec and Chenes zones. Late Classic Calakmul participated in an essentially Petén-focused interaction sphere, with only limited quantities of ceramics, obsidian, jade, basalt, and shell entering the kingdom from other regions.

Classic-Period Monuments and Architecture

Approximately 120 stelae, dating from A.D. 431 to some time after A.D. 830, have been found within the site core of Calakmul (Marcus 1987; Pincemin et al. 1998). Only two of these, Stelae 43 and 114, clearly date to the Early Classic period. Despite the paucity of early texts at Calakmul, we know that the Early Classic was a period of significant expansion. The masks on Structure II, the largest pyramid at the site, probably were dedicated during the reign of the king who ordered the carving of Stela 114 (Carrasco Vargas 1998: 381). In addition, Structure IV of the astronomical commemorative group was remodeled as a funerary monument to the great k'uhul kan ajaw Tuun K'ab' Hix (?). A lintel from this building displays the king as the resurrected maize god sitting above a cleft in the earth, an identity later chosen by K'inich Janaahb' Pakal of Palenque for his sarcophagus lid. At the end of the Early Classic period, Structure V was converted into the most important stelae shrine at the site.

Although the architecture of Calakmul is best described as Petén style, a few stylistic elements from the Río Bec region and the northern lowlands were added to some buildings dating to the end of the Late Classic period. These include decorated benches or altars with niches (e.g., Structure II-B and Structure VII [Figures 4b, 6b]) and cord-holders incorporated into door jambs. The latest superstructures of Structures V and VI also contain Río Bec features (Carrasco Vargas 1998). Conversely, the influence of Calakmul can be found in Río Bec architecture dating to this period. Becán Structure 4, very similar to the much earlier Calakmul Structure III, was built near the end of the Late Classic period.

At least 100 stelae date to the century between A.D. 652 and 752, the apogee of the political and military power of the Calakmul state (Folan, Marcus, Pincemin et al. 1995: 327; Marcus 1987). Many of these relate events that occurred during the lifetime of Yukno'om Yich'aak K'ahk' (nicknamed "Jaguar Claw the Great"), a ruler who became k'uhul kan ajaw in A.D. 686 in a great public ceremony attended by B'alaj Chan K'awiil ("Ruler 1") of Dos Pilas (Marcus 1987; Mathews and Willey 1991). King Jasaw Chan K'awiil ("Ruler A") of Tikal claimed to have defeated Yukno'om Yich'aak K'ahk' on Lintel 3 of Temple 1, but it is unlikely that the Calakmul king actually was captured. The stucco frieze from Tikal Structure 5D-57 shows the Tikal ruler with a bound captive, but he is a secondary lord named Aj B'olon Oon Aj Sa (?) (Marcus 1997; Marcus and Folan 1994). It is not entirely clear that this individual came from Calakmul.[2] Similarly, a carved bone from the tomb of Jasaw Chan K'awiil depicts Uux Ja Te' Hixil Ajaw (?), another secondary lord, and not Yukno'om Yich'aak K'ahk' himself (Pincemin et al. 1998; Schele and Friedel 1990: 213). The recent discovery of Tomb 4 in Structure II of Calakmul suggests that Yukno'om Yich'aak K'ahk' died at Calakmul and was not captured and taken to Tikal. A plate from this tomb identifies its owner, the deceased, as Yukno'om Yich'aak K'ahk' (*Arqueología Mexicana* 1997: 77; Carrasco Vargas et al. 1999).

An additional 362 stelae have been found at secondary and smaller sites in the Calakmul kingdom, including a *bak'tun* 8 monument from Balakbal (Pincemin et al. 1998). But like most of the carved monuments from the capital, the majority of these stelae date to the Late Classic period. The earliest of eighty-two known references to Calakmul found outside the kingdom was carved on a hieroglyphic stairway at Dzibanché dating to A.D. 495. Most appearances of the Calakmul Emblem Glyph, however, date to the late seventh and eighth centuries, the period of greatest power of the kingdom.

Late Classic Demography

Using a 55 percent contemporaneous occupancy rate for the habitation structures found in the urban core of Calakmul, we calculate a Late Classic population density of some 1,000 per square kilometer for the center of the city. Greater Calakmul, consisting of 122 square kilometers, supported an average population density of 420 individuals per square kilometer. Hence, we estimate that the total population was approximately 50,000 souls during the Late Classic period (Fletcher and Gann 1992; Fletcher et al. 1987, 2001). Calakmul was a true city, and not simply a well-developed central place consisting of a royal household surrounded by the dwellings of lesser nobles and commoners. Although it is certain that few Maya centers approached the size or functional complexity of Calakmul, the notion that the Classic Maya world lacked urban cities is mistaken.

A total of twenty secondary sites, including large centers such as Oxpemul, La Muñeca, Naachtún, Uxul, and Sasilhá, are located within the Calakmul kingdom. Based on previous publications (Ruppert and Denison 1943; Turner 1990) and our own surveys, we estimate that the total population of these sites during the Late Classic period was 200,000 people.

The *El Petén Campechano: Su Pasado, Presente y Futuro* project continues to survey rural areas of the Calakmul kingdom where numerous third- and fourth-level sites are located. For example, the recently concluded survey transect running south from the Escárcega-Xpuhil highway to the Centro Chiclero Buenfil and Calakmul has located fifty-two sites. This 400-meter-wide transect, which crosses 16.5 kilometers of bajo, is fifty kilometers long. Many of the sites along the transect are relatively small, consisting of multiple courtyard groups inhabited during the Late Classic period. Larger sites contain palaces, temples, and stelae, and were occupied during several periods. These larger rural sites tend to be located on elevated ridges emerging from the bajo margins, that is, in ecotones very similar to that of Calakmul.

After deducting that portion of the terrain left unoccupied, using a 68 percent contemporary occupation rate (see Robichaux 1995), and an estimate of 5.6 individuals per residence, we calculate that the Late Classic rural population of the Calakmul kingdom was 1.5 million people.[3] Turner (1990: Table 15.5) has estimated that the rural-intersite population density of the Calakmul kingdom was

96.3 people per square kilometer (515,484 people in 5,355 square kilometers), a figure slightly lower than our calculation of 120 people per square kilometer but in general accord with it. Incorporating our population estimates for the city of Calakmul (50,000), the twenty secondary sites (200,000), and the rural population (1.5 million), we derive a total population of 1.75 million individuals for the 13,000-square-kilometer Late Classic kingdom of Calakmul. This value is larger than the Late Classic population (1,520,107) calculated by Turner (1990: Table 15.4) for the 12,600-square-kilometer Tikal polity. Thus we see no reason to think that the Tikal regional state was either larger in territory or more populous than the Calakmul kingdom (Folan 1988: 157).

CALAKMUL DURING THE TERMINAL CLASSIC (A.D. 800–900/950)

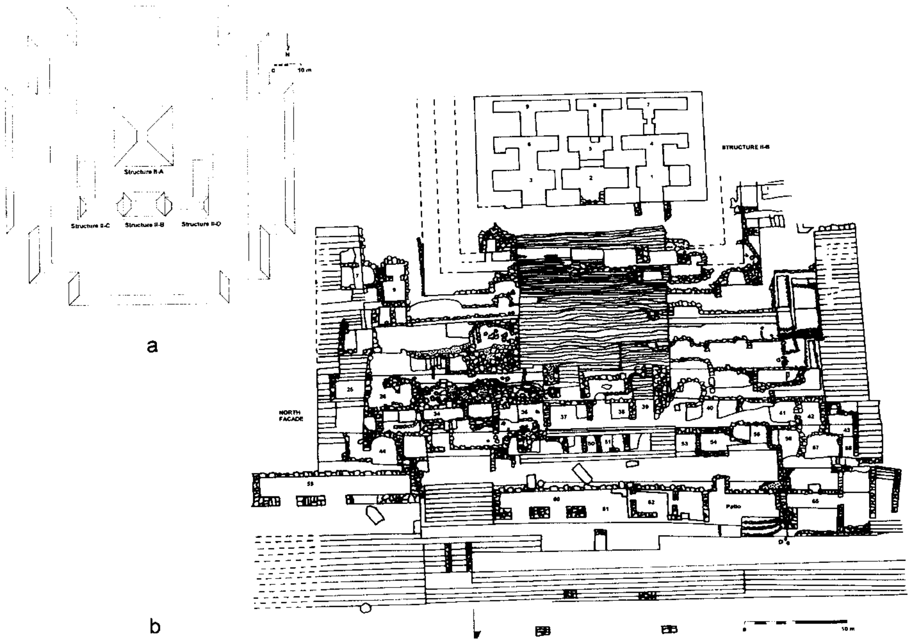
Excavations in the Site Center

Excavations conducted by the Centro de Investigaciones Historicas y Sociales of the Universidad Autónoma de Campeche in 1984–1985, 1988–1989, and 1993–1994 focused on three buildings: Structures II, III, and VII. Additional excavations were undertaken in Structure I. All four structures evince substantial occupation during the Terminal Classic period.

Significant quantities of artifacts were recovered from in situ floor contexts in three of the four structures. These include incense burners and other items used in rituals, but the majority of the artifacts are related to mundane domestic and economic activities. Although we are aware of the recent emphasis placed by archaeologists on termination rituals (e.g., Freidel 1998; Freidel et al. 1998; Mock 1998d), few of the floor assemblages recovered from Structures II, III, and VII appear to be offerings of any kind, let alone termination offerings. Items such as Postclassic incense burners were found in some rooms, but they cannot be linked to termination rituals conducted at the end of the Classic period. Instead, we interpret the vast majority of the artifacts found in primary floor contexts at Calakmul as representing certain aspects of the last use of a building before abandonment. We caution, however, that we have no evidence that these collections resulted from a hurried and unplanned abandonment, as has been noted at Aguateca and Joya de Cerén (Inomata 1997; Inomata and Stiver 1998; Inomata et al. 1998; Ponciano Alvarado et al. 1998; Sheets 1992, 1997). Thus, the artifacts found in the rooms of Structures II, III, and VII are those items left behind—perhaps deliberately—by a population preparing to leave the site. They form an incomplete assemblage that may not represent the full range of behaviors conducted in the buildings. We presume that other items were carried off by the last inhabitants of Calakmul.

Structure II

Like many other important Preclassic Maya temples, Structure II is a triadic construction (Figure 9.4a). The structure, measuring 140 meters to a side and



9.4 Calakmul Structure II: (a) plan, (b) detail of north facade.

rising to a height of 55 meters, is one of the largest buildings in Mesoamerica extensively occupied during the Classic period. Early Classic modifications to the building did little to change its fundamental appearance. But beginning in the middle of the eighth century, an important building program forever altered the original Late Preclassic triadic pattern of the temple-pyramid. At this time, the Early Classic masks of Structure II were buried, a large central staircase was raised, and Structures II-B, II-C, and II-D were built on the northern edge of the platform. The construction of these superstructures, which served as a palace complex, altered the basic function of Structure II. Somewhat later, a series of crude rooms were built on the facade of Structure II. Thus, in the late eighth and ninth centuries, Structure II was both a sacred temple and a secular residence.

Structure II-B originally consisted of three vaulted, parallel rooms. During the Terminal Classic period, the inner space was divided, creating a total of nine rooms (Figure 9.4b). The building once supported a stuccoed and painted roof comb. The front two rows of rooms (Rooms 1–6) in Structure II-B were used for food preparation, cooking, and sleeping. Each room contained two or more hearths and at least one trough-shaped *metate* fragment (Folan, Marcus, Pincemin et al. 1995: 317). More metates and hearths were found outside Structure II-B and on the platform associated with the center stairway. A few hearths were found in the darker recesses of Rooms 7–9, but no evidence for food preparation was found, presumably because these rooms are farthest from light and ventilation. Sleeping benches with niches were discovered in Rooms 1 and 6, Room 8 contained what may be a ceremonial altar with Río Bec–style niches, and Room 7 was a sweat bath. A small stone slab found in situ in this room was used to seal the restricted entrance (Folan et al. 1989, Folan, Marcus, Pincemin et al. 1995: 317–318).

A Terminal Classic burial was found beneath the floor along the south side of Room 5. It contained an adult male in supine position oriented with his head toward the east. All the bones were articulated, but his tibiae and femora had been removed (Coyoc Ramírez 1989a, 1989b; Folan, Marcus, Pincemin et al. 1995; Pincemin 1999, 1994; Tiesler Blos et al. 1999). Burial goods included a metate fragment covering the cranium, a bone needle and imitation stingray spine, and a small stone. Two vessels, a tecomate placed inside a dish, also were recovered. The dish is of Fine Orange ware and is similar to the Terminal Classic type Provincia Plano-Relief (Ball 1977a: 101; Forsyth 1983: Figure 32gg; 1989: 124, Figure 50g; Smith 1971: Figure 9d). The tecomate, assigned to the type Tinaja Red, contained a cord covered in red pigment and a small cloth bag enclosing bone fragments and ash (Folan, Marcus, Pincemin et al. 1995: 318–319; Pincemin 1989).

A series of small, crudely built masonry rooms were added to the north facade of Structure II at the end of the Late Classic and in the Terminal Postclassic period (Figure 9.4b). Activities such as preparing *nixtamal*, cooking, serving and consuming food, weaving, stone knapping, and shell working are demonstrated by the stone tool kits, ceramics, faunal remains, and lithic and shell debitage recovered as in situ floor assemblages (Domínguez Carrasco et al. 1996, 1998a, 1998b; Folan et al. 2001). These assemblages have allowed the identification of activity areas.[4] A concentration of *Spondylus* debitage in Facade Room 7 is evidence that shells were worked somewhere near this midden. Facade Rooms 9, 42, 43, and 53–58 contained hearths, cooking vessels, and metates. For this reason, we have identified them as food preparation areas. Large storage vessels found in open patios were used for storage and perhaps for the collection of water. Facade Rooms 36–42 tentatively have been identified as sleeping quarters. Fine stone tools, including obsidian instruments, encountered in situ in Facade Rooms 50–51 and 59–62, suggest that detailed precision work was carried out by the occupants of these rooms. Spindle whorls and obsidian blades found together in sets in Facade Rooms 34 and 58 indicate that these spaces may have been places where textiles were produced. Rooms 25–26 contained large quantities of partially worked bone and shell beads as well as fine stone tools. Numerous resharpening flakes from chert bifaces had accumulated in Rooms 59 and 62, consistent with their use as lithic production loci or temporary disposal sites. Similarly, 7,000 chert waste flakes were recovered from a floor context in Room 61. Finally, crude lithic instruments, deer antler billets, and discarded cores were found in association with animal bones on the floors of Facade Rooms 44, 65, and on the lower patio. During this final occupation, tons of ash containing domestic and household production waste were deposited at the base of Structure II, further demonstrating the daily use of a structure that had once served a purely sacred function.

Importantly, the floor assemblages from the Structure II rooms demonstrate production activities traditionally associated with both men and women. We therefore suggest that the building was occupied by one or more extended families. It is difficult to imagine that so much garbage would have been stored for long periods in occupied rooms. Hence the debris, particularly lithic debitage and other dangerous waste material, is indicative of the final use of the structure shortly before its abandonment in the tenth century (cf. Clark 1991).

The rooms on the north facade of Structure II stand in stark contrast to the structures surmounting the pyramid. With the exception of food preparation in the front of the Structure II-B elite residence and to the sides of Structure II-A, there are few indications of production activities on top of the platform. Despite significant functional changes to other parts of the building, Structure II-A served as a temple throughout the Late Classic and Terminal Classic periods. Most of the ceramics associated with Structure II-A were polychrome serving vessels; no cooking vessels were found in the temple. Significant quantities of elite serving wares also were present in Structure II-B, but as predicted by the numerous hearths and metates in this building, utilitarian ceramics were more numerous. The rows of rooms constructed on the north facade of Structure II, on the other hand, contained very few imported finewares. We therefore interpret these lower rooms as places where artisans, servants, and less important elite lived and conducted everyday activities during the Terminal Classic period. In contrast, Structures II-B, II-C, and II-D constituted a palace compound. Structure II-A, at the summit of the pyramid, continued to serve as an important temple, with access limited to those elite living in the palace compound.

At the time of abandonment in the tenth century, Structure II was still undergoing renovation. In particular, the stair leading to Structure II-B was being rebuilt, as was the upper stair leading to Structure II-A. The inner floor of the temple was being replastered, and several plaster-covered earthen additions at the rear and west side of Structure II-B were under construction. These ongoing construction projects, the accumulated debris in occupied rooms, the deliberate placement of metates in inverted positions, and the careful storing of obsidian blades, cores, and projectile points in niches, all suggest to us that the final abandonment of Structure II was sudden but orderly, and that the Terminal Classic occupants planned to return.

Structure III

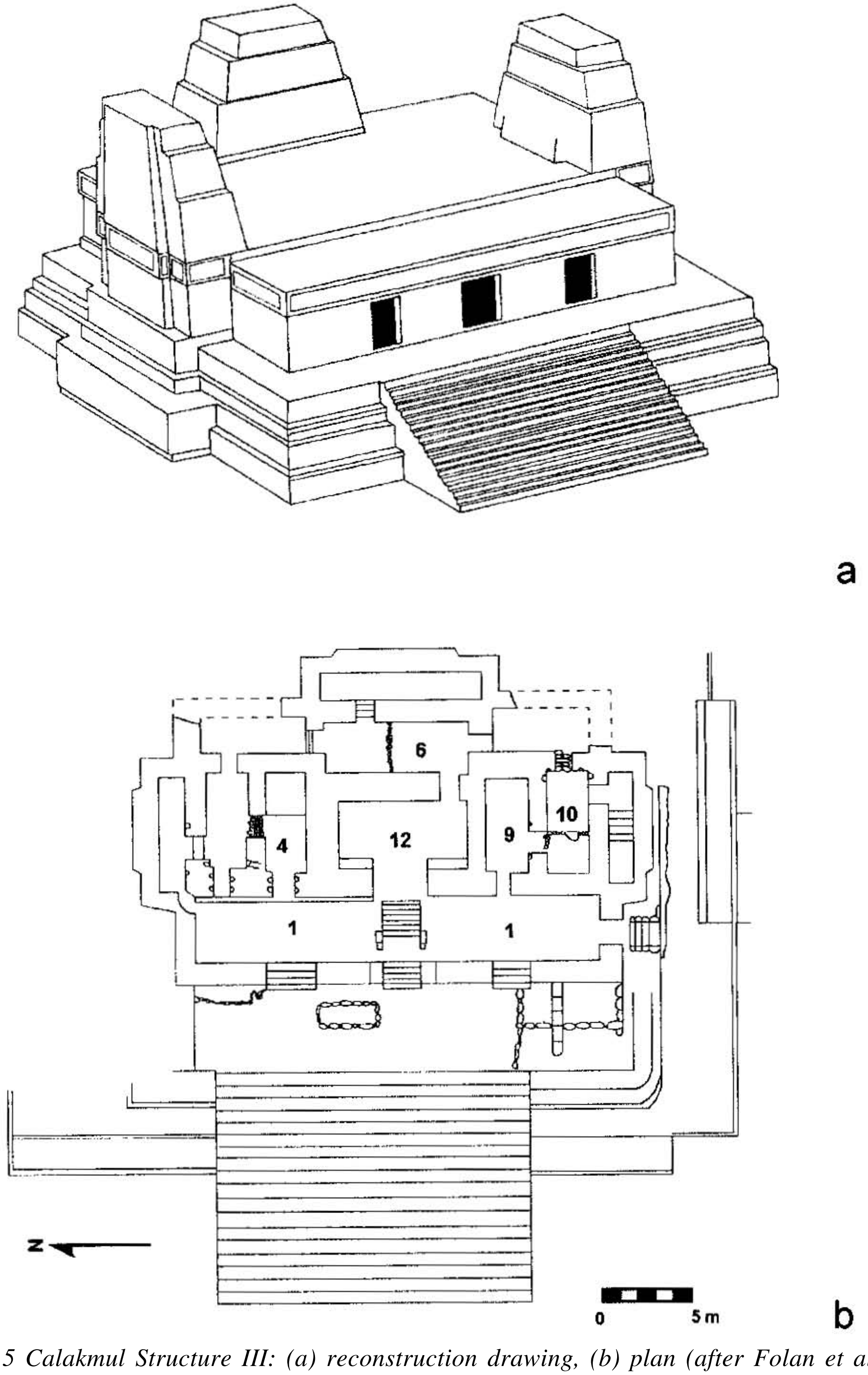
Lundell's Palace, or Structure III at Calakmul, is a twelve-room residential structure located east of the Central Plaza (Figure 9.3; Alvarez Aguilar and Armijo

Torres 1989–1990). The western facade, originally adorned with stucco masks, contains three doors. Three roof combs, positioned on the north, south, and east sides of the structure, imitate the triadic summit of the earlier Structure II (Figure 9.5a). This design not only tied the royal family who lived in Structure III to religious events held in Structure II (Folan et al. 2001), but also served to identify the city as Ox Te' Tuun.

Lundell's Palace, built early in the Early Classic, was occupied continuously until the Terminal Classic period. Although some minor changes, such as the opening of a door between Rooms 1 and 9, were made during the Terminal Classic, the building never was significantly altered. This demonstrates its importance to the ruling family of Calakmul. One reason Structure III was maintained for so many centuries is that it served as a funerary monument to an important ruler. Tomb I, one of the most elaborate burials known from the site, was found beneath a raised section of Room 6 (Figure 9.5b). A nine-meter-long "psychoduct" connected the tomb to the northern facade of the building, outwardly indicating that the palace contained an important burial (Coyoc Ramírez 1989a; Pincemin 1999; Tiesler Blos et al. 1999). The funerary goods accompanying this late fourth or early fifth century k'uhul kan ajaw have been described in detail elsewhere (Folan, Marcus, Pincemin et al. 1995; Pincemin 1994). We suspect that he may have been a predecessor to the king who dedicated Stela 114, the earliest known monument at the site (Pincemin et al. 1998: 323).

As was the case in excavations of Structure II, numerous artifacts were recovered from in situ floor contexts within the rooms of Structure III and on the stairs and platform in front of the superstructure. The greatest concentration of ceramic material was found in the latter area, particularly in the northern and southern corners. Most of these vessels were large *ollas* and jars assigned to the type Tinaja Red. These may have been used for food storage, but also could have been placed outside to collect rainwater. Evidence for Terminal Classic household activities within the superstructure includes the presence of hearths and cooking wares, metates, carbonized seeds, stone tools, and gastropods in Room 9. It probably served as a kitchen. The Terminal Classic doorway in the wall between Rooms 1 and 9 probably was opened to allow more light and better ventilation into this cooking space. Hearths, cooking vessels, and metates also were found in the northern half of Room 1, and so it too may have been used for food preparation. Room 10 has a sleeping bench, and Room 4 contained significant quantities of lithic debitage, including casual percussion cores made of chert. It may have served as a temporary storage place for hazardous lithic debris or even as a production space. Several metates were found in situ in Structure III. As for Structure II, we interpret this pattern as indicating that the last occupants of the building intended to return.

Figurines, nearly all of which were musical instruments, were left on the stairs and in the center of Room 12, on the platform in front of the central and



9.5 Calakmul Structure III: (a) reconstruction drawing, (b) plan (after Folan et al. Figures 9–10).

southern entryways, and on the upper risers of the main stairs (Braswell et al. 1998; Domínguez Carrasco et al. 1998a, 1998b; Ruíz Guzmán 1998; Ruíz Guzmán et al. 1999). These artifacts, no doubt, were placed in front of the superstructure during ceremonial activities at the end of or postdating the Terminal Classic occupation of the building. Although there are other possibilities, it is conceivable that they represent termination rituals. Oddly enough, all the figurines are of Late Classic style. We suspect that they were heirlooms or finds left on the stair as offerings.

Structure VII

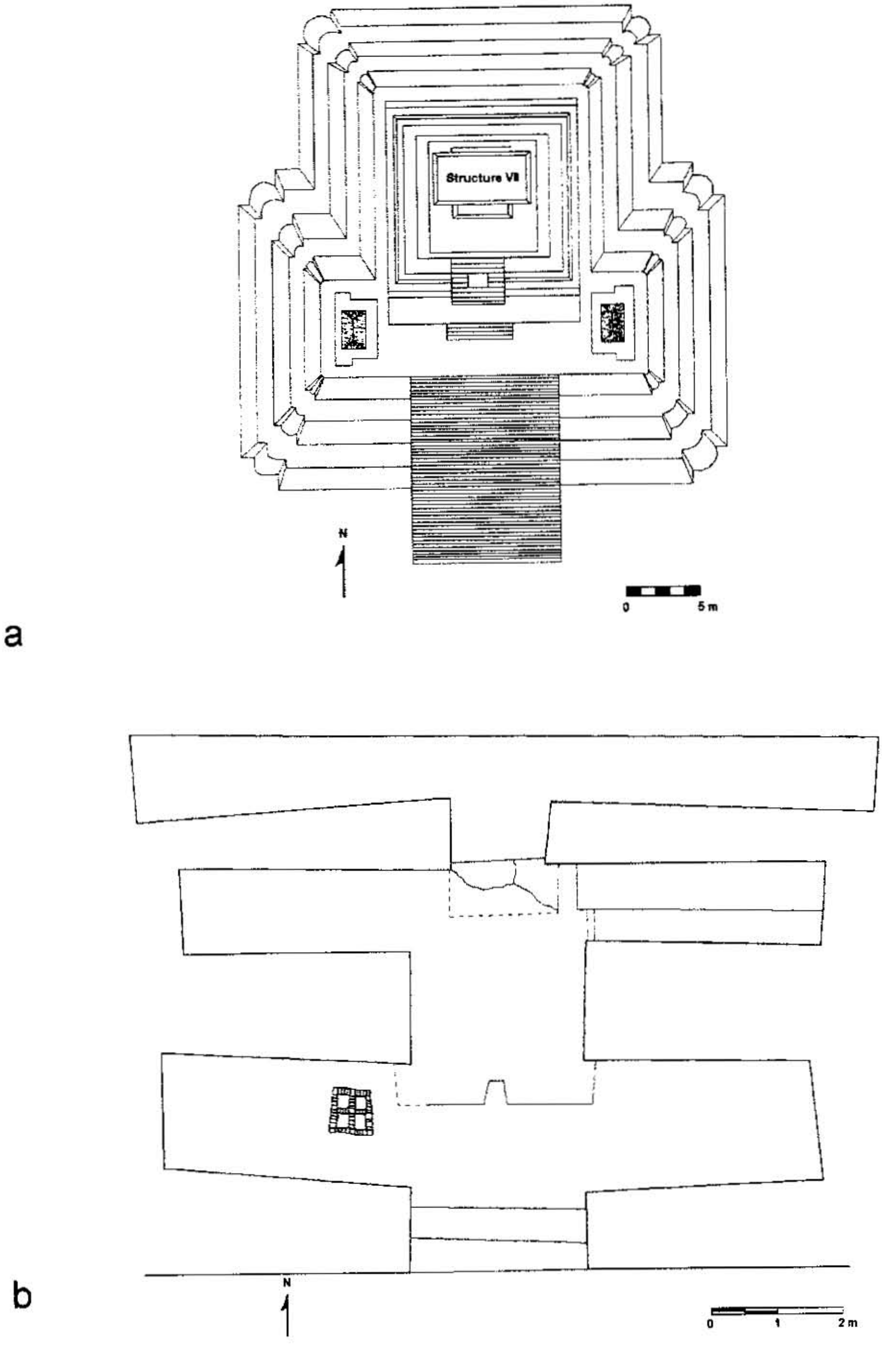
Like its much larger counterpart on the southern extreme of the Central Plaza, Structure VII is a pyramid surmounted by three superstructures placed in a triadic arrangement (Figure 9.6a). The earliest construction phase dates to the Late Preclassic period, the central superstructure dates to the Late Classic, and a final building episode dates to the Terminal Classic period.

The central temple contains an important burial dating to about A.D. 780 (Coyoc Ramírez 1985; Domínguez Carrasco 1992b). The burial was found under a Río Bec–style altar containing a niche (Figure 9.6b). It consists of the remains of an adult male who was wrapped in a mat, which then was exposed to fire. Jaguar claws, skull fragments, and a portion of a tail also were associated with the funerary bundle, suggesting that the noble was buried with his jaguar cloak. The elaborate tomb furnishings contained 2,147 pieces of jadeite, including a mosaic mask, shells, a pearl, and ten Late Classic vessels. An offering of six obsidian blades also was found in the tomb, and fifty-eight additional complete blades were found with chert eccentrics in an associated cache (Domínguez Carrasco and Gallegos Gómora 1989–1990; Folan, Marcus, Pincemin et al. 1995: 319–320). All sixty-four obsidian blades, probably bloodletters, are made of obsidian from the El Chayal source, and many appear to have been struck sequentially from the same core.

Floor assemblages from Structure VII included numerous *incensario* fragments found along the central axis of the structure. Some of these are Chen-Mul Modeled Mayapán-style incense burners dating to the Late Postclassic period. Terminal Classic cooking vessels recovered from the eastern half and a *patolli* board scratched into the western half of the outermost room suggest that the superstructure was inhabited for a time (Domínguez Carrasco 1992b, 1994c; Domínguez Carrasco et al. 1998b; Folan, Marcus, Pincemin et al. 1995: 320).

Structure I

Limited clearing and test excavations were conducted on the summit of Structure I, a temple-pyramid structure fifty meters high. Excavations concentrated on two platforms and a small temple. The superstructure was found to be in poor condition, and almost all cultural material was recovered from slump and fall



9.6 Calakmul Structure VII: (a) plan, (b) detail of central temple (after Folan et al. 1995: Figures 7–8).

contexts. For this reason, it is difficult to conduct a functional analysis of the structure based on the associated artifacts (Zapata Castorena and Florey Folan 1989–1990). Still, nearly half of the ceramics from the temple were large ollas and jars dating to the Terminal Classic Halibé phase. These are utilitarian vessels used predominantly for cooking and storage (Domínguez Carrasco et al. 1998b: 607). It seems likely, then, that Structure I served as a residence during the Terminal Classic period.

Interpretation: The Terminal Classic Palace-Temple Pyramid

Excavations in Structures I, II, and VII reveal that the simple characterization of pyramidal structures as "temples" does not hold for the Terminal Classic occupation of Calakmul. Instead, a variety of activities including cooking, eating, sleeping, and craft production were conducted in architectural space that in previous periods was reserved for ritual activities. The earliest evidence we have for this shift in the use of temple-pyramids is the construction of Structures II-B, II-C, and II-D in the mid-eighth century. These buildings, elite residences of the highest order, formed a small palace compound. Terminal Classic residential debris also was collected from Structures I and VII, suggesting that they, too, were inhabited. We stress that these Terminal Classic occupants were not squatters, but members of an elite class that had access to high-status goods including imported finewares and jade. Evidence of cooking, shell working, lithic reduction, bead production, and textile manufacture was recovered from the series of rooms and patios on the north facade of Structure II. These rooms contained far fewer polychrome or imported serving vessels than their counterparts on top of the platform. We conclude, therefore, that by the end of the Late Classic period, temple-pyramids served as palace compounds where everyday production and consumption activities were conducted by the elite and their retainers.

This important functional shift toward the secular use of pyramidal structures should not be interpreted as indicating a decline in the use of buildings as temples. Incense burners, whistle figurines, and other offerings were recovered from Structures I, II-A, and VII. They also were found in Structure III, an archetypal palace structure. These artifacts indicate that certain portions of the buildings, particularly interior rooms and stairs leading to the highest superstructures, retained their sacred function. For this reason, we choose to call such structures "palace-temple pyramids."

Structures like the palace-temple pyramids of Terminal Classic Calakmul are not widely known in the central Maya lowlands, though the Caana of Caracol may be another example (see A. Chase and D. Chase, Chapter 16, this volume). Such structures are more common, however, in the northern lowlands of Campeche and Yucatán. Williams-Beck (1995, 1996) has called them "linear (vertical) complexes." They include such well-known buildings as the Cinco Pisos pyramid at Edzná (as well as the entire elevated Great Acropolis at that site), the palaces of Santa Rosa Xtampak and Halal in the Chenes region, numerous palaces of the Río Bec region (e.g., Becán Structure I, Xpuhil Structure I, Río Bec-B Structure I, and Hormiguero Structure II), and the Palace of Sayil. In all these Late and Terminal Classic structures, temple-pyramids and palaces are conflated. The Late to Terminal Classic modifications of both the form and function of temple-pyramids at Calakmul suggest to us that the elite maintained important cultural ties with the Río Bec, Chenes, and Puuc regions.

Terminal Classic Stelae

The last Period Ending recorded as a Long Count date at Calakmul was 9.19.0.0.0 (A.D. 810), appearing on Stela 16 and Stela 64 (Marcus 1987: Table 1). Three additional monuments (Stelae 15, 17, and 65) are assigned to the range 9.17.0.0.0–10.1.0.0.0 (A.D. 771–849) for stylistic reasons (Marcus 1987: Table 1; Proskouriakoff 1950). Two very late monuments, Stelae 84 (west of Structure IV-B) and 91 (north of Structure XII), have been attributed to bak'tun 10 on stylistic grounds and date to around A.D. 889 (Marcus 1987: Table 1; Proskouriakoff 1950: 152). Stela 61 contains an abbreviated date of either A.D. 899 or 909, as well as a reference to Aj T'ok' (?), the last identified ruler of Calakmul (Martin 2000: 44–45). Two other monuments, Stela 50 and Stela 93, may date to an even later period. Proskouriakoff (1950: 152) noted similarities between the sandals on Stela 50 and footwear depicted at "Toltec Period" Chichén Itzá. We see broad affinities between the late stelae of Calakmul and ninth- and tenth-century monuments found in the northern lowlands, and are particularly intrigued by similarities with carved columns at Chichén Itzá. The Cycle 10 stelae of Calakmul also are notable for what they lack: depictions of so-called "Chontal Maya" or other immigrants (as at Seibal) carved in a noncanonical style (Folan, Marcus, Pincemin et al. 1995: 330).

Terminal Classic stelae are known from secondary sites within the Calakmul kingdom. Several are firmly dated by Initial Series dates. These are Oxpemul Stela 7 (10.0.0.0.0, A.D. 830), La Muñeca Stela 13 (10.2.10.0.0, A.D. 879), and La Muñeca Stela 1 (10.3.0.0.0, A.D. 889; Folan, Marcus, Pincemin et al. 1995: 330; Proskouriakoff 1950; Ruppert and Denison 1943).

There is clear evidence, then, that despite significant demographic decline, Calakmul and some of its dependencies continued to be occupied well into the Terminal Classic period. Moreover, the continued commissioning of carved stelae by rulers demonstrates that divine kingship continued in some form until at least the last decade of the ninth century.

Terminal Classic Ceramics

A total of 22,795 Halibé-phase sherds have been identified, accounting for 36.7 percent of the ceramics in our collection (Domínguez Carrasco 1994a: 357). These have been classified into thirty-nine types and thirteen ceramic groups

(Domínguez Carrasco 1994b). The vast majority of the Terminal Classic ceramics, as in the Late Classic period, are types and varieties known from Petén. The most striking difference between the Petén Gloss ware ceramics of the Ku and Halibé phases is the great reduction in variation of elite ceramics and the complete cessation of polychrome production.

Although the quantity of Terminal Classic ceramics imported from outside the central Maya lowlands is relatively small, economic ties with sites in the northern Maya lowlands and lower Usumacinta were substantially more important than in the Late Classic period. A total of 873 sherds, representing 3.8 percent of the Halibé-phase collection, come from these regions (Domínguez Carrasco 1994a: 357). These imported ceramics include Fine Orange wares of both the Altar and Balancán groups, also known from the Río Bec region (Ball 1977a: 163) and El Mirador (Forsyth 1989: 134). A few sherds of Chicxulub Incised, a Fine Gray ware, also were recovered. Unlike at El Mirador, the Terminal Classic assemblage from Calakmul contains a variety of Cehpech slate wares of the Muna, Ticul, and Dzitas groups. All types of these groups represented at Calakmul occur in the Río Bec region in greater frequencies. It is possible, then, that trade connections with the Puuc, the lower Usumacinta, and Chichén Itzá were indirect and mediated by Becán. Another possible intermediary, particularly for access to goods produced in the Gulf Coast region, is Edzná (Boucher and Dzul 1998).

A peculiar ceramic grinding pestle dating to the Halibé phase was recovered from Structure II-F (Florey Folan and Folan 1999). To our knowledge, the only other examples are from Sotuta contexts at Chichén Itzá in the Group of the Phalli, the Caracol, the Temple of the Atlantean Columns, the House of the Grinding Stones, and the Northeast and Southeast Colonnades (Brainerd 1958: 256, Figure 72g). Brainerd proposed that the punched surfaces of the artifacts were used to grind chile on grater bowls. He further suggested that their closest known relatives are found among the Tairona of Colombia (see Mason 1939: 373), and may have diffused to Yucatán along with gold artifacts (Brainerd 1958: 256). It is significant that the only copper ring known from Calakmul was found at the same floor level as the pestle. More recently, Smith (1998a) has linked the distribution of grater bowls (and presumably the pestles used with them) to ethnic identity in Terminal Classic Yucatán.

Two previously undocumented ceramic types, which we have named Calakmul Slate and Calakmul Slate Impressed, also were identified in the Halibé complex (Domínguez Carrasco 1994a: 288–291). The surface treatment of the second type is similar to that of the Pantano Impressed: Pantano variety of the Tinaja group. We therefore suspect that Calakmul Slate Impressed was produced somewhere in the *petén campechano*. Recent geochemical analyses of sherds belonging to both types support our hypothesis that Calakmul Slate and Calakmul Slate Impressed—the two most common types of slate ware found at Calakmul—were local products.

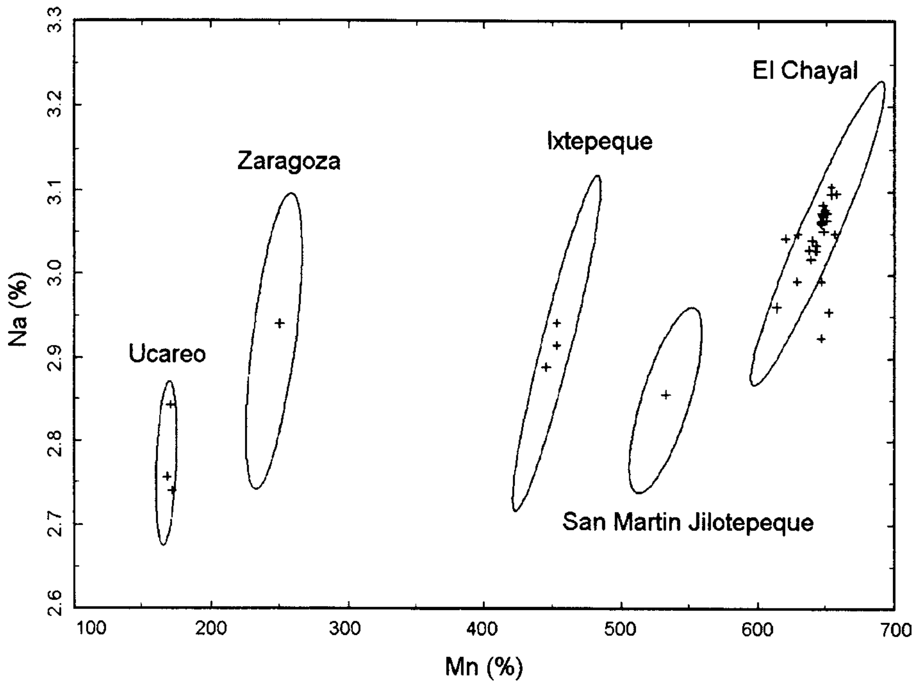
Boucher and Dzul (1998: Cuadro 1) have identified 6,407 sherds belonging to fifty-two types and fourteen ceramic groups assigned to the Halibé phase. In addition to the types we have noted, their collection also contains thirty-one polychrome sherds of the types Zanahoria Scored and Droga Roja (Ball 1977a: 63–64, 90), best known from the Río Bec region. They also found Altar Group Fine Orange ware in the form of tripod *molcajetes*, perhaps used in conjunction with the effigy pestles discussed here. Finally, Boucher and Dzul (1998: 12) identified ten sherds belonging to the Hontún and Chencán groups, previously reported only at Edzná and Jaina (Forsyth 1983: 113, 123). For this reason, they suggest that economic ties with Gulf Coast peoples may have been mediated by Edzná (Boucher and Dzul 1998: 12).

Although the details of our analyses differ somewhat, Boucher and Dzul's (1998) results support our earlier conclusions (Domínguez Carrasco 1994a, 1994b, 1996). During the Terminal Classic Halibé phase, few elite polychromes of Petén style were produced or consumed at Calakmul. Instead, these were replaced by Fine Orange, Fine Gray, and Slate wares originating in the north and in the Usumacinta region, and by two types of locally produced Slate ware. Because most of the imported wares also are known from Terminal Classic contexts in the Río Bec zone, it seems likely that trade between Calakmul and the northern lowlands was indirect. Nevertheless, it is clear that during the Terminal Classic period, economic ties with the northern lowlands became more important than in any earlier period.

Terminal Classic Obsidian

A total of 515 obsidian artifacts were recovered during excavations in Structures I, II, III, and VII. With the exception of the sixty-four prismatic blades from Tomb I and an associated cache in Structure VII, all were subject to three kinds of study: geological or geochemical provenience analysis, typological classification, and metric analysis.[5] Although many of these artifacts undoubtedly come from fallen architectural fill, 140 were recovered from floor assemblages in Structures II, III, and VII. As ceramic analysis continues, we are beginning to separate Terminal Classic obsidian from artifacts of earlier periods. In addition, certain characteristic technological traits and source procurement patterns recently have been shown to be diagnostic of the Terminal Classic period (e.g., G. Braswell 1997a, 1997b, 1998a). These also can be used to identify Terminal Classic obsidian artifacts.

All 451 analyzed obsidian artifacts were first assigned to geological sources according to visual criteria. We have found that using this method, we can attribute artifacts to sources with a 95 percent or better success rate (G. Braswell 1997a, 1997b, 1998a, 1998c, in press; Braswell et al. 1994, 2000). As a test of these assignments, thirty-nine artifacts were assayed by neutron activation analysis (Figure 9.7). One small piece had been given an erroneous assignment, sug-



9.7 Sodium and manganese contents of thirty-nine obsidian artifacts from Calakmul. Ellipses indicate 95 percent–confidence intervals for assignments to each geological source.

gesting a success rate for visual sourcing of the entire collection of about 97 percent. This is a conservative estimate, because only those pieces judged difficult to assign to a source were subject to neutron activation analysis.

Results of the combined sourcing methodology indicate that obsidian from El Chayal, Guatemala, accounts for 86.3 percent (N=389) of the collection. The remainder consists of obsidian from Pachuca, Hidalgo (4.7 percent, N=21); Ixtepeque, Guatemala (4.4 percent, N=20); Ucareo, Michoacán (2.4 percent, N=11); San Martín Jilotepeque, Guatemala (1.6 percent, N=7); and Zaragoza, Puebla (0.2 percent, N=1). Two additional pieces (0.4 percent) were not assigned to sources and are unique artifacts that could not be assayed by a destructive technique. The first, a fragment of a ground and polished earspool, is probably of Otumba obsidian and is certainly from a Mexican source; we know of no such artifacts produced in the Maya area. It was found associated with Structure II-A.

The vast majority of Late Classic obsidian from sites in the Petén and southern Campeche comes from El Chayal. In comparison, assemblages from throughout the Maya area dating to A.D. 800–1000 show a more diverse pattern of resource procurement. At the beginning of the Terminal Classic, obsidian from the Ucareo, Zaragoza, and Zacualtípan sources reached the Maya region for the first time (Aoyama 1996; Braswell 1997b; Stiver et al. 1994). Pachuca obsidian, famous for its gold-green color, also is found in significant quantities at many Terminal Classic sites. Although obsidian blades were imported from this source during the Early Classic period, there is very little evidence that Pachuca polyhedral cores were worked in the Maya area until after A.D. 800. Thus, green core-reduction debitage, which is not found at Early Classic Maya sites (with the exception of Tikal), is occasionally present in Terminal Classic contexts.

Obsidian from the San Martín Jilotepeque and Ixtepeque sources also is found commonly in Terminal Classic contexts in the central Maya lowlands. Material from the former source was used frequently during the Preclassic period, but is uncommon in Early and Late Classic assemblages. Ixtepeque obsidian, though found in trace amounts at Petén and southern Campeche sites dating to the Early and Late Classic periods, grew rapidly in importance after A.D. 800. At sites in the Petén lakes region such as Topoxté, Ixtepeque obsidian serves as a clear diagnostic of Terminal Classic and later contexts (G. Braswell 1998a; Rice et al. 1985). By A.D. 1050–1200, Ixtepeque obsidian became the chief source of obsidian utilized in the northern Maya lowlands, Belize, and Petén.

The most diagnostic feature of Terminal Classic and Postclassic prismatic blades is the presence of ground platforms, a modification that allows the tip of the pressure crutch to find solid purchase on the core. Platform grinding is a production step in the preparation of macrocores for export; that is, it is conducted at or near quarry workshops. Most blades manufactured in the central Maya lowlands during the Early and Late Classic periods have scratched platforms, a modification made as sequential rings of blades were removed from the core. Pachuca obsidian blades from Early Classic contexts in the Maya area have smooth, unmodified platforms, as do Classic-period blades found at Teotihuacan. In contrast, the vast majority of highland Mexican blades found in Terminal Classic and later contexts have ground platforms. Some time between A.D. 800 and 1000, macrocore producers in the Guatemalan highlands also began to grind their platforms.

Ground platforms on proximal prismatic blade fragments of El Chayal, Ixtepeque, Pachuca, and Ucareo obsidian recovered from Structures II and III indicate that these buildings were occupied during the Terminal Classic period. The presence of Ucareo and Zaragoza material also is diagnostic of a Terminal Classic date, as is the presence of significant quantities of Ixtepeque and Pachuca obsidian. Finally, a stemmed prismatic blade point made of Pachuca obsidian was recovered from Structure VII. This type of artifact is particularly diagnostic of the Terminal Classic and Postclassic periods.

The highland Mexican sources represented in the collection suggest that Terminal Classic inhabitants of the site participated in a trade network that also included sites belonging to the Sotuta ceramic sphere of the northern Maya lowlands. Ucareo and Pachuca material together account for more than half of the obsidian consumed at Chichén Itzá (G. Braswell 1998c), but these sources are infrequently represented at Cehpech-sphere sites (G. Braswell 1997b, 1998c). Furthermore, the distribution of Ucareo and Pachuca obsidian within the Cehpech ceramic sphere is limited to late occupations (after A.D. 900) at the largest sites. And many of these late Terminal Classic contexts—at sites like Uxmal, Kabah, and Dzibilchaltún—also contain significant quantities of Sotuta ceramics. Thus Chichén Itzá seems to have been the principal, if not sole, importer of Ucareo and Pachuca obsidian to the peninsula during the ninth century. The presence of material from these sources in the Calakmul collection suggests at least indirect contact with that important economic and political power.

Comparison of the samples from Structures II and III reveals an interesting difference in procurement patterns. While only 4 percent of the artifacts recovered from Structure II are from sources in highland Mexico, 13 percent of the obsidian from Structure III is Mexican. In fact, the relative proportion of Ucareo material in Structure III is nearly six times greater than that of Structure II. In contrast, Structure II has considerably more obsidian from the Ixtepeque, Guatemala, source. These patterns and the fact that a greater proportion of Terminal Classic ceramics were recovered from the rooms in Structure II suggest that occupation was more intensive at a later date in Structure II than in Structure III.

ECOLOGICAL CRISIS: CALAKMUL AND A TERMINAL CLASSIC DROUGHT

A prominent result of an extensive and rapidly expanding program of climatological research is that the tropics are strongly affected by changes in global temperatures (e.g., Broecker 1995). The notable record of the rise and fall of state-level political organization in the Maya lowlands makes it an important area for studies of the interaction of climatic change and cultural patterns. Although studies of Maya lowland ecology and how it relates to climate have appeared during the last two decades (e.g., Dahlin 1983; Folan 1981; Folan et al. 1983; Gunn and Adams 1981; Gunn and Folan 1996; Gunn et al. 1994, 1995; Messenger 1990), interest in global climate change is now increasing. The Maya lowlands also have attracted the attention of limnologists (e.g., Curtis et al. 1996; Deevey 1978; Dunning et al. 1998; Hodell et al. 1995). Their data, derived from cores extracted from lakes in the northern and central lowlands, provide a wealth of information on climate fluctuation on the regional level that has verified our earlier findings.

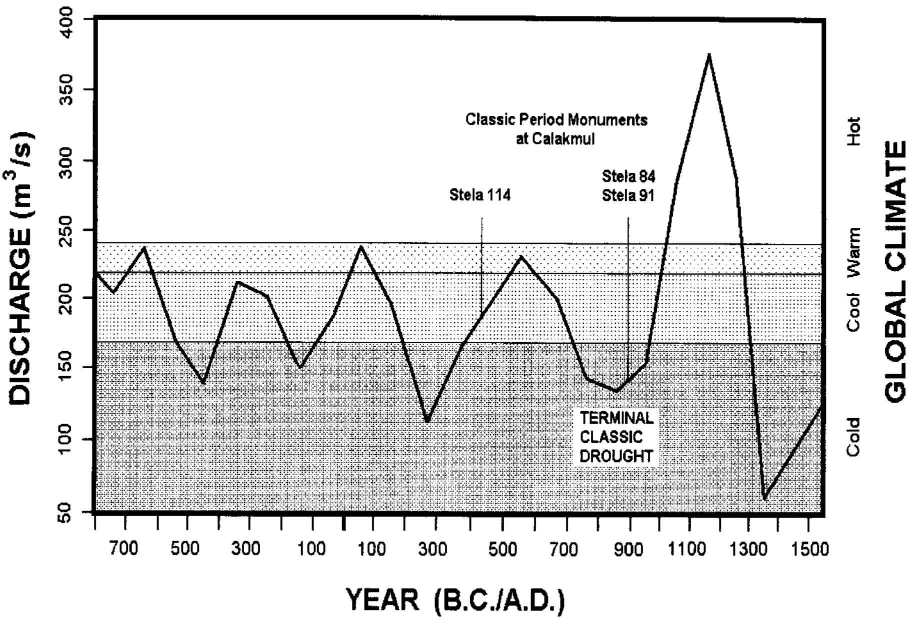
Modeling Terminal Classic Climate in the Calakmul Basin

The dynamics of climate in the central and northern lowlands are driven by shifts in the boundary between the southeastern tropics and the northwestern subtropics (e.g., Folan et al. 1983; Gunn et al. 1994, 1995). The regional atmospheric mechanism that causes this change is a double sea-breeze effect that normally brings rainy season precipitation through the convergence of eastern and northern air streams (see Folan et al. 1983). The former, supported by the eastern trade winds, carries moist air and tropical storms from the Caribbean. Dry air comes from the north and has its origins in the Bermuda-Azores high. During the rainy season, the collision of these two sea breezes over the course of the day creates a line of northeast to southwest precipitation. Global warming leads to greater amounts of moisture, an earlier rainy season, and a northwest shift in the tropical-subtropical boundary. Conversely, cooling leads to a later rainy season, less precipitation, and southeast movement of the tropical-subtropical boundary.

One approach to assessing the regional effects of global warming on the climate of the Maya lowlands is to analyze the discharge of rivers. The Calakmul Basin forms part of the Río Candelaria watershed. We have found that a comparison of the annual discharge of the Río Candelaria with global temperature fluctuations during the period 1958–1990 strongly supports the double sea-breeze model (Gunn et al. 1994, 1995). This model, abstracted as a regression equation predicting river discharge from mean global temperature, was projected over the last three thousand years to estimate the impact of global temperature regimes on local climate. The model indicates extended droughts at the end of the Preclassic, Classic, and Postclassic periods, and overly moist conditions during the Early Postclassic period (Figure 9.8; Gunn et al. 1994, 1995). The longest period of extended drought during the Classic period began about A.D. 750 and lasted for approximately 200 years.

Subsequent analyses of lake sediment cores provide an empirical assessment of the double sea-breeze model. Hodell et al. (1995) analyzed a core from the northern Maya lowlands that records a very strong drought during the Terminal Classic period. Another core studied by Curtis et al. (1996) also shows a drought at the end of the Classic period. Nonetheless, a sample taken from Laguna Tamarindito, located in the Petexbatún region of southwestern Petén, Guatemala, does not provide unambiguous evidence for a Terminal Classic drought. Increased charcoal levels and a shift from gilled to gilled-and-lunged snails were observed in the core. These indicate a local drying trend in the Terminal Classic, but there is no evidence that climatic change—rather than human action—was responsible (Dunning et al. 1998: 147).

Subregional variation may reconcile our double sea-breeze model and data from the northern lowlands with the Laguna Tamarindito core. The Petexbatún receives some of its water from an uplift of the Maya Mountains and the northern foothills of the Sierra Chamá. These hills may have continued to generate precipitation despite generally drier conditions to the north. Alternatively, global cooling may not have been sufficient to push the tropical-subtropical boundary far enough to the south to affect southern Petén. Laporte (Chapter 10, this volume; Laporte and Quezada 1998) has documented a heavy Terminal Classic occupation of south-



9.8 Fluctuations in the annual discharge of the Río Candelaria during the late Holocene (after Gunn et al. 1995: Figure 7).

eastern Petén, precisely that area predicted to be least affected by southeasterly shifts in the boundary.

If a regional drought contributed to the decline of Calakmul during the ninth century, why did the Chichén Itzá and Puuc regional states thrive in the even drier northern lowlands? Although the northern lowlands also experienced decreased precipitation levels, a southern shift in the tropical-subtropical boundary did not affect this area to the same extent because it lies to the northwest of the boundary. Conversely, global warming, resulting in greater precipitation, would have more impact on climatic conditions in the north than in the central Maya lowlands.

One of the most important conclusions of our climatological research is that global changes in temperature often create different climatological effects on regional and local levels (Gunn and Folan 1996). In the case of the Terminal Classic, global cooling may have adversely affected sites located in the Candelaria watershed. But without further data, we should not extrapolate a drought at Calakmul to sites in other watersheds within the Maya lowlands (see Ringle et al., Chapter 21, this volume). Discharge studies of the Río Champotón (to the north of the Candelaria) and Usumacinta (to the south) watersheds indicate highly variable responses to global conditions. The Usumacinta shows no effects from moderate changes in global temperature (Gunn and Folan 1996). This provides a partial explanation of why Terminal Classic centers along the lower Usumacinta continued to thrive at a later date than some cities in the central lowlands. The Tamarandito core, drawn from the upper Usumacinta region, may reflect the buffering effects inherent to that watershed. Analyses of osteological remains from the Petexbatún region do not suggest any undo subsistence failure (Wright 1997; Wright and White 1996), a result that also is inconsistent with a drought in the upper Usumacinta watershed. For these reasons, and because the processes of political fragmentation and depopulation were underway in the Petexbatún before the Candelaria drought, we are particularly hesitant to apply a dessication model to that region.

The Río Champotón, on the other hand, is extremely flood-prone during periods of global warming, which makes its lower reaches virtually uninhabitable (Gunn and Folan 1996). In other words, precisely the same global conditions that contributed to the demise of Calakmul may have fostered the continued occupation and florescence of Edzná during the Terminal Classic period. But anthropogenic factors play an equally important role in the Champotón watershed. Deforestation in the upper Champotón also causes flooding of the lower reaches of the river. Scenarios that posit a drought as the unique cause of a pan-regional Classic Maya "collapse" must be viewed with caution. We stress that regional and local environmental factors (including human-induced changes to the landscape), as well as cultural responses to deteriorating conditions, must be incorporated in any environmental model of the Maya "collapse."

Terminal Classic Demography

One issue worthy of study is the suggestive evidence that drought was an important factor in the demographic decline of the Calakmul kingdom during the Terminal Classic. Despite ample proof of a significant Terminal Classic occupation in the epicenter of Calakmul, and evidence—in the form of carved monuments—for a late occupation at secondary sites within the kingdom, most rural sites were abandoned early in the period. We have recovered only trace quantities of Terminal Classic ceramics from our recent survey transects, and so far have identified only two C-shaped and no "Petén veneer" structures known to be diagnostic of the Terminal Classic and Postclassic periods (e.g., Bey et al. 1997; Orrego Corzo and Larios Villalta 1983; Tourtellot 1988b; D. Rice 1986; P. Rice 1987c; Tourtellot et al. 1992). Although our demographic analyses are still in their initial stages, we believe that the rural zone lost 90 percent of its population during the ninth century.

Why did occupation, albeit diminished, continue at Calakmul and certain secondary sites after much of the rural zone was abandoned? We suspect that the principal reason was access to water. Calakmul and many of the larger sites in the kingdom have elaborate reservoir systems and are built along the bajo margins. Our ethnographic investigations indicate that planting in artificially and naturally raised areas in the bajo is a viable strategy in years when the rainy season is too short to support agriculture in the uplands (Folan and Gallegos Osuna 1992). Reconnaissance and excavations in the El Laberinto bajo have discovered not only lithic extraction and reduction stations, but also house platforms and raised agricultural fields bounded by stone walls (Figure 9.2; Domínguez Carrasco 1992a). The ecotone of the bajo margin, when complemented by a functioning reservoir system, is therefore the best local environment for habitation during periods of drought. Calakmul and many of the secondary sites of the kingdom were the last places to be abandoned during the Terminal Classic because they were the most habitable.

THE "COLLAPSE" OF CALAKMUL AS AN EXAMPLE OF PAN-REGIONAL PROCESSES

The political and demographic processes that led to the "collapse" of Calakmul during the Terminal Classic period have parallels elsewhere in the Maya region (e.g., Culbert et al. 1990; Fash et al., Chapter 12, this volume; Fash and Sharer 1991; Fialko et al. 1998). As at Copán, the political decline of the Calakmul regional state began long before a period for which there is any evidence of population loss. We date the beginning of this political process to A.D. 695, when, after a series of spectacular victories (some of which were won through lesser allies such as Caracol) lasting almost 200 years, Calakmul suffered an important defeat at the hands of Jasaw Chan K'awiil of Tikal. The recent discovery of the tomb of Yukno'om Yich'aak K'ahk' in Structure II makes it highly unlikely that Jasaw Chan K'awiil captured and sacrificed the great Calakmul king (Carrasco Vargas et al. 1999; Pincemin et al. 1998). Nevertheless, at least two important lords of Calakmul seem to have been captured in this action. Moreover, it is certain that the Calakmul king did not live long after this event and it is conceivable that he died as a result of the battle. Thus the end of the "hiatus" at Tikal, the beginning of which was signaled by a defeat of that site orchestrated by Calakmul in A.D. 562, marks the beginning of the political decline of Calakmul (cf. Marcus 1998: Figure 3.1). Although we can find no evidence linking this loss in war to a loss of population, we concur in a general way with Demarest (Chapter 6, this volume). Success in warfare played an important role in the rise of Calakmul, and a reversal of fortunes contributed to its political decline.

But early eighth-century Calakmul was still one of the two greatest political forces of the Maya lowlands. In A.D. 736, a lord of Calakmul visited K'ahk' Tiliw Chan Yopaat at Quiriguá, apparently extending the influence of the Calakmul regional state to the southeastern periphery. The defeat of Waxaklajuun U B'aah K'awiil of Copán less than two years later may have been accomplished with the consent of this k'uhul kan ajaw (Looper 1995). Thus the first event in the political decline of Copán may have been precipitated by the machinations of a still powerful Calakmul.

By A.D. 750 Calakmul began to forge stronger political and economic ties with polities to the north. This, as Carrasco Vargas (1998) has speculated, may have been a response to the waning political strength of the ruling dynasty. Alternatively, we suggest that this change in external relations represents a shift away from the weakening political and economic sphere of the south, toward the vibrant and emerging system of the north. In our view, this change of focus was an attempt by the ruling elite to reinforce the political and economic strength of Calakmul. These new connections are manifested in the archaeological record by the first appearance at Calakmul of ceramics from the Río Bec, Chenes, and Edzná regions. Northern affinities also can be seen in Calakmul architecture, particularly in modifications to Structure II, which became a palace-temple pyramid with the addition of Structures II-B, II-C, II-D, and the rooms on the north facade. Such buildings that integrate the economic, residential, and administrative functions of palaces with the sacred role and architecture of temple-pyramids were common in the northern lowlands during the eighth century.

At about the same time that Calakmul began to engage in significant interaction with sites in the northern lowlands, global cooling started to affect rainfall in the Río Candelaria watershed (Gunn and Folan 1996; Gunn et al. 1994, 1995). Although we do not know the precise date when climatic deterioration became serious enough to lead to population loss—either through lowered birth rates, migration, or starvation—much of the rural area of the kingdom was abandoned in the ninth century. By A.D. 900, the population of the Calakmul regional state had declined by at least 1.3 million individuals from its Late Classic maximum.

We have identified two general adaptive strategies to waning political power and the first century of the drought (A.D. 750–850). First, economic ties with the northern Maya lowlands and the lower Usumacinta region became more important. As the Petén economic sphere became less important to Calakmul, greater quantities of goods like Fine Paste ceramics and Mexican obsidian were received from trading partners to the north and west. In particular, trade connections were formed with the Puuc region and Chichén Itzá, and access to Gulf Coast trade may have been mediated by Edzná. Second, existing populations within the kingdom became focused on bajo margins, particularly in areas with existing reservoirs. The abandonment of drier uplands and the construction of slightly raised fields in the moister bajos served as a maximization strategy during a period of diminishing agricultural returns (cf. Fialko et al. 1998).

Despite significant political setbacks, climatic deterioration, and a subsequent demographic crisis, a political system based on the precepts of divine rulership continued to function until at least A.D. 899 or 909, when the last dated stelae were erected in the kingdom. Calakmul Stelae 61, 84, and 91, Oxpemul Stela 7, and La Muñeca Stelae 1 and 13 all depict individuals dressed in the trappings of divine kings. These all are coeval with the last dated monuments at Toniná and Dzibanché.

Terminal Classic Calakmul, Tikal, and Copán: Shared Political and Demographic Processes

Although the event that marked the gradual ebbing of the political importance of Calakmul ushered in a Late Classic revival of Tikal, the ninth-century demographic declines of both sites were contemporary. By the beginning of the Eznab phase about A.D. 850, central Tikal and its sustaining area already had suffered an 80–85 percent depopulation (Culbert et al. 1990: Tables 5.1 and 5.2). The last dated monument at that site, erected by a second king named Jasaw Chan K'awiil, was raised two decades later, and carved monuments continued to be produced within the Tikal kingdom until A.D. 889. Here, too, some semblance of divine kingship continued into the period of demographic crisis. Like the Halibé phase at Calakmul, the Eznab phase is marked by increasing economic ties with the north and northwest. As production of Petén polychromes decreased, increasing quantities of Fine Paste wares were imported for use by the Terminal Classic elite (Boucher and Dzul 1998; Domínguez Carrasco 1994a).

At Copán we see a similar pattern of slow political decline in the early eighth century followed by rapid depopulation, a restructuring of economic ties, and an eventual dynastic collapse (Braswell 1997c). There is no credible evidence that the demographic crisis at that site began after A.D. 800.[6] Instead, it is likely that population levels began to drop before that date. The first *k'atun* (A.D. 763–783) of the reign of Yaax Pasaj Chan Yopaat saw a renaissance at Copán, but very few monuments or buildings were raised during the last four decades of his life. In fact, the only substantial addition to the acropolis dating to after A.D. 775 is his tomb. The cessation of artistic and architectural elaboration at Copán during the last decades of the eighth century may indicate the decay of dynastic power, but also may reflect population loss. By A.D. 800, the workforce necessary to cut and erect stone blocks and to carve monuments in honor of a decrepit king already may have dispersed. Yet the royal dynasty of Copán continued to survive for at least another twenty years.

There also is evidence for the decline in local ceramic variation and richness at Copán by A.D. 800, suggesting the loss of production loci and perhaps population (Bill 1997, 1998). An economic response of the late Coner phase (A.D. 800–850/900) was the strengthening of trade relations with partners in northwestern and central Honduras. The last decades of dynastic Copán saw an influx of Ulúa/Yojoa polychromes replacing locally produced Cream Paste ceramics (Bill 1997: 406–408, Table 2.28). Thus, as the elite of Calakmul and Tikal were turning to the northern lowlands and Gulf Coast region, the royalty of Copán fashioned stronger economic bonds with their non-Maya neighbors.

Investigations at Calakmul, Tikal, and Copán suggest a similar series of events and an analogous pattern of economic response to the changing conditions of the Terminal Classic period. The political decline of both Calakmul and Copán began as a result of a military setback in the Late Classic period. All three sites probably suffered significant population losses by the first decades of the ninth century, though reliable demographic data for this period still are lacking for Copán. A major factor in the process of demographic decline at all three sites appears to have been environmental degradation, stimulated by natural or human causes. Calakmul and perhaps Tikal suffered from a drought caused by global cooling (see Fialko et al. 1998). Anthropogenic factors played an important role in the deterioration of the local ecology of Copán (e.g., Fash and Sharer 1991; Fash et al., Chapter 12, this volume). Nonetheless, the political institution of divine kingship seems to have survived at all three sites into the period of demographic crisis. The Terminal Classic elite of each polity reacted to political, environmental, and demographic stresses by forming new (and strengthening existing) economic alliances beyond their kingdoms.

Despite these stresses, and perhaps because of economic adaptations to them, the k'uhul ajawob of Calakmul and Tikal were able to maintain the airs of divine rulership until the waning years of the ninth century. The Copán dynasty, in contrast, was less successful, lasting only to A.D. 820. At that site, the entire history of political decline from first defeat to fragmentation was condensed to an eighty-two-year span.

Finally, at all three cities, the end of dynastic rule was followed quickly by abandonment. The sequence and nature of events surrounding the abandonment of each site, though, were different. The last inhabitants of Tikal seem to have been squatters inhabiting abandoned palaces and remnant populations living in buildings constructed in a new architectural style. Central Copán and its residential suburb of Sepulturas were burned, destroyed, and abandoned between A.D. 820 and 900 (Andrews and Bill in press; Fash et al., Chapter 12, this volume). But there is no evidence that the last Terminal Classic inhabitants of Calakmul were squatters or were forced violently from their homes. There are no indications of widespread burning as found at Copán, and there is no evidence of warfare—in the form of fire, defensive works, the repositioning of population, and large quantities of projectile points—as has been noted for the Petexbatún region. In contrast, domestic artifacts left in Structures II and III of Calakmul were carefully stored in ways suggesting that their owners hoped to return.

Differences in their last days of occupation notwithstanding, we are struck by the generally similar sequence of processes shared by Calakmul, Tikal, and Copán. Calakmul and its two Terminal Classic contemporaries endured analogous political and environmental stresses and adapted to them in similar ways. It is not surprising that their historical trajectories also were parallel.

NOTES

1. The tallies presented here come from our analyses of ceramics recovered through the 1989 field season. They do not include materials from our 1993 and 1994 excavations. In our original examination (Domínguez Carrasco 1994a) we assigned Traino

Brown: Traino variety and Encanto Striated: Encanto variety to the Terminal Classic Halibé phase because they both were found in lots containing typical Terminal Classic diagnostics. In contrast, Boucher and Dzul (1998) place both in the Late Classic Ku phase. This difference in interpretation is particularly significant for Encanto Striated: Encanto variety, the predominant utilitarian ceramic used at Calakmul, accounting for 18.7 percent of our total collection and 11.6 percent of Boucher and Dzul's (1998). We now strongly suspect that both varieties straddle the arbitrary boundary between the Ku and Halibé phases. In fact, neither our own collections nor those of Boucher and Dzul (1998) contain varieties that we have assigned to more than one ceramic phase. Although we recognize that both Encanto Striated: Encanto and Traino Brown: Traino probably were used during both phases, we nonetheless have opted to assign these two ceramic taxa to the Ku phase, enabling easier comparison with Boucher and Dzul (1998).

2. Marc Zender (personal communication 2000) points out that this title or name, which means 'He the ninth noble, he of Sa,' suggests a connection with Naranjo. The toponym Sa is found commonly in inscriptions related to that site.

3. While writing this chapter, we conducted a demographic analysis of the northern twenty-five kilometers of the survey transect running from Conhuas to Calakmul. Although a substantial portion of this ten-square-kilometer area is bajo, a total of 559 structures were recorded. Applying the same adjustments as Robichaux (1995), this is equivalent to a Late Classic population density of 340 inhabitants per square kilometer for land outside the bajo. Using this result for the entire Calakmul kingdom, a total rural population of three million people is calculated. Caution should be used in extrapolating from such a small sample, but this result, the only population estimate for the Calakmul rural area generated from data gathered in the field, should not be ignored.

4. We use the general term "activity area" because the location of production debris reflects discard patterns and does not necessarily indicate the actual locus of production. Moreover, we avoid the word "workshop" because we are uncertain of the scale and organization of craft production associated with Structure II.

5. The prismatic blades are on permanent display in the Baluarte San Miguel in Campeche and were not available for detailed study.

6. The only data that have been mustered to support a demographic decline after A.D. 800 are a series of highly suspect obsidian hydration dates (e.g., Webster et al., Chapter 11, this volume). These dates have been rejected by most Copán researchers for a wide variety of reasons. First, they were generated from external rinds. External surfaces of obsidian artifacts at Copán have been proven to be significantly eroded (Braswell 1997c). That is, if the correct values are used for hydration rate constants and environmental variables, external rinds always will yield late dates. Second, the hydration rate constants used to generate these dates were determined by a process demonstrated to cause surface erosion (Stevenson et al. 1989; Tremaine and Frederickson 1988), and in fact yield rates that are off by a factor of two (Braswell et al. 1996b). Third, effective hydration temperatures were estimated using air-temperature data from two distant meteorological stations and integrated using the most inaccurate method known (Jones et al. 1996). A later thermal cell program demonstrates that these estimates are seriously in error, as is the assumption that all archaeological soils in the Copán pocket have a relative humidity of 100 percent (Braswell 1997c). Fourth, the hydration dates

were not treated as a statistical data set, and the probability of having outliers in a very large sample was underestimated (Braswell 1992; Cowgill and Kintigh 1997). Fifth, ceramic types recently recovered from Early Postclassic structures were not reported for contexts that yielded Postclassic hydration dates, that is, there is no ceramic evidence supporting the late dates (e.g., Fash et al., Chapter 12, this volume; Manahan 1996). Sixth, although some of the more than seventy radiocarbon dates from Copán concur with some of the hydration dates, there are only a small number of radiocarbon dates later than A.D. 900. These come from samples collected from contexts that contain typical Early Postclassic Ejar ceramics (Kan ware, Tohil Plumbate, and Las Vegas Polychrome), and not from Coner-phase contexts (Fash et al., Chapter 12, this volume; Manahan 1996). Seventh, ceramics collected from recently re-examined sites—which, according to obsidian hydration dates, were first occupied during the Postclassic period—are types assigned not only to the Coner phase, but also to the earlier Acbi and Bijac phases (Canuto 1997, 1998).

Given the unreliable nature of these obsidian hydration dates and the now discredited method used to generate them, we concur with Andrews and Bill (in press), Fash et al. (Chapter 12, this volume), and Manahan (1996) in their dismissal of a prolonged demographic collapse at Copán. All credible evidence suggests that the Copán region was abandoned sometime before A.D. 900, and perhaps as early as A.D. 822. A brief reoccupation, conceivably by Lenca peoples native to Honduras, dates to the Early Postclassic Ejar phase (A.D. 950–1050).

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