

The Exploration of the Maya World

After nearly a century and a half of discovery, Maya archaeology continues to provide ever earlier glimpses of an important ancient civilization

The remains of ancient Maya civilization first attracted widespread attention in the 1840s, as a result of the explorations of John Lloyd Stephens and Frederick Catherwood in Honduras, Guatemala, and southeastern Mexico, and their two popular books of *Incidents of Travel* (Stephens 1841, 1843). Yet the ruined cities in the tropical rain forest which Stephens described so evocatively and Catherwood illustrated with equal felicity had been known and wondered at since the Spanish conquest three centuries earlier, and were attributed from the beginning to the ancestors of the Maya peoples who dwelt in the area in the sixteenth century. What the work of Stephens and Catherwood did accomplish was to launch Maya archaeology as a serious field of research, one in which both exploration and discovery have continued unabated for 140 years.

The Spanish conquistadors found a dense Maya population organized into fractious city-states in both northern Yucatan and the highlands of Guatemala and Chiapas. The vast forest area of Petén and what is now Belize was less fully settled and less easily penetrated, so

that in spite of numerous incursions the Itzá around Lake Petén Itzá submitted only in 1697, and many of the Maya in Quintana Roo and Belize either nominally or not at all. In Yucatan, however, Spanish settlement proceeded rapidly, and some of the clerics who arrived there took care to note the vestiges of a bygone age. In 1548, when Lorenzo de Bienvenida and other Franciscans settled at the new capital of Mérida, born out of the ruins of the Maya city of Tihoo, he observed that they found themselves among buildings "which it seems to us were built before Christ, because the trees on top of the buildings were as high as the ones around them. . . . There was no record of who built them, [and] in all the discoveries in the Indies none so fine have been found" (Bernal 1977, p. 21).

In this initial period of interest in Maya sites, which persisted until about 1759, we can see an admiration for the vanished builders and an assignment of substantial age, but no attempt to attribute the ruins to any known Old World culture in spite of their acknowledged quality.

A second and better-known commentator of this period was another Franciscan, Diego de Landa, whose overzealous pursuit of Inquisitorial ideals, extending to the destruction of many Maya hieroglyphic books, led to his recall to Spain for trial. The document he prepared as part of his defense, the *Relación de las cosas de Yucatán*, is the best evidence we have of the colonial Spanish view of Maya culture. With the aid of informants and field notes on ruins at Tihoo, Izamal, and Chichén Itzá, Landa described the architecture and calendar of the Maya, and attempted to explicate their hieroglyphic script in terms of the Spanish alphabet.

This and other, briefer but equally intelligent assessments indicate curiosity but not any systematic pursuit of knowledge. The ancestors of the contemporary Maya were implicitly accepted as the builders of the now-ruined sites, and the high quality of the architecture and the sculpture was frequently remarked upon.

In the succeeding period, from 1759 on, Spain was ruled by the antiquarians Charles III and Charles IV, and the deliberate exploration of a few Maya ruins was undertaken. Almost all the expeditions concentrated on Palenque, in the forest lowlands of Chiapas, where between 1773 and 1807 four separate attempts were made to find out more about the mysterious "stone houses" with their intricate stucco decorations. The last two attempts, by Antonio del Rio and Guillermo Dupaix, were carried out under explicit royal instructions, and in their sampling of building materials and pottery as well as their careful illustration were as responsible as any archaeological projects then being carried out in Europe. This work, and that of such lesser lights as Jean-Frédéric Waldeck, directly inspired the explorations of Stephens and Catherwood, which from 1840 on ushered in a new age of Maya studies.

This period, which lasted until 1924, is marked by the contributions of a series of major scholars who laid the foundations of Maya archaeology as it existed until well after World War II. Their work was concentrated in two fields: the study of hieroglyphic writing and the exploration of fresh sites in the forests of Mexico and Guatemala.

The first of these scholars was Charles Etienne Brasseur de Bourbourg, again a priest, who after traveling through Central America in

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the early 1850s and editing two important fragments of surviving pre-Hispanic Maya literature, the epic of the *Popol Vuh* and the drama of *Rabinal-Achí*, made his most significant discovery in the prosaic surroundings of the Academy of History in Madrid. This was the then unknown *Relación de las cosas de Yucatán*, and the information on the Maya calendar and writing that it contained proved vital to working out a chronology for this ancient civilization.

Three men share the principal credit for this achievement. One was a field archaeologist, Alfred Maudslay, who between 1883 and 1894 made numerous expeditions to Maya sites, bringing back a superb photographic record as well as molds of inscriptions and sculptures (Fig. 1). His work, published in the *Biologia Centrali-Americana* between 1889 and 1902, is still invaluable to archaeologists today. The second person was Ernst Förstemann, Royal Librarian of Saxony and custodian of the late pre-Hispanic Maya book known as the Dresden Codex, one of only three surviving codices and the key to understanding Maya observations of the moon and Venus as well as the place-notation mathematics used in Maya astronomical calculations. Förstemann was able to demonstrate the existence of the Long Count, a cumulative calendar proceeding from a base date in the distant past, and in 1894 used Maudslay's data from the site of Copan to read dates on seven of the magnificent stelae there. The third man, Joseph T. Goodman, was able to link the floating chronology to the Christian calendar by correlating Maya dates for given events with dates provided by colonial documents. His scheme remains accepted in its essentials today: thus we recognize that the great monuments of Copan, Palenque, Tikal, and other sites were carved and erected during a Classic Period of A.D. 250-900 (Table 1), when Maya civilization reached its apogee.

After World War I, Maya archaeology entered an "institutional" period, extending from 1924 to 1970, when the field was dominated by a few North American establishments led by the Carnegie Institution of Washington. With the stimulus of Sylvanus G. Morley and under the guiding hand of Alfred V. Kidder, the Carnegie's Division of Historical



Figure 1. One of many vestiges of Maya civilization photographed in the 1880s by Alfred Maudslay, the Temple of the Sun at Palenque was the object of archaeological interest as early as 1773, when the first of four Spanish expeditions explored the site. Now known to be part of a complex of dynastic temples erected by Chan-Bahlum in the late seventh century A.D., the temple takes its name from an elaborately carved tablet in an interior shrine depicting Chan-Bahlum receiving power from his father, the great Pacal (see Figs. 9 and 10); between them stands a shield bearing a mask of the sun god in his nocturnal aspect as jaguar. The mansard roof and latticed roof comb of the structure represent a regional variant of the Classic Maya style.

Research carried out massive long-term projects at Chichén Itzá in Yucatan, at Uaxactun in Petén, where the earliest known dated Maya stela had been located, and at numerous other sites, including Copan. Dozens of new sites were discovered and mapped, and their monuments recorded. The immense corpus of material built up by the Carnegie has proved to be of enduring use, and even now some of this rich store is still being published for the first time. During the 1940s the Carnegie was severely criticized for its atheoretical approach, and it conducted little field research after World War

II apart from the study of the Post-classic capital of Mayapan in Yucatan, which had flourished from about A.D. 1250 to 1450.

The postwar period was dominated by universities, and in particular by the Peabody Museum at Harvard and the University Museum of the University of Pennsylvania. The former had acquired Gordon R. Willey as Bowditch Professor in 1950, and he brought the techniques of settlement archaeology developed in Peru into the Maya field with an important project at Barton Ramie in Belize, deliberately avoiding the massive ceremonial centers that had



Figure 2. The Maya area lies wholly within the tropics, embracing the southern part of Mexico and all or part of four Central American countries. Its northern part, the Yucatan peninsula, is flat and low-lying,

while to the south the area encompasses the rugged highlands of Chiapas and Guatemala, where a spine of active volcanoes forms the continental divide. Although the ancient Maya had external

contacts as far east as Panama City and as far west as Central Mexico, the strongest cultural and linguistic links were with the Gulf Coast and the Oaxaca regions of Mexico, just west of the Maya area.

hitherto monopolized the attention of archaeologists. Willey next turned (1959–68) to a regional study of the basin of the Pasión River, centered on the sites of Altar de Sacrificios and Seibal. Over much of the same period the single most ambitious excavation ever undertaken in the Maya lands, a study of the huge site of Tikal, was being carried out by the University of Pennsylvania under Edwin M. Shook and later William R. Coe.

From 1970 on, global economic factors together with the influence of the "New Archaeology" in North America resulted in smaller projects focused on explicit problems. One of the first of these was the Harvard-Arizona Cozumel Project of 1972–73, which sought to test formal models of trading on the island of Cozumel, off the coast of Yucatan. Other problem-oriented projects have dealt with a wide range of topics in Maya archaeology over the past decade, and

it is this topical focus which has led to the entirely new view of the ancient Maya that we have today.

Early occupation

There is general agreement that the territory defined culturally as the "Maya area" consists of those parts of Mexico and Central America bounded on the west by the narrowing of the Isthmus of Tehuantepec, on the north by the Gulf of Mexico and the Caribbean coastline, on the south by the Pacific shore, and on the east by the Ulua and Lempa rivers of Honduras and El Salvador (Fig. 2). With one exception, all culturally Maya sites and most living Maya speakers lie within these boundaries, which have, however, been penetrated both culturally and linguistically by non-Maya groups at various times in the historic and pre-Hispanic past.

The region immediately to the west of the Maya area saw the rise of the Olmec culture in the late second millennium B.C., and the burgeoning of the Zapotec and Mixtec cultures from the middle of the first millennium B.C. onward. Still further to the northwest, the urban civilizations of Teotihuacan, Tula, and Aztec Tenochtitlan flourished from the time of Christ until the Spanish conquest, sporadically extending their influence eastward into the Maya lands. In both historic and prehistoric times the Maya had external contacts as far west as central Mexico and as far east as Panama.

For more than a century after the birth of Maya archaeology, the Maya of the Classic period and their immediate forebears were the only known pre-Hispanic inhabitants of the Yucatan peninsula and the adjacent highlands, in spite of a deliberate search for Paleolithic remains

and, toward the middle of the twentieth century, the discovery of early Holocene and late Pleistocene occupation in many other parts of the Americas. While the passage of the first Americans through some part of the Maya area en route to South America was acknowledged, traces of their presence proved hard to find. The first indubitably Paleo-Indian site, Los Tapias in western highland Guatemala, was discovered as late as 1969 (Gruhn and Bryan 1977); it dates from the end of the Pleistocene epoch, and is notable for evidence that its inhabitants procured obsidian from three separate sources up to 75 km away.

In the late 1970s, however, renewed investigation of the Caves of Loltun in northern Yucatan uncovered a long preceramic sequence with the remains of extinct megafauna in the lowest levels (Velazquez V. 1980). Apparent corroboration of this early human presence has been reported by MacNeish and his co-workers (1980), who have located numerous aceramic sites in coastal Belize. Some of these have a chert macroblade technology unknown in Formative and later Maya lithic industries in the region and appear to be appropriately early, while others have an assemblage of artifacts closer to those found around 2000 B.C. (radiocarbon years) and later, when sedentary occupation is known to have begun.

Correlating their material with the stratigraphic sequence from the Tehuacan valley in highland Mexico, MacNeish and his associates (1980) have proposed five phases spanning the period from 9000 to 2000 B.C. Although initial attempts to confirm the details of this sequence stratigraphically have met with limited success, the discovery of a fluted projectile point dating from perhaps 9000 B.C. near Belize City suggests that its length is plausible (Hester

Table 1. Chronology of Maya cultural periods

Colonial	A.D. 1540–1810
Postclassic	
Late	A.D. 1450–1540
Middle	A.D. 1250–1450
Early	A.D. 900–1250
Classic	
Terminal	A.D. 800–900
Late	A.D. 700–800
Middle	A.D. 400–700
Early	A.D. 250–400
Formative	
Late	400 B.C.–A.D. 250 ^a
Middle	1000–400 B.C.
Early	2000–1000 B.C.
Archaic	9000–2000 B.C.

^a Dates before A.D. 250 are based on uncorrected radiocarbon dates, those after this point on a correlation of Maya and Christian calendars.

1981). The quantity of aceramic sites reported from another area, the El Quiché highlands (Brown 1980), indicates that lack of a broad enough survey rather than absence of settlements may have been the principal factor in the past failure to detect the earliest human presence in the Maya area. The current picture is one of

widespread, if thin, occupation extending from northern Yucatan south to the Pacific slope, from at least the end of the Pleistocene on. The major interpretive problem that now presents itself is the relationship between these early inhabitants and the later Maya tradition. Direct descent is perhaps the most intellectually parsimonious solution, but stratigraphic continuity has yet to be demonstrated, and Maya origins seem likely to be a continuing focus of research in the 1980s.

Early farmers

No earlier period than the Classic was known until about 1930, when the Carnegie excavations at Uaxactun revealed a Preclassic, or Formative, sequence. This was estimated to go back to about 500 B.C., and was divided into two phases identified by distinctive pottery types: an initial Mamom phase, from 500 to 300 B.C., and a Chicanel phase, from 300 B.C. to A.D. 300, the time of the then earliest known dated stelae. Both phases were thought to have been characterized by a simple village farming culture similar to that which exists to this day in parts of the Maya lowlands. Willey's work at Barton Ramie in 1953–56 indicated a slightly earlier period of occupation, tentatively

Figure 3. The earliest known Maya pottery, dating to the Early Formative period, has been well documented at Cuello. A shallow bowl of the Swasey complex about 22 cm in diameter (*left*) is simply but competently made, with a double slip of vermilion and incised grooves below the rim. Pottery of the late Swasey complex similar to that found at Cuello has also been uncovered at other sites in northern Belize, and more distant links have been traced elsewhere in the Maya lowlands. With the advent of specialist potting toward the end of the Late Formative period, exuberant new forms appeared such as the polychrome bowl with swollen mammiform supports shown at the right. Found at Nohmul, the vessel measures about 36 cm in diameter and displays a blend of lowland traits; however, many of the individual traits of this innovative pottery have also been observed throughout the highland zone. (All photos are by the author unless indicated otherwise.)



dated as stretching back to 600 B.C., and his subsequent work at the sites of Altar de Sacrificios and Seibal produced equally early or earlier material with acceptable radiocarbon dates in the seventh and eighth centuries B.C.

Meanwhile, other areas of Mesoamerica which had supported complex societies, such as Oaxaca, the Gulf Coast, and the valley surrounding present-day Mexico City, all proved to have had long antecedent periods of settlement extending back into the second millennium B.C. The supposed arrival of the Maya was by comparison very late, and their rise to civilization then so rapid that some injection of outside influence from more complex cultures seemed certain. Thus the model of the Maya as a "secondary state" formed on the margins of a

more developed region became widely accepted.

Excavations from 1975 to 1980 at the site of Cuello, in northern Belize, demonstrated the existence of a pre-Mamom phase, assigned to the Early Formative period on the basis of a long sequence of radiocarbon dates spanning the entire second millennium B.C. The phase is associated with pottery of the Swasey complex (Fig. 3), which was clearly ancestral to that of Mamom (Hammond et al. 1979). The priority of the Swasey phase has been confirmed by excavations at Colha, 27 km southeast of Cuello, and Swasey pottery has been recognized at several other sites in northern Belize and at Becan in Campeche.

The excavations at Cuello showed that the architectural techniques characteristic of later Maya culture—the use of stone-filled platforms faced with lime plaster and bearing a timber-framed, thatched superstructure—came into existence there between about 1800 and 1600 B.C. in radiocarbon years (Fig. 4). They further demonstrated that long-distance procurement of useful minerals had begun by the same time, and that acquisition of both jade and obsidian from the highland zone some 400 km to the south was initiated before 1000 B.C. The presence of blue jade suggests contact with the burgeoning Olmec society 600 km to the west around 1100 to 900 B.C.

Flotation of material from occupation and midden layers at Cuello has yielded numerous fragments of carbonized maize cobs and kernels, which have been classified into a succession of types exhibiting increased size through time (Miksicek et al. 1981) and thus perhaps deliberate selection by the Maya to increase yield. The earliest type, Swasey-1, is comparable in size to the early maize found by MacNeish in

the Tehuacan valley of highland Mexico. Maize is a highland plant by origin, and is known to have been tended in the highland valleys since the early Holocene; its abundant presence at Cuello shows that this crop had been successfully adapted to the humid tropical lowland climate by the start of the second millennium B.C. Numerous other plants, especially trees and their fruits, are known to have been exploited by the early Maya at Cuello (Hammond and Miksicek 1981), and the pattern of mixed dependence on forest and farm characteristic of the Maya in historic times would seem to have been established for over two thousand years before the beginning of the Classic period.

Pre-Mamom occupations are known from a number of other sites, and the Mamom horizon itself, which recent radiocarbon dates indicate probably began by 800 B.C., is so widespread throughout the Maya area as to suggest that further early settlements remain to be discovered. The uniformity of Mamom pottery style leaves little doubt that Maya society was culturally consolidated by the middle of the first millennium B.C., and that the roots of Maya civilization must be sought at this period rather than later. A Maya sphere of interaction with accepted cultural norms and extensive internal communication had come into being to the east of the existing, and by now disintegrating, Olmec sphere. In social terms, the growth and fissioning of tribal groups that has been envisioned by Ball (1977) as an explanation for the expansion yet continued unity of Maya culture would constitute a partial explanation of this phenomenon.

Emergent civilization

While for many years it was thought that the appearance of monuments with inscriptions, polychrome pottery, and vaulted stone architecture together marked the birth of specialized craft production linked to concentrated economic power and thus the inception of civilization in the Maya lowlands, it is now recognized that these innovations were cosmetic rather than fundamental and came into being within the context of an already complex society. Although the earliest dated stela in the Maya lowlands is still Tikal Stela

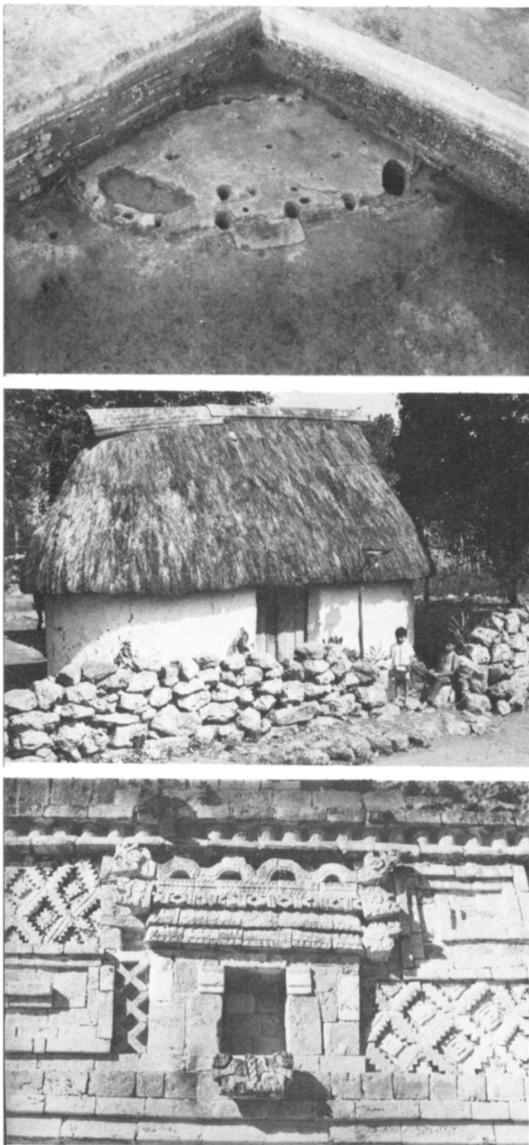


Figure 4. A view from above of the excavated platform of an Early Formative building located about 3 m below ground level (*top*) at the site of Cuello shows the postholes surrounding the original frame of the house, which is similar in form to a modern Maya dwelling (*center*). The translation of this structure into stone by the Classic Maya is apparent in a ninth century A.D. sculpture at Uxmal (*bottom*). These structures and the Temple of the Inscriptions at Palenque (Fig. 10) show the range of Maya architecture from private to public, from the Early Formative to the height of the Classic period.

29 (A.D. 292), at least one earlier plain stela of about A.D. 100 is known at Cuello (Hammond 1982). A number of earlier carved and dated monuments have been found at sites in the highland zone; at Abaj Takalik, for instance, Stela 5 was erected in A.D. 126 and Stela 2 probably at least two centuries earlier (Graham 1979). The sites of El Baul and Chiapa de Corzo each have a stela of the early first century A.D., and the style of these highland examples is reflected in several lowland monuments of uncertain, but apparently Late Formative, date: Mirador Stela 2, Tintal Stela 1, and Polol Altar 1 (I. Graham and P. Mathews, pers. comm.; G. Pahl, pers. comm.).

The existence of a numerical system and record-keeping in the lowlands throughout the Late Formative period is suggested by scattered pieces of evidence. A stamp-seal of about A.D. 100 from Cuello has the bar-and-dot coefficient for "9," and the roof comb of the Temple of the Inscriptions at Tikal bears a precise and possibly historical date of 6.14.16.9.16, 11 Cib 4 Zac in the Long Count, falling in 456 B.C., when Tikal was already a center of substantial size. If not imaginary, this precision of dating suggests well-maintained archives, presumably consisting of bark or deerskin books that have long since vanished. Stone beaters used for making such writing surfaces are known from Late Formative archaeological contexts.

Polychrome pottery (Fig. 3) appears during the Late Formative period—the dedicatory cache of Cuello Stela 1 contained an early example—as a direct development from dichrome wares in northern Belize and perhaps in other parts of the lowlands. Although some of the characteristics of the first elaborate polychromes in the Floral Park ceramic complex at Barton Ramie, Holmul, and Nohmul derive from the highlands, from a zone stretching west from El Salvador to Oaxaca, the particular combinations of form and decoration are peculiar to the lowland Maya. The invasion hypothesis of Gifford and his associates (Sharer and Gifford 1970; Sheets 1976), which proposes a northward migration by Salvadoreans displaced by the catastrophic eruption of Ilopango in about A.D. 260 and their settlement at such places as Barton Ramie, does not accord with more recent evi-

dence of indigenous development in the lowlands.

Elaboration in architecture during the Late Formative period goes far beyond the achievement of the stone corbel vault, an innovation which led to the replacement of perishable roofs with permanent stone superstructures on many public buildings. While corbel vaults of this period exist at Tikal and probably at Holmul, recent exploration has shown that colossal temple pyramids were also being built. At Lamanai, in northern Belize, Structure N10-43 was already more than 33 m high by 100 B.C. (Pendergast 1981), and was only one of a number of huge buildings of Late Formative date at the site. Further north, on the coast, the small site of Cerros, which includes both large pyramids and a smaller one decorated with polychrome stucco masks of Maya deities, has proved to be entirely Late Formative in construction (Freidel 1979). The masks are similar to those on the most famous example of Late Formative architecture, Structure E-VII-Sub at Uaxactun (Fig. 5), as well as to masks recently uncovered at Lamanai. Both Cerros and Colha have Late Formative ball courts, the earliest so far known from the Maya lowlands, which served as arenas for the sacred game *pok-ta-pok*.

Dwarfing all of these sites is Mirador, in northern Petén, where the enormous Tigre, Monos, and Danta groups are all apparently of Late Formative date. While excavations have only just begun in earnest, it seems likely that the bulk of Mirador, one of the largest known Maya ceremonial centers, will prove to be of the Formative period.

Thus several large precincts in the southern lowlands, to which must be added Komchen near Mérida (Andrews, V., et al., in press), have yielded evidence of monumental architecture indicating a dense and well-organized society with an established iconography and craft specialists. Surveys at Nohmul, Tikal, Seibal, Komchen, and elsewhere show that large population nuclei were developing throughout the Late Formative period, and that in some cases these were at least as large as the succeeding settlements of the Classic period. Where regional surveys have been carried out the same picture emerges of large and dense populations occupying almost all favorable locations in the landscape.

The existence of specialist craft groups within this preindustrial urban society is indicated by portable art as well as by architecture. Pottery becomes more adventurous in its

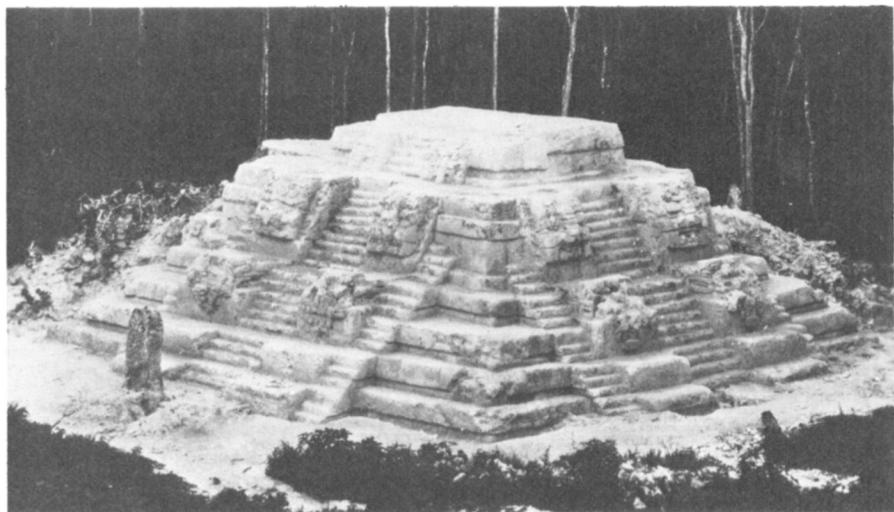


Figure 5. The first Late Formative building to be completely excavated, Structure E-VII-Sub at Uaxactun provided important evidence about the evolution of Maya architecture and iconography. The timber-framed temple at the top of the platform was approached by flights of steps flanked by gigantic masks of the gods molded in white lime stucco. Like other masks of the same period, these portraits are ancestral to more sophisticated depictions of the deities in the Classic period. Although the scale of the structure is substantial—the stone stela standing in front of the stairs in this early photograph of the excavated site is as high as a man—much larger buildings of this period have been found in recent years at Mirador, Tikal, and Lamanai. (Photo by the Carnegie Institution of Washington; reproduced by permission of the Peabody Museum, Harvard University.)

forms in the Late Formative period, particularly between 100 B.C. and A.D. 250, when a distinct suite of funerary ceramics appears comprised of vessel forms rarely, if ever, found in domestic trash. The carving of jade is now a developed art form, with sets of god heads supplementing the ubiquitous beads. One of the finest of all Maya jades, a giant ear flare from Pomona in central Belize (Fig. 7), comes from a burial dating from the end of the Late Formative period; the glyphs incised on its surface offer some of the earliest evidence for literacy in the Maya lowlands. The iconography of these jades reflects that of the stucco temple fronts of the period, depicting a distinct set of divine personages.

Jade was an imported material, the nearest known source being in the valley of the Motagua River in southern Guatemala, and was probably received in raw form. Another import from the same direction, but from sources 100 km more distant on the continental divide, was obsidian. The first source of obsidian to be exploited was San Martín Jilotepeque, northwest of Guatemala City, which supplied Cuello, Seibal, Barton Ramie, and other sites during the Middle Formative period. During the Late Formative period this source was eclipsed by another at El Chayal, northeast of Guatemala City, and a third major source, at Ixtepeque near the El Salvador frontier, began to export obsidian north into the lowlands.

The presence of a network of routes radiating from El Chayal and Ixtepeque and competition between the two sources proposed for the Late Classic may well have already been operative in the Late Formative period. Certainly the distribution of some types of jades and the use of offshore islands as trading stations along the Caribbean coast are consonant with the existence of a canoe route along the eastern side of the Yucatan peninsula. Even if these precise routes were not yet in use, the quantity and distribution of highland minerals throughout the lowlands show that efficient communications linked all parts of the Maya area.

Craft specialization at an industrial level in the Late Formative period has been demonstrated by Hester (1979) and his associates at Colha, in northern Belize, where

extensive chert workshops have been discovered. Colha had two periods of florescence, one in the Late Formative and a second in the Late Classic, although its occupation began at the end of the Early Formative and continued into the Postclassic—a span of more than two millennia. Among the products of the Late Formative period were stemmed triangular blades made by the hundred using a highly skilled technique in which a blade was struck off a core in such a way that it had a needle-sharp point; thus only the stem needed to be chipped into shape. Blades from Colha have been found at other sites across northern Belize, and the discovery of large numbers of such objects—probably from another factory site further south—at the offshore trading island of Moho Cay suggests that they were exported by canoe to more distant regions as well.

What kind of subsistence economy supported this superstructure of craft production and incipient urbanism? Contemporary Maya grow maize, beans, squash, and root crops in a *milpa*, or field, which is cut annually or biennially from the forest, allowed to dry, burned during the dry season that extends from January to May, and then planted at the beginning of the rains. This swiddening regime is extensive, each family requiring a reserve six to ten times the size of the annual planted area to allow the forest to regenerate between cuttings. For many years the pre-Hispanic Maya were thought to have employed a similar technique, and the known density of settlements did not contradict this idea. The population was believed to have lived on scattered farmsteads, gathering at intervals in the local ceremonial center to venerate the gods and to bring tribute to the theocratic rulers. Such a pattern was given added plausibility by its living presence among the Tzotzil of Chiapas.

The first challenge to this arca-dian view came with the detailed mapping of Tikal in the late 1950s, which revealed the presence of a very large and fairly dense settlement around the massive ceremonial precinct, with a population estimated by Haviland (1970) to be in the region of 40,000. There was no room for swiddening between the clusters of dwellings, and the existence of other large sites such as Uaxactun

nearby precluded a broad outer band of *milpas*.

How had these people been fed? An initial reaction was to attribute greater productivity to the *milpa* regime by increasing the presumed importance of such crops as sweet potato and manioc (Bronson 1966), and to suggest a greater reliance on tree crops such as *ramón*, or breadnut (Puleston 1968 diss.). This was followed by an appreciation that more intensive methods of production could have been used, and by the detection of artificially constructed facilities for such intensive farming. While raised, or drained, fields in wetlands had been known in South America for some time, they were noticed in the Maya lowlands only after it was recognized that our picture of Maya civilization "seemed to defy the principles of ecological possibility" (Culbert 1974, p. 37).

The first areas of raised fields to be located were those in the Candelaria basin in Campeche (Siemens and Puleston 1972), but more fields were swiftly noticed in the Rio Bec region (Turner 1974), in northern Belize (Hammond 1973; Puleston 1977), and in northeastern Petén (Fig. 6). Most of these areas were discovered by direct aerial observation or by the use of aerial photography. Zones of canals and fields now covered by forest were subsequently detected by Adams and his associates (1981) through the use of synthetic-aperture sidelooking airborne radar. Ground checks in five separate areas of Belize and Petén established that some 20 to 25% of the linear and reticulate patterns detected by radar were of probable pre-Hispanic origin, others being modern or natural features, and that as much as 1,285 km² of canalized and drained land could have existed in the Maya lowlands—about ten times the area of the functionally similar Aztec *chinampa* system in the valley around Tenochtitlan.

While a substantial proportion of these fields may have been constructed and used during the Late Classic period, when population was at its maximum, some fields, such as those at Cerros, are undoubtedly of Late Formative date, and others are probably this early—for example, those at Pulltrouser Swamp, on the eastern margin of the large Late Formative settlement of Nohmul (Turner and Harrison 1981). There

has been some debate as to whether organized mass labor was needed to construct and maintain these networks of drained fields. Although the question cannot be resolved directly, the circumstantial evidence of the massive public architecture at Lamanai and Mirador shows that Late Formative Maya society *was* organized in such a way that construction of fields could have been collective and centrally directed.

A second artificial means of improving agricultural output was hillside terracing. Terraces had been noted in the 1920s in the Maya Mountains of southern Belize, but were seen as irrelevant to the assumed *milpa* mode of agricultural production. Surveys of the central lowlands of the Rio Bec zone in the late 1960s and early 1970s revealed large areas of terracing intersected by field walls (Turner 1974). An important characteristic was the shallowness of many of the slopes. The walls were not strictly necessary to counter erosion or to trap silt, as in the Maya Mountains, but were used to form permanent divisions of the terrain. Small farmsteads were included in the field pattern, which appears to be far more organized than a *milpa* cycle would justify: continuous cropping under some kind of rotation system with short fallow periods seems much more plausible. The Rio Bec fields date mainly from the Late Classic period, but Healy and his co-workers (1980) have suggested that an earlier use of terracing occurred on the western side of the Maya Mountains from the Late Formative to the end of the Classic period, peaking in the Early Classic period. Here again, construction need not have been centrally controlled, but the level of social organization throughout the entire period would be consonant with such a solution to economic problems.

Thus a number of lines of evidence—settlement patterns and population concentration, the use of artificial econiches to enhance agricultural output, the level and scale of craft production, the extent of procurement networks, and the massive investment in public buildings at a number of sites—all converge to suggest that Late Formative Maya society crossed the threshold of civilization before the time of Christ, and arguably before the emergence of the Teotihuacan culture near

modern Mexico City brought urban civilization to the highlands of Mexico.

Teotihuacan grew rapidly from insignificant beginnings from 100 B.C. on, with the population reaching 70,000 to 100,000 during the period from A.D. 1 to 150. Whereas the Late Formative Maya polity was split into numerous entities that appear from the evidence of the Becan fortifications to have been regional

states embroiled in conflict (Webster 1977), Teotihuacan dominated the basin in which modern Mexico City lies and the surrounding plateau with few rivals, except possibly Cholula. At some point in the Early Classic period, Teotihuacan and the Maya came into contact with each other. The impact of Teotihuacan was especially strong at Kaminaljuyú, in the highlands, where Teotihuacanos with a high political, diplomatic, or



Figure 6. The discovery in the early 1970s of traces of intensively cultivated raised fields in swampy areas in the Maya lowlands was followed by further exploration and the identification of numerous fields, some constructed as early as the Formative period. Those shown in this aerial photograph of Nohmul may date from one of two florescences of the site, which underwent expansion in both the Late Formative and the Late Classic periods. The raised fields formed an artificial environment in which drained fertile fields intersected by open canals replaced swamp. The canals may have been used to breed fish, turtles, and aquatic snails, all esteemed items of the Maya diet in the region, as we know from faunal remains recovered by flotation techniques.

commercial status seem to have occupied part of the site (Sanders and Michels 1977); in the lowlands their influence was much more dispersed, occurring in only a few centers.

The earliest example of such influence has been found at Altun Ha, in central Belize. There a burial site has yielded a cache of green obsidians of Teotihuacan manufacture as well as locally made pottery vessels in Teotihuacan style; the presence of a ritually knowledgeable Teotihuacano seems likely from the disposition of the goods in the burial. Pendergast (1971) suggests that the contact occurred at the end of the Late Formative period, but a date at the start of the Early Classic period seems to accord better with E. C. Rattray's reworking of the Teotihuacan ceramic sequence (pers. comm.), which would place the vessels at about A.D. 300–350. Even so, this is earlier than the contacts at Becan and Tikal, which began after A.D. 378 and persisted for about a century.

At Tikal and Yaxha, Teotihuacan influence appears in monuments and in architecture as well as in portable art (Coggins 1979) (see Fig. 8). Teotihuacan had more than simply a commercial or a diplomatic impact

on these important Maya centers. Whether this influence was exclusively a direct one or whether it was mediated through Teotihuacan "colonies" such as Kaminaljuyú or Maticapan is uncertain. The role of Maticapan in particular is worth further investigation, because of the later existence of entrepôts intermediate between the Maya and Mexican territorial cores in this same Gulf Coast region.

Classic Maya civilization

The withdrawal of Teotihuacan stimuli may have occurred as early as A.D. 530, and may be connected with a curious hiatus in the erection of stelae that lasted for sixty years in most central cities (Willey 1974). Certainly this withdrawal took place no later than the destruction of Teotihuacan and its political and commercial eclipse in about A.D. 650. This period, however, saw the beginning of the most flamboyant period of Classic Maya civilization. Surveys of settlements show populations at their maxima at almost all sites. Some centers that had been small villages during the Early Classic period, such as Seibal, grew back to their Late

Formative size or even larger; new centers such as Lubaantun were founded on previously unoccupied sites (Hammond 1975); places such as Palenque that had been of no previous importance suddenly came into prominence; and Tikal grew even larger. More numerous and larger, more closely packed centers existed in Petén and Belize than at any previous period, indicating a dense mosaic of petty states thrust into close proximity with one another. That this was a situation of stress is suggested by numerous depictions of rulers dominating captives and of scenes of battles such as the one shown in the Bonampak murals, as well as by skeletal evidence of a decrease in the physical well-being of the common people at both the large site of Tikal and the much smaller one of Altar de Sacrificios (Haviland 1967; Saul 1972).

The elite, on the other hand, were glorified as never before. The practice of erecting stelae reached its peak in A.D. 790, and recent decipherment of inscriptions on these monuments has told us something about Maya dynastic politics and about Maya rulers as individuals. In 1960 Proskouriakoff demonstrated what Stephens and other early travelers had assumed, that the history of the Maya "was graven on their monuments," showing that the dates on the stelae of Piedras Negras were consonant with the life-spans of human rulers. Kelley (1962) found a corroborative pattern on the monuments of Quirigua, identifying five rulers, while Proskouriakoff turned her attention to Piedras Negras's upstream neighbor Yaxchilan and elucidated the official biographies of two of its most prominent rulers, Shield-Jaguar and Bird-Jaguar. At about the same time, Berlin (1958) showed that the central sign of a hieroglyphic form which he dubbed the "emblem glyph" varied from location to location, suggesting that it referred to the name of a place or people. A number of sites in Petén and in the Usumacinta River basin, including Tikal, Seibal, Piedras Negras, Yaxchilan, and Palenque, were shown to have emblems with a local variant, which in each case has been found mainly in the centers and the surrounding regions. Some distant occurrences have also been noted, however—for example, Tikal and Palenque emblems have appeared at



Figure 7. Possibly ceremonial in function rather than intended for personal adornment (see the large flare in the left ear of the Maya ruler Stormy Sky in Figure 8), this giant ear flare from Pomona measuring 15 cm in diameter is one of the finest known pieces of Late Formative lapidary work. Although the raw material comes from the highlands to the south—perhaps from the valley of the Motagua River, at present the only known source of jade in this period—the actual carving is likely to have been done in the lowlands. The four heads shown in profile are those of Maya deities, and scholars have recently demonstrated that the language inscribed on the piece is Yucatecan, a tongue spoken in the northern part of the lowlands.

Copan, implying diplomatic or martial alliance.

The studies initiated by Proskouriakoff and Berlin have recently borne rich fruit in the long dynastic sequences adduced for Tikal and Palenque. The first named ruler of Tikal, Jaguar Paw, died in A.D. 376 and is thought to be portrayed on the early jade known as the Leyden Plate, which bears a date of A.D. 320. Coggins (1979) has argued that Jaguar Paw's daughter married Curl Nose, who appears on Tikal Stelae 4 and 18 (on the former in a frontal, highland Mexican, pose) as a ruler in his own right, and on the famous Tikal Stela 31 (Fig. 8) as a deified ancestor in the sky above his son, Stormy Sky. Stormy Sky's granddaughter, the nameless "woman of Tikal," is the first female to appear in

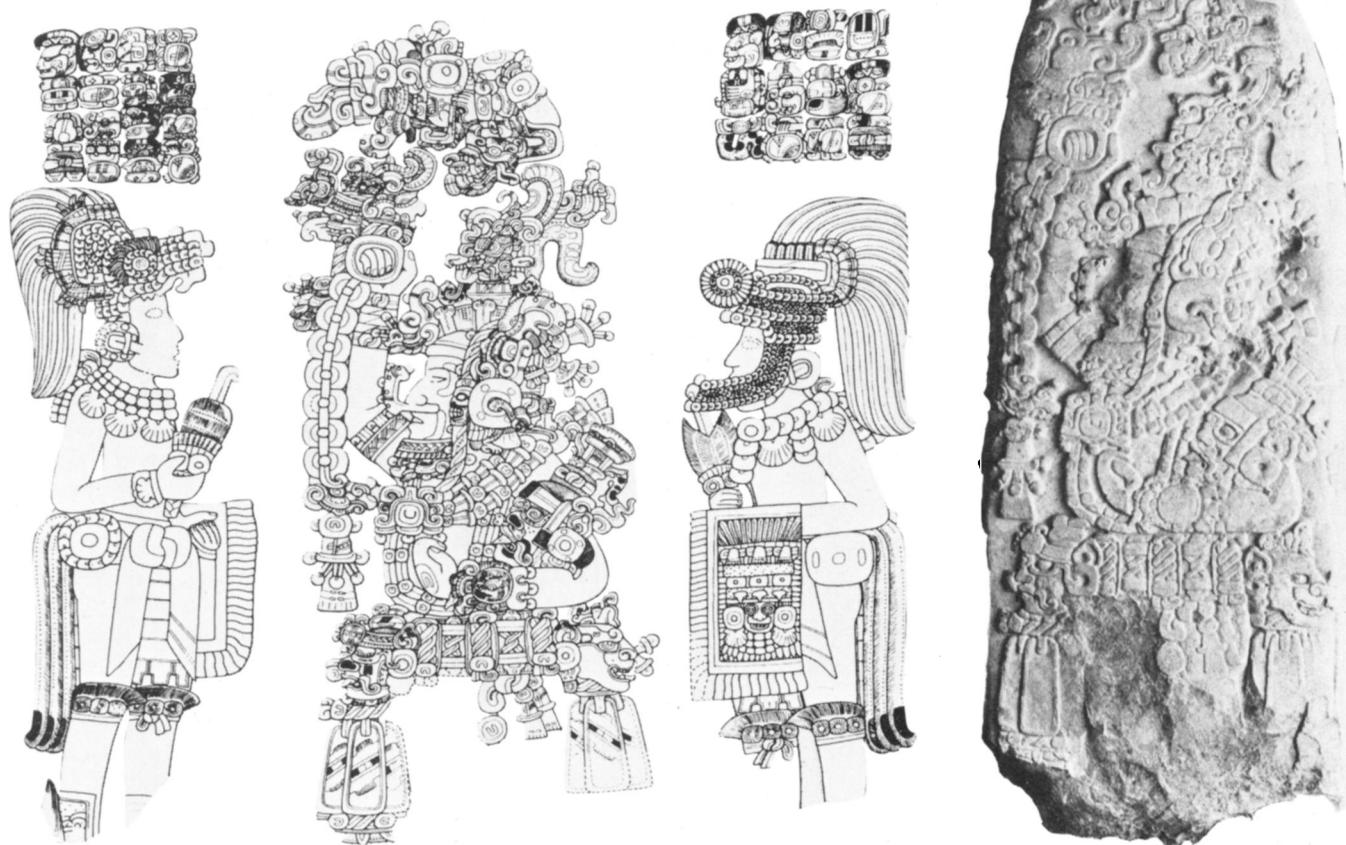
monumental art there; she seems to have transmitted to her husband the throne of Tikal.

The dynasty appears to have been deposed, but was restored in A.D. 682 with the accession of a powerful man we know only as "Ruler A," who engendered a cultural renaissance at Tikal that may have been part of a more general moral revitalization of the community. Choosing as the formal date of his accession a day precisely 13 *katunob* (260 years) after his great predecessor Stormy Sky assumed the throne, and thus invoking a time of past prosperity (Coggins 1979; Jones 1977), Ruler A began a colossal building program that included the first of a series of twin-pyramid groups as well as Temple I, his own funerary temple on the main plaza.

The twin-pyramid groups seem to have been cosmic diagrams representing the passage of the sun, in which the ruler's image on a stela could be equated with the glory of the sun god. The stela stood in an enclosure on the north side of the group, representing the zenith; stepped pyramids lay on the east and west sides and a nine-doored building on the south recalled the nine gods of the night and thus the sun's nocturnal journey below the earth.

Ruler A was over 60 years old when he died, and under his son and grandson, Rulers B and C, the impetus that he had given to the development of Tikal continued until the settlement became the largest Classic center in the Maya world. Ruler B built Temple IV, at 65 m the tallest Maya building known, as his burial place on the western edge of the great precinct, and linked it to the center by broad paved causeways. He died before A.D. 768, and was succeeded by Ruler C, the last Tikal ruler of whom we know and the builder of the two largest twin-pyramid groups.

Figure 8. Erected in A.D. 440, Tikal Stela 31 (right) is one of the most complex and finely executed pieces of Classic Maya relief sculpture known. The front face of the squared limestone shaft, about the height of a man, depicts Stormy Sky, ruler of Tikal in the first half of the fifth century A.D. The incised design, seen in more detail at the left, shows Stormy Sky wearing a headdress incorporating the hieroglyphic for "sky," riven to allow a god with a smoking ax in his forehead, representing storm or thunder, to emerge—hence the nickname "Stormy Sky," given to him by archaeologists. Stormy Sky's elaborate costume, while typical of that of a Maya ruler, incorporates Teotihuacan emblems such as the quail on his left wrist and the skull on his helmet. The two figures carved on the sides of the stela are dressed in emphatically Teotihuacan costumes; an image of the highland rain god Tlaloc adorns the square shield whose face is visible, and they carry *atlatl* spearthrowers. Above the head of Stormy Sky his predecessor Curl Nose looks down as a godhead, validating the dynastic succession. (Drawing courtesy of William R. Coe.)



The rise of Palenque was later and more modest than that of Tikal, but because its rulers chose to inscribe their dynastic texts on large panels rather than narrow stelae, they have left us the longest continuous records of any Maya site. The length of the texts has been of enormous help in working out their meaning, a task accomplished over the past eight years by Lounsbury, Schele, and Mathews (Lounsbury 1974; Mathews and Schele 1974). The most celebrated ruler of Palenque was named Pacal—"shield" in Maya—and his tomb was discovered in 1952 under the Temple of the Inscriptions by the Mexican archaeologist Alberto Ruz Lhuillier (Fig. 10). Pacal lay in a great stone sarcophagus whose elaborately carved lid shows him falling into the jaws of death; images and inscriptions on the lid and around the tomb chamber attested to his real and mythical ancestry, which included a number of gods. The body was smothered in jade jewelry, including a mosaic mask that covered the ruler's face (Fig. 9). A stucco head thought to be a portrait of Pacal was also found in the tomb.

A vigorous dispute has been in progress over the past few years concerning the actual age of Pacal at death. The Lounsbury group claims (Mathews and Schele 1974) that the inscriptions make it clear that he was born on 24 March A.D. 603; acceded to the throne of Palenque on 27 July 615, at the age of twelve; and died on 29 August 683, at the ripe age of 80; and they point to the advanced ages reached by Rulers A and B of Tikal, Cauac Sky of Quirigua (over 80), and Shield-Jaguar of Yaxchilan (between 92 and 96). Ruz (1977), on the other hand, stresses the physical identification of the skeleton as that of a man of about 40, and claims that the inscription on the sarcophagus lid gives Pacal's age as 39 years and 9 months. While the death of Ruz has ended the argument, it is fair to say that the view of the Lounsbury group has found greater acceptance thus far.

Pacal was succeeded by his son, Chan-Bahlum, who built the beautiful temples of the Cross Group just east of the Temple of the Inscriptions. Here, on four superb relief tablets in the Temples of the Sun (see Fig. 1), Cross, and Foliated Cross and Temple XIV, Chan-Bahlum celebrated the



Figure 9. The jade death mask of Pacal, ruler of Palenque for most of the seventh century A.D., was found in place when the sarcophagus within the Temple of the Inscriptions (Fig. 10) was opened in 1952. The life-size mosaic mask with its eyes of inlaid shell and iron oxide is an example of the public and private art commissioned by the rulers of Palenque, which made it one of the most aesthetically innovative of Maya capitals.

same dynastic ancestry depicted in his father's tomb and portrayed his reception of power from his father. Pacal's name can be represented either by a pictograph of a shield or by three signs spelling out "pa-cala"—an important corroboration of the view that Maya hieroglyphic writing has a major phonetic component. Further corroboration comes from one of his titles, "ma-kin-a" ("lord"), which uses two elements: the known sign for *kin* ("sun") and a sign to which one of Bishop Landa's informants in the sixteenth century had assigned the value "ma." The Palenque texts have thus simultaneously provided us with an extraordinarily detailed portrait of a Maya dynasty of the seventh and eighth centuries—we know of at least seven rulers following Pacal—and vital clues for the elucidation of the Maya script.

Similar dynastic successions have been documented in less detail for Quirigua, Copan, Caracol, Bonampak, and other sites, mainly for the Late Classic period, and we have begun to get a picture of the Maya world as an uneven patchwork of kingdoms of varying size and prosperity, not unlike medieval Italy or the Holy Roman Empire or even the states of highland Mexico in the sixteenth century. The persistence of this pattern from Late Formative times on for perhaps a thousand

years seems highly likely: there is little evidence for an initial stage of theocratic organization, as was once thought. The gods were in the service of the Maya rulers rather than vice versa.

The collapse of Maya society

During the eighth and ninth centuries, however, the Classic Maya world crumbled. The erection of monuments ceased, population slumped, and the great ceremonial precincts were permanently abandoned to the jungle. The reason for this dramatic collapse has been one of the most widely debated topics in Maya archaeology for the better part of a century, and there are still as many opinions as there are scholars to voice them. When the present, problem-oriented phase of Maya studies began in 1970, the collapse was the first complex process to be studied (Culbert 1973). A wide range of theories has been advanced, invoking the malign operation of both natural and human agents. One cluster of ideas suggested environmental deterioration as the result of overcultivation. According to these theories, the exhausted soil was removed by erosion, filling in the shallow lakes, which were thus transformed from a vital water supply into useless swamps and sources of disease. A variant held that the competition between food crops and weeds became too intense for the Maya to counter with their neolithic technology. An extension of these "ecological" theories was the idea that the tropical rain-forest environment was basically unsuitable for an advanced society, so that failure was predestined as population outran resources and disease swept across the Maya lowlands.

A second group of theories focused on social rather than ecological factors, suggesting that weakness in the framework of Maya society led to internal dissolution or made invasion from without tempting. In either case warfare and the collapse of the ruling elite would have resulted. Thompson (1966) propounded a "peasant revolt" model in which the lower classes became disaffected by mounting exactions of tribute for an increasingly esoteric and irrelevant pantheon of incorporeal gods. A gap opened between rulers and ruled



Figure 10. The Temple of the Inscriptions at Palenque, named for the long panels of dynastic texts that line its walls, was the funerary pyramid of Pacal. Slabs in the floor of the upper building cover a stairway descending through the heart of

the pyramid to a burial vault that was dug in the bedrock before the structure was built. A massive triangular door slab opened onto the vault, which was almost completely filled by Pacal's sarcophagus. The outer walls of the temple at the top of

the stairs are decorated with polychrome stucco figures of Maya rulers, recently damaged by volcanic ash. The structure, with its permanent stone superstructure, is representative of Classic Maya architecture at the height of its development.

which led to a bloody revolution, the destruction of the elite and their cities, and a return to a less organized level of society. Thompson's model thus links economic stress to moral dismemberment, and he subsequently incorporated the effects of malnutrition and disease to account for the massive depopulation of the forest zone that accompanied the collapse of the social order. Concrete evidence for this theory was adduced from the smashing of stelae—portraits of hated rulers. The model has recently been reiterated in a slightly modified form by Hamblin and Pitcher (1980).

Military intrusion from the Gulf Coast of Yucatan has also been suggested as a prominent factor in the collapse (e.g., Sabloff and Willey 1967), although proponents of this view admit that such an intrusion could simply have taken advantage of a power vacuum resulting from an

internal collapse rather than being its proximate cause. Seibal is a key site in this argument, because in A.D. 851 there was constructed in the center of its main plaza a building in Yucatecan style surrounded by four tall stelae, two of which display impressive personages in Maya dress but with non-Maya faces. At both Seibal and Altar de Sacrificios, further downstream, new pottery types appeared, made of fine temperless paste and bright orange or dull gray in color. Although analysis has shown that these "fine paste" wares were made locally, both the technique used and the taste for this new product come from the Gulf Coast region around the lower reaches of the Usumacinta River. Thus the foreign elements at Seibal may well have been Putun, or Chontal, Maya, the canoe-borne traders and warriors whom Thompson called "the Phoenicians of the New World."

Detailed examination of the collapse of Maya society convinced researchers that none of these explanations was sufficient in itself, and an overarching model combining many of the elements was advanced (Willey and Shimkin 1973). To juggle a number of variables simultaneously, Hosler and her colleagues (1977) devised a computer simulation linking resource exploitation, trade, external pressure, and certain prestigious activities of the elite within an overall context of rising population level and density. They concluded that the growth of an urban artisan class in the dense settlements around the major ceremonial centers may have led to excessive stress on the networks by which food was produced and distributed to the rapidly growing cities.

A systems approach has been adopted by Culbert (1977) and Sharer

(1977). Culbert presents Maya culture as a growth system, with craft production and exchange the mechanism by which deviation was amplified, resulting in increased specialization of producers and of the settlements in which they lived. The rate of growth of these settlements exceeded the rate of increase in subsistence production, causing the system to collapse. Sharer suggests that the Maya were aware of this problem, but his stress/response model holds that they took the wrong turn by investing effort in appeals to the supernatural through massive temple-building programs while simultaneously destabilizing their environment. This process of weakening in the internal system is exacerbated by changes in the external system: the rise of externally oriented maritime trade routes increased the internal stress and enhanced susceptibility to outside intervention.

Cowgill (1979) argues that endemic warfare was a major destabilizing factor in the collapse, with the struggle for supremacy among the Maya states diverting resources and energy into an unproductive path that at the same time increased overall stress within the system.

A highly original view was advanced by Puleston (1979), who noted that intervals of 13 *katunob* occur between the Classic hiatus in the erection of stelae and the collapse, between the collapse and the reputed abandonment of Chichén Itzá, and between that event and the fall of Mayapan. As the unlucky Katun 11 Ahau repeated itself, Puleston argued, the Maya saw it as a self-fulfilling prophecy of disaster and thus fatalistically accepted the crumbling of the Classic world. Puleston's thesis looks into the Maya mind for an explanation of the collapse, but all theories must also take into account the observed physical phenomena: the high population levels and density recorded by surveys and the increasing social distance between rulers and ruled documented by monumental tombs, rich grave goods, and differences in the comparative health of the two classes.

Finally, the gradual abandonment of the erection of monuments and the subsequent desertion of the great ceremonial precincts have to be explained through a demographic

model which allows for migration or death on a substantial scale—although neither of these possible causes of depopulation has yet shown up convincingly in the archaeological record. Such a record of overpopulation followed by apparent rapid decline suggests a fatal strain on the subsistence system, either in production or in the distribution system that had developed to serve an increasingly urbanized society. Systems modeling and computer simulation both have a future in helping us analyze these still imponderable factors as they become more clearly defined.

Maya archaeology has become, in fact, a prime candidate for the kind of cooperation among varied disciplines that is taking place in Chinese studies (Chang 1981). Advances in deciphering both inscriptions on monuments and short ritual texts such as those on funeral vases, and the elucidation of the complex iconography of these same monuments and vases, show us how inextricably the Maya interwove life and death, mystery and imagination (Coe 1973). The stylistic development of this art can be discerned, and its roots sought, in the earlier styles of the highlands and Pacific piedmont (Graham 1979), while the actual centers that produced and disseminated artifacts such as vases can be established by elemental analysis, including neutron activation, and by x-ray fluorescence techniques (Bishop et al., in press). The study of provenance and trade patterns can be expected to have an increasing impact on Maya studies as new data emerge from fundamental studies such as that of the huge chert-tool factories at Colha.

The economic infrastructure of Maya civilization—an infrastructure based on agricultural production supporting craft industries—is at last beginning to be understood. The application of flotation techniques has led to the recovery of valuable data on the early establishment of maize farming and the wide range of forest resources used by the Maya (Hammond and Miksicek 1981; Miksicek et al. 1981). Such economic archaeology comes full circle to illuminate the intellectual superstructure of Maya culture in the work of Puleston (1977), where the pattern of drained fields used for intensive cultivation is seen as exemplifying

the scaly back of the saurian monster which in Maya art and myth supports the living world.

This "holistic" approach (Willey 1980) is likely not only to enlarge our understanding of the ancient Maya civilization but to yield new evidence on more general problems of human cultural development, and in particular on those transitions, gradual or catastrophic, which result in the emergence and dissolution of complex societies.

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