ECOLOGY AND RITUAL: WATER MANAGEMENT AND THE MAYA

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How the ancient Maya of the central Yucatecan Lowlands managed their water and land resources remains poorly known, although crucial to an understanding of ancient political economy. Recent archival research and field data suggest the widespread use of artificially altered, natural depressions for the collection and containment of water, both for potable consumption and agricultural ends. During the Classic period (A.D. 250–900) several of the principal cities in the Maya area constructed their largest architecture and monuments at the summit of hills and ridges. Associated with these elevated centers—"water mountains"—were sizable, life-sustaining reservoirs quarried into their summits. The effect of this town-planning design was the centralization of a primary and fundamental resource. Although elite managers controlled the water source, other decentralizing forces prevented anything similar to Wittfogel's "total power." However, by ritually appropriating the everyday and mundane activities associated with water by the sustaining population, elites used high-performance water ritual as manifest in the iconography to further centralize control. The significance of modifying the urban landscape in the partial image of the ordinary water hole defines the extraordinary in Maya ritual.

El tema de cómo los mayas antiguos de las tierras bajas del centro de Yucatán administraron sus recursos de agua y tierra permanece raquíticamente explicado, aunque esto se considera muy importante para llegar a entender la economía política antigua. Recientes investigaciones de los archivos e información del campo insinúan el extenso uso de las depresiones naturales modificadas artificialmente, para la recolección, y el represamiento del agua, para los consumos domésticos y agrícola. Durante el período Clásico (250–900 d.C.) varias de las ciudades principales en el área Maya construyeron la arquitectura mayor y los monumentos en la cima de los cerros y lomas. En asociación con estos centros elevados—"las montañas de agua"—había grandes depósitos de agua, las reservas de sostenimiento de vida excavados en sus cimas. El efecto de este diseño de planificación de asentamientos fue la centralización de un recurso principal y fundamental. Aunque los administradores de la élite controlaban la fuente del agua, otras fuerzas descentralizadoras prevenían cualquier cosa que fuera similar al "poder totalizador" de Wittfogel. Sin embargo, al apropiarse ritualmente de las actividades cotidianas y mundanas asociadas con el agua por parte de la población a la que mantenían, los administradores de la élite usaron ritos acuáticos sofisticados, como se manifiesta en la iconografía para controlar centralmente más y más. El significado de la modificación del paisaje urbano a través de la imagen del pozo ordinario de agua define lo extraordinario del ritual maya.

> When processual archaeologists waive their right to include cosmology and ideology in their reconstructions, one gets the kind of dichotomy which we have seen in Mesoamerica: anthropologists writing about settlement and subsistence, while humanists write about religion and cosmology. And the humanists, for the most part, do not have the ecological and evolutionary perspective of the anthropological archaeologists [Marcus and Flannery 1994:55].

> Shamanism is his medium; he can see "faraway" by going into a trance and looking into a mirror or a container with water [Covarrubias 1937:349].

The Maya Lowlands of the greater Yucatán Peninsula were a difficult environment in which to make a living. The semitropical landscape was defined by thin karstic soils, seasonal and erratic rainfall, and a marked absence of permanent natural water sources. In keeping with a tropical ecosystem, species diversity was abundant, but concentrations of any single species at any one location were minor—preventing the large natural harvests associated with more temperate environments. Nevertheless, one of the ear-

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Latin American Antiquity, 9(2), 1998, pp. 135–159.

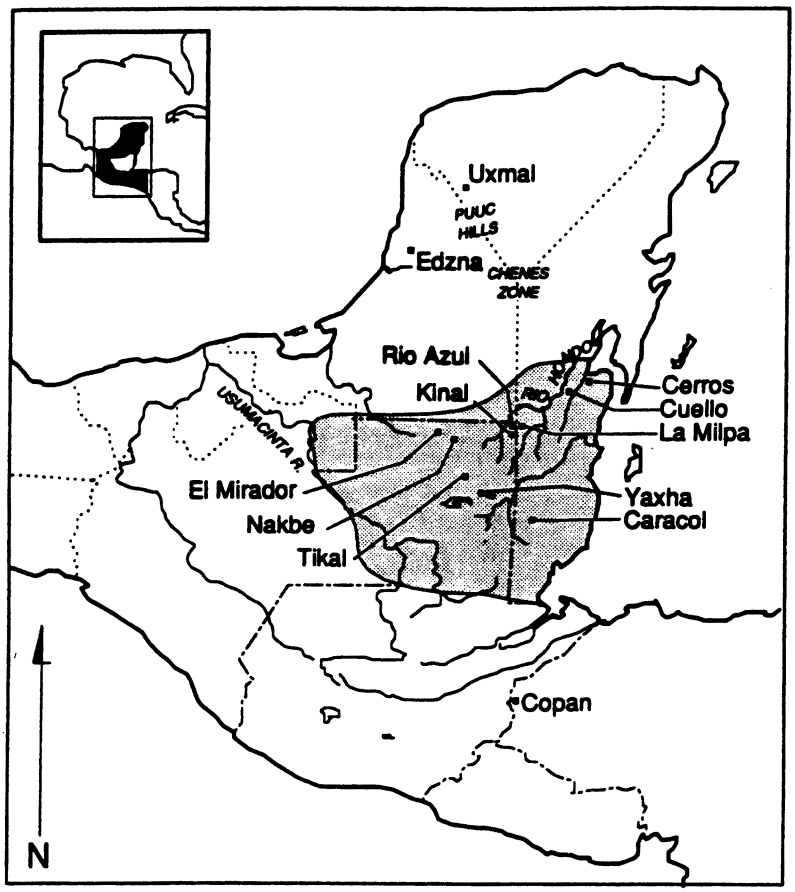

Figure 1. Map of Maya area with boundaries for the Southern Lowlands.

liest tropical/semitropical states known evolved in this setting. The apogee of political and economic development occurred during the Classic period (A.D. 250–900) in a Maya heartland extending over Belize, central and northern Guatemala, and adjacent portions of Mexico and Honduras—the southern Maya Lowlands (Figure 1). Given the difficulties in accessing and centralizing resources from the semitropical setting, how did the ancient Maya organize a labor force to harvest the landscape? One window into their political economy—how a society employs power relationships between groups to organize the use of resources—is the management of land and water.

As a critical and scarce resource during the lengthy dry season, water was politically manipulated by a Maya elite to centralize and control power during the Classic period. Clearly, other means were used to marshall authority in the Maya Lowlands: overt warfare, acquisition and conspicuous consumption of luxury goods, the conspicuous manipulation of monumental architecture, and charismatic rulers. But the fundamental need for water and the food that it allows—preparing and maintaining the earth for planting or the daily requirements for drinking water—made water management in a fragile, water-stressed environment another powerful organizing force.

The construction and maintenance of water systems in the towns and cities of the ancient Maya concentrated water in a quantity and quality unavailable naturally. By placing water and its management apparatus in the center of their elevated Classic-period communities, the Maya permitted a controlling elite to manipulate the resource. Nevertheless, the dispersed settlement and land-use design of the ancient Maya required the elite frequently to draw the attention and activities of the sustaining population into the

public centers, in part by incorporating a wide variety of ritual. In spite of the complexity of Classic-period cities that functioned like "water mountains"—gravity-flow, reservoir systems positioned at the summit of natural hillocks and ridges—a support population could opt for another environmental and political situation, given the weakly developed, centralizing forces at work in a Maya center. Elite managers are posited to have symbolically appropriated the everyday tasks of a sustaining population associated with water use by promoting water-related activities in high ritual performance. By locating tanks near the largest civic architecture—structures used in public theater—the Maya elite employed ritual acts derived from water use and availability.

The paper begins with an extended introduction to the physical hydraulic systems in the southern Maya Lowlands. Reference is made to the centralizing effects of the water-management design during the Classic period in spite of a dispersed sustaining population. The principal case study for the presentation is Tikal, representing in microcosm aspects of the many urban environments established throughout the southern lowlands. Next, the argument for the ritual appropriation of mundane and everyday activities by an elite is articulated using ethnographic and ethnohistoric examples drawn principally from Bali, Madagascar, and highland Chiapas. Each case study represents a tropical or semitropical complex society employing water as a physical and symbolic tool for organizing and maintaining social order. Where social hierarchical divisions are pronounced, water is manipulated by elite managers to secure and maintain power through high performance ritual. Finally, iconography is examined to reveal the significance of water systems and ritual acts by the controlling Maya elite. Tikal is again the principal context for this discussion, which attempts to link water imagery to the physical hydraulic features there, although other iconographic sets from a greater Mesoamerican tradition are included. The practice of elaborate ritual expression—emphasizing the importance of water systems by way of their functional and symbolic architectural manifestation within the great centers—countered the natural centrifugal forces pulling a dispersed support population away (cf. Farriss 1978).

Ecological Possibilism and Hydrological Accomplishment

Water and land use during the Classic period of the Maya was a complex and sophisticated set of systems and techniques adapted to the semitropical microclimatic rhythms and topographic constraints of the karstic Upper Central American lowland setting. Because the Yucatán Peninsular environment is characterized by marked seasonal scarcity of permanent water sources—be they springs, open lakes, or perennial streams—populations invested in creative landscaping adaptations to collect and store surface runoff during the six to eight months of abundant annual precipitation. As I have suggested elsewhere (Scarborough 1993a, 1994), it was the limitations of these environs that partially stimulated the accretionary or incremental modifications made to the landscape by the Maya.

Much has been made of the dispersed land-use patterns of the ancient Maya. In spite of truly sizable populations demonstrable throughout the lowlands—estimates comparable to the highest known for preindustrial states (Rice and Culbert 1990)—the lack of densely concentrated populations (and by extension, resources, as the argument goes) within their largest cities implies a less complex social order than is apparent in other primary state systems. V. Gordon Childe (1950) set the tone for definitions of the state with his trait list emphasizing urbanism. His greatest challenge was what to do with the Maya. "Hence the minimum definition of a city, the greatest factor common to the Old World and the New will be substantially reduced and impoverished by the inclusion of the Maya" (p. 9). The association of dense urban communities of scale with thresholds cresting 5,000 people/km are frequently equated with state levels of social complexity; societies with something less become suspect, less complicated—the largest Maya centers being nearly a full magnitude less dense (Sanders and Price 1968; Sanders et al. 1979; cf. Whitehouse and Wilkins 1986).

What Childe and others have neglected are the ecological constraints influencing a tropical state. Because specific biological resources were never concentrated in extensive plots naturally, early settlement adaptations were dispersed—designed

to harvest best a wide variety of resources. Ethnographic and ethnohistoric data indicate that before Spanish colonization of the region gardening and milpa production were not as dependent on sizable maize surpluses (Atran 1993; Nations and Nigh 1980; Schwartz 1990)—although maize was always a staple. Polyculture included a number of tropical domesticates as well as several cultivars that were as healthy with or without human propagation. Frequently cropping was done in the tangle of the jungle canopy, some crops conserved and harvested best in a managed forest setting (Marcus 1982; cf. Groube 1989:301). The significance of these cropping strategies illustrates the productivity of a tropical landscape constrained by thin soils and erratic rainfall. Early in Maya prehistory the best adaptations to the environment were those that mimicked it—tricking the ecosystem into producing more for sedentary human populations. Larger agricultural plots supporting maize or complementary beans or perhaps squash functioned well in highland Mexico, but the constraints of a semitropical setting were less conducive until the Spaniards arrived.

The organizing parameters for the Maya were put in place at an early date; by 600 B.C. sizable investments in monumental architecture were made (Hansen 1991), and intensive forms of swamp agriculture were initiated (Pohl et. al 1996; Scarborough 1993a). Because the environment was always a constraint, labor skills and scheduling, coupled with the kinds and amounts of land and water available, were carefully blended to accommodate best the forces and relations of production. As argued elsewhere (Scarborough 1993a, 1994), the environment was never a constant or fixed-in-form setting for the Maya; they accretionally altered it producing a highly productive setting for humans. Maya economic organization operated within the ecological parameters of the semitropical setting, preventing the kind of resource concentrations—biological assets as well as some physical ones such as water—found in more temperate or semiarid environments where most other archaic states developed. The significance of Maya resource and settlement dispersion is not that it was less centralized than defined in semiarid state systems, but that the Maya developed a political and economic organization that pushed, invented, and reinvented their environmental parameters to accommodate a level of complexity different than some other better understood social systems. Controlling water access and the manner by which land was developed to accommodate the use of water typifies aspects of Maya political economy through time.[1]

Water and Land Development

During the initial colonization of the Maya area (> 1000 B.C.), the coastal plain and the few, small, perennial drainages leading to the sea were the only zones that could support sedentary populations for the long term. Settled fisherfolk tethered to coastal riverine resources probably experimented with domesticates initially better suited to highland environments (MacNeish 1964; MacNeish and Nelken-Terner 1983; Puleston and Puleston 1971). Because of the environmental limitations associated with the interior of the Yucatán Peninsula, colonization lagged perhaps half a millennium behind incipient sedentism elsewhere in Mesoamerica (Andrews and Hammond 1990; Flannery and Marcus 1983; Hammond 1991; MacNeish 1964; Niederberger 1979; Sanders et al. 1979). With increasing population, however, pioneer groups pushed inland following the minor streams and associated swamp margins adapting to the four-month-long dry season by living near natural depressions that might hold water for an extended period.

Evidence for formal food storage pits—a characteristic associated with long-term residency at a site and a common feature in most early Mesoamerican villages—is seldom identified until the Late Preclassic period (400 B.C.–A.D. 250) in the Maya area. The lack of this kind of storage for food may indicate a cropping strategy that allowed for adequate swamp-margin agricultural production by the first interior villages on the peninsula. High humidity and temperatures conspire to prevent simple storage adaptations, making other economic adjustments necessary for long-term sedentism. One adaptation may have been to the elevated water table in swamp settings—even in the dry season—that may have allowed two crops annually. When supplemented with natural forest foods and fibers, year-round residential occupation was possible given low

population densities (Scarborough 1994).

By the Late Preclassic period sizable populations were established throughout the seasonally variable lowlands. Communities and sometimes regions adapted to the microclimatic and topographic variation apparent from one end of the Yucatán Peninsula to the other. Years of trial and error in modifying the landscape to raise its naturally limiting carrying capacity resulted in an engineered environment that was extremely productive. Some sites and site areas constructed their centers near the base of shallow natural depressions to take advantage of the slope runoff generated into these settings, conserving the water resource in carefully altered reservoirs next to the growing investments made in monumental architecture. Sites as small as Cerros (Scarborough 1983, 1991a) and as large as Edzná (Matheny 1976, 1978) or even El Mirador (Dahlin 1984; Matheny 1986; Matheny et al. 1980) positioned their centers to receive runoff from a large, but essentially natural, watershed. These communities used "concave microwatersheds" to direct the water and, by extension, the use of the land resource (Scarborough 1993a, 1994) (Figure 2). Nevertheless, the Late Preclassic adaptation can be viewed as a passive form of water management in that it represents a logical extension of the earliest sedentists' use of natural depressions for agricultural ends.

By the Classic period a significant water-management variation occurred at several sites (Figure 2). Throughout the southern lowlands, cities selected elevated ridges and hillocks to position their most grand architecture. Through a process of moving centers away from immediate and predictable water sources and relocating them to the summits of karstic hills, the Maya chose to excavate deliberate and sizable reservoirs in proximity to their elevated and massive architectural works—especially pronounced at the enormous cities of Tikal and Calakmul (Folan et al. 1996; Scarborough and Gallopin 1991). By cutting and filling the naturally undulating and craggy summit surfaces, the foundations for a grand concentration of engineered landscaping occurred. Although well-defined reservoir systems are demonstrable at slightly smaller communities such as La Milpa (Scarborough et al. 1995) and Kinal (Scarborough et al. 1994), and recently articulated by Barbara Fash at Copán using iconographic references (Fash 1996), true water control of scale is best manifest at the huge site of Tikal (Scarborough and Gallopin 1991). Together with Copán (Fash 1991; Fash and Andrews V 1998), Tikal continues to represent one of our best-reported large communities in the southern Maya Lowlands.[2]

What sprang from the cut-and-fill operations in establishing the tiered building foundations in the core of the largest Classic centers were towering pyramids, massive acropolises, and open plaza pavements architecturally knit together in dramatic enterprises. Seen from kilometers away, the greatest centers were beacons to thousands occupying the densely settled rain forest. Although some of the fill necessary for the construction of the standing architecture was taken from the initial leveling operations within a center (Scarborough et al. 1994), much more was obtained by formal quarrying activities. This was a planned process in the construction of a center, with the location of quarry fill and the depression that resulted a deliberate act, possibly as important to the built environment as the pyramids themselves. It was the conversion of these depressions into tanks and formal reservoirs that provided the water necessary for both the construction of the center as well as its maintenance. Natural swales were sometimes mined and widened for fill but closed off during the construction process, with basal surface exposures sealing naturally by way of clay in runoff suspension or by deliberate acts of plastering. From the onset of construction, water was at a premium in a large Maya site. Water was required in mortar preparation from the cementing of veneer stone to the paving and plastering of floors and walls. The work gangs themselves needed potable supplies, further suggesting that the first order of business at a Maya construction site was the excavation of a tank system. In most cases, the location of the elevated tanks was in immediate proximity and below the most grand construction projects at a site.

Tikal as a Water Mountain

Tikal illustrates the archetypical management of water within a center (Figure 3). Located away from permanent natural sources of water, Tikal

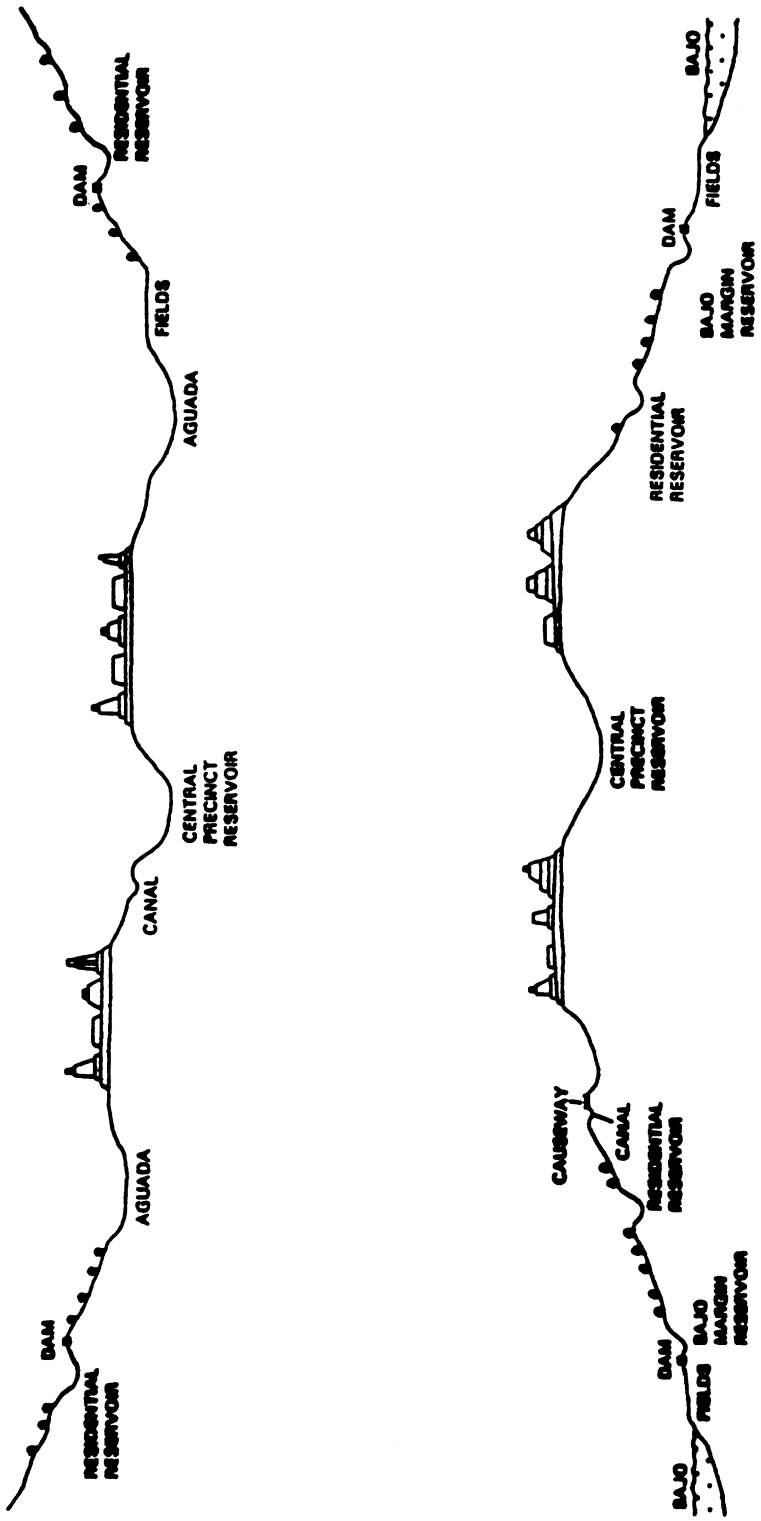

Figure 2. Schematic reconstruction of concave (Late Preclassic) (top) and convex (Late Classic) (bottom) microwatersheds (from Scarborough 1993a:40).

was dependent on the collection of seasonal rainfall. Precipitation rates today range from 1,350–2,000 mm per year in this portion of north-central Petén, Guatemala, with a four-month period of annual drought (Scarborough and Gallopin 1991). By the Late Classic period (A.D. 600–900), Tikal consisted of extensive zones of paved surfaces—plazas, courtyards, platforms—on which temples, pyramids, and palacelike structures were built. The immediate impact of this architecture and its surfaces was to dramatize the power of those responsible for the construction and maintenance of the center (Trigger 1990); however, these same pavements provided a deliberate set of impervious catchment areas subtly designed to seal the underlying, naturally porous limestone and direct rainy season runoff into the sizable tanks within the central precinct of the site.

Six catchment areas or microwatershed divisions were engineered on the principal hillock on which Tikal rests (Figure 4). Five catchment areas occupied the densest portion of residential space, positioned on the gentle slope but originating at or near the elevated central precinct. The most completely altered catchment was at the summit or central-precinct catchment covering an area of 62 ha and enclosing much of the monumental architecture at Tikal. Within this catchment alone, more than 900,000 m^3 of water could be potentially collected (based on 1,500 mm of annual rainfall) by way of slightly canted pavements and subtle diversion weirs directing runoff into six central-precinct reservoirs. Where excavations were conducted in the Palace Reservoir (Figure 4), Harrison (1993:84) reports that the tank was deliberately sealed by liner stones and imported clays. The reservoirs had a combined storage capacity of 100,000–250,000 m^3 and allowed the planned release of water during the dry season through posited sluice gates located under the causeway system, especially well defined on the eastern margins of the site (Figure 5).

Within the densely occupied residential zone immediately below the summit of the site, smaller tanks for domestic use were apparent. Although considerably smaller in capacity, these reservoirs were likely recharged through the scheduled release of water from the central-precinct tank system. Near the foot of the hillock and adjacent to the swampy terrain surrounding Tikal were four sizable reservoirs positioned loosely in the cardinal directions. These "*bajo*-margin" reservoirs, located at the base of four of the six catchment areas, were designed to capture and recycle "used" or "gray" water from the upslope residential settings into postulated swamp-margin agricultural plots (Figures 4 and 5). On the scalar order of the central-precinct tanks—but located away from the dense population aggregates farther upslope—*bajo*-margin reservoirs had a combined storage capacity of 50,000–175,000 m^3, runoff collected from a set of catchment areas larger than the central precinct itself.

Although we will likely never know the amount of food made available to the residents of Tikal, we can posit the area watered by the *bajo*-margin tanks. Near present-day Tehuacán, Mexico, Wilken (1987:159) indicates that a canalized spring allows each member of the community at Chilac at least one turn of water or 1.3 x 106 liters (1 m^3 = 1,000 liters), enough water to irrigate one hectare of green corn, garlic, and tomatoes. If we use the mean average storage capacity for the tanks, then approximately 85 ha could be agriculturally supported at Tikal by the *bajo*-margin tanks—a figure believed low given the elevated water table associated with the seasonally inundated *bajos*, the lower evaporation rates found in the Maya Lowlands, and the likelihood that many of the crops grown by the ancient Maya were less water demanding than those produced today in the cash-crop economy of Chilac. With water available year-round, two or three crops could potentially be produced annually. Although the actual identification of fields below the *bajo*-margin reservoirs remains conjecture, field systems are recorded ethnographically and archaeologically in similar settings elsewhere in the Maya Lowlands (Harrison and Turner 1978; Puleston 1983; Wilk 1985). Such agricultural features are notoriously difficult to identify because of the obvious natural processes affecting seasonally inundated swamps and the influence of alluviation and colluviation during the last thousand years since Terminal Classic (A.D. 800–900) abandonment.

Tikal represents our best-documented example of a complete water-management system in the Maya area, though segments of the system out-

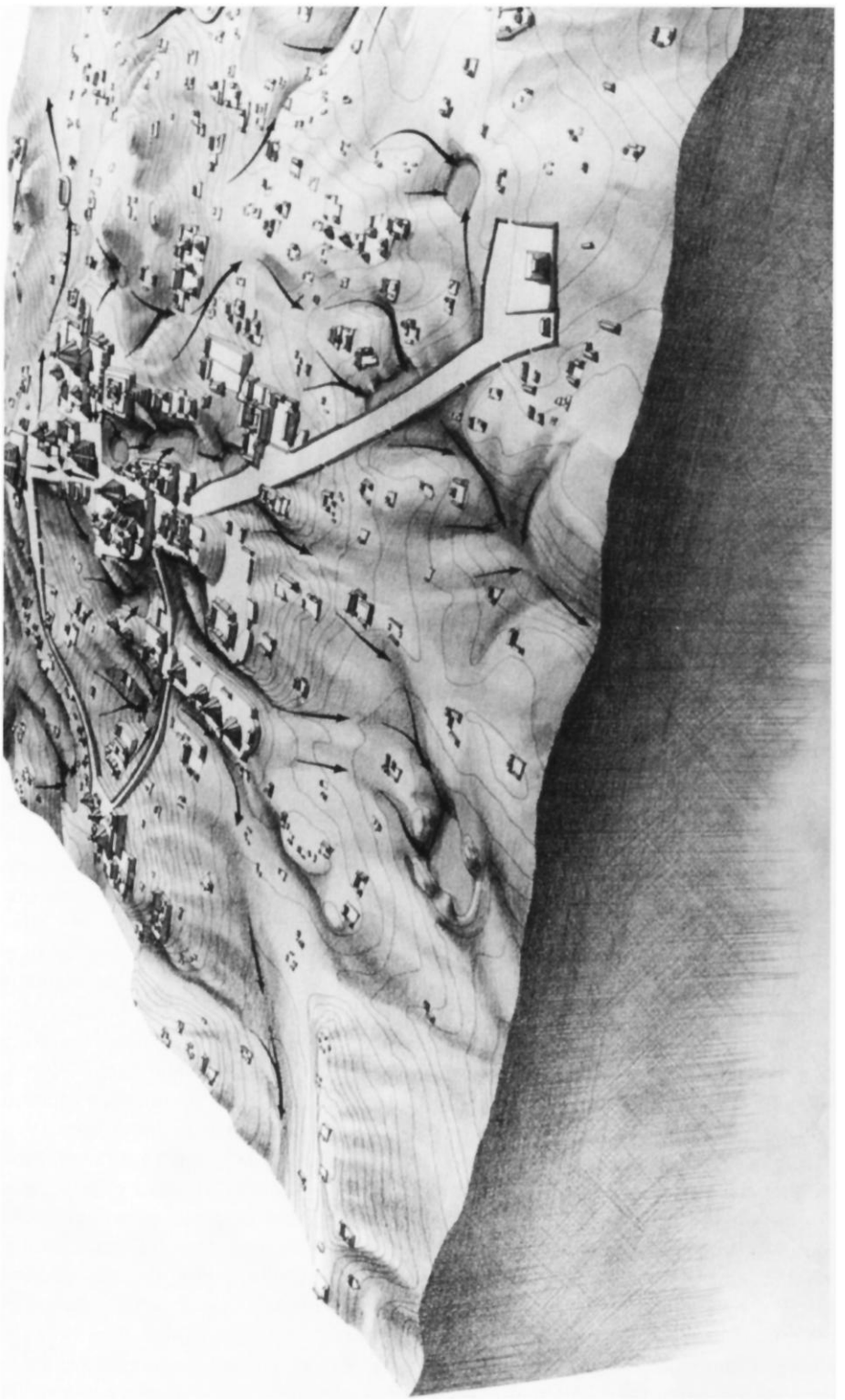

Figure 3. The landscape at Tikal. (Reprinted with permission from *Research and Exploration* 10:188. Copyright © 1994 National Geographic Society)

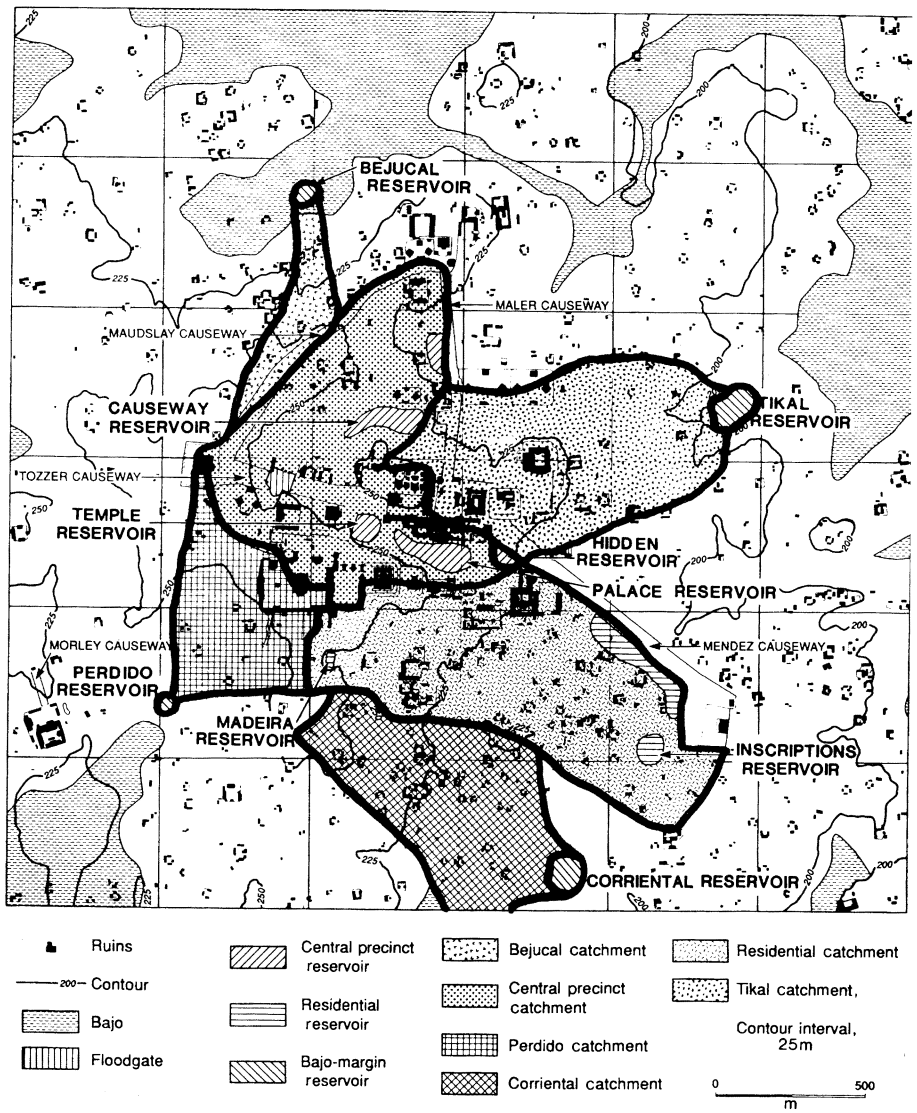

Figure 4. Main catchment areas at Tikal. (Reprinted with permission from *Science* 251:659. Copyright © 1991 American Association for the Advancement of Science)

lined above are known at other centers (Scarborough 1993a). Unlike the Late Preclassic adaptation based on a passive, concave microwatershed water system, Late Classic systems entailed considerably greater control of the water resource based on elevated site selection and an associated "convex microwatershed" adaptation (Figure 2). The significance of this control and the centralizing forces associated with the manipulation of the summit central-precinct catchment area suggest the economic and political power of a king or ruling elite. But the functional accessibility of the water source represents only one aspect of the overall importance of the water system; that a set of elite managers was capable of altering a limestone hillock or outcrop into a "water mountain," to produce a water source where there was none, also permitted the symbolic appropriation of this fundamental yet mundane natural resource by the elite. It is the proximity of reservoirs to some of the largest and most complicated architecture at Tikal—all cen-

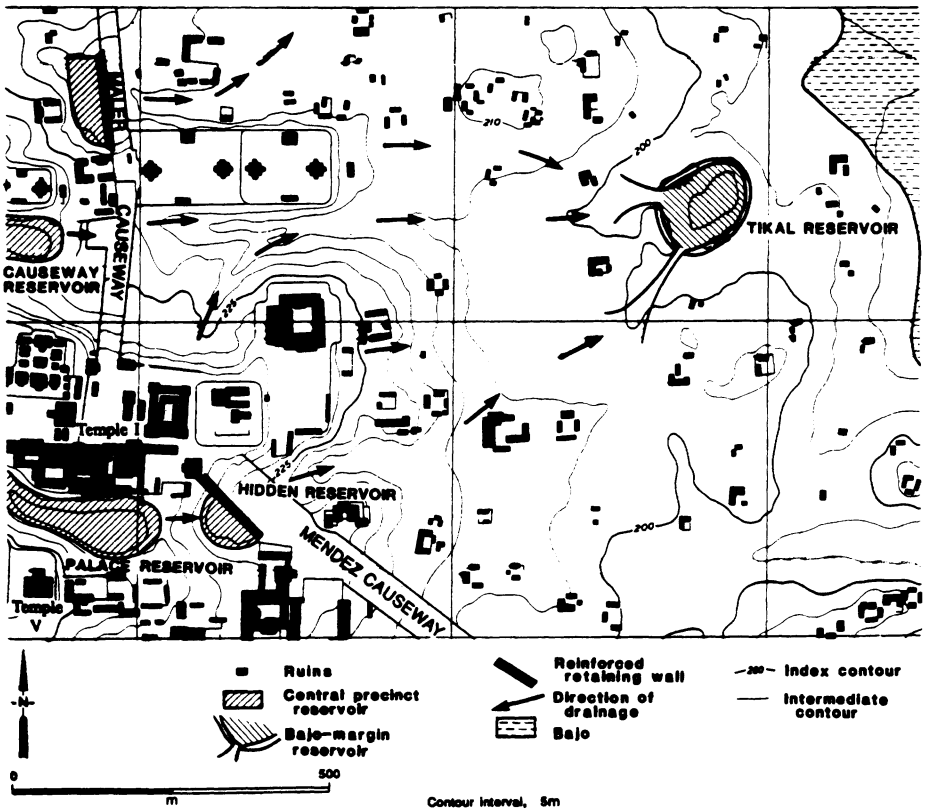

Figure 5. East margins of central Tikal. (Reprinted with permission from *Science* 251:660. Copyright © 1991 American Association for the Advancement of Science)

tral-precinct reservoirs within 100 m of at least one major civic-ceremonial building complex—that helps link water to ritual.

Scale, Water Availability, and Ideology

What made the paved, convex microwatershed system so effective was precisely its scale. Tank systems away from the great centers were likely much more ubiquitous and dispersed than present-day archaeological surveys can identify—in keeping with the natural separation of biological resources in the semitropics. Small housemounds are difficult enough to record; the few shallow tanks nearby are even less visible after one to two millennia of abandonment and siltation. But the inability of the known small tanks to hold enough water through more than one dry season after a not uncommon extended period of drought prevented these household water holes from providing the necessary risk reduction when compared to the truly huge catchments and reservoirs associated with the largest centers. Little to no rain for two or three years—symptomatic of either the natural regional variation in precipitation or something more climate altering (Harrison 1993; Scarborough 1993b)—would result in abandonment of a household tank system, but not at a site like Tikal.

Nevertheless, the technology associated with reservoir management at a less sophisticated scale was known and practiced throughout the lowlands outside the immediate political sphere of many large centers (Beach and Dunning 1997; Matheny and Gurr 1983). Tikal did have control over a scarce resource by way of the huge tanks located in its elevated core, and the immediate sustaining population residing in proximity to the release channels was heavily invested in the generations of land modifications associated with this engineered landscape. Although functionally sophisticated, the Classic water-control system was never an example of "total power" à la

Wittfogel (1957); a support population had the option to relocate, given a work force large and coordinated enough to construct a smaller but sustainable tank system elsewhere. However, the social and economic costs of moving from an accretionally altered landscape constructed over centuries (Scarborough 1993a, 1994) would be a strong incentive to remain (cf. McAnany 1995), since building a water system as elaborate as that at La Milpa or Kinal—let alone Tikal—would be extremely expensive. Still, the option was there.

Elites in the great centers recognized the fluidity and fragility of lineage alliances, and not only within the ranks of the nobility (Haviland 1992; cf. Hendon 1991). The support population required periodic and substantial "proof" of the ruling body's right and legitimacy to govern. Much of the literature devoted to Maya ideology focuses on the methods that the nobility employed to capture the minds and souls of their subjects (Demarest 1992; Freidel et al. 1993). Demonstrating direct descent from a great king or set of deities or even a powerful lineage was most important to the ruler and the ruled; the role of blood sacrifice in establishing that bond in public theater has received disproportionate attention when compared to the more mundane appropriation of economic resources by an elite (cf. Montejo 1991)—the latter generally assumed necessary to control and order statecraft elsewhere in the world (Adams 1992; Carneiro 1992).

However, another interpretation of the iconography from the great centers suggests that an attempt was made to link the economic and ecological underpinnings of the Maya to the elite trappings of control. Water ritual illustrates some of the ways that economic power was manipulated by the elite in Maya society. It is the linkage between the functional necessity of occupying an engineered landscape, allowing households and lineages to make a living, and the evolution of an elite ideology to accommodate and subsequently appropriate that reality that directs the remainder of this presentation.

Ritual

The ecological underpinnings of ritual are based on the ordinary, day-to-day actions and routines that humans carry out. They assume that the underlying relationships and energy exchanges between humans and their landscapes are fundamental and that the daily activities and decisions of a group within this context strongly affect the kind and degree of ritual performance. Unlike beliefs, symbols or myths, and the "conceptual blueprints" for ritual, rituals themselves are the habitual actions necessary for publicly defining an ideology (Bell 1992:19). Rituals are the prescribed activities that regularly provide aspects of meaning for religion or ideology within society. Ritual is performed at all hierarchical levels of society but frequently draws its influence from the mundane, grounded in everyday experience (Reynolds and Tanner 1995:8). It is the everyday routines within a society that foster significant aspects of religious ritual, everyday tasks based on subsistence-level activities and dependent on the immediate disposition of the landscape.

The role of ritual among the ancient Maya is difficult to project without knowing more about the structure of ritual as revealed by its influence over other societies: societies at similar levels of socioeconomic and sociopolitical complexity and those for which a rich ethnographic and ethnohistoric literature exists. Because the Maya themselves did not record the kind of information necessary for a complete understanding of their political economy—especially the role of ritual in attracting and maintaining a support population—an examination of three well-reported groups occupying similar semitropical to tropical settings to those of the Maya follows. Each group has a well-developed set of water rituals, in part conditioned by constraints in access to water.

Madagascar

In an important study treating the definition of ritual and the manner by which it allows and legitimates power, Bloch (1987) examines the late-nineteenth-century royal bath ceremony of the Merina in Madagascar. Here the influence and authority of the grand royal ceremony were derived from a similar, but less complex and involved, ritual performed widely at the local level. Water blessings were splashed from father to child in each household at the beginning of the New Year. All fathers in the kingdom acted as the spiritual medium in accessing and delivering the blessings of their immediate ancestors to their children by way of ancestral tomb visitations the

day before. It is by elaborating and publicly articulating this household ceremony within the state palace that the annual royal bath of the king legitimized his ancestral right to govern and declared his fatherly domination over his constituency.

> The political significance of this fact cannot be overstressed. On the one hand the ritual of the royal bath is the same as the ordinary rituals of blessing by which each and every Merina assures and represents the reproduction of his family and himself. As such the royal ritual is a large scale descent group ritual and the whole kingdom appears as one large family. On the other hand, the ritual of the royal bath is a ritual of the pre-eminence of the king, represented in the ritual as the violent conqueror and absorber of cattle and the Vazimba. Within this idiom the king is by implication a violent being whose violence, whether directed towards outsiders or subjects, is justified. These two sides of the representation are in the ritual quite inseparable and as a result subjects can celebrate their own subordination as though it were their own reproduction [Bloch 1987:296].

To draw from Roy Rappaport (1968), we are describing an aspect of his "ritually regulated ecosystem"—here the term "ecosystem" is recast as the complex social relations between individuals and subgroups influenced by the availability of cattle and related environmental constraints—a system that promotes hierarchy and manifests a controlling elite. The political economy is partially regulated by a state ideology that incorporates a small-scale, lineage-specific ritual by appropriating its immediate significance to each household and reinventing its meaning to place the support population in a subordinate position. Ideological regulation occurs when all subordinates follow a calendar of prescribed events established by the state and set in motion by the actions of the king. Ritual and elite controls in this context define themselves by way of reaching into the base structure of society, examining aspects of routine behavior that reflect ordinary activity, and exaggerating and formalizing ritual in a widely public context. In this way, the ordinary is made extraordinary and used by the ritual specialists to confirm their deep and compelling understanding of the root and essence of society.

Bali

Bali is the source of one of the more recent and pervasive models incorporated, both explicitly and implicitly, in Maya studies—the theater state. Nevertheless, Bali is also the origin for another interpretation of complex society grounded in economy and the environment.

Much has been written with respect to Balinese water systems. Geertz's (1980) notion of a *negara*, or theater state, operating independently of the water and land base has received considerable attention in cultural studies. More recently, Lansing (1987, 1991) has shown that a more topographically and regionally sensitive assessment provides a more complex interplay between the theater state and the water-temple system. His skillful assessment of the water-temple system and its interdependency with agriculture and ideology is perhaps the best presentation of Rappaport's "ritually regulated ecosystem" theme available for a highly complex society—significantly more complicated than Rappaport's own study of the New Guinea Highlands.

As in the Maya area, Balinese water and its availability is of critical importance and is regulated by water districts or *subaks*. Laborers from different villages and village districts (*bandjar*) farm within the *subak* district, forming significant political associations. Although unstated, such a widespread social network between village districts may allow ready access to additional workers drawn from a broad labor pool at peak activity times associated with the intensive demands of a rice economy. Unlike Geertz's view of subak divisions as independent and autonomous, Lansing has demonstrated that they are hierarchically organized, with a dendritic plan mapped onto the bifurcating system of streams and canals. A series of decision makers—priests—occupy water temples located at the juncture of downward-flowing diversion channels. Ultimate authority over the system is positioned with the High Priest of the Temple of the Crater Lake, who resides near the apex of the island—a location viewed by the Balinese as the source of their irrigation waters.

Many rhythms drive Balinese society, but a central element is the tempo set by the water-temple priests and their ability to regulate and schedule water for each *subak*. Lansing shows that water amounts are finite, and allocation at each diversion dam depends on a complicated variety of information made most intelligible within the water temple. Planting and harvesting cycles are defined by consulting calendars—both a sacred

and secular seasonal round—as well as the immediate conditions reported by the farmers themselves during their regular devotional visitations to the water temples. Lansing illustrates how pest damage is curtailed by preventing contaminated paddy fields from spreading weevil infestations, forcing necessary but extended fallow conditions on portions of a *subak*. I would suggest that the structure of the *subak* system, with farmers coming from several *bandjars*, spreads such risks and allows the irrigation of another set of paddies.

Because of the strong Balinese-Hindu ideology pervading the island and the role of the water-temple hierarchy, considerable ceremony and ritual are invested in the success of the rice crop (Barth 1993). With each new crop, "holy water" is obtained from the Temple of the Crater Lake at the summit of the water system and carried down to each water temple to bless the predicted bounty. Lansing describes the activity and emphasizes the role of purity in obtaining water from the "source" and the domain of the High Priest.

Although coming from halfway around the world, the Balinese case study provides a window into a previously engineered landscape that has long disappeared in the Maya Lowlands. Water imagery and ritual remain fundamental to contemporary Maya groups, as evidenced by the frequently described *Cha-Chaac* ceremonies performed in the field to avert drought (Farriss 1984:292; Freidel et al. 1993). But as Farriss demonstrates, these ceremonies represent a significantly altered survival of precolonial public ritual—former community ritual conducted in the grand civic spaces of ruined cities, today performed on agricultural plots away from towns and churches.

Highland Chiapas

The Maya area has been studied ethnographically, ethnohistorically, and linguistically for nearly a century. But as Farriss suggests, much changed structurally in society following the Classic and Early Postclassic periods (> A.D. 1200), making clear comparison to the Classic past from contemporary Maya populations difficult. Although less integrated, less complex, and much reduced in scale, present-day Maya groups still reveal valuable information about their landscape, water use, and associated rituals that is pertinent to the Classic period (cf. Marcus 1993).

Perhaps the best information about reservoirs and social structure in contemporary Maya society is presented by Evon Vogt's (1969) classic study of the community of Zinacantan in highland Chiapas. By way of direct historical analogy, water ritual in Zinacantan reflects less the drama performed in Classic Maya civic centers, and more the deeply rooted and conservative, everyday activities of a sustaining population from antiquity. Zinacantan ritual is not viewed as a broken down set of ritual survivals—threads and patches of high rituals performed by kings and nobility during the Classic period—but as an adaptive set of indigenous practices with antiquity probably as great as the ancient kings themselves.

According to Vogt, settlement and social relationships in Zinacantan are significantly influenced by the location of the water hole. A water hole group consists of clusters of dispersed neighborhoods or *snas*, the latter defined as "residential units composed of one or more localized patrilineages" (1968:158–159). A collection of water hole groups forms a hamlet, or *paraje*, 11 of which together define Zinacantan when the *cabecera* or ceremonial and political center is included. Vogt indicates that "waterhole groups cut across *paraje* lines," which may suggest a similar economic and social risk-sharing strategy to that of the *subak/bandjar* association noted in the Balinese case. Regardless, "the waterholes are highly sacred, and there are myths about each of them describing the circumstances under which the ancestors found the water and how the waterhole acquired its distinctive name. The waterholes are also the focal points for special ceremonies, called *k'in krus*, performed by their neighborhood settlements" (Vogt 1968:158).

Because water holes run dry seasonally, water hole groups regularly consolidate around the few more permanent sources in the dry season but extend back out to the nearest seasonally filled source during the rainy season. The *k'in krus* ceremony functions to clean and maintain the water hole twice a year but also appears to purify ritually the Zinacantecos themselves (Vogt 1968:167, 1969:147).

Zinacantan water holes indicate the importance of water ritual and shamanism among small populations of living Maya. Their water-control

system is undeveloped and functionally passive, not at all as sophisticated as the landscape engineered by the ancient Maya. In spite of the ethnographic record's richness in describing the water-hole group in Zinacantan, it is the water use and ritual of the Balinese that may best explain the engineered landscape and iconographic display of the ancient Maya at the summits of their great water-temple mountains. Nevertheless, Zinacantan demonstrates the role of reservoirs in coordinating daily activities in a rural Maya setting and the influence of ritual in elevating water's fundamental life-sustaining properties to the extraordinary; it probably illustrates the kinds of adaptations made by the smallest aggregates of ancient Maya away from their cities.

The above examples of water's role in ritual emphasize water's daily use and how its economic significance can coordinate social activity at many different levels. In the case of Madagascar, power is institutionalized by appropriating water ritual based on ancient traditions defined at the lineage level, a design projected for the Classic-period Maya. At similar complex institutional levels, the high priest and his acolytes in Bali, located at the summit of the island, command the same kind of sway over the water source as envisioned for the elevated rulers at Tikal; neither is in a position to coerce control severely, but through ritual manipulation is capable of directing and appropriating labor and social activity further downslope. Ritual in this context functions as a conduit for the exchange of agricultural or economic information. Aspects of water ritual maintain a conservative presence in Zinacantan, ritual continuing as survivals from the more rural practices of the Classic Maya nonelite—precisely the kind of practices that were appropriated by the nobility.

Iconography and Water

The ethnographic record shows the significance of water ritual and how some elites acquire elements of power by appropriating everyday water activities in developing a state-level ideology. These social anthropological examples—together with the documentation of the ancient, physical water system and its resource centralizing design—suggest how the Maya elite could have control over their support constituency, in part by employing elaborate water ritual. For the Classic Maya, however, ethnography is absent, forcing a reexamination of a third research arena—iconography, the last major source for assessing ritual elite propaganda and the importance of water.

Because of the importance of water to Mesoamerican societies, a portion of this section refers to iconography outside the Maya area. These data indicate ways in which water was used and revered in neighboring states, or chiefdoms in the case of the Olmec. Tikal will represent the focused context for well-provenienced imagery from a single site in an attempt to link best the functional hydraulic system outlined above with ritual display—though supportive iconographic expression from elsewhere is mentioned. The evidence presented will challenge the sensibilities of some readers. Nevertheless, the arguments draw from the writings of respected Mesoamerican art historians and symbolic anthropologists who have, in ways, recently redirected their subdisciplines. In keeping with the epigraph at the beginning of the article, initial forays into water imagery by ecologically oriented archaeologists are necessary—but in dialogue with those already treating the subject matter.

Greater Mesoamerican Water Traditions and the Maya

An important link in integrating reservoir activities into the limited corpus of iconographic images featuring reservoirs is their association with caves, springs, and mirrors. Unfortunately, direct historical or epigraphic allusions connecting tank systems to these other images are rare and subject to interpretation. This is especially true in the Maya area where the human-made convex microwatersheds of the Classic-period—evolving from the less centralized Preclassic system—indicate the control necessary to order society's water needs, supplying it to at least a portion of the support population in proximity to the great centers. Unequivocal evidence for elite manipulation of water ritual is not easily marshalled empirically and requires frequent associations to other zones of Mesoamerica.

The hillock-positioned cities of the Classic-period Maya were derived from a slowly altered

landscape with deep ancestral roots of perhaps a millennium. The passive water systems of the Preclassic assumed the presence of water and invested in sustaining and extending its natural availability, not reinventing the landscape to accommodate true water control by creating a "source." This lack of immediate environmental or economic control did not stimulate less iconographic imagery or excite a less-developed, underlying water ideology than did a later burgeoning Classic elite expressing itself in the control of water and the associated social relations of production. Evidence for a long-lipped earth monster is widespread from the Pacific Coast into the interior of the Petén, the latter at sites like Uaxactún and Cerros before the Classic period (Tate 1982). At Abaj Takalik and Izapa, on the Pacific side, the long-lipped trait is associated with celestial water givers at an early date as well (Parsons 1972; Quirarte 1977).

Some of the most evocative interpretations of water imagery are associated with Olmec antecedents that appear incorporated into later Classic Maya water ritual—much of it understood as evolved shamanistic ritual (Freidel et al. 1993). In a recent paper, Reilly (1994) reveals several intriguing hypotheses for the symbolic function of Olmec plazas. At La Venta, specifically, he suggests that the buried serpentine mask or Massive Offering 2 in Plaza A was an expression of the watery underworld in which a key ruler was placed some 4 m above the offering. Reilly's interpretation has Monument 6, the basalt sarcophagus carved in the image of a swimming crocodilian and prepared for an uninterred ruler, floating but teetering into the underworld.

Over a millennium later at Tikal a set of four carved long bones found in Tomb 116 associated with Temple 1 and Ruler A (Hasaw Ka'an K'awil) suggests a similar scene (Schele and Miller 1986:Figure 7.1) (Figure 6). Here a canoe load of animal spirits (*naguals*) and the accompanying Paddler Gods escort the ruler into the watery depths. In two of the carvings the canoe is shown dipping into the watery world, with the back of the ruler's wrist pressed to his forehead. As early as the Preclassic, or Formative, period, water symbolism was well developed and associated with the heart of an architectural center.

Caves and Springs

Much of what is linked to water imagery in Mesoamerica is associated with cave symbolism; caves frequently define the springhead for an otherwise scarce water supply. Where precipitation was slight at such early sites as Chalcatzingo, cave and water associations are clear (Grove 1987). Nevertheless, even here recent evidence for holding tanks (Angulo 1993; Grove 1987) suggests an additional connection between the iconography and reservoirs. The fierce-looking Relief IX (Figure 7), with its symmetrically squarelike or quatrefoil maw, need not be a cave opening given Reilly's novel claims. Below I suggest that during the Classic period in the Maya Lowlands the quatrefoil represented reservoir imagery as well as cave associations. Relief IX may accent the importance of Reilly's plazas and/or the role of reservoirs in storing water in proximity to the core area of some Olmec centers. The gaping maw may be a plaza surface or tank opened wide to receive or belch forth those passing between worlds.

At Teotihuacan the significance of spring imagery is most profound with the Pyramid of the Sun constructed over a caverned water source (Heyden 1975, 1981). Springs were the city's principal source of potable water and a considerable amount of its agricultural supply (Sanders et al. 1979). In a graphic image from the Tlalocan mural in the Tepantitla compound (Stone 1995; Taube 1983) (Figure 8), water mountains were the sources of springs—the Pyramid of the Sun may have been the material, human-made symbol of these mountains. Water mountains were functionally understood to provide spring water associated with cave entrances. Among the Aztec, Broda indicates that the word in Nahuatl for village or community was *altepetl*, which translates as "mountain of water" (Broda et al. 1982; Fash 1996).[3]

Less metaphorically, the Maya actually constructed functional water mountains where there were none. Ironically the illustration from the Tlalocan mural may best depict the site of Tikal, although no known springs exist at Tikal, and few are identified at ancient lowland cities. Cave and spring imagery was used to emphasize the import of water use—both functionally and ritually—

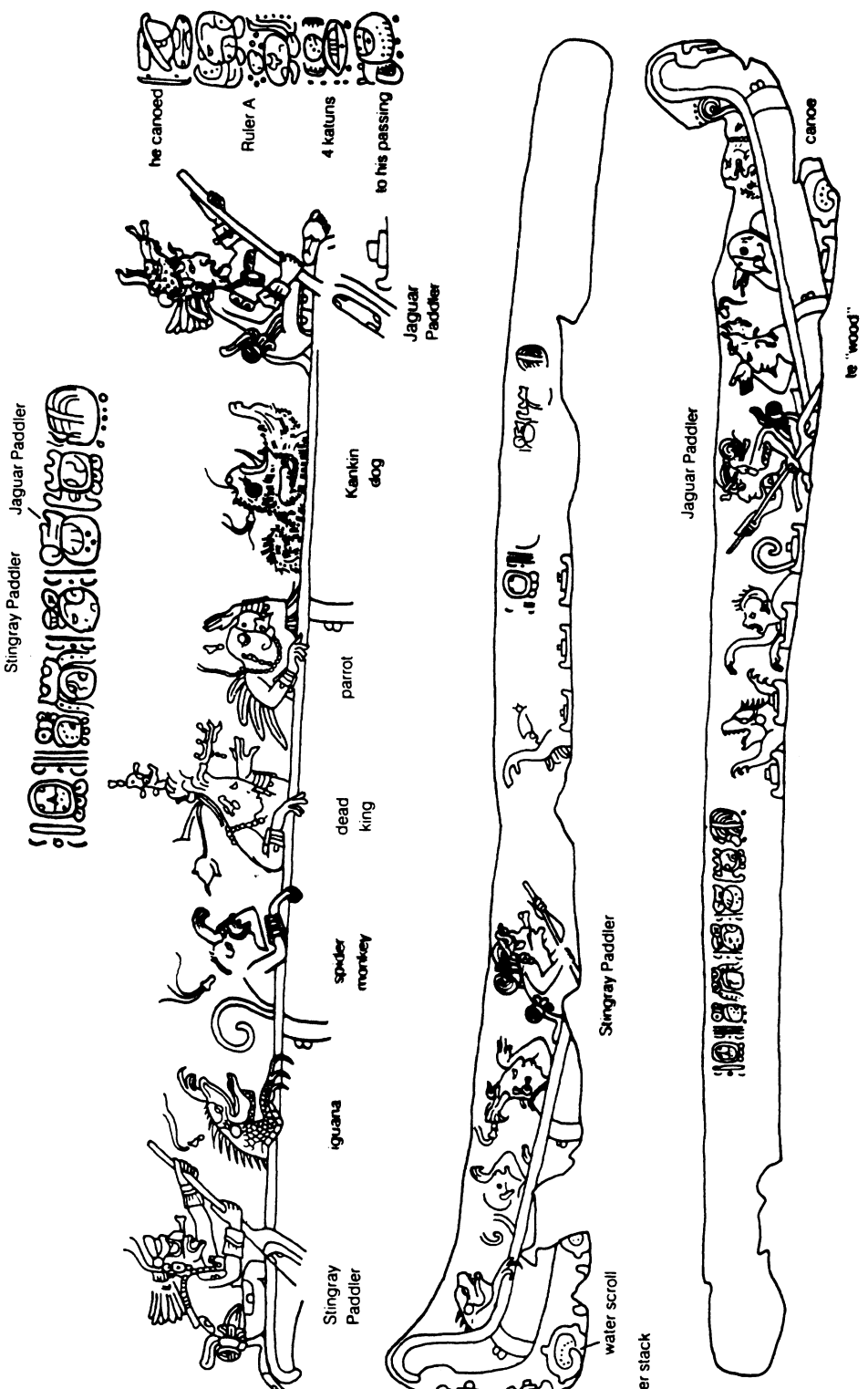

Figure 6. Incised bones from Burial 116 at Tikal (from Schele and Miller 1986). (Drawing courtesy of Linda Schele and the Kimbell Art Museum)

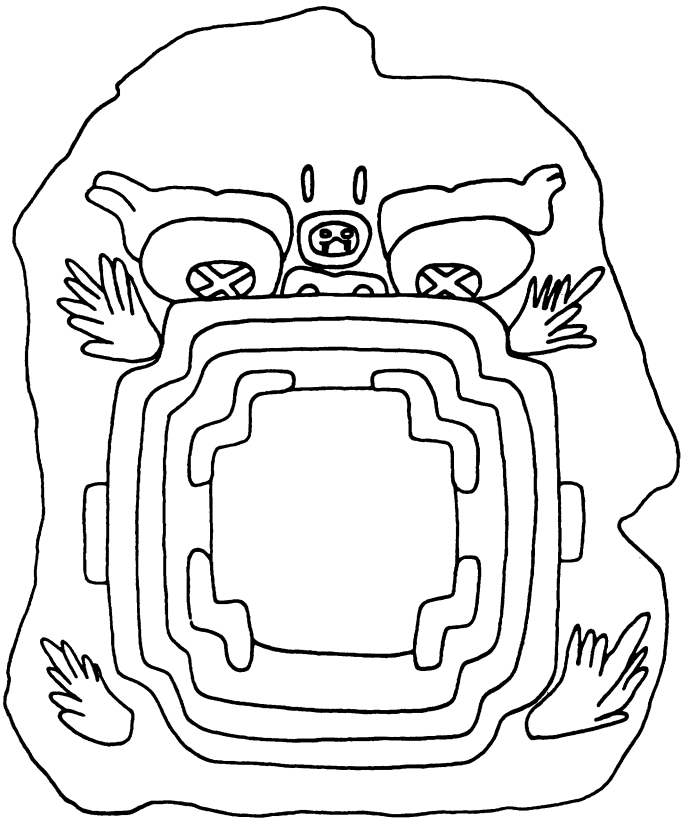

Figure 7. Relief 9 at Chalcatzingo (from Stone 1995). (Courtesy of the University of Texas Press and Andrea Stone)

throughout Mesoamerica; in the Maya area much of this iconography was probably related to reservoir activities too. Essentially, reservoirs were the primary source of predictably potable water in the southern Maya Lowlands during the Classic period—making most iconographic allusions to water references to reservoirs as well.

Mirror Images and Surface Tensions

Of special import is the influence of mirrors and reflections suggested by shamanistic ritual and the role of reservoir surfaces. The associated water symbolism incorporated by Mesoamerican groups indicates the empowered role of elite specialists in evoking and controlling broadly understood knowledge derived from deeply rooted traditions, with more subtle and esoteric aspects of ritual used to mystify, once these basic associations to water's use were made. Kings and nobility drew on the significance of water and water symbolism to all Maya and then appropriated that symbolism to elevate their worth and control over society. The sometimes reflective, sometimes transparent quality of water may have predisposed it as a source of both contemplation and purity. Large, human-made bodies of water, when located within the core of a sizable center surrounded by towering structures, functioned partially as reflective surfaces. Saunders's (1988) recent survey of mirrors and mirror imagery in the greater Mesoamerican lowlands suggests the implications of creating a reflective reservoir surface.

The manufacture of magnetite and ilmenite mirrors as early as Olmec times at San José Mogote and their movement into the Olmec Veracruz and Tabasco heartland persuasively document the sociopolitical significance of these status markers (Flannery 1968; Pires-Ferreira 1976). Their use was more than socioeconomic, as illustrated on the many pieces of Olmec and Maya art (Saunders 1988). Frequent association with

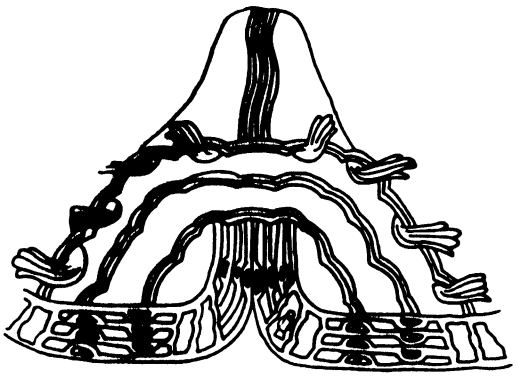

Figure 8. Water mountain from the Tlalocan Mural at Tepantitla, Teotihuacan (from Stone 1995). (Courtesy of the University of Texas Press and Andrea Stone)

rulers' attire suggests shamanistic connections (Freidel et. al 1993; Schele and Miller 1986), with mirrors reflecting the other parallel worlds from which curers are able to marshall supernatural forces. Taube (1983:112–119, 1992:186–189) shows the significance of scrying ("crystal gazing") with mirrors and watery surfaces throughout Mesoamerica. The Tikal bones and the La Venta sarcophagus illustrate the passing of rulers through such watery "surface tension."

At Tikal (Carr and Hazard 1961; Scarborough and Gallopin 1991), Calakmul (Folan et al. 1996), Coba (Folan et al. 1983), Caracol (Beetz and Satterthwaite 1981; Chase and Chase 1987), Río Azul (Adams 1990), La Milpa (Scarborough et. al 1995; Tourtellot et al. 1993), and many other principal Maya cities, reservoirs rest immediately below the most grand temples and palaces. From the temple and palace forums, high-ritual performance by an elite overlooking the reservoirs reenforced the temple drama to those in proximity to the tanks. The thin reflective reservoir surfaces defined the tension between this world and the next, with the mirrored ritual actions of the elite strengthening their association to and control over water. That these great mirrored surfaces were also the metaphorical source for the most precious of economic resources—a terrestrial water source created through societal energies—with the same resource acting as a potential passageway to other worlds, ritual activity in association comes as no surprise.[4]

Ancient Maya Water Ritual

Although many iconographic elements allude to water, e.g., waterlilies, fishes, etc. (Puleston 1977; Schele and Miller 1986), high-performance water ritual is best discernable in scenes capturing aspects of water's use. Ethnography as well as on-the-ground hydraulic systems help in interpreting the significance of these depictions. By examining the following scenes—principally from Tikal—we are allowed a glimpse into how the Maya elite may have transformed and appropriated mundane everyday activities into ritual performance and power. Their associations with reservoir imagery, possible acts of quarrying, even the passing into and out of the watery world of afterlife, reveal aspects of everyday life that an entire society faced and questioned.

A repeated set of images found at several southern Maya Lowland sites—including Tikal—and associated with both water and earth is the Cauac, or Witz, Monster and the Waterlily Monster (Fash 1996; Schele and Miller 1986; Spero 1986; Tate 1980; cf. Stuart 1987) (Figure 9). Tate indicates that the Cauac symbol "was a place, the earth or ancestral abode, for the transformation of matter into energy" (1980:111 in Spero 1986:186).[5] Perhaps most illustrative was the Cauac Monster identified with frequent images referencing water, but defined by a zoomorphic head with a cleft or "fontanel" (Schele and Miller 1986) connecting or opening to an underworld. As a half quatrefoil, Fash (1996) associates similar imagery at Copán with caves or waterholes. The Cauac Monster is frequently positioned as the ground on which an ascending ruler stands, providing the symbolic support of the "earth or ancestral abode" in legitimizing sovereignty. Given the connotations, the Cauac Monster and its related manifestations may represent the stone-quarried chasms cut into the summits of many large Maya cities; the Maya unearthed the building blocks for pyramids and palaces—converting "matter to energy"—then filled their quarried chasms with water in defining the reflective surface between this world and the next. The quatrefoil enclosure is argued as "an opening between cosmic realms, a yawning chasm in the earth's crust that leads to the underworld" (Tate 1980:47 in Spero 1986:186).

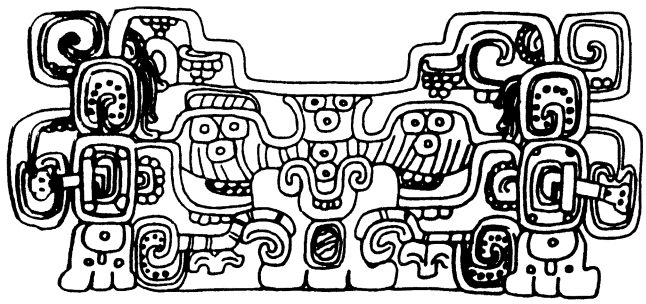

Figure 9. Cauac Monster from Stela 1 at Bonampak (from Stone 1995). (Courtesy of the University of Texas Press and Andrea Stone).

Altar D from the North Acropolis at Tikal (Jones and Satterthwaite 1982) (Figure 10) shows four repeated views of God N, with his water-turtle carapace seated in a cartouchelike quatrefoil, extending his left arm and hand through the frame to offer tobacco, perhaps a flint, and even maize. Andrea Stone (1995) suggests that the enclosing border around God N is a cave, his gifts associated with his emergence from the underworld. Given the absence of well-defined caves and the size and abundance of reservoirs at Tikal—as well as the population's dependency on these latter features—another interpretation of Altar D is more likely: God N's water-adapted attire may represent his relationship to the great reservoirs within the central precinct of Tikal, and his holy offerings the kinds of gifts proffered (see Note 4). God N's ability to pass though this world and into the next suggests the transformative role of reservoir symbolism.

Schele and Miller (1986) indicate that two principal metaphors defined death for the Maya elite. The first was represented by a fall or sinking into a watery underworld or into the open maw of an earth monster, the second, a canoe trip that carried the ruler into the underworld. "The Xibalba of the Classic period was different in one way from the Popol Vuh version of Hell. It was a watery world that could only be entered by sinking beneath water or by passing through a maw in the surface of the earth (p. 267) . . . . A second metaphor of death was derived from the watery nature of the Underworld and from the major vehicle of water transportation, the canoe" (p. 269). It is in this context that the governing elite legitimized their rightful association to the actions of their ancestors carved at the summits of their water mountains. By metaphorically passing into the watery realm, the king was associating himself with the immortality of deities like God N and the transformative effects of water. The canoe scenes from Burial 116 carrying Ruler A into the underworld lie within 100 m of the Palace Reservoir, Temple 1 acting as the cenotaph overlooking the reflective surfaces of the central-precinct reservoirs at Tikal. Although the iconography associated with water management harbors expected ambiguity, it demonstrates the significance of water ritual to the Maya elite.

Water containment and consumption for domestic and agricultural purposes away from the central precincts of the largest cities was an everyday act, but one dependent on the sustainability and longevity of the centers. From the principal cities, it is posited that Classic Maya rulers influenced their constituencies by inventing a state ideology that emphasized the ritual appropriation of water's use. The power of Tikal and its many subordinate capitals, for example, encompassed a political domain or regional state of approximately 2,000 km^2 (Culbert et al. 1990:117)[6]—Tikal manifesting a rich record of water imagery. Copán represents another center with abundant and well-documented water symbolism (Fash 1996). As mentioned earlier, during periods of prolonged drought farmers could migrate to the margins of the great cities to sustain themselves—or at least this was the implicit

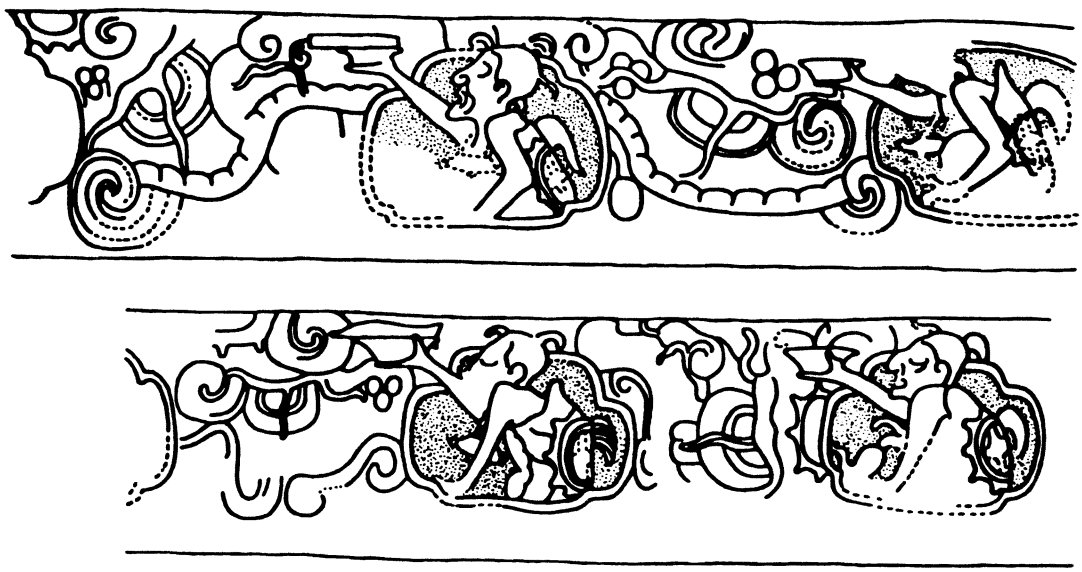

Figure 10. God N from Altar 4, Tikal (from Jones and Satterthwaite 1982). (Courtesy of the University of Pennsylvania Museum and Christopher Jones)

message symbolized by the architecture of the grand catchment areas and tanks. More likely, centers became the locus for elaborate ceremony, constructed to make the mundane and common the uncommon. Acknowledging the great water mountains as the source for much of the water made available to the hinterlands is analogous to the Balinese view that the Crater Lake at the summit of the island is the source for all water to the *subak* systems—hydraulically an impossibility.

In a recent study by Bassie-Sweet (1996), a good case for water shrines in the ancient Maya Lowlands is developed. Drawing on the Popol Vuh and ethnographic work, she argues that the Maya geographically and topographically defined high-water shrines and low-water shrines. Low-lying cenotes, lakes, springs, and pools of water in caves are low-water shrine sites, while mountains and ridges are potential high-water shrines. She further states that in Highland Guatemala today, some communities take water samples from high-water shrines—elevated volcanic lakes—and add them to their own low-water shrines in an act of purification.

> In the Quiche area the four seas of the horizon appear in the local landscape as four sacred lakes, each located in one of the cardinal directions. After returning from a pilgrimage to the sacred lakes, the ritual specialist deposits water from these locations into the streams at their low watery shrines. "This water both purifies the spring and adds information from the cardinal direction, which are called upon in divinations and prayers on behalf of clients with illness" (Tedlock 1982:139). This information provides direct links between the watery shrines, the sacred lakes of the community, and the four seas at the horizon [Bassie-Sweet 1996:70].

The significance of this water ritual is its similarity to those performed in Bali and the possibility that the Quiche example is a survival of an earlier practice associated with the Classic Maya.

Tikal, as the principal case study for this presentation, manifests four low-lying *bajo*-margin reservoirs (Figure 3 and 4). Located approximately in the cardinal directions, these features are equidistant from the summit of the civic center and prime candidates for the kind of low-water shrine areas identified in the ethnographic record. Is it possible that the high-water shrines associated with the central-precinct reservoirs were the source of "holy water" offered to the carefully positioned *bajo*-margin tanks? Such a ritual display within the core of the Tikal community—scheduled at opportune periods of the year by the elite—may have influenced much of the regional capital's sustaining population. Given that the *bajo*-margin reservoirs were designed to extend

the agricultural productivity of the area, high ritual conducted in the context of a water "cosmogram" (cf. Ashmore 1989) of the site was a transparent way of appropriating the mundane activities of the hinterlands by the ruling elite. Not unlike the structurally similar Balinese case, it also allowed a monitoring of agricultural productivity by the Maya elite.

Conclusion

Maya political economy was based on the fragile, sometimes inhospitable surrounds of a semitropical jungle. The immediate abundance apparent in some other archaic statecraft experiments associated with permanent water sources—principally high-volume rivers with rich sediment loads—was not an option. Nevertheless, diverse biological resources were harnessed by incrementally changing the landscape to capture some of the many variant and alternative energy pathways defining a tropical ecosystem, harvesting those pathways that accommodated humans. Centralizing the reservoir systems at the summit of many of the great centers during the Classic period was one of the ancient Maya's most significant evolutionary adaptations.

However, constructing the great "water mountains" of the Classic period was not enough to permit kingly power; the political economy of the Maya required aggressive warfare, sizable luxury surpluses, and charismatic leadership. It also required a persuasive set of state-level rituals, many appropriated from the everyday activities of a sustaining constituency. The physical and symbolic investments associated with water management were key elements in centralizing a naturally less-centralized society, one modeled on a different set of environmental and organizational expectations than some other early examples of statecraft.

The ultimate effects of specific rituals in ancient Maya society remain unclear, but by examining the function of ritual in other complex societies, as well as among contemporary Maya, a better understanding is possible. This approach to elucidating ancient Maya ritual permits a grounding in ecology and economy, the base substructure on which society depends. The everyday activities of a group stimulate much of the creativity for what is ideologically possible. This analysis proposes a causal link that endeavors to explain how elites are able to maintain control of a convincing ideology, one that persuades and accommodates the needs of a subordinate support population.

The research arena associated with water and land management in the Maya area remains sorely understudied. Until more time and energy are invested in the study of landscapes and their implications for the political economy, ambiguity will continue. Through controlled excavation, survey, and artifactual analysis of reservoirs, catchment zones, and drainages, we will begin to appreciate the complexity of the Maya physical system. Further, ethnohistoric and ethnographic studies need to examine water systems as a principal component in evaluating the organization of labor and land management—an orientation already taken in many other parts of the world (Scarborough 1991b).

This presentation has attempted to integrate two research orientations that have grown apart—ecological and economic studies vs. ritual, iconographic, and ideological examinations. The division between these two orientations is partially an academic one based on institutional disciplines and how we are trained to evaluate information. However, if more time and energy is not invested in "crossing over," vast data sets are sure to be neglected. Anthropological archaeologists are intellectually positioned to engage both spheres.

Acknowledgments. The genesis of this paper was an invitation from Elin Danien to participate in the University of Pennsylvania/University Museum's Maya Weekend on March 29–31, 1996. The title of the conference was "Stone Mountain, Sacred Stone: The Face of Maya Ritual," forcing an economically and ecologically oriented archaeologist to assess ideological issues governing Maya decision making. In addition to Elin and the staff responsible for the grand gathering, I would like to thank Wendy Ashmore and Jeremy Sabloff for the manner in which the museum extended itself. The original draft of the paper was submitted to *Latin American Antiquity* at the invitation of Gary Feinman—and together with comments and reviews from Joyce Marcus, Peter Harrison, Dorie Reents-Budet, Barry Isaac, and Boyd Dixon, I was encouraged to revise the manuscript for publication. The manuscript benefited from the constructive exchange provided by Pat Culbert and his invitation to discuss this paper with his students in his graduate Maya seminar at the University of Arizona. Andy Hofling read versions of the paper and offered incisive commentary at the outset. Barbara

Fash provided her excellent unpublished Copán water-management manuscript for which I am grateful. Additionally, Julie Kunen, an advanced graduate student at the University of Arizona, provided a fine seminar paper that brought my attention back to the Balinese case studies. My wife, Pat Mora, strengthened the presentation at several critical points. Revisions to this manuscript were completed during a sabbatical leave from the University of Cincinnati, a year-long leave made partially possible by a Taft Faculty Sabbatical Grant. I am grateful further to the School of American Research in Santa Fe for a summer residency during 1996.

References Cited

Adams, R. E. W.
1990 Archaeological Research at the Lowland Maya City of Río Azul. *Latin American Antiquity* 1:23–41.

Adams, R. McC.
1992 Ideologies: Unity and Diversity. In *Ideology and Pre-Columbian Civilizations*, edited by A. A. Demarest and G. W. Conrad, pp. 205–222. School of American Research Press, Santa Fe, New Mexico.

Andrews, E. W. V, and N. Hammond
1990 Redefinition of the Swasey Phase at Cuello, Belize. *American Antiquity* 54:570–580.

Angulo V., J.
1993 Water Control and Communal Labor during the Formative and Classic Period in Central Mexico. In *Economic Aspects of Water Management in the Prehispanic New World*, edited by V. L. Scarborough and B. Isaac, pp. 151–220. Research in Economic Anthropology, Supplement 7. JAI Press, Greenwich, Connecticut.

Ashmore, W.
1989 Construction and Cosmology: Politics and Ideology in Lowland Maya Settlement Patterns. In *Word and Image in Maya Culture: Explorations in Language, Writing, and Representation*, edited by W. F. Hanks and D. S. Rice, pp. 272–286. University of Utah Press, Salt Lake City.

Atran, S.
1993 Itza Maya Tropical Agroforestry. *Current Anthropology* 34:633–700.

Barth, F.
1993 *Balinese Worlds*. University of Chicago Press, Chicago.

Bassie-Sweet, K.
1996 *The Edge of the World: Caves and Late Classic Maya World View*. University of Oklahoma Press, Norman.

Beach, T., and N. P. Dunning
1997 An Ancient Maya Reservoir and Dam at Tamarindito, El Petén, Guatemala. *Latin American Antiquity*:20–29.

Beetz, C. P., and L. Satterthwaite
1981 *The Monuments and Inscriptions of Caracol, Belize*. University of Pennsylvania Press, Philadelphia.

Bell, C.
1992 *Ritual Theory, Ritual Practice*. Oxford University Press, New York.

Bloch, M.
1987 The Ritual of the Royal Bath in Madagascar: The Dissolution of Death, Birth and Fertility into Authority. In *Rituals of Royalty: Power and Ceremonialism in Traditional Societies*, edited by D. Cannadine and S. Price, pp. 271–297. Cambridge University Press, New York.

Broda, J., D. Carrasco, and E. Matos M.
1982 *The Great Temple of Tenochtitlan, Center and Periphery in the Aztec World*. University of California Press, Berkeley.

Carneiro, R. L.
1992 Point Counterpoint: Ecology and Ideology in the Development of New World Civilization. In *Ideology and Pre-Columbian Civilizations*, edited by A. A. Demarest and G. W. Conrad, pp. 175–204. School of American Research Press, Santa Fe, New Mexico.

Carr, R. F., and J. E. Hazard
1961 *Tikal Report No. 11: Map of the Ruins of Tikal, El Petén, Guatemala*. Museum Monographs. University of Pennsylvania, Philadelphia.

Chase, A. F., and D. Z. Chase
1987 *Investigations at the Classic Maya City of Caracol, Belize: 1985–1987*. Monograph No. 3. Pre-Columbian Art Research Institute, San Francisco.

Childe, V. G.
1950 The Urban Revolution. *Town Planning Review* 21:3–17.

Coggins, C. C., and O. C. Shane III
1984 *Cenote of Sacrifice: Maya Treasures from the Sacred Well at Chichen Itza*. University of Texas Press, Austin.

Covarrubias, M.
1937 *Island of Bali*. Alfred A. Knopf, New York.

Culbert, T. P., L. Kosakowsky, R. E. Fry, and W. A. Haviland
1990 The Population of Tikal, Guatemala. *In Precolumbian Population History in the Maya Lowlands*, edited by T. P. Culbert and D. S. Rice, pp. 103–122. University of New Mexico Press, Albuquerque.

Current Anthropology
1996 Agency, Ideology, and Power in Archaeological Theory. *Current Anthropology* 37:1–86.

Dahlin, B. H.
1984 A Colossus in Guatemala: The Preclassic Maya City of El Mirador. *Archaeology* 37:18–25.

Demarest, A. A.
1992 Ideology in Ancient Maya Cultural Evolution: The Dynamics of Galactic Polities. In *Pre-Columbian Civilizations*, edited by A. A. Demarest and G. W. Conrad, pp. 158–158. School of American Research Press, Santa Fe, New Mexico.

Farriss, N. M.
1978 Nucleation versus Dispersed: The Dynamics of Population Movement in Colonial Yucatán. *Hispanic American Historical Review* 58:187–216.
1984 *Maya Society under Colonial Rule: The Collective Enterprise of Survival*. Princeton University Press, Princeton, New Jersey.

Fash, B. W.
1998 Iconographic Evidence for Water Management and Social Organization at Copán. In *The Rise and Fall of the Classic Maya Kingdom of Copán*, edited by W. L. Fash and E. W. Andrews V. School of American Research Press, Santa Fe, New Mexico, in press. Ms. 1996.

Fash, W. L.
1991 *Scribes, Warriors and Kings: The City of Copán and the Ancient Maya*. Thames and Hudson, London.

Fash, W. L., and E. W. Andrews V (editors)
1998 *The Rise and Fall of the Classic Maya Kingdom of Copán*. School of American Research Press, Santa Fe, New Mexico, in press.
Flannery, K. V.
1968 The Olmec and the Valley of Oaxaca: A Model for Inter-Regional Interaction in Formative Times. In *Dumbarton Oaks Conference on the Olmec*, edited by E. P. Benson, pp. 79–130. Dumbarton Oaks, Washington, D.C.
Flannery, K. V., and J. Marcus (editors)
1983 *The Cloud People: Divergent Evolution of the Zapotec and Mixtec Civilization*. Academic Press, New York.
Folan, W. J., E. R. Kintz, and L. A. Fletcher
1983 *Coba: An Ancient Maya Metropolis*. Academic Press, San Francisco.
Folan, W. J., J. Marcus, S. Princeman, M. Domínguez Carrasco, L. Fletcher, and A. Morales López
1996 Calakmul: New Data from an Ancient Maya Capital in Campeche, Mexico. *Latin American Antiquity* 6:310–334.
Friedel, D., L. Schele, and J. Parker
1993 *Maya Cosmos: Three Thousand Years on the Shaman's Path*. William Morrow, New York.
Geertz, C.
1980 *Negara: The Theatre State in Nineteenth Century Bali*. Princeton University Press, Princeton, New Jersey.
Groube, L.
1989 The Taming of the Rain Forests: A Model for Late Pleistocene Forest Exploitation in New Guinea. In *Foraging and Farming*, edited by D. R. Harris and G. C. Hillman, pp. 292–304. Unwin Hyman, London.
Grove, D. C. (editor)
1987 *Ancient Chalcatzingo*. University of Texas Press, Austin.
Hammond, N. (editor)
1991 *Cuello: An Early Maya Community in Belize*. Cambridge University Press, Cambridge.
Hansen, R. D.
1991 The Road to Nakbe. *Natural History*, May:8–14.
Harrison, P. D.
1993 Aspects of Water Management in the Southern Lowlands. In *Economic Aspects of Water Management in the Prehispanic New World*, edited by V. L. Scarborough and B. L. Isaac, pp. 71–120. Research in Economic Anthropology, Supplement 7. JAI Press, Greenwich, Connecticut.
Harrison, P. D., and B. L. Turner II (editors)
1978 *Prehispanic Maya Agriculture*. University of New Mexico Press, Albuquerque.
Haviland, W. A.
1992 Status and Power in Classic Maya Society: The View from Tikal. *American Anthropologist* 94:937–940.
Hendon, J. A.
1991 Status and Power in Classic Maya Society: An Archaeological Study. *American Anthropologist* 93:894–918.
Heyden, D.
1975 The Cave underneath the Pyramid of the Sun at Teotihuacan. *American Antiquity* 40:131–147.
1981 Caves, Gods and Myths: World-view and Planning in Teotihuacan. In *Mesoamerican Sites and World-Views*, edited by E. P. Benson, pp. 1–35. Dumbarton Oaks, Washington, D.C.
Jones, C., and L. Satterthwaite
1982 *Tikal Report No.33, Part A: The Monuments and Inscriptions of Tikal: The Carved Monuments*. Museum Monograph No. 44. University of Pennsylvania, Philadelphia.
Lansing, J. S.
1987 Balinese "Water Temples" and Management of Irrigation. *American Anthropologist* 89:326–341.
1991 *Priests and Programmers: Technologies of Power in the Engineered Landscape*. Princeton University Press, Princeton, New Jersey.
Lockhart, J.
1992 *The Nahuas after the Conquest*. Stanford University Press, Palo Alto, California.
MacNeish, R. S.
1964 Ancient Mesoamerican Civilizations. *Science* 143:531–537.
MacNeish, R. S., and A. Nelken-Terner
1983 The Preceramic of Mesoamerica. *Journal of Field Archaeology* 10:71–84.
Marcus, J.
1982 The Plant World of the Sixteenth- and Seventeenth-Century Lowland Maya. In *Maya Subsistence: Studies in Memory of Dennis E. Puleston*, edited by K. V. Flannery, pp. 239–273. Academic Press, New York.
1993 Ancient Maya Political Organization. *In Lowland Maya Civilization in the Eighth Century A.D.*, edited by J. A. Sabloff and J. S. Henderson, pp. 111–183. Dumbarton Oaks, Washington, D.C.
Marcus, J., and K. V. Flannery
1994 Ancient Zapotec Ritual and Religion: An Application of the Direct Historical Approach. In *The Ancient Mind*, edited by C. Renfrew and E. B. W. Zubrow, pp. 55–74. Cambridge University Press, New York.
Matheny, R. T.
1976 Maya Lowland Hydraulic Systems. *Science* 193:639–646.
1978 Northern Maya Lowland Water-Control Systems. In *Pre-Hispanic Maya Agriculture*, edited by P. D. Harrison and B. L. Turner II, pp. 185–210. University of New Mexico Press, Albuquerque.
1986 Investigations at El Mirador, Peten, Guatemala. *National Geographic Research and Exploration* 2:332–353.
Matheny, R. T., and D. L. Gurr
1983 Variation in Prehistoric Agricultural Systems of the New World. *Annual Reviews in Anthropology* 12:79–103.
Matheny, R. T., R. Hansen, and D. L. Gurr
1980 *El Mirador, Peten, Guatemala: An Interim Report*. Papers No. 45. New World Archaeological Foundation, Brigham Young University, Provo, Utah.
McAnany, P. A.
1995 *Living with the Ancestors: Kinship and Kingship in Ancient Maya Society*. University of Texas Press, Austin.
Montejo, V.
1991 In the Name of the Pot, the Sun, the Broken Spear, the Rock, the Stick, the Idol, Ad Infinitum and Ad Nauseum: An Expose of Anglo Anthropologists' Obsessions with and Invention of Mayan Gods. Paper presented at the 90th Annual Meeting of the American Anthropological Association, Chicago.
Nations, J. D., and R. B. Nigh

1980 The Evolutionary Potential of Lacandon Maya Sustained-Yield Tropical Forest Agriculture. *Journal of Anthropological Research* 36:1–30.

Niederberger, C. B.
1979 Early Sedentary Ecology in the Basin of Mexico. *Science* 203:131–142.

Parsons, L.
1972 Iconographic Notes on a New Izapan Stela from Abaj Takalik, Guatemala. *Atti de XL Congresso International degli Americanisti*, pp. 203–212. Casa Editrice Tilgher, Genova, Italy.

Pires-Ferreira J.
1976 Shell and Iron-Ore Mirror Exchange in Formative Mesoamerica, with Comments on other Commodities. In *The Early Mesoamerican Village*, edited by K. V. Flannery, pp. 311–328. Academic Press, New York.

Pohl, M. D., K. O. Pope, J. G. Jones, J. S. Jacob, D. R. Piperno, S. A. deFrance, D. L. Lentz, J. A. Gifford, M. E. Danforth, and J. K. Josserand
1996 Early Agriculture in the Maya Lowlands. *Latin American Antiquity* 7:355–372.

Puleston, D. E.
1977 The Art and Archaeology of Hydraulic Agriculture in the Maya Lowlands. In *Social Process in Maya Prehistory: Studies in Honour of Sir Eric Thompson*, edited by N. Hammond, pp. 448–467. Academic Press, New York.
1983 *Tikal Report No. 13: The Settlement Survey of Tikal*. Museum Monographs. University of Pennsylvania, Philadelphia.

Puleston, D., and O. S. Puleston
1971 An Ecological Approach to the Origins of Maya Civilization. *Archaeology* 24:330–337.

Quirarte, J.
1977 Early Art Styles of Classic Maya Art. In *The Origins of Maya Civilization*, edited by R. E. W. Adams, pp. 249–283. University of New Mexico Press, Albuquerque.

Rappaport, R.
1968 *Pigs for Ancestors*. Yale University Press, New Haven, Connecticut.

Reilly, K. F. III
1994 Enclosed Ritual Spaces and the Watery Underworld in Formative Period Architecture: New Observations on the Function of La Venta Complex A. In *Seventh Palenque Round Table, 1989*, edited by M. Greene Robertson and V. M. Fields, pp. 125–135. Pre-Columbian Art Research Institute, San Francisco.

Reynolds, V., and R. Tanner
1995 *The Social Ecology of Religion*. Oxford University Press, New York.

Rice, D. S., and T. P. Culbert
1990 Historical Contexts for Population Reconstruction in the Maya Lowlands. In *Precolumbian Population History in the Maya Lowlands*, edited by T. P. Culbert and D. S. Rice, pp. 1–36. University of New Mexico Press, Albuquerque.

Sanders, W. T., J. R. Parsons, and R. S. Santley
1979 *The Basin of Mexico: Ecological Processes in the Evolution of a Civilization*. Academic Press, New York.

Sanders, W. T., and B. J. Price
1968 *Mesoamerica: The Evolution of a Civilization*. Random House, New York.

Saunders, N. J.
1988 Anthropological Reflections on Archaeological Mirrors. In *Recent Studies in Pre-Columbian Archaeology*, edited by N. J. Saunders and O. de Montmollin, pp. 1–39. BAR International Series 421. British Archaeological Reports, Oxford.

Scarborough, V. L.
1983 A Preclassic Water System. *American Antiquity* 48:720–744.
1991a *Archaeology at Cerros, Belize, Central America, Volume III: The Settlement System in a Late Preclassic Maya Community*. Southern Methodist University Press, Dallas, Texas.
1991b Water Management Adaptations in Non-Industrial Complex Societies: An Archaeological Perspective. In *Archaeological Method and Theory* vol. 3, edited by M. B. Schiffer, pp. 101–154. University of Arizona Press, Tucson.
1993a Water Management Systems in the Southern Maya Lowlands: An Accretive Model for the Engineered Landscape. In *Economic Aspects of Water Management in the Prehispanic New World*, edited by V. L. Scarborough and B. L. Isaac, pp. 17–69. Research in Economic Anthropology, Supplement 7. JAI Press, Greenwich, Connecticut.
1993b Introduction. In *Economic Aspects of Water Management in the Prehispanic New World*, edited by V. L. Scarborough and B. L. Isaac, pp. 1–14. Research in Economic Anthropology, Supplement 7. JAI Press, Greenwich, Connecticut.
1994 Maya Water Management. *National Geographic Research and Exploration* 10:184–199.

Scarborough, V. L., M. E. Becher, J. L. Baker, G. Harris, and F. Valdez, Jr.
1995 Water and Land at the Ancient Maya Community of La Milpa. *Latin American Antiquity* 6:98–119.

Scarborough, V. L., R. P. Connolly, and S. P. Ross
1994 The Prehispanic Maya Reservoir System at Kinal, Peten, Guatemala. *Ancient Mesoamerica* 5:97–106.

Scarborough, V. L., and G. G. Gallopin
1991 A Water Storage Adaptation in the Maya Lowlands. *Science* 251:658–662.

Schele, L., and M. E. Miller
1986 *The Blood of Kings: Dynasty and Ritual in Maya Art*. Kimbell Art Museum, Fort Worth, Texas.

Schwartz, N. B.
1990 *Forest Society: A Social History of the Peten, Guatemala*. University of Pennsylvania Press, Philadelphia.

Spero, J. M.
1986 Beyond Rainstorms: The Kawak as an Ancestor Warrior, and Patron of Witchcraft. In *Sixth Palenque Round Table*, edited by V. M. Fields, pp. 184–193, University of Oklahoma, Norman.

Stone, A. J.
1995 *Images from the Underworld: Naj Tunich and Traditions of Maya Cave Painting*. University of Texas Press, Austin.

Stuart, D.
1987 *Ten Phonetic Syllables*. Research Reports on Ancient Maya Writing, vol. 14. Center for Maya Research, Washington, D.C.

Tate, C.
1980 *The Maya Cauac Monster: Visual Evidence for Ancestor Veneration among Ancient Maya*. Unpublished Master's thesis, University of Texas, Austin.

1982 The Maya Cauac Monster's Formal Development and Dynastic Contexts. In *Pre-Columbian Art History*, edited by A. Cordy-Collins, pp. 33–54. Peek Publications, Palo Alto, California.

Taube, K. A.
1983 The Teotihuacan Spider Woman. *Journal of Latin American Lore* 9:107–189.
1992 The Iconography of Mirrors at Teotihuacan. In *Art, Ideology, and the City of Teotihuacan*, edited by J. C. Berlo, pp. 169–204. Dumbarton Oaks, Washington, D.C.

Tedlock, B.
1982 *Time and the Highland Maya*. University of New Mexico Press, Albuquerque.

Tourtellot, G. III, A. Clarke, and N. Hammond
1993 Mapping La Milpa: A City in Northwestern Belize. *Antiquity* 67:96–108.

Trigger, B. G.
1990 Monumental Architecture: A Thermodynamic Explanation of Symbolic Behavior. *World Archaeology* 22:119–132.
1996 Comment on "Agency, Ideology, and Power in Archaeological Theory." *Current Anthropology* 37:63–64.

Vogt, E. Z.
1968 Some Aspects of Zinacantan Settlement Patterns and Ceremonial Organization. In *Settlement Archaeology*, edited by K. C. Chang, pp. 154–173. National Press Books, Palo Alto, California.
1969 *Zinacantan: A Maya Community in the Highlands of Chiapas*. Belknap Press, Cambridge, Massachusetts.

Whitehouse, R., and J. Wilkins
1986 *The Making of Civilization*. Alfred A. Knopf, New York.

Wilk, R. R.
1985 Dry Season Agriculture among the Kekchi Maya and Its Implications for Prehistory. In *Prehistoric Lowland Maya Environment and Subsistence Economy*, edited by M. Pohl, pp. 47–58. Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 77. Harvard University, Cambridge, Massachusetts.

Wilken, G. C.
1987 *Good Farmers*. University of California Press, Berkeley.

Wittfogel, K. A.
1957 *Oriental Despotism: A Comparative Study of Total Power*. Yale University Press, New Haven, Connecticut.

Notes

1. A set of articles examining the importance of "Agency, Ideology, and Power in Archaeological Theory," recently published in *Current Anthropology* 37:1–86 (1996), convincingly articulates the interpretive role of ideology for archaeologists. The focus of the discussions is about a political economy based on "top-down" elite to elite alliance formations and power relationships drawing on material symbols of control. Clearly, this is an important element in understanding the influence of ideologies in decision making, but it does not address the "economy" in political economy well. The base stratum on which any society rests is the manner by which it feeds itself. All cultures have invented creative ways of provisioning themselves and, in the case of complex societies, ways of ensuring that some "agents" get less than others, in terms of both quality and quantities of resources. From my perspective, these are organizational or institutional patterns that remain at least partially grounded in the limitations of an environment, an environment that is frequently engineered to produce more of what society wants. Some environs are naturally more productive than others, and technological adjustments can stimulate the modification of a landscape to accommodate greater organizational stability or resilience. For elites to marshall power—the labor of others, especially food producers—they probably also appropriated ideologies grounded in water and soil at both the local and regional level. A support population in the decentralized archaic states of Mesoamerica could "vote with their feet" if ideology did not have a "bottom-up" component.

The insightful critique by Bruce Trigger (1996) of the above mentioned papers relates their shortcomings: "they tend to treat religion much as Voltaire did in the eighteenth century—as an exploitative deceit that elites practice upon the lower classes. No convincing argument is advanced why the lower classes initially should have accepted such claims if it would have been contrary to their own interests to do so" (p. 64).

2. The focus of the presentation concerns the collection and deliberate allocation of water by the ancient Maya. However, during the rainy season, rainfall and runoff were probably in excess of the storage capacities of even the largest Classic-period centers. The drainage system designed for controlled distributions during the dry season was as effective in discharging overflow during the wet season.

3. Joyce Marcus (personal communication 1996) has made me aware of Lockhart's (1992) fine study in which he interprets *altepetl* as a territory and the organization of people controlling that territory.

4. Cenotes during the Postclassic period were the depositories for significant ceremonial offerings. Coggins and Shane (1984) reinventoried and interpreted many of the offerings made at the Sacred Well of Sacrifice at Chichén Itzá. Classic-period reservoirs in the southern Maya Lowlands are expected to yield similar findings, the posited origin for this water ritual. Unfortunately, little excavation has yet to occur in the human-made tanks of the lowlands.

5. Bassie-Sweet (1996) indicates that "the word *chac* is a cognate for *cauac* 'lightning, thunder, storms'" (p. 56), a clear association to water.

6. Calakmul, as the capital of a regional state, administrated control over an area of 8,000 km^2, according to Folan et al. (1996:310), a region four times larger than the Tikal state and one-and-one-half times larger than Bali.

Received May 16, 1996; accepted January 24, 1997; revised February 17, 1997.