poses to exploit the varied and valuable lake resources. By dividing the lake into several sectors, they defined water rights of the shore towns dependent on Azcapotzalco. The political agenda of the rulers and their court who commissioned, built, and managed the vast hydraulic features was an equally influential element in the Mexica’s empire building. The intertwined relationship of water management to water ritual helped to organize and maintain the overall system.

Controlling water flow also suited two practical purposes: to prevent flooding and to control the flow of freshwater. After doing a quick analysis of the record of floods reported in historical sources (1382, 1449, 1499, 1517, 1555, 1604–7, 1627–30, 1674, 1707, 1714, 1747, 1763, 1819, and 1875), we can see that in pre-Hispanic times these occurred periodically every fifty to sixty years on average, with shorter intervals during the Colonial period. Considering the relation of the determining factors we can make two suggestions. First, it is possible that floods were more frequent in pre-Hispanic times but that their effects were diminished by the construction of hydraulic structures and their constant maintenance. Second, the use of hydraulic constructions from the Teotihuacan period onward involved the function of protecting not only the population inside the lake but also those who lived on the shore and depended on lake resources. During the Colonial period the seasonal flood intervals became more frequent and the effects more violent. The Europeans had different needs and methods and introduced important economic changes, including their agriculture practices, the herding of cattle, and the accelerated cutting of forests. These modifications, however, resulted in deforestation, with the consequent environmental changes following. In addition, since the Spanish viewed lake cities with a European eye (e.g., Venice), they did not appreciate the need to continually maintain the dikes, channels, and other water features, which fell into disuse until the flood of 1550, after which the Spanish authorities reactivated the pre-Hispanic systems. Despite these attempts, flooding continued to affect lake settlements and life, as it does at present, and residents of Mexico City continue to deal with the consequences of living within a lake.

Mayapan, the Late Postclassic cultural capital of Maya society (c. AD 1200–1450), is in the arid northwestern corner of the Yucatán Peninsula (fig. 11.1). This region is pitted with several kinds of cenotes that are the sole sources of water and were the focus of ancient settlement and ritual. As axes of the sacred landscape, the cenotes were the keys to the political and spatial organization of the site. The nearby lakes of the Cenote Zone probably supplied various resources and would have been important to the local economy.

This chapter is about the water sources in and around Mayapan (fig. 11.1). I begin by presenting historic evidence suggesting that the name Mayapan was related to water sources. Then I discuss aspects of the environment, climate, hydrology, geology, and geomorphology of the area related to water sources and their connections to settlement. I describe the two different types of water sources. Next, I review the historic and archaeological evidence for the economic and religious significance of these water sources. Finally, I appraise their influence on the social structure and settlement patterns at Mayapan.

Mayapan

Mayapan was the political capital of most of northern Yucatán and the largest Maya settlement during the Late Postclassic period. The city was the seat of a “joint government” (mul tepal), or political confederacy, that ruled the region for about two hundred years. To the Maya and Spaniards of the Colonial period the rise and fall of Mayapan formed the most salient drama in Maya history. Archaeologically, Mayapan is the premier center in the region: the ruins encompass 4.2 square kilometers inside a 9-kilometer-long defensive wall within which over four thousand ancient
structures are densely packed. Mayapan’s lofty political and economic status probably also conferred upon it preeminence in art and literature.

Mayapan was the archetype of the Late Postclassic Maya city. The name Mayapan, Bishop Landa tells us, “means Pendant of the Maya, because the language of the land is called Maya; and the Indians call the city Ychpa, which means within the walls” (1986:13, my translation). The metaphor of Mayapan as the walled city (ich paa Mayapan) was ubiquitous in Colonial Maya literature. Thus, this central place and political capital was also the trope and mirror of Maya urban life. Landa’s statement implies that /-pan/ came from pantli, Nahua for “flag” (Karttunen 1992:186). Landa’s testimony about Mayapan is highly credible because he interviewed the children and grandchildren of the city’s rulers. Pantli, though, has a homonym that means “wall” (Karttunen 1992:187). If we read Mayapan as the “Wall of the Maya,” then ich paa Mayapan (e.g., in the Books of Chilam Balam [Edmonson 1982:9, 10, 1986:53, 54, 91]) becomes a bilingual kenning or couplet in which “wall” is the repeated element (see Edmonson 1982, 1986; Edmonson and Bricker 1985 on kennings and couplets in these texts). Edmonson (1982:9–10 n. 144), in contrast, suggested that Mayapan should be scanned as may, Yucatec Maya for “cycle,” and -apan, Nahua for “water place.” This idea gains support from a passage in the Book of Chilam Balam of Chumayel: “Hol tun ake acanqueh ti cooh ti ch’ah-il ti-chac mayapan ych paa y-ok-ol haa” (Bricker 1990a:596; cf. Edmonson 1986:91), which can be glossed as “Holtun, Ake, Acanceh, Tecoh, Tich’ahil, Telchaquillo, Mayapan in the walls, over the water.” The capitalized words are place-names, in a general north–south geographical order, except Tich’ahil, which could be an as-yet-recognized toponym. So Mayapan may have been known for its water sources. Yucatecan towns were often named after their water sources (Brown 1999:526–31); some even think that Yucatec phrases like “the caves, the wells” also meant “the towns, the villages” (Edmonson 1982:89).

Environment and Rainfall

Mayapan lies some 40 kilometers south-southeast of Mérida, Yucatán. This northwest sector of the Maya Lowlands is hot, dry, and flat. Precipitation in the lowlands decreases progressively to the north and west; the northwest tip of the peninsula is a virtual desert. Around Mayapan annual precipitation is estimated by the Instituto Nacional de Estadística, Geografía e Informática (INEGI) to be 1,081.37 millimeters, with a range of 686–1,366.20 millimeters. These statistics derive from twenty-six years of observations made in Telchaquillo, a Maya village 2 kilometers from the ruins (INEGI 1985b). The rain is enough, usually, for traditional swidden agriculture, which is practiced throughout the area. In Telchaquillo about 200 millimeters of rain falls in the dry “winter” from November to April (INEGI 1983a); the balance, about 900 millimeters, falls in the wet season “summer,” between May and October (INEGI 1983b). The corn, especially the fast-growing x-mehen-nal race, is watered by summer thundershowers that distribute rain in a patchy way across the landscape. One cornfield can enjoy plentiful rains and yield a bumper crop, while only a couple of kilometers away a similar milpa may dry up completely. For this reason, among others, a milpero may plant in more than one place to improve the chances of having at least a partial crop. Later in the year significant precipitation comes from cold fronts that drift slowly across the peninsula, bringing chill winds and long rainy days. These “norters” water the slow-ripening corn, called x-nuk-nal in Mayan, and the beans in the milpa. More late-season rain comes from tropical storms and hurricanes. As the statistics show, the dry season at Mayapan is quite arid. During two or three months between December and March it may not rain at all. High temperatures average 30°C from November to April (INEGI
1983a), and extreme temperatures above 40°C occur. In this climate reliable water sources are indispensable for sedentary settlement.

Water Sources

The Yucatán Peninsula is a karstic limestone shelf blessed with few streams and almost none in the north. Because of the karst most drainage is internal, with rapid infiltration and little runoff. In general, the limestone is lower, flatter, and younger in the north of the peninsula and higher, older, and rougher in the south (Sharpton et al. 1993: fig. 1; West 1964: 68-73). The heat, the dryness, and the young, thin soils of the north lead to the growth of a low, scrubby thorn forest. Notwithstanding the low level of relief, the land is actually sharp, stony, and broken. At Mayapan elevation varies only about 5 meters (see Jones 1952), but it varies continually: ubiquitous ridges, knolls, and cockpit make for high average slopes, which contribute to the thinness of the soil and the difficulty of travel. This tumbled, broken landscape is created by the solution and corrosion of the limestone. The collapse dolines—sinkholes formed by the collapse of the caprock into underground voids—at the site are deeper than the solution dolines—depressions formed by chemical dissolution of limestone. The former are up to 13 meters deep.

In general, all the water sources in the Mayapan area are karstic solution features of one kind or another. In one sense, then, all are “cenotes.” The word “cenote” comes from the Yucatec Maya word ts’o’olot, meaning “sinkhole” or “doline” (Bricker, Po’ot Yah, and Dzul de Po’ot 1998). The broad use of the term “cenote,” however, masks variability related to the geomorphology, function, and significance of these features. I prefer to divide water sources into at least two groups: ch’ene’o’ob, or “wells,” and the small lakes of the Cenote Zone. In the first category I include all collapse dolines and caves that have water in them. These are common, nearly ubiquitous, features throughout Yucatán, and they are the only kind of water source within the wall of Mayapan. One can subdivide this group into solution caverns, vertical (“true”) cenotes, and funnel-shaped dolines (West 1964: 72) using morphology or hydrologic history. The small lakes of the Cenote Zone are often called cenotes by both the local Maya and geologists, but compared to the ch’ene’o’ob they have a distinctive geologic history, morphology, hydrology, distribution, and social function. Therefore, I discuss these lakes separately, after which I talk about the ch’ene’o’ob of Mayapan.

The use of the words ts’o’olot, ch’een (literally, “well”), and ‘iaktun (literally, “cave”) in modern Yucatec is complicated enough to merit com-

ment (Bricker, Po’ot Yah, and Dzul de Po’ot 1998: 2, 54, 82). The ranges of denotation for these words appear to overlap considerably. The term ch’een refers not only to some natural caves and cenotes that have water in them but also to modern artificial wells. One might hypothesize that a ch’een is open to the sky, whereas an ‘iaktun is a natural tunnel or chamber that is roofed. But some caves with water in them are called ch’ene’o’ob, falsifying that hypothesis. The word ‘iaktun is also used to denote caves with water in them as well as dry caves. On several occasions I have attempted to elicit systematically the differences among these terms from native Yucatec speakers, and I have also tried to observe the different usages in modern spoken Yucatec discourse. I have not, however, succeeded in deciphering the ethnotaxonomy underlying this semantic domain or relating it to a geomorphic classification.

Lakes of the Cenote Zone

The Chicxulub Crater is the major geological structure nearest to Mayapan. It is one of the largest craters in the inner solar system (Sharpton et al. 1993) and has been dated to the end of the Cretaceous period, 65 million years ago (Swisher et al. 1992). The aftermath of the impact evidently caused the extinction of the dinosaurs (Alvarez et al. 1980; Alvarez 1997). The crater, a complex structure, is buried under 300–1,000 meters of Tertiary (i.e., post-Cretaceous) limestone deposits (Pope, Ocampo, and Duller 1993). Most of the references about the morphology of the crater come from gravity measurements (Hildebrand et al. 1995; Morgan, Warner, and the Chicxulub Working Group 1997; Sharpton et al. 1993) and observations of secondary surface features. The crater’s diameter has been a topic of much debate. It may have multiple rings and a central peak (Sharpton et al. 1993; Morgan, Warner, and the Chicxulub Working Group 1997).

The carbonates (i.e., limestones and dolomites) inside the crater differ from those outside it. The surfaces outside the crater are higher in elevation than those inside. Possibly, the crater was not completely infilled by the later marine carbonates, so it still forms a slight depression. Also, ejecta seem to have landed around the crater’s edges. The limestone outside the crater is older than that inside because the former (being higher) was exposed by marine regression earlier than the limestone that formed in the depression within the crater. The limestone outside the crater is both eroded (by solution, corrosion, and weathering) and fractured, whereas the deposits within the crater exhibit less fracturing and erosion. The soils and their degree of development also provide evidence
that the geomorphic units inside the crater are younger than the surfaces outside it (Pope, Ocampo, and Duller 1993; Pope et al. 1996). The differing characteristics of the interior and exterior carbonates, particularly the degree of fracturing, mean that the boundary between the two dramatically affects the local hydrology.

Along that boundary is a semicircular ring of cenotes, called the Cenote Zone on INEGI maps. These cenotes lie within a topographic trough several meters deep (Pope, Ocampo, and Duller 1993). The Cenote Zone has a complicated impact on the regional hydrology. The water level declines in the area of the Cenote Zone, and the ring of cenotes captures groundwater flow and shunts it to the sea (Perry et al. 1995). Mayapan lies on the inner edge of the trough (Kevin Pope, personal communication, 2001). At least a dozen cenotes of the Cenote Zone lie about 5 kilometers south of Mayapan (INEGI 1985c). As mentioned earlier, these are not typical Yucatecan cenotes but more like small lakes in depressions that are much larger than the typical collapse dolines in the area.

These lakes, their hydrology, and the general environment of the Cenote Zone influenced the archaeological settlement patterns and cultural landscape of the area. Since these lakes are the only open bodies of water in the vicinity of Mayapan, we must consider the possibility that their presence influenced the decision to found Mayapan in the spot where it lies today. Furthermore, the resources offered by the lakes very likely formed part of the economy of Mayapan. Thus, my review of the water sources at Mayapan would be incomplete if I did not include an appraisal of these lakes. Therefore, I discuss below the historical and archaeological evidence for human settlement and economic exploitation of the Cenote Zone.

The water quality in these cenotes varies but is generally poor. INEGI (1985a) found that some are highly saline. The cenote Polol, for example, one of the largest, is about 12 kilometers south-southwest of Mayapan; it is highly saline and apparently impotable. The water is the hardest tested (CaCO₃ concentration = 1,129 mg/l) of some 330 samples. The U.S. government classifies anything over 180 mg/l as very hard. The level of total dissolved solids is also very high (3,351 mg/l). Farther west, the cenote Nicanche is also very hard, highly saline, and impotable, as is an unnamed lake (sample 157) geographically intermediate between the previous two. The cenote Xpoc, one of the nearest of these lakes to Mayapan, is listed as having "tolerable" water quality (total dissolved solids [sample 169] = 1,288 mg/l). It is also hard (CaCO₃ concentration = 533.5 mg/l). The water of all the lakes tested is reported to be poor for irrigation and is generally used for animal husbandry. The poor water quality may be caused by the lack of outlets in these lakes. The high heat and low humidity in the area lead to high evaporation rates that help concentrate salts and solids.

Predictably, the people in Telchacpap report that the water in these lakes is poor and generally impotable. People fish in some lakes, while cattle are watered at others. Most lakes seem to have wells dug near the water's edge. I have visited several of these lakes, and they have remarkably diverse characteristics. The cenote San Antonio is the lake nearest to Mayapan, about 5 kilometers south-southwest of the site, halfway between Xkanchakan and Mahzucil. It produces small, tasty fish for the occasional fisherman. Within its depression the water is surrounded by wild groves of caña brava, a large variety of native bamboo. Like bamboo elsewhere, caña brava has many possible uses (e.g., construction, furniture, spear and arrow shafts, etc.).

Across the road small rings of squared stones surround the cenote Xpoc. These rings are 2 or 3 meters wide and 30 or 40 centimeters high (just a few courses of rough stone) and are filled with soil. Several concentric circles of these rings surround the lake, although none were visible along a precipitous portion of the shoreline. The inner circles are partly inundated, and all are close to the water. We know nothing about the function of these features or even if they are prehistoric. The ruins of a historic ranch or hacienda lie above the lake near the edge of the depression, so the circular features may be historic. It is not unreasonable to speculate that they might have been used either as planters for raising an economically important tree crop such as cacao (see Kepecs and Boucher 1996 for a parallel example from northeast Yucatán) or as pens for raising animals (see below).

The cenote Xhokancol is a few hundred meters farther south on the road to Mahzucil. It is seasonally dry, and when it is dry, grass grows across its flat bottom. The foundations of a small structure with an unusual plan are visible in the bottom of the basin near a shallow well that reaches the water table. I briefly discuss this structure later.

The cenote Timul is about 11 kilometers southeast of Mayapan, west of the old hacienda road between Te'et and Tecoh, south of San Isidro Ochil. Timul is the largest of the lakes in the vicinity, with the exception of Polol. As its name suggests (mul = "mound, pyramid"), Timul has a modest ruined pyramid on its edge. The pyramid has been robbed for stone, probably for the nearby ranch. The ancient building is now a shapeless hulk.

The role of these water sources in pre-Hispanic Maya society can be inferred in part through the descriptions of them that appear in the Relaciones histórico-geográficas de la gobernación de Yucatán, which were written only some thirty years after the Spanish Conquest. The Relación de
Mama y Kantemo quite accurately describes six lakes that are obviously the lakes of the Cenote Zone that are closest to Mayapan. The Relación states that the lakes have fish in them and also mentions that the lakes have “alligators” (probably iguanas) that were “put there by hand” (de la Garza, Izquierdo, and León y Tolita Figueroa 1983:112). I say “iguanas” because elsewhere in the Relaciones iguanas are described as “lagartos” (e.g., de la Garza, Izquierdo, and León y Tolita Figueroa 1983:96). Clearly, the Maya exploited the lakes in surprising ways. The Relación de Tekit also describes some of the lakes, emphasizing the unhealthy quality of the water (de la Garza, Izquierdo, and León y Tolita Figueroa 1983:287). The Relación de Tiah y Tek makes a similar comment and goes on to say that the natives used the lakes to raise small turtles for food (de la Garza, Izquierdo, and León y Tolita Figueroa 1983:320). The historical use of these lakes for raising turtles and iguanas is surprising. Perhaps the small stone circles at the cenote Xpoc were part of a turtle hatchery, or maybe the odd stone foundation in the cenote Xhokancol was related to iguana farming. The economic potential of these lakes seems to have been overlooked by archaeologists.

Each of the lakes I have visited is noticeably different. This diversity, the unusual topography, and the restricted distribution of resources offered by these lakes should have led to the development of a distinctive pattern of ancient settlement. Part of the area, especially to the east of Mayapan, is poorly surveyed, so we cannot draw firm conclusions. The Atlas arqueológico del estado de Yucatán (Garza Tarazona and Kurjack Basco 1980) shows us very few sites in the Cenote Zone. The site of Timul (16Qd(7): 166), mentioned above, appears to be an exception. Unfortunately, little is known about its age or function. There may well be other small sites in the Cenote Zone, but it seems unlikely that there are really large ones that remain unknown. Thus, the most salient feature of settlement in the Cenote Zone is its absence. The author of the Relación de Sotuta y Tibolon reached the same conclusion (de la Garza, Izquierdo, and León y Tolita Figueroa 1983:148) and ascribed the lack of settlement to the bad water of the lakes.

Ch’e’eno’ob’

All the water sources within the great wall of Mayapan fall into the category of ch’e’eno’ob’, which, as I explained earlier, literally means “wells” (fig. 11.2). In geomorphological terms they are either natural collapse dolines that reach the water table or karst solution caverns that have pools of water in them. None of the cenotes at Mayapan look much like the Cenote of Sacrifice at Chichén Itzá: a round depression with vertical sides and water-covered bottom. To be clear, I should specify that despite the term wells, none at Mayapan were artificially excavated. Ch’e’eno’ob’ are also common in the vicinity of Mayapan, outside the Great Wall.

The cenotes/wells of Mayapan had both sacred and mundane functions in prehistory. Among the profane functions there is evidence that they supplied raw materials, including possibly pottery clay, cave travertine for ceramic temper, stalactites for construction of altars, and perhaps fish.

In the cenote Ch’en K’ulu, which has extensive subterranean passageways, the clay in some tunnels looked like potting clay, or k’at la’um. I collected a small sample of this clay and made pots from it. The ceramic paste did not resemble that from the archaeological ceramics of Mayapan, but the vessels seemed functional. Clay may have been mined historically or prehistorically in Ch’en K’ulu.¹

In one excavation, Pit 4 near Structure AA-46 (Brown 1999:199–202), I recovered several small fragments of cave travertine displaying large clear
calcite crystals. An elder from Telchaquillo told me that this ch’aak xiix was ground up and used as temper in ceramics. There is little clear calcite temper in the ceramics of Mayapan, but various kinds of clear calcite temper are common in the Late and Terminal Classic ceramics of the Cholpet and Sotuta complexes (Smith 1971).

Adams (1953:153, 171, 175) reported that stalactites were used as vertical tenons or supports to form three modeled stucco statues in front of Structure Q-71, a shrine in the ceremonial center. The small figures were evidently modeled and painted. The stalactites must have come from a cave or cenote, and in some of the caves of Mayapan, such as Ch’en K’ulu, most of the stalactites have been cut off or broken off.

Caves were also used for interments. I observed human remains in Ch’en Mul, Ch’en K’ulu, and Yo Dzonot and in the main cenote in the plaza of Telchaquillo. The Carnegie Institution also found burials in caves, including the cenotes X-Coton (Shook 1952a; Smith 1953a, 1971:116) and Ch’en Mul.

Fish live in Yucatecan cenotes, particularly Cichlasoma sp., which is eaten by the local people; the same species apparently live in the lakes of the Cenote Zone (Pollock and Ray 1957:649–51). These were among the most common fishes that were excavated by the Carnegie Institution at Mayapan. Although they were recovered in only a couple of lots, the minimum number of individuals was the highest of all the fishes found (Pollock and Ray 1957). Little, however, is known about the Carnegie’s recovery methods, although they were surely not systematic; therefore, it is difficult to evaluate Pollock and Ray’s quantitative conclusions. The archaeological remains also include large numbers of turtles and iguanas that may have come from cenotes or lakes. In my excavations in residential middens, in which the soil matrix was systematically screened, fish bones occurred in small numbers. It is fair to infer from these data that the water sources of Mayapan provided material and resources that influenced the economy of the community.

The ritual and religious use of cenotes at Mayapan influenced the spatial organization of the site and probably its social and political organization as well. Three important cenotes were associated with ceremonial architecture: Ch’en Mul, X-Coton, and Itz’mal Ch’en. The cenote Ch’en Mul is located in the heart of the ceremonial center at the foot of the Temple of Kukulcan. This location has clear symbolic significance in the context of Mesoamerican religion. It incarnates the link between the cave, the water, and the pyramid–mountain, which in Mesoamerican thought was a single idea—ahepil—of community or town (Bierhorst 1985; Broda et al. 1987:93; Lopez Austin 1997; Stark 1999a; see also French, Stuart, and Morales and Fash and Davis-Salazar, this volume). The juxtaposition embodies the geography of the heavens, the underworld of the cavern, and the multilayered firmament. The religious center of the city is thus an axis mundi, representing the levels of the Maya cosmos (Eliade 1954:12). Moreover, the Temple of Kukulcan is a radial temple, likely associated with completion, specifically with calendrical termination rituals, such as katun endings and New Year ceremonies (Brown 2005; Carlson 1981; Goggin 1980, 1983). The temple also presents an astronomical hierophany on the winter solstice (Aveni, Milbrath, and Peraza Lope 2004), which highlights the building’s ritual significance as the center of the community.

There is direct evidence that the Temple of Kukulcan at Mayapan acted as an axis mundi that united the heavens, the earth, and the underworld. Like its analog at Chichén Itzá, the Temple of Kukulcan at Mayapan had nine terraces (Shook 1954:93), equal to the number of levels in the Maya underworld (Carrasco 1990:67). The connection to the underworld is made explicit, however, by the presence of a natural cave below the temple. Robert Smith reported that an arm of the cenote Ch’en Mul extended approximately west-northwest beneath the Temple of Kukulcan (1953b:280, 1954). It has since been discovered that caves or tunnels occur beneath several major pyramids in Mesoamerica, including the Temple of the Sun at Teotihuacan (Heyden 1975, 1981, 1989), the Temples of K’ukumatz and Tojil at Uxactún (Fox 1991), and the El Duende pyramid at Dos Pilas (Brady 1997). These tunnels and caves appear to be related symbolically to the Central Mexican creation myths and to the Maya underworld, Xibalba, of the Quiche Maya Popol Vuh. The cave beneath the Temple of Kukulcan probably possessed similar mythic significance.

My exploration of the cenote Ch’en Mul indicates that the tunnel that passes beneath the Temple of Kukulcan departs from the southwestern edge of the collapse doline and runs southwest and then west, apparently near the southern edge of the temple. Looking at my measurements, taken casually years ago, and comparing them to the existing maps (fig. 11.3) (Smith 1954; ceremonial center map drawn by Proskouriakoff, in back pocket of Pollock et al. 1962), I first noted that Smith’s map was inaccurate. The tunnel marked with an arrow as going “to the West Water Hole” is the one that passes below the Temple of Kukulcan. On Smith’s map it is not drawn in but appears to be oriented north of west. In fact, my notes show this tunnel running from the southwest corner of the collapse doline and bearing slightly south of west, with an average azimuth of about 257° (mag.) for more than 30 meters. I used the U.S. National Oceanic and Atmospheric Administration’s online calculator (http://www.ngdc.noaa.gov/cgi-bin/seg/mag/flsntfl1.pl) to calculate the changes in magnetic
Fig. 11.3 Partial plan and profile of the cenote Ch'en Mul, located in the ceremonial center of Mayapan. (After Smith 1954; courtesy of the Carnegie Institution of Washington)

decentr from those of the Temple of Kukulcan (Pollock et al. 1962:113–17). In the Maya area round temples seem to be evidence of Central Mexican influence, as they may be at Mayapan. Among the Aztec in Central Mexico round temples were dedicated to Ehécatl, lord of the wind and an avatar of Quetzalcoatl (Aveni 1980:262; Carrasco 1990:72). Since Kukulcan is the Maya incarnation of Quetzalcoatl, the principal temples at Mayapan may celebrate different aspects of the same deity. That two tunnels of the same cave extend beneath both structures may be an allusion to this parallelism.

While Ch'en Mul may be the most significant sacred cenote at the site because of its central location, X-Coton and Itz'mal Ch'en also exhibit evidence of sacredness. X-Coton has human burials and a small platform within it. Proskouriakoff (Pollock et al. 1962:130) thought that the city wall had been extended to encompass this cenote. Two small ceremonial buildings sit on the rim of the cenote, Structures T-70 and T-72. Structure T-70 is a rare double temple (Shook 1952a, 1953), reminiscent of Central Mexican ones, which are best exemplified by the Templo Mayor of Tenochtitlan. Itz'mal Ch'en is a dramatic hole in the ground. The men of Telchaquillo have held their ch'aa'chaak rain-bringing ceremony at Itz'mal Ch'en for many years (Shook 1952a).

Two cenotes also have an evil supernatural reputation. Sac Uayum is a large cenote located just south of the city wall. I have suggested (Brown 2005) that the exclusion of the cenote from the city was intentional and that the course of the wall was deflected for this purpose. Sac Uayum is held to be the home of a feathered serpent that eats children. Yucatecan mythology is filled with caves (Burns 1983:244–57). In these legends they are homes of serpents. Sometimes the flying serpent, called Hapai Can, eats children (Dzul Poot 1985:47–53). Other stories emphasize the cave serpent’s role as protector of the cenotes and the sacred zyuha, or “virgin water,” used in ceremonies such as the cha'ah-chaak (Tec Chi et al. 1992:22–24). The cenote Cosil is also considered a dangerous place. My employees refused to enter it with me. These facts bespeak a storied sacred landscape heavy with meaning.

**Water, Ritual, and Ancestors**

Equally important is the relationship among water sources, ritual, and kinship. Vogt (1969, 1976, 1981) and others (e.g., Brady 1997; Collier 1975) have meticulously documented the geographic and ritual interconnections among lineages, ancestor worship, and settlement in the highlands of Chiapas and Guatemala. Similar systems are documented poorly
among the Yucatec Maya. I have noted (Brown 2005) passages in the Books of Chilam Balam that imply that a similar association of lineages, rituals, and caves existed at Mayapan. The clearest passage on this theme is from the Book of Chilam Balam of Tizimin:

\begin{tabular}{l}
Tutz'oc ucuch katun & The burden of the katun is finished \\
Ti to ul yokol Mayapan & Which is one moon over Mayapan, \\
Ti uchom may cu & The cycle seat, \\
Uyetz' & His setting, \\
Uch'ibal & His lineage, \\
Tuch'enil & At the wells, \\
Ti yactunil & At the welling fountains. \\
Tix uchom cimchehil & And there occurred deer death \\
Ma ya cimlal & And painless death. \\
\end{tabular}

(Edmonson 1982:110)

This passage indicates that caves and cenotes were ritually and religiously associated with lineages at Mayapan. The translation has some problems, such as the rendering of yactunil as “welling fountains” rather than as “cave,” its literal, commonplace meaning. Edmonson does, however, provide the basic meaning. A nearly identical passage appears in the Pérez (Miram 1988, 3:90).

Considerable evidence suggests that the government of Mayapan was organized around the kinship system, which was certainly patrilineal and probably bilineal (Brown 1999). Therefore, political power and legitimacy must have been interwoven with cenote rituals and ancestor worship. As the principal lineages, the Cocom and Xiu may have vitalized their power through their association with certain water sources and the deities who dwelled in them. Perhaps Ch'en Mul was affiliated with the ancestors, tute- lary deities, and political power of the Cocom, the city’s founding lineage, or the Xiu, who also claimed to have been a paramount lineage at the site.

Many ch’eno’ob occur outside the great wall, but their density is unknown. They are common, but without reliable survey data we will never know whether the cenote density within Mayapan is exceptional. The Carnegie Institution investigated almost eighty caves and cenotes within a radius of about 19 kilometers of Telchaquillo. Over sixty caves contained Mayapan-type ceramics, and some have Mayapan period architecture nearby. The survey was not exhaustive; some nearby cenotes were not included. For example, the cenote Chaak, which is in Telchaquillo and gives the town its name, is not listed. The number of cenotes visited hints at both their ubiquity and the density of Mayapan period settlement in the region.

\textbf{Conclusion}

Water sources played several important roles in the culture of Mayapan. They supplied water in a dry land. They offered food and raw materials for pottery and construction. The small lakes of the cenote zone were sources of food and perhaps other materials, although the water is poor. The lakes were used for raising iguanas and turtles. Many cenotes had sacred or supernatural associations. In Mayapan residential settlement was related to cenotes. Given a patrilocall and patrilineal kinship and residence sys- tem, the cenotes would have been associated with specific patrilineages, as they are in the Maya Highlands. Passages from the Books of Chilam Balam suggest there were specific rituals and sacrifices related to lineages that took place at cenotes. The ethnohistorical data clearly imply that govern- ment at Mayapan was organized around principles of kinship (Brown 1999). Therefore, the cenotes were tightly integrated into the system of political power and legitimacy.
Chapter 10. Hydraulic Features of the Mexico-Texcoco Lakes during the Postclassic Period

1. The studies entitled “Gravimetrical Maxim” and “Theory of Differential Density of the Ground” as well as several investigations conducted in the Instituto de Geografía/UNAM stand out. Currently, more than twelve hundred minor basins related to the distribution of the igneous mass in the subsoil have been recorded.

2. “En este año 4 acatl se apercibio para la guerra Itzoahuaztizin, rey de Tenochtitlan. Aún no se manifestaba bien entonces. . . En el mismo año 4 acatl se torció y cambio el río de la ciudad de Cuauhtitlán. . . La causa por que se cambió, fue que muchas veces sucedió que todo arrastraba el agua y se derrumbaban las casas en tiempo de avenida” (Chimalpopoca Código 1975:49).

Chapter 11. Water Sources at Mayapan, Yucatán, Mexico

1. The walls of some tunnels seem to be stained with clay at levels well above the top of the current clay stratum. I also saw a few small pits in the clay deposit that might have been old excavations, but I do not consider this conclusive evidence of mining. So I conclude that although the clay from Ch'en K'ulu can clearly be used to manufacture pottery, whether the pre-Hispanic inhabitants of Mayapan did use it to make ceramics is uncertain. This question could be resolved through chemical and petrographic analysis of the clay and the archaeological ceramics.

Chapter 13. Mirror of the Earth

1. Crown (1987b:210) developed a typology of water storage features based upon function and setting. Although here I use the term “reservoir” in the generic sense and in deference to traditional usage, most features of this type in the northern Rio Grande would, under her suggested nomenclature, be called “catchment basins” or “retention basins” (see also Wilshusen, Churchill, and Potter 1997:665).

2. I use these in preference to other descriptive terms, such as “towns,” which may conjure up erroneous associations. Community houses are large single pueblos with some residential and socially integrative functions. Varien defines a community center as a “relatively permanent . . . densely settled area usually associated with public architecture” (1999:3). Such a classification fits the large, multi-room block pueblos constructed in the northern Rio Grande during the fourteenth and fifteenth centuries AD as well as the room block clusters of earlier periods, although they were established on a smaller spatial scale than the community centers for which Varien’s terminolo was initially developed.

3. It has been suggested that some of the Galisteo reservoirs were constructed by nineteenth- and twentieth-century ranchers as stock tanks, although Nelson’s photographs of one such feature at Pueblo Blanco (LA 40) illustrates the vertical slab foundations typical of Ancestral Pueblo construction.

4. The information from Pecos comes from site data on file at the New Mexico Historic Preservation Division and was brought to my attention by Genevieve Head, director of the Pecos Survey for the National Park Service. It has been suggested to me that the “tanks” noted by Jeancon at the Poshuinge shrine would today be identified as pits from which gravel was obtained to create mulch for nearby garden plots. As Kurt Anschuetz (1998:335) has demonstrated, however, features of this type have complex functional and symbolic associations with water, suggesting relationships similar to those between shrines and more formal reservoirs.