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Human Adaptation in Ancient Mesoamerica

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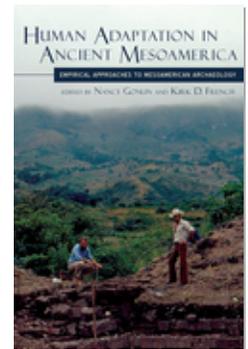
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Water Temples and Civil Engineering at Teotihuacan, Mexico

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INTRODUCTION: CIVIL ENGINEERING AND CEREMONIAL SPACE AT TEOTIHUACAN

This chapter explores how Teotihuacanos controlled the flow of water through their urban domain using a masterful blend of practical engineering and nuanced hierophany. Contextualized within the evolving demographic and political landscape of this great city, Teotihuacan's formal hydrological system developed along with its monumental and residential building programs. Through their engineering projects and their art, Teotihuacanos reveal themselves to be water worshippers from the earliest days of their city, and over time they emphasized different water sources and the deities associated with them. Iconographic evidence suggests that as Teotihuacan's hydrological grid grew to encompass and harness the flow from springs, their control by the state was advertised by water temples bearing sacred symbols related to rulership.

Teotihuacanos worshipped water because in their valley in central Mexico (figure 1.1), it was the critical resource in least abundance; average rainfall was

just above the bare minimum for maize (ca. 500 mm), with many years falling short. The early city needed reliable harvests from rainfall-dependent fields in the Teotihuacan Valley, and sought to secure them with irrigation from runoff and by veneration of the Storm God (an early version of Tlaloc) and probably also a Teotihuacan goddess, an enigmatic figure sharing attributes with the Aztec water goddess Chalchihuitlicue. This strategy successfully underwrote two of the young city's first great monumental projects: the Street of the Dead and its northern complex (Pyramids of the Moon and Sun). Monumental construction would eventually include the great southern complex (Ciudadela and Great Compound), but before that could be established, the river running through the building site had to be diverted and canalized.

The canalized San Juan River was essential to the southern complex's development and its iconographic message. Visitors approaching the city from the west or southwest would travel on or alongside the river-canal's arrow-straight course that pointed directly to—and thus was visually associated with—the water-themed tiers of the Temple Pyramid of the Feathered Serpent. Associated with rain and flowing water, the Feathered Serpent cult probably reached its height right before the city's Early Classic urban renewal program.

It is clear from Early Classic art that the Feathered Serpent and Storm God continued to be revered, but the redeveloped city's walls bore murals abounding with images of another water-related spirit, the jaguar, avatar of the powerful deity known to the Aztecs as Tezcatlipoca, master of fate, patron of rulers, and patron of water from springs. Early Classic Teotihuacan murals show felines in procession, including jaguars dancing in front of water temples covered with symbols of royal political power. One of these symbols, the pierced jade disk *chalchihuitl*, mimicked the concentric ripples of a water droplet and was one of Teotihuacan's international emblems in its Early Classic apogee.

Teotihuacan's sharp decline in the sixth century CE may have been hastened by climate changes that disrupted the reliability of some water sources, and some of these changes are being documented (Kennett et al. 2012; Lachniet et al. 2012; McClung de Tapia 2012). In this near-desert environment, Teotihuacan's large population depended on all available resources, and the disruption of any supply would threaten well-being and also undermine the power of the rulers that in part rested on their reputations for propitiation of water-providing deities. Drought was a chronic threat, but torrential rains brought erosion and flooding, a challenge to the city's planners who tried to harness the flow of water through the city as well as minimize potential damage from these powerful forces. When the city's decline began in the sixth century, with challenges to the rulers and a falling population, the stresses of severe weather would further weaken community stability.

ENVIRONMENTAL CHALLENGES AND SETTLEMENT HISTORY AT TEOTIHUACAN

The gridded plan of the Early Classic city is diagonal to the natural drainage of its setting, to the orientation of the natural slope of Cerros Colorado and Malinalco, southwest outliers of Cerro Gordo. Teotihuacan's land-and-water relationship was shaped by drainage down these slopes, with several large barrancas draining into the San Juan River as it curved along the foot of the Colorado-Malinalco slopes, running northeast to southwest (figure 2.1).

The barrancas and river frame most of the ceremonial center and the mature city's areas of densest population. This Early Formative period (ca. 1200–650 BCE) settlement was along the barrancas. One such occupation along the southwest side of Barranca de San Martín endured and developed along with the city, becoming the settlement concentration that modern scholars call the “Old City” (Millon et al. 1973, N6W2, N6W3).¹

While the Middle Formative–period pre-urban villages underlying the later city seem to have clung to barranca formations, during the Late Formative, large villages developed on the alluvial plain. The largest Cuanalan phase (Middle to Late Formative, ca. 650 BCE–1 CE) village, with at least 1,000 people, was located on well-drained land near the marshy area around Teotihuacan's springs where, until recently, drained field agriculture was practiced (Cowgill et al. 2003, 9).

MONUMENTAL COMPLEXES AND LANDSCAPES: LATE AND TERMINAL FORMATIVE PERIODS

In the Late and Terminal Formative periods (300 BCE–250 CE) Teotihuacan grew dramatically. This growth marked the beginning of planning and construction of the major monuments at the northern end of the Street of the Dead. First, the Moon Pyramid was begun, with its initial construction stage having an orientation of 11–12° east of north (Sugiyama 2012, 220).

Second, the urban grid's diagonal-to-nature orientation was formalized by the monumental Street of the Dead, established in the Terminal Formative Tzacualli phase (“Teo I,” midpoint ca. 100 CE). The street and the Pyramid of the Sun set a dominating alignment at 15° 25' east of astronomic north, and thereafter the city's layout was skewed 45° from its natural drainage.²

THE NORTHERN COMPLEX AND THE EROSION CYCLE

Besides the Street of the Dead and the great pyramids, other components of the northern complex were the plaza between the two pyramids and the Xalla compound on the eastern side of that plaza.³ This complex may have served as the first city center.

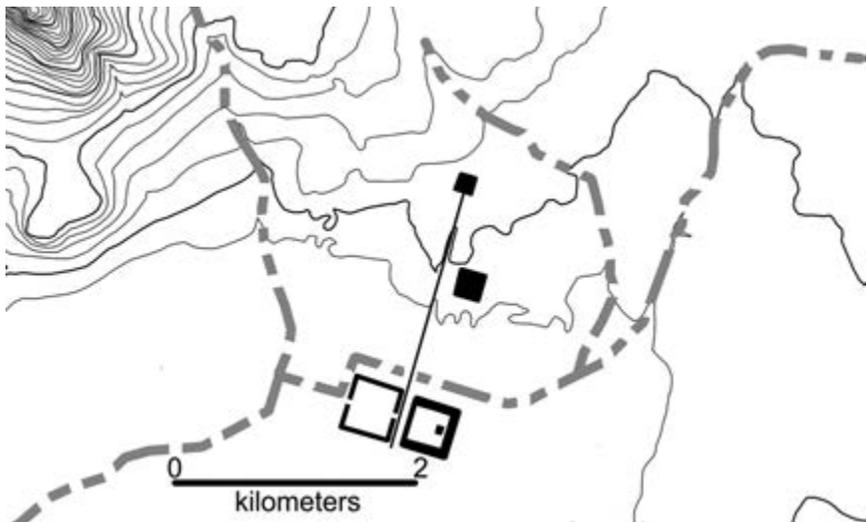


FIGURE 2.1. *The basic layout of Teotihuacan's ceremonial center crosscuts the topography of the slopes of the Teotihuacan Valley. Major drainage (broken gray lines) underwent radical rerouting as part of the city's development (drawing by S. T. Evans).*

All this construction activity seems to have prompted a change in the Teotihuacan Valley environment, ending a period when modifications to the landscape were modest in scale because of a relatively small population. By 100 BCE, if not earlier, the effects of deforestation and intensive agriculture prompted dynamic cycles of erosion and sedimentation, a pattern persisting throughout the life of the city, until about 650 CE (Lorenzo 1968; McClung de Tapia et al. 2005, 173).

The human-induced erosion-sedimentation cycle would complicate existing civil engineering challenges faced by Teotihuacan's planners in the Terminal Formative and Early Classic periods: construction compromised environmental stability, and instability demanded corrective measures. If the instability was minor and correction affordable, then the city's well-being was not placed under serious stress.

IRRIGATION AT HOME AND ABROAD

Elsewhere in the future area of the mature city, irrigation canals were dug as early as the Terminal Formative (Patlachique and Tzacualli phases). During this time, if not earlier, floodwater irrigation was widely practiced in the Teotihuacan Valley and farmers probably made use of the permanent irrigation sources as well. Irrigation canals have been discovered in several areas of

the city, including Tlajinga (Millon et al. 1973, W2S3), the Oaxaca Barrio (N1W6, N2W6), and the La Ventilla barrio (S1W2 and S1W3) (Gómez Chavéz 2000; 2012, 77; Nichols 1987, 1988; Nichols et al. 1991; Nichols and Frederick 1993, 128–132). Floodwater canals also have been recorded near Maquixco Bajo (TC–8), an outlier community on West Avenue 5 km west of the Street of the Dead, and oriented to the city’s grid (Sanders et al. 1979, 348). More floodwater canals were found on the north slope of Cerro Gordo and at Otumba north of Teotihuacan, probably established in the Terminal Formative (Charlton n.d.a, n.d.b, n.d.c). As the city grew, new buildings would cover over previously irrigated fields, probably once controlled by local corporate groups. At the same time, grading the construction sites of the ceremonial cityscape involved the displacement of enormous amounts of soil.

Irrigated fields could be planted before the start of the rainy season, improving both crop security and productivity, a tradition that may extend back at least to the Terminal Formative period. Irrigation ditches were part of an even larger project of drainage, as Teotihuacan continued to create a managed and organized landscape out of the one colonized by the first farmers in the Teotihuacan Valley. The urban landscape incorporated into the natural environment the temple pyramids and urban grid. And thus Teotihuacan expressed its special relationship with water and its efforts to harness and regulate its power.

Chinampa cultivation of the swampy area around the springs has been proposed as critical to Teotihuacan’s urban expansion (Sanders et al. 1979, 269; Scarborough 2003, 131). The city’s urban grid and architectural order may express “a highly routinized set of regulatory principles grounded in the intensity of *chinampa* exploitation” (Scarborough 2003, 131). Drainage canals have been dated to Late Tlamimilolpa/Early Xolalpan and perhaps earlier near the springs (Gamboa Cabezas 2000; Sánchez-Sánchez 1982). However no drained fields yet have been definitely dated to the Formative or Classic periods (Gazzola 2009; González-Quintero and Sánchez-Sánchez 1991, 363) and some might possibly date to the Colonial period (McClung de Tapia 2012, 153).

The area of drained fields around the springs could have supported only a fraction of the urban population. Teotihuacan’s dramatic growth in the Terminal Formative period depended also on fields in the middle and lower Teotihuacan Valley and the extension of permanent irrigation into the northern Texcoco region using the waters of the Rio Papalotla (Sanders 1976; Sanders et al. 1979, 387–389). Even so, the Teotihuacan-Papalotla system was not large enough to sustain the expanding urban population that required the development of irrigated lands elsewhere in the Basin of Mexico and adjacent regions. We do not know how these systems were engineered, but at least in the Cuauhtitlan area, the settlement of Axotlan had close ties to Teotihuacan (Clayton 2009, 88; 2011; 2013).

Teotihuacan expanded its hinterlands beyond the Basin of Mexico to include the Yautepec Valley (Morelos) that could supply it with tropical cultigens such as cotton (Hirth and Villaseñor 1981, 145). Large irrigation canals were constructed there in the Late Formative, and the Classic period saw a substantial increase in agricultural capital and creation of a more organized agricultural landscape (Nichols et al. 2006, 59–61). In contrast, Teotihuacan's economic control over the southeastern and southwestern Basin was significantly less centralized than previous models have suggested (Nichols et al. 2013).

THE SOUTHERN COMPLEX AND SAN JUAN RIVER

The Terminal Formative period saw continued planning and construction along the Street of the Dead, with the development of a southern complex of monumental architecture about a mile (1.6 km) south of the Pyramid of the Moon. The complex consists of five parts: a portion of the Street of the Dead, two huge (nearly 500 m on a side) square compounds, the canalized San Juan River, and the East-West Avenue. The dimensions of the monumental canals and buildings and the distances between them may reflect calendric touchstones such as the Venus cycle, as these figures are calculated in Teotihuacan Measuring Units (0.83 m; Sugiyama 1993, 114; 2005, 47–48).

Developing the southern complex began with rerouting the San Juan River because its natural northeast-to-southwest course cut across the planned area of the Ciudadela compound and the Great Compound. In placing the Feathered Serpent Temple-Pyramid in an established river course, the associated cult demonstrated control over its flow as well as the rainfall runoff from the slopes upstream (Sugiyama 1993, 114). Runoff was tamed into a system of orthogonal canals and drains.

Flowing water was under the patronage of the Feathered Serpent, as was rainfall. The sharp seasonality of rains in this valley was a matter of great concern to the Teotihuacanos, who worshipped time in part as a means to monitor the regular habits of the seasons, including water supplies that ensured regular harvests. Teotihuacanos spent lavishly to honor water-related deities as well as deploying various practical agricultural intensification measures, from terracing to canals and drained fields.

Rerouting and canalization of the San Juan River probably took place in the second century CE and involved planning and excavating nearly two miles (~3.2 km) of canalized river course that conformed to the city's grid and sacred orientation as the river passed around the southern complex, and additional miles (km) of straight diagonal canals up the slopes and down to the spring line. It was part of a larger set of hydrological projects in this sector of the city—the San Lorenzo River was also rerouted, as were other watercourses such as the

numerous barrancas and smaller streams, conforming to the urban grid. Their engineered hydrography also included an organized drainage system to manage flooding in the city, including around the Pyramid of the Sun (Angulo Villaseñor 1987b; Gómez Chavéz 2008; McClung de Tapia 2012; Sarabia and Sugiyama 2010). They constructed reservoirs behind the Ciudadela and elsewhere to collect water for use during the dry season, and to control runoff (Millon et al. 1973, quadrants N1E2, N5W1, N5W2, N6W1).

These projects were costly, so the energetic outlay invested in developing the southern complex was much greater than that entailed simply by building the Ciudadela compound and the Great Compound. The city's new monumental canal ran west along the north edge of the southern complex, turning south to hug the northwestern corner of the Great Compound and then, at the midpoint of the west side of the compound, it turned west to run alongside the West Avenue for almost half a mile (.8 km) before turning south once more.

The San Juan River canalization project extended and expanded the canal system, and this expansion would have had consequences for several important interest groups in the city. Of course the water worshippers of the Feathered Serpent cult would have proposed and supported the project. The city's working class citizenry may have welcomed the chance to work on the construction project, as well as an implicit suggestion that the extension of the city's grid of grading and drainage signaled future improvements to their ramshackle neighborhoods, where chronic problems related to flooding and drainage could be addressed by incorporation into the grid.

SOUTHERN COMPLEX COMPOUNDS

The southern complex also served the interests of merchants. The Feathered Serpent had many areas of patronage, and mercantile activity was among them. Canalizing the river connected the southern complex with Lake Texcoco, at least in some seasons; at the spring line about 2 km downstream from the Street of the Dead canalized water courses ran down to the lake. The course of the San Juan River today is distinguished as a double line of well-watered trees (figure 2.2), not as a vital watercourse, but in precolumbian times it was fed by a higher water table as well as by rainfall runoff. Even if only seasonally navigable, the canal was an improvement in access to the city and would enhance regular subsistence provisioning, as well as regional trade and long-distance interchanges such as trade, diplomatic missions, and pilgrimages.

After the southern complex area's hydrology had been rearranged, the building program could begin, with the leveling of the area of the compounds. The timing and synchronicity of construction of the southern complex's pyramid, perimeter platforms, and room groups is uncertain, but the present version



FIGURE 2.2. *The San Juan River is today a modest stream, as shown here in early summer, in the southwestern quadrant of the city (photo by David Carballo).*

of the Feathered Serpent pyramid was begun, on sterile soil, in about 200 CE (Sugiyama 2005, 54). The third century marked the height of power for the Feathered Serpent faction, who initiated their great temple-pyramid, presumably the funerary monument of their leader (possibly Teotihuacan's ruler), with hundreds of human sacrifices.

The temple-pyramid arose over these bodies, its seven tiers of sculpted and painted feathered serpents swimming in watery riches, themes of the pyramid's façade that were continued in the decoration of the temple that crowned it.⁴ The Ciudadela itself may represent a "watery Underworld" (Sugiyama 2005, 48, 52; see also Coggins 1996). A canal running underneath the north platform of the Ciudadela diverted water from the river into a well/pit in the center of the Ciudadela's plaza, an important space for rituals linked with water symbolism (Quintanilla Martínez 1982; Rodríguez García 1982, 56, 67–68; Sugiyama 1993, 121; 2005, 48, 51).

The Ciudadela was mirrored on the west side of the Street of the Dead by the Great Compound. A huge enclosure like the Ciudadela, nearly 500 m on a side, now underlying modern construction, its present condition and situation complicating extensive archaeological investigation. In spite of the problem of definitively proving the function of this space, most scholars agree that exchange-related activities (probably) took place there, with the Great Compound's open central square (200 m by 250 m) serving as the eastern terminus of West Avenue as it met the Street of the Dead, suitably situated as a depot and marketplace. Bracketing the square on its north and south sides were low, broad, perimeter platforms; each bore half a dozen large buildings, possibly warehouse-residences like those of the Aztec *pochteca*. These dozen or so compounds were possibly linked to Teotihuacan's various *barrios* (Sload 1987) and possibly served as depots and guesthouses for visiting trading or pilgrimage partners.

A caravan of porters or pilgrims from the west would enter the city center through the wide west gateway of the Great Compound, and could look through the wide east gateway to see the center front of the Ciudadela with the Temple Pyramid in the background. In the Great Compound, caravan leaders would check in at the warehouses to which they maintained ties, and porters would unload packs and canoes.

HYDROLOGY AND HIEROPHANY

The southern complex's conjunction of land and water—sacred site and flowing river—permitted Teotihuacan's planners to use the canalized river along West Avenue as an extension of the meaning of the Feathered Serpent, becoming a visual emblem of the great fertility god and his watery associations. The sight line of the East-West Avenue bisected the Feathered Serpent Temple-Pyramid so

that travelers along that route from either direction enjoyed the dramatic dead-ahead view of the temple and the top of its pyramid rising above the Ciudadela's perimeter platform.

This impression was particularly powerful for those coming from the west or southwest, by land along West Avenue or traveling up from the lake along the canals by canoes or on the adjacent footpaths. The great pyramids are visible for miles, but the theater of processional approaches to Teotihuacan grew more dramatic where the canal and paths converged on West Avenue, about a mile (1.6 km) west of the Temple-Pyramid. Facing a vista centered on the Temple-Pyramid, city-bound travelers were in canoes or walking on the path alongside the canalized river, its shimmering ripples suggesting the feathers on a serpent such as the ones straight ahead. The whole landscape composition was an effective merging of hydraulic engineering and ideology, artful urban design in the service of water worship as expressed through devotion to the Feathered Serpent, associated with rain and flowing water.

Once in the Great Compound, the travelers would begin to relax after a long journey. When they felt prepared for further participation in city life, visitors might then visit the Ciudadela and the Feathered Serpent Temple-Pyramid across the street, and as they moved out onto the Street of the Dead, their gaze would be irresistibly drawn to the vista up the Street of the Dead (figure 2.3).

Teotihuacan's planners were masters at creating dramatic effects, and the view south from the Moon Pyramid was another example because it revealed the Sun Pyramid's profile as an echo of that of the Patlachique Range behind it. Thus the southern and northern complexes along the Street of the Dead formed a coherent series of vistas shaping the experience of being in the city's ceremonial center.

EARLY CLASSIC: THE GREAT HOUSING (AND DRAINAGE) GRID

About 150 years after the completion of the Feathered Serpent Temple-Pyramid, its elaborate façade and temple were so severely damaged that a much simpler front was built, an Adosada "mask" to hide the wreck of the feathered serpents. Some scholars (e.g., Sugiyama 1998, 148) believe that the pyramid's destruction was vandalism, an outpouring of simmering rage at poor living conditions at a time when the Feathered Serpent faction was capable of exacting costly sacrificial rites from the people. Another possibility is that heavy damage may have resulted from an earthquake (Pérez-Lopez et al. 2010) instead of—or in addition to—an angry mob. In a world of powerfully animated and meaningful natural forces, the rage of the Earth Deity would have had similarly costly consequences for the cult in terms of physical destruction and loss of prestige (Evans 2013, 272).



FIGURE 2.3. Teotihuacan’s two largest pyramids, known as the Moon Pyramid (center) and the Sun Pyramid (right), arrest the attention of those on the Street of the Dead as they pass between the Ciudadela complex and Great Compound (photo by S. T. Evans).

An earthquake may have damaged the city’s shoddy housing, providing another reason for Teotihuacan’s urban renewal project, which transformed situational housing and drainage patterns into one of the ancient world’s great gridded cities, thus formalizing the relationship of the city’s drainage with the irrigation system flowing from the springs. This was Teotihuacan’s third great period of development, creating in its new residential quarters a third great “complex” area of building and landscape transformation on a monumental scale. Calculation of the costs of labor and materials of each of these three great pulses of construction is unfortunately beyond the scope of the present effort.

POLITICAL CHANGE AND AFFORDABLE HOUSING

This gridded revolution in residential architecture and civic infrastructure no doubt represented an improvement over the city’s existing housing, probably a jumble of thousands of patio room groups and shacks. This phase of urban development has been plausibly interpreted as coinciding with a change in political power that initiated Teotihuacan’s “golden age” (Early Classic [ca. 300–550/600 CE; Teo III], Teotihuacan ceramic phases Late Tlamimilolpa, Xolalpan, and Metepec), about 250 to 300 years of prosperity and influence when the city was the greatest Tollan of its age.

The grid extended the city’s sacred orientation over a huge area, 20 km², spreading out on both sides of the Street of the Dead and centering on the

largest apartment compound of all, the Street of the Dead Complex. Measuring ca. 300 m on a side and straddling the street just north of the canalized San Juan River, this complex probably served as the administrative residence of the rulers. In figure 2.3, the Street of the Dead Complex is straight ahead, a gateway to further access to the northern complex monuments.

In descending size and quality, the other apartment compounds ranged from well-built “palaces” near the city center to smaller units on the outskirts. Apartment compounds may have been established by building the compound’s windowless outer walls as a kind of permanent fence around several existing patio groups (Angulo Villaseñor 1987b). The additions of rooms, passageways, and impluvia created a single cohesive dwelling that housed related families. The new arrangements brought changes, bringing their lives closer as they became relatively more isolated from the common life of the city. And while their household rituals were held within compound walls, pious observance of necessary rites at the altars in the patios could be coordinated and monitored from the tops of the Pyramids of the Sun and Moon, a form of state surveillance (Sanders and Evans 2006, 269).

Thousands of new interior walls, many plastered, provided the ground for the mural art that became a major Teotihuacan artistic signature. Many common themes, such as processions and a central figure bountifully bestowing riches, and common motifs recur in murals across the city. One such motif is the net, indicated in murals by looped twine within round frames or as part of costumes and representing an early avatar of Tezcatlipoca (Taube 1983, 127).

TETITLA

Such murals adorned the walls of the Tetitla compound, typical of the dwellings of the affluent (Angulo Villaseñor 1987a). Tetitla was about 60 m on a side and incorporated several patio groups (figure 2.4). Subsequent remodeling raised the levels of the rooms over time; at the time of its abandonment, Tetitla’s active stratigraphic record consisted of over three dozen floors extending down over 2 meters to sterile *tepetate* (compacted volcanic ash) (TE24 [Millon 1992, 348–349]).

Such courtyard houses have an oddly contemporary feel—even the modest ones seem livable (Pasztor 1997, 47). Furthermore, Teotihuacan’s plan, so unusual for the ancient world, strikes us as unexceptional because of our familiarity with the grids of modern cities. Our empathy with the house plans and city layout no doubt colors our understanding of the social conditions of Teotihuacan’s new direction in large-scale building programs, including the great housing (and drainage) scheme.

The rectilinear grid of drains outlining (and sometimes underlying) the new apartment compounds merged with irrigation canals that connected with the set of nearly 80 permanent springs located along the city’s southwest edge about

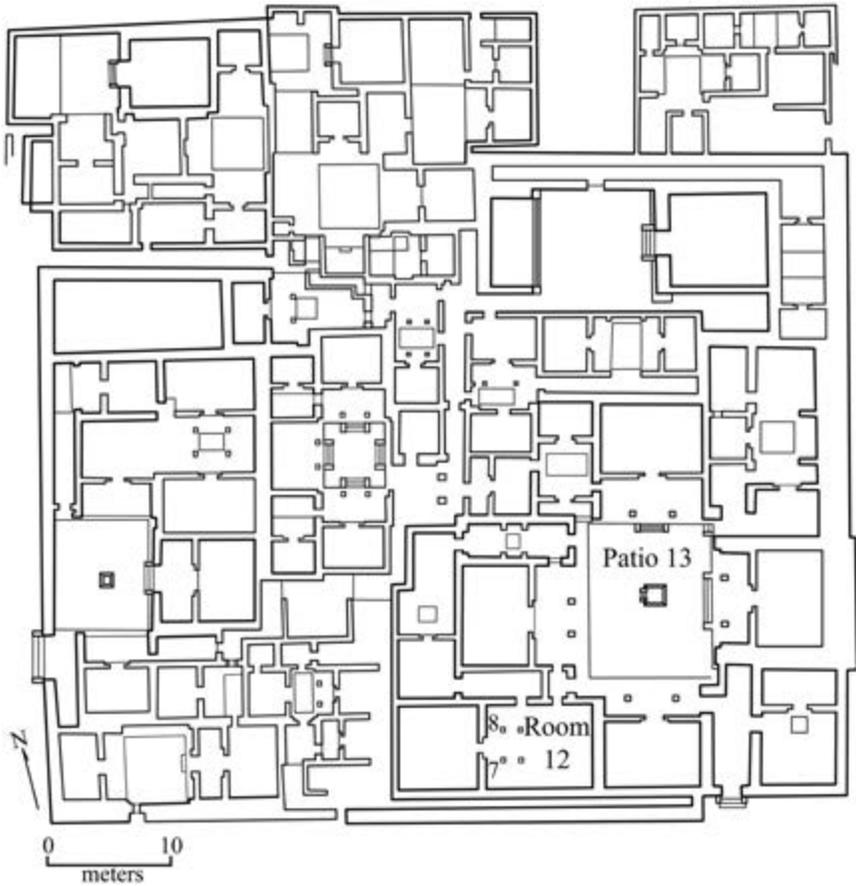


FIGURE 2.4. *The Tetitla apartment compound, like others at Teotihuacan, consisted of several patios surrounded by rooms, suggesting a multifamily dwelling. The water temple murals are located near the compound's entrance in Room 12, located in the south central area of the compound (lower right) (drawing by S. T. Evans).*

2 km west of the Street of the Dead at 2250 masl (Millon et al. 1973, quadrants N1W4, S1W4 and W5, S2W5). The springs were probably marked with water temples, as Tetitla's murals suggest.

WATER TEMPLES, NETTED JAGUARS, AND POLITICAL CONTROL

Water management projects transform the productivity of the agricultural landscape, so their control may be essential to other forms of power, particularly political power. At Teotihuacan, construction and maintenance of

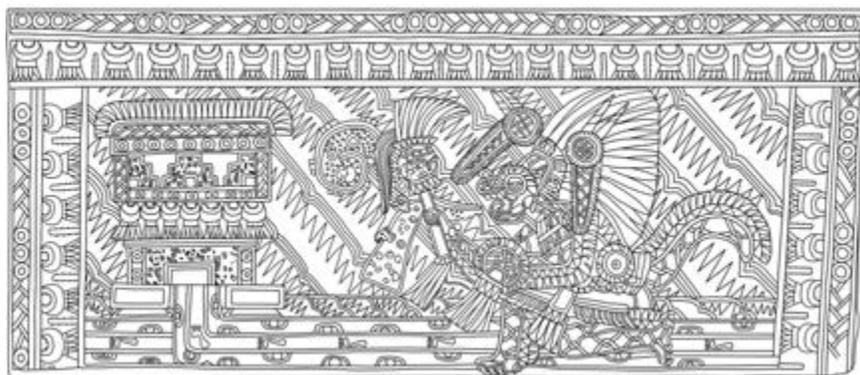


FIGURE 2.5. In this and the seven other “net jaguar” murals, a feline clad in a net kneels before a water temple (drawing by S. T. Evans).

the irrigation network were probably managed by local corporate groups—perhaps those associated with apartment compounds and neighborhood divisions within the city (Carballo et al. 2014, 117–120; Nichols and Frederick 1993, 128–131; Nichols et al. 1991). But evidence from Teotihuacan iconography suggests that this local management was overseen by the rulers. In contrast to Bali’s *subak* irrigation system and its water temples, which represent an institution separate from that of the state (Lansing 1991; 2006), Teotihuacan’s water temples seem, from their depictions, to have had strong associations with rulership (Evans 2009, 72–73; 2010a, 25).

Tetitla’s eight water temple murals are nearly identical images: a netted jaguar kneeling before a temple that gushes water into canals (figure 2.5). For many years, these images have been known as the “Net Jaguar murals” because of the enigmatic and compelling figure dominating half of the panel: a gorgeously outfitted jaguar kneeling reverently.

Jaguars are fairly common in Teotihuacan mural art, but netted jaguars are rare, and the Tetitla examples are the most elaborate known. They are adorned with precious feathers; scrolls emanate from their mouths; and from their bountiful paws shower carved jades (including *chalchihuitls*) and seeds. The trilobes on the borders of the scrolls and the footstep choreography along the causeways indicate that the jaguars were dancing and singing about precious things, and that this was an established processional space.

The features and context of these netted jaguars suggest associations with the deity later known as Tezcatlipoca (Séjourné 1962, 88–90, figure 102; Taube 1983, 111, 127). Tezcatlipoca was, of course, enormously powerful and mercurial and the great patron of rulers. The jaguar is associated with water from the earth, just as the Feathered Serpent was associated with flowing water and water from



FIGURE 2.6. Leonardo da Vinci's *Annunciation* shows a format similar to that of the “net jaguar” murals, a balanced symmetry of worshipper and object of adoration (drawing [reverse of original] by S. T. Evans).

the sky. Here at Teotihuacan in the Early Classic we see another round in the age-old and “mythic opposition between the jaguar and the serpent” (Lombardo de Ruiz 1996, 24).

And yet, as powerful as the netted jaguar appears, it knelt in reverence before the water temple in a posture not unlike that of the angel before the Virgin in Leonardo’s *Annunciation* (figure 2.6) The water temple is the focus. This primacy of the water temple documents the high value placed on water from springs. The water temple’s “door” is actually the outflow aperture for a powerful spring, and from the doorway, large canals flanking a causeway take the water to the smaller canals covering the fields behind the net jaguar. The water temples are shown covered with enduring symbols of preciousness and rulership: quetzal feathers, tassels (tasseled hats were insignia of high-ranking Teotihuacanos), woven *petate* mats widely signaling rulership, jaguar skin (emblem of the companion spirit of rulers), and the essence of preciousness, jade disks (Evans 2010c).

CHALCHIHUITL AS SYMBOL OF TEOTIHUACAN

The pierced jade disk *chalchihuitl* was strongly associated with rulership and power in Mesoamerica from Formative times into the Colonial period, and indelibly with Teotihuacan presence elsewhere in Mesoamerica in the Early Classic (Evans 2010b). The *chalchihuitl* has been accepted as emblematic evidence of Teotihuacan contact in the Guatemala highlands (Borhegyi 1965, 24) and at Copan on Structure 26 (Fash and Fash 2000, 456 and figure 14.9.c [p. 455]). At

Tikal, where talud-tablero architecture used the disk motif as its subject on a platform base in the Central Acropolis, the Teotihuacan-style Mundo Perdido neighborhood featured the Spearthrower Owl ball court marker, whose pierced disk frame resembles the feathered collars of the Feathered Serpent heads on the old façade of that temple-pyramid, which in turn suggest *chalchihuitls*. Spearthrower Owl's influence on Tikal is dated to 378 CE (Stuart 2000, 483), during Teotihuacan's urban reorganization—and its prime (Late Tlamimilolpa/Early Xolalpan transition).

The disk motif has many meanings, including use as a unit of time, a suggestion of divination (because basins of water offer possibilities for scrying), a suggestion of Tlaloc goggles, and, of course, as itself: a precious object whose possession was the privilege of those who ran the state (Evans 2010b). This meaning was perhaps the *chalchihuitl*'s most enduring one. While the word *chalchihuitl* is not part of the Nahuatl compound word for palace (which is *tecpan calli*, “lord-place house”), the *chalchihuitl* glyph was a crucial part of the Central Highlands palace glyph, which was a house glyph with a lintel bearing a line of disks like those on the Teotihuacan water temple, signaling the sanctity and gravity of the ruler's power to transform any space with royal presence.

On the Tetitla murals the *chalchihuitls* on the water temples demonstrate institutionalized control over an essential resource. The water temples bear multiple and unmistakable privileged symbols of state authority, and we suggest that by the time of the city's urban renewal and planned drainage program (ca. 300 CE), Teotihuacan's rulers established water temples to regulate and control water and canal use, or they renovated and embellished existing ones to demonstrate state control.

These murals have been variously dated: stylistically, to the Xolalpan phase (current estimate of midpoint ca. 400–450 CE) (Lombardo de Ruiz 1996, 34) and, from test excavation, to the middle of the subsequent Metepec phase (current estimate of midpoint ca. 500–550 CE) (Millon 1992, 348). In this part of the Tetitla compound, the room containing the murals was remodeled from a kitchen into a more formal room at the beginning of Xolalpan, so the art program could have been established then, and persisted as the room was remodeled a dozen times more before the Metepec phase. Because we have no way of knowing at what point the water temple murals were originally painted, we cannot assume that their mid-Metepec occurrence marks the establishment of the water temples. We do know that Xolalpan and Metepec phases were both expansive times for Teotihuacan, with growing sophistication and wealth, judging from the high quality of these murals and other art and architecture in the city. Elsewhere in Tetitla are murals with Maya and Zapotec motifs (Millon 1972, 11).

THE END OF METEPEC AND TEOTIHUACAN'S GOLDEN AGE

The end of Teotihuacan's reign as Mesoamerica's most powerful city was signaled in the archaeological record by widespread burning along the Street of the Dead, which is taken to be the end of the Metepec phase. After the Metepec phase, the next, Coyotlatelco, was dominated by ethnic groups with a much simpler cultural repertoire, maguery farmers from the northwest whose main town, Azcapotzalco, was on the west side of the Basin of Mexico.

When did Teotihuacan "fall"? How quickly? The timing of the city's decline is a matter of scholarly debate, complicated by ongoing changes in the corpus of absolute dates and how they are being interpreted. For many years, scholarly opinion converged around 750 CE. But new methods of analysis have pushed the burning episode(s) to as early as 500 CE (Wolfman 1990) and 550 CE (López Luján et al. 2006). Meanwhile, the proto-Krakatoa event of 536 CE caused problems around the world; it "dramatically lowered temperatures for sixteen years and caused years without summers" (Sheets 2012, 55). Quite possibly, problems went on for decades, and thus pinning the end of the Metepec to a particular point in time violates historical reality. We authors would not be terribly surprised to see the end of Metepec phase occurring between 550 and the early 600s, but wish to note that the recent literature includes a range of choices (and evasions, like ours) and 750 CE is still being used by some scholars. Furthermore, if scholarly consensus gathers behind the 550–600 dates, then by some chronologies, Metepec is over before it begins; the timing of all the earlier ceramic phases will need readjusting.

In spite of all these dating questions, we know that by the end of Metepec, the city's ruling elites could no longer hold the city center, and the Street of the Dead was torched, a dramatic sign of a decline that resulted in the permanent abandonment of the city center. Much of the city's remaining population would eventually disperse, some to the old city's outskirts. The half dozen villages that grew at this time survive to this day, and of greatest enduring importance is San Juan Teotihuacan, encompassing a particularly strong part of the spring line.

During the Epiclassic and Early Postclassic periods, depopulation of the Valley relieved the pressure on the environment and relatively stable environmental conditions returned (McClung de Tapia et al. 2005, 173). The Central Highlands of Mexico in general may have been affected by a dry period occurring around 1000 CE (Metcalfe et al. 2000, 716–717), which may have spurred the growth of Tula, watered by its rivers.

The town we know today as San Juan Teotihuacan has been the local political capital and the most urbanized center in the Valley ever since the Aztec period (Garraty 2006, 373, 380). Controlling the relationship of the cityscape to its water was a great achievement by Teotihuacan's generations of civil engineers and

architects, and it was but one chapter of the larger story of land and water in the Teotihuacan Valley. Just as Teotihuacan's urban expansion and its hydraulic works significantly modified the landscape, so too did its collapse (McClung de Tapia 2012). Seasonal flooding probably increased and hinterland areas experienced episodes of erosion and deposition as populations declined and relocated. By Aztec times, the Teotihuacan Valley again was intensively managed, with both floodwater and permanent irrigation at their maximums, and terraces covered hillsides. Nezahualcoyotl, Acolhua ruler of Texcoco, directed construction of dikes across Lake Texcoco and perhaps channelized drainages in the lower Teotihuacan Valley to control flooding and the influx of saltwater into the southern freshwater lakes and chinampas (Sanders et al. 1979).

THE COLONIAL PERIOD AND AFTER

It appears that water veneration did not end in the Postclassic period, or with the Spanish intrusion. After the conquest, the springs were claimed for Spanish use. In the sixteenth century, a permanent irrigation system extended from the springs to the shore of Lake Texcoco watering about 5,800 ha in 1519 CE (Sanders 1976; Sanders et al. 1979). The high value placed on the springs has clearly become a local tradition lasting into the present, and common sense would tell us that water temples at the major springs persisted from Teotihuacan times until they were destroyed or transformed in the sixteenth century.

Among the most enduring springs was the one now enclosed within the churchyard of the Iglesia (now Catedral) San Juan Bautista. Established as a Franciscan parish church in the late 1550s, its wall (probably of even more ancient foundation) encompasses its enclosure, where a pond about 20 feet across is all that remains of one of ancient Teotihuacan's oldest springs (figure 2.7). In Teotihuacan times, as the Tetitla mural illustrates, a water temple would have guarded this sacred site and other important outflows. We can safely assume that no trace of a water temple remains; sixteenth-century proselytizing Catholics typically leveled temples and built churches on temple platforms.

The Spaniards colonizing Mexico knew the high value of water as pragmatic fact from their own cultural experiences, and they also recognized the importance of capturing sacred sites and repurposing their associations in order to proselytize and convert. In the case of the town with the springs, the patron saint John the Baptist was an ideal guardian water spirit.

Spanish-introduced grazing animals, crops, diseases, devastating population loss, and the policy of *congregación*—forced abandonment of rural villages, ca. 1600 CE—caused land degradation and massive sheet and gully erosion, with effects that are still evident in the Teotihuacan Valley. To control the Rio San Juan and the flooding of Mexico City, the Spanish constructed a dam south of



FIGURE 2.7. *Within the enclosure of the Cathedral of St. John the Baptist in San Juan Teotihuacan, a pond marks the outflow of one of the ancient city's remaining springs (photo by William Mather III).*

Acolman, creating a lake that covered the town. Meters of sediment inundated the convent of Acolman and the church of Atlatongo and obscured ancient agricultural and settlement features (Gamio 1922, 370–371).

CONCLUSIONS: IN MODERN TIMES, AN UNFORTUNATE LACK OF WATER WORSHIP

In the early 1920s, Manuel Gamio's research on the flow from Teotihuacan's 80 springs yielded an average (at the end of the rainy season) of 1,500 liters per second. In the early 1960s, William Sanders's research yielded 588.6 liters per second, a "decline apparently due to the perforation of artesian wells up-valley by large landowners" (Sanders 1965, 36). This decline was yet another blow to the water supply of the lower Teotihuacan Valley.

Hydrology of the modern Valley of Mexico in general is a fascinating puzzle, merging tempestuous and tumultuous climatic and geophysical events with a staggeringly large urbanized population. Even when palliative efforts succeed in providing some measure of stabilization of the effects of flooding, drought, erosion, earthquakes, and volcanic eruptions—and the stress of 20 million people in an area unable to adequately sustain them—the problems will always erupt again.

As more people share declining global water resources, flashpoints of stress between concerned factions of water users and water controllers highlight the growing recognition that water is not just an essential resource but also a commodity for leveraging profit and political power. In today's world, "water is the new oil," as capitalists make great profits from privatizing open-access sources and governments demonstrate power by exploiting water for local purposes, thus restricting downstream use. From neither of these factions has come much interest in sustainability, or strong sensitivity to the limitations of various kinds of water sources and how they should be respected and nurtured.

The Teotihuacano value system shares with ours an understanding that water is an essential resource of great worth. Their worldview recognized the mercurial nature of essential resources, casting the supernatural patrons of rainwater, flowing water, and water from springs in the earth as very different personalities and powers. From Teotihuacan's innovations to control the flow of water through the city and surrounding fields, we recognize a pragmatic attitude toward technological adaptations, adopting them when necessary to maintain or possibly improve crop production and housing, with resulting intensification of land use over time and some regularization of the urban landscape (see chapter 3 in this volume). The Teotihuacan Valley's long culture history of feedback relations between culture and the environment shows the principle of cultural ecology at work as human management of the landscape prompted responses in resource availability. Looking back over two thousand years of adaptive innovations and responses, we find that the Early Classic period's program of state-designed drainage and state-controlled water temples stands up well in comparison with hydrological management in other periods. The creativity of Teotihuacanos extended to their landscape of fertile fields as well as to their great city.

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NOTES

1. Settlement downslope of the Old City, if present, is now obscured by the northern Street of the Dead complex, with the Pyramids of the Moon and Sun and adjacent architecture.

2. The Pyramid of the Sun recently yielded dates ranging from 170 CE to 310 CE (Sugiyama et al. 2013, 429).

3. Xalla's location and the presence of Terminal Formative (Tzacualli and Miccaotli phases) ceramics would suggest that it was an integral part of the northern complex since its inception in the Tzacualli phase (López Luján and Manzanilla 2001, 14). The surviving architecture, however, dates from the Terminal Formative to Early Classic ceramic phases Tlamimilolpa and Xolalpan phase (Manzanilla and López Luján 2001, 6).

4. Of the temple atop the Temple Pyramid of the Feathered Serpent nothing remains except fragments of burned clay temple sculpture recovered from the fill behind the Adosada. These motifs include feathers, shells, scrolls, feathered disks, and circles (Sugiyama 2005, 76–84).

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