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Architecture, Astronomy, and Calendrics in Pre-Columbian Mesoamerica

Vincent H. Malmstrom *

INTRODUCTION

It has long been recognized by archaeologists working in Mesoamerica that the great pre-Columbian ceremonial centers of this region were the consciously planned products of societies with highly developed architectural sensitivities. The design and construction not only of individual buildings or complexes but also, on occasion, of entire cities are known to have been carried out with careful attention to such concepts as harmony, balance, and proportion. On the other hand, only relatively recently has it begun to be appreciated that many of the architectural alignments found in Mesoamerica appear to be related to the religious and/or cosmological beliefs of the early civilizations which built them. This tardy recognition of the correlation between architecture and religion is all the more surprising when we pause to consider that most of the monumental structures which these societies erected, be they pyramids, temples, or ball-courts, were meant to serve a religious function. And because an almost obsessive preoccupation with the calendar and astronomy was central to the spiritual lives of all Mesoamerican cultures (Miles 1965:284), it is only reasonable to expect that many structural orientations within this region should reflect such astronomical events as the equinoxes, the solstices, or the zenith passages of the sun. In spite of this, an alignment which has frequently been encountered on the Mexican plateau but not adequately explained to date is one that is oriented to an azimuth approximating 285º, or about 15º north of west.

The foremost example of this alignment (which is skewed some 15º clockwise from the cardinal points) is that provided by Teotihuacán, located approximately 50 km northeast of the present city of Mexico. In its heyday, which lasted from approximately the time of Christ until the mid-seventh century of the Christian era, Teotihuacán was the largest urban agglomeration anywhere in the New World. Indeed, synchronous with Rome in Europe and Peking in Asia, it may have ranked as one of the three most populous cities

*The author is especially indebted to Paul A. Dunn, Dartmouth Class of 1981, for his assistance in conducting measurements in the field, and to Mark S. Fagan, Dartmouth 1980, for preparing the final maps.

in the world at the time. It owed its greatness to a congenial site on the shore of a large lake which afforded both ease of transportation and irrigation water for the rich alluvial soils of its semi-arid mountain basin. Moreover, it was strategically located on a pass leading across the mountains which fringe the Mexican plateau so that it could effectively command the exchange of goods between the cooler, drier uplands to the west and the warmer, moister lowlands to the east. At its peak, Teotihuacán was a thriving metropolis of well over 50,000 inhabitants (some estimates place the city's population as high as 100,000 to 200,000), but a city which--as Millon has emphasized -- was as much a religious center as it was an economic node (Millon 1973:54-59).

As the configuration of this great city was revealed during the Teotihuacán Mapping Project in the 1960s and 1970s, it was realized that its principal thoroughfare--a grandiose avenue called the "Street of the Dead" by the Aztecs--was oriented 15.5º east of north, and that a grid system having this same alignment had been superimposed on all of the surrounding countryside. Even the drainage ditches separating the productive, alluvial farm-plots or chinampas, that had been reclaimed from the south end of the lake near present-day Xochimilco, display the same well-ordered orientation (Coe 1964:96). Here
was urban and regional planning on a massive scale, but what was the principle behind it? Why had the Teotihuacanos chosen to orient everything 15.5º off of north, rather than to the cardinal points?

As early as 1945 Macgowan, in a brief note published in *American Antiquity*, had commented on the fact that most pre-Columbian ceremonial centers in Mesoamerica appeared to have been oriented east of north (Macgowan 1945:118). He observed that orientations seemed to cluster in three general groups: true north, about 7º east of north, and about 17º east of north. From field measurements begun in 1971, Aveni was able to confirm that 50 of 56 sites which he examined were indeed oriented east of north, and that a 17º "family" of alignments did in fact seem to exist (Aveni 1975:166). Aveni also concluded that this particular pattern of orientation seemed to be most prevalent in the Valley of Mexico and he specifically mentioned Tenayuca, Tepozteco, and Tula as sites where this alignment was encountered. (It should be pointed out that Aveni's "17º family" of alignments includes orientations as far off as 15.5º, for he includes Teotihuacán in this "group".)

Ever since the 15.5º alignment of the Street of the Dead at Teotihuacán--and the consequent orientation of the front of the Pyramid of the Sun toward an azimuth of 285.5º--was first recognized, numerous explanations have been advanced to explain it. In 1967, Dow suggested the setting position of the Pleiades as a possible motive for such an orientation (Dow 1967:326-344), following the same line of thought as Marquina and Ruíz had presented for the orientation of the Tenayuca pyramid in 1934 (Marquina and Ruíz 1934:101-106). However, Dow also considered the rising positions of both Sirius and Dubhe as possible factors in the orientation of Teotihuacán as well. Heyden and Gendrop (1975:39) stated that the Pyramid of the Sun is oriented toward the sunset position on the day that the sun passes vertically overhead at Teotihuacán, though this

can easily be shown to be 291.0º rather than 285.5º In the same year, Heyden offered another possibility, suggesting that the Pyramid of the Sun might be aligned in the same direction as the mouth of a cave which had recently been discovered beneath the structure (Heyden 1975:131-147). Summarizing the various hypotheses on orientation which had been advanced up to 1975, Aveni also mentioned an unpublished idea of Drucker that the Pyramid of the Sun might be oriented to solar positions which utilize local topographic features (Aveni 1975:170), but he himself concluded (Aveni 1977b:5) that "they (the Pleiades) must remain the prime candidate for an astronomical motivation in the orientation of Teotihuacán." Aveni reached this conclusion after admitting in his earlier work that (1) the Pleiades would have been "invisible well before they reached the horizon of Teotihuacán" and (2) "the precessional motion of the Pleiades is so rapid that a mistake of 100 years in the dating of the baseline is equivalent to a shift of .5º in the azimuth of the setting point" (Aveni 1975:169). Recognizing the latter point as a particularly critical flaw in the "Pleiades hypotheses," Aveni has had to dismiss all later sites built on the Mexican plateau having similar orientations to Teotihuacán (such as Tenayuca, Tepozteco, and Tula) as being simply "non-functional imitations" of the great Mesoamerican metropolis (Aveni 1975:170).

More recently (1978), Aveni and his associates have investigated the distribution of "pecked cross symbols" in Mesoamerica, most of which are located on the Mexican plateau near Teotihuacán, and some of which seem "to have been modified to fit the overriding architectural plan" (Aveni et al. 1978: 279). On the basis of these observations, Aveni concludes that "Teotihuacán North" was more important than "astronomical north" and that, apart from the "surprising" discovery of similar symbols in the Petén region of Guatemala, the "data are consistent with an origin in and diffusion from the classic Teotihuacán empire" (Aveni et al. 1978:279). The fact that some of the symbols are composed of approximately 260 elements further suggests that they may have been related to the ritual-count of 260 days that was used throughout preColumbian Mesoamerica (Aveni et al. 1978:267-269).

As a result of fieldwork completed in early 1979, the present author has been able to confirm alignments to an azimuth of ~285º not only at several sites on the Mexican plateau but in the Yucatán, Petén, and Oaxaca regions as well. These observations were refined and augmented by data kindly supplied by Professor A. F. Aveni (personal communication 1979) and are tabulated in Table 22.1. Although no claim can be made for the completeness of the survey, the principal conclusions which can be drawn from the distribution which emerges are that (1) virtually all regions of Mesoamerica are represented and (2) sites ranging in age from 1000 B.C. to well into the Classic Period (A.D. 300-900) are included. In the discussion to follow, a brief resumé is given of only the major sites which have been identified elsewhere than on the Mexican plateau.

Thanks to the work of Matheny (1976:639-640), it is now known that the ceremonial center of Edzná in the southwestern part of the Yucatán peninsula was a large and thriving urban agglomeration as early as 150 B.C. It was thus essentially synchronous with Teotihuacán. It is interesting to note that the major structure at Edzná -- a five-story pyramid known in Spanish as "Cinco Pisos"--is squarely oriented to an

azimuth of 285.5º, and as the map prepared by Andrews reveals (Aveni 1975:257), a similar orientation is shared by many other structures at the site.

At Chichén Itzá, Toltec reconstruction has altered most of the buildings on the northern side of the site, but several of those on the southern side, such as Chicchan Chob and the House of the Deer, show a 285º orientation. The observatory, or Caracol, is an especially interesting case, for the older Maya core of the building has the mid-line of its front window (Window 1) oriented squarely toward 285º whereas the encircling platform and front stairway added by the Toltecs (Gendrop 1972:151) faces directly toward the summer solstice sunset.

Although individual structures at a number of smaller sites demonstrate orientations approximating 285º, it is perhaps significant that in many of the later and more peripheral ceremonial centers of the Maya cultural realm fewer and less important structures seem to share this alignment, as though suggesting that the "vogue" for such orientations gradually tended to die out both with time and distance. For example, at such recent centers as Palenque and Comalcalco on the western edge of the Maya area, no structures at all were found which were aligned to 285º.

THE ASTRONOMICAL MATRIX AT TIKAL

The largest and most impressive ceremonial center constructed by the Maya is undoubtedly Tikal, located in the rainforest of Petén, the northernmost department of Guatemala. It is dominated by five great pyramids, all of which reach or exceed 60 m in height. Although each of these structures is architecturally interesting in its own right, it is their spatial relationship to each other that is of paramount importance to any appreciation of the astronomical significance of the site. Radiocarbon dating of the lintels found in the pyramid superstructures reveals that Temples I, II, and V were all completed about A.D. 700, whereas Temple IV, the highest, was completed about 741 and Temple III was finished about 810. The range in completion dates, although spanning more than a century, should not obscure the possibility that the entire ensemble may have been planned as an integrated complex. The reason for thinking this is that Temples I and II face each other across the 80-m wide Great Plaza on an axis which runs 9º clockwise of a true east-west alignment (i.e., 99-279º), but Temple I is offset just enough to the north of Temple II so as to afford an unobstructed view of Temple IV some 730 m to the west. The roof comb of Temple II is also the lowest of the five pyramids, suggesting that although the structure lends symmetry to the Great Plaza, it was not intended by either its height or its distance from Temple I to serve any astronomical function. (The fact that the edifices fronting on the Great Plaza are oriented 9º off of the cardinal points may reflect a magnetic alignment extant in the eighth century; today the magnetic variation in the Petén averages 5º E.)

Once the spatial arrangement of the four most widely separated pyramids is mapped, it becomes apparent that Temple I served as the anchor-point of a relatively sophisticated astronomical matrix. A sight-line between the doorways of Temples I and IV marks an azimuth of 285º, whereas one between the doorways of Temples V and I

TABLE 22.1

STRUCTURES ORIENTED TO ~285º a

General Region	Site	Time-Frame	Structure	Orientation	Measurement
Mexican plateau	Teotihuacán	A.D. 0-650	Pyramid of the Sun	Front	*285.5º (M)
	Tula	A.D. 950-1150	Temple B	Side	287.1º (A)
	Tenango	A.D. 650	Principal Structure	Side	283.7º (A)
	Xochicalco	A.D. 650	Temple of Plumed Serpent	Front	286.8º (A)
Yucatán	Edzná	150 B.C.-A.D. 850	Cinco Pisos	Front	*285.5º (M-D
	Sayil	A.D. 600 (?)	Main Palace	Side	282.4º (A)
	Labná	A.D. 600	Temple of Columns: Mirador	Side	282.1º (A)
	Kabáh	A.D. 600	Codz Pop	Front	283.6º (A)
	Mayapan	A.D. 900-1300	Observatory: (152)	Front	282.8º (A)
			Temple of Sacrifices (151)	Side	282.8º (A)
	Izamal	A.D. 600 (?)	Platform, Pyramid of Kinich-Kakmo	Side	287.2º (A)
	Chichén Itzá	A.D. 700-1300	Chicchan Chob	Front	285.0º (M-D
			House of the Deer	Side	285.0º (M-D
			Caracol (mid-line -Window)	Front	*284.9-285.7º (A
	Cobá	A.D. 600	XV, XVI	Side	285.0º (M-D
	Kohunlich	A.D. 600	Ball-court	(Main axis)	285.0º (M-D
	Chicanná	A.D. 450	Groups C and E	Side	283.0º (M-D
	Becán	A.D. 450	East Group (I, IV)	Side	283.0º (M-D
			II, III	Front	283.0º (M-D
Belize-Petén	Altun Ha	A.D. 600 (?)	Structure A-5	Front	285.0º (M-D
	Tikal	A.D. 200-900	Alignment of Temple I to Temple IV	Front	*285.0º (M-D
			Alignment of Temple I to Temple V	(Right Angle)	15.0º (M-D)
Oaxaca	Monte Albán	600 B.C.-1100 A.D.	Mound Y	Front	285.0º (M-D
	Huamelulpan	300 B.C.- ?	Main Pyramid	Front	285.0º (M-D
Gulf Coast	La Venta	1000-600 B.C.	Stirling "Acropolis" & "Plaza"	Side	*285.0º (B)

a The present author has chosen to re-define Aveni's "17º family" of alignments as the "15.5º family" inasmuch as the principal structures in the major sites of Mesoamerica appear to center on this value; see asterisked items above.

b Sources of measurements: A--Aveni; B--Bernal; M--Millon; M-D--Malmström and Dunn. Inasmuch as the author and his assistant carried out their measurements with a surveyor's compass, wherever data obtained by more precise instrumentation are available, they are cited instead--rounded to a tenth of a degree.

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marks a right-angle to this, namely 15º (Fig. 22.1). Thus the placement of both Temples IV and V appears to commemorate the same recurrent alignment found in the ceremonial centers of the Mexican plateau and of the Yucatán peninsula. In addition, however, a sight-line between the doorways of Temples I and III demarcates a true east-west line and therefore the axis of equinoctial sunrise and sunset. Moreover Temple III is so located (ca. 280 m west of Temple I and 400 m southeast of Temple IV) that the middle of its roof-comb breaks the horizon precisely at an azimuth of 115º as seen from the doorway of Temple IV, permitting an accurate calibration of the sunrise position at the winter solstice. Thus, two of the great pyramids at Tikal are keyed to alignments related to 285º and a third apparently is situated so as to serve both as an equinoctial and solsticial marker. When one is aware that Tikal constitutes not only the Mayas' crowning achievement in architecture, engineering, and artistry but also a brilliantly conceived and superbly executed astronomical and calendrical matrix, one cannot but stand in yet greater awe of their outstanding abilities and accomplishments.

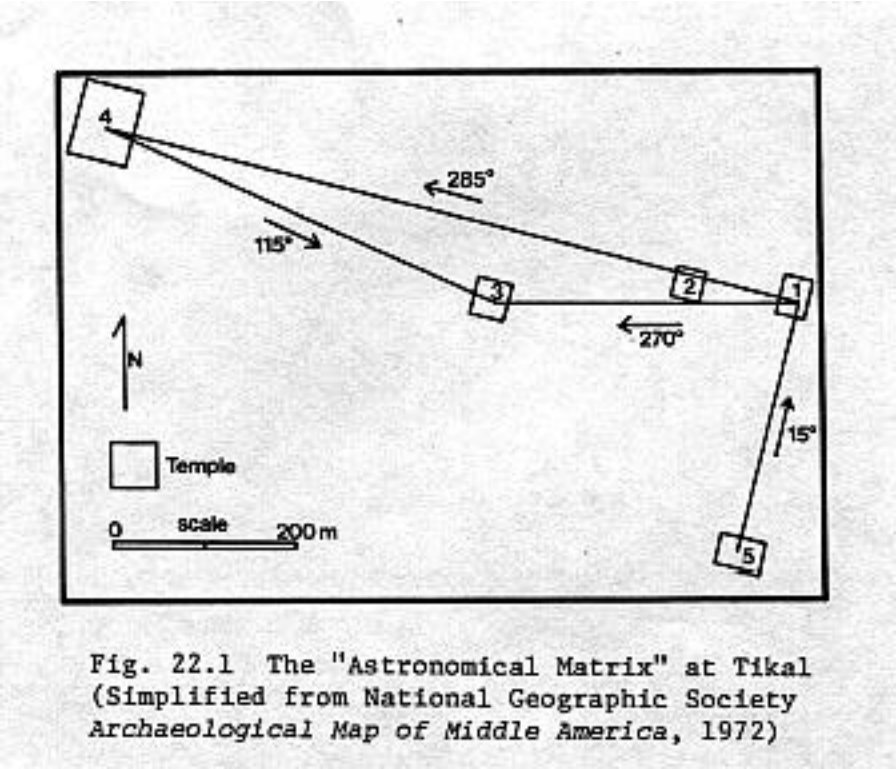


Fig. 22.1 The "Astronomical Matrix" at Tikal (Simplified from National Geographic Society *Archaeological Map of Middle America*, 1972)

SITES IN THE OAXACA AND GULF COAST REGIONS

Having confirmed the presence of architectural alignments toward an azimuth of 285º at both extremities of Mesoamerica (i.e., on the Mexican plateau in the west and in the Yucatán and Petén regions in the east), the author was encouraged to investigate the possibility of similar orientations in intervening geographic areas such as the highlands of Oaxaca and the coastal lowlands bordering on the Gulf of Mexico. The former region constitutes the core area of both the Zapotec and Mixtec peoples, and one key site in each cultural realm was selected for field study. For the Zapotecs, the site selected was Monte Albán, located on the top of a mountain overlooking the modern city of Oaxaca; for the

Mixtecs, the ancient site of Huamelulpan in the district of Mixteca Alta, some 100 km northwest of Oaxaca city, was chosen for study. In the Gulf Coast region, the site of La Venta (the "capital" of the Olmecs), was also examined for structural orientations with the help of a map.

Monte Albán dates back to at least 600 B.C. and has been rebuilt in whole or in part several times during its long history. Today virtually all of the mountain-top site conforms to a rigid symmetry oriented to an axis running about 5º east of north. The only structure that deviates markedly from the overall layout is an arrowhead-shaped edifice known as Mound J. Because of its strange configuration and its lack of conformity with the remaining structures in and around the Great Plaza, Mound J has been interpreted as an “observatory," and Aveni has argued that its orientation toward an azimuth of 45º commemorates the heliacal rising of the star Capella, which heralds the passage of the vertical sun over Monte Albán. In support of his contention, Aveni observes that there is a zenith-tube located in Mound P, a structure situated directly to the northeast of Mound J. Without challenging this explanation, one can only wonder what Mound J originally looked like, for it is known to have been rebuilt about the time of Christ and was also probably involved in the total renovation of the site which occurred about A.D. 600. In any event, neither Mound J nor any other structure in and around the Great Plaza demonstrates an alignment toward 285º. Nevertheless, lying half a kilometer to the northeast of the Great Plaza on a lower ridge of the same mountain is a structure known as Mound Y; its orientation is visibly at variance from the general plan of the site even at a distance. Although some restoration of Mound Y has taken place, the largest stones (comparable to those used in the construction and reconstruction(s) of Mound J) which form the foundation platform for the temple have quite obviously not been moved since they were first set in place. Thus Mound Y appears to have been one of the earliest buildings to have been erected at Monte Albán but, unlike Mound J, it does not seem to have been rebuilt on the two occasions that the Great Plaza was reconstructed. It is in all likelihood the oldest structure on the site that still retains its original alignment. Significantly, the front of the platform of Mound Y was found to face squarely toward an azimuth of 285º.

The site of Huamelulpan in the Mixteca Alta district is a far more remote and modest site than Monte Albán. In fact, it consists today of no more than one partially excavated and restored temple. Although the upper walls of the temple have been largely destroyed through centuries of neglect and agricultural activity, the lower foundation is still solidly in place. The southeast corner of the temple is especially interesting, because it is composed of several massive, well-dressed stones measuring up to 2 m in length, almost 1 m in width, and about 0.5 m in thickness. There one finds a beautifully preserved carving of a lizard, underlain by calendrical symbols that pre-date the initiation of the Long Count (i.e., at least going back before the third century B.C.). Once again the front of the temple foundation was found to be oriented precisely toward an azimuth of 285º.

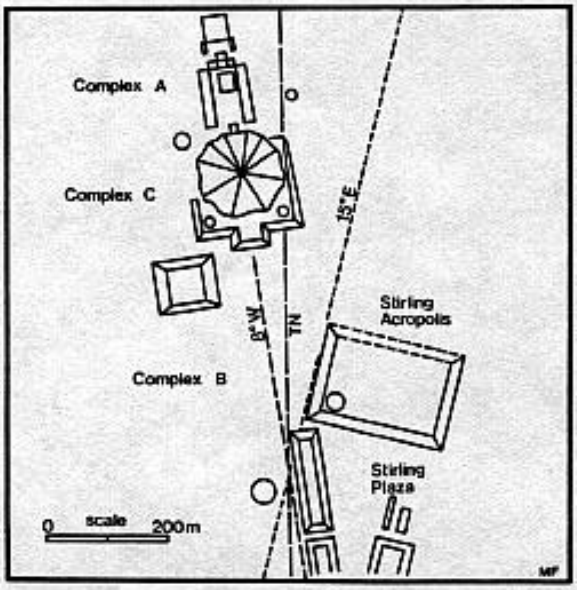


Fig. 22.2 Structural alignments at La Venta (from Bernal 1969:34)

Because accurate field studies of some of the most ancient ceremonial centers of Mesoamerica (namely those erected by the "Mother Culture" of the region, that of the Olmecs) were precluded in this survey, it was decided to utilize the site map of La Venta, an accessible reproduction of which is found in a publication by Bernal (1969:34). Although it has been known ever since the site was first excavated by Stirling that its principal orientation lay 8º west of true north, what has apparently been overlooked is the fact that the structures that comprise the so-called Stirling "Acropolis" and Stirling "Plaza" are aligned some 23º to the east of that axis. In other words, the Stirling "Acropolis" looks 15º east of north, while its northwestern face is oriented once again toward an azimuth of 285º (Fig. 22.2). Although the discovery of this alignment at Monte Albán pushed the origin of this "innovation" back at least as far as 600 B.C., its presence at La Venta means that even the Olmecs were commemorating this orientation as long ago as 1000 B.C.!

THE MEANING OF THE 285º ALIGNMENT

Because many of the sites listed in Table 22.1 were either synchronous with Teotihuacán or preceded it, the possibility that the pattern of orientation toward an azimuth of 285º originated in or diffused from that great pre-Columbian metropolis is thereby ruled out. Furthermore, the geographic distribution of 285º orientations occurs through such a broad zone of latitude (roughly 5-8º depending on which sites are being included) that a stellar association of any kind must be totally discounted. Similarly, they are found through such a wide longitudinal range that a uniform magnetic alignment is likewise precluded. The variation within Mesoamerica currently exceeds 5º between the easternmost reaches of the Yucatán and the westernmost areas of the Mexican plateau. A lunar association with an azimuth of 285º is also quite unlikely, because only the most

extreme moonset positions are easily definable, and in the northwest quadrant of the sky these occur at approximately 290º and 300º. Therefore, unless one is willing to discount all such 285º orientations as coincidences, one must ascribe a solar origin to them, for no other explanation can be advanced which is both spatially and temporally consistent through the whole of Mesoamerica during a time span of well over 2000 years.

Because the azimuth of 285º demarcates a point on the western horizon some 15º north of west, it is apparent that it must commemorate a sunset position at a time of the year when the sun is overhead in the northern hemisphere--i.e. between the vernal equinox (March 21) and the autumnal equinox (September 21). Obviously, because this is not the summer solstice sunset position--an azimuth that averages 295º throughout the Mesoamerican region--it could commemorate a date either before June 22 or after it. With the assistance of a solar ephemeris or a nautical almanac one can determine that an average sunset position of 285.5º is recorded throughout Mesoamerica before the summer solstice on April 30-May 1, and after the summer solstice on August 12-13.2 Of these two possibilities, the latter is definitely the more interesting to students of Mesoamerican calendrics. This is because the Maya--the most highly advanced of all Mesoamerican peoples in the realm of astronomy--believed that the present era of the world began on August 13, 3114 B.C., according to the Goodman-Martinez-Thompson correlation between the Maya and Christian calendars. Ironically, Thompson himself dismissed the correspondence between the beginning date of his correlation and an astronomical origin for the most ancient of Mesoamerican calendars, the 260-day ritual almanac, as being coincidental (Thompson 1960:98). However, recurrent building alignments throughout Mesoamerica appear to commemorate a date which can only have had astronomical (i.e., solar) origins or, at the very least, could only have been established by astronomical means--i.e., by counting the number of days from some fixed point in time. (In the latter regard it should be pointed out that the August 13 sunset position could easily have been defined simply by counting 52 days from the summer solstice.) In the light of the evidence at hand, one can conclude that far from being just one more in a series of "coincidences," the correspondence of building alignment azimuths throughout Mesoamerica and the beginning date of the Goodman-Martínez-Thompson correlation should more realistically be considered as additional proof of the validity of the latter. (3)

If the 285º architectural alignments indeed lend support to the Goodman-Martínez-Thompson correlation, they also perforce support the argument that the "beginning of time" as defined by the Maya actually commemorates an astronomical event--not necessarily a one-time "happening" but some solar occurrence which is replicable every August 13. It is highly unlikely, however, that sunset on that day, in and of itself, would be sufficient cause to initiate a calendar such as the 260-day sacred almanac. In that case it would be far more likely that the explanation first put forward by Nuttall in 1928 is the correct one. She argued that the 260-day count probably could be traced to the interval between vertical sun positions at the latitude of Copán, the Mayas' principal astronomical center, located just south of the fifteenth parallel of latitude in the mountains of western Honduras (Nuttall 1928). This argument won further support from Merrill who remarked on the correspondence between the first zenith passage of the sun

at Copán (i.e., August 13) and "the beginning of time" as calculated by the Goodman-Martínez-Thompson correlation (Merrill 1945:307-311). However, both arguments were dismissed by Thompson, who preferred to believe that the 260-day almanac was either (1) an approximation of the human gestation period, or (2) simply a permutation of the numbers 13 and 20, both of which had magical significance to the Maya (Thompson 1960:98-103). (Obviously, if one adopts either of the latter explanations, an August 13 beginning for the sacred almanac has to have been a coincidence.) Even so, one is left wondering whose gestation period was so important as to commemorate it, and specifically how did one decide when it actually began? Or similarly, what day was so remarkable that a series of permutations of 13 numerals with 20 day-names was initiated on that date and none other?

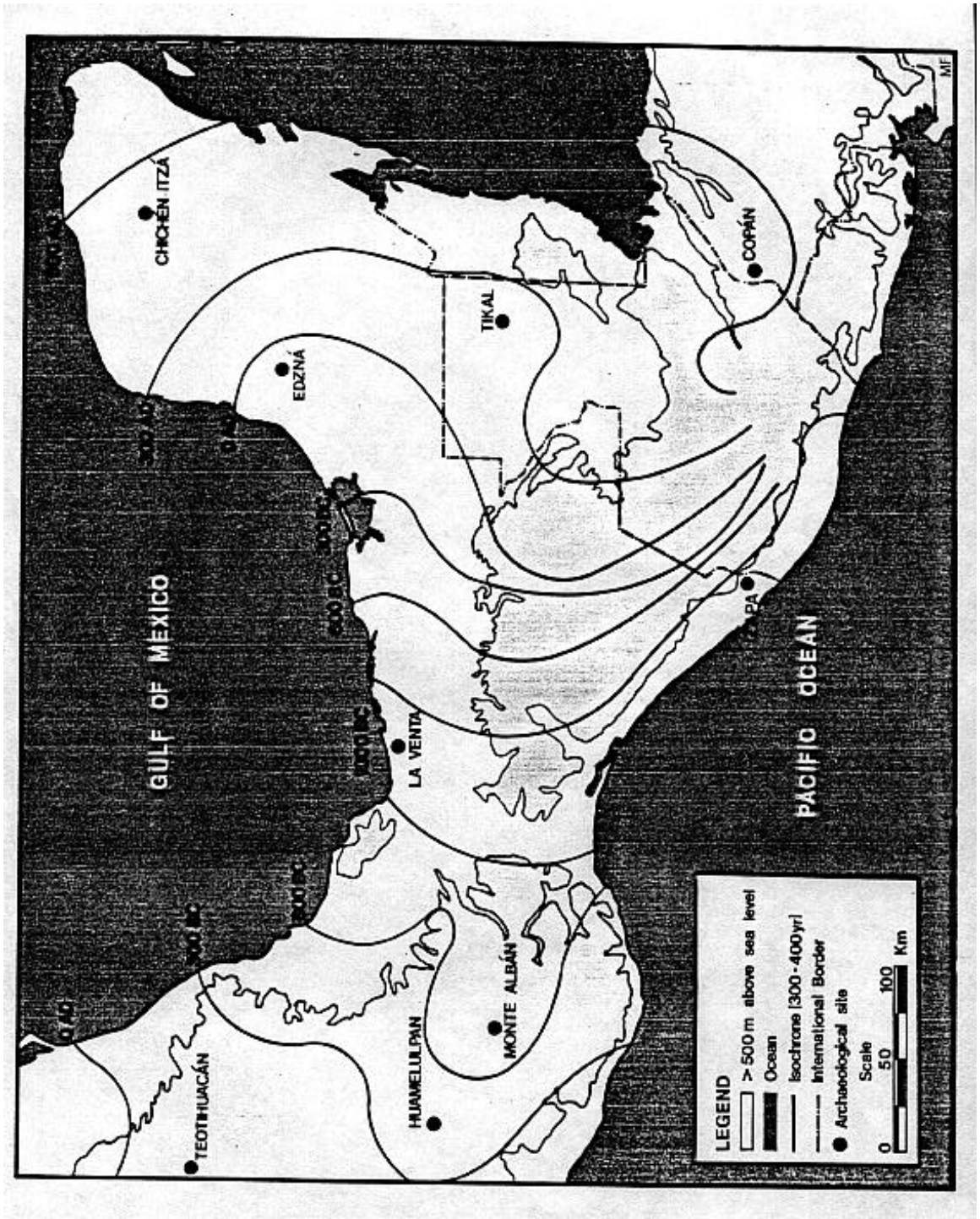
Although both Nuttall and Merrill were correct in pointing out that the sacred almanac could be accurately calibrated at Copán, they were wrong in hypothesizing that the 260-day count had actually begun there. In an earlier paper, I have demonstrated that both geographical and historical arguments can be raised against such a contention (Malmström 1973:939). On the first score, they appear to have overlooked a very cogent observation made by the German naturalist Gadow in 1908 and cited by Thompson (Gadow 1908:303). Gadow argued that the 260-day count must have begun in a tropical lowland region because several of its day-names commemorate animals such as the alligator, monkey, and iguana; none of these is native to the highland ecological niche of oak and pine forests where Copán is situated. On the second score, they both seem to have been unaware that Copán was a relatively recent ceremonial center, whereas the sacred calendar was a very ancient creation. Morley, for example, points out that the oldest dated monument at Copán goes back only to A.D. 465 (Morley 1946:59), while also contending that the ritual almanac must have been devised at least as early as the fourth century B.C. (Morley 1946:47). Even if one accepts Morley's relatively conservative estimate of the calendar's age, one is confronted with a hiatus of at least eight centuries between the time when the count supposedly started and the ceremonial center of Copán was founded. It was for these reasons, therefore, that I was prompted to look for a tropical lowland site on the same parallel of latitude as Copán but of sufficient antiquity to qualify as the birthplace of the 260-day sacred almanac. This I identified as the large ceremonial center known as Izapa, located on the Pacific coastal plain of Mexico adjacent to the Guatemalan border. Here a tropical rainforest environment surrounds a site whose earliest radiocarbon date goes back to 1500 B.C. (Ekholm 1969:1).

Therefore, if the alignments of buildings throughout Mesoamerica to an azimuth of 285º do indeed commemorate the sunset position on August 13, they not only help to confirm the validity of the Goodman-Martínez-Thompson calendar correlation, but they also testify to an astronomical origin for the calendar on which it is based. Moreover, they conclusively restrict the geographic origin of that calendar to a location where the date of August 13 was locally significant--in other words, just south of the parallel of 15º north latitude. Ironically, the 285º alignments provide precisely the kinds of clues that Thompson argued the 260-day almanac did not provide. For example, Thompson wrote

that there were "serious drawbacks" to the thesis that the 260-day count represented the interval between zenith sun positions because this interval varies across Mesoamerica from 260 days on the south to 311 days on the north: "One must assume, then, that the cycle of 260 days originated on the periphery of the area in which it was current, and that, spreading northward and westward, it was eagerly adopted by peoples for whom it had no solar significance" (Thompson 1960:98). That, in fact, seems to be exactly what happened, for orienting one's buildings and ceremonial centers to an azimuth that had no meaning except at the latitude of Izapa must have been a learned pattern of behavior which diffused along with the ritual almanac itself. Thompson wrote further that "there is absolutely no evidence that the 260-day cycle originated in the vicinity of Copán or anywhere along latitude 14º30' which is on the periphery of the area it covered" (Thompson 1960:98). Yet that evidence has lain undiscovered and unappreciated all these years in the very alignments of the great religious edifices and ceremonial centers themselves. Indeed, there are probably few other regions of the world where the principles of architecture, astronomy, and calendrics found so intimate and dramatic a blending as they did in pre-Columbian Mesoamerica. Today, as we gaze at the grid pattern rigidly superimposed by Teotihuacán on the valley of Mexico or the majestic pyramids rising out of the rainforest at Tikal, we must marvel anew at the complementary roles which science and religion played in the lives of these now-dead civilizations.

Finally, we must recognize in this diffusion of almanac and architectural alignments a spatial-temporal scenario that is perfectly consistent with an Izapa-based point of origin. In an earlier publication (Malmström 1978:105-116), I presented a reconstruction of the chronology of the Mesoamerican calendrical systems that now gains further support from these architectural findings. For example, if La Venta was commemorating August 13 at 1000 B.C., it is obvious that the calendar must already have been well established by then. Indeed, my reconstruction postulated an origin in the fourteenth century B.C. (Malmström 1978:108). This suggests that a fairly rapid diffusion had taken place through the lowland corridor of the Tehuantepec Gap into what has been called the "metropolitan area" of the Olmecs (Bernal 1969: 16), and that thereafter it had spread into the highlands of Oaxaca, reaching the Mexican plateau sometime before the birth of Christ. About the same time it was showing up in Edzná, the first great urban center of the Maya; it then gradually diffused east and southwards to reach such peripheral areas as Chichén Itzá and Copán. (Fig. 22.3 presents a hypothetical reconstruction of the diffusion pattern of the 260-day sacred almanac.)

Because no calendrical inscriptions have been found at La Venta, we must turn instead to Monte Albán, which has the oldest recorded dates of any site in Mesoamerica (ca. 600 B.C.). It was for this reason that Caso was led to hypothesize that the calendar had, in fact, first been developed there (Caso 1971:333-348). But neither at Monte Albán nor at Huamelulpan (where the dating has been given as 300 B.C.) has any evidence of the Long Count been found (Broda de Casas 1969:80, 83). The latter represents the fusion of the 260-day almanac with the 265-day secular calendar in such a way that it records both



a number and a day-name in each of the counts. (For example, in the Long Count a day would be known as 4 Ahau 8 Cumku, the first number and name being its designation in the sacred almanac and the second being its position in the secular calendar; prior to the initiation of the Long Count the same day would have been recorded simply as 4 Ahau.) The earliest Long Count dates yet discovered record events around the time of Christ, suggesting that it did not come into use until some time between 300 B.C. and A.D. 0; again, this conclusion is entirely consistent with my earlier reconstruction, which had

pinpointed a date of 235 B.C. for its inception (Malmström 1978:108). Unlike the 260-day almanac, however, the Long Count was never adopted in the highlands of Oaxaca or on the Mexican plateau, and remained confined almost entirely to the Maya dominated areas of Mesoamerica. Similarly, the notational system used to record calendrical dates shows a corresponding variation between the Oaxaca and Mexican plateau regions to the west--both of which gradually came to employ only dots for numbers--and the Maya culture realm to the east, where the original notational system employing both dots and bars (the latter signifying a value of 5) continued in use throughout pre-Columbian times.

CONCLUSION

It has long been known that the sacred 260-day calendar was utilized by all of the pre-Columbian civilizations of Mesoamerica, from the Maya in the south and east to the Aztecs and Tarascans in the north and west. Only recently has it been recognized that recurrent architectural alignments centered on an azimuth of 285.5º are also spatially distributed over a similarly extensive geographic area, ranging from the rainforests of the Yucatán and Petén on the one hand to the semi-arid basins of the Mexican plateau on the other. Because these alignments involve structures spread over nearly 10º of latitude and almost 20º of longitude and were constructed during a span of more than 2000 years, any astronomical significance they may have would appear to commemorate a recurring event that remained essentially unchanged throughout this expanse of space and time. This event seems to have been sunset on the thirteenth of August, a date which the Maya equated with "the beginning of time" in the Goodman-Martínez-Thompson correlation. Because August thirteenth also marks the southward passage of the zenith sun over the fifteenth parallel of north latitude, initiating a 260-day period which ends on the following May first when the northward passage of the zenith sun occurs at the same place, there is the strong likelihood that these alignments not only testify to the astronomical origins of the 260-day sacred calendar but also to its specific geographic birthplace at the Early Formative site of Izapa on the coastal plain of southeastern Mexico. A diffusion of the sacred calendar from Izapa beginning in the fourteenth century B.C. is perfectly consistent both spatially and temporally with what is known of the ages of alignments of key structures at a number of major archaeological sites distributed throughout the length and breadth of Mesoamerica.

(2) At 0º horizon altitude, sunset positions on these dates vary from 285.4º at 13º N latitude to 286º at 20ºN latitude.

(3) Although at least nine other correlations have been proposed, none of them comes within 40 days of the beginning date of the Goodman-MartínezThompson correlation. In terms of sunset azimuths, the closest approximation is some 8º away. The Spinden correlation, which is the best known of the other systems, employs a starting date of October 15, when the sun is vertically overhead at approximately 8º south latitude and its sunset azimuth is about 262º.

(This article was published as Chapter 22 of *Archaeoastronomy in the Americas* edited by Ray A. Williamson, Ballena Press/Center for Archaeoastronomy, 1981, pp.249-261.)

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