THE CALENDRICAL SYSTEMS OF PRE-COLUMBIAN MESOAMERICA: A RECONSTRUCTION OF THEIR ORIGINS AND DIFFUSION

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Abstract: In earlier papers the author has presented evidence for the development during the 14th century B.C. of both the 260-day ritual almanac and the 365-day secular calendar at the Formative site of Izapa near the Pacific coast of southern Mexico. In this paper he traces the spatial and temporal diffusion of these calendrical systems throughout Mesoamerica using archaeoastronomic, architectural, and geomantic data. He identifies a center of major calendrical innovation at Edzná in the Yucatán and demonstrates the importance of the calendar in city-planning, both among the Maya and on the Mexican plateau.

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As the author has demonstrated in an earlier paper, the convergence of astronomical, geographical, and historical evidence strongly suggests that the 260-day ritual almanac which was in use throughout Mesoamerica in pre-Columbian times was developed at the large Formative site of Izapa near the Pacific coast of southern Mexico. (1) In support of his contention that the ritual almanac had an astronomic origin, he has shown that only at the latitude of Izapa (14°45' N.) can a 260-day interval be measured between zenithal sun positions, and that such an interval can only be measured commencing on August 13 -- a day which the Maya commemorated as 'the beginning of the world', according to the Goodman-Martinez-Thompson correlation. His geographic argument centers on the fact that Izapa is the only archaeological site located on this parallel which is likewise situated in a lowland tropical environment where animals such as the alligator, monkey, and iguana are found -- all of which were used as day-names in the ritual almanac. And finally, he has pointed out that Izapa is the only archaeological site located at this latitude which would have been in existence early enough to have served as the birthplace of the ritual almanac, that is, by about 1500 B.C.

While carrying out field-work at Izapa, the author found additional evidence -- admittedly circumstantial -- that the 365-day secular calendar, which was also used in pre-Columbian Mesoamerica, could likewise have been devised at the same ceremonial center. At this site the true length of the solar year could have been determined simply by counting the number of days that elapse between successive sunrises over Tajumulco, the highest volcano in Central America -an event that, as seen from the main pyramid, takes place each year on the summer solstice. Subsequent investigations revealed that more than thirty of the major ceremonial centers of Mesoamerica appear to have been located according to the same principle of solstitial orientation, that is, they are situated directly in line with a sunrise or sunset position over the highest topographic feature within sight on either June 21 or December 22. (2) Although several of the oldest ceremonial centers in Mesoamerica demonstrate such an alignment, including the Olmec sites of San Lorenzo and La Venta which have been dated to 1200 and 1000 B.C. respectively, it can,
of course, be argued that this geomantic principle was first developed in the Gulf coastal plain of Mexico, as the Olmec culture itself is supposed to have done. Although the author believes that a stronger case can be made for the discovery of this principle at Izapa, where the topographic marker in question is scarcely 30 kilometers away than at either San Lorenzo or La Venta, where the mountains to which they are oriented lie at a distance greater than 120 kilometers, he recognized that more convincing evidence for the origins of the calendrical systems at Izapa would be required before his hypothesis would win general acceptance.

That evidence now seems to have been found in the astronomical orientation of key structures in all of the major pre-Columbian ceremonial centers. From the Valley of Mexico in the north and west to the Yucatán and Petén regions of the south and east, the alignments of buildings erected by such diverse cultures as the Olmecs, Zapotecs, Mixtecs, and Mayas all demonstrate a common azimuth approximating 285º. Throughout the entire Mesoamerican realm this azimuth corresponds to the sunset position on August 13 -- a date that has astronomical significance only at the latitude of Izapa. That such a date would have been commemorated anywhere else in Mesoamerica meant that its meaning would have to have been known, namely that it marked “the beginning of the world”; that it could have been commemorated meant that a 'formula' for its determination would have to have been understood, namely counting fifty-two days following the summer solstice. Thus, both the knowledge of this date and the mechanism for calculating it, appear to represent innovations whose geographic diffusion outward from Izapa was susceptible to reconstruction. It is the result of this reconstruction that the author now wishes to present.

Using clues supplied both by the Maya themselves and early Spanish chroniclers such as Bishop Landa of Yucatán, the author first sought to reconstruct the chronology of calendrical innovation in Mesoamerica. Although the detailed results are published elsewhere, (3) the critical dates may be summarized as follows: (1) the creation of the ritual almanac at Izapa about 1358 B.C.; (2) the determination of the length of the solar year and the invention of the secular calendar, also at Izapa, about 1323 B.C.; (3) the development of the so-called “Long Count” -- a means of meshing the two calendars for reasons of precision, most probably at Izapa in 235 B.C.; and (4) the shift of the Maya New Year's, Day to July 26, at a site in the Yucatán, about the year 40 A.D.

Although the great antiquity of calendrical innovation in Mesoamerica may at first glance seem surprising, recent excavations near Izapa carried out by Lowe and his associates suggest that a major change in dietary patterns took place in that region shortly after 1400 B.C. -- a shift from a dependence on manioc to maize. (4) Indeed, it may have been that the organized cultivation of maize prompted calendrical experimentation, for unlike a root crop, some knowledge of the seasonality of precipitation patterns is necessary to secure the success of the harvest. In any case, Coe also argues for the 'high antiquity' of the calendrical systems in Mesoamerica, on the basis of their consistency of symbolism and internal ordering, (5) and believes that the ritual almanac was already in use at the time of the founding of the oldest Olmec ceremonial center of San Lorenzo in 1200 B.C. (6)
However, evidence that peoples elsewhere than at Izapa were celebrating August 13 seems first to appear at La Venta, a site dated to 1000 B.C. which has been termed 'the capital of the Olmecs'. Although the principal axis of La Venta runs 8º west of north, the so-called "Sterling Complex", which forms the southern nucleus of the ceremonial center, is oriented 23º away from this line, i.e., 15º east of north. Thus, the assemblage of structures in this complex, all being perpendicular to the latter axis, demonstrate an alignment squarely toward an azimuth of 285º. (7)

That calendrical innovations from Izapa should have reached San Lorenzo by 1200 B.C. or La Venta by 1000 B.C. is hardly surprising. Although both of them are situated in the Gulf coastal plain, they have ready access to the Pacific through the Tehuantepec Gap, the lowest inter-ocean corridor in all of Mesoamerica. Indeed, diffusion across the isthmus would have meant simply following the 'line of least resistance' for any innovation originating in Izapa.

By the sixth century B.C. the calendar seems to have penetrated into the mountains of southern Mexico, no doubt following the valley of the Tehuantepec River. In any case, Monte Albán, the large and impressive Zapotec site which overlooks the modern city of Oaxaca, demonstrates the oldest calendrical inscriptions ever found in Mesoamerica -- a fact which led the Mexican archaeologist Alfonso Caso to conclude that the calendar had indeed been invented there. Despite the antiquity of its inscriptions, however, Monte Albán satisfies none of the requisite conditions for having served as the calendar's birthplace. Moreover, one of its oldest and least altered structures -- a building known as Mound Y -- is pointedly aligned toward the western horizon at an azimuth of 285º, in contrast to the assemblage of buildings surrounding the Great Plaza, all of which have been rebuilt one or more times and today adhere to a rigid orientation that is essentially north-south.

Some 100 kilometers to the northwest of Monte Albán lies the ancient Mixtec capital of Huamelulpan. Although it is a far more modest site that the Zapotec capital, Huamelulpan provides clear evidence in its magnificent calendrical inscriptions that the ritual almanac was already in use among the Mixtec peoples by 300 B.C. Similarly, the orientation of its main pyramid to an azimuth of 285º suggests that the significance of August 13 was known and commemorated in the rugged Sierra Madre del Sur by this time. Moreover, the fact that its calendrical inscriptions -- like those of Monte Albán -- employ only the ritual almanac and not the Long Count lends further support to the author's contention that the latter was first developed in 235 B.C., and then most probably at Izapa.

By about the time of the birth of Christ, the calendars appear to have reached both the Mexican plateau in the north and the base of the Yucatán peninsula in the east. In both of these areas there is dramatic evidence of the interplay of astronomic, calendric, and religious factors in the layout and design not only of major architectural structures but also of entire cities or ceremonial centers. Let us look first at the Valley of Mexico where the greatest metropolis in pre-Columbian America arose. Located some 50 kilometers to the northeast of Mexico City, Teotihuacán is estimated to have been one of
the three most populous cities in the world in its day (100 B.C.-650 A.D.). Architecturally, the city was dominated by the more-than-60-meter high Pyramid of the Sun and its somewhat smaller companion, the Pyramid of the Moon, which is situated directly north of it and thus helps to fix the meridian of the city. More important to our argument, however, is the realization that the Pyramid of the Moon demarcates the northern end of the "Street of the Dead" -- the grand axis to which the entire city is meticulously gridded. This axis is aligned precisely toward an azimuth of 15.5º, meaning that the Pyramid of the Sun which was constructed at right angles to it, faces 285.5º -- the sunset position on August 13. Thus, lest we dismiss this as a pure coincidence, we have strong circumstantial evidence that an event whose significance could only have been known at Izapa was 'immortalized' in the very plan of the largest urban center ever to emerge in the pre-Columbian New World.

Were Teotihuacán the only urban center which demonstrates such an orientation on the plateau of Mexico, it might well be considered a 'coincidence', but it is not. As Aveni and others have shown, there are a whole host of later sites in this region that appear to have used Teotihuacán as their 'model' and adopted similar orientations. (8) However, it is to the Mayan realm that we turn next, for about the same time that Teotihuacán was taking shape near the shores of the Lake of the Moon in the Valley of Mexico, the first true urban center of the Maya was evolving in the largest alluvial lowland of Yucatan. This was Edzná, whose initial settlement Matheny has traced to about 150 B.C. and whose agricultural support system was linked to the central-city by an elaborate pattern of radial canals. (9) At the very heart of the canal system stands a five-story pyramid known as Cinco Pisos, and at the base of whose stairway is a stela, or gnomon, capped by a disk of stone.

The author was first led to Edzná by his investigations into the chronological development of the Mesoamerican calendrical system, for it appeared that it was there -- at a latitude of 19º 30' N. -- that the Mayas 'corrected' the calendar so that their New Year's Day would fall on July 26, the date when the zenithal sun passes southward over Edzná. The fact that Thompson found a one-day correction in the calendar first being implemented at Edzná and then gradually winning adoption throughout the Maya world also suggests its authoritative position in calendrical affairs. (10) Certainly, the presence of a specially designed gnomon at the base of the main pyramid likewise argues for a careful calibration of the passage of the zenithal sun having been carried out at Edzná.

More relevant to our present concern, however, is the orientation of Cinco Pisos itself. Built atop a man-made platform some eight meters in height, Cinco Pisos looks out across a plaza toward an elongated mound of stone that appears to have been used as an artificial horizon. Near the middle of the mound, immediately opposite the doorway opening into the courtyard of Cinco Pisos, is a notch, and immediately behind the notch rises the apex of a pyramid. Lined up like a gun-sight, the doorway, the notch, and the pyramid yield a precise orientation of 285º. Definitive as this alignment is, there may have been two further sight-lines possible from the same doorway -- one over the southern end of the mound demarcating the equinoxes, and one over the northern end of the mound marking the summer solstice. In any event, from the top of Cinco Pisos an
almost unobstructed 360 degree view of the true horizon, some 30 kilometers distant, is obtained. Only at one point -- an azimuth of 300º -- does a man-made feature, in this case, a large pyramid, intersect the true horizon. Since this is exactly 5º past the northernmost setting point of the sun, it can only mark the extreme northern still-stand of the moon -- a fact which suggests that Cinco Pisos may have served as the oldest lunar observatory in the New World. For a people as astronomically sophisticated as the Maya, it may seem strange that they were still experimenting with the prediction of lunar eclipses as late as the first centuries of the Christian era; yet, as Coe notes, the earliest calendrical inscription which carries a lunar notation dates only to 357 A.D. (11) One must, however, conclude that Edzná was not only the earliest large urban agglomeration produced by the Mayas, but also a major center of astronomical and calendrical innovation.

Although the orientation of major edifices to an azimuth of 285º recurs in site after site throughout the Mayan region, the two most dramatic examples are found at Chichén Itzá in northeastern Yucatan and at the Maya capital city of Tikal in the Petén region of northern Guatemala. For example, at El Caracol, the great observatory of Chichén Itzá -- a building whose lack of architectural symmetry and balance led Thompson to malign it as the ugliest creation of the Mayas (12) -- the author found that what the structure lacks in beauty, it more than makes up for in precision of function. Although its main stairway is oriented squarely toward the setting sun on the summer solstice, the mid-line of its principal doorway and window aim precisely at the sunset position on August 13.

The final and supreme test of the author's hypothesis, however, came in the rain forests of northern Guatemala. There, where the crown height of the trees averages 50 meters, the Mayas were obliged to build 'sky-scraper' pyramids in excess of 60 meters to observe the heavens or see the horizon. Five such structures dominate the site, all of which date to the 8th century A.D. and appear to have been conceived as the components of a sophisticated astronomical matrix. Thus, a sight-line from the center of the doorway of Temple I to the corresponding position in Temple IV, the highest pyramid in the complex, yields a bearing of 285º, whereas a similar measurement between Temples I and III has an azimuth of 270º, which, of course, marks the sunset position on the equinoxes. From Temple IV it will be seen that the roof-comb of Temple III is just high enough to intersect the horizon, and in the process it fixes the sunrise position on the winter solstice at an azimuth of 115º. Moreover, from Temple V to Temple I we have a bearing of 15º which forms a perfect right-angle with the sunset position on August 13 and may have served as a means of confirming that date using the star Kochab. Only Temple II, just across the main plaza from Temple I, fails to reveal a demonstrable astronomic function, and seems instead to have been constructed to provide an esthetic counter-weight to its massive neighbor.

From the foregoing evidence, several conclusions seem justified. First, that the ritual almanac does appear to have had an astronomic basis, namely, it originated as a measure of the interval between zenithal sun positions just south of the 15th parallel of north latitude. Second, the fact that this interval commences on August 13, a date which
the Maya themselves believed marked the 'beginning of the world', can scarcely be considered a coincidence, but should more likely be regarded as additional proof of the validity of the Goodman-Martínez-Thompson correlation. Third, the geographic hearth of calendrical innovation in Mesoamerica can be pinpointed as having been the Formative site of Izapa on the Pacific coastal plain of southern Mexico. Fourth, the author's reconstruction of the chronology of the calendars' invention and diffusion is perfectly consistent with radiocarbon dates for the establishment of major ceremonial centers throughout the Mesoamerican realm. And fifth, the significance of the August 13 date and the means of determining it, elsewhere than at Izapa, not only diffused as widely as the calendars themselves, but also appears to have served as a 'model' for the layout and design of several major urban and/or ceremonial centers including Teotihuacán', the largest pre-Columbian city in Mesoamerica.

References


6. Ibid, p. 112.


11. M.D. Coe, op. cit., p. 120.


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