

A) ARQUEOASTRONOMÍA MAYA: LA ARQUEOLOGÍA

Chapter 4

EDZNA: EARLIEST ASTRONOMICAL CENTER OF THE MAYA?

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Although the archaeological site of Edzná is one of the more accessible Mayan ruins, being located scarcely 60 km to the southeast of the port-city of Campeche, it has until recently escaped the notice which its true significance would seem to merit. Not only does it appear to have been the earliest major Mayan urban center, dating to the middle of the second century before the Christian era and having served as the focus of perhaps as many as 20,000 inhabitants, but there is also a growing body of evidence to suggest that it played a key role in the development of Mayan astronomy and calendrics. Among the innovations that seemingly had their origin in Edzná are the Maya's fixing of their New Year's Day, the concept of "year bearers", and what is probably the oldest lunar observatory in the New World.

Geographic Setting

The site of Edzná is located near the northern end of what is probably the largest solution-basin in all of peninsular Yucatan. Measuring almost 90 km from north to south and averaging about 20 km in width from east to west, the basin has soils of stratified clay that are unusually deep for this region of tabular limestone. (1) Although the water table is some 20 m below the surface -- which over most of the basin floor approximates an elevation of 30 m -- there is no local sink-hole or cenote to serve as a supply of water. On the other hand, the heavy clay soils become so impermeable to water once they become soaked that they retain the summer rains well into the winter dry season. Hence, it was this combination of deep, productive soils and a dependable source of surface water that led the initial Mayan settlers to identify this location as a premium agricultural area. (It is likewise interesting that one of eastern Mexico's largest land reclamation programs was undertaken in the Edzná basin for precisely the same reasons.) (2)

As the early Maya were quick to appreciate, access to fresh water held the key to life in this low, rolling region of porous limestone. Climatically, the western portions of Yucatan are marginally deficient in moisture even under the best of circumstances. Water-budget studies at Tixmucuy, a station some 15 km to the west of Edzná, record on average a deficit of more than 330 mm. of moisture per year (fig. 1) (3) As a result of the constantly high temperatures, and consequently high water need, in the area, the native vegetation tends to consist of trees of low to medium height (i. e., up to 15 m), about half of which lose their leaves in the dry season. In common with the rest of Mexico, the Campeche region experiences a marked seasonality in its rainfall regime,

with fully 7/8 of the total coming between the months of May and October. Thus, not only is water in short supply, but it is also very poorly distributed throughout the year. For this reason, in the Edzná area access to water may have provided the initial impetus to settlement, but the continued control of water was essential to insure its permanence.

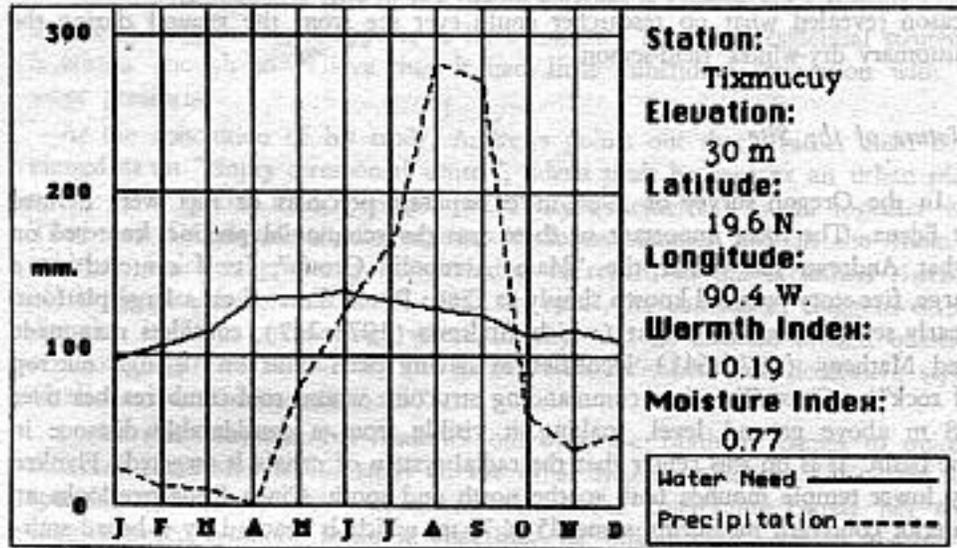


Figure 1.
 Annual Water Need and Precipitation at Tixmucuy Station, Campeche

It was Matheny who, in his investigation of the site between 1971-1974, first recognized the monumental hydraulic system that the Maya had constructed there in the late pre-Classical period. He noted that over 20 km of canals and reservoirs had been built to serve Edzná, of which the main canal alone was over 12 km in length, averaged some 50 km in width over at least half of this distance, and measured 1.5 m. in depth (Matheny 1976:640). Although the main canal extended southward into the heart of the solution-basin –past what Matheny has identified as a moated earthen fortress, he was also able to map at least seven large canals and two smaller ones in the northwestern and northeastern sectors of the site. His estimates of the amount of earth which had to be moved in the construction of this elaborate radial network of canals suggest that the undertaking was a prodigious expenditure of labor as the building of the Pyramids of the Sun and the Moon at Teotihuacán (Matheny 1976:642), which was taking place at about the same time in the Valley in Mexico. Between 1958 and 1962, the site of Edzná had been partially excavated and restored by R. Pavón Abreu, but without discovering the existence of the canal system. At the time, Edzná was one of the lesser-known Mayan centers, and was generally thought to be a minor site. However, an extensive survey carried out there in 1968 by a University of Oregon team headed by G. F. Andrews identified Edzná as a "very large and important center" with definite "urban" characteristics (Andrews 1975:246), but, other than identifying the trajectory of a "relatively straight, obviously man-made channel" running through the center of the site, no inkling of the elaborate canal system was suspected. It remained for Matheny, flying over the site in October, 1973, to recognize the extensive water-filled network as the life-support system

for what not only one of the earliest but also one of the largest Mayan population centers through most of the Classic period. Infrared aerial photographs taken at the height of the wet season revealed what no researcher could ever see from the ground during the customary dry-winter field-season.

Nature of the Site

In the Oregon survey of 1968, three separate precincts or foci were defined at Edzná. The most important of these was the ceremonial precinct centered on what Andrews has called the "Main Acropolis Group", itself centered on a large, five-story pyramid known simply as Cinco Pisos. Situated on a large platform nearly seven meters in height (which Andrews (1975:247), considers man-made and Matheny (1976:641) identifies as having been built on "a high outcrop of rock"), Cinco Pisos is a commanding structure whose roof-comb reaches over 38 m above ground level, making it visible from a considerable distance in the basin. It is on this center that the radial system of canals is targeted. Flanked by lower temple mounds both to the north and south, Cinco Pisos overlooks an interior courtyard measuring some 45 X 75 m, which is reached by a broad staircase from the main plaza below. The latter is some 120 m in width and extends over 180 m in length, being bordered on the west side by a long, ridge-like platform. Andrews identifies this platform as the base of two Palace type structures, each 55 m in length, separated by a "narrow opening" about four meters in width. He notes further that "the central doorway on the front, or west side of the temple (Cinco Pisos) is on axis with the opening" and that "the axis terminates in a large pyramidal mound with the remains of a round building on its top". He goes on to argue that "These axial configurations are too precise and too pronounced to be accidental, and a further examination of the balance of the ceremonial zone shows that similar axial alignments and arrangements are the dominant ordering notions used in the organization of the center as a whole and can be observed at several scales" (Andrews 1975:248-253).

The second precinct or node which Andrews recognizes within the built-up area of Edzná is that centered on the so-called Northwest Pyramid, which is located about one kilometer to the northwest of Cinco Pisos. This structure measures some 22 m in height and over 90 m in diameter at its base. He notes that "remains of a small temple are found on top of this pyramid, but almost nothing can be made of its ground plan". He goes on to say that "There are faint traces of stairways on the northeast and southeast sides of the large pyramid, indicating that its orientation was significantly different from the structures in the main ceremonial area which are consistently oriented seven to eight degrees east of magnetic north." He concludes that "This gives added weight to the assumption that it was not directly associated with the main center" (Andrews 1975:255).

The final area that the Oregon survey mapped at Edzná was what Andrews has termed the Far West group, located some three kilometers distant from Cinco Pisos. Even he concedes that there is some question as to whether it should properly be considered a part of the site or whether it represented a distinct agglomeration; the fact that it appears

to have consisted solely of residential structures is reason enough to believe that it had little functional association with the other precincts.

At the conclusion of his study, Andrews points out that, "rather than being viewed as an "empty ceremonial center", Edzná must be seen as an urban place, a city of a special kind, perhaps, but a city nonetheless. Taken together with Tikal and Dzibilchaltun", he argues, "it forms another link in the chain of evidence which is gradually accumulating in regard to the urbanized character of the larger Maya settlements. This, in turn", he concludes, "suggests a new direction in Maya archaeology where inquiry will be directed toward questions of social organization and city life *rather than calendrics* and decorative styles" (Italics mine, Andrews 1975:257).

I cite this comment by Andrews only because Matheny comes to quite a different conclusion in his study of the canal system at Edzná. "We can only speculate" he says, "that the orientation of the converging canals has some long-forgotten symbolic meaning that may be linked with celestial observation or some cosmological concept." (Matheny 1976:641) By coincidence, my own studies of the astronomical and/or calendrical significance of Edzná were just beginning as the Andrews and Matheny works appeared in print.

Edzná an Astronomical Center: The Deductive Evidence

Although my first visit was made to Edzná in 1974, it was not until about two years later that I began to appreciate its importance as one of the leading Maya astronomical centers. This appreciation grew out of a study I was then making of the chronological development of Mayan calendrics. Having earlier identified the southward zenithal passage of the sun as the critical astronomical "benchmark" which launched the 260-day sacred almanac at the Formative site of Izapa, on the Pacific coastal plain of southernmost Chiapas (Malmstrom 1973) (cfr. fig. 2), I was led to hypothesize that a similar event may have been used by the Maya to calibrate the beginning of their New Year. Indeed, the manuscript of Don Juan Pio Pérez, cited by John Lloyd Stephens (1843:436), serves to confirm that this was in fact the case, and both Pérez and bishop Landa fix the commencement of the Mayan New Year as July 16 on the Julian calendar (or July 26, according to the present Gregorian count; Tozzer 1941:150). Using, these observations as a point of departure, I determined that the southward passage of the zenithal sun takes place on July 26 each year at approximately 19 degrees 30 minutes N latitude, a position marked, interestingly enough, by the location of Teotihuacán on the Mexican plateau, but in the Mayan realm, only by the sites of Edzná and Dzibilnocac (fig. 3). The then-accumulating evidence of Edzná's importance as an urban center suggested that it was the more likely of the two places to have been the geographic "cradle" of the Mayan New Year. However, because my reconstruction of the chronology of such a development placed it in the first century of the Christian era, the then-prevalent belief in a "Late Classic" origin for Edzná's founding led me to make no mention of Edzná in my paper published in 1978. It was later the same year that I learned from Matheny of his early radiocarbon dates for the site, which, in effect, tended to confirm the validity of the chronology associated with my basic hypothesis.

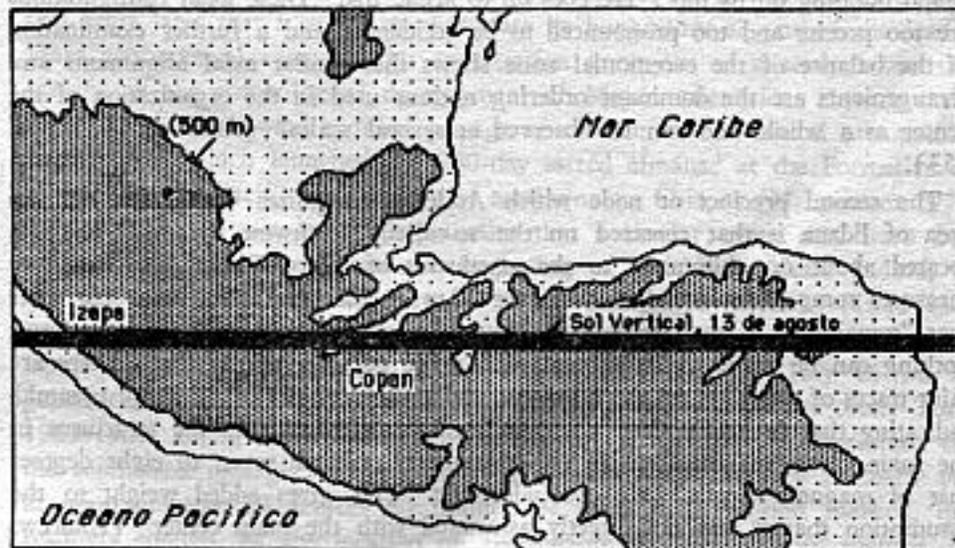


Figure 2.
Geographical Latitude of 15°N, Archaeological Sites of Izapa and Copan. Second Solar Zenith Passage on August 13

The latter argues not only that the Maya calibrated their New Year with the aid of the southward passage of the zenithal sun over Edzná each July 26, but also that the first time such an event would have coincided with the day 1 Pop of the secular calendar would have been in the years 41 through 44 A. D. (4) Because such occurrences also coincided with the dates 6 Eznab, 7 Akbal, 8 Lamat and 9 Ben of the sacred almanac, these day-names became the so-called "year-bearers" with which the beginning of each New Year was thereafter associated. (In this connection, it is interesting to note that Thompson (1965:649) suggested that a shift in year-bearers to Kan, Muluc, Ix and Cauac may have taken place at Edzná as early as 672 A.D., although he also conceded that "it may have had its beginnings far earlier when the calendar first came into use in that area". The so-called Puuc style of dating, which Thompson once supposed "was a heresy", may simply have reflected the fact that, alone of all the Mayan priests, those of Edzná were in the only geographic location where the imprecision of the 365-day secular calendar would so quickly have become apparent.)

The accuracy of bishop Landa's association of the Maya New Year with the Julian date of July 16 has been questioned by some researchers, among them Lafarge, who argued that he was mistaken by one day.' Landa observed that the New Year began on 12 Kan 1 Pop, apparently using the Christian year of 1553 as his source of information. (It is an interesting coincidence that the time-frame of 1550-1553 constitutes the first occasion that the beginning date of the Mayan. year (1 Pop) fell on. the equivalent of July 16 since its postulated adoption one Sothic cycle (1461 years) earlier, in the first century of the Christian era.) However, the Goodman-Martínez-Thompson correlation of the Long Count places the date of July 16, 1553 at 12 Kan 2 Pop instead; had the New Year begun

on 1 Pop, the previous day, it would, of course, had the year-bearer 11 Akbal. If one accepts the basic hypothesis that the southward passage of the vertical sun at Edzná was indeed the mechanism by which the Maya calibrated their New Year, then it is perhaps instructive to note that the site's precise latitude (19.7 degrees N) is such that the zenithal transit does in fact take place each year on the equivalent of the Julian day, July 15 (Gregorian, July 25).

Archaeological Evidence of the Astronomical Importance of Edzná

What evidence, if any, has been encountered in Edzná to suggest that calibration of the zenithal passage of the sun was indeed carried out there? Is there, for example, any structure or device that might have been employed as a gnomon, or as a zenith tube, such as have been identified at Monte Albán and Xochicalco?

The answer to this question is affirmative, for in the upper court-yard at the base of the staircase of Cinco Pisos is a beautifully fashioned gnomon which is as simple in design as it is effective in operation (fig. 3). Standing in the center of a raised, stone platform is a tapered stone shaft approximately 40 cm in height, surmounted by a stone disk whose diameter is identical to that of the base of the shaft. Thus, on the two days of the year when the sun is vertically overhead at noon, the stone disk ensures that the entire shaft is in shadow; on all other days, a stripe of sunlight will fall across the shaft. As a result, there can be little doubt that the priests of Edzná had an accurate gauge on the timing of the sun's zenithal passage.

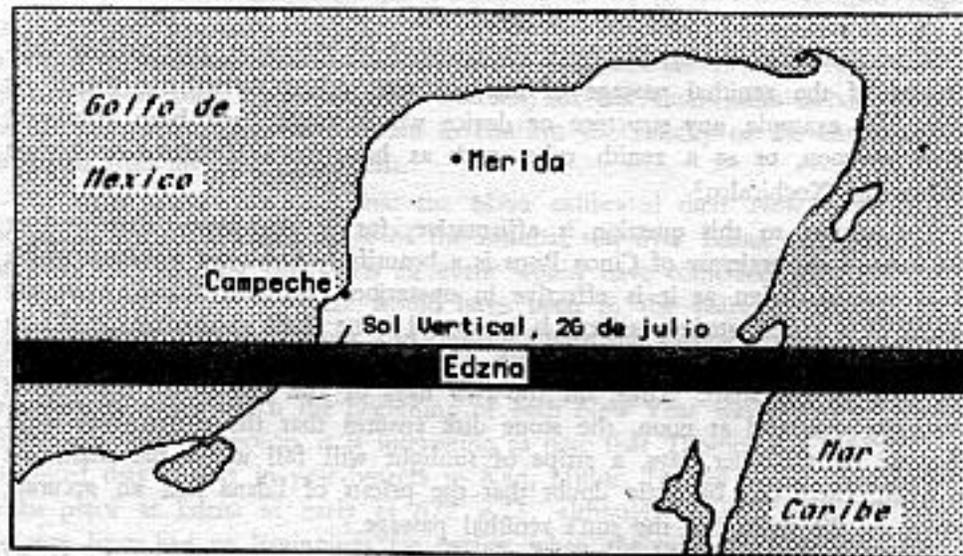


Figure 3.

Geographical latitude of 19°30' N. Archaeological Site of Edzná, Campeche. Second Solar Zenith Passage on July 26

But, are there any other critical astronomical associations that can be found in the architectural layout or design of the site? Again, the answer is affirmative, for it turns out that the "axial configurations" which Andrews has characterized as the "dominant ordering notions used in the organization of the center as a whole" are identical to those found at Teotihuacán, and at many other key Mesoamerican sites. These were first identified by the author in 1978 but not fully explained until the following year.

The principal axis cited by Andrews is that formed by the central doorway on the west side of Cinco Pisos and the opening in the elongated platform across the main plaza which "terminates in a large pyramidal mound with the remains of a round building on its top". From the doorway of the court yard, the elongated ridge on the west side of the main plaza will be seen to constitute an artificial horizon which totally obscures the true horizon. When the spatial relationship of the doorway, the opening in the platform, and the top of the pyramid behind it are defined, they are found to demarcate an azimuth of 285.5 degrees, or an angle 15.5 degrees to the N of W (fig. 4). Such a value corresponds with the azimuth of the sunset on August 13, the date on which (according to the Goodman-Martínez-Thompson correlation) the Mayas believed that the present cycle of creation began. As noted above, this is identical to the alignment of the grid at Teotihuacán (6) and has likewise been identified by the author as one of the key "axial configurations" obtaining at major ceremonial centers throughout the Mesoamerican cultural realm. (Reference is also made to the author's earlier paper in which he has argued that the origin of the 260-day sacred almanac may be traced to the Formative site of Izapa, just south of the 15th parallel of N latitude, where the vertical sun passes overhead on its way equator-ward on August 13.) (7) Thus, the manner in which the "date of

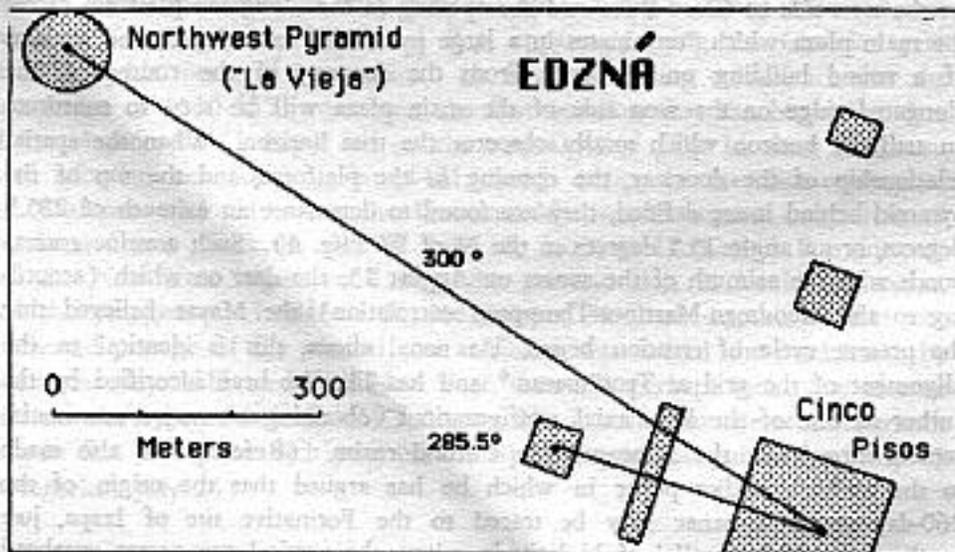


Figure 4.

Basic Western Alignments from Cinco Pisos Pyramid, Edzna, Campeche

creation" was established at Izapa appears to have been diffused as widely as the knowledge of the almanac itself, but how was this day fixed by priests in locations other than at the latitude of the almanac's origin? The answer seems to have been by means of a very simple formula: establish the sun's northernmost setting position (the summer solstice, June 22), and count 52 days.

While the "axial configuration" of Edzná to an August 13 alignment seems indisputable, there is some question as to whether the ridge-like "artificial horizon" across the main plaza might have been used to demarcate other sunset positions as well. For example, had a stela been erected near its southern end, as seen from the doorway of the Cinco Pisos court-yard, the azimuth of the equinoctial sunsets could have been designated. Similarly, had a stela been positioned near its northern end, the azimuth of the sunset on the summer solstice might have been established. However, because there is no evidence of which I am aware that such stelae, or their remains, were ever found in such locations, this further use of the "artificial horizon" must remain conjectural.

Nevertheless, there is one additional orientation at Edzná about which there can be little disagreement. When one climbs to the top of the Cinco Pisos pyramid, one is afforded virtually a 360-degree view of horizon. At only one point on the sky line does a man-made feature interrupt the continuity of the horizon. This is toward the northwest where the top of the 22 m high Northwest Pyramid identified by Andrews just intersects the line of low hills that defines the horizon. When the azimuth of its summit is measured, it is found to be almost exactly 300 degrees (fig. 4). Here in Mesoamerica where the northernmost setting position of the sun at the summer solstice is 295 degrees, it is obvious that the Northwest Pyramid could not have recorded a solar azimuth. On the other hand, the fact that it stands exactly 5 degrees farther to the north than the extreme sunset position strongly suggests that what we are seeing is a horizon-marker for the maximum still-stand of the moon. If this is true, then we can safely conclude that the Cinco Pisos Pyramid may have been not only a lunar observatory, but, indeed, the earliest lunar observatory yet identified in Mesoamerica.

It should, however, be noted that despite the intriguing spatial relationship between Cinco Pisos and the Northwest Pyramid, or "La Vieja" as Matheny has called it, the temporal relationship between the two structures is neither as simple nor as clear-cut. This is because the excavations by Matheny revealed that the Northwest Pyramid was a pre-Classic structure while Cinco Pisos is of Classic origin. Thus, any hypothesis which seeks to functionally link the two structures must either postulate: 1) that Cinco Pisos was built as a horizon marker which was viewed from "La Vieja", and therefore marked the southernmost still-stand of the rising moon, or 2) that the present edifice of Cinco Pisos may indeed be superimposed upon an older building erected on the same site. Knowing what we do of the Maya's propensity for reconstructing their major temples with cyclic regularity, the second of the two postulates would appear to be the most reasonable.

It is interesting that when Matheny encouraged the author to investigate possible astronomical alignments at Edzná, he did so in keeping with his previously cited statement, namely that "the orientation of the converging canals has some long-forgotten

symbolic meaning that may be linked with celestial observation or some cosmological concept". However, the axes of the seven radiating canals to the north of Cinco Pisos and of the main canal to its south all lie within 30 degrees of the meridian, thus rendering any solar, lunar, or planetary associations impossible. Because postulated stellar associations are dubious under all but the most well documented of circumstances, the author is forced to conclude that the canal pattern at Edzná has no recognizable astronomical basis.

Conclusions

The recognition of the Mayan site of Edzná as an urban center of some importance has come only belatedly during the last decade. Thanks in part to the studies of architect George Andrews and his University of Oregon team, Edzná may no longer be viewed as an "empty ceremonial center" but as "an urban place, a city of a special kind". Almost by chance, this assessment of Edzná's significance was validated by Matheny's fortuitous discovery of its elaborate water-control system a few years later and by his calculations of the considerable resident population that the site's deep, productive soils were capable of supporting. By the same token, it was not until the detailed studies carried out by Matheny that Edzná's true antiquity was suspected. What had been believed to have been of Classic vintage was now proven to date back to the pre-Classic era, making the origins of the site virtually contemporaneous with the foundation of Teotihuacán.

Ironically, however, Andrews was led to remark that Edzná, in common with Tikal and Dzibilchaltun, suggested "a new direction in Maya archaeology where inquiry will be directed towards questions of social organization and city life rather than *calendrics* and decorative styles". Matheny, on the other hand, was tempted to speculate that the orientation of the converging canal system had "some long-forgotten symbolic meaning that may be linked with celestial observations or some cosmological concept". In this paper, the author has attempted to show that, contrary to Andrew's conclusion, the ceremonial center of Edzná does demonstrate calendrical associations, but not in the way Matheny suspected. Rather, these associations are seen in the "axial configurations" which Andrews identified but could not define, and in the spatial relationships between structures within the site, as for example, between Cinco Pisos and the Northwest Pyramid. . A heretofore unsuspected aspect of the site's astronomical importance is its very geographic location -- a fact which the author has suggested may have been responsible for the Maya's choice of July 26 as the beginning of their New Year, and for the establishment of the notion of a given sequence of "year-bearers". If his arguments are valid, then Edzná was not only one the earliest true urbanized places of the Maya, but also most likely the birth-place of their modified version of the calendar and the seat of the oldest lunar observatory in the Mesoamerican realm.

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Footnotes

(1) "Uso actual del suelo", Carta Sinóptica, Estado de Campeche, escala 1: 5 00 000, Secretaría de Agricultura y Recursos Hidráulicos, 1976.

(2) "Campeche", hoja E 15-3, y "Ciudad del Carmen", hoja E 15-6, Carta Topográfica, 1:250 000, Secretaría de Programación y Presupuesto, 1981.

(3) "Datos de temperatura media mensual y anual de las estaciones meteorológicas", Carta de temperaturas medias anuales, escala 1:1 000 000, (Mérida), y "Datos de precipitación media mensual y anual de las estaciones meteorológicas", Carta de precipitación total anual, escala 1:1 000 000 (Mérida), Secretaría de Programación y Presupuesto, 1981.

(4) The Goodman-Martínez-Thompson, or 11.16.0.0.0, correlation is used in equating all Mayan and Christian dates in this paper. Among the evidence that has been presented to confirm the accuracy of this correlation was that cited in the author's (1981) paper.

(5) Cited in Linton Satterthwaite (1965-613).

(6) First recognized by the author in 1975 and cited in his 1978 paper. His arguments were supported by B.C. Chiu and Philip Morrison (1980:55-64).

(7) Cfr. Malmstrom (1973, 1981).

(This paper was presented at the Symposium on Archaeoastronomy and Ethnoastronomy in Mesoamerica hosted by the Autonomous University of México in Mexico City on 24-28 September 1984, and published in the Proceedings of the Symposium in 1991, pp. 37-47.)

[\(Back to Table of Contents\)](#)