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The Pecked Cross Symbol in Ancient Mesoamerica

A Mesoamerican petroglyphic design is interpreted as a calendar, an orientation device, and a religious game.

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Summary. Attention is directed to a design, possibly of Teotihuacan origin, carved both in rock and in the floors of ceremonial buildings throughout ancient Mesoamerica. Consisting generally of a double circular pattern centered on a set of orthogonal axes, the so-called pecked cross or quartered circle figure is shown to exhibit a remarkable consistency in appearance throughout its 29 reported locations, thus suggesting that it was not perfunctory. The metric properties of the symbols gleaned from field surveys are delineated, and several interpretations of their possible functions are discussed. These symbols may have been intended as astronomical orientational devices, surveyor's bench marks, calendars, or ritual games. Evidence is presented which implies that more than one and perhaps all of these functions were employed simultaneously, a view which is shown to be consistent with the cosmological attitude of the pre-Columbian people.

In 1889, Mexican poet Vicente Riva Palacio edited a multivolume work entitled *Mexico a Través de los Siglos*. In an extensive discussion of ancient Mexican calendar systems in the first volume, Alfredo Chavero (*1*) made reference to a place near the northern frontier of Mexico where there can be found (*2*)

> a great slab of more than 28 square varas [about 16 square meters] on which are marked two circles and in the middle one diameter, then another at right angles to it, all indicated with groups or points giving the chronological periods.

The drawing is shown in Fig. 1a. The holes in the stone appear to have been pecked with a percussive instrument. The artisan who wielded it was careful enough to space the depressions evenly and to set equal numbers into each quadrant. The numerological arrangement exhibits a purposeful pattern: the outer circle consists of 25 holes per quadrant, totaling 100; the inner circle consists of 20 holes per quadrant, totaling 80; there are 20 holes per axis, totaling 80; and the total number of holes (not including the central hole) is 260. Furthermore, the axial arrangement consists of ten holes between the center and the first circle, four holes between the circles, and four holes beyond the outer circle (see Table 1 for detailed data; the line labeled RIV tabulates the relevant data for the petroglyph cited in the Riva Palacio volume).

A logically valid association of this design pattern with the pre-Columbian calendar seems evident, not only because of the presence of the basic number 20 but also because the count totals 260, the most important cyclic interval in the native ritual calendar as well as the most puzzling because of the indeterminacy of its origin (*3*). Formed by the successive matching of 13 numerals with 20 named days, the 260-day cycle (called Tonalpohualli or Count of the Days by the Aztecs and Tzol kin or Wheel of the Days by the Maya) is the most frequently represented calendric period in the pre-Columbian written record and it almost always occupies a central position in the codices.

Chavero's roving mind led him to several speculative conclusions about astronomical periodicities depicted on the borderland stone. Among the better ideas is his interpretation of the 10 + 4 + 4 axial pattern, which we find occurring on other cross petroglyphs. It is based upon the notion that the Mexicans divided their 18-month tropical year into segments demarcated by the passage of the sun across the zenith and the commencement and termination of the agricultural year. Since the relation between astronomical events and agricultural practice in ancient Mesoamerica is already well documented (*4*), this view is not so unreasonable.

Six decades after Riva Palacio's work and apparently unaware of it, Smith (*5*) reported the presence at Uaxactun, Guatemala, of a cross and double circle which looks almost exactly the same (UAX 1). Not a true petroglyph or rock carving, it was pecked into the floor of structure A-V at the Early Classic Maya site. Smith stated that the axis of the cross pointed to the cardinal directions, but our 1978 measurements with the surveyor's transit indicate an orientation of 17.5° east of north, nearly the same as the Street of the Dead at Teotihuacan. Smith's photo of the design (Fig. 1b) reveals that the north-south axis bends abruptly at the central point. It is interesting to speculate whether the north-south axis of the cross might have been deliberately bent in order to point to the direction of the great ruins of Tikal, which can be viewed easily at a distance of 19 kilometers by an observer standing on the pecked cross at the edge of the platform of structure A-V and looking off

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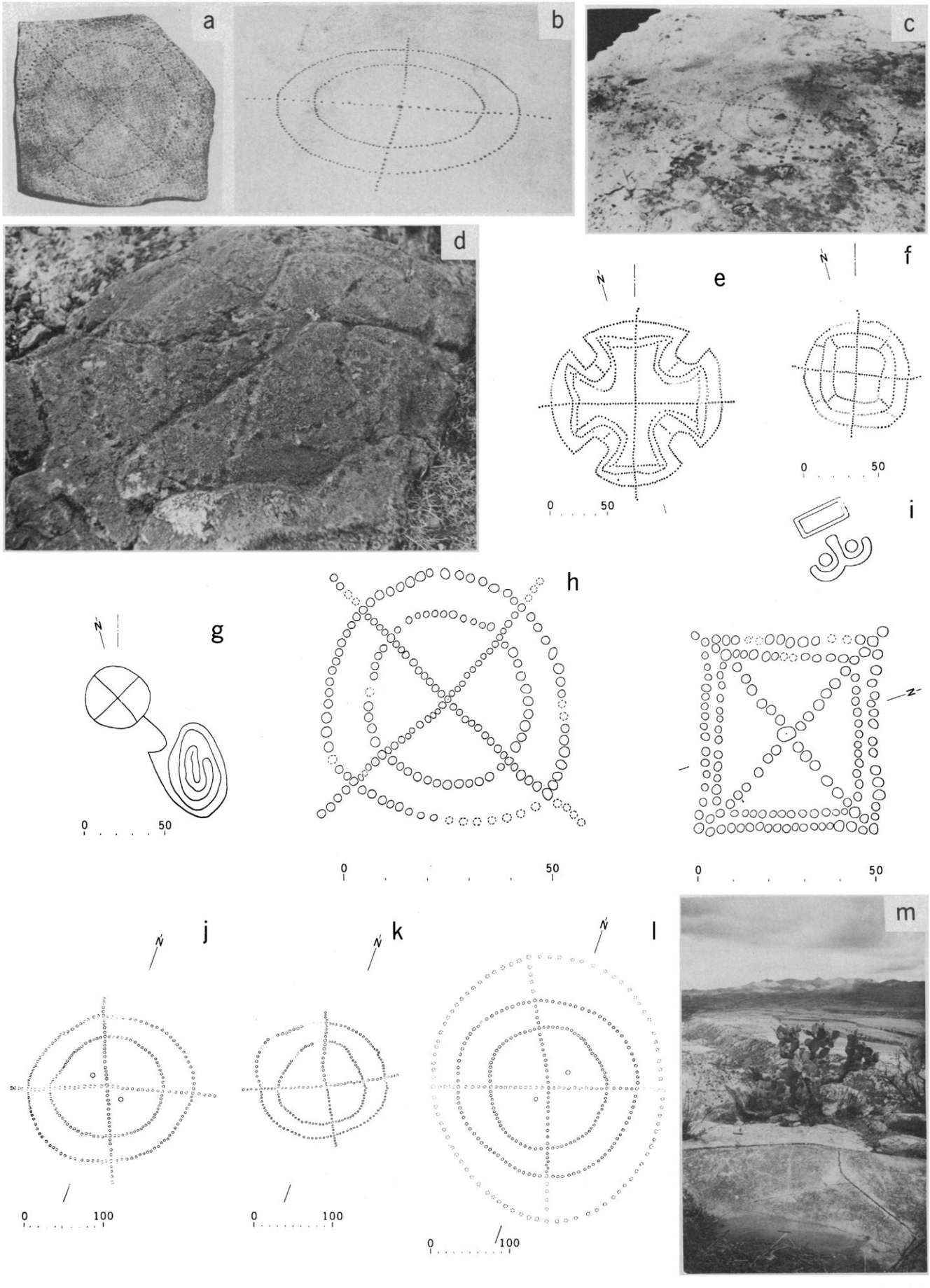
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Fig. 1. Photographs and drawings from rubbings of representative cross petroglyphs: (a) RIV; (b) UAX 1; (c) TEO 1; (d) TEO 5; (e) TEO 2; (f) TEO 3; (g) TEO 6; (h) TEP 2; (i) TLA 3; (j) CHA 1; (k) CHA 2; (ℓ) TUI; and (m) CHA 1, with its axis pointing to Cerro Picacho, where the sun rises at the summer solstice. Quite commonly the petroglyphs are situated at the edge of a hill offering a panoramic view of the eastern horizon.

to the south. Smith reported but did not discuss two similar pecked designs (UAX 2 and 3) on floors in the same complex. We were unable to locate them while visiting the ruins in January 1978. Smith likened the carvings to a calendric diagram pictured in the Book of Chilam Balam of Kaua (*6*) (see Fig. 2c). We shall have more to say about the resemblance of calendars to cross petroglyphs in a later section.

The count of the number of elements comprising the Uaxactun design reveals a further basis for comparison (compare RIV and UAX 1 in Table 1). Smith explicitly recognized that "the straight lines are arranged so that each has 10 dots from the center to the inner circle, four dots from the inner to the outer and four dots beyond the outer circle"—exactly the same pattern found on the petroglyph near the U.S. border. Moreover, the number of holes on the inner circle of UAX 1 is close to that on the outer circle of RIV (101 versus 100). If we were to include in the count the four additional points of intersection of the circles with the axes, the tallies become 105 and 104. The 104-year period is not an unlikely one to appear in a calendric counting device. It represents two calendar rounds, formed by permuting the 365-day year with the 260-day ritual count. Also, the difference between the number of days in inner and outer circles extant on the Uaxactun design is 256 (264 if we count the eight intersection points); therefore, it is possible that the artist intended to tally a 260-day count.

About three decades after the discovery of the Uaxactun quartered circles, two more examples of the design were reported by workers of the Teotihuacan

Table 1. Pecked cross data.

Name (figure)	General description	General setting	Geographic coordinates	Approximate outside dimension (cm)	Number of elements*	Averaged orientation of axes†	Remarks	References
			Teotihuacan					
TEO 1 (Fig. 1c)	Double concentric circles centered on rectangular coordinate axes	Pecked in floor of building 400 m southwest of the Pyramid of the Sun	19°42′N, 98°51′W	117	57, X, 96, 80 (233)	17°50′	Aligns with TEO 5 perpendicular to the Street of the Dead; also astronomically oriented	(*9*), figure 4; (*41*), figure 8D; (*42*), part 1, figure 57a
TEO 2 (Fig. 1e)	Triple cross centered on rectangular coordinate axes	Pecked in floor of building opposite the Street of the Dead from TEO 1, 67 m distant	19°42′N, 98°51′W	164	167, 223, 260, 142 (792)	16°11′	Compare calendar in Codex Fejervary-Mayer (*31*)	(*9*), figure 1
TEO 3 (Fig. 1f)	Triple concentric circles centered on rectangular coordinate axes	Pecked in floor of same building as TEO 2, but 5.6 m "Teo South"	19°42′N, 98°51′W	77	64, 85, 100, 100 (349)	17°00′	Note square shape of inner "circle"; see Tlalancaleca crosses	(*9*), figure 3
TEO 4	Same as TEO 1 except much smaller	Pecked in floor of building 81 m south of TEO 2	19°42′N, 98°51′W	51	84, X, 109, 80 (273)	16°34′		(*9*), figure 5
TEO 8	Same as TEO 1	Pecked in floor of patio west of structure E-3, 700 m northwest of the Pyramid of the Sun	19°42′N, 98°51′W	?	?	?		(*9*), plano 1; (*43*)
TEO 9	Same as TEO 1	Same as TEO 8 except near the talud of the first platform of structure E-3	19°42′N, 98°51′W	65	?	15°		(*9*), plano 1; (*43*)
TEO 10	Same as TEO 1	Pecked in floor of same building as TEO 2 between TEO 2 and TEO 3	19°42′N, 98°51′W	?	?	16°05′		(*9*)
TEO 12	Same as TEO 1	Pecked in floor of same building as TEO 2, 3.5 m southeast of TEO 3	19°42′N, 98°51′W	50	?	16°	Discovered by the authors	

Table 1 (continued).

Name (figure)	General description	General setting	Geographic coordinates	Approximate outside dimension (cm)	Number of elements*	Averaged orientation of axes†	Remarks	References
			Teotihuacan vicinity (within 100 km)					
TEO 5 (Fig. 1d)	Same as TEO 1	Pecked in basaltic outcrop 3 km "TEO West" of TEO 1; tilted 20° facing Teotihuacan	19°42′N, 98°52′W	94	52, X, 69, 80 (201)	35°42′	Aligns with TEO 1 perpendicular to the Street of the Dead	(*42*), part 1, figure 57b; (*9*), figure 6
TEO 6 (Fig. 1g)	Single circle centered on rectangular coordinate axes	Carved on outcrop tilted 30°, facing Teotihuacan; 7 km "Teo North" of the Pyramid of the Sun	19°45′N, 98°50′W	40	None	61°07′	Aligns with the center of the Pyramid of the Sun parallel to the Teotihuacan grid; axis points to summer solstice sunrise	(*9*), figure 8
TEO 7	Six axes emanating from a point; half circle and coordinate axes nearby	Carved on outcrop at summit of Cerro Chiconautla, 14 km southwest of the Pyramid of the Sun	19°39′N, 98°58′W	95	?	?		(*9*), figure 9
TEO 11	Same as TEO 6	Carved in low relief 7 km west of the Pyramid of the Sun	19°41′N, 98°56′W	?	None	?		(*10*), p. 322
Acalpixcan (ACA)	Similar to TEO 2	Pecked in outcrop 60 km south-southwest of Teotihuacan; 25 km southeast of Mexico City	19°15′N, 99°04′W	160	?	?		(*44*)
Tepeapulco (TEP 1)	Same as TEO 1, with an outer circle	33 km northeast of Teotihuacan; pecked on outcrop at the edge of a small hill	19°48′N 98°33′W	77	60, 87, 99, 87 (333)	80°24′	Axis points to Cerro Gordo	(*11*)
Tepeapulco (TEP 2), (Fig. 1h)	Same as TEO 1	33 km northeast of Teotihuacan; pecked on vertical outcrop facing Cerro Gordo	19°48′N, 98°33′W	58	42, X, 60, 76 (178)			(*11*)
Tepeapulco (TEP 3)	Same as TEO 1	33 km northeast of Teotihuacan; pecked on flat stone	19°48′N, 98°33′W	60	?	76°	Stone now broken into three fragments; axis points toward Teotihuacan	(*45*)
Cerro Teponaxtle (TEX)	Similar to TEO 1	Pecked on outcrop 10 km east-southeast of Teotihuacan	19°37′N, 98°49′W	120	?	14°05′	Axis aligns with Teotihuacan north-south direction	(*46*)
Tlalancaleca (TLA 1)	Same as PON; double concentric squares on rectangular coordinate axes	90 km southeast of Teotihuacan; pecked on vertical fragment	19°20′N, 98°30′W	50	35, X, 47, 33 (115)			(*13*)
Tlalancaleca (TLA 2)	Same as TLA 1	Pecked on vertical outcrop	19°20′N, 98°30′W	50	31, X, 38, 28 (97)			(*13*)
Tlalancaleca (TLA 3) (Fig. 1i)	Same as TLA 1	Pecked on a horizontal outcrop on the edge of a small hill	19°20′N, 98°30′W	50	49, X, 59, 39 (147)	65°54′	Axis points to summer solstice sunrise	(*13*)

Mapping Project [TEO 1 and 5; Fig. 1, c and d (7)]. One was pecked into the floor of building 34-C in square N3E1 about 365 m southwest of the center of the Pyramid of the Sun; the other was hammered into a small rock outcrop 3 km to the west. Both exhibit the 10 + 4+ 4 axial pattern. The axes of the cross pattern of TEO 1 appear to be aligned closely with the Teotihuacan grid, which is oriented about 15.5° east of north. As at Uaxactun, the penetration of the design pattern through several layers of floor plaster is testimony to the importance of the location and the intended permanence of the symbol. Moreover, a line connecting TEO 1 to TEO 5 is oriented almost exactly perpendicular to the Street of the Dead, which defines the north-south Teotihuacan axis (see Fig. 3). Accordingly, Millon (7) proposed that the crosses served as orientational bench marks to assist the Teotihuacan architects in laying out the rectangular system of the ceremonial center.

Since the orientation of the ceremonial center runs generally contrary to the lo-

Table 1 (continued).

Name (figure)	General description	General setting	Geographic coordinates	Approximate outside dimension (cm)	Number of elements*	Averaged orientation of axes†	Remarks	References
			Northwest Mexico					
Poncitlan (PON)	Same as TLA 1	400 km west-northwest of Teotihuacan; pecked on outcrop with constellation figures(?)	20°27′N, 102°49′W	45	?	?		
Cerro El Chapin (CHA 1) (Fig. 1j)	Same as TEO 1, except larger	650 km northwest of Teotihuacan; pecked on horizontal outcrop on edge of hill	23°24′N, 103°57′W	200	80, X, 100, 81 (261)	67°44′	Bend in east-west axis; east axis directed toward summer solstice sunrise	(*14, 15*)
Cerro El Chapin (CHA 2) (Fig. 1k)	Same as CHA 1	Pecked on horizontal outcrop 50 m south of CHA 1	23°24′N, 103°57′W	160	83, X, 101, 81 (265)	63°14′	Bend in north-south axis; east axis directed toward summer solstice sunrise	(*14*)
Tuitan (TUI) (Fig. 1ℓ)	Same as CHA 1, except triple circle	720 km northwest of Teotihuacan; pecked on horizontal floor of lava field	24°03′N, 104°13′W	225	81, 93, 80, 87 (341)	67°08′	Bend in north-south axis; east axis directed toward summer solstice sunrise	(*47*)
Riva Palacio (RIV) (Fig. 1a)	Same as TEO 1	Near U.S. border (?)	?	400	80, X, 100, 81 (261)	?	Actual location unknown	(*1*)
			Peten-Maya					
Uaxactun (UAX 1) (Fig. 1b)	Same as TEO 1	1000 km east-southeast of Teotihuacan; pecked in floor, southwest corner of structure A-V	17°24′N, 89°38′W	250	101, X, 156, 81 (338)	17.5°	Bend in north-south axis; aligns with Uaxactun grid and Teotihuacan north-south direction	(*5*)
Uaxactun (UAX 2)	Same as TEO 1	Same as UAX 1 except in the southeast corner of building	17°24′N, 89°38′W	250	?	17.5°		(*5*)
Uaxactun (UAX 3)	Same as TEO 1	Same as UAX 1 except in the southwest corner of building	17°24′N, 89°38′W	250	?	17.5°		(*5*)
Seibal (SEI)	Similar to TLA 1	1000 km east-southeast of Teotihuacan; pecked on loose stone	16°30′N, 90°05′W	250	30, X, 15, 18 (63)	?	Stone may be of different provenience	(*48*)

*The hole count on the inner, middle, and outer circles and the axes is tabulated. For double circles an X is inserted for the middle hole count. The axial count includes the holes at the intersection of the circles and the crossarms. The total count appears in parentheses. †The averaged orientation of the axes relative to astronomical north is tabulated. Unless otherwise stated, all orientation data were determined at the sites of the pecked crosses. A transit and astronomical reference (usually the sun) were employed. The techniques for acquiring and reducing the data have been discussed elsewhere (*8*).

cal topography, one might suppose that the direction assigned the grid was attributable at least in part to Teotihuacan cosmology or geomancy. In fact, the clarity with which one views the western horizon in the vicinity of TEO 5 from the vantage point of TEO 1 near the center of the ruined city has led to the elucidation of several astronomical hypotheses for the skewed orientation (*8*). In these schemes the observer uses one of the pecked crosses as a foresight and the other as a backsight to view a particular celestial body along the horizon.

Other Pecked Cross Designs

Since the inception of the Teotihuacan Mapping Project, we have learned of the existence of 29 pecked cross designs of undeniable detailed similarity; we have mapped and measured 22 of them in situ (Fig. 4 shows the locations). In this section we delineate the basic properties of the more important petroglyphs (Table 1 lists the fundamental characteristics of all of them in brief form; in Table 1 the crosses are divided into four groups on the basis of location).

Teotihuacan. The work of Gaitan *et al*. (*9*, *10*) has brought to light the existence of eight cross designs in or near the ceremonial zone which had not yet been reported. Figure 1, e, f, and g, are representative rubbings that we made. Figure 3 shows the positions (on two different scales) of the pecked cross designs located in and around Teotihuacan (the first two groups in Table 1). Four of these (TEO 2, 3, 10, and 12) are pecked into the floor of a building directly across the Street of the Dead from TEO 1. They are situated adjacent to one another with their axes all precisely aligned parallel to the Street of the Dead. A fifth cross (TEO 4), much smaller than the rest and badly eroded, can be found 81 m south of TEO 2. It is also pecked into the floor of a building. Two more designs, said to possess essentially the same description (TEO 8 and 9), are reported to reside in the patio behind and near the facade of the first platform of structure E-3 adjacent to the Pyramid of the Moon [see (*9*), plate 1]. We could neither locate the latter pair nor learn any details about their form from the literature. Finally, three cross petroglyphs were reported within view of the ceremonial center: one atop Cerro Gordo (TEO 6, Fig. 1g), 7 km "Teotihuacan north" of the Pyramid of the Sun; one on Cerro Chiconautla (TEO 7), 14 km to the west-southwest; and TEO 11 on Cerro Maravillas, 7 km west of the Pyramid of the Sun. There is a radical departure from the general pattern in TEO 7. It consists of only a partially circular plan adjacent to a system of several radial lines. The only two designs that are not comprised of cuplike depressions are TEO 6 and 11. Instead, they seem to have been scratched into the rock matrix. Furthermore, the rock on which TEO 6 is carved is tilted 30° out of the horizontal, leaning toward the ceremonial center 800 m below. A petroglyph taking the form of a coiled serpent, adorned with several cuplike depressions, adjoins the cross and circle design.

A spectator standing on the TEO 6 petroglyph is treated to a commanding view of the Teotihuacan Valley to the south. Furthermore, the line of sight taken from TEO 6 to the center of the Pyramid of the Sun lies exactly parallel to the Street of the Dead (Fig. 3b). Conceivably, it could have been part of the Teotihuacan rectangular grid system, although it is difficult to demonstrate convincingly that an astronomical orientation lay at the origin of this base line. A cross on Cerro Teponaxtle, 11 km south of the Pyramid of the Sun, has its axis pointing in the general direction of the Street of the Dead (see TEX in Table 1).

Looking for common occurrences in the hole count pattern, we find that nearly all the Teotihuacan crosses exhibit the familiar 10 + 4 + 4 plan and that about 100 holes are common. Two of the crosses (TEO 2 and 3; Fig. 1, e and f) have a triple concentric design, the latter with a squarelike pattern at the center; both exhibit a dotted pattern interconnecting the circles at about 45° to the orthogonal axes. Crosses within the ceremonial center seem to align reasonably well with the Street of the Dead, as the reader can discern by scanning the orientation column of Table 1; those outside the zone do not.

Tepeapulco. We learned of the existence outside the immediate environment of Teotihuacan of two cross petroglyphs [TEP 1 and 2 (Fig. 1h)] (*11*) at Tepeapulco, an outlying site of the Tlamimilolpa-Xolapan phases (A.D. 200 to 650), located 33 km east-northeast of Teotihuacan. Both carvings are situated on a small, isolated hill populated by

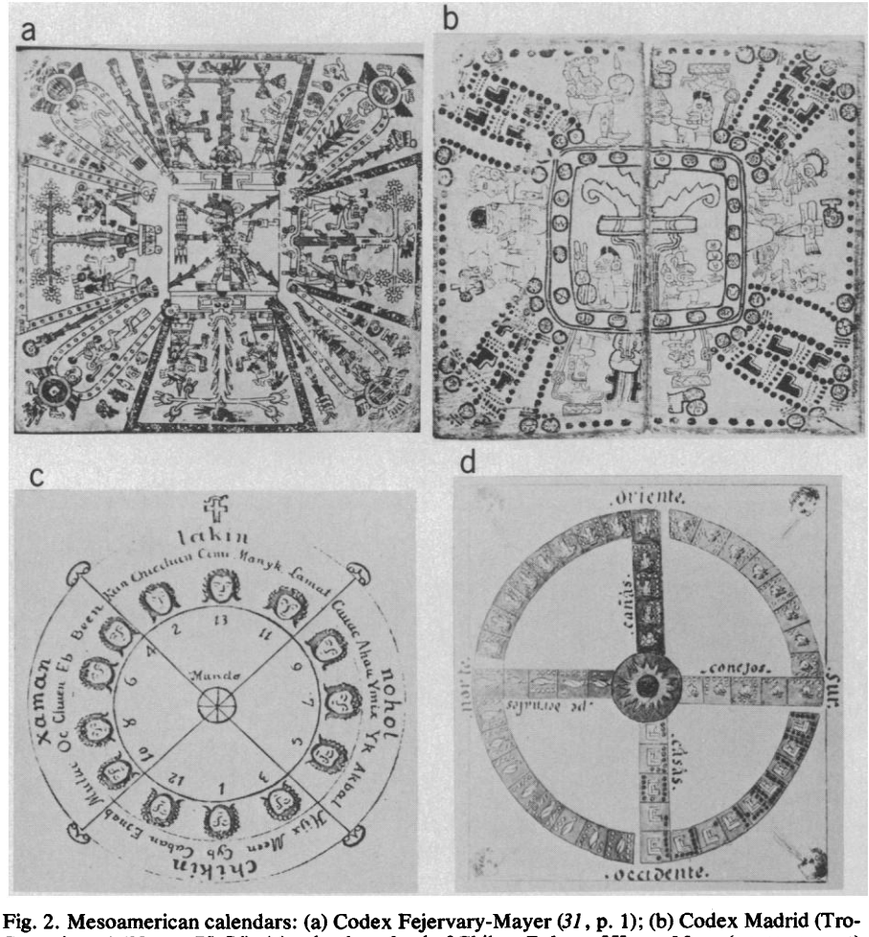

Fig. 2. Mesoamerican calendars: (a) Codex Fejervary-Mayer (*31*, p. 1); (b) Codex Madrid (Tro-Cortesianus) (*32*, pp. 75–76); (c) calendar wheel of Chilam Balam of Kaua, Maya (postconquest) [after Bowditch (*6*)]; and (d) calendar wheel in Duran's *Book of the Gods*, Aztec, 15th century (*36*). Note the resemblance of (a) and (b) to the TEO 2 petroglyph (Fig. 1e). One can count the same number of dots on the periphery of all three designs.

many large boulders. A pyramid with tablero and talud platforms, a combination of talus and vertical panel which serves as a characteristic feature of Teotihuacan architecture, is located approximately 100 m to the northeast; high mountains limit the immediate view to the east and north.

On the western side of the hill and nearly on the highest level, the TEP 1 triple circle is pecked on a slightly inclined rock. The holes comprising the pattern are rather small and not very deep, but the 10 + 4 + 4 plan is exhibited by three of the axes. One axis of the cross points directly to Cerro Gordo, which appears on the northern horizon at a distance of 30 km, flanked by two low hills of similar shape and symmetrical placement in the immediate foreground.

The pattern at TEP 2 is a double circle and cross chisled on a vertical slab of rock on the southwestern side of the hill not very high above the surrounding flatland. The view to Cerro Gordo is quite similar to that seen from TEP 1. Other petroglyphs consisting of a variety of shapes, especially spirals, abound in the vicinity.

It may be significant that Tepeapulco lies along one of the natural foot routes emanating from the northeast section of the Valley of Mexico. From surface archeological studies, Charlton (*12*) has shown that between the Terminal Formative and Late Aztec periods obsidian trade proliferated between Teotihuacan and the Tulancingo Valley, Tepeapulco serving as a nodal point on the route.

A later trip to Tepeapulco revealed the existence of a fragment of a third cross petroglyph (TEP 3). See Table 1 for details.

Tlalancaleca. There are three pecked cross petroglyphs at La Pedrera de Tlalancaleca, a lava field 60 km southeast of Teotihuacan and 10 km north-northwest of the city of San Martin Texmelucan. The volcanic rock on which the petroglyphs are carved lies about 50 m above the surrounding fields (elevation, 2500 m above sea level). Small creeks cut through the terrain, and the crosses seem to be located near the creeks. Occupation dates for the site have been documented for the period 1100 B.C. to A.D. 100, although the archeological studies indicate that major activity occurred between 500 and 100 B.C. After A.D. 100, the site was abandoned. It is difficult to date the carvings precisely but, if they belong to the occupation period between 500 and 100 B.C., they would be the earliest of our series (*13*).

These cross petroglyphs stand apart from the others in that squares replace the circular elements. We find little consistency in the hole count, although the artists seem to have exhibited a slight preference for 9 and 13 (both of these numbers are of calendric significance).

Two crosses (TLA 1 and 2) are situated on the upper slopes and at the northeastern end of a hill. They are carved on vertical outcrops within 100 m of each other, but TLA 1 is probably a fragment that fell from a small rock cliff above after the design had been carved. An observer standing on the large flat rock on which the TLA 3 (Fig. 1i) design is carved views a wide panorama of the eastern horizon. With the surveyor's transit we found the azimuth of the west-east axis of TLA 3 to be 65°54′, which correlates very closely with the azimuth of the sunrise at the summer solstice. A petroglyph having the appearance of a grotesque face, the eyes and nose of which bear a distinct resemblance to a Venus symbol [see the description of elemento 11 in (*13*)], appears on the same slab about 0.5 m west of the cross (see Fig. 1i).

Pecked crosses at the Tropic of Cancer. With the assistance of J. C. Kelley, we were able to locate two petroglyphs in northwestern Mexico approximately 650 km northwest of Teotihuacan. Cerro El Chapin is a plateau of dimensions 80 by 250 m with a clear view of an eastern mountain range at a distance of the order of 15 km. The site may be related to the

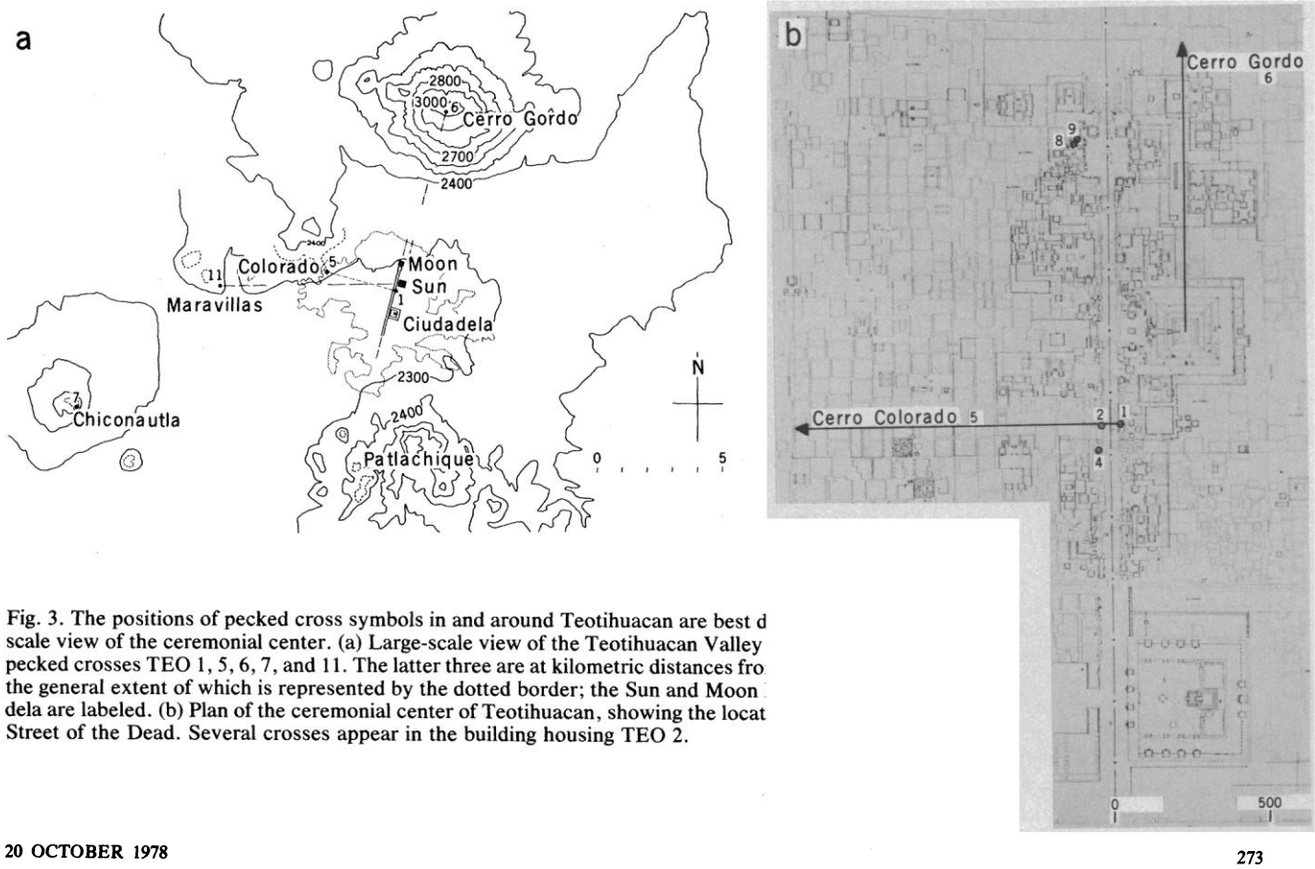

Fig. 3. The positions of pecked cross symbols in and around Teotihuacan are best d scale view of the ceremonial center. (a) Large-scale view of the Teotihuacan Valley pecked crosses TEO 1, 5, 6, 7, and 11. The latter three are at kilometric distances fro the general extent of which is represented by the dotted border; the Sun and Moon dela are labeled. (b) Plan of the ceremonial center of Teotihuacan, showing the locat Street of the Dead. Several crosses appear in the building housing TEO 2.

Alta Vista ruin 7 km to the northeast, which was developed and occupied about A.D. 650 and shows strong Teotihuacan influence (*14*). One of the petroglyphs, originally cited by Gamio (*15*), is a pecked cross of unusually large dimensions and clarity (CHA 1, Fig. 1j) located at the eastern rim of the summit. The hole count (261) is identical to that found on the Riva Palacio petroglyph (*1*), which could be taken to imply that the two are one. However, the dimensions quoted by Riva Palacio are far too large to fit CHA 1 and the shape of the slabs upon which the two designs are carved does not seem to be in general agreement. Furthermore, he refers to his cross as being "in a ruin." The second cross on El Chapin possesses almost the same hole count and axial orientation (CHA 2, Fig. 1k); it is positioned 50 m south of CHA 1.

The El Chapin crosses show the same curious bend in one of the axes as that exhibited by UAX 1. The eastern axes of both crosses point toward the summer solstice sunrise position, which occurs over the prominent peak Cerro Picacho (Fig. 1m). If in either case the axes were intended as solstitial pointers, they were not planned with great precision. Kelley (*16*) reported that the vernal and autumnal equinox sunrises as viewed from Alta Vista occur in a notch adjacent to the same peak. These developments raise the intriguing possibility that a double astronomical alignment, keyed to a pair of prominent solar events along a common horizon, was sought. Furthermore, Kelley has pointed out that the ruins are located very close to the Tropic of Cancer; in fact, he has suggested that they were deliberately placed at the Tropic. The latitude of Cerro El Chapin is 23°24.3′N, whereas that of the Alta Vista ruins is 23°28.7′N (*17*). Using the formula for the inclination of the earth's equator to the plane of the ecliptic (*18*), we determined that the latitude of the Tropic of Cancer at about the time of occupation of Alta Vista (about A.D. 650) would have been 23°36.9′N, or 21.3 km north of the pecked crosses. The present latitude of the Tropic of Cancer is 23°26.7′N.

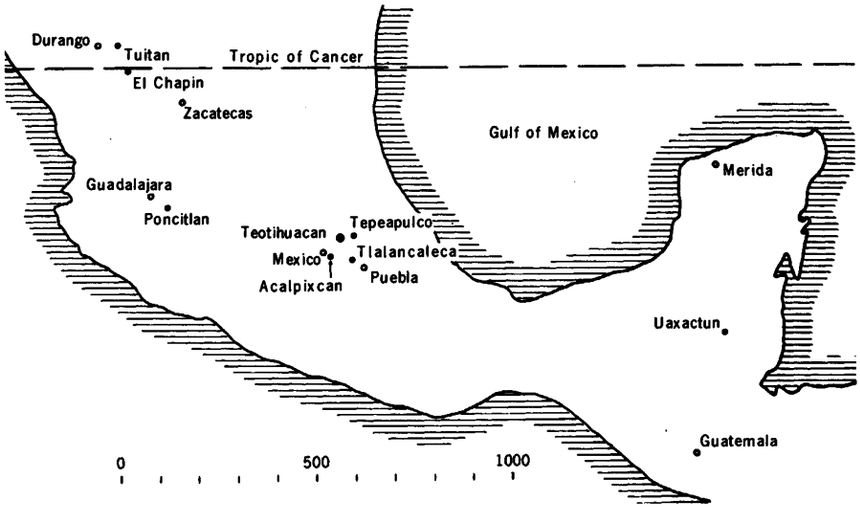

Fig. 4. Map showing the location of cross petroglyphs (closed circles) cited in this article. Open circles designate cities.

Fig. 5. A spiked fringe pattern between circles on the CHA 1 petroglyph. Under appropriate lighting conditions the same design is visible on the right side of the TUI cross petroglyph.

Did Teotihuacanos, migrating to the north, deliberately seek out this particular location? Might they have surveyed the planning of Alta Vista from Cerro El Chapin just as they had laid out Teotihuacan using the pecked crosses? South of the latitude of the Tropic, the sun would cross north of the zenith at noon for a number of days, staying there for a longer duration accordingly as one progresses closer to the earth's geographic equator. North of the Tropic, the sun would never attain the zenith. Thus the Tropic can be thought of as a dividing line. Here the sun would reach the zenith at noon only on the longest day of the year, the summer solstice. It appears that the very close proximity of the Tropic to these elaborate pecked designs is no coincidence. The use of the concept of the sun at the zenith in the formulation of Mesoamerican calendars is well documented ethnographically. A 19th-century quote by Juan Pio Pérez (*3, 4, 19*) regarding the determination of the date of passage of the sun across the zenith states that [(*19*), p. 250]

> To this day the Indians call the year Jaab or Haab, and, while heathens, they commenced it on the 16th of July. It is worthy of notice that their progenitors, having sought to make it begin from the precise day on which the sun returns to the zenith of this peninsula on his way to the southern regions, but being destitute of instruments for their astronomical observations, and guided only by the naked eye, erred only forty-eight hours in advance. That small difference proves that they endeavoured to determine, with the utmost attainable correctness, the day on which the luminary passed the most culminating point of our sphere, and that they were not ignorant of the use of the gnomon in the most tempestuous days of the rainy season.

An error of 48 hours in the determination of zenith passage translates to a variation of about 0.5° in solar declination, about 50 km of latitudinal distance if one were attempting to determine the place

in Mexico where the sun would cross the zenith on a given day. Whether the Mesoamericans used shadow-casting devices or vertical sight tubes incorporated into the architecture for viewing the zenithal event (*20*), an error of 50 km in pinpointing the spot seems quite respectable in view of the crude state of their astronomical technology.

Another pecked cross is located 67 km north of the Tropic of Cancer. About 6 km east of the village of Tuitan, near the city of Durango (70 km north-northwest of El Chapin), is a large design (TUI) carved into a smooth flat portion of the lava fields, a rare location considering the rugose, undulating character of the terrain called "Mal Pais." The design (Fig. 1*l*) consists of a large triple circle superposed on the usual 10 + 4 + 4 axial pattern; the east-west axis is badly eroded. The hole count, estimated at 341, is reduced to 257 (again close to 260) if one omits the tally on the outer circle. A curious array of pits, including two large holes equidistant from the center, appear within the inner circle. The same pair of holes but in different quadrants can be identified in the CHA 1 design (Fig. 1j). Conceivably these could have served as postholes in a complicated shadow-casting scheme.

The east-west axis of this northern petroglyph also can be interpreted as a direction marker either for the December solstice sunrise or the June solstice sunset, to which it points. Under favorable lighting conditions, a spiked fringe pattern between the circles on the CHA 1 (see Fig. 5) and TUI petroglyphs is clearly visible. With this fringe pattern, the designs resemble the drawings of solar symbols found in the Mixtec codices (*21*).

Summary of Petroglyphic Data

In the foregoing sections we have presented a body of descriptive data concerning 29 pecked cross designs found at several widespread locations in Mesoamerica (see Fig. 4). The examples share a number of common characteristics which should be listed before we consider various hypotheses to account for their origin.

1) General form: Averaging somewhat less than a square meter in size, the most frequent design form incorporates a set of orthogonal axes on which a double circle is centered. In a few cases a single or triple circle is used. Departures include the TEO 2 and Acalpixcan carvings in which the circular patterns take

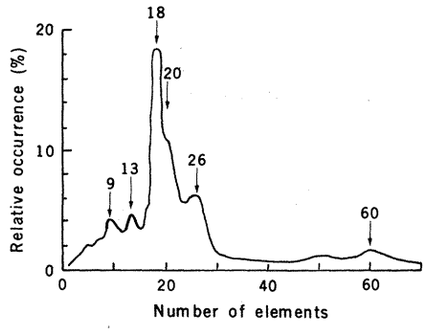

Fig. 6. Histogram showing the relative frequency of occurrence of different numbers of elements comprising the quadrants of circles and axial arms of the pecked crosses.

the form of two-dimensional crosses, the Tlalancaleca and Poncitlan crosses in which a double square border replaces the double circle, and TEO 7, which is a multiaxial pattern with no completely closed geometrical figure.

2) General setting: Eleven designs are pecked into the floors of buildings (three at Uaxactun and eight at Teotihuacan). The remainder are carved on rock outcrops, most of which offer panoramic views of the horizon to the east (TEO 5, 7, and 11; CHA 1 and 2), south (TEO 6 and TLA 3), and west (TEP 1 and 2).

3) Mode of execution: All but two crosses, TEO 6 and 11, were created with some sort of percussive device. The cuplike depressions constituting the design average 1 centimeter in diameter and are spaced 2 cm apart.

4) Orientation of the axes: The axes of the crosses located along the Street of the Dead align with the Teotihuacan grid, and those at Uaxactun seem to have been intended to match the orientation of its buildings. A few of those located outside ceremonial centers, particularly those in northwestern Mexico, exhibit a tendency to point in the general direction of the rising or setting points of the sun at the solstices. Two of these may have been deliberately placed to mark the Tropic of Cancer. Certain of the axes of five of the petroglyphs exhibit marked deviations from orthogonality which may have been deliberate (TEO 1, UAX 1, CHA 1 and 2, and TUI).

5) Orientation between the crosses: TEO 1 and 5 seem to have functioned as architect's bench marks with respect to Teotihuacan. Possibly we can say the same for CHA 1 and 2 with respect to Alta Vista, TEP 1 and 2 with respect to Teotihuacan, and TEO 6 and TEX with respect to Teotihuacan. In these cases a significant cross-to-cross or cross-to-site alignment exists. Some of these long-distance base lines may have resulted from astronomical motives such as the desire to align the markers with the position of appearance or disappearance of an important astronomical body on the local horizon.

6) Numerology: The most obvious pattern in the placement of the holes is the 10 + 4 + 4 axial grouping, which is practically universal. A count of 260 ± 5 days is frequently depicted. In Fig. 6 we examine the relative occurrence of the number of holes on axes and quadrants of all the patterns. Peaks in the histogram occur at the most important numbers we find recorded in native American calendars. The most frequent integer by far is 18, the number of days in a month of their 365-day year; it is probably related to the 10 + 4 + 4 count. Not surprisingly, 13 and 20 are prominent as well as a double 13, which shows up as a peak in the region 25 to 26 on the horizontal axis. Less certain are 9 (the number of Lords of the Night?) and 60 (triple 20?).

Iconography of the Pecked Cross Symbol

The quartered circle is a common symbol in Mesoamerican art. Coggins (*22*) has recently summarized a number of iconographic contexts in which this form occurs in Mesoamerica. Most of her examples exhibit a specific calendric reference (for example, the Kan cross, the Kin sign, the Maya symbol of Venus, the Maya completion sign). But we must be careful about drawing conclusions based upon general comparisons between symbols we find pecked in stone and those that occur in other media or in other locations outside Mesoamerica. Nevertheless, we encounter a few examples in the literature which bear enough resemblance to the pecked crosses discussed in this article to deserve mention.

Schwarz and Biedermann [(*23*), figure 127a] have displayed petroglyphs found in California that consist of a double circle on a Cartesian frame; other examples (figures 127, 127b, and 133) show divided circles suggestive of cardinal direction and intercardinal point indicators. Mayer (*24*) has listed symbols in Heizer and Baumhoff [(*25*), figures 113, 173g, and 352], showing the motif clearly displayed in Nevada and eastern California rock art, and in Heizer and Clewlow [(*26*), figures 168e, 272a, 335i, and 371b], showing examples from California rock art. Numerous cross-circle designs are pictured in Fundaburk (*27*) and Emerson (*28*). Six examples of flat stamps showing motifs of the patolli

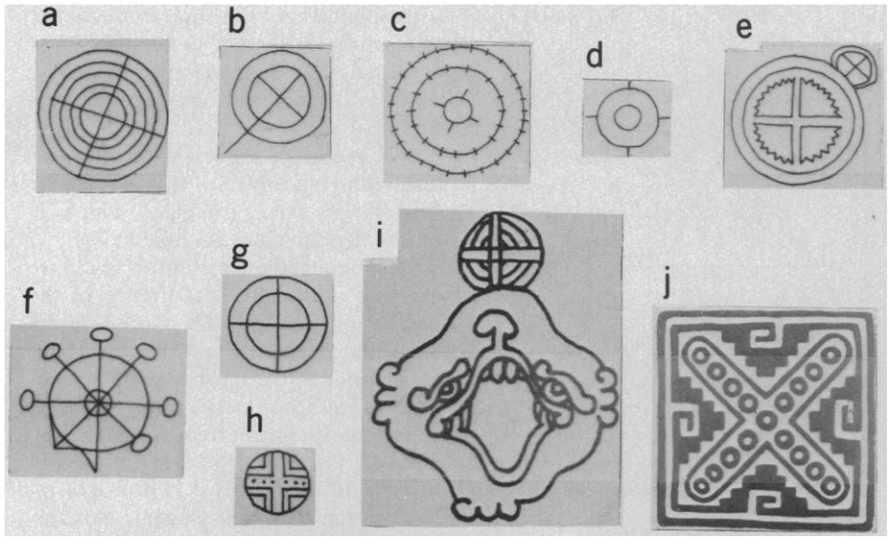

Fig. 7. Carved and painted symbols resembling pecked crosses (a through h) in California and Nevada rock art [(*25*), figures 352 and 173g; (*26*), figures 371b, 335i, 272a, and 168e; (*23*), figures 127a and 133]; (i) as a cave symbol (*30*); and (j) as a roller stamp design (*29*).

game are given by Enciso (*29*). These display the pecked cross design as well as the cardinal and intercardinal directions.

Finally, a representation of the design in connection with the cave symbol may be found perched on the nose of an open-mouthed serpent in the toponymic glyph of the village of Oztoticpac (*30*), one of the many Mexican villages located near caves. Since both the Teotihuacan and Cerro El Chapin crosses are located in the vicinity of caves and since the Pyramid of the Sun at Teotihuacan may have been oriented to face the direction of the mouth of the cave over which it lies, this reference may have special significance. Some of the aforementioned examples are displayed in Fig. 7. A thorough study of the quartered circle design motif in other contexts should be initiated.

Discussion and Interpretation

Reviewing the mass of data in Table 1 and the brief analysis of its content in the last section, one is hard-pressed to generate a single hypothesis that can adequately account for the location, orientation, and numerology associated with all pecked cross symbols. It is our basic purpose in this article (i) to demonstrate that a petroglyphic design possessing features which imply a common motive in the minds of its creators is widespread and (ii) to suggest several hypotheses for the design which seem consistent with the facts emerging from a careful examination of the data. Since so many detailed similarities exist among the crosses, we cannot dismiss them as only symbols. To conclude that they merely represent the sun or that they were solely intended to serve a ritualistic function would be to disregard a sizable portion of the body of facts gleaned from the historical record and our fieldwork. Accordingly, in this section we consider three separate hypotheses which, taken individually, appear to be quite reasonable. Then we attempt to weave these hypotheses into a broad multipurpose explanation that is consistent with both the body of petroglyphic data considered as a whole and the Mesoamerican cosmological mentality.

Pecked crosses as calendars. Since our analysis of the numerological data generates precisely those numbers that occur most frequently in the Mesoamerican calendar, the most logical hypothesis one might formulate upon cursory examination of the pecked crosses is that their creators utilized them as calendars. This view seems to have struck both Smith (*5*) and Chavero (*1*) when they first saw examples of the design.

To facilitate the comparison between pecked crosses and calendars, let us take a closer look at how Mesoamerican calendar wheels actually functioned. We consider two diagrams from the codices: Fejervary-Mayer (east of the Puebla-Tlaxcala region, 15th century) (*31*, p. 1) and Tro-Cortesianus (Madrid) (Maya, 15th century) (*32*, pp. 75–76). Since both are nearly identical (Fig. 2, a and b) (*33*), we shall review the function of only one of them [A. Caso's interpretation of the Fejervary-Mayer in Kingsborough (*34*)].

Viewed both symbolically and functionally, the basic feature of the diagram is a floral symbol with two sets of four petals: (i) a "Maltese cross" with large trapezoidal petals fitting a Cartesian frame and (ii) a "St. Andrew's cross" or floral pattern consisting of four smaller rounded petals positioned at angles of 45° between those of the Maltese cross. A square design forms the center of the pattern.

The border of the entire design is marked with circles whose count totals 260. The ritual count is divided into cycles of 20 named days, counted in groups of 13. The first set of 13 commences with the sign 1 Cipactli (alligator), which is located just above the upper right-hand corner of the central square. Moving counterclockwise along the border, we proceed to count 12 blue dots (shown on a dark field in the figure) completing the count of 13 on 1 Ocelotl (jaguar). The third cycle passes across the top of the diagram ending on 1 Mazatl (deer). We continue the pattern all the way around the diagram, finally returning to 1 Cipactli, to close the ritual count. All of the day symbols are pictured at the vertices of the double-cross design. Thus the 260-day cycle is made to encapsulate all the other astrological and calendric material depicted within the diagram.

The five regions of the world along with their associated colors are enshrined in the four arms of the Maltese cross and at the center: the four cardinal points (crossarms) and the zenith (center). We have east (red) at the top, west (blue) at the bottom, north (yellow) to the left, and south (green) to the right. When the sun rises, "he" sees the north to his right, and the south to his left; straight ahead is the region of the west where he will "die" each night. In this depiction the sun is represented by a disk placed on an altar in the eastern arm of the Maltese cross, while the death head is pendant in the corresponding position below the central square. The four arms of the St. Andrew's cross signify the four houses of the sun in the sky, two in the east and two in the west. These are the intercardinal points symbolizing the extremes to which the sun will migrate along the horizon during the course of the year. Thus, we have summer solstice sunrise at the upper left, winter solstice sunrise at the upper right, summer solstice sunset at the lower left, and winter solstice sunset at the lower right.

Within each quadrant signifying a cardinal direction, one finds a representative tree, a source for the tree, a bird, and a directional ritual. Xiuhtecuhtli, the

celestial war god, is located at the center. He is armed with spears and atlatl, a device to extend the arm in spear-throwing, and toward him flow four streams of blood. He is the first of nine Lords of the Night. The remaining eight Lords are also pictured, two to each flap of the Maltese cross.

To use the calendar to tally the count of the 365-day year we begin in the east with 1 Acatl, the name associated with New Year's Day for that year and consequently the day that brings in or bears that year. Counting through the cycle of 20 day names 18 times, we are left with a remainder of 5 days; thus we arrive at the name of the day bearing the second year: Tecpatl. Likewise, New Year's Day of the third year bears the name Calli and that of the fourth year, Tochtli. The fifth year begins on the same day as the first, Acatl (since $365 \times 4 = 1460$ and division by 20 gives a remainder of zero), and we close the cycle. Thus, only four day names can coincide with the initiation of the New Year. These are the so-called year bearers, and their day glyphs are pictured, one to each tip of a petal of the St. Andrew's cross, each borne on the back of a ceremonial bird. The 20 day names, including the year bearers, are divided into four groups, and they appear in four of the interstices between the arms of the two crosses. In the other four spaces flow rivers of sacrificial blood, each beginning at a different part of the human anatomy.

Clearly, the expositors of the Mesoamerican calendar were trying to unite various symbols within a cosmological framework. Associated with each direction in the Fejervary-Mayer diagram we find a color, bird, plant, or various other symbols; even parts of the body take on a spatial cosmological interpretation.

It is of astronomical interest that the diagram embodies both the 260-day ritual count and the solar-based 365-day year, not only in the form of a count of days but also in the incorporation of the oscillatory annual movement of the rising and setting sun along the horizon. Thus, the central theme of the calendar seems to be the unification of the two counts, a matching or fitting of the ritual and solar year cycles. Unfortunately, we have little evidence to suggest how Mesoamerican astronomers actually accomplished this task from observations of the heavens. This spatiotemporal unification is also exemplified in calendric diagrams through the use of year bearers for directions, the allocation of certain named days to zones around the horizon, and the counting of the 260 sacred days

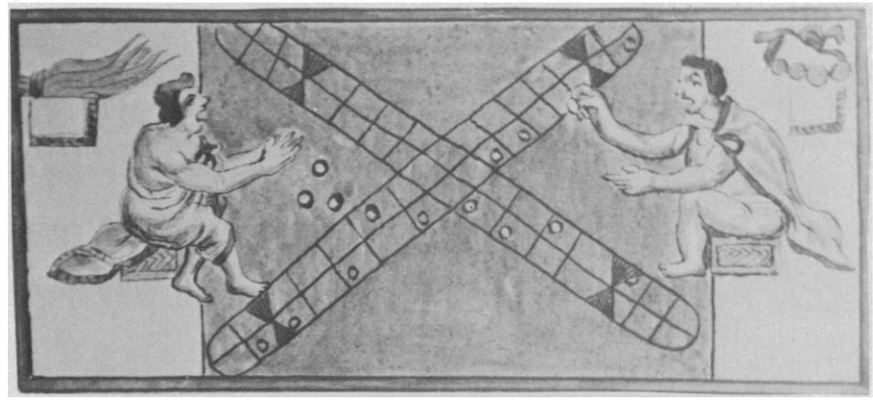

Fig. 8. A representation of the game of patolli. [After Duran (*36*)]

along the perimeter of the world. We also find time and the calendar taking on spatial characteristics in Mesoamerican architecture. At Uaxactun, certain buildings were designed so that their tops would occult the rising sun at the equinoxes and solstices as viewed from a central location. Zenithal solar observatories at Monte Alban and round tower observatories in the Yucatan also incorporate sight lines for viewing time-based events on the celestial sphere. For a full discussion, see Aveni (*35*).

Two other calendars in the conquest period literature which resemble the pecked cross designs are shown in Fig. 2, c and d. Figure 2c is the one to which Smith (*5*) referred in his discussion of the quartered circles at Uaxactun. Of early postconquest origin, it features a world symbol at the center. Cardinal directions are labeled (east at the top again), and the intercardinal points project to the horizon. The 20 named days and 13 day numbers, symbolized by human faces, are positioned around the horizon, each being assigned to a specific region of space. Cauac, Kan, Muluc, and Ix (Hijx) are the year bearers. Reckoned counterclockwise, these are the first named days in each cardinal region.

In the calendar wheel presented in Diego Duran's *Book of the Gods* [(*36*), plate 35] (Fig. 2d), the Aztec 52-year cycle is displayed in a cross and circle motif, which is divided into four groups of 13 years, each with year bearer dates. It is intended to be read from the center outward in spiral fashion in a counterclockwise direction. Thus we begin with 1 Reed at the top, representing the east, 2 Flint Knife (left, north), 3 House (bottom, west), 4 Rabbit (right, south), 5 Reed (top, east), and so on. Apropos of the pattern in the pecked crosses, it is worth noting that the 13 count proceeds from the central sun along each Cartesian axis in patterns of 4, then bends to a 9 count along each quadrant of the circumference.

We developed the calendric hypothesis not because of a similarity between the general appearance of pecked crosses and calendar wheels but specifically because many of the numbers associated with the symbols carved in stone are matched in the picture calendars in the codices. The 260-day count appears on the outer border of TEO 2 and as total counts on the CHA 1, CHA 2, and RIV petroglyphs. What is probably an approximation to the double Tzol kin ($2 \times 52 = 104$) occurs on the outer circles of TEO 1, TEO 3, CHA 1, and CHA 2 as well as on the inner circles of TEP 1 and UAX 1. The persistent $10 + 4 + 4$ pattern may imply that months as well as days and years were being counted. But how do we explain the many deviations from 104, 260, and other standard calendric numbers? We might suppose (i) that in some cases the pecked crosses are purely symbolic rather than functional calendric abaci or (ii) that in other cases the crosses were used as agricultural calendars and the different counts resulted from varying calendric needs at the local level. (iii) Many of the petroglyphs are effaced, and in most cases we can approximate the total count only to within $\pm$ 5 or 6 holes.

Pecked crosses as orientational devices. The data also tell us that there are a number of reasons for believing that the situation and orientation of the pecked cross designs emerged as a consideration in their construction. Some of the data suggest orientation with respect to local sites, other data suggest an astronomical motive (principally solar), but no all-encompassing orientational theme has yet emerged.

If we scan the orientational data of Table 1, we are immediately struck by

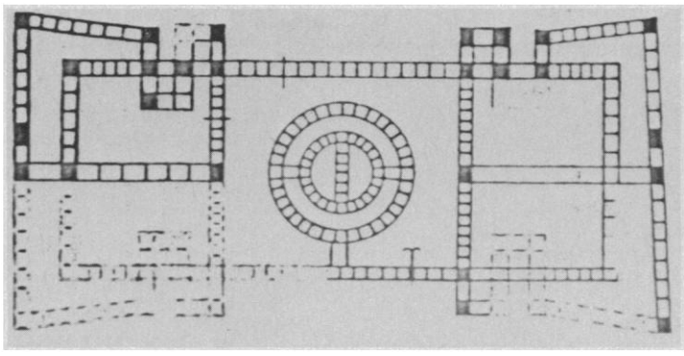

Fig. 9. One of two painted designs possibly representing the game of patolli on the floor of a Huastec structure. [After Muir (*40*)]

the nonrandom arrangement of axes. The arms of the crosses cluster rather heavily about two directions: (i) the basic Teotihuacan grid orientation with its clockwise skew of 15° to 17° from the cardinal points and (ii) deviations 22° to 26° clockwise from the cardinal directions. The former orientation, generally applicable to pecked crosses in the ceremonial zone of Teotihuacan, without doubt must be related to the propagation of the grid plan of that city. The latter orientation is more common among the pecked crosses of northwestern Mexico and appears to have served as a solstitial register intended to mark the sun's extreme positions on the horizon. For example, the western axes of the crosses at Cerro El Chapin point close to the direction of summer solstice sunset. This pair must have been carefully laid out since, although they are 50 m apart, their western axes lie within 52 minutes of arc of parallel. Curiously, two of the cross sites are very close to the Tropic of Cancer.

There are two other orientational coincidences: (i) TEO 2, 3, 10, and 12 are carved in the floor of the same building at Teotihuacan with their axes all parallel, and (ii) UAX 1, 2, and 3 are carved in the floor of the same building complex at Uaxactun with their axes parallel. Other solstitial arrangements include TLA 3, TUI, and possibly TEO 4, the only cross along the Street of the Dead that does not align with the Teotihuacan grid. This design may have been utilized to attach an astronomical reference frame to the Teotihuacan grid system. The spiked fringes on CHA 1 and TUI further suggest a solar motive.

Since we find orientational relationships between pairs of crosses as well as in the axes of individual crosses, the orientational hypothesis may be regarded as dualistic. The most obvious cross-to-cross pattern connects TEO 1 and 5 to the Teotihuacan grid direction and also offers an astronomical motive (*8*).

Since all of the sites mentioned show Teotihuacan influence and seem to have flourished during the zenith of the Teotihuacan empire, a common connection among all of them might be postulated. The orientational scheme, although far from being completely understood, suggests a relationship to Teotihuacan. This is especially evident when one stands on the TEP 1 carving and finds his view directed to the back of Cerro Gordo, where another quartered circle overlooking the ceremonial center is located.

Pecked crosses as games. The following statement, written shortly after the conquest of Tenochtitlan by the Spanish in 1519 [(*36*, p. 302], suggests another possible function for the pecked crosses.

> Another game was played as follows. *Small cavities were carved out of a stuccoed floor* in the manner of a lottery board. Facing each other, one [player] took ten pebbles, and the other [also took] ten. The first placed his pebbles on his side, and the other on his. Then they cast split reeds on the ground. These jumped, and those that fell with the hollow side face upward indicated that a man could move his pebbles that many squares. Thus they played against one another, and as many as a player caught up with he won, until he left his opponent without chips. Occasionally it happened that, after five or six [pebbles] had been taken, with the four remaining ones the reeds were also bet, together with the others, and thus the game was won [authors' italics].

According to Pasztory (*37*), the Aztec game of patolli was known at Teotihuacan (as suggested by the appearance of several game board designs incised into the plaster floors of buildings); Pasztory did not suggest directly that the pecked crosses have anything to do with the game boards. By Aztec times, these devices were cross-shaped and the players moved beans over a pecked surface or over a painted mat. In at least one form of the game played in the southwest, a circle consisting of ten pits per quadrant was used (*38*). As the depiction of the playing surface in Fig. 8 suggests, the game bore a distinct resemblance to the Indian game of pachisi. The principal feature of the board was an "X" or cross, undoubtedly symbolizing the four directions. Frequently, the board was divided into 52 or 104 divisions and the players moved markers from point to point on the board. Dried beans were painted with numbers representing the value of the number of points to be advanced. According to Duran [(*36*), p. 303; see also (*39*)]:

> If the painted number was five, it meant ten [squares]; and if it was ten, it meant twenty. If it was a one, it meant one; if two, two; if three, three; if four, four. But when the painted number was five, it meant ten, and ten meant twenty. Thus those small white dots were indicators and showed how many lines could be passed while moving the pebbles from one square to another.

The grouping of numbers in units of 5, 10, and 20 may bear a distinct connection to the arrangement of cuplike depressions on the axes of the pecked crosses. If we include in the count the intersection of the axes with the circles, then our tally becomes 10 + 1 + 4 + 1 + 4 or 10 + 5 + 5.

Two paintings of the patolli board on the floors of Huastec buildings were reported by Muir (*40*). Although they are quite different from the board pictured in Fig. 8, the patterns, one of which is depicted in Fig. 9, bear a significant resemblance to the Teotihuacan crosses. Not only do they occur in the same architectural context (the floors of buildings) but also they consist of double circles, the axes of which appear to be aligned with or skewed slightly from the cardinal directions. The number of elements on the outer circles is 32 and 28, on the inner circles 22 and 20, not counting the intersection points. Muir indicated that exposures of the underlying stucco floor, now destroyed, revealed similar painted designs from an earlier phase of the culture.

General Conclusions

The Mesoamerican cosmic view encompassed a multivariate interpretation of the calendar, a characteristic quite different from our Western view of dealing with time. Are space and time also locked together in the symbolism of the cross petroglyph? If we are willing to believe that design patterns such as the Maya calendar in the Book of Chilam Balam of Kaua (*6*), the Aztec calendrical wheel in Duran (*36*), or those in the Codices Fejervary-Mayer (*31*) and Madrid (*32*) bear a distinct resemblance to the quartered circle petroglyphs, then it should not be so surprising to find evidence in the examination of the petroglyphic data which permits not only orientational and numerical interpretations but also the possibility that religious games were involved.

The evidence for a hidden likeness between cross petroglyphs and calendar wheels discussed in this article seems quite specific. The axes of several cross petroglyphs do, in fact, correlate with solstice positions, and the solar symbolism is strongly suggested by the spiked fringe we find on two of the symbols. In the case of the TEO crosses, axial direction seems to have been modified to fit the overriding architectural plan. Evidently "Teotihuacan North" was more important than "astronomical north," at least important enough to warrant marks in the floors of buildings. The environment of many of the crosses seems to have been chosen because of the advantage of long-distance unobstructed observations, either of heavenly bodies near the horizon facing the site or of other markers, signs, or perhaps ceremonial centers in the adjacent landscape.

The chronology of the petroglyphs is difficult to establish. Based on what we know about the sites at which the designs are located, our data are consistent with an origin in and diffusion from the classic Teotihuacan empire. The Tlalancaleca crosses, however, may be somewhat earlier. Their simpler and smaller forms, with the diagonalized square pattern and fewer holes, may have been the forerunner of the more sophisticated, carefully oriented pecked crosses at Teotihuacan and elsewhere.

The discovery of perfectly preserved examples in the Peten seems surprising, especially at so early a site as Uaxactun. This petroglyph, along with its two adjacent companions and the pecked cross at nearby Seibal (see Table 1), are the only ones we have found south of highland Mexico and would appear to be a direct result of the Teotihuacan influence we already know existed there. But the extraordinary number of pecked cross designs found in the Teotihuacan environment does not necessarily preclude the possibility that these curious patterns are more numerous elsewhere. Perhaps the most thoroughly examined tree has simply yielded the most fruit.

References and Notes

1. A. Chavero, in *Mexico a Través de Los Siglos*, V. Riva Palacio, Ed. (Editorial Cumbre, Mexico City, 1889), vol. 1, p. 737. A picture of the design with no commentary appeared 3 years earlier in A. Chavero, *An. Mus. Nac. (Mex.)* **3** (1886), plate C2.
2. Authors' translation from the Spanish.
3. Hypotheses proposed for the origin of the 260-day count include (i) that the tropical year can be divided naturally into periods of 260 and 105 days by the passage of the sun across the zenith of Copan, which possesses the proper geographic latitude; (ii) the same except that the count originated at Izapa, located west of Copan but possessing nearly the same latitude; (iii) that the commensurability of the eclipse half-year (a 173.5-day eclipse cycle) with the Tzol kin in the ratio of 3 to 2 is responsible; (iv) that 260 days is close to the gestation period of the human female; and (v) that 260 results simply from the union of the two basic numbers 13 and 20. For details, see: V. H. Malmstrom, *Science* **181**, 939 (1973); J. S. Henderson, *ibid.* **185**, 542 (1974), and references therein.
4. S. G. Morley, *The Ancient Maya* (Stanford Univ. Press, Stanford, Calif., ed. 3, 1956), p. 132; M. Coe, in *Archaeoastronomy in Pre-Columbian America*, A. F. Aveni, Ed. (Univ. of Texas Press, Austin, 1975), pp. 3–31; R. Girard, *El Calendario Maya-Mexica* (Editorial Stylo, Mexico City, 1948), pp. 49–85. The 17 May zenith passage day is one of the pivotal points in the Aztec calendar. Occurring on 4 Toxcatl in Aztec times, it symbolized the Black Tezcatlipoca of the north. Religious festivals were installed to celebrate the zenithal event, which was said to inaugurate the rainy season. That the New Year began on 1 March (= 1 Atlcahualo) seems quite reasonable in view of the statements in the chronicles about the time of the observation and celebration of the vernal equinox. See P. Carrasco, in *Historia General de Mexico, Tomo I* (Colegio de Mexico, Mexico City, 1976), pp. 272–278; in *Homenaje a Paul Kirchhoff* (Colegio de Mexico, Mexico City, in press).
5. L. Smith, *Carnegie Inst. Washington Publ. 588* (1950), pp. 21–22.
6. C. P. Bowditch, *The Numeration, Calendar Systems and Astronomical Knowledge of the Mayas* (Harvard Univ. Press, Cambridge, Mass., 1910), figure 64.
7. R. Millon, *Acts 37th Int. Congr. Am.* **1**, 113 (1968).
8. J. Dow, *Am. Antiq.* **32**, 326 (1967); A. F. Aveni, in *Archaeoastronomy in Pre-Columbian America*, A. F. Aveni, Ed. (Univ. of Texas Press, Austin, 1975), pp. 163–190. See A. Aveni and S. Gibbs [*Am. Antiq.* **41**, 510 (1976)] for a detailed discussion of the problem of Teotihuacan orientations. Apparently later builders in central Mesoamerica copied this direction in the layouts of their cities.
9. M. Gaitan, A. Morales, H. Harleston, G. Baker, paper presented at the 41st International Congress of Americanists, Mexico City, 1974.
10. Some of the results in (*9*) are reported in P. Tompkins, *Mysteries of the Mexican Pyramids* (Harper & Row, New York, 1976), pp. 314–325.
11. G. Cowgill, personal communication.
12. T. Charlton, *Mem. 15th Mesa Redonda Soc. Mex. Antropol.*, in press.
13. A. Garcia Cook, *Proyecto Puebla Tlaxcala Comun.* **9**, 30 (1973). He calls the carvings elementos 9, 10, and 11.
14. J. C. Kelley, personal communication.
15. M. Gamio, *An. Mus. Nac. Antropol. Hist. Etnol. Mex., Tomo II* (1910), pp. 468–492. Although Gamio described the design as a curious geometric representation (authors' translation), his interpretation suggests that it was a calendar designed to measure the 260-day cycle and the religious year of the northern people. Apparently he did not notice the second El Chapin cross.
16. J. C. Kelley, paper presented at the American Anthropological Association meeting, Houston, December 1977.
17. CETENAL (Dirección de Estudios Económicos; Comisión de Estudios del Territorio Nacional), Carta Topográfica; Chalchihuites, F-13-B-34 (1971).
18. E. Woolard and G. Clemence, *Spherical Astronomy* (Academic Press, New York, 1966), p. 258.
19. See J. Pio Pérez (a political chief in Yucatan at the time of John Lloyd Stephens's visit there) in the appendix of J. Stephens, *Incidents of Travel in Yucatan* (Harper, New York, 1843), vol. 1, p. 280.
20. See A. Aveni and R. Linsley [*Am. Antiq.* **37**, 528 (1972)] for an example of a vertical sight tube at Monte Alban.
21. For example, *Codex Nuttall*, Z. Nuttall, Ed. (Dover, New York, 1975), p. 44 (lower right), p. 67 (upper right), p. 76 (lower right).
22. C. Coggins, paper presented at the Colgate University Symposium on Teotihuacan and Classic Mesoamerica, Hamilton, N.Y., August 1977.
23. I. Schwarz and H. Biedermann, *Das Buch der Zeichen und Symbole* (Droemer Knaur, Munich, 1975).
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26. R. Heizer and C. Clewlow, Jr., *Prehistoric Rock Art of California* (Ballena, Socorro, N.M., 1973).
27. E. Fundaburk, *Sun Circles and Human Hands* (Paragon, Knoxville, Tenn., 1957).
28. E. Emerson, *Indian Myths* (Ross & Haines, Minneapolis, 1965).
29. J. Enciso, *Design Motifs of Ancient Mexico* (Dover, New York, 1947).
30. D. Heyden, *Am. Antiq.* **40**, 134 (1975).
31. Codex Fejervary-Mayer, facsimile edition, *Codices Selecti* (vol. 26) (Akademische Druck-u Verlagsanstalt, Graz, 1971).
32. Codex Tro-Cortesianus (Codex Madrid), facsimile edition, *Codices Selecti* (vol. 8) (Akademische Druck-u Verlagsanstalt, Graz, 1967).
33. They are duplicated side by side in A. Maudslay, *Archaeology: Biologia Centrali-Americana, or Contributions to the Knowledge of the Fauna and Flora of Mexico and Central America* (Porter, London, 1889), vol. 1, plate 32.
34. E. Kingsborough, *Antiquities of Mexico* (Havell, London, 1831), vol. 4, pp. 185–275 (Codex Fejervary-Mayer).
35. A. Aveni, in *Native American Astronomy*, A. Aveni, Ed. (Univ. of Texas Press, Austin, 1977), pp. 3–19. Carrasco (*4*) suggested that by Aztec times an orderly method must have evolved for the regulation of the tropical year (of length 365.2422 days) with the 365-day count (called Xihuitl by the Aztecs). Apparently, the setting of certain feast days celebrating the months was determined by astronomical observations (for example, Tlacaxipeualiztli by the vernal equinox and Panquetzaliztli by the winter solstice).
36. D. Duran, *Book of the Gods and Rites and the Ancient Calendar*, F. Horcasitas and D. Heyden, Eds. (Univ. of Oklahoma Press, Norman, 1971).
37. E. Pasztory, *The Murals of Tepantitla* (Garland, New York, 1976), pp. 191–193.
38. C. J. Erasmus, *Southwest J. Anthropol.* **6**, 369 (1950), especially figure 2. He also discusses possible diffusion of the game from Asia.
39. S. Culin, *U.S. Bureau of American Ethnology, 24th Annual Report* (Smithsonian Institution, Washington, D.C., 1902).
40. J. Muir, *R. Anthropol. Inst. J.* **56**, 231 (1926).
41. H. Hartung, *Die Zeremonialzentren der Maya* (Akademische Druck-u Verlagsanstalt, Graz, 1971), plate 8.
42. R. Millon, B. Drewitt, G. Cowgill, *Urbanization at Teotihuacan* (Univ. of Texas Press, Austin, 1973).
43. A. Cuevas, unpublished data. For details, see (*9, 10*).
44. C. Cook, *El Mexico Antiguo* (Sociedad Alemana Mexicanista, Mexico City, 1955), vol. 13, p. 169.
45. H. Harleston, personal communication.
46. J. Parsons, *Mem. Mus. Anthropol. No. 3* (1971), plate 36B.
47. Drs. A. Peschard, J. Ganot, and E. Lazalde, three Durango physicians who discovered the petroglyph, were kind enough to escort us to the remote site.
48. A. L. Smith, personal communication.

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