Symmetry of STRUCTURE

an interdisciplinary Symposium

Abstracts

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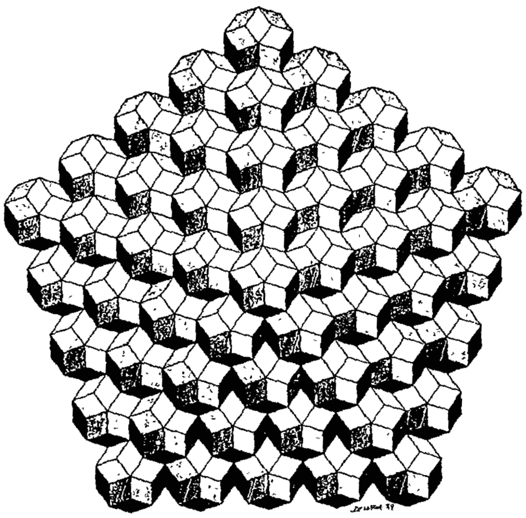

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ANCIENT MEXICO, A WORLD OF ORDER; BUT ALSO A WORLD OF SYMMETRY?

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Paul Kirchhoff, the eminent investigator of ancient Mesoamerica, wrote in his unedited notebooks:

"Ancient Mexico is a world of order, in which everything and everybody has his proper place .... All things have their place because thus it has been prophesized. Architecture and calendrics are structuring principles: the calendar is a two-fold structuring principle, with time and with space. These cultures do not know chaos."

We found the orderly structure of ancient Mexico in the reality not only in the architecture but also in the orientation lines in the landscape, in the planning of towns, ceremonial centers and of settlements with their surrounding fields. The four solstitial points were of fundamental importance. They provided the basis for the conception of cosmological space. This concept is represented on the symmetrical day sign "olin", (see Fig.1), very clear designed in Olmec times but also to see in the center of the Aztec Calendar Stone. The solstices explain the

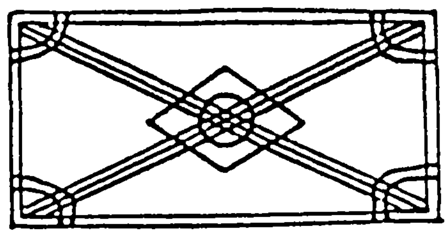

Fig. 1: Olmec engraving on a stone celt from La Venta, Tab. Mexico, identified as a complex representation of the cosmic ideogram (after Koehler 1982, fig. 4).

clockwise deviation of about 25°, that orientation lines show from our usual cardinal directions, see the ground plan of the pyramid and town of Cholula. There are other deviations as for example at Teotihuacan with $16-17^{\circ}$ and the Templo Mayor of Tenochtitlan and the ground plan of the city with 7°. Although other lines had been measured in the pre-Columbian architecture, their total number was too small to draw unambiguous conclusions. Another method was more successful, the measurement of the churches, i.e. the buildings succeeding pre-Hispanic ceremonial structures (Fig. 2).

The frequency distribution permitted to identify a sequence of angles with regular intervals of $4-5^{\circ}$: 2°, 7°, 11°, 16°, 20° and 25°. There might have existed an underlying angular unit of 4.5° or 5^{g}, i.e. 1/20 of a right angle. We see the geometry of an angle observation system for the Central Mexico area, based on the sunsets in the summer half-year (Fig. 3). This is <u>the order of space</u>. The geometry of the system did not seem to be an sufficient explanation for the orientations observed. So the attempt was made to find an orientation calendar, the <u>order of time</u>.

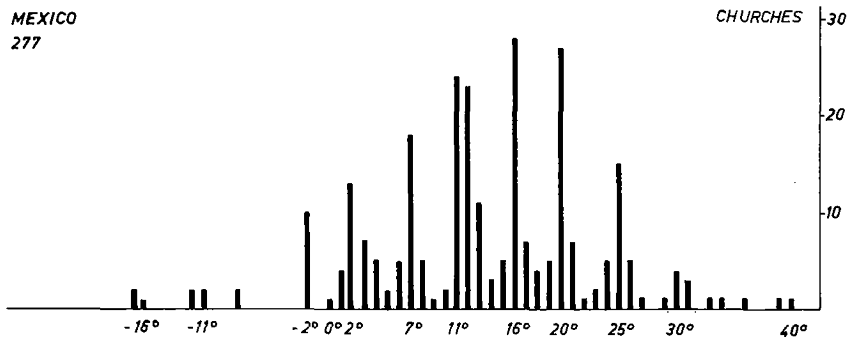

Fig. 2: Histogram showing the distribution about astronomical east of the axes of 277 churches in the Mexican basin.- From Tichy 1982, p.65.

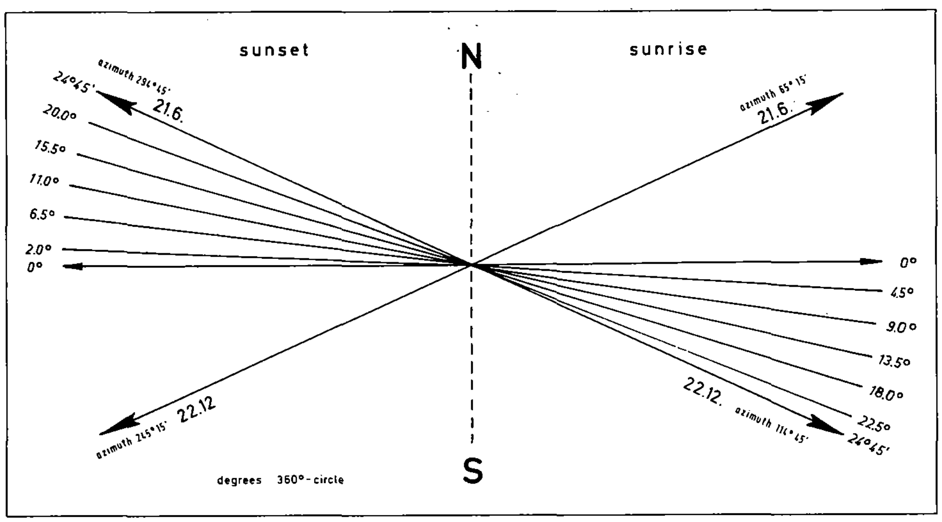

Fig. 3: Diagram of the Mesoamerican Orientation System. The alignments are in accordance with the hypothetical solar orientation calendar with 13-day weeks. The clockwise deviations from East represent the "Winter Sunrise Maya Type" and the deviations from West the "Summer Sunset Centralmexico Type".

There remaines the possibility of a fixed, i.e. a solar calendar according to the known mexican calendar which contained 18 periods of 20 days and 5 days rest. But that permits to explain only two of the direction lines. The calendar does not include the frequent direction of 11-12^{o} nor the zenith passage and solstitial directions.

The direction lines found to be frequent in the Maya area we ordered to their numerical sequence. There is an angle series of 1°, 5°, 9°, 14°, 18°, 22°, also with regular intervals of 4-5°. These values are rarely found outside the Maya area.

Now raised the question of the intervals in days at which these angles occur at the horizon as solar positions. It was sufficient to consider the data for the declination of the sun. The result was more or less 13 days. We know a 13 day week, used in ancient Mexico and there existed also a calendar with 13-day periods but in form of a rotational calendar. A fixed calendar with 13-day periods had to be checked. The year beginning has been placed on the day of the winter solstice. This makes the calendar valid for the whole of Mesoamerica.

What are the properties of the hypothetical orientation calendar? It is very close to the actual motion of the sun. The periods coincide exactly with the solstices and with the days between the solstices, the socalled mid-year days. There exists also a coincidence for the zenith passage days at the latitudes of 15° and 21° n.L. It contains the important days of the agrarian year and it contains all the direction lines between the solstice points which are frequent enough.

The question raises, if there is a strong symmetry in the structure *of the geometrical scheme and of the observational* calendar. We see the symmetry in the course of the sun with the varying values of the declination, the distance from the celestial equator representable with a sine curve (Fig. 4). Where

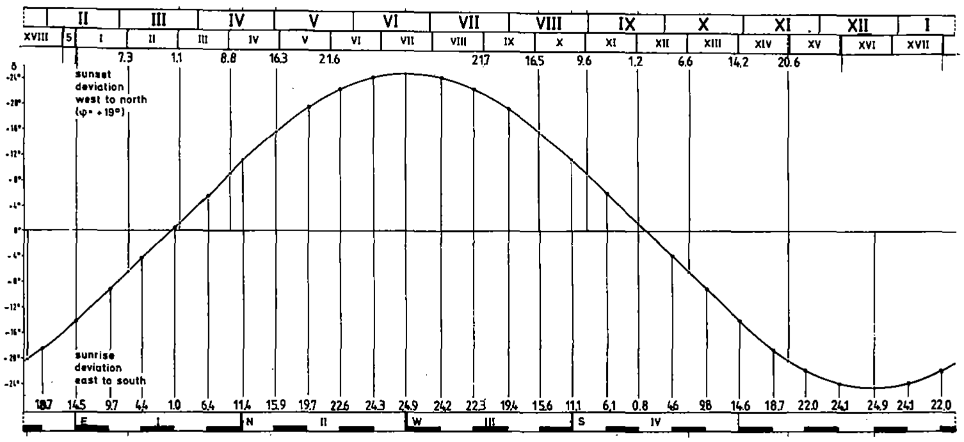

Fig. 4: Hypothetical solar orientation calendars with 20-day periods (above) and with 13-day weeks (below). Vertical: Declination of the sun. Horizontal: Deviation of azimuths on the horizon of 19° N.L.

the ascending and descending branches are more or less rectilinear there we see the coincidence of 13-day periods and angle values of declination and at the same time the angle values of azimuths in the horizon. But the sequence of the direction values is different in the winter half-year and in the summer half-year. In the winter half-year we find the sequence of the Maya area and in the summer half-year the sequence of Central Mexico. The reason for the asymmetry is the unequal motion of the earth around the sun. On January 2 the earth is in her nearest position, the Perihel, and on July 2 at the greatest distance, the Aphel. In the winter half-year the motion is faster than in the summer half-year.

Symmetry and asymmetry we have for that reason also in the angular series and in the orientation calendar. The great order of the mesoamerican world is based on the solar symmetry and asymmetry observed in pre-Columbian times.

Symmetrical structures of great importance we see in the spezialized assemblages of maya buildings able for astronomical observations. There is the group E of Uaxactún/Guatemala, but also Central Mexico has in Xochicalco a structure of this kind in the group C and D with the "Estela de los dos glifos" in the center. The axis is oriented to the sunsets of the midyear days. Other orientation lines allow the observation of sunrises and sunsets at the solstice and zenith passage days and other important days of the calendar. Such symmetrical structures give expression to the unity of the order of time and space given by the course of the sun.

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