## Venus Orbital Pattern in Mayan Structures Orientation

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#### Abstract

To build organized sites or structures, the builder needs to have an understanding of basic geometry and deploy a grid, which would allow him to design and control a successful development with predetermined results. This short Research Note is showing one potential conceptual method that would allow a Mayan builder to accomplish such a task.

\section*{Introduction}

It is generally accepted that Mayans built many of their sites and structures with an astronomical orientation. General orientation following East-West, North-South, Solstice and Equinox directions can be easily recognized. However, there are sites and buildings not exactly following these established cardinal orientation points and there is an ongoing debate why there are so many sites oriented 2-19 degrees of the true North.

One of these structures is the Caracol Complex in Chichen Itza, Mexico, that we will use as an example for the application of this method.




Chichen Itza - Caracol Complex (after Ruppert)

## The Method

In "A Different Approach to Interpreting the Dresden Codex, Page 3" posted on Academia.edu, the idea that Mayan Tzolk'in is more than a calendar was addressed. It could be used as a positional matrix visually tracking the movement of the Venus pattern. Here, we would like to demonstrate how it can also be used as a tool when analyzing the layout of Mayan structures geometrically.

The Tzolk'in $13 \times 20$ matrix has been structured as a von Koch first generation fractal square grid as shown in Picture 1. The Venus orbital pattern (Picture 2) has been superimposed on the fractal square grid as shown in Picture 3. For comparison purposes, a traditional presentation of the five-pointed star pattern is included (in red) to highlight the difference in angular measurements in using the grid/mapping in Picture 3. In Picture 2, Venus Orbit Pattern, the star points are labeled as A, B, C, D and E. The axes are labeled as Roman numerals I, II, III, IV and V.

| Picture 1, von Koch first <br> generation fractal square | Picture 2, Venus Orbital <br> Pattern |
| :--- | :--- |
| Picture 3, Super-imposed <br> Venus Orbit Pattern on von <br> Koch |  |

## The Analysis

The following examples demonstrate how this Venus Orbital Pattern can be superimposed on the Caracol Complex in Cichen Itza following a simple orientation alignment rule and scaling the transparency consistently in all directions. The key to this this pattern is the ability to record and preserve angular measures correctly.
A. An initial alignment of the outer platform long edge ( $A, C$ ) to the North-South ( $A, D$ ) coordinate (the star point is oriented to the North) is highlighted in red. The scale is proportionately adjusted so that the two points $(A, C)$ of the Venus Star Pattern are defining the length of the platform edge.

B. The second alignment (in red) is oriented East-West alongside A, D. The star is pointing to the West and the pattern triangle side $A, C$ is aligned with the short edge of the outer platform.

C. In this picture the basic alignment (in red) is on the East-West ( $\mathrm{E}, \mathrm{B}$ ) axis as a tangent to the middle circle, with the longest triangle (A, II) pointing to the North. The transparency is scaled proportionately in all directions so that the four points of the star pattern do touch the three edges of the outer platform

D. In this picture the basic orientation is North-South (V, C). The inner pentagon pattern is touching the largest circle on all 5 sides.

E. This picture is aligned to the West-East orientation along one of the axes (II, E in red) and the center of the pattern is aligned with the center of the structure circle. It is scaled so that two points of the star are touching the outer edges of the platform. $\mathrm{AC}, \mathrm{BE}, \mathrm{BD}, \mathrm{CE}$ and DA are all tangents to outer circle.

F. In this combination the Venus Orbital Pattern transparency is oriented South-North along one of the axes $(C, V)$ when the other axes $(D, I)$ is aligned with the northern edge of the inner platform. Side $C, E$ is aligned with the western edge of the inner platform.

G. In this combination, the Venus Orbital Pattern transparency is aligned to the East-West along one side $(B, D)$ at the bottom, and the one axis ( $D, I$ ) and one side $(C, E)$ are aligned with two adjacent edges of the inner structure.


## Conclusion

We think that these results are not coincidental and this subset of examples demonstrate the use of this type of a method when designing the layout of structures. This concept could be repeatedly tested at other sites where good topographical or Lidar surveys are available.

There are also questions which could be explored more extensively, such as:
Did Mayans understand and deploy an accurate way to project the celestial dome measures to a "flat earth" pattern, similar to today's cartographers projecting sphere measures to two dimensional maps?

Is it a coincidence that a fractal-based grid of base 13 count can produce these numerous documented results when it comes to Mayan geometry and calendars?

The interpretation of these results presented here covers only a subset of possible mathematical, geometric or astronomical correlations. The question remains: are there other instances when this method is consistently used?

