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American Woodhenge: Archaeoastronomy at Cahokia

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ABSTRACT:

This paper examines the post-circle monuments at Cahokia for astronomical alignments other than the already well-established solar alignments. Using data from previous studies and photographs taken at Cahokia, the woodhenge is reconstructed in the virtual sky feature of an astronomy software program, TheSky6. Then using data from previous archaeoastronomy studies, and historical and ethnographical sources, the Pleiades and the moon are examined as potential targets for observation. The Pleiades, which makes its first appearance over one of the woodhenge posts, was significant in cultures worldwide and may have had special significance in the agricultural calendar at Cahokia. New moon observations suggest that the woodhenge may have been used to track the lunar calendar and to bring the solar and lunar years into alignment.

I. INTRODUCTION

Throughout prehistory and history astronomy has played a role in man's cultural adaptation to his environment. The art and mythology of cultures throughout the world reflect an interest in astronomy. Ancient cultures depended on the stars for navigation. Astronomical knowledge was used to guide subsistence efforts. By observing the position of the celestial objects ancient astronomers could determine the appropriate times for hunting, planting and harvesting. Rulers and specialists used astronomy for political means to control and direct the population.

In the early 1960's, Dr. Warren L. Wittry discovered five post-circle monuments at the Cahokia site in Illinois. Dr. Wittry named the circles woodhenges because of their resemblance to monuments of the name in England. He theorized that the monuments had astronomical as well as social and religious functions (Wittry 1996). Early investigations at the site supported Dr. Wittry's theory. Since the discovery, the "American Woodhenge" has been the focus of much research and debate concerning the function of these monuments. More recent research on the woodhenges tends to focus on the social and religious functions of the monuments.

This paper is an investigation of the astronomy of the post-circle monuments or woodhenges. The evidence considered in this investigation consists of the archaeological evidence from Cahokia, ethnographic evidence, and studies of the astronomy of other Native American groups or sites for analogy. This evidence will be used as a framework to explore the sky as these ancient people would have seen it. The ancient sky will be reconstructed using astronomy software. The first section will be a general overview of the Cahokia site and archaeoastronomy. The next section will discuss the history of woodhenge research including the early studies of solar alignments and a summary of some of the more recent ideas. This will be followed by a summary of methods. The final section discusses the investigations and results.

II. BACKGROUND

Cahokia

Before beginning a study of the woodhenge it is necessary to understand something of the Cahokia site and the field of archaeoastronomy. This section covers general information about the prehistory of the Cahokia site in order to put the woodhenge research in context. Cahokia is located near the present day city of East St. Louis on a part of the Mississippi floodplain known as the American Bottom. For a period of almost four hundred years, Cahokia was the "seat of the largest political chiefdom and probably the most ranked society in North America" (Hall qtd in Fowler 1994:p3). Mississippian societies were found throughout the midwest and southeast between A.D. 800 and 1500. At its peak, from around A.D. 1050-1250, Cahokia covered an area of more than five square miles. Population estimates range from 16,000 to 50,000. (Fagan 2000, Fowler 1994)

The city of Cahokia appears to have been very carefully planned. The more than 100 man-made earthen mounds, plazas, dwellings and other buildings were arranged according to a planned layout along a north-south axis. The largest of the mounds, Monks Mound, lies along the north-south axis at the heart of the site. Monks Mound was constructed in stages over a period of three hundred years beginning around A.D. 1000 (Fagan 1998, 2000). Because Cahokia had been abandoned by the time of European contact no historical accounts exist. To study Cahokia we must rely on archaeology and ethnographic analogy.

Archaeoastronomy

In the study of archaeoastronomy it is important to take into account three general considerations. The first is what modern astronomy can accurately reconstruct in the night sky. The second is effect of precession on alignments. The third consideration is the nature and uses of astronomy for the culture being studied. Modern astronomy can reconstruct the night sky at any location on earth tens of thousands of years in the past with certain limitations. Considered most reliable are fixed objects such as stars. Recurrent phenomena such as the positions of the sun and moon are reliable as well. The positions of the planets relative to the stars and eclipses are subject to cumulative errors the farther one goes back in time. These events then are not considered reliable in reconstruction. Non-recurrent or long period events such as novae or the appearance of comets cannot be accurately reconstructed. (Ruggles and Saunders 1993:9)

Precession is the result of the earth's wobble on its axis. This wobble causes the stars to shift slightly in their positions relative to the sun. Over the course of a few centuries, the shift is such that it is impossible to directly observe possible stellar alignments. This is not the case for the sun, moon, and planets. The shift in these objects over the course of a thousand or fifteen hundred years is small enough that alignments can be directly observed against the present night sky. (Williamson 1984:49) Table 1. contains data from rise-set azimuth tables computed by Anthony F. Aveni (1972). The table shows the effect of precession on the rise-set azimuths of the sun and moon over the course of a thousand years. As can be seen from the table the effect is very slight.

	A.D. 500	A.D. 1000	A.D. 1500
SUNRISE	64*14'	64*19'	64*14'
MOONRISE	67*12'	67*12'	67*12'

Table 1 From Aveni 1972. Sun and Moon rise azimuths for a thousand years at latitude 21*N.

The nature and uses of astronomy of the group being studied must also be considered. Ancient Native American astronomy was a horizon based naked-eye system. Modern astronomers often impose western standards of precision on monuments and as a result often question the astronomical capabilities of ancient astronomers and their devices (Gartner 1996:128). The Native Americans trying to make a living at Cahokia a thousand years ago would not have been concerned with western style precision. A calendar would have been valuable for scheduling events and activities related to the ritual and agricultural or subsistence cycle. An astronomically aligned monument then would function to anticipate and schedule rather than to gather astronomical knowledge.

Summary of Previous Woodhenge Research

Dr. Warren Wittry discovered the post-circle monuments during excavations that were part of a salvage archaeology project. Five circles were discovered in roughly the same area west of Monk's Mound (see Figure 1). Archaeological evidence indicates that all five circles post-date A.D. 1050. The earliest circle, Woodhenge I, had 24 posts, Woodhenge II had 36 posts, Woodhenge III 48, and Woodhenge V had 60 posts. Woodhenge V, had it been a complete circle, would have had 72 posts. This final Woodhenge consisted of twelve or thirteen posts along the sunrise arc. (Wittry 1996)

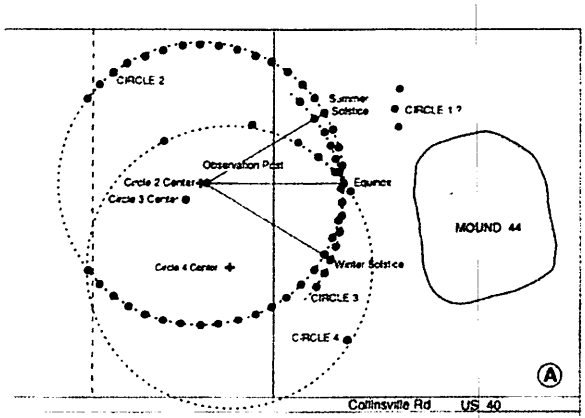

Figure 1 Diagram of the plan of all five post-circle. In this diagram Woodhenge III is referred to as Circle 2 Reprinted from Wittry 1996.

Woodhenge III (circle 2 in Fig. 1) is the most completely excavated circle. This circle had a diameter of 410 ft. with 48 posts spaced each separated by 27.4 feet. Only 39 posts have been located. The locations of the nine posts on the west edge of the circle were lost when the highway department dug in the area for fill during an earlier project. The posts stood 20-30 ft high. An observation post was erected 5.56 ft east of the geometric center of the circle. Woodhenge III was reconstructed at the original site in 1985 and has been the focus of research on the function post-circles. (Wittry 1996; Young and Fowler 2000)

Dr. Wittry theorized that Cahokia's woodhenges had astronomical functions and could have been used as a solar calendar. In 1977 he tested the hypothesis by placing posts at the three key points along the sunrise arc, the summer and winter solstice and the equinox sunrise points. An observer standing at the off-center post facing Monk's Mound would see the sun appear to rise from the notch created by the first and third terraces of the mound and aligns with the eastern post of the Woodhenge. The center post was placed 5.56 feet east of the geometric center of the circle. The result was a viewing angle of 30.8 degrees north and south of east at the summer and winter solstices. This adjustment on the part of the ancient builders made the solstice alignments more accurate and gives strength to the interpretation that the alignments were deliberate. (Wittry 1996:29.)

Figure 2 below represents the eastern horizon as seen from the center of the woodhenge. The posts are numbered using Dr. Wittry's system. Post number 12 is the equinox sunrise post. Post number 8 toward the north end of the horizon is the summer solstice sunrise post and number 16 is the winter solstice sunrise post. It is interesting that Monk's mound appears to be framed by post numbers 11 and 12. Mound number 44 is visible closer to the posts and is framed nicely by posts 12-14. After the winter solstice the sun reaches post 15 in about 39 days. The sun reaches post 14 after another 20 days. As the sun approaches the equinox, the number of days between posts is fewer. The pattern repeats north of the equinox. (Wittry 1996:p30) This calendar could have functioned to anticipate the date of important events and to mark the turning of the seasons (Krupp 1996:63).

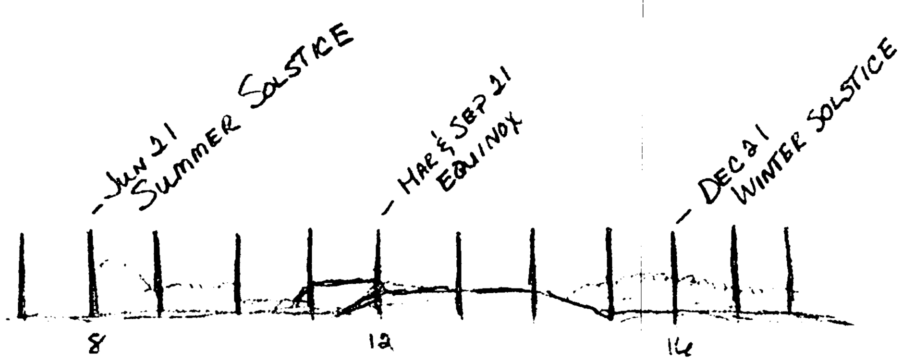

Figure 2 The Sun's path across the woodhenge

Further support for the significance of the solstice was the discovery of the beaker fragment shown in Figure 3 below. The fragment was discovered in a pit with a large burnt area near the winter solstice sunrise post. The design on the fragment shows a cross within a circle, which is significant in Native American cosmology. For many Native American cultures, the world is divided into four quadrants based on the cardinal points. The cross in circle is symbolic of this worldview (Fowler 96:39). Dr. Wittry interpreted the open band on the southeast part of the circle as "representing rays of sunlight entering the earth from the winter solstice sunrise, and the opposite band, which is closed, as representing rays of sunlight streaming toward the center of the earth from the winter solstice sunset." (Wittry 1996:30). Because the apparent motion of the sun is so small at the time of the solstices, the winter solstice was a cause for concern among cultures worldwide (Williamson 1984:39-40). The find has been interpreted as a possible offertory pit where a fire was burned to "warm the sun and encourage it to return northward for another annual cycle and rebirth of the earth" (Iseminger 2005).

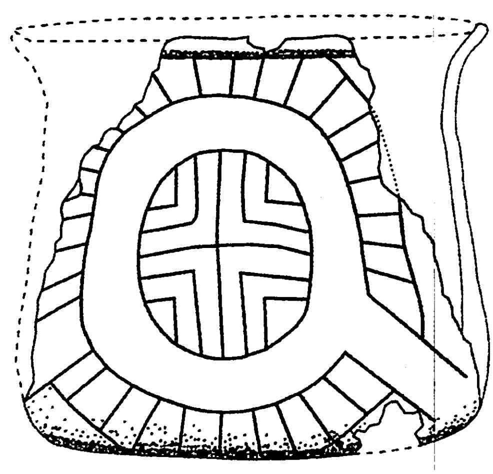

Figure 3 Beaker fragment found near the winter solstice sunrise post. Reprinted from Wittry 1996

Solar alignments account for the posts along the sunrise arc and potentially the western sunset arc. What about the remaining posts? Because these posts seem to have no astronomical function, Dr Wittry theorized that they completed the circle as part of the ritualization of the calendar. While a solar calendar may not have been necessary strictly for planning purposes, those in power could have used such a device to control and direct the population (Wittry 96: 32).

Since Dr. Wittry's discovery and research other scholars have been interested in the woodhenge as well. Much of the more recent thinking centers on the ritual and political functions of the woodhenges. Dr Melvin Fowler looks at the uses of astronomy in Native American culture. Astronomy could have been used in community organization, religious and social ideologies, and calendrics. All of these uses might have been incorporated into the design of the woodhenge. Fowler considers the shape of the woodhenge and its relation to the cross in circle symbol that represents the Native American worldview. He suggests that the woodhenge is this symbol planted in the ground as a public monument that had a function in the annual ritual cycle. (Fowler 1996: 39-40)

Martha Ann Rolingson interprets the woodhenges as "aligners" or surveyor's tools. These tools were used to establish the placement of the mounds (Rolingson 1996). Timothy Pauketat studies the place of the post-circle monuments (woodhenges) in the political history of Cahokia. He looks at the monuments beyond their function and symbolism in order to study what they tell us about social complexity and power at Cahokia. (Pauketat 1996). Robert Hall looks at the woodhenges in terms of Native

American cosmology and symbolism (Hall 1985). These studies illustrate the range research and ideas that have revolved around the woodhenges since their discovery.

III. METHODS

TheSky6

In order to explore the Cahokian night sky, the woodhenge was simulated in an astronomy software program, TheSky6. This program was chosen because it is widely available, has a virtual sky feature, and the capability to go back in time to view the night sky as it would have appeared in A.D. 1150. This date was chosen because it falls in the middle of the A.D. 1100-1200 estimate for construction of the circles and because Woodhenge III was the third circle in the sequence.

First, TheSky6 settings were adjusted for naked-eye astronomy. This means that any celestial object that could not be seen by the naked eye was removed by adjusting the magnitude settings to show only objects with a magnitude 6 or brighter. The date and location settings were changed. The date chosen was A.D. 1150 as a starting point. This date is an estimate based on the information that the woodhenges were constructed between 1100 and 1200 (Iseminger 2005). The location was adjusted to the latitude of Cahokia: 38*39'5" (Krupp 1996).

The woodhenge horizon was drawn into TheSky6 using a photograph taken on September 19, 2005 as a reference. The photo was taken from the center of the woodhenge facing east toward Monk's Mound. The following estimates were made for the horizon altitude. The point where the posts meet the ground was set as 0 degrees. The altitude of the posts was set to 5.5 degrees. Monks Mound in the distance was estimated to be 3.5 degrees. Mound 44, which is smaller but closer, was set to 3 degrees. The distant horizon behind the posts and the mounds was set to 1 degree.

There were two limitations related to the TheSky6 horizon editor. The first limitation concerned horizon altitude and azimuth. All of the altitude degree estimates had to be rounded to the closest half degree. TheSky6 only allows whole degrees for azimuth. Since the posts of Woodhenge III are separated by 7.5 degrees of arc, it was not possible to place all of the posts on the horizon. Instead every other post was placed at every 15 degrees of azimuth. A grid was placed onto the virtual sky to simulate the remaining posts. The grid allows the user to define right ascension and declination spacing on the sky. These correspond to earthbound latitude and longitude. Right Ascension spacing was set to 7.5 degrees (the spacing between posts) and declination spacing was set to 5.5 degrees (the altitude of the posts). So in place of each alternate post there is a grid line. The points on the grid where the lines cross represent the tip of the posts. Using the grid allowed for the posts to be placed the correct distance apart.

The second limitation concerns the place of the viewer. In the astronomy program, the perspective is always from the center of the circle. As mentioned above, the builders of the woodhenge erected a post 5.56 feet from the geometric center of the circle to allow for a more accurate viewing angle for the summer and winter solstice sunrises. To adjust for this, since the viewer cannot be moved, these two posts were moved. All other viewing will take place from the geometric center of the circle. Figure 1. below is a screen shot of the virtual sky at sunrise on March 21, 1150, the equinox sunrise. The figure shows all of the posts along the sunrise arc and the two mounds, Monk's mound and mound 44. In figure 4 there are two posts that do not lie on the grid lines. These are the adjusted solstice sunrise posts.

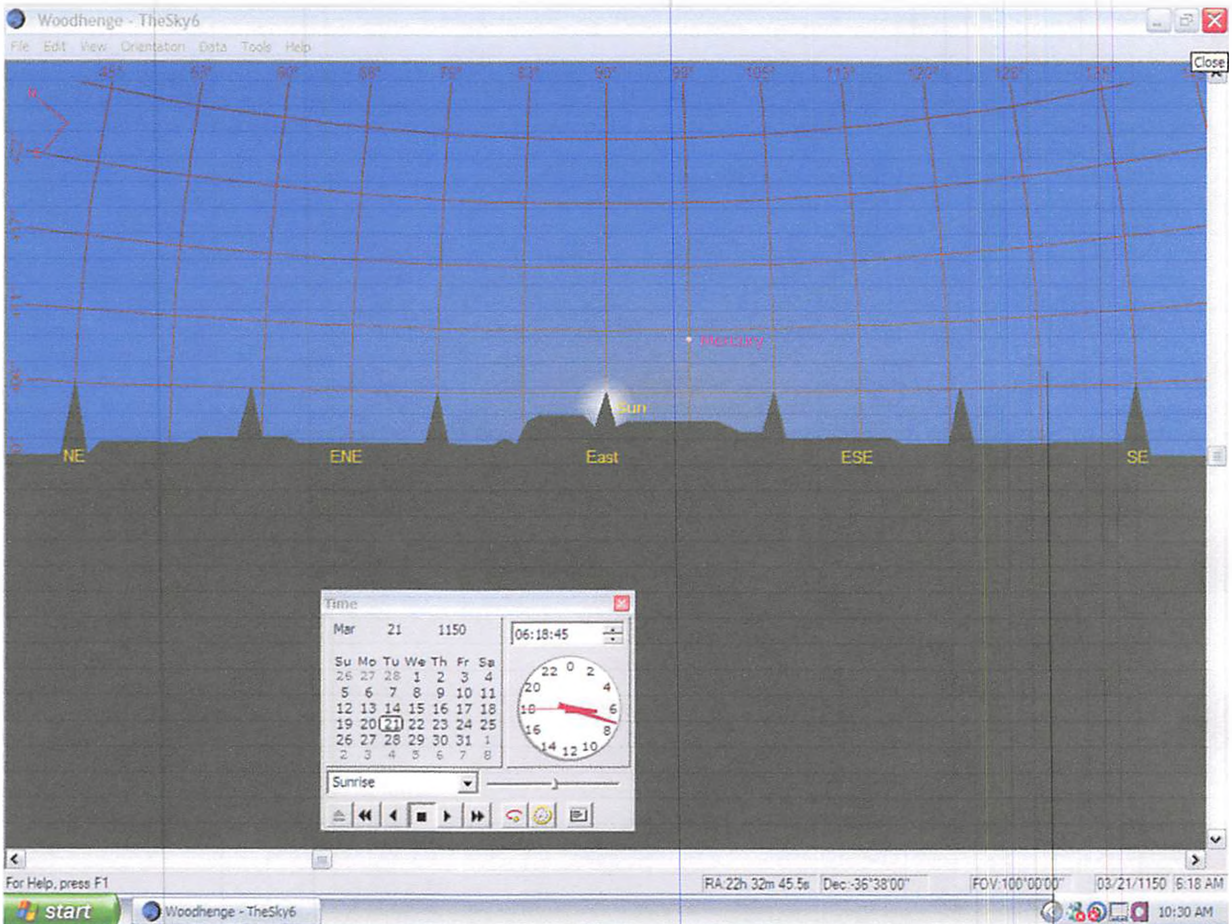

Figure 4 TheSky6 Virtual sky and woodhenge posts

Sources of Error. There are two categories of potential sources of error. The first category is the assumptions that were made in the study. The second category of error is perception. First, without data regarding other obstructions in the forms of houses or buildings, it was assumed that the horizon from the photo represented the horizon in A.D. 1100. The exception to this is Monk's Mound. The mound was built in stages over a period of about three hundred years. The horizon above is based on the current size of

Monk's mound. The mound would actually have been smaller when this circle was in use.

Another assumption is the definition of the rise point for an object and how we determine if we have an alignment. Without written records we have no means of knowing how these would have been defined so we have to make assumptions. For the purpose of this study, it was assumed that the rise point or alignment would be different depending on the type of object observed. The assumption was made that there were certain predefined standards that would have been used concerning for example the point of sunrise. Depending on the time of year and the angle of the sun, the point at which the sun lines up with a post will vary. For example, near the equinox, the sun will line up near the tip of the post. At the solstices however, the sun rises from behind the posts much lower.

The second category of potential source of error is perception. Native American astronomy is a naked eye system. Alignments will always be subject to the interpretation of the viewer. Atmospheric effects can affect perception as well. Refraction can cause an object to appear higher that it is. Changes in humidity and barometric pressure can affect the appearance of objects. (Ruggles and Saunders 1993:9).

IV. ETHNOGRAPHY AND ASTRONOMY

<u>The Pleiades</u>

One of the ways that ancient astronomers kept track of the year was through observations of stars and constellations. The Pleiades, a cluster of bright stars, seem to have been significant to cultures throughout the world. This is perhaps due to their distinct appearance. Both old world groups such as the Celtic people and new world groups calibrated their calendars by the dawn rising of the Pleiades. This section examines a study by Lynn Ceci (1978) of the significance of the Pleiades to the Algonquian Indians of North American with the aim of attempting to determine if the Pleiades could have been a target for observation at the woodhenge.

According to Ceci, among the North American tribes to observe the Pleiades were the Cherokee, Cheyenne, Hopi, Inuit, and Hasinai. This list is simply a sampling of the groups and shows that the significance of the Pleiades was widespread. Ceci attributes this widespread use to two factors. The first is that the Pleiades form a cluster of bright stars that is highly visible and easily identified. The second factor is the schedule of annual movements of the Pleiades. The Pleiades first appears in the fall on the eastern horizon after sunset. By midwinter they have reached their zenith and disappear in the west by spring. (Ceci 1978)

Ceci found that among agricultural groups throughout the northern hemisphere, this schedule coincides with important seasonal changes and so plays an important role in the calendar. Historical accounts of the Algonquian Indians in the northeast revealed that the Pleiades were no longer visible in the sky from May 5-10 until October 10-15. These dates coincide with the frost-free growing season in the area. So if the Pleiades could be seen there was the danger of frost. (Ceci 1978). Agricultural data indicated that the limits of the frost-free season for the midwest are from around April 2 to November 8 and this time frame would be longer for the southeast. (O'Brian and McHugh 1987).

In the fall, the Pleiades appear on the eastern horizon about an hour after sunset (Ceci 1978). To test for the Pleiades in TheSky6, the date was set to September 15, 1150.

The observer was rotated to face east and the time was set to sunset. For each sunset, the software computed the time of sunset and the clock was manually adjusted to one hour after that time. Then for each day the eastern horizon was visually checked for the appearance of the Pleiades. The Pleiades were first visible on October 16 just above the tip of post 9. By April 15, the Pleiades were very faintly visible at the tip of post 39.

This evidence suggests that the Pleiades could have been a target for observation at the woodhenge. Further, this could have been a culturally meaningful object because the schedule fits into the limits of the frost-free growing cycle. In a city with a population density such as that at Cahokia, the use of astronomy in subsistence planning would be especially meaningful.

The Moon

In this section the moon is considered as a target for observation at the woodhenge. In a summary of the calendars of the North American tribes, Leona Cope states that all tribes recognized the phases of the moon and that new moon usually marked the beginning of a month (Cope 1919:p129). It seems reasonable then that this would have been the case for the Cahokia Mississippians as well. Since we have no written record of the people and their customs at Cahokia, we must rely on another group for an analogy. Ethnographic data on the calendar of the Natchez will be reviewed. Then this information will be used to reconstruct the calendar year in the woodhenge in order to investigate the potential of the woodhenge to function as a device to track the lunar year.

Many scholars believe that the Natchez are the closest parallel for the Cahokia Mississippians. At the time of European contact at the end of the seventeenth century, the

Natchez were grouped in nine villages in Mississippi. Each village referred to its chief as the Sun and the paramount chief was referred to as the Great Sun. According to Natchez myth the chiefs are descendents of the Sun. (Galloway and Jackson 1978:pp604-606)

The Natchez, like the Cahokia Mississippians, were also mound builders and had a solar theocracy. Early settler's accounts report that the chief lived on an earthen mound. Natchez ceremonies were resplendent with the theme of the sun as a life giving force. The chief had daily ceremonial contact with the sun. A perpetual flame which was sacred and stood for the sun was maintained by four temple guards. The chief's responsibilities as the religious and political leader were to ensure that the polity was preserved. This included ensuring that matters relating to harvesting and other seasonal activities were managed. (Galloway and Jackson 1978:pp604-606)

There is also evidence that the moon played an important role in the Natchez calendar. According to the Natchez, the sun and the moon were man and wife. The wife was more powerful because "she has taken medicines and baths more regularly" (Swanton 1922: p781). Eighteenth century accounts indicate that the Natchez year was based on thirteen "moons" each named after a food item or animal. (Galloway and Jackson 1978:604-606). Cope (1919) lists twelve months of the Natchez year as follows:

1. Cold meal 2. Chestnuts 3. Deer 4. Strawberries 5. Little corn 6. Watermelons
7. Peaches 8. Mulberries 9. Maize or great corn 10. Turkeys 11. Bison 12. Bears

The months are all named after seasonal events or activities related to subsistence. Cope has listed the months to correspond with the western calendar year. The Natchez year began with the month of the deer, which corresponds to March. The New Year was commemorated with a ceremony in which the Great Sun was captured by an enemy and then rescued by a Natchez warrior party. Each of the following moons was celebrated by community observances, feasting and dance. (Galloway and Jackson 1978604-606:).

To test the Natchez calendar against the woodhenge the following assumptions were made. The first is that the point of alignment was determined to be the moon must cross a post at any point before it leaves the circle. This assumption is based on the idea that the goal of the ancient astronomers would have been to keep track of the months rather than to determine a precise date. The second assumption was that the new moon would be the target of observation in tracking the year. This assumption was made because at new moon is the only point in the moon's cycle when sunrise and moonrise occur at roughly the same time. This makes the Natchez belief that the Sun and moon were man and wife more interesting. New moon could also have been easily anticipated because for about two days prior to new moon it is invisible because it is close to the sun.

The beginning point for the test was sunrise on March 21, 1150. According to Swanton (1922) the vernal (spring) equinox marks the New Year for the Natchez. Data on the dates of the new moon were obtained from moon phase reports in TheSky6. It was decided that the new moons should be observed for five years, A.D. 1150-1154, in order to observe the pattern of the moon's movement throughout the year and to determine if there could have been any effort to correct for the discrepancy between the solar and lunar years. Each moonrise for the five-year period was observed and the alignments, if any, were noted.

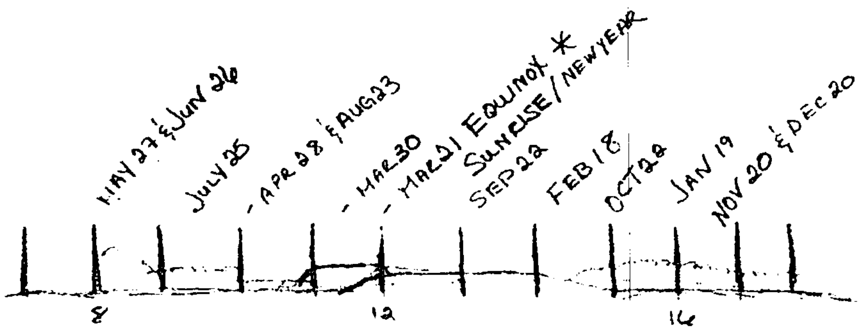

Figure 5 New moonrise horizon positions for one year.

The most obvious pattern that was observed is that the moonrise follows the same annual path across the horizon as the sun. Figure 5 above shows the moon's path. The beginning point was the vernal equinox on March 21, 1150. The next new moon was on March 30. This moonrise was over post number 11. At each new moon, the horizon position shifted farther north until the moon changed direction in June and headed south again. The moon reached its southern most position by December 20.

In Figure 5 we can also see that if the Natchez used the twelve month calendar according to Cope (1919), not only would the solar and lunar years would be out of sync but the names of the months would be inappropriate for the season. Given that the names of the months are tied to subsistence activities this could pose a problem. Figure 6 below shows the dates of the first new moon if a twelve-month calendar was used with no method of correction. The beginning date was the equinox at March 21, 1150. The first new moon of that year was on March 30, 1150, which rose over post number 11. The final new moon was on February 14, 1154. Over the course of five solar years, the lunar calendar slipped behind by about 45 days.

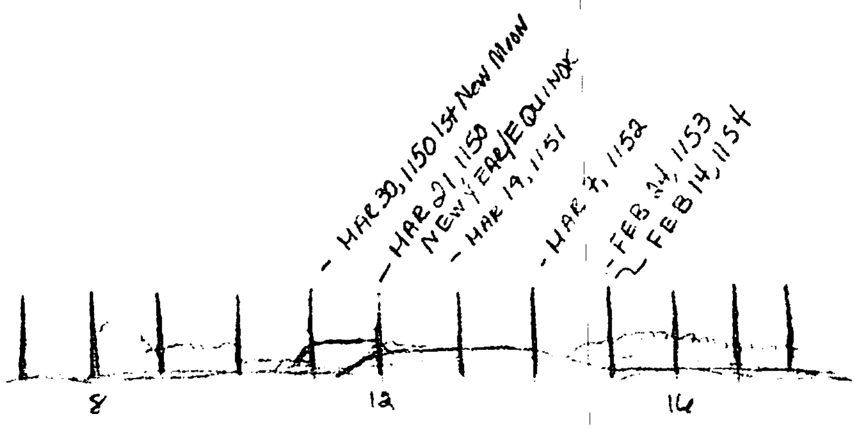

Figure 6 Horizon positions for the first month of the year assuming a twelve-month calendar.

The calendar could have been adjusted by adding a thirteenth month. Although Cope lists twelve months, eighteenth century sources indicate that the Natchez did have a thirteen-month calendar (Galloway and Jackson 1978: 604-606). If the thirteen months were counted from new moon to new moon, the lunar year would be too long. The result would be the same as in Figure 6 but the moonrise positions at the New Year would advance farther north. According to Cope (1919:137), this discrepancy between the solar and lunar years was the cause of some confusion and even occasional disputes about the correct month. Methods of correction varied among the Native American tribes and could have involved adding an occasional thirteenth month or a thirteenth month of shorter length.

Given these results, it seems very likely that one of the functions of the woodhenge would have been to observe the moon. Cahokia was a complex and highly organized society. This cannot happen without a calendar to organize the people and to plan ritual and subsistence events. Given the nature of naked-eye astronomy and individual perception, it is plausible that the responsibility for tracking the calendar would have fallen to specialists.

V. DISCUSSION

In this investigation we first looked at the Pleiades as a target of observation at the woodhenge. The results show that the woodhenge could have been used to track the rise of the Pleiades. It is possible then that constellations and possibly other stars could have been observed as well. The Pleiades has agricultural significance because schedule of its annual motions coincide with the limits of the frost-free growing season. Other stars and constellations may have been significant as well.

The second celestial object that was investigated was the moon. The woodhenge could have served as a tool for monitoring the lunar year. Adjustments would have been necessary to keep the solar and lunar years in sync and to schedule subsistence activities and ritual at the appropriate time of year. It has been well established that the Cahokia Mississippians observed sunrise. At new moon, the sun and moon rise together. This is the only point during the moon's phases that this occurs. It seems reasonable to assume that moonrise at the new moon would have been significant.

What is not clear from this investigation is whether the woodhenge was necessary for these functions. Although not entirely necessary the woodhenge could have served as a guide for observations. For example, if an ancient astronomer knew that the Pleiades would appear above post number nine at a particular time of year then that is where observations would have been directed. Other cultures observed celestial events such as these but no woodhenge has ever been found outside of Cahokia. It is at this point that the size and complexity of Cahokia must be considered. Cahokia was a city with "suburbs".

Within the city, the population estimates were in the tens of thousands. The woodhenges served as astronomical calendar devices but they were also public monuments and would have served as a sacred geography. The woodhenges were a symbol of the power and authority of the leaders and specialists who where in charge of the calendar.

VI. CONCLUSION

The goal of this investigation was to determine if the woodhenges had astronomical functions other than the already well-established solar alignments. The history of the woodhenge research was reviewed. Then ethnographic evidence was reviewed for use as analogy and applied to the woodhenge using TheSky6 astronomy software. The results support the idea that the woodhenge had other astronomical functions.

Suggestions for further research include study of the motion of the planets. Venus should be a particular focus because of its proximity to the sun and it prominence in mythology. Further research should also include in-person observations of moonrise at the reconstructed woodhenge. William Iseminger has suggested (Public lecture 9/18/2005) that the woodhenges may have been rebuilt so many times over the course of the one hundred year period in an effort to improve the astronomical precision of the monument. An interesting study would be to repeat this project using the measurements of the two later woodhenges.

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