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# INDIGENOUS RIVERSCAPES AND MOUNDS: THE FEMININE RELATIONSHIP OF EARTH, SKY AND WATER

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**Indigenous Riverscapes and Mounds: The Feminine Relationship of Earth, Sky and Water**

**Synopsis:**

This session focuses on the burial and effigy mounds along the rivers of Turtle Island, as well as who and how they were created. Many mounds contain knowledge that mirrors earth with sky as expressions of art, humanities, science, math, and engineering. We will examine the strong feminine cosmology connected to these sites through a lens of Critical Indigenous Pedagogy of Place and what they offer to the study of astronomy, environmental and Indigenous education.

## **Indigenous Mounds and Riverscapes: Feminine Earth-Sky Relationships**

### **Abstract**

The focus of this research is on the burial and effigy mounds along the riverscapes of Turtle Island and the technology, wisdom, labor, and love needed to develop and interpret them. Many of these mounds contain Indigenous feminine, place-based knowledge and numbers. These mounds mirror earth with sky as interdisciplinary expressions of art, humanities, science, math, engineering, and technology. We also examine the strong feminine cosmology connected to these sites and the impact of colonial settler practices through a lens of ecofeminism and critical Indigenous pedagogy of place (CIPP).

The interdisciplinary approach to this study is essential to deconstruct the engineering, science, math, cosmology, and history of cooperation among Indigenous peoples to create the mounds. These sites provide lessons that can be found in Indigenous languages, ceremonies, protocols, stories, and teachings, which have been put through an archaeo-astronomical and ethno-astronomical analysis, application, and synthesis. The mounded riverscapes of these regions still hold greater knowledge than previously understood, and through this research we believe we have decoded some of the meaning and purpose behind these amazing earthworks.

**Key Words:** Indigenous sacred sites, Dakota cosmology, ethnoastronomy, critical Indigenous pedagogy of place, ecofeminism.

## **Introduction**

Indigenous peoples across Turtle Island were building massive, polysemous effigy and burial mounds until around 700 years ago, but left little evidence as to why and how they were created (Birmingham, 2010; Kavasch, 2004; Milner, 2004). According to Gould and Rock (2016), the mounds that were built above a cave in the limestone bluffs of St. Paul, Minnesota contained a beautiful feminine cosmology of how the Dakota peoples came to be:

The area now known as Wakanj Tipi/Indian Mounds Park is the embodiment of Maka Ina for Dakota peoples. Wakanj Tipi/Indian Mounds Park was not just a place of death as the archaeologists claim; it was—and is—first and foremost a place of birth. When the Dakotas left their stellar home near the backbone of the buffalo constellation they came to Maka Ina. In fact, to the Dakotas, Wakanj Tipi/Indian Mounds Park is the embodiment of Maka Ina. So they created a pregnant belly-like mound up on the bluff and saw themselves as being birthed from the womb-like cave of Wakanj Tipi at the base of the bluff, with the flowing birth water emerging onto Maka Ina. (p. 226)

This story speaks not only of an earthly home but a stellar home that connects the mounds to Dakota astronomical knowledge based on a strong feminine cosmology. We will demonstrate through this research that certain effigy mounds were interconnected and aligned. They were used for multiple, polysemous purposes in memorium, ceremonially, and spiritually, but also predictively, regarding lunar and solar

syzygies or alignments. This last use requires a deep awareness of Earth-Sky relationships and their place in the ever-changing phenology and cosmos. This would also reinforce the feminine ties to moon, water, pregnancy, and life itself.

The Indigenous peoples of Turtle Island have worked as cocreators with Mother Earth since time immemorial. The building of the mounds to honor their relationship with Earth and Sky in this life and the next is just one example of this reciprocity. Sadly, these mounds, for the most part, have not survived contact by colonizers, farmers, railroad builders, missionaries, industrial engineers, and the military, who brought different metaphysical values, epistemologies, and philosophies. The Manifest Destiny and Doctrine of Discovery ideals laden with racial bias and patriarchal hegemony were brought to Turtle Island with settler colonialism and have worked aggressively and violently to erase the Indigenous life-affirming cosmologies and practices from the continent.

Although the Indigenous tribal cultures of Europe once held similar beliefs as the Indigenous peoples of Turtle Island, these beliefs were destroyed along with the women healers and teachers who ensured their passage to future generations. European settlers arrived having been indoctrinated with such pseudobiblical injunctions as “Thou shalt not suffer a witch to live, a credo that justified death,” according to Minkowski (1992, p. 288). He goes on to state, “Thus both secular and clerical authorities joined in prosecuting and persecuting those predominantly peasant women alleged to be in league with the Devil. Thousands were tortured and executed” (p. 289).

According to Ojibwa (2016), the Doctrine of Discovery asserted that Native peoples were to come forward of their own free will to convert to Catholicism:

or with the help of God we shall use force against you, declaring war upon you from all sides and with all possible means, and we shall bind you to the yoke of the Church and Their Highnesses; we shall enslave your persons, wives, and sons, sell you or dispose of you as the King sees fit; we shall seize your possessions and harm you as much as we can as disobedient and resisting vassals.

Those who resisted were found guilty of noncompliance and put to death with “just” war waged against them.

By the time settlers arrived on the shores of Turtle Island, they had hundreds of years of indoctrination about the evils of paganism and animism that had strong feminine ideologies. Indigenous peoples were only necessary for settlers to gain a foothold in a particular territory and then were removed, exiled, or murdered, as were the Dakotas of Mni Sota Makoče. Once removal or genocide was complete, the business of relentless destruction, development, and extraction of Indigenous homelands could take place without the protests from the original peoples. The destruction of the mounds and the removal of those who created them, has made it challenging to understand the teachings deeply embedded in the mounds.

We assert that ecofeminism and critical Indigenous pedagogy of place (CIPP) are important to deconstruct the tangled history of the mounds as well as offering a framework to determine the best methodology to use for this research. Ecofeminism describes how destruction of the environment is gendered, while critical pedagogy of place offers a critique of imperialism and capitalism, both of which are at the core of Indigenous land theft, sacred site destruction and genocide (Mies & Shiva, 1993;

Trinidad, 2012).

CIPP builds upon the literature of critical pedagogy, the concept of place, and Indigenous studies, putting them in the center of knowledge exchange and production, according to Trinidad (2012). CIPP recognizes that “knowledge is structured by the existing sets of social relations and power dynamics” (Trinidad, 2012, p. 3) and seeks to reclaim and incorporate the personal and political context of knowledge construction in regard to place (Trinidad, 2012; Smith, 1999). CIPP centers Indigenization and reinhabitation of place in Indigenous epistemology. It can bring healing to a place that has been disrupted and injured through past exploitation, allowing for Indigenous peoples to live well socially and ecologically and tell their own stories (Trinidad, 2012, p. 5).

As we move forward it is important to examine what Indigenous science is and possible areas of conflict with Western scientists. Indigenous science stands like a place-based tripod or initial foundation for a tipi. Indigenous science includes: 1) phenology, 2) phenomenology and 3) cosmology. Curiosity is not enough for Indigenous science, which is tied together by an axiology of ethical protocol, like a rope that binds those first three tipi poles, giving stability and strength to the structure.

Cajete (2000) offers an Indigenous phenomenological approach to science that is, experiential, intergenerational, interdisciplinary, highly symbolic and metaphorical. He states:

Native science is an echo of a pre-modern affinity for participation with the non-human world...Native science embodies the central premises of

phenomenology...by rooting the entire tree of knowledge in the soil of direct physical and perceptual experience of the earth (pp. 22-24).

Metaphysics, on the other hand, is one's view of reality. Therefore, Indigenous and non-Indigenous scientists and scholars may inhabit different metaphysicalities in the same shared, but unshared and conflicted space. Wilson, an Opaskwayak Cree from Manitoba living in Australia and forming deep connections with Aboriginal relatives, says,

Relationships don't just shape Indigenous reality, they are our reality.

Indigenous researchers develop relationships with ideas in order to achieve enlightenment in the ceremony that is Indigenous research. Indigenous research is the ceremony of maintaining accountability to these relationships. For researchers to be accountable to all our relations, we must make careful choices in our selection of topics, methods of data collection, forms of analysis and finally in the way we present information (Wilson, 2008, back cover).

Cajete (2000) also explains why Indigenous assumptions about the universe set up a continuing clash of values with non-Indigenous scientists, stating:

In the inclusive view of natural democracy, humans are related and interdependent with plants, animals, stones, water, clouds, and everything else. Thus it becomes in every sense abnormal to view the world as dead matter, private property, commodities, or commercial resources. The manifestations and roots of the Native sense of democracy run much deeper than the modern American political version of democracy today in that all of nature, not just humans, has rights. This is the



essential “cosmological clash” between the foundations of Native culture and those of modern society (p. 53).

In short, relationships form and inform our reality. In an attempt to avoid the clash of bringing differing worldviews into academic or actual physical space, consider these broad assumptions to be bridged. Consider also the legacy of previous craniometric analysis of our ancestral bones removed from mounds in the name of Western science and biased truth, as certain paradigms are in need of being broken and new research paradigms established:

<b>Western Research Method(ology)</b>	<b>Indigenous Research Methodology</b>
Quantitative with direct cause and effect (Scientific method)	Both qualitative and quantitative, emphasis on qualitative and descriptive
Linear and literal	Relational methodology based in phenomenology
Numerical measurement favored, especially in STEM fields	Long-term observation of place-based, ancestral relationships. All is alive and related.
Observation, hypothesis, experimentation of hypothesis followed by data gathering	Symbolic and metaphorical
Analysis of data, confirmation or refutation of hypothesis, and conclusions	Science with ethics, protocol and ceremony
Future recommendations, communication of results with tech/economic/business applications.	Research IS ceremony

(Adapted from Cajete 2000, 1999,1994; Wilson 2008; Deloria & Wildcat 2001).

This research is an Indigenous-led analysis and interpretation of the Indigenous mound systems of Turtle Island, particularly the rattlesnake mound of Afton, Minnesota as it relates to other mounds in the Midwest region. As of this date all previous research on this mound has been conducted by non-Indigenous scholars looking through Western values and epistemologies. We do not dispute the numerical data in regard to this mound but offer our approach, which encompasses the discussion about phenomenology and metaphysics of Indigenous science and the CIPP and ecofeminist theories. We do this in full view of our departed ancestors and living elders who will either nod in approval and point the way or turn away in silence.

### **Methodology with Method**

This study is an Indigenous and Western, qualitative and quantitative study surveying mound sites near riverscapes, most of which have associated serpent forms, symbolism, and interpretative meanings. It began as a qualitative study until specific data were discovered that allowed for a strict quantitative method to be tested in order to better inform the qualitative ideas, descriptions, and symbolic patterns. We use ethno-astronomical and archaeo-astronomical techniques, software, and direct experience, tested within the quantitative scientific method. We also use ethnographic and Indigenous research protocols and methodologies through a lens of CIPP and ecofeminism.

We are not attempting to confirm previous estimates and age ranges of each site's construction and additions over time. Rather, we can now say with relative confidence, that these mounds were used for measuring and commemorating cycles of time for well over a thousand years. Their use predicted the reoccurrence of lunar and solar syzygy (eclipse measurement), and held numerical and symbolic interpretations of time cycles.

We began first with 3 sites and expanded our research to 19 sites over a vast watershed of local, regionally-interconnected, riverscapes. A number between 18 and 19 will be shown to shed light on the lunar and feminine significance of these mound sites. We were able to find both the data and mathematical model, embedded in the mound forms, worthy of testing. See Fig. 1A (West to East version not shown).

Fig.1A 19 Mound or related sites

## Mound Sites (North to South Latitude)

- |  |                              |
|--|------------------------------|
| • Westbourne Mound, Manitoba, Canada                                 | • 50.12046 N, 98.61570 W     |
| • Grand Mound, Minnesota   | • 48.515488 N, 93.707984 W   |
| • <u>Namekagon</u> Area, Wisconsin                                   | • 46.09 N, 92.18 W           |
| • Lake Traverse Area, South Dakota                                   | • 45.63 N, 96.94 W           |
| • Indian Mounds Park, Rice Lake, Wisconsin                           | • 45.5152701 N, 91.7394102 W |
| • <u>Wakan</u> Tipi Cave, Bruce Vento Nature Sanctuary, St. Paul, MN | • 44.948874 N, 93.067656 W   |
| • Indian Mounds Park, St. Paul, MN                                   | • 44.945311 N, 93.054883 W   |
| • Upper <u>Wakanda</u> Park Mound Group UWPMG, Wisconsin             | • 44.899513 N, 91.917247 W   |
| • Rattlesnake Effigy Mound, Afton, MN                                | • 44.899024 N, 92.782221 W   |
| • Rice Lake, Ontario, Canada   | • 44.208426 N, 78.155263 W   |
| • Effigy Mounds National Monument, Iowa                              | • 43.090158 N, 91.185021 W   |
| • Effigy Mounds of Madison's 4 Lakes Area, Wisconsin                 | • 43.044464 N, 89.330892 W   |
| • Newark Earthworks, Ohio  | • 40.041085 N, 82.430975 W   |
| • Serpent Mound, Ohio  | • 39.025329 N, 83.428911 W   |
| • Cahokia Mounds State Historic Site, Illinois                       | • 38.654943 N, 90.062016 W   |
| • <u>Fajada</u> Butte, Chaco Canyon, New Mexico                      | • 36.0189 N, 107.9098 W      |
| • <u>Kituwa</u> , North Carolina                                     | • 35.438712 N, 83.401066 W   |
| • 3 Rivers Petroglyphs Site, New Mexico                              | • 33.34423 N, 106.00738 W    |
| • <u>Kukulkan</u> /Merida, Yucatan, Mexico                           | • 20.68278 N, 88.568612 W    |

Fig. 1B Sites in watershed of riverscapes

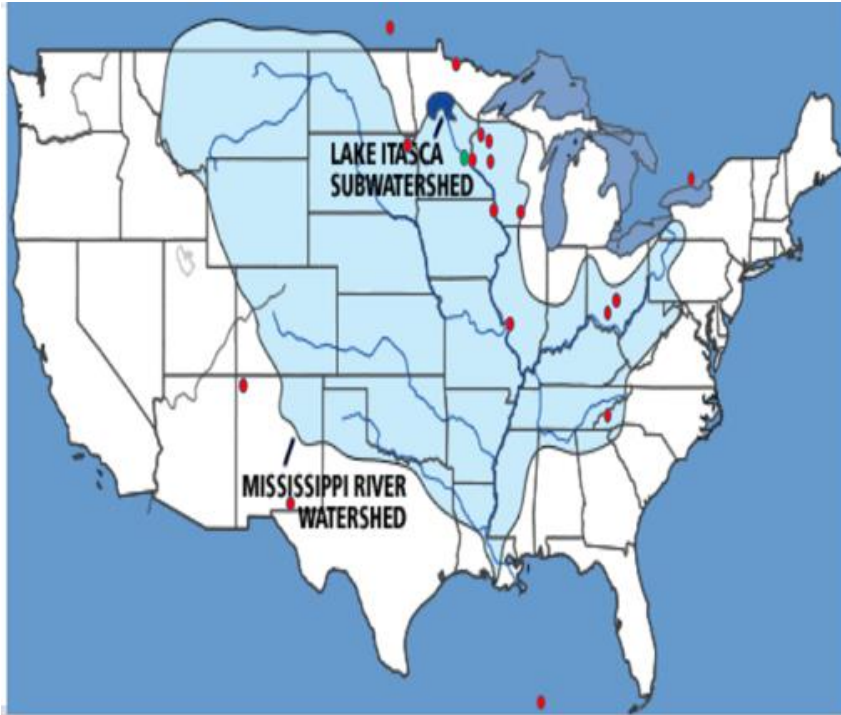
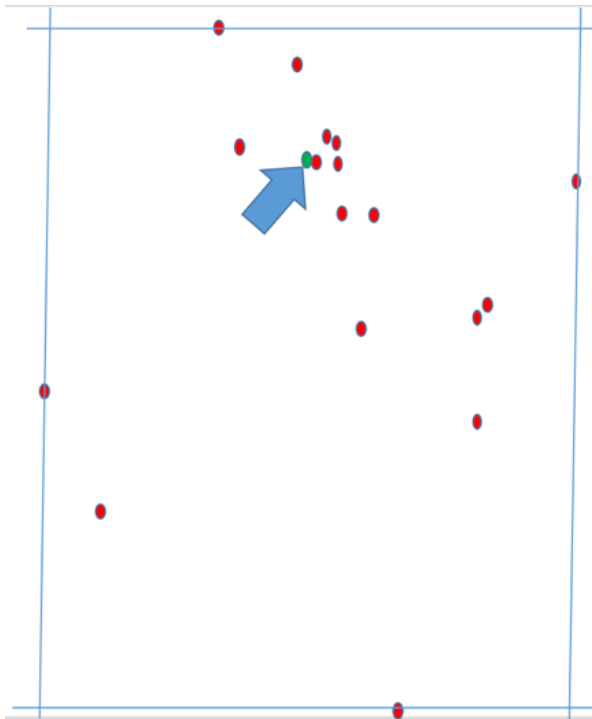


Fig. 1C 19 Sites only



These 19 sites (Fig. 1C) once held a literal mound of earthen data, but the three sites originally researched were severely damaged over a century ago (see arrow). Nineteenth-century ethnographers such as T. H. Lewis recorded some useful numerical data that can still be analyzed and confirmed or refuted in situ with observation. It is essential however, to do all this through an Indigenous, place-based cultural context. This analysis and synthesis uses both ethno-mathematical and digital, astro-geometrical modelling. Indigenous ethnoastronomy is not mainstream ethnoastronomy (Kidwell, 2003).

Sometimes the western method can seem too harsh and foreign until interpreted and contextually softened. This can make data recording methods like graph paper more acceptable, as they can also reveal visual patterns similar to intuition, for others to clearly see. Geometry and astrometry from an Indigenous view is like starting with two navels: Mother Earth's navel-center and Father Sky's navel-center. These two coordinates establish the four directions upward, outward and downward. So if one looks at polar coordinate graph paper in this way, it is not threatening but comforting. The sun, moon and star constellations of animals and plants show the exact places, times and ways to live in balance. We argue both the Indigenous and Western approaches used in this research strengthen one another to create a strong bridge of understanding offered to help other researchers to find a greater truth.

## **Introducing the Data from the Rattlesnake Effigy Mound at Afton (REMA): Natural Numeracy & Natural Literacy**

At the mere mention of Nature's number patterns written all around them and within them, most people tend to roll their eyes and fall asleep. Our Indigenous ancestors however, knew that that these numbers are hidden in plain sight. This is our phenology, our version of reading Nature and what could be called natural literacy and natural numeracy (Rock, 1997).

Known as Smithsonian Code 21-WA-0010, the Rattlesnake Effigy Mound in Washington County (WA) at the City of Afton [called REMA after this], is filled with millennia-old numbers as recorded by archaeologist T. H. Lewis. He surveyed and recorded the following in his notes (pp.15-16):

The land here slopes toward [St. Croix lake], and the rattlesnake lies just above high water mark. The head is 5 ½ feet high, 88 feet long, and, 56 feet wide at the broadest point, which is also the highest from which it gradually descends to the body connected with the extremity of the tail, there are three small mounds whose bases interlock, thus forming the rattles. The last of these mounds is 20 feet long and 18 feet wide, and the two between it and the tail are each 18 feet in diameter, and all three are of the same height as the end of the tail. The total length of this effigy is 534 feet. On June 25, 1883, when this survey was made, in addition to the snake, there were four round mounds and one embankment in the group. Formerly there were other mounds, but they had been demolished (Lewis, 1887, as well as 1889a, 1889b, 1898, 106 Group).

Twenty-eight years later, Winchell (1911) concurs and adds,

This group is on sloping ground. No. 5 [the 'rattlesnake'] is just above overflow, but its approach, or tail, is partially overflowed in high water which is 20 feet above low-water line. The head is 56 feet in transverse diameter and 5 1/2 feet high, length 88 feet. This effigy, if it be intended to be a rattlesnake, increases in width from the tail, which is 18 feet wide, to midway in the body, where it is 26 feet wide and then diminishes to 22 feet at the neck. Its height also increases from the tail, 1 foot, to the neck, 2 feet. Its entire length is 534 feet. Surveyed June 25, 1883. Mr. Lewis has published a description of the 'rattlesnake mound' in Science, 220; 1887.

We used both Lewis and Winchell to calculate several other essential life values in the rattlesnake mound. The results of this synthesis follow next.

Consider the initial hypothesis that the numbers 18 to 19 are feminine, Earth-Sky numbers. The in situ data, data analysis, and results will be discussed now as the following 13 questions are answered. Although snakes likely would not swallow a turtle, we see metaphorical and mathematical turtles in, on and under THIS rattlesnake. These 13 questions are meant to correlate with the 13 moons in a year, and the 13 scutes of a turtleshell, and all of these are feminine numbers.

- 1) What is the turtle shell calendar and why is it used?
- 2) Why is 534 feet long and 2 feet high at REMA's neck significant?
- 3) What is the ratio of REMA's [head + tail length] compared to [body length]?

- 4) Why are women's sky knowledge, ceremony and midwifery all connected to the Red Day Star (Venus), and to this Rattlesnake Mound (REMA) which resembles an umbilical cord?
- 5) Why is REMA's head turned slightly to the left like the Great Serpent of Ohio?
- 6) What lunar periods and longer cycles are encoded into the REMA Rattlesnake?
- 7) Why, how and when does the REMA Rattlesnake shake its tail mounds? Why 19 and why NOT 19? This is the central question of our hypothesis.
- 8) Why less than 19?
- 9) What is the REMA Rattlesnake's error using lunar month values and 12 or 13 lunations per year for the Metonic (6940), 18.61 (6797), and Saros (6585) cycles?
- 10) What if we don't use the REMA Rattlesnake's average for the turtleshell year, rather just 18 or 19 years of turtleshells?
- 11) So how well can a turtle or a Turtle Islander tell time anyway, regarding eclipses?
- 12) What other rattlesnake lessons are hidden in plain sight in this REMA snake?  
What lessons will the snake still teach us about pregnancy and a turtle?
- 13) Who was the first woman to record the mathematics of her relationship between the moon and her menses? And where are such feminine Indigenous science places where this was written then and now?



### **Question 1) What is the turtle shell calendar and why is it used?**

An ancient way used by our ancestors to tell luni-solar time used the turtle's shell. Based on observational phenology, there are thirteen main scutes or sections surrounded by about 28 smaller scutes around the shell perimeter. Since  $13 \times 28 = 364$ , each scute represents a moon of 28 days where light is gained for 14 days and lost for 14 days. In between these two periods is about a day and a half when the moon seems to be missing or new. Because a tropical year from spring equinox to spring equinox is actually 365.24219 days, the turtle shell calendar would require some intercalation, or additional days added as a possible adjustment. If not, the error is 1.24219 days per year for 0.34%. However, we will show that it could function very well for the sake of measuring moon-sun syzygy alignment cycles like eclipses and lunar standstills (LALS and GALS). But if nature has written numbers in a turtle shell, we will also show how such turtle numbers are placed into the REMA snake from head to tail.

### **Question 2) Why is 534 feet long and 2 feet high at REMA's neck significant?**

Pregnancy and fertility are amazing mysteries, gifts and responsibilities. Human gestation means being connected to an umbilical cord for 266-267 days or nine months of human gestation. This snake mound embodies this number by taking the length of 534 feet and dividing by the neck height of 2' to give dimensionless number 267 as  $534/2 = 267$ . This was an extremely satisfying, remarkable, well-planned and executed and also highly symbolic STEAM project. Snake petroglyphs can be a symbol of the umbilical cord and may be merged with lightning, rain and water in countless examples drawn around the Three Rivers site in New Mexico (Slifer, 2000, 2013).

**Question 3) What is the ratio of REMA's "head + tail length" compared to "body length?" Why?**

The first thing to notice is that the head is 88 feet (H) and the tail is 56 feet (T) which equals 144 feet together and these may be subtracted from the entire length of 534 feet. This leaves 390 feet for the body (B). Taking these percentages, we see that  $H+T=144/534 = 27\%$  versus the body at  $390/534 = 73\%$ . It should be noted that Earth Mother is 27-28% covered by water after this last glacial melting, but this ratio is increasing. Also if we decide to take an intuitive leap and equate the Snake with a year, then this means that 27% of 365 = 99 days and 73% of 365 = 266 days. However, if we use the more precise tropical year as 365.24219 days, then this becomes 98.6 (99) and 266.6 which rounds up to 267 days. Yet again for the second time, and by a different method than the above method of length divided by neck height, 266 or 267 was derived!

**Question 4: Why are women's sky knowledge, ceremony and midwifery all connected to the Red Day Star (Venus), and to this REMA Rattlesnake Mound which resembles an umbilical cord?**

These 267 days or nine months also mirror the time that Venus as morning "star" appears rising before the eastern sun for 263 days on average, or also following the sun after sunset in the west for another nine months or 263-day period. However, between these two times in East and West, Venus is not visible for around 50 days, and is again invisible for around 8 days between the West to East appearances. This is a total of 263 (a.m.) + 50 + 263 (p.m.) + 8 = 584 days or 1.6 years during which Venus performs five

kinds of dance shapes when she appears.  $5 \times 1.6 \text{ years} = 8 \text{ years}$ . Dakotas refer to her as the Red Day Star or Anpao Wičanĥpi (Lee, Rock, & Gawboy, 2014).

The Red Day Star is full of women's knowledge and is the family name of a co-author's Dakota grandmother who was both a Red Day woman and a Waĥpe Winyanĥ or Leaf Woman herbalist. The eight-pointed star quilt we are wrapped in at birth and death and wedding and honorings in-between, refers to the 8 years that the Red Day Star travels through the sky to return back to the same star place in the sky from which she left 2,920 days earlier. This is because  $8 \times 365 = 5 \times 584 = 2920$ . Uŋktehi, the underwater serpent is the Dakota water protector represented by the snake mound, and also by petroglyphs in a not-so-distant cave considered to be its home. Many other moon-related numbers in addition to 267 are also encoded in the snake mound. For 9 months, we are in fluid connected by our umbilical cord and breathing within our mother's cave-like womb.

### **Question 5: Why is REMA's head turned slightly to the left like the Great Serpent of Ohio?**

As the serpent crawls northward and upstream, its head is looking slightly northwest. Is this possibly on an over land course heading toward Indian Mounds Park and Wakanĥ Tipi Cave at 285 degrees or 15 north of west? Actually, the head angles from the neck at about 330 degrees or 45 degrees more to the north than the direct line to the Wakanĥ Tipi cave where the 4 petroglyph snakes exist. However, if we travel exactly 100 miles at 335 degrees (an extra 5 degrees) from the snake mound, we are in the center of "Mille Lacs" or Bde Wakanĥ (Holy Lake). If we leave for this lake from

Wakanj Tipi Cave we head 93 miles north at 343 degrees. Actually, if the head is headed at 330 degrees this is 17 degrees past the greatest annual lunar standstill or GALS of 313 degrees where the moon sets about every 19 years.

The Ohio Serpent head appears to look at 295 degrees. This is 18 degrees less than GALS. These two snakes both stargaze northwest and only 35 degrees differently. The Ohio Great Serpent Mound also encodes the solar and lunar, east and west, rising and setting points by the curves of its body. It also is around 1330 feet long and 5 feet maximum height for  $1330/5 = 266$  days and it also looks more like an umbilical cord than REMA. Finally, people have speculated that this snake is about to swallow an egg but this could be the placenta attachment region (which once held the egg passed from the fallopian tube) within mother. There is another serpent with egg mound at Rice Lake, Ontario to be tested like REMA and Ohio. To better understand the Indigenous perspective in this area, see McCoy, Ironstrack, et. al. (2011), but also Squier and Davis (1848) for the earliest non-Indigenous drawings of these sites.

**Question 6) What lunar periods and longer cycles are encoded into the REMA snake?**

One way to see the number of days per moon, is to divide 267 by 9 moons during pregnancy to give 29.7 days per month. Whereas, 266 divided by 9 = 29.6 days per month which is only 0.24% error from the synodic lunar period of 29.53059 days for the moon to cycle from full to new to full again. This method shows less than 1% error, but it is not based upon measuring the snake. But if the snake's length (534) is divided by the tail shaker's width or length where it attaches to the snake's body (18 feet), we

also see  $534/18 = 29.7$  days per month. This is still less than one percent error at 0.57% from the true synodic lunar period. To achieve even greater accuracy, we would want to use more precision than just measuring in feet. Could we measure and then calculate  $534'/18.083' = 29.531$  days rather than the less precise 29.6 or 29.7 days? Yes, by measuring this extra 0.083 foot = 1/12 foot = 1 inch.

However, can it be assumed that one twelfth of a foot was used as a fractional unit of measurement, no matter what it was called in Dakota language? We would assert yes. We will see how the cave's carved petroglyphs were measured at either 1.5 inches or 2.0 inches deep. My thumb is an inch wide and called *napahunka* or *napahunke* in Dakota; my hand is *Nape*, my finger *napcupe*; and the middle finger is *napcoka* for some other possible, measurement unit name examples that are smaller than a foot. Base 10 came from ten fingered people, yet base 12 might also come from people who have polydactyly.

In addition to seeing the synodic lunar period or synodic month in the snake mound as 29.6 or 29.7 days to within less than one percent error, we can also calculate a close value for the sidereal month by the following method. Since the 3<sup>rd</sup> tail shaker at the end is 20 feet long and not 18 feet long like the other two shakers and tail width, we should also use this number to divide the length by 20 and see that  $534/20 = 26.7$  or nearly 27 days per month. Before dismissing this as too small a moon time interval, recall that the sidereal lunar period is 27.3 days (more precisely 27.321661 days) for the moon to return to the same star place in the sky from which it left, in order to complete one dance circle or orbit around and between the stars and the Earth. So 26.7 days has only 2% error.

It is also possible to see the draconic month of 27.212220 days and the anomalistic month of 27.55455 days by dividing the 543 feet snake length by a width of 19.7 feet and 19.95 feet respectively as it gradually increases from 18 feet wide to a maximum of 26 feet wide before tapering back to 22 feet wide at the neck. Also the tropical month of 27.32158 days can be derived using a width of 19.54 feet. This thin to thick to thin again width reminds us of the gradually increasing and then decreasing width of the snake's body. It shows a metaphorical connecting principle to not only the waxing and waning of the phases and light but the 5 possible ways to define and measure a month. There is yet another 6<sup>th</sup> way to consider and measure a month of 28 days based on the turtleshell in question #1. This 28 number will turn out to be the most significant, as it will also relate best to the 18.61 year-cycle called the precession of the lunar nodes.

**Question 7) Why, how and when does the REMA Rattlesnake shake its tail mounds? Why 19?**

And now for the central and seventh question of our hypothesis at the 7<sup>th</sup> direction or center-navel of the six directions: west-north-east-south-above-below-center. Most snakes shake to give a warning and so does this one, but it is really more of a prediction about when something big might occur that connects the Sky with Earth. As we look at the tail mounds, they are from the end of the tail: 20'-18'-18'. The three tail mounds are in lengths of 20 feet +18 feet +18 feet = 56 feet.

However, this 20-18-18 pattern smells of something missing to us. It implies the missing number 19, doesn't it? Shouldn't we ask, "Why *not* 20-19-18?" Precisely

because they are *not* in descending sequence, we believe they represent the numbers of years totaling 56 which should then be divided by 3. Why? Why *not*? Because the average of 18-19-20 is a trivial answer of 19. But the average of two eighteens and a nineteen is non-trivial, and a very significant 18.66! How significant? We believe it is intended to be a very close approximation to the 18.61 year GALS cycle. So the most direct answer to “Why 19?” is that nearly 19 years are required for the moon to complete a cycle from its “greatest annual lunar standstill (GALS)” to return again. Why not 19 as a middle mound length is now answered.

We should also try to see what’s missing, like the moon’s waning light as it is hidden in plain sight (during a new moon) right there, but not there! A snake head or tail is silently hiding until...it is heard shaking, then seen and possibly felt. The head and the tail have the same length of 56 feet which are mirrors of one another and complete a circle like a month or a year or the beginning and ending of a story or a STEAM paper such as this.

### **Question 8) Why less than 19?**

More significantly, if we sum these three numbers,  $20+18+18 = 56$  and then divide by the number of tail shaker mounds (3), we obtain  $56/3 = 18.7$  as rounded up from 18.6666 to the proper number of significant digits. Why is this so interesting and essential to being noticed and to our central argument of 18 to 19 and why 19 here? Because the precession of the lunar nodes is 18.61 years and this number written in these basketfuls of piled up earth is less than 0.5% error from the true value!

**Question 9) What is the REMA rattlesnake's error using various lunar month values and 12 or 13 lunations per year for the Metonic (6940), 18.61(6797) and Saros (6585) cycles?**

The answer to these and more is summarized in Fig. 4, the Rattlesnake Error Chart. To show how this was done, see Fig. 2 for how to use different types of years to achieve different average values which might be accurate warning signals that deserve a tail shake! Fig. 3 shows how to use the turtleshell calendar example in the snake's tail to calculate the number of days until a possible sky appearance and warning. Before digging in, consider Fig. 4 with the analogy of shooting at three targets with twelve arrows and measuring how close to perfect bull's eyes were those efforts.

Fig. 2 Rattlesnake Tail Calculations (with 12 data blanks to fill)

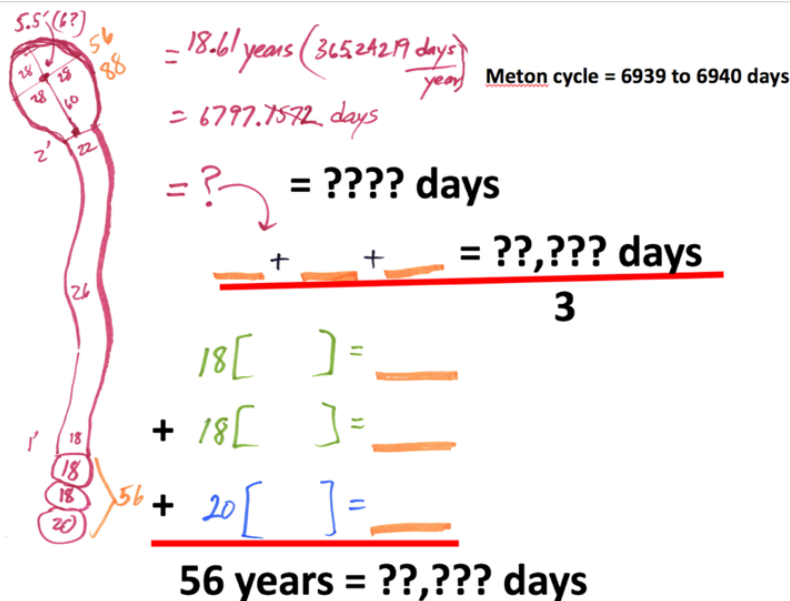




Fig. 3 Rattlesnake Tail Calculations (testing Turtleshell year)

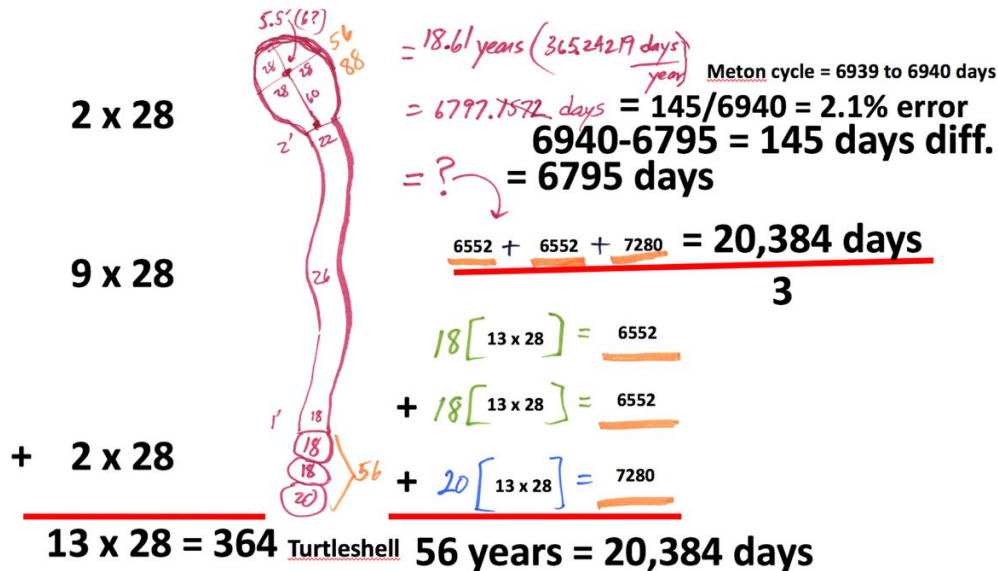


Fig. 3 shows how the entire rattlesnake mound was used as a mnemonic calculating device, like a bowstring to shoot arrows at bull's eyes for a nearly 19-year, daily counting cycle. This could be used for several purposes, including Earth-Sky alignments.

We examine and further interpret these expressions:

$$[20 \times (13 \times 28)] + [18 \times (13 \times 28)] + [18 \times (13 \times 28)]$$

where each set of brackets [ ], represents a mound, and where the 20 feet tail mound and bracket may point skyward (blue) and the two 18 feet mounds between the tip and the body may touch the earth (green). Now, what do we make of the numbers buried or hidden or contained in each of these three, moving, mounded brackets?

Second, we combine and reduce each of these bracket-mounds to see them as:

$$[20 \times (364)] + [18 \times (364)] + [18 \times (364)]$$

Third, "shake another time" to see the number of turtleshell scutes per each [mound]:

$$[7280] + [6552] + [6552]$$

Now give it another shake by summing this expression to equal:

$$= 20,384 \text{ days (or scutes)}$$

Do you see the tapering, rattlesnake's tail yet in these changing, moving expressions?

Now, "rattle" it still once again for a fifth time by dividing by 3 the total of 20,384 days in

56 years = 20 + 18 + 18 = for the number of 3 tail shakers. This gives the average or

mean value of:

$$= 20,384 / 3$$

$$= 6795 \text{ days}$$

Why is this significant? Because it is only 2 days different (= 0.03% error, "three hundredths of a percent") from 18.61 years multiplied by the 365.24219 days per tropical year to give 6797 days. These numbers are also close (by 143 days) to the cycle of exactly 19.00 years x 365.24219 days/year = 6939.6 days (rounded to 6940 days), and this is known as the precession of the lunar nodes needed for eclipse prediction. Perhaps these three may also symbolize Sun, Moon and Earth when all three align for eclipses like 3 shakers aligned on a timber rattlesnake's tail down by the river.

This 19-year cycle was supposedly discovered in the "Old" Greco-Roman, Western world by Meton (fl. 432 BC) of Athens, and now bears both his surname as the Metonic cycle or as it is also called the "enneadecaeteris" or "19 cycle."

In Greek, "Cycle of 19" is said "enneadecaeteris" (15 letters). But in Dakota it is possibly "čañhdeška haŋwi uŋ waniyetu wikčemna ake napčiwañka" (<45 letters) or "Čañhdeška Haŋwi 19" or ČH19 shortened to ČH'napčiwañka which can be further shortened to ČH'9. So who was our Dakota Meton who worked as the local phenomenologist and experimental observer here in this riverscape?

Her or his goal was to know the relationships of many inter-woven cycles and when certain Sky-Earth alignments and calendrical ceremonies will happen. Then s/he had to be able to predict eclipses and other re-occurrences so as to guide how we can all live together as relatives in this place. This CH19 period is almost exactly equal to 235 synodic lunar periods of 29.53059 days. However, 19 tropical years are about two hours shorter than this period which can add up over long periods of time and cause miscalculation and missed alignments and predictions if not understood.

Computation from modern data shows that 235 lunations are 6,939 days, 16.5 hours; and around 19 solar years at 6,939 days, 14.5 hours. Since 14.5 hours = 0.6041667 day and 16.5 hours = 0.6875 day, we will add each of these to the number of days for more precision to get 235 lunations = 6939.6875 days (rounds to 6940 days) or 19 solar years as 6939.6041667 (also rounds to 6940) days. This difference is 0.08333 day or 2 hours. So what is the error using our rattlesnake with the turtle shell method, at hitting this Metonic “bullseye” number of 6939 or 6940?  $6940 - 6795 = 145$  days which is  $145/6940 = 2.09\%$  error or  $144 \text{ days}/6939 = 2.08\%$  error from the bullseye of cosmic truth. This 2.1% is still quite useful. But it can get better or worse depending on which total number of lunations is used, either 12 or 13, then multiplied by which number of days per lunar cycle is used (six possibilities). So this makes 2 x 6 or 12 possibilities to test in the snake’s tail for calculating the 56-year average accuracy and error. These are the twelve possible arrows to shoot from the rattlesnake bowstring at three targets.

Due to space considerations, we only show the compared error results in Fig. 4. This repetitive process shows how many possibilities can be calculated and tested with observation to see if they re-occur and “come true” as predicted such as a full moon

rising on a June solstice. Today we can enter this REMA snake-mound formula into an Excel spreadsheet to quickly calculate the most accurate ways to count 12 or 13 moon times of either 27.3 days/month or 29.5 days/month or others. The three attempted bulls eyes are: 6940, 6797 and 6585 days. See below.

See Fig. 4 Rattlesnake Error Chart

<u>Days/Yr.</u>	<u>Year</u>	<u>Error from 6940 days</u>	<u>Error from 6797 days</u>	<u>[6585 Saros]</u>
365	13 x 28.1	1.7%	0.3%	
<u>365.00</u>	13 x <u>28.077</u>	1.8%	0.25%	
<b>364</b>	<b>13 x 28</b>	2.1%	<b>0.03%</b>	<b>3.2%</b>
386	13 x 29.7	3.9%	6.0%	
356	12 x <u>29.7</u>	4.1%	2.1%	
356	13 x 27.4	4.2%	2.2%	
353.759	13 x <u>27.2122</u>	4.8%	2.8%	
<del>328.8</del>	<del>12 x 27.4</del>	<del>11.6%</del>	<del>9.7%</del>	
with & w/o last point	22.6/7 or 34.2/8		13.68/7 or 23.38/8	
	3.2% to 4.3%		1.97% to 2.92%	
<b>350.4</b>	<b>12 x <u>29.2</u></b>	5.7%	3.8% ( <u>Wakan Tipi</u> )	<b>0.67%</b>
379.6	13 x <u>29.2</u>	2.1%	4.3% ( <u>Wakan Tipi</u> )	7.6%
After adding <u>Wakan Tipi</u> lunar data points: 19.58/9 or 31.48/10 = 2.2% to 3.2%				

Clearly, by examining the error trends as a result of testing both hypothetical “bulls-eyes” of 6940 and 6797, it would seem that REMA’s designers should prefer to use the turtle shell calendar as the simplest, Swiss gold standard of timekeeping. Also this rattlesnake with turtleshell model of computation achieves the goal of hitting the 6797 target with far less error, than if they were attempting to hit the 6940 target (0.03% vs. 2.1%). We gently conclude that they valued the 18.61-year cycle as a better

benchmark or bull's eye, than the 19.0-year cycle as based on REMA's tail and other lunar dimensions which provided this synthesized and hypothesized model used to gain these very encouraging (<2-3% error) results.

The turtle shell calendar and REMA snake mound method was also tested for its accuracy (3%) to the Saros cycle. Saros (Babylonian for 3600 = 60x60), which is the best known and best predictor of eclipse cycles, is 223 synodic moons which almost perfectly coincide with 242 draconic moons to within 51 minutes, and also with the 239 anomalistic moons. If they knew of more than one of these cycles, each cycle could be used like a tipi pole and leaned or averaged together for better prediction just as our weather forecasting models today! There is more to test, but not in this paper.

**Question 10) What if we don't use the REMA rattlesnake average applied to the turtleshell year, rather just 18 or 19 years of turtleshells?**

By using  $18 \times (13 \times 28) = 6552$  days, this is 5.6% error from the Metonic(6940) or 3.6% error from the 18.61(6796), but only 0.50% from the Saros value of 6585. Whereas,  $19 \times (13 \times 28) = 6916$  days which is 5.0% from the Saros and 1.8% from the 18.61(6796) but the best effect is compared to the Metonic at only 0.30% error! So we now see that the turtleshell calendar year is amazingly close by itself over 18 or 19 years or also when it is averaged over 56 years.

**Question 11) So how well can a turtle or a Turtle Islander tell time anyway, regarding eclipses?**

The prediction ability is somewhere among 0.30% from Meton to 0.5% for Saros to only 0.03% from the 18.61 year (6796) value for determining possibilities for reoccurring syzygies. If these three values were the initial three tipi poles in a tripod, then the rope would hang down at a central median error value of  $0.83/3 = 0.28\%$  overall average error. This is 99.72% accurate if the turtleshell year is applied with the right cycle(s) when Nature lines up a winner!

One final lunar calculation derived from the four snake petroglyphs carved inside the Wakanj Tipi cave was tested (29.2 days/mo.). It was found to have less than 4% error from the 6797 day value. However, the error was only 0.67% (less than 1%) for predicting the Saros cycle of 6585 and also only 2.1% for predicting the Metonic cycle of 6940. Was the 29.2 day period an earlier synodic month measurement perhaps used for centuries based on these 4 petroglyph snakes, until it was refined from 29.2 (1.1% error in cave) to 29.7 (0.6% error in snake mound) days per month? Or was this a later refined value, if they were shooting for the Saros cycle? Again, more to test for future considerations to come.

This qualitative research study began as a survey of mound sites with snake and related associations, and now has tested the hypothetical and quantitative analysis apparently “buried” and encoded within it, with still further, future and more hypothetical, qualitative and quantitative syntheses yet to come. Just as the numbers were “discovered” embedded or hidden in plain sight all along, the Western quantitative analysis is here, but hopefully not dominating, nor hidden, nor camouflaged within the

qualitative methodology. This gives the qualitative methodology both power and venom-like, strength to resist and outlast the criticism, skepticism, bulldozers and sewer lines that now run through the snake mound as of 2017. Sadly, it is now too late to save REMA and her time-telling abilities.

Some will dismiss, ignore, or choose not to dig so deeply as this. Or they will venture no further than the qualitative survey out of respect or fear of numbers or their unawareness of natural numeracy and natural literacy (Rock, 1997). But Nature's numbers are already and always all around us, and within us, just waiting to be synesthetically sensed, seen and understood, in all their powerful, place-based, ecofeminine and contextual relationships.

**Question 12) What other rattlesnake lessons are hidden in plain sight in this REMA snake? What lessons will this snake still be able teach us about pregnancy and a turtle?**

A quick summary so far should suffice, that Wakanj Tipi's 19 mounds and Indian Mounds Park's 18 mounds are aligned and average to 18.5 mounds, which would be very close (0.6% error) to the 18.61-year lunar nodal cycle. The designers did not think it necessary to place 18 and a half mounds midway between the two groups at 0.35 miles between. We will show how the 19 or 19.0 years number [6,940 days] or the 18.61 years number [6,797 days] closely relate to the Wakanj Tipi Mounds and Indian Mounds Park sites, as well as to the snake petroglyphs carved within the cave below the 19 mounds, after this final analysis and synthesis of REMA snake teachings.

Since REMA's body widens to 26 feet before tapering back to 22 feet wide at the head, we still have at least two more numbers to try: 26 and 22. So  $534 / 26 = 20.5$  and  $534 / 22 = 24.3$ . These 3 to 3.5 week periods do seem to be shorter than a "moon" time period, unless we consider that some women experience menses at other than a regular 28 days. Since fertility and pregnancy are essential to life, knowing these moon numbers is all about such fertility. These are Nature's phenology numbers or math problem mysteries for us to solve. Consider also that the timber rattler (*Crotalus horridus*) or banded rattlesnake's original range corresponded with our vast eastern watersheds, and that it has 20 to 29 dark brown or black, crossbar stripes. This number range makes even more sense as lunar number patterns or snake markings.

Of course,  $534/19.3 = 27.7$  days is still close to the more precise lunar sidereal period of 27.321661. This is only 1.4% error.  $534/19.5 = 27.4$  is even closer, to within 0.3% error. Since the cave snake's carvers intended for at least "half-inch" measurement precision, this last value (19.5) seems reasonable and acceptable depending on where we cross-sectionally divide or "slice" the snake somewhere between the tail and the widest place. It was said that snakes were to be cut into nine parts by ceremonial practitioners in the Maya world. Division cuts the whole into its various parts or fractions. We say "dividend divided by divisor equals quotient."

Between the 1-foot high tail and the 2-feet high neck, we have a gradual rise which would imply and include 1.5 feet at some point, perhaps half way between tail and head. But this is unknowable now thanks to the Army Corps of Engineers in 1971 and others placing concrete sewer pipes in 2017.



So  $534/1.5 = 356$ . The head of the snake mound was measured at 28 feet and 28 feet in opposite directions across from the top center which totals 56 feet together. 56 feet is the same width as the tail's length as made of three mounds of  $20 + 18 + 18$  feet for 56 feet total. If the combined [head] and [tail] represent **[28 + 28] + [28+ 28]** feet implying four lunar periods, perhaps the body of the snake then contains the remaining 9 lunar periods of 28 days for **9 x 28 = 252 days**? Since  $[4 \times 28] + [9 \times 28] = 13 \times 28 = 364$ . This shows and reinforces the turtle shell calendar once again. See Fig. 3 again.

Perhaps now we should use the height of the head at 5.5 feet to calculate  $534 / 5.5 = 97$  days which if subtracted from 365, leaves 268 days and is very close to the 267 we found by dividing the length by the neck height  $534 / 2 = 267$ . Recall that the previous paragraph showed  $534/1.5$  feet as the possible midpoint height giving 356. Notice that  **$356 - 267 = 89$**  which we could rewrite as  **$[534 / 1.5] - [534 / 2] = 89$** . Also if the snake head height was originally 6 feet and not 5.5 and worn down after 30 years of settler's feet standing on it, then  $534/6 = 89$ . This would concur better.

Now 89 is not the 97 we obtained at the head, leaving an 8-day discrepancy, but it still seems to be saying that about a year of pregnancy is roughly 9 months connected by the čekpa or umbilical-cord like a tipi-rope, plus 3 months after emerging from the mother's tipi at birth, thus equaling 12 months. In other words,  $365 - 266 = 99$  or  $365 - 267 = 98$  or  $365 - 89 = 276$ .

Does this mean that after we "head" out of our mother on our birthday upon reaching 266 to 267 or 270 days within her, we will then experience our first 89 to 95 to 97 to 98 or 99 days of life apart from the umbilical cord? In so doing we first breathe directly outside upon and from Earth Mother. Since  $356 / 12 = 29.7$ , we now see for the

third time how we have found this 29.7 number along with  $534 / 18$  and  $267 / 9$  all of which equal 29.7 days per moon. It would seem they saw the synodic lunar period as 29.7 days, which is 0.6% error (less than 1%). But again, did the cave number of 29.2 come first or second like the proverbial chicken and egg? Or perhaps rattlesnake and egg? Actually, rattlesnakes are ovoviviparous carrying eggs within and giving live birth!

**Question 13) Who was the first woman to record the mathematics of her relationship between the Moon and her menses? And where are such feminine Indigenous science places where this was written then and now?**

The oldest known example of lunar counting is the more than 20,000-year old, African Ishango bone from the headwaters of the Nile. Also at roughly 37,000 years old, we have the similar Lembombo bone from Border Cave. The more mathematical Ishango bone shows three columns of numbers and was likely carved by a very numberphilic woman (Zaslavsky, 1992) who counted  $28 \text{ days} \times 6 = 168$ . This is  $28 + 28 + 28 + 28 + 28 + 28$  with an implied 9 days missing as follows:  $168 + 9 = 177$ .

The same number of 177 days is also written in dot-bar numbers in one of three surviving Maya Codices called the Dresden Codex (Bricker & Bricker, 2011, p. 490). It contains eclipse cycles and Venus (as feathered serpent Kukulcan) cycles with an image of four snakes ascending, like those in Wakanj Tipi cave of the Dakota. Wakanj means sacred, holy, mystic or both creation and destruction in Dakota. These 4 snakes are surrounded by pairs of dot-bar numbers perhaps as spoken words and are pronounced, “wak” “kan,” “wak” “kan” or “wak” “chan,” “wak” “chan,” which means

6-4...6-4 in Yucatec and Chol Mayan language(s). Are these repeated to possibly represent four snakes echoing in a cave? K'an is the homophonous term for snake or yellow, but also for the number four (kan) and sky (ka'an) in Mayan. So we have 4 sky snakes in a yellow rock cave. Tun is rock and kan is yellow, so Tunkan is yellow rock or limestone cave rock. Tunkanj is also Dakota for rock or grandfather rock.

Wak can also mean lifted up or raised up or standing. So Waka Chan in Chol refers to the lifting up or standing up of the Milky Way Road also seen as a cosmic tree, and apparently also imaged here as four serpents forming an X shape. This is also four ropes raising up a tree in order to push up the sky from earth. This is like the Lakota sun dance ceremony. We use Indigenous science to hypothesize such possible meanings for these place-based numerologies and phenomenologies.

There is also a strong association of the Kukulcan snake-planet Venus with water, as its shadow descends northward and downward into a nearby yellow limestone well (dzonod/cenote) on both equinoxes. This occurs at the Kukulcan pyramid and Caracol Venus observatory complex at 20 degrees N. latitude. Symbolizing human gestation with nine levels or months as when Venus appears, the pyramid has 364 steps in four staircases of 91 steps each. They escalate from four inter-cardinal directions, again like the rising X-form of snakes in the cave and in the Dresden Codex. Prayers are offered to Sky from Earth then and now, for the annual return of the fertility of earth with rains, lightning and Venus.

On May 20 which is 60 days after the appearance of the descending, equinox shadow snake, the sun will achieve its annual zenith location directly overhead so no shadows are seen. It is also aligned in front of the Maya constellation of a rattlesnake's

tail stars (Pleiades). May 20 is also Dakota planting time and our last frost-free day at 45 degrees latitude N. Used to predict rain, the Maya stars of the rattlesnake's tail are for Dakotas the Tayamni's head, a bison embryo's head (Lee, Rock, O'Rourke, 2014, Bassie-Sweet, 2008).

The K'iche Maya today believe the Pleiades stars are two fistfuls of corn seeds while the nearby Hyades stars are bean seeds. The Maya also plant corn on full moon when the snake tail stars are overhead at zenith on May 20. The Cakchiquel Maya have a whirlpool, cloud serpent in volcanic Lake Atitlan, which mirrors the sky place below Orion's belt stars at the center of a triangle of three firestone stars. They refer to the Milky Way near these turtle stars of Orion as the wet season tree, and to the Milky Way near the opposite scorpion stars as the dry season tree (Bassie-Sweet, 2008, p. 274). Lastly, the Great Ball Court of Twin Snakes at Kukulcan measures 545 feet long, while the Afton Rattlesnake Effigy Mound (REMA) is 534 feet or just 11 feet shorter. This is only a 2% difference.

We seek to understand and re-contextualize the REMA mound data by analysis and synthesis to reform a meaningful whole and a complete story. Elder Sam Blowsnake of the snake clan told the Hochunk origin creation story of four snakes placed at the corners of sky and earth (Smith, 1997, pp. 212-215). Hochunk country includes the glacial hills and caves of Wisconsin once covered in 20,000 or more effigy mounds – including snake mounds.

Annually, the REMA snake mound was slightly or even more flooded over after snow and ice melts. In the north country, glaciers first carved river valleys leaving behind dome-shaped and snake-like earth forms called eskers, drumlins and kames by

glaciologists (Imbrie & Imbrie, 1979; Bennett & Glasser, 2011). These may have inspired the ancestors of the Hochunk people to build effigy mounds near Madison's four lakes area and upon these snake-like eskers. Nature's written patterns upon the land are seen as a form of Natural literacy that inspires us to read every leaf, feather, turtleshell and glacial remnant (Rock, 1997).

After the glaciers turned into the many lakes of Mni Sota Makoče, winter ice and snow melt continue to create annual flood waters which have their powerful way of dominating the landscape all down through the riverscapes of Iowa, Ohio, Illinois, Missouri as these waters co-mingle at the Louisiana delta and gulf. See Warriner for a source on the Effigy Mounds National Monument in Iowa.

Mounds were built upon these glacial earth remnants especially concentrated around the Four Lakes Area of Madison and across southern Wisconsin. Hochunk Nations claim these as the work of their ancestor Mound Builders between one to two thousand or more years ago (Birmingham, 2010; Mann).

### **Wakanj Tipi Cave Data and Analysis**

Following these 13 questions, we are now ready to show the cave snake data and how we derived the lunar period of 29.2 days per month and noticed the southeastern snake angle. The same T. H. Lewis (1898) who measured the Afton REMA snake also documented and measured the four rattlesnake petroglyphs drawn on the Wakanj Tipi cave ceiling as if they were moving upward to the common

centerpoint above the lake. He says, that upon entering the cave, to the right or southeast, there was a snake with embossed stripes not carved away.

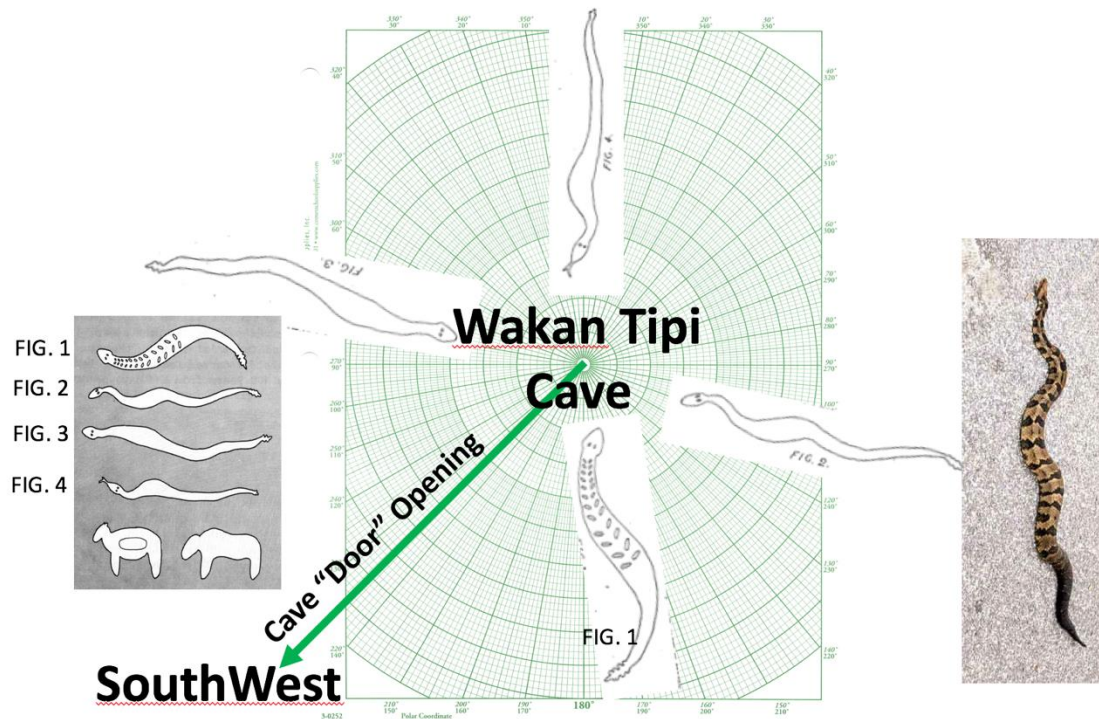
Figure 1 represents a rattlesnake, 3 feet 7 inches in length and about 2 inches in depth at its widest part. In cutting this figure, portions of the natural surface were left in the form of bosses, which were probably intended to represent the darker colorings on the back of the snake. It was located on the southeast slope of the roof and a little to the right of the entrance. This was doubtless the "snake" seen by so many of the early visitors, and is also mentioned in history."

Figure 2 represents a rattlesnake 3 feet 8 inches in length and about 1 1/2 inches in depth. It was located to the eastward of Fig. 1, parallel with it, but a little lower down the roof. The eyes were bosses, as was the case with the others, but in addition, a cavity had been scooped out in the center of each.

Figure 3 also represents a rattlesnake 4 feet 11 inches in length and about 1 1/2 inches in depth. It was to the west of Fig. 1 and a little below it.

Figure 4 probably represents a rattlesnake with but one rattle and a button. Its length was 3 feet 4 inches, depth about 1 1/2 inches, and was located directly west of Figure 3. The forked tongue may be intended to represent speaking rather than hissing. (pp. 40-42)

Fig. 5 Polar coordinate placement of petroglyphs in Wakan Tipi (Rock)



Tobacco would be offered as protocol before entering such a sacred cave space, since it is also the home of Unktehi the water protector. As we enter this realm, the reader is also encouraged to intellectually offer tobacco and prepare for some unexpected surprises. Co-author Rock noticed that the number of drawn rattlesnake tail shakers may be a significant clue for several reasons. Lewis Fig. 1 has 4 shakers while Lewis Figure 4 has only 1. Lewis Fig. 2 has 3 and Lewis Fig. 3 has 2 shakers. So if we read them counter-clockwise from within the cave and starting at the north with Fig. 1 they are read as: 1-2-Door-4-3.

By seeing the number of tail shakers, we believe the ancient protocol order of North to West to East to South was documented and preserved in this way within these yellow rock walls of Her womb. Observe that the first protocol order described was N-W-E-S and that the tail shakers match this perfectly and directionally as 1-2-3-4 respectively! The night sky was also written upon the cave ceiling with origin story, constellation animal-relatives such as the bison, snake, lizard and turtle.

However, if we move counterclockwise as the 7+ stars that always circle overhead, then the order 1-2-(door)-4... reminds us of the family tree and our ancestors as you see yourself (1) coming from parents (2) and grandparents (4)...et. al.

There is an even more interesting and yet another auditory reason, like the echo of wak-kan for the snake drawings to be arranged by their number of tail shakers. If the door is zero which we enter first, then, the numbers 0-1-2-4 are pronounced MI (0), HUN (1), KA (2), and KAN (4) in Yucatec Mayan language. Yet mihunkakan is also the Dakota word for my ancestors and the creation stories they pass down to us. Notice that the snake with 3 tail shakers is located ascending on the east-southeast wall toward the ceiling center over the lake's surface water. Is it possible this snake was oriented at 105 degrees to point us from Wakanj Tipi and Indian Mounds Park toward REMA at Afton? We may never know for sure as James J. Hill, the railroad empire builder and "resource" robber baron, dynamited this cave and its ancient, sacred data in the 1880s soon after the Dakota exile and genocide. He expanded his empire and riches by "draining the swamp" and removing "obstacles" to his profit-taking dynasty for then and future petro-billionaires. These rails still haul fracked, shale oil from our North Dakota relatives. Hill does not receive a "pass" for ignorance here.



Notice the central, pipestone-colored result in Fig. 7, which is the average of the four quotients calculated from the Lewis rattlesnake data in Fig. 6 below. It equals 29.2, rather than say 29.5 which is only a 1% error from the synodic lunar period in days (= 0.3/29.5) for full moon to new moon to full moon! This means 0.3 of a day is only 8 hours per month error or 99 hours per year (= 4.13 days “off”).

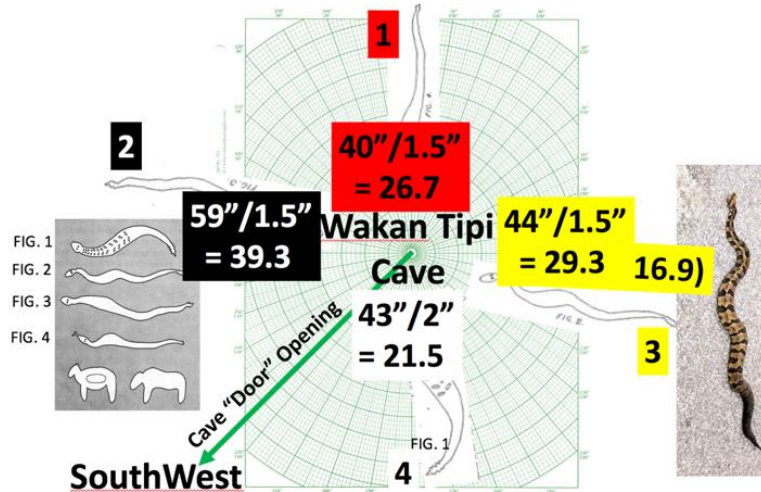
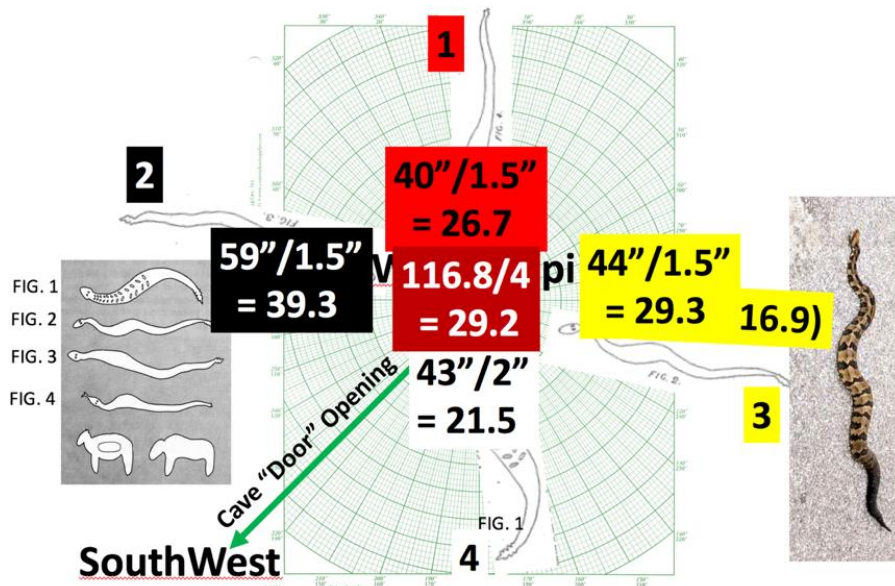


Fig. 6

Fig. 7



The sum of the four quotients (before dividing them by 4) is 116.8. This is the fifth and central dividend (like the fifth wind brother Homni or Yumni – “to turn or spin around

in circles”). 29.2 is shown here in pipestone color at the ceiling center of the four snakes colored red-black-yellow-white or 1-2-3-4. Pipestone is the color formed from these four directional colors. So take the sum of the first four quotients in Fig. 6 with 116.8 at center to see that every 18.61 years the full moon rises at 116.8 degrees (+/- 0.1 degree 4 out of 5 times since 1959 CE), and on or near the June summer solstice in the Northern Hemisphere. 116.8 is also just 0.5 degree, or one full moon’s width, from the least annual lunar standstill (LALS) at 117.3 degrees on the horizon for 2016 which occurred in December. At the December LALS the moon would appear to rise right behind this water tower. This rising lunar image on 6-20-2016 (Rock) is in Fig. 8A & 8B. It appears near the water tower which is about one-third of the way toward the Rattlesnake Effigy Mound at Afton (REMA). In full disclosure, the REMA snake mound

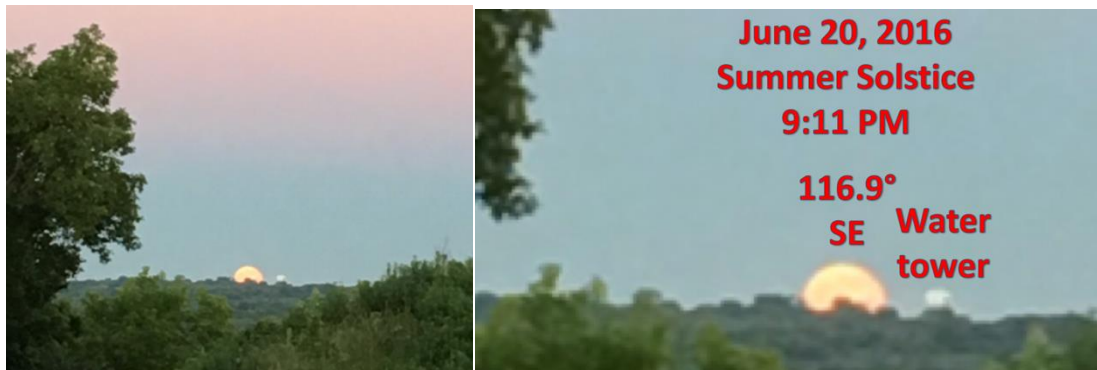


Fig. 8A

Fig. 8B

with 3 tail shaker mounds is still another 12 degrees to the left (North) of the moon.

If the four cave snakes were randomly scratched into the limestone, or purely for art sake rather than art combined with math, what are the chances that the total of their 4 quotients summed and divided by 4, would be the synodic lunar period to within 1% error? Also, what are the random chances that the fifth dividend number would be the same directional angle in degrees, as the June Solstice moon rise about every nineteen

years? Finally, if this isn't a coincidence, would pre-contact people here on Turtle Island really be using a base-sixty number of degrees in a circle, that also just happens to match the sum of the four directional quotients? Likely not.

But if this is a coincidence, rather than Egypto-Babylonian influence or some independent invention of base 60 (as a triple base 20), then what measuring system was in use 2,000 or more years ago? Fingers, in fact! Twenty fingers and toes for base 20 works just fine. Actually, using fingers at full arm extension is a powerful method. The sun is half a finger wide and so is the moon, which can then cover the sun in an eclipse. But as to where the shadow path falls and moves, is a much more challenging observation pattern and calculation to perform.

If we dismiss some or all of this as wishful speculation or coincidence or both, then the next question is this. Why is the snake with exactly three tail shakers (like REMA) etched into the cave dome ceiling in the southeast ( $\approx 135$  degree) quadrant at say 105 degrees or possibly even 117 degrees. Why does this number "match" the June 2016 Summer Solstice Full Moonrise angle of 116.9 degrees?

More importantly, why would we want to align 19 mounds above Wakanj Tipi cave with the 18 mounds up and along the bluff 0.7 miles to the southeast and stand at the former mound site #1 on the bluff? The answer is, to see across the riverscape where lies a Mythical 534 feet long REMA rattlesnake mound, beside the next river to the east, a river now called St. Croix. We could then walk this 22 kilometers or 13.7 miles alignment for four and a half hours. See Fig. 9 which is over Fig. 10 IMP to REMA.



We have now defined our first riverscape of 3 mound sites beside two rivers that join down streams to the southeast. These 3 sites are like the first three tipi poles tied together for a tipi. Imagine this tripod of poles spread apart within a large tipi circle from

what is today St. Paul to Afton and southward to what was Kapoža, Inyan Šha (Red Rock), Grey Cloud Island and beyond. It can also extend northward through the chain of St. Paul lakes and on up to Bde Wakan, or Sacred-Holy-Mystic Lake of Creation (Mille Lacs as called by French). This defines our Dakota Garden of Eden just like the Old World's Tigris and Euphrates Mesopotamian riverscape. Furthermore, the umbilical cord and the tipi rope both show our feminine connection to where and how we should live together, from the cave and the star in the bison embryo's backbone (Orion's belt), up beside the Milky Way River of Stars. The spirits above are reflected and matched down below as Fig. 11 shows the kapemni form (Gould & Rock, 2016; Bailey, 2002).



So “we come from a cave, or a star, or we’ve always been here” (Dakota Elder Gary Cavendar, 1986, personal communication). These three STARchitectural principles show our tribal definition as the 7 Star-Fire Nations born beside the Milky Way riverscape (Gould & Rock, 2016 & 2017).

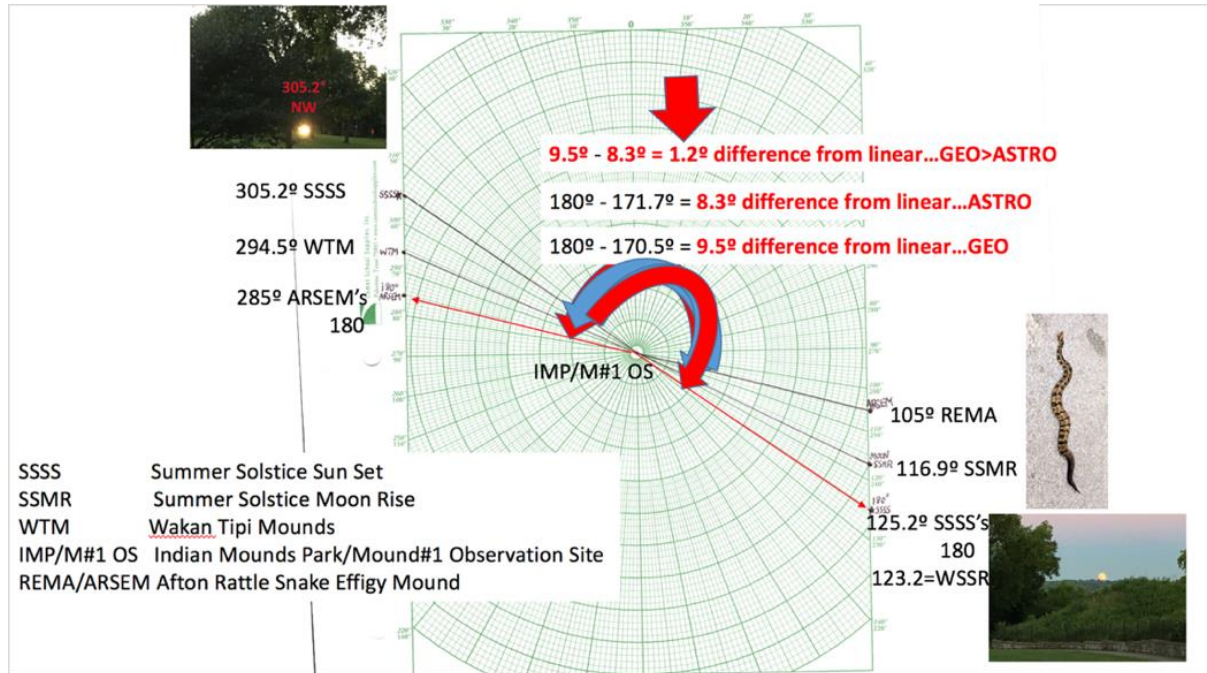
It is both artistically subtle and beautiful that the 1.5 to 2-inch concave depth of a snake petroglyph carved into a cave wall, does directly correspond with the 1 to 2 feet convex height of a nearby snake mound. REMA's mound of numbered mounds piled onto the floodplain are made of loamy, riverbank soil to show us that we are supposed to divide the mound's length by its height. Therefore, we have also taken the length and divided by the depth of the 4 cave petroglyphs, in order to see similar lunar numbers

connected in both places. Coincidence or consequence? Either way, it is now a possible numerical connection or hypothesis to be reckoned with further.

### **Sky-Earth Mound Alignments for Solstice, Equinox, and Lunar Standstills: GALS (Greatest Annual Lunar Standstill) & LALS (Least/Minor Annual Lunar Standstill)**

The kapemni principle was used to test whether the earth and sky map onto one another. In spite of the loss of 31 of the 37 mounds at Wakanj Tipi and Mounds Park, we tried to reconstruct the alignments from only six remaining points or mounds at one of the two sites. This place was every bit as significant and old (5000 BP observation site) as the Egyptian Pyramids when Thuban was the North Star, yet the painted caves of Europe have not been destroyed and removed by intellectual and spiritual racism and an anti-feminine bias to do so. By using digital astronomy software (SkyGazer 4.5 by CarinaSoft.com), iPhone compass software, date stamp photography and also by plotting on polar coordinate graph paper with many calculations pondered for years, here is what our data shows. Also, giving tours of these sites for 30 years with and for Indigenous Elders, youth and academics, both Native and non-Native, local and global, helped to create Figure 12A. This shows the Earth-Sky Alignments as a Composite of 12B through 12E not included here for space considerations.

Fig. 12A Earth-Sky Alignments: Composite Analysis from 12B-E (not shown).



Regarding the Earth-Sky alignments of the two mound groups at Wakanj Tipi and Indian Mounds Park in St. Paul (Figs. 9,10 &12), we have the greatest confidence and no doubt, that these sites were intentionally developed and constructed with spiritual and ceremonial, as well as astronomical and geospatial cycles in mind, heart, body and spirit. If the Indigenous peoples used the lunar period values as shown from the data and data analysis, and applied them in the rattlesnake mound formula for determining a 56-year average, then if they observed a syzygy they could predict another *possible* subsequent syzygy with great to reasonable results.

They would have an “advanced alert” warning predictor (like a shaking snake tail) of days, weeks or months before the event! This could possibly have meant that the snake will metaphorically (but not literally) bite the Sun or Moon. As a trained observer and scientist, Rock measured the angle error between Sky (“ASTRO”) and Earth

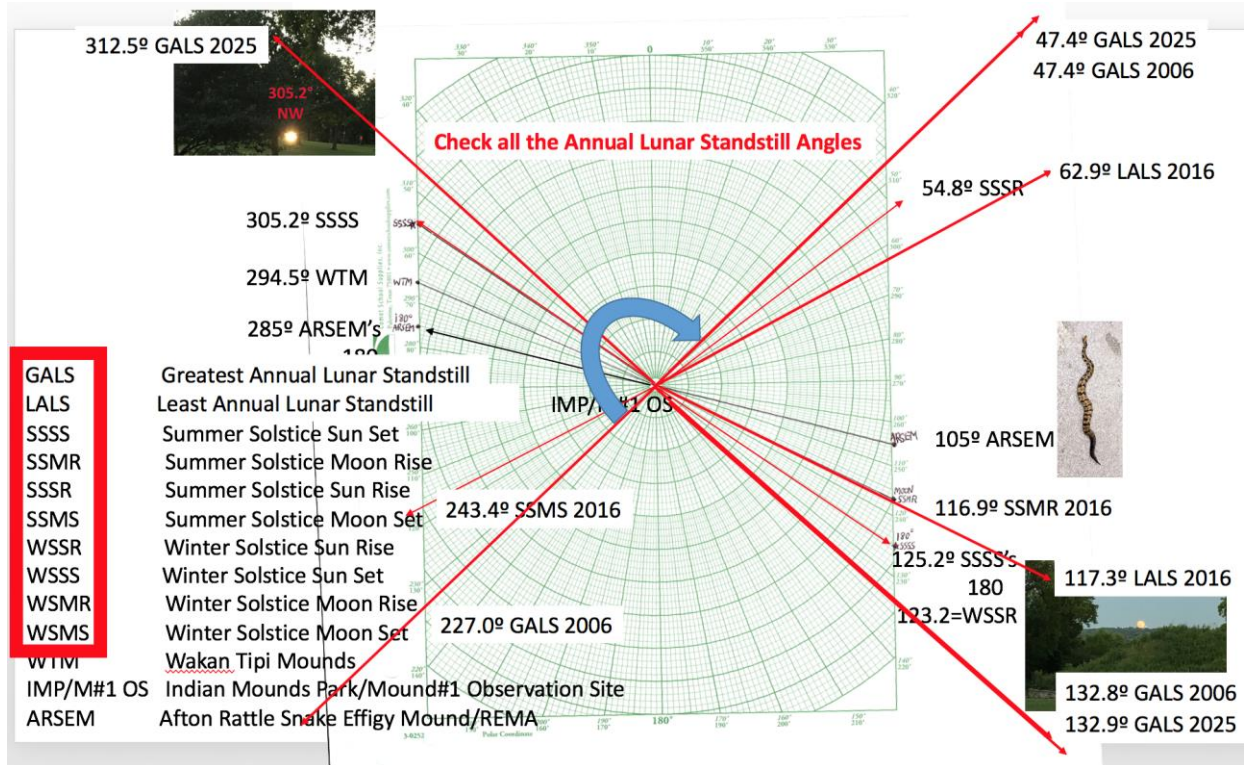
("GEO") to only 1.2 degrees (Fig. 12) which can still be reduced even further with better technology and more time for the next study of this kapemni mirror principle.

But again, we have the greatest confidence and no doubt whatsoever that our ancestors were showing us the Earth-Sky, feminine relationship of birth to death with the continuing hope of renewing the Circle in cosmic and personal cycles out through eternity. These on-going cycles and mound sites have been seen and accurately measured here for *millennia* (over 95% of their constructed, semi-permanent existence) right up to the coming of invasive and destructive foreign technology, culture and philosophy only a *century and a half ago*.

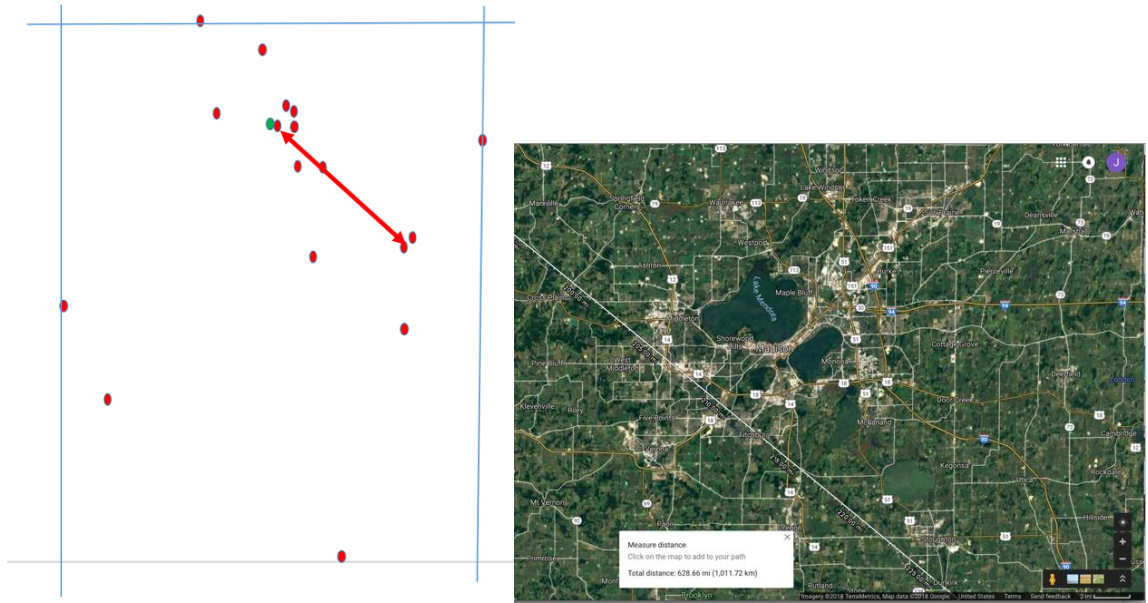
So how accurately did they measure and function? The answer: to only 0.33% error [1.2 degrees/360 degrees], as measurable even now without using lasers and precise mound coordinates. This accuracy was achieved with only 6 of the 37 mounds, because 31 were removed, bulldozed "for a better view" as stated in one of the reports. They never added to nor removed any mounds as placed in their numbers and angles, or it would have weakened the meaning, message and communication between the worlds above, below and in between. Therefore, we should do no harm. We should not interfere with the sacred realms, either our own or our neighbor-relatives' sacred realms. This is a much-needed message of coexistence and consanguinity for all times and places. More potential Earth-Sky alignments probably exist(ed) along these angles.



Fig. 13 Same as 12A with (GALS & LALS) Greatest/Least Annual Lunar Standstill



At least three sites, REMA at Afton, with Effigy Mounds at Madison, with Ohio's Great Serpent are all aligned directly through Chicago! If we draw an alignment course between Afton's rattlesnake and Ohio's Great Serpent, we see that it goes through the effigy mounds beside the four lakes (by 2 miles) of Madison (Birmingham), and directly through Chicago (just out into the lake from the Adler Planetarium). Note: This alignment course is the 132.8 degree GALS line starting from Wakan Tipi Observation Site (former mound) #1 and walking for 7 days at 30 miles/day to Madison's 4-lake effigy mounds, then walking 14 more days at 30 miles/day (or 23 days at 28 mi/day total) to Ohio Serpent Mound and Ohio Newark Works. One could leave at full moon from either end, and arrive on the next full moon for ceremony if averaging 21.3 miles per day. See Fig. 14 (below left) and 15 (below right).



For another multi-site example with similar data and data analysis as the Wakan Tipi-Indian Mounds Park-Afton triplex, we go to two Ohio sites: Newark Works and Great Serpent Mound. Newark Works is a complex site of observational platforms with circle-octagon and circle-square structures for Sky-Earth measurement (Hively & Horn, 2015) with the Great Serpent 88 miles to the southwest. Hively & Horn's (2015, p. 89) Table 1 shows how they viewed the bluff points from the river plain below and also from the panoramic bluff above to below, producing tables of alignments including the 116.7 degree lunar minimum southrise. This is the same method and also one of the same angles as measured with Indian Mound Park's bluff to the Afton riverscape below.

### **Test of Umbilical Hypothesis:**

The connection between these distant, snake-mounded, riverside sites crosses and defines a 630 mile riverscape of flowing water upon the turtle scutes of Turtle Island. Does the Great Serpent Mound also show the pregnancy ratio of an umbilical cord-snake with 266 days, or turtle shell numbers of  $13 \times 28 = 364$ ? If the Great Serpent

Mound has 800 feet of turns in its curving body, as some sources say, divided by an average height of 3 feet, then  $800'/3' = 266$  and yes, we do see the same numbers as REMA. If as other sources cite, we have a length of  $\cong 1330$  to 1331 feet long by 5 feet max. height, then we also see:  $1330'/5' = 266$  or  $1331'/5' = 266.2$ . Or as most sources say, if 1348 feet long, then  $1348'/5' = 270$ . Since 1329 feet is 405 meters (this is also 266 to 270 double paces) divided by 1.5 to 1.52 meters (1 double pace). An average walking stride length is 2.5 feet, so a double stride is 5 feet or 1.52 meters. This is slightly less than the height of the Afton snake, which is a scaled-down version of Ohio by a factor of 2.5, or less likely Ohio is a scaled-up version of Afton by 2.5!

These are significant numbers since 266 are the days of umbilically connected human gestation and the mound looks like a placenta (the “egg”) and cord. Also if a walking, double pace is a lunation of waxing moonlight (14 days) and waning moonlight (14 days), then 405 lunations are just short of 33 years (32.75) or 1 to 2 generations. Note, 405 divided by 28 = 14.5. The Maya recorded such a number with amazing precision when they wrote that 405 lunations are 46 Tzolkin periods. A Tzolkin is 13 x 20 or 260 days. So  $46 \times [13 \times 20] = 11,960$  days = 405 lunations of 29.53086 days, instead of 29.53059 days. This is a tiny difference of 0.0003 day = 20 heartbeats. This means that NASA only caught up to this precision in 1972 when a mirror was placed on the moon to reflect a laser from earth to give an extra 20 seconds per month better than the Maya!

### **Other mound sites not yet mentioned from survey of 19 sites:**

We originally intended to group regional mound sites together a few at a time to connect them together like tipi poles, which are laid into the initial tripod and tied by an encircling rope together into one structure. However, we will only mention just a few of the 19 sites not discussed here which are in Fig. 1A, 1B, 1C & 14. From the Great Serpent Mound of Ohio 450 miles to the northeast (@36 degrees), lies another serpent with egg mound at Rice Lake Ontario, Canada. These are also aligned to within two miles of the Newark Earthworks and 4 miles from the Hopewell Culture National Historic Park. This line intersects the REMA to Ohio Great serpent alignment at an 83-degree angle. It is also interesting that Cahokia to REMA is 453 miles, a similar distance as Ohio Great Serpent to Rice Lake serpent.

Also further to the northwest and not a snake mound site, lies a water-loving muskrat mound site that was briefly considered a snake mound at the Minnesota-Canada border wetland of the Rainy River (Mather, 2015). Also in the northwest region around Lake Traverse and western Minnesota at the headwaters of the Minnesota River were buffalo burials with humans (Johnston, 1987). See Oneroad and Wallis (1999) as local Indigenous sources for reasons and stories about these sites.

Obviously, the greatest mound built at Cahokia and also the Mother town, home mound of the Cherokee at Kituwa, plus so many more examples deserve study but were omitted here due to space. The Cherokee water protector is called Unktena like the Dakota's Unktehi. We also included the Chaco Canyon Fajada Butte site and its spiral petroglyphs with the Three Rivers New Mexico Petroglyphs site, because although not mound areas, these thousands of images inform mound meaning and

explain the role of lightning, cloud, rain, snake, umbilical cord and corn fertility (Slifer, 2000; Staller & Stross, 2013; Bassie-Sweet, 2008). It is also useful to contrast and understand a dry desert area with the Great Lakes wetland mounds area.

## **Conclusion**

Because of the settlers who came to Turtle Island with preconceived notions of the wickedness of women and evils of Indigenous cosmology, they missed and almost completely destroyed evidence of how advanced our Indigenous societies were. They failed to see how amazing women's bodies are, how they are tied to cycles of the moon, planets and Earth, and how these teachings were connected to the effigy and burial mounds of Turtle Island.

Rather than trying to understand the knowledge and teachings in the massive earthen mound structures across the continent, settlers bulldozed them for development. It hasn't been until this research that the evidence has been pieced together from Indigenous elders, historians, and settler archives and scholars to show that Indigenous nations collaborated and built mounds that could predict when the sun and moon would align in syzygy times, such as eclipses, predicting sacred alignments. They carefully watched the sky and measured patterns to commemorate, honor and tell their powerful, place-based, stories in these earthen works using turtle shell mathematics and the numbers associated with women's bodies, such as their moon/menses cycles and length of gestation. So powerful were women during these times that they lived separately from the village in moon lodges until their menses cycle had passed. Women, like Mother Earth, were honored for their life-giving abilities.

From Indian Mounds Park/ Wakaŋ Tipi to the Rattlesnake Mound continuing on further to the southeast, toward Madison's Four Lakes effigy snake and bird mounds, and then even further southeast toward the Great Ohio Serpent mound, these Sky dates would have marked a time for ceremonies, dances, thanksgivings and petitions followed by giveaways and feasts, paying homage to Uŋktehi the water protector serpent and Wakiŋyan the thunderbird, ultimately to unite and balance Earth and Sky.

## Glossary

Anpao Wičanĥpi	Dakota, dawn star, morning star
Bde Wakaŋ	Dakota, Holy, Sacred or Mystic Lake, Mille Lacs, Minnesota
Bdote	Dakota, where rivers join
Čaŋhdeška haŋwi uŋ waniyetu wikčemna ake napčiwaŋka	Dakota, 19-year moon cycle
ČH'napčiwaŋka	Dakota, shortened from above 19 year moon cycle
ČH19	Dakota, abbreviation for above 19 year moon cycle
ČH'9	Dakota, abbreviation for above 19 year moon cycle
Chan	Mayan
Dzonod/cenote	Mayan/Spanish sub-surface limestone well
Enneadecaeteris	Greek, 19-year moon cycle
GALS	acronym for Greatest Annual Lunar Standstill
Homni	Dakota, to turn or spin around in circles
Iŋyaŋ Sha	Red Rock, a glacial erratic boulder of red painted stripes(equinox?)
K'an	Mayan, snake or lizard or yellow
Kan	Mayan, four
Ka'an	Mayan, sky
Kapemni	Dakota, twisting shape of tipi poles reflecting same above as below
Kapoža	Dakota, Little Crow's village near Wakaŋ Tipi cave
LALS	acronym for Least/Minor Annual Lunar Standstill
Mni Sota Makoče	Dakota, land where water reflects sky
Napahuŋka or napahuŋke	Dakota, thumb
Napčoka	Dakota, middle finger
Napčupe	Dakota, finger
Nape	Dakota, hand
Polysemy	Greek, capacity for a sign, word, symbol to have multiple meanings
REMA	Rattlesnake Effigy Mound of Afton
STEAM	acronym for Science Technology Engineering Arts Mathematics
Tayamni	Dakota, constellation of bison embryo emerging from circle of stars
Turtle Island	Continent of North America
Uŋktehi	Dakota, underwater serpent, water protector
Waĥpe Wiŋyaŋ	Dakota, Leaf Woman, herbalist
wak	Mayan, six or lifted up or raised up or standing

Waka Chan                      Mayan, lifting up or standing up Milky Way Road as cosmic tree  
Wakinayan                      Dakota, Thunderbird and Thunderbird constellation

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