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ARCHAEOMAYA

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Maya Astronomical Prowess Further Revealed

Demonstrating an understanding of precession is the holy grail of archaeoastronomy. No direct evidence can be found among the ancient cultures of Asia, Egypt, or even Mesopotamia. The ancient Greek astronomer Hipparchus wrote of it in the second century BC, though his calculations were in error. But now, a complex argument constructed by Dr. Michael Grofe provides considerable evidence that the ancient Maya not only understood precession, but that they could calculate its movement with astounding accuracy.

Michael Grofe explaining Stela C at Copan, Honduras

What is precession, you ask? Precession, also called Precession of the Equinoxes, is the slow apparent backward movement of the Sun against the background of fixed stars, using the spring equinox as the day to observe its position year after year. The Sun isn't really moving backwards, it's the Earth's slow wobble on its axis and its orbit around the Sun that causes the effect. To an observer looking out into space night after night, a specific star appears to rise at the same time each year. However, after about 70 years of observation, that star will appear to rise one day later, while the Sun appears to move backwards by one day. This translates to one degree of apparent movement about every 72 years. The time it would take for the Sun to "precess" the full 360° of the sky would be just shy of 26,000 years. Hipparchus had guessed that the movement was one degree every 100 years, thus concluding that the entire cycle amounts to 36,000 years.

Hints that the Maya were aware of precession have been floating about for decades. Numerologists have found the number 72 reoccurring in Maya mathematics and associate it with the 72 years per degree of precessional drift. An assumption that the Maya "grand cycle" is made up of five 13 bak'tun cycles results in a calculation of 25,630 years, temptingly close to the full precessional cycle. Research going back over eighty years to the work of John Teeple has made it clear that the Maya could have calculated the tropical year to the fourth decimal place. But that ability to calculate the true tropical year, being the time it takes the sun to return to an exact point on the horizon, was only part of what the Maya needed to calculate precession. The tropical year has to be compared to the ever so slightly longer period of time it takes for the Sun to return to its same position in front of the stars, called the sidereal year. Unlike the tropical year, which slowly

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Letter from the Director

Happy Autumnal Equinox! After a scorching summer and the recent terrible wildfires, we at the MEC office in Central Texas are welcoming the cooler fall weather with open arms. As usual, fall is our slow travel but high planning season. I've been chained to my desk for weeks, planning out what promises to be a winter and spring full of MEC study abroad programs and educational tours. We already have twelve study programs and six public tours planned for 2012. After two hard years as a non-profit swimming upstream through global economic collapse and a drug war in Mexico, we are excited to have our phone ringing again.

While this edition of ArchaeoMaya reports a bit on our adventures this past summer, its real foci are new archaeological discoveries and future plans. As you'll read in our lead article, MEC's own Dr. Michael Grofe is finally getting the credit he deserves for his years of brilliant discoveries in Maya archaeoastronomy. There's also exciting news from archaeology in the United States, with a Paleo-Indian discovery in Maryland and the identification of a new snake mound in Ohio. Back in our second home of Chiapas, excavations at Plan de Ayutla inch ever closer to proving it is indeed the lost city of Sak Tzi'.

As you'll notice, this edition is full of new travel programs, plans, and products from MEC. We know that a lot of people will want to visit the Maya world in 2012, so we've created public tours during the spring equinox, summer solstice, and August zenith passage. Each features a different region and a different MEC scholar. Also featured are two summer Chautauqua Program trips to Peru – one to Cuzco's pre-Columbian Inti Raymi festival and the other to Paracas and the Nazca Lines. Last but not least, our 2012 Mayan Calendar wall calendars are designed and currently in press. Pre-sales official begin with this newsletter's announcement and shipping begins November 1st.

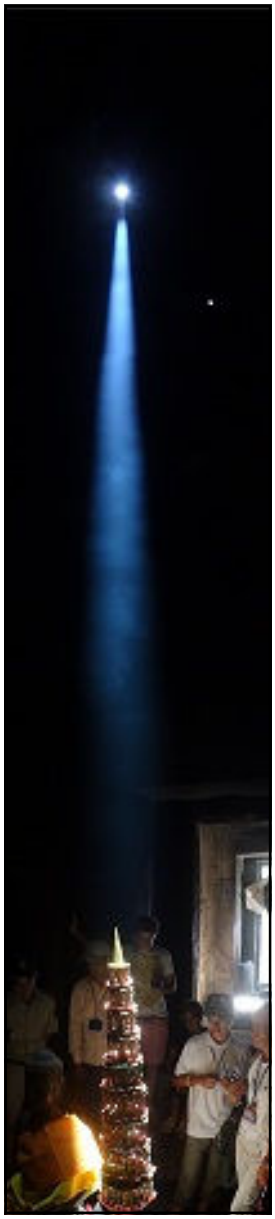
Personally, after an at times overly adventurous adventure in Guatemala and the long, long journey back and forth from Cambodia, I'm happy to be back at my quiet desk in Austin for a while. As the weather cools and the holidays approach, I'm thankful for MEC's successes in 2011 and looking forward to a busy 2012. I want to end this letter by expressing my gratitude to the now over 2000 people in MEC's extended community. Without you, MEC doesn't exist. Thank you for continuing to support MEC in the ways you can, please feel free to contact us with your questions about Maya civilization, and have a wonderful autumn.

And also—Happy Birthday Kirk French!

Regards From Austin,

Zenith Passage at Angkor

For the second year in a row, Dr. Barnhart led a group of intrepid travellers into the heart of Cambodia. The timing and purpose of the trip was the same as in 2010 – to document zenith passage at Angkor and search for evidence that its ancient Khmer inhabitants were aware of it. The 2010 expedition had discovered a unique feature in virtually every one of Angkor's temple towers – a tubular hole running straight through their capstones. Why would someone want a hole in their roof? That must have been what French archaeologists were thinking when they decided to seal up all the roofs in Angkor Wat's complex. At places where the French had not sealed the roofs, Barnhart's team took amazing photos of zenith passage light beaming through the holes and down upon the temple altars. But the days were cloudy in 2010 and 2011 brought an opportunity to do better a better job of documentation.



Bayon at Zenith Passage
photo - Brent Williamson

August 17th, the day of zenith passage arrived and as noon approached Barnhart's team walked into the central tower of the Bayon. The monks and the nuns tending the shrine recognized him saying, "We remember you. Is today the day again?" With a wry smile Barnhart replied, "Yes. Yes, it is." The temple guards also remembered and kindly offered to remove a parasol blocking the view. Just a few moments later, the light show began. Beams of light burst through broken segments of the roof walls, coming in at an angle at first. Then, as the sun came into its perfectly overhead position at 12:09pm (slightly off noon because Angkor does not sit on an exact time zone line), a brilliant beam of tubular light cast straight down onto the temple of the floor. By now a crowd of tourists had gathered, laughing in wonder, snapping photos, and marveling at how brightly lit the normally dark chamber had become. As the moment passed and the light trailed out of the temple, Dr. Barnhart thanked the monks and nuns for sharing their sacred space. The group left with a feeling of elation with the expedition's primary goal achieved.

Much of the rest of the week was spent exploring other temple complexes within Angkor, always looking up to confirm the presence of holes in the tower roofs. At less intact sites, they searched the rubble piles for the discarded capstones. Special attention was given to Angkor's earliest temples, dating back to the beginning of the 9th century. In every case, the team found evidence of these uniquely open temple-top features.

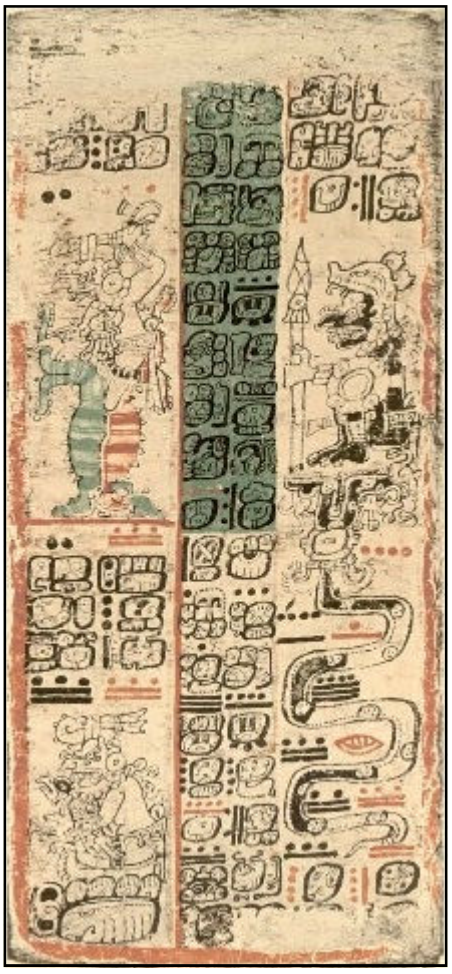
Angkor's temples are obviously inspired by earlier Hindu temples in India, yet a survey of Indian temples fails to find the same holes in their tower capstones. So the question now becomes when and where did these distinctive, zenith passage friendly architectural features begin? The earliest Sanskrit texts at Angkor state that Jayavarman II, the first king of Angkor, founded the Khmer Empire only after escaping from captivity on the island of Java. Looking to Java's history, we find the massive Hindu temple complexes of Bobobudur and Prambanan were at their height in the 9th century. Further enticing is the work of bobobudur.tv's Mark Long, who believes Prambanan's arrangement of 224 small temples in a single courtyard are denoting the days between zenith passages at that latitude. Though he does not mention holes in any of the temple-tops, Long goes on to make a general argument for the importance of zenith passage in ancient Java. With these new clues in hand, where will the next stop along Dr. Barnhart's quest in South East Asia be? You guessed it - Central Java on October 13, 2012, zenith passage for that latitude. Watch the MEC website for information about how to join him on the expedition.

Maya Astronomical Prowess… (continued from Page 1)

changes in length over time, Grofe points out that the sidereal year remains highly stable over thousands of years.

The same old lines of evidence and speculation had been debated for decades until scholars began taking interest in a recorded cycle of 33 bak'tuns, called the 3-11 Pik title. In 2002, Matt Looper noted that the 3-11 Pik cycle inscribed on bones in a Tikal tomb could be read as a smaller interval of 3 x 8660 days. Then Grofe and Barbara MacLeod independently noticed that 3 x 8660 days was about 71 years, approximating one degree of precessional drift, while 33 Bak'tuns curiously amounted to precisely half of the full 26,000-year cycle of precession. MacLeod demonstrated that the 3-11 Pik title was apparently given to kings who lived long enough to enter a third cycle of 8660 days. Furthermore, this title is found not just at Tikal, but in cities across the Maya world, and its new interpretation led to renewed hope that the Maya understood precession.

The 3-11 Pik title implied knowledge of precession, but the question of how they calculated it remained. Michael Grofe knew that the missing element was evidence for calculation of the sidereal year, and thus he went on the hunt for it in the inscriptions. The sidereal year is minutely longer than a tropical year, only .014 days in 365. To see such a fractional difference within Maya inscriptions of whole numbers of days would require a very large distance number between dates. Grofe decided to examine the Dresden Codex Serpent Series, which contains several distance numbers, some in excess of 30,000 years. To his amazement, the 15,009-year distance number in the preface to the Serpent Series was a whole multiple of a highly accurate sidereal year of 365.2565128 days (the actual value is 365.25636 days). Therefore, the Sun would appear in the same stellar position on both ends of this gigantic distance numbers. In 15,009 years the sidereal year had drifted away from Teeple's known Maya value for the tropical year by 218 days, and lo and behold, a 218-day interval is referenced throughout the seasonal table accompanying the Serpent Series. He had found what seemed to be a clear Maya comparison between the sidereal and tropical years used to calculate precessional drift over a15,009-year period. Furthermore, this same precise sidereal year value appears as a whole multiple in several other distance numbers in the Serpent Series, including an interval of over 34,055 years.



Dresden Codex Page 69 of the Serpent Series

Grofe found that each of the Serpent Numbers were, in part, used to track eclipse nodes, and the immense distance number of some 34,055 years is also a whole multiple of the eclipse year, ending on the very day of a historical lunar eclipse. This suggests that the Maya were attempting to calculate a similar eclipse in the *same* position in the stars over 34,055 years in the past. Indeed, since you cannot easily observe the position of the sun in the stars, Hipparchus used a similar method to track precession by observing the *changing* star positions of lunar eclipses that fell on the spring equinox over a century apart, whereas the Maya appear to have been interested in observing lunar eclipses that occurred in the *same* star position over long periods of time, but at different times of the year. This subtle difference appears to have led the Maya to a much more accurate calculation for the sidereal year that did not depend on the length of the tropical year.

This discovery became Grofe's dissertation and after completing it at U.C. Davis in 2007 he went eagerly to share it with the academic community. However, it did not meet with the kind of acceptance he had hoped for. Archaeoastronomers were especially critical, branding it as a numerological parlor trick and lumping Grofe in

with 2012 new age authors. Undaunted, Grofe used his analysis of the Serpent Series as a methodology for finding sidereal year calculations in other "deep time" inscriptions. First he found exact multiples of the Serpent Series' sidereal year on an immense deep time distance number from Tikal Stela 10, then more sidereal calculations on Naranjo Altar 1, on Copan Stela J, and most recently in the now famous Tortuguero Monument 6. Even some of the long pondered large distance numbers at Palenque turned out to contain whole number multiples of the sidereal year. What had begun as an enigma had turned into a very solid pattern.

As Grofe's list of supporting examples grows, his list of detractors shrinks. Even Anthony Aveni, who had discounted Grofe's work publicly and in print, has now conceded that he had misunderstood his methodology and congratulated Grofe on his recent publication with Cambridge University Press. In January of 2011 he was invited to present his findings at the Ninth Oxford International Symposium on Archaeoastronomy in Lima, Peru, which led to his recent publication in *Ethnoastronomy and Archaeoastronomy*.

Today, Grofe continues to scan the corpus of Maya hieroglyphs for deep time inscriptions to analyze. One of the most recent and fascinating by-products of his research on the sidereal year is their repeated connection to a mythological creature referred to as the Celestial Caiman. That caiman, in turn, is strongly associated with Mars, Venus, eclipses, and the Milky Way. Whether or not these new observations will lead him to more astronomical epiphanies remain to be seen, but one thing is certain – Michael Grofe's work has provided significant evidence that the ancient Maya understood and could accurately calculate the Precession of the Equinoxes and given us a methodology to further investigate it.

To learn more about Michael Grofe's work, you can read his dissertation posted in the Online Publications section of the MEC website. More of Grofe's papers will be posted as they become available.

News From the Field

New Finds at Plan de Ayutla

Ongoing excavations at Plan de Ayutla in Chiapas have discovered a Terminal Classic phase of the city. Structure 4 at the site shows occupation from 900-1000 AD and a corresponding influx of ceramic wares from the Chontal region of the Western Tabasco. Though hieroglyphic evidence has yet to be found, INAH archaeologists contend that Plan de Ayutla is in fact the lost city of Sak Tzi', best known as the enemy army from Bonampak's famous battle murals. Looted Sak Tzi' stelae from collections in Europe and the United States date to the 9th century, indicating that it had outlived its rival Bonampak by at least 100 years. Now that Plan de Ayutla has been reliably dated to the same late time period, INAH's hypothesis seems all the more credible. With hopes of finally finding the name of Sak Tzi' in an inscription, excavations will continue in the spring of 2012.

Clovis Man in Maryland?

What began as an archaeological site of unremarkable age in Maryland has now become one of the oldest habitation sites ever found in the United States. Pig Point, excavated since 2009 by Anne Arundel County archaeologist Al Luckenbach, began with surface finds dating to the 1400's AD. Digging deeper through surprisingly wide stratigraphic layers, his team found copper beads from the Great Lakes and ceramics from the Ohio Valley dating back 800 to 1000 years. Below that, they found a sequence of wigwam post holes going back over 3000 years. Those wigwams already classified as the oldest structures ever found in Maryland, but now excavations conducted this last summer have uncovered a 9260 year old stone hearth. The year before neighbors had shown Luckenbach several fluted Clovis Points said to have been picked up at the base of Pig Point's bluff. Originally, those unprovenienced artifacts did not hold much weight for him. But in light of his new discovery, Luckenbach is now hopeful that yet deeper layers of the Pig Point site will yield in-situ paleo-points, confirming a previously unknown Clovis Period of Maryland's ancient history. With seven feet of well layered stratigraphy and C14 dates already behind him, the archaeological community has their fingers crossed that he's right.

2012 Tour Offerings from MEC

January 19-26, 2012

The Fiestas of San Sebastian in the Highlands of Chiapas

Led by Chip Morris and Carol Karasik.

February 10-18, 2012

Pillars of the Classic Maya - Palenque to Tikal

Led by Alonso Mendez

February 16-23, 2012

Carnival in the Highland Villages of Chiapas

Led by Chip Morris and Carol Karasik

March 16-25, 2012

Spring Equinox in the Yucatan - Calendars and Astronomy

Led by Dr. Michael Grofe

June 18-28, 2012

Summer Solstice in Chiapas and the Highlands of Guatemala

Led by Dr. Christopher Powell

August 5-15, 2012

Surfing the Zenith in the Maya World, Guatemala and Honduras

Led by Dr. Ed Barnhart

Learn more about these tours at mayaexploration.org/tours.php

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