

SOCIETY FOR CULTURAL ASTRONOMY
IN THE
AMERICAN SOUTHWEST



CONFERENCE ON CULTURAL ASTRONOMY
IN THE GREATER SOUTHWEST

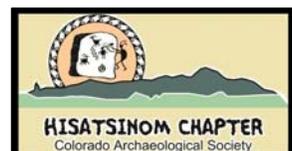
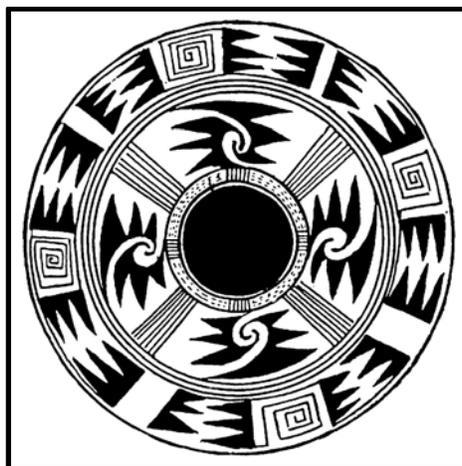
**Crow Canyon Archaeological Center
Cortez, Colorado**

October 25 - 29, 2016

***Before Borders: Revealing the Greater
Southwest's Ancestral Cultural Landscape***

Program Schedule

Compendium of Abstracts



Session Three	Host – Bryan Bates	Mesa Verde Room
9:00 - 9:15	Introductory remarks	
9:15 - 10:00	Community Circle Introductions	
10:00 - 10:45	<i>Connecting to Mother Earth</i> Filmer Kewanyama	
10:45 - 11:15	<i>Applying STK Software to Archaeoastronomy: Bridging Gaps between Western and Indigenous Science</i> Jason Cordova	
11:15 - 11:45	<i>Yadila oolye!: What does it mean?! Navajo Archaeology in the 21st Century</i> William Tsosie	
11:45 - 12:30	Discussion Forum - Native People Working in Anthropology	
12:30 - 1:30	Lunch – Crow Canyon Dining Hall	
Session Four	Host – Tony Hull	Mesa Verde Room
1:30 - 2:00	<i>Cosmic Symbolism of Zuni Fetish Carvings</i> Von Del Chamberlain	
2:00 - 2:30	<i>Euro-American Perceptions of the Land</i> Bryan Bates	
2:30 - 3:30	Discussion Forum – Energy Development on Cultural Landscapes	
3:30 - 5:00	Interactive Session – Hovenweep Room	
4:00 - 4:30	Mesa Verde Room <i>Advanced Geometrical Constructs in a Mesa Verde Pueblo Ceremonial Site with Known Solar and Lunar Alignments</i> Sherry Towers	
4:30 - 5:00	Silent auction closeout	
4:30 - 6:00	Reception	
6:00 - 7:00	Dinner hosted by Crow Canyon Archaeological Center	
7:00 - 8:30	Evening program for conference participants <i>Crystals in the Sky: Dine' Stellar Depictions</i> Von Del Chamberlain	
8:30 - 9:00	Transport to conference hotel from Crow Canyon	

Friday October 28, 2016

8:00 - 8:30 Transport to Crow Canyon from conference hotel
8:30 - 9:00 Open registration
Carol Ambruster Memorial Fund silent auction continues

Session Five *Host – Ric Alling* *Mesa Verde Room*

9:00 - 9:30 *The Cross Canyon Stone Circle: Age and Implications*
Scott Ortman

9:30 - 10:00 *Ancient Ritual Landscape and Associated Solstice Interactions in Southeastern Utah*
Virginia Wolf and Edward Wheeler

10:00 - 10:30 *Upper World, Lower World, and a Line Runs Through It: A Consideration of the Procession Panel and Its Landscape*
Jonathan Till

10:30 - 11:00 Morning Break – Hovenweep Room

11:00 - 11:30 *Reconsidering Casa Rinconada, Chaco Canyon*
Ray Williamson

11:30 - 12:00 *Thoughts on Shadow Formation and Implications for Interpretation of Light-Shadow Markers in Cultural Astronomy*
Tony Hull and Elizabeth Jewell

12:00 - 1:00 Lunch at Crow Canyon Dining Hall

1:00 - 1:30 SCAAS Business Meeting
Organizational summary – Greg Munson
Financial report – Ric Alling
Board of Directors election – Greg Munson

Session Six *Host – Ray Williamson* *Mesa Verde Room*

1:30 - 2:00 *Tree Harvesting on Lunar Standstill Dates and Its Relationship to Chacoan Sociopolitical Complexity: Revisited*
Larry Baker

2:00 - 2:30 *The Architecture and Astronomy of Sun Temple at Mesa Verde National Park*
Greg Munson

2:30 - 3:00 *Creating Symmetry: Building Social Landscapes in the Central Mesa Verde Region*
Grant Coffey

3:00 - 3:30 Afternoon Break – Hovenweep Room

Silent auction closeout

3:30 - 4:30 Discussion Panel – Lunar Standstills in the Ancestral Puebloan World

4:30 - 5:00 Conference closing remarks – Ray Williamson and Greg Munson

5:00 - 5:30 Transport from Crow Canyon to conference hotel

6:00 - 9:00 Conference Awards Banquet – Destination Grille, Cortez, CO
Reception and Private Cash Bar
Fajita Dinner Buffet with Desert
Evening Program
The Mirror-Image and Tewa Origins
Scott Ortman

Interactive Session Presentations

Rarick Canyon Update

Bryan Bates and William Seven

Basketmaker II Winter Solstice Sunrise Observational Shine in Squaw Canyon, Utah.

Bernard Bell and Virginia Wolf

The Bull Creek Basin is Lunar

Frederick Martin and Elizabeth Martin

Sun Marker

Davd Valentine

Field Trips – Saturday October 29, 2016

Mesa Verde National Park – Leaves Holiday Inn at 9:00 AM (additional fee)

Hovenweep National Monument – Leaves Holiday Inn at 8:00 AM

Cross Canyon Stone Circle – Leaves Holiday Inn at 9:00 AM

Register for field trips at conference registration table. Additional fee for Mesa Verde National Park tour.

SCAAS 2016 Conference Compendium of Abstracts

(in alphabetical order by author)

Tree Harvesting on Lunar Standstill Dates and Its Relationship to Chacoan Sociopolitical Complexity: Revisited

By Larry L. Baker

There has been considerable study and in some cases, controversy regarding astronomy and its relationship to Chacoan great houses. Nevertheless, many researchers would agree, at some level, that Chacoan architecture has incorporated a variety of constructional elements related to observations of astronomical phenomena by the architects of Bonito Phase structures. Studies of solar and lunar observations have included relationships to: the location of sites; orientation and constructional forms of buildings; select features incorporated into the masonry and interiors of the structures; and tree harvesting (cutting dates) related to great house constructional sequences. Particularly intriguing with respect to these observations is the lunar standstill cycle and more specifically, the movement of the moon from the major lunar standstill at maximum to the minor lunar standstill at minimum and back over an 18.6 year period. This paper revisits earlier evidence related to lunar maximum and minimum tree cutting dates at Chacoan pueblos and provides additional data from select sites to support the importance of tree harvesting during these specific lunar standstill positions. Evidence of major tree cutting during these periods of lunar observation reinforces the premise that esoteric knowledge and the power it embodied in an elite class further supports the hierarchical organizational structure of Chacoan society.

Euro-American Perceptions of the Land

By Bryan C. Bates

An objective of this conference is to address the cultural perception of “the land” by traditional native people. Embedded within this tacit assumption is that other races/ cultural assimilations of people each have their own “cultural perception of the land”. Is “turnabout” a necessary component to evaluate whether and what constitutes the cultural perception of land by Euro-Americans, and how has that perception effective interactions between it the different cultures? One of the obvious differences between these two basic cultures is that one (native people) primarily built an economic system based upon barter. There was direct personal interaction in the exchange of services. Amongst Euro-Americans however, there was an evolution to using a valued commodity as a mechanism of exchange. Whether gold, silver, copper or other element, coins were created to symbolize a value. Any currency needs to be a convenient mechanism of exchange (coin or textile), hold its value over time, and be a commodity of limited availability. What appears to happen is that thru dehumanizing the economic process in Euro-American societies (take this coin for those foodstuffs, bye), that human interaction with nature shifts from interacting with natural cycles to a more insular role of buffering natural effects on survival and potentially ceremonial processes. This presentation will be geared more to stimulating discussion than of resolving difference in the nuances of cultural perception of the land. It seems that better understanding the role of nature within the worldview of each culture (understanding that there are numerous cultures within the category of “native” and “Euro-American”) can better help participants to conceptualize the differences and the similarities.

Rarick Canyon Update

By Bryan C. Bates and William Seven

At the 1999 Oxford VI Conference, the author hypothesized that trade routes may be avenues of information exchange, including astronomical perceptions. A test for that hypothesis was that solar calendar markers would be located near communities along the Palat'kwapi Trail. NO conclusion was reached on this hypothesis due to the low sample size of ancestral communities. However, a solar calendar petroglyph near Stoneman Lake indicated intentional observation of the February cross-quarters, equinox and May cross-quarters, all with cultural context that tended to support use of short-term, seasonal light-shadow interaction on a large spiral petroglyph to mark important cultural events. Continued study has demonstrated that the winter solstice was probably intentionally marked; however, the summer solstice does not show a significant light-shadow interaction that could be claimed to support a year-round seasonal calendar system. This observation has led to the revised hypothesis that observation of intentional constructs may also have been markers indicating time to migrate from warmer winter habitations to cooler summer encampments. Besides the obvious comfort facts, seasonal migration may also have been related to other survival aspects such as gathering different wild foods, harvesting different plants and accessing different water sources. Research continues in an attempt to determine whether the northern Sinaguan people were year-round residential folks or whether they migrated in search of better seasonal resource acquisition.

Greater than we Thought!: Aztec Ruins Landscape, Connectivity and Collapse in Relation to the Chaco Regional System

By Erin Baxter

Aztec Ruins is bigger than we thought; its landscape is further reaching, its ties to Chaco more pronounced, and its end more dramatic than previously known. Research into these claims comes not from new excavations, but from the re-analysis of century-old historic photos and documents housed in museums across the country. This paper will present new data related to landscape features, demography, and collapse at Aztec that illustrate extraordinary parallels to Pueblo Bonito, architectural data that greatly increases site size and scope, and burial data that may give new insight into the consequences of the break-up of the Chaco regional system.

Yucca House National Monument: Calibrated Skies & Alignments

By Bernard Bell

This paper presents a novel technique for simply but accurately calibrating horizons and thus solar, lunar and stellar positions illustrated using findings at Yucca House National Monument (YHNM). Ute Mountain (aka "Yucca Mountain" in Tewa) viewed in profile from the roof of the Upper Yucca (Great) House appears as a reclining figure known as Sleeping Ute. A sharp prominent natural feature, the Toe of Sleeping Ute, rises ~600 meters from the surrounding terrain and precisely marks the location of the December Solstice Sun Set (DSSS). The June Solstice Sunset (JSSS) occurs just south of the Elbows (tallest peak) and the Pleiades sets directly atop the Elbows from the Great House. The Tewa annual ritual cycle is based on the 9 works of the Made People (Ortiz 1969, 98). The final work of the year is a winter solstice/new year ritual known as the Days of the Sun. The Yucca House National Monument site matches Tewa historical accounts of remembered ancient Tewa settlements (Ortman 2012, 184-187). Horizon views of the Toe from

other prominent structures at Yucca House National Monument provide anticipatory observation sites also mentioned in Ortiz's Description.

East-West Cardinaly Aligned Yellow Jacket Boulder Tunnel Shaft Targets June Solstice

By Bernard Bell

A shaft of Sunlight passes through a 20 cm diameter tunnel in 2 meter sized boulder in the morning around the time of June Solstice casting a bright spot on the ground in the shadow of the boulder for about one hour as the sun rises in the East. The tunnel shaft appears naturally formed with no visible signs of being shaped and runs through the boulder parallel to the stratifications in the boulder. The entire boulder is tilted with chock stones such that the patch of sky allowing sunlight through the hole is aimed due East at 45 degrees up (Azimuth=90° and Altitude=45°) to catch the Sun Rises around the June Solstice. Photos and videos of the event are presented.

Basketmaker II Winter Solstice Sunrise Observational Shine in Squaw Canyon, Utah.

By Bernard Bell and Virginia Wolf

Diagnostic petroglyphs date a stone and boulder delineated slab floored shrine enclosure to the Basket-maker II period. Stone slabs propped against and stacked on the boulder create openings that frame the view over a 30m diameter Dance Circle to the Winter Solstice Sunrise horizon event marked by Ute Mountain.

Cosmic Symbolism of Zuni Fetish Carvings

By Von Del Chamberlain

The people now living at Zuni Pueblo in northwestern New Mexico have a rich heritage that includes knowledge of fundamental observational astronomy. Zuni astronomical traditions began to be known by scholars in the late nineteenth century. Zuni practices included the use of stone fetishes that started when people found natural stones resembling an animal or other element of great importance within the culture. Eventually, features were added by minimal carving to accentuate significant parts of the objects. As time went on, more and more alterations produced ever-finer renderings of the fetishes, and they became known by ever-larger numbers of people outside the Zuni culture. Today, many skilled carvers make large numbers of carvings as an art form and sell their work throughout the world.

In the beginning the figures were carved from stones found near Zuni, but today they can be made from all sorts of materials found anywhere in the world. Most common are animals such as mountain lions, bears, badgers, wolves, eagles, and shrews, along with some human figures, especially corn maidens.

A goodly amount of astronomical symbolism, including Sun, Moon, stars, solstices and relationships between these and other things, is represented by and on these renderings and that is the topic of this paper, which will detail principal astronomy symbolism. This is an exploratory paper offered by the author with the intent of developing it further through joint authorship with a highly respected Zuni individual and consultation with selected master carvers.

Crystals in the Sky: Dine' Stellar Depictions

By Von Del Chamberlain

The anthropological view of the Navajo culture is that they wandered from the Pacific Northwest to arrive in the American southwest, probably by about 1200 A.D. However, their own traditions maintain that they emerged from the womb of Mother Earth directly into their southwestern homeland. Their legends explain how the Holy People put the Sun, Moon and stars into the heavens. This presentation explores the meanings stars have for the Navajo people and the ways we find them portrayed in ceremony and rock art.

Creating Symmetry: Building Social Landscapes in the Central Mesa Verde Region

By Grant Coffey

Pueblo people created cultural landscapes with a sense of balance that mirrors that found in the natural world. Individual buildings and larger architectural landscapes were designed to reference aspects of the natural world, including the cardinal directions and important astronomical events. These spatial relationships were patterned, and often display a dualistic symmetry. Through analyzing the spatial relationships between public buildings at different spatial scales it may be possible to identify larger alliances or partnerships that extended beyond individual communities in the central Mesa Verde region.

Applying STK Software to Archaeoastronomy: Bridging Gaps between Western and Indigenous Science

By Jason Cordova

In 2010 Jason S. Cordova led a team at the Metropolitan State University of Denver to investigate the application of Analytical Graphics Incorporated STK software to assess astronomical alignments of El Caracol at the Mayan complex of Chichen Itza. A three dimensional computer model was built and imported into STK physics modeling software and demonstrated a proof of concept. The project was entered into the Analytical Graphics Incorporated University Grant Completion and received an Honorable Mention.

In 2011 a new group of students under the guidance of Professor Jose Lopez initiated a follow up and named it the Cordova Project. Jason was invited to participate as a consultant and the project was expanded to assess astronomical alignments of three prominent archaeological sites. The sites included El Caracol, the Temple of Kukulcan at Chichen Itza, Pyramid Khufu in Giza, and Machu Picchu. The goal was to confirm that structures at these sites were built to mark and observe the movement of celestial objects. Computer modeling of the structures was integrated into the STK physics modeling engines and celestial data. Celestial alignments at two of the three sites were confirmed after turning back the clock to account for precession.

The project received an Honorable Mention in the Analytical Graphics Incorporated University Grant Completion for the second time.

Jason would like to use this proof of concept to create a catalog of Ancestral Pueblo and Mound Sites in North America. As a descendant of Tewa Pueblo and Mexica people, Jason is honored by

the opportunity to contribute cultural perspective and reference traditional knowledge in order to reach a better understanding of the way his ancestors lived and related to the universe.

It is believed that the Spirits of the Ancestors still reside in many of these sites. Conventional study methods can be invasive and risk disrespecting the traditions and wishes of the modern Pueblos. By applying STK and computer modeling it is unnecessary to disturb these sacred sites, while providing a vehicle for study.

Simple Methods for Creating 3D Computer Models of Archeological Sites

By Christopher Dombrowski

Using available software, such as Photosynth from Microsoft, complex geometries can be accurately modeled from a collection of photographs using photogrammetric techniques. Common features are identified across the photographs to determine their relative positions in space. Given enough photographs, 3D models of physical objects and geographies can be constructed. 3D models of archeoastronomy sites are useful tools which can be used for documentation and alignment testing. Light and shadow effects can easily be explored on the 3D models computationally, which can eliminate the need to be on site at specific times with good weather. This will alleviate a major obstacle archeoastronomy research. Photogrammetry also provides an opportunity to record the complex geometries of archeoastronomy sites as they change in time. If the site becomes damaged or changed in the future, the 3D models provide a unique tool that preserves the site for future study. If sites have already been disturbed, then 3D models could be constructed and compared from historic photographs, recovering geometries that may have been lost to time. Two models will be presented: the Painted Rock site near Gila Bend, AZ and the Sears Point site near Dateland, Az. The documented sun dagger at Gila Bend was accurately reproduced in the 3D model as well as a sun/glyph interaction at the Sears Point site. My goal is to create a standardized methodology to create 3D models that is easily accessible to all in the archeoastronomy community. The costs are negligible and the benefits can be invaluable to our field. The only tools that are required are a camera, ruler, and compass, which are all tools that are already carried into the field.

Thoughts on Shadow Formation and Implications for Interpretation of Light-Shadow Markers in Cultural Astronomy

By Tony Hull and Elizabeth Jewell

We address the complications in using shadow markers as indicators for cultural astronomy. With shadow markers the source, the sun (and sometimes moon), is not a point source but rather an extended object. The geometry is discussed, together with the uncertainty of the resulting “unsharp” shadow. This uncertainty will be described in the context of the constraints it imposes on the accuracy of using shadows as date markers, definers of cardinality and of Equinox date, and also how it relates to WINDOW size in Monte Carlo evaluation of the cultural meaningfulness of a light-shadow observation. Discussion of the concerns shadow observers have experienced in field studies and in interpretation of results will be invited.

Connecting to Mother Earth

By Filmer Kewanyama

After a personal introduction, this program will orient people to the Hopi Mesas and the worldview of the Hopi people. A history of Hopi and their emergence stories will be given followed by a discussion of their dances, migrations and the ceremonial calendar. I will discuss the pilgrimage into Ongtupka (Grand Canyon) and visit Dawa Park and Tutuveni (Newspaper Rock) to discuss petroglyphs. I will conclude with a discussion of involvement in preservation of sacred sites.

Some Findings of a Survey of Peterson Mesa

By Frederick W. Martin and Elizabeth F. Martin

Peterson Ridge lies like a giant protractor subtending an arc to the west of the two spires of Chimney Rock in southwestern Colorado. We have made a survey of the stone remains on this elevated ridge. Two stations fit observation at the major and minor lunar standstills, although the spires are barely visible over an intervening hill. Seven others may have been for use in eclipse prediction at the solstices. Eight theoretical declinations are calculated for the first and third (1,3) quarter moons at winter and summer (W,S) solstice eclipses, and for the two possible orientations (a,d) of the line of nodes at solstice eclipses. Preliminary evidence is shown for 3Wa, 3Wd, 1Wa, and 1Wd cases. Only the winter solstice seems to have been of interest.

The high hills in the Bull Creek region to the southwest of the spires contain a basin that fits the lunar declination halfway between the standstills, nearly at the winter solstice sunrise. We suggest that it also was associated with observation of quarter moons, except that eclipses at an equinox were of interest, when the full moon rises nearly due east.

Previous researchers have suggested that the reason for sending a delegation of Chacoan men to build pueblos at Chimney Rock had a lunar aspect, and have shown that mirror flash communication is possible to Chaco canyon. Our finding suggests that the aspect was prediction of interruptions to major lunar ceremonies.

The Bull Creek Basin is Lunar

By Frederick W. Martin and Elizabeth F. Martin

We have made a theodolite survey of the profile of the towers of Chimney Rock near Pagosa Springs, Colorado, as observed from the Bull Creek basin. This 7" round basin is found in a stone table located in the high hills southwest of Peterson Ridge, associated with pueblo ruins containing rectangular apparently Chacoan stones. The basin is sufficiently distant from the towers so that the question of whether solar or lunar observation was practiced can be decided by the 0.9 degree effect of lunar parallax. Our outstanding finding is that the basin cannot be for observing the summer solstice sunrise, which misses the towers by nearly a degree. Instead the basin appears to be designed for observing the moon as it rises on days halfway between the standstills. If a quarter moon before an equinox rose behind the towers on such a day at an hour known to calendar specialists, an eclipse at the subsequent full moon could be predicted, and communicated to Chaco Canyon in timely fashion before a major ceremony. It is unlikely that the quarter moon nearest a solstice was involved, because it would not be seen from this location, and because stations for observing the quarter moons before the full moon near winter solstice (but not the summer solstice)

do seem to be present on Peterson Ridge. The use of the large towers to enable accurate prediction of lunar eclipses that would interrupt a subsequent ceremony may be the reason that an outpost was set up so far from Chaco Canyon.

Preliminary Progress of the Archaeoastronomy of Peñon del Diablo Site, Northwest Chihuahua, México

By Alan Muñoz

This presentation shows the preliminary information collected of my thesis researching in the Escuela de Antropología e Historia del Norte de México (EAHNM) in Chihuahua, México, called “*Early Archaeoastronomy in Northwest Chihuahua. The Case of the Peñon del Diablo, Janos, Chihuahua*”. My interest is to know the importance of the astronomical observation in an archaic period site using the astronomical association of petroglyphs, the relation with the landscape and the archaeology record.

In a preliminary way, we can say that the archaeoastronomical evidence of the Peñon del Diablo site is quite similar to archaeoastronomical findings in the Southwest of the United States; with light and shadow interaction of petroglyphs (principally concentric circles), the establishment of calendar horizon and alignments of rocks with the sunrise and sunset.

The Architecture and Astronomy of Sun Temple Mesa Verde National Park

By Gregory E. Munson

Fundamental to anthropology is attempting to determine how the definition of space and use of knowledge affect human social structure. One artifact of ancestral civilization is their architecture, as architecture defines spaces, correlates with building function, and gives insight to resource allocation. Sun Temple, located in Mesa Verde National Park, has been the subject of much speculation and archaeological mythology since it was first photographed by Gustav Nordenskiöld in 1891.

A characteristic architectural form of the thirteenth century Central Mesa Verde region is the D-shaped building. These structures are typically constructed of double-coursed pecked and ground block masonry, sometimes in the form of a bi-wall with rubble core fill. The best documented examples of D-shaped architecture in southwest Colorado are Sun Temple in the Cliff-Fewkes Canyon Community of Mesa Verde National Park, Sand Canyon Pueblo in Canyons of the Ancients National Monument, and Goodman Point Pueblo in Hovenweep National Monument. Additional examples occur in other canyon-rim villages, but only one such structure occurs in each pueblo community. Even though the details of each structure are unique, evidence suggests they were the homes of community political and religious leaders and settings for exclusive ritual. Their common layout – with a D-shaped perimeter wall – also suggests a political or ceremonial function, although the exact nature of this symbolism has been obscure.

This contribution will examine the history of research at Sun Temple and its architectural construction. We will also explore the probable functions of the structure and the potential for symbolism in its form and how that may relate to other D-shaped structures in the Central Mesa Verde Region.

The Cross Canyon Stone Circle: Age and Implications

By Scott Ortman

The Cross Canyon Stone Circle is an enigmatic feature in Southeast Utah that has been argued to be everything from a Navajo sheep corral to a uranium prospecting pit to an Archaic ceremonial site. In 2015, the University of Colorado collected several soil samples from beneath certain stones for optically-stimulated luminescence (OSL) dating analysis. In this paper I share the dates obtained from our two highest-quality samples and consider their implications for the interpretation and significance of this feature.

The Mirror-Image and Tewa Origins

By Scott Ortman

Archaeological studies of material culture typically focus on the evolution of the image. I suggest here that resolving some of the thorniest problems in southwest archaeology will require us to pay more attention to the mirror-image. I illustrate this point using the example of Tewa origins. Recent research has brought together several independent lines of evidence which suggest the Tewa Pueblo society of New Mexico formed through mass migration from the Mesa Verde region in the 13th century. However, material culture continuities between the two regions are conspicuously absent even though it appears the immigrants far outnumbered the locals in this process. I suggest one can account for these discontinuities in terms of a native ontology built from the phenomenon of *reflection*. There are many aspects of experience in which light creates mirror images. Contemporary Tewa understandings of the spirit world, time and space, and future and past build from these experiences, and archaeological evidence suggests this conception has a deep history in Pueblo culture. I suggest that Tewa ancestors recruited this worldview in promoting the social transformation associated with Tewa origins. Thus, the way to “see” the continuities between Mesa Verde and the Rio Grande archaeologically is to think in terms of mirror-images.

Revisiting the Solar Markers of Horseshoe Mesa, Wupatki National Monument

By David Purcell

Robert and Ann Preston identified three petroglyph panels at Horseshoe Mesa (WS834) in Wupatki National Monument as possible solstice and/or equinox markers during the mid-1990s. Detailed baseline documentation and condition assessment of the Horseshoe Mesa rock art was undertaken cooperatively by Museum of Northern Arizona and Flagstaff Area National Monuments, National Park Service in 2014-2016, during which the possible solar markers were re-recorded and reassessed. Shadow and sunlight interactions with petroglyphs were observed at the three panels on the equinoxes. Panel 50 clearly marks the equinoxes with a series of interactions from noon until sunset; Panels 39 and 52 do not mark the equinoxes. Photographs taken by the Preston's suggest that Panels 39 and 50 mark the winter solstice. Panel 52 does not mark the summer solstice, despite previous claims. The nature of the evidence for or against the prehistoric use of these panels as solar milestone imaging locations is discussed as it relates to archaeoastronomical theory, especially in evaluating the context of Panel 50 and the summer solstice.

Toward an Understanding of Myths, Gods and Ceremonial Timing in the Greater Southwest

By Mark Raney

This year's paper is an extension of my 2014 SCAAS presentation entitled Stars and Ceremonial Timing in the American Southwest. The introduction is an overview of what is commonly known about Pueblo stars and ceremonial timing as well as religious concepts shared by both the Pueblos and ancient Mesoamerica. Next is a summary of my 2014 presentation, matching ancient Southwestern iconography to stellar formations and then showing repeating patterns between stellar position and ceremonial timing. The paper concludes by taking the Southwest findings into Mesoamerica showing significant similarities in myths, Gods and event timing.

Upper World, Lower World, and a Line Runs Through It: A Consideration of the Procession Panel and Its Landscape

By Jonathan Till

The famous Procession Panel of Comb Ridge in southeastern Utah has spurred discussions pertinent to chronology, demography, and social organization. I suggest that a consideration of the panel in terms of its broader landscape complements a simultaneous consideration of the Puebloan/Navajo emergence narrative. This "landscape approach" to examining the panel fosters greater potential understanding of the panel itself as well as a suite of features in the panel's vicinity that span the Basketmaker II through Pueblo IV periods. These features include Basketmaker and Pueblo period rock art panels, a Chacoan road alignment and road-associated shrines, a suite of post-Chacoan features, Hopi pottery, and the Comb Ridge itself.

Advanced Geometrical Constructs in a Mesa Verde Pueblo Ceremonial Site with Known Solar and Lunar alignments, c 1200 AD

By Sherry Towers

Summer 2015 marked the 100th anniversary of the excavation by J.W. Fewkes of the Sun Temple in Mesa Verde National Park, Colorado; an ancient complex prominently located atop a mesa, constructed by the Pueblo Indians approximately 800 years ago. While the D-shaped structure is generally recognized by modern Pueblo Indians as a ceremonial complex, the exact uses of the site are unknown, although the site has been shown to have key solar and lunar alignments.

In this study we examine the potential that the site was laid out using advanced knowledge of geometrical constructs. Using aerial imagery in conjunction with ground measurements, we performed a survey of key features of the site. We find strong evidence that the Pueblo natives laid out the site using the Golden rectangle, Pythagorean 3:4:5 triangles, equilateral triangles, 45 degree right triangles, and squares. The survey also reveals that a single unit of measurement, $L=30.5\pm 0.5$ cm appears to be associated with many features of the site.

These findings represent the first quantitative evidence of knowledge of advanced geometrical constructs in a prehistoric North American society, which is particularly remarkable given that the Pueblo Indians had no written alphabet or number system.

Yadila oolye!: What does it Mean?! Navajo Archaeology in the 21st Century

By William Tsosie

Understanding the Navajo Cultural landscape vs. non-Navajo archaeology as it is interpreted by Navajo and non-Navajo cultural lens. This session will look at the Navajo understanding of archaeological in the 21st Century from the Navajo Nation prospective. Concerns related to being told who you are as a Navajo by Non-Navajos. Understanding working with the laws imposed by a Non-Navajo Governments.

Sun Marker

By Davd Valentine

Edge of the Cedars State Park Museum in Blanding, Utah, houses a sculpture that interacts with the sun, named Sun Marker. Sun Marker functions as a calendar, with dramatic plays of light on the solstices and equinoxes. The sculpture, created by Joe Pachak, is inspired by sun-watching customs of the prehistoric cultures in the Four Corners region. The Sun Marker (2014) video is designed to educate visitors to the museum about how the sculpture works and its significance as a scientific case study. This short documentary film captures the beauty and scientific significance of Sun Marker and how it relates to the peoples of today.

Reconsidering Casa Rinconada, Chaco Canyon

By Ray A. Williamson

Casa Rinconada, located to the south across the canyon from Pueblo Bonito, is a unique great kiva structure. It is an 11th Century structure, located by itself within the canyon on a gentle rise which affords a good wide view of much of the surrounding canyon floor. One of the remarkable features of Casa Rinconada is the strikingly accurate orientation of its principal axis along a north-south line. Most other structural features of the kiva are organized symmetrically around this line. In earlier research (Williamson, *Living the Sky: The Cosmos of the American Indian*, Houghton Mifflin, 1984.), we found that other features in the kiva were astronomically oriented as well. This paper reexamines the available information on the excavation, stabilization and reconstruction of the building, and reexamines the astronomical orientations evident in it. The paper explores the great kiva's astronomical significance in light of other known astronomically oriented structural features in the canyon, including the so-called Great North Road. Finally, this paper attempts to interpret the possible meaning of Casa Rinconada for Chaco society.

Ancient Ritual Landscape and Associated Solstice Interactions in Southeastern Utah

By Virginia Wolf and Edward Wheeler

A megalithic-stone circle was located on a ridgeline in southeastern Utah's Canyon Country that qualifies as a very large "Dance Plaza" and it is part of a larger man-made and natural ritual landscape. The site is exceedingly old, by southwestern archaeological standards, and at this moment, its age is undetermined, as well as who might have engineered this vast landscape. It is

pre-Puebloan, and might extend back into the Archaic. The stone circle is so large (115 feet in diameter) and the size of the stones placed around the perimeter suggests quantities of people were involved in moving these large boulders, but this ritual landscape includes much more than the circle. Quantities of standing stones were also placed in proximity to the circle, and some were ringed with smaller stones to keep the standing stones in place on a steep hillside. Extensive lines of stones were placed perhaps as markers for people to follow to *properly* gain access into the circle, and one long line (170+ meters) of medium sized stones demonstrated the summer solstice on a flat horizon. But the ritual landscape extended farther out to the highest peak of Sleeping Ute Mountain which is over 30 miles away. This peak is not visible below the circle, and if one stands within the circle on winter solstice the sun will rise up along the side of the peak and then lifts off the top.

Summer Solstice near the Mouth of Mancos Canyon in the Ute Mountain Tribal Park, Colorado

By Virginia Wolf and Edward Wheeler

Located in a north-south trending side canyon of Mancos Canyon are seven large spiral petroglyphs which define this Basketmaker III-Pueblo I location. The petroglyphs are scattered among three large talus boulders along an east-west line that was meant to show the summer solstice. Three well defined interactions occur in the late afternoon of the solstice. The first interaction occurs inside what appears to be a well-constructed storage unit. The second involves a large boulder, with a deep old spiral petroglyph, and what appears to be a man-made tunnel under the boulder allows a beam of light to exit into a semi-circle of stones on the back side. Lastly, the western horizon is irregular, and if one stands in front of the boulder engraved with four spiral petroglyphs, just at sunset, one can observe the setting sun disappear into a well-defined notch on the horizon. Viewing the setting sun is hard on the eyes, and cameras, but the ancient ones created a viewing notch behind the boulder probably to save one's eyes, and it still validates the sunset's position on the horizon. Puzzlingly, we still don't understand why two additional large spiral petroglyphs on an adjacent boulder were so placed, but further observations might provide the information.

Notes

Notes

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