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Caves, Liminality, and the Sun in the Inca World

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Abstract: Caves were liminal features of the Inca sacred landscape, connecting this world with the underworld. They were places for making contact with ancestors and the powers of creation. In this paper we examine caves in southeastern Peru for solar orientations and cosmological context, with recourse to the concept of liminality that appears central to cave use. The cave within Kenko Grande has ceremonial steps adjacent to an altar upon which sunlight climbs at midday in June. A rear entrance and altar are illuminated at the time of the solar equinox sunrises. Lacco has three caves which have one solsticial orientation and two light-tubes. A primary opening in the cave at Lanlakuyok faces sunrise at the time of the equinoxes. Tambomachay contains a major fountain and a cave with a platform oriented to December solstice sunrise. Rumiwasi Bajo contains a number of niches and a nine-meter-long passageway oriented close to the June solstice sunset, while the other door opens to December solstice sunrise. Choquequilla is a complex cave opening to December solstice sunrise. The Royal Mausoleum is one of the major shrines of Machu Picchu and opens to June solstice sunrise. Intimachay is a cave with a constructed opening for the December solstice sunrise. The Temple of the Condor contains a cave approximately open to the anti-zenith sunrise. The Gran Caverna includes both an upper and a lower cave oriented for June solstice sunset. There are two caves at the River Intihuatana that, while part of an astronomically oriented complex, don't have solstitial nor equinoctial orientations, nor do they have interior carvings. We end the paper by considering the role of caves and liminality in Inca cosmology.

1. Introduction

Caves connected the Inca world of the present to the ancestors and the cosmological forces of the underworld. Some contain carved steps, which are further symbolic of movement between three cosmological worlds, *hanan*, *hurin*, and *ucu pacha*.[1] In the major Inca creation story, the creator god made human beings from rock in the vicinity of Lake Titicaca and sent them through underground tunnels to emerge from caves, springs, and

[1] Gary Urton, *At the Crossroads of Earth and Sky: An Andean Cosmology* (Austin: University of Texas Press, 1981).

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rivers in different places in the Andes. The ancestors of the Incas emerged from the center-most of three caves at a place called Pacariqtambo, 'The Inn of Dawn'.

The Inca considered the remains of deceased to be like seeds (called *mallki*, 'seedlings') that were planted in caves, sometimes intended as offerings for the Earth Mother, Pachamama, as well, apparently, to affirm the non-duality of the living and dead. In their search for riches, the Spanish destroyed the tombs and burials that they could locate and burned royal mummies. Fortunately, they missed about a hundred caves discovered by Bingham in Machu Picchu, with burials in them. The caves were modest, sometimes only rock alcoves, and the burials were not of royalty.[2]

In this study we have investigated caves in the Cusco basin associated with known huacas (shrines) as well as the major caves associated with huacas in the Sacred Valley and Machu Picchu. The number of such natural structures associated with huacas that have orientations to either the solstices or equinoxes is somewhat surprising. It appears that in the selection of caves to be huacas some preference was given to those with solar orientations. The significance of the passage of the Sun into the dark interior of these caves is not explicated in Inca Origin Myths. The phenomenon may be understood in terms of empowerment and animation of interior spaces, such as is suggested in double-jamb doorways and windows at Machu Picchu and Llactapata.

2. Inca Cosmology

The Sun, Moon, planets, and stars appeared to rise from the ground and subsequently return to it when viewed from the ancient perspective of a flat Earth. The underworld, therefore, becomes a natural extension of the path traveled by these celestial bodies.[3] In effect, the cosmos of the Incas existed in three distinct worlds – that of Ucu Pacha, the underworld; Kay

[2] George R. Miller, 'Food for the Dead. Tools for the Afterlife: Zooarchaeology at Machu Picchu', in Richard L. Burger and Lucy C. Salazar, eds., *The 1912 Yale Peruvian Scientific Expedition Collections from Machu Picchu* (New Haven: Yale University Publications in Anthropology 85, 2005), pp. 1–63.

[3] Michael A. Rappenglück, 'Copying the Cosmos: The Archaic Concepts of the Sacred Cave Across Cultures', in Herman Jung and Michael A. Rappenglück, eds., *Symbolon – Jahrbuch der Gesellschaft für wissenschaftliche Symbolforschung: Neue Folge, Band 16 – Signaturen des Lebens: Bilder und Zeichen von Kosmos und Bios und Symbole des Alltags – Alltag der Symbole* (Frankfurt am Main: Peter Lang, 2007), pp. 63–84.

Pacha, the here and now; and Hanan Pacha, the world above.[4] There are many extant examples of symbolic sets of three stairs representing transition between the three worlds of the Incas' being. Caves figure prominently in Inca origin myths and were thought also to be chthonic connectors to the underworld.[5]

Water empowered the shrines known as huacas through a life-energizing force that could be used to provide sentience to the inanimate or renew power to the living.[6] The world's water cycled through the heavens and Earth in its journey down the Vilcanota with return via the Milky Way.[7]

Inca cosmology viewed the Milky Way as a river flowing across the night sky in a very literal sense. They saw earthly waters as being drawn into the heavens and then later returned to Earth following a celestial rejuvenation. The Earth was thought to float in a cosmic ocean.[8] When the celestial river's orientation was such that it dipped into that ocean, waters were drawn into the sky. 'The Milky Way is therefore an integral part of the continuing recycling of water throughout the Quechua universe'.[9]

2.1. Sacred Landscape

The Incas venerated natural features such as mountains, outcroppings, caves, springs, and rivers, all believed to be endowed with sacred powers. Most of all the Incas revered mountains and the great entities within them. Sacred mountains are prominent on the horizons of Cusco and Machu Picchu and the Inca's great reverence for the Earth was no better displayed than in their worship of these majestic snow peaks. Quechua populations today view mountains either as powerful deities themselves or the residences of deities. They are worshipped as ancestors, sources of water and weather, and in the case of Ausangate, the father of alpacas and lamas.

[4] Urton, *At the Crossroads of Earth and Sky*.
[5] Maartin J. D. Van de Guchte, 'Carving the World: Inca Monumental Sculpture and Landscape' (PhD Dissertation, University of Illinois, 1990).
[6] J. McKim Malville, 'Animating the Inanimate: Camay and Astronomical Huacas of Peru', in Jose Alberto Rubiño-Martín, Juan Antonio Belmonte, Francisco Prada, and A. Anexton Alberdi, eds., *Cosmology Across Cultures, ASP Conference Series, 409* (San Francisco: Astronomical Society of the Pacific, 2009), pp. 261–66.
[7] Frank Salomon and George L. Urioste, *Introductory Essay in The Huarochiri Manuscript: A Testament of Ancient and Colonial Andean Religion* (Austin: University of Texas Press, 1991).
[8] Urton, *At the Crossroads of Earth and Sky*.
[9] Urton, *At the Crossroads of Earth and Sky*, p. 60.

Mountains were often venerated as the most important of deities throughout the empire.[10]

Similar to sacred mountains, many rock outcrops were also understood to be hierophanies, or manifestations of the sacred. Eliade's definition of hierophanies seems particularly apt: the breaking through of the sacred into the mundane world. Rock outcrops were indeed places where the underworld is breaking through into this world.[11] Pachacuti may have believed that he could improve upon these stones and, as the son of the Sun and co-creator of the land, he could modify and enhance the work of the creator. The carved huacas are bedrock features with their roots in the earth, an important aspect of the symbolism involving three worlds. They also seem to be laid out across the landscape in meaningful patterns. A limited number of motifs were used in the shaping of huacas suggesting that the carvings were not a form of mindless or inventive graffiti, but elements in a symbolic language with cosmological significance.

2.2. Carved and Uncarved Rocks

Inca emperors felt it their right to improve upon nature by sculpting in situ outcrops that often became huacas.[12] Improvements to rocks appear to have been state-controlled and likely guided by a certain class of artisans as evidence does not suggest innovation. These methods also were not sudden inventions, but instead had developed over time with knowledge acquired from other societies.[13]

The Incas used carved rocks as a vehicle for promoting state ideology and the solar religion. They were symbols of commemoration, mediation with the cosmos, and state identity, all the while remaining part of the Incas' perception of their sacred relationship with nature and the land.[14]

A rock, once carved, became a hierophany and was worshipped by the Incas. Uncarved rocks could also become sacred and animated such as a

[10] Johan Reinhard, 'Sacred Mountains: An Ethno-Archaeological Study of High Andean Ruins', *Mountain Research and Development* 5, no. 4, (1985): pp. 299–317.

[11] Mircea Eliade, *Patterns in Comparative Religion* (New York: New American Library, 1974).

[12] César Paternosto, *The Stone and the Thread: Andean Roots of Abstract Art* (Austin: University of Texas Press, 1996).

[13] Susan Niles, *Callachaca: Style and Status in an Inca Community* (Iowa City: University of Iowa Press, 1987).

[14] Van de Guchte, 'Carving the World: Inca Monumental Sculpture and Landscape'.

white boulder in the center of the Palace of Huayna Capac.[15] Embedded in the Earth, these manifestations of the sacred were connected with the powers of the underworld.

Sculpted steps in huacas, were an important part of cosmological symbolism regarding the three worlds of the Incas.[16] Ritual stairs are a dominant motif, perhaps expressing movement from the underworld to the Earth to the heavens and are often associated with these three realms. Carved stairs are quite common and frequently non-functional, such as those on inaccessible cliff sides at Ollantaytambo and within a cave at Machu Picchu. They often include three steps, corresponding with the three worlds, and likely were symbolic representations of this cosmology. Carvings of condors, pumas, and serpents proliferate as representatives of these respective spiritual domains. Carved rocks also had geopolitical function as they were used to mark territory during expansion of the Inca empire. They were elements in a language used to communicate political concepts and to transmit state ideology.[17]

2.3. The Meaning and Function of Caves

As with numerous other ancient cultures, caves represented a connection with ancestors and primeval forces and this played centrally in Inca origin myths and ritual emergence.[18] Caves were residences of ancestors with niches for mummies and served as locations for food and offerings to the dead. They were huacas empowered and animated by sunlight.

Caves are lineal places serving as openings to other worlds, passages that can carry one from one realm to another. The word comes from the Latin word *limen*, meaning a threshold. These passageways may involve the frightening (and transformative) ambiguity and disorientation that can occur when one crosses into a new and unfamiliar space and time. Moving through a cave, such as that near the summit of Huayna Picchu, could mean a rebirth, cleansing, or entry into the realm of the gods. The idea of

[15] J. McKim Malville, 'Astronomy of Inca Royal Estates I: The Sacred Valley', in C.L.N. Ruggles, ed., *Handbook of Archaeoastronomy and Ethnoastronomy* (Heidelberg: Springer, 2014), pp. 865–77.

[16] Paternosto, *The Stone and the Thread: Andean Roots of Abstract Art.*

[17] Jessica Joyce Christie, *Memory Landscapes of the Inca Carves Outcrops* (Lanham: Rowan and Littlefield, 2016).

[18] Michael A. Rappenglück, 'Cave and Cosmos, a Geotopic Model of the World in Ancient Cultures', in Mauro Peppino Zedda and Juan Antonio Belmonte, eds., *Lights and Shadows in Cultural Astronomy: Proceedings of the SEAC 2005* (Isili: Associazione Archeofila Sarda, 2007), pp. 241–49.

liminality was extensively developed by Victor Turner in his analysis of pilgrimage and the unsettling experience of traveling into unfamiliar landscapes.[19] While in the liminal state, human beings have a heightened awareness of their surroundings and are open to transformative suggestions from the environment or their companions. Liminality can involve places as well as experiences. Liminal places can range from springs, caves, shores, rivers, crossroads, bridges, and sacred spaces such as temples. Caves and springs, especially, were viewed as openings or doorways to the place of origin of the world and to the realm of ancestors and deities. In the Andean world caves and windows are considered symbolically equivalent. The frame of a window or doorway (especially a double jamb doorway) is like the entry to a cave.[20] The Temple of Three Windows at Machu Picchu may thus have been intended as a representation of the three caves at Pacariqtambo.

3. Methodology

As is clear from the foregoing, caves were multivalent features in Inca and Andean cultures. Our approach has been to frame these various meanings in term of multiple hypotheses to be tested. We have studied the caves associated with known huacas in the Cusco valley, the Sacred Valley, and Machu Picchu and asked which of the following hypotheses for the meaning of Inca caves stands up to scrutiny:

1. Analogues to the three caves in the origin myth of the Inca;
2. Entry into the underworld; places for offerings and communication with Pachamama;
3. Transformative ritual passageways;
4. Metaphorical windows; penetration of light into darkness;
5. Geopolitical markers of Inca hegemony;
6. Sites for ancestral mummies placed like seeds in the Earth.

Magnetic bearings and inclinations were initially recorded with a Suunto Tandem Compass Clinometer Survey Tool, a liquid-filled precision compass and clinometer. Measurements were validated with a Wild

[19] Victor Turner, 'Liminality and Communitas', in *The Ritual Process: Structure and Anti-Structure* (New Brunswick: Aldine Transaction Press, 2008); Victor Turner, *Process, Performance, and Pilgrimage: A Study in Comparative Symbology* (New Delhi: Concept, 1979).
[20] Carolyn Dean, *A Culture of Stone: Inka Perspectives on Rock.* (Durham: Duke University Press, 2010).

Heerbrugg T2 Theodolite. Solar horizon positions and inclinations were verified trigonometrically for position and time of sunrises on the actual horizon. Photo-documentation was accomplished with a Canon 8-magapixel digital camera and tripod. Global positioning was made with a Garmin GPS. GPS Azimuths were validated trigonometrically. Magnetic declinations were taken from the National Oceanic and Atmospheric Administration: National Environmental Satellite, Data and Information Service – National Geophysical Data Center.

4. The Caves of Cusco

4.1. Kenko Grande (Patallacta, Ch. 1:2)

The first cave examined is within Kenko Grande, also known as Patallacta and classified in the Cusco ceque and huaca system of Bauer as Chinchaysuyu 1:2, or Ch. 1:2.[21] It is located at S 13° 30.53' W 071° 58.24' and 3614 metres above sea level. Visible from the central Coricancha sun temple of Cusco, Kenko Grande is a sculpted limestone outcrop north of the city that incorporates carvings and crevices as well as a stone monolith surrounded by a series of niches along an arced plaza.

Kenko Grande exhibits a visually dramatic phenomenon at the time of the June solstice which is known locally as 'the awakening of the puma'. The Inca venerated the condor, puma and snake as representing cosmological correlations with the sky, earth, and underworld.[22] Located atop the huaca and carved into the stone are two carved cylinders perhaps designed at gnomons for effects of light and shadow. The cylinders are about twenty-five centimeters high and are spaced thirty-five centimeters apart. In close proximity is a small wall with a fissure aligned for the sunrise at the June solstice. Light from the morning Sun passes through the fissure and first touches the left side of the left cylinder. As the Sun continues to rise, its rays move across the cylinder and then illuminate the opposite one as well. The cylinders are situated in such a way that the glowing pair and the relative shadows now resemble a puma – 'the puma's awakening'.

The top of Kenko Grande exhibits many once-fine carvings including an offering/divination channel flowing to a cave. A common motif of carved huacas is a straight or zigzag channel through which liquids, most probably the revered maize corn beer chicha, could flow. The current of

[21] Brian S. Bauer, *The Sacred Landscape of the Inca: The Cusco Ceque System* (Austin: University of Texas Press, 1998).

[22] Van de Guchte, 'Carving the World: Inca Monumental Sculpture and Landscape'.

energy necessary to establish harmony and maintain equilibrium in the world was stimulated by the pouring of liquid offerings into these channels. The channel begins with a cup-like basin, extending first for 130 centimeters and then 145 centimeters before splitting into two eighty centimeter branches. *Kenko* in Quechua means a zigzag, which was also known as a *paqcha*. It is a remarkable ritual device in which liquids would be poured to flow downward to feed and honor the earth[23].

Located within Kenko Grande is a sculpturally-enhanced cave with two entrances, two altars, niches, and a set of three ritual stairs (see Fig. 1). Locals maintain that light entering the cave within a niche at the northwest end of the cave was reflected with gold or silver plates in order to illuminate the entire chamber. The cave includes an additional niche to the right of the altar large enough to hold a mummy.[24]

Fig. 1 Interior cave of Kenko Grande.

[23] Paternosto, *The Stone and the Thread: Andean Roots of Abstract Art.*

[24] Steven R. Gullberg and J. McKim Malville, 'The Astronomy of Peruvian Huacas', in Wayne Orchiston, Tsuko Nakamura, and Richard Strom, eds., *Highlighting the History of Astronomy in the Asia-Pacific Region* (New York: Springer, 2011), pp. 85–118.

The primary altar was carved and polished with three ritual stairs at its northwestern end. Approaching local noon nearing the June solstice sunlight enters the cave, approaches the altar and climbs the three stairs. Ritual stairways are common features, symbolizing shamanic movement between the three worlds. Such a cave could serve as a portal for communication with Ucu Pacha, the world below. Light enters through an opening approximately 341.5° in azimuth and an inclination of +40°.

At times of the solar equinoxes the cave's secondary altar is illuminated at sunrise. The opposite entrance of the cave near the main altar is oriented to the equinox sunset. The meaning of this remains uncertain as the ethno-historical record is ambiguous with regard to Inca interest in equinox horizon observations, as discussed elsewhere.[25]

4.2 Lacco (Chuquimarca, An. 3:4)

Lacco, Antisuyu 3:4, is a carved limestone outcropping incorporating several astronomical orientations. It was barely visible from the Coricancha. The elaborate huaca, also known as Salonpuncu, is located above Cusco to the northeast of Kenko Grande. Zuidema and Aveni suggest Lacco as being at or near the site of Chuquimarca (An 3:4).[26]

> [An-3:4] The fourth was called Chuquimarca; it was a temple of the Sun on the hill of Manto calla, in which they said that the Sun descended many times to sleep. For this reason, in addition to everything else, they offered it children.[27]

Lacco is the largest limestone outcrop in the vicinity, covering an area of about 1670 square meters, and contains elaborately carved stairways, caves and niches. Three caves were modified with altars and exhibit astronomical orientations.

Lacco, on its northeast face, has a cave opening which is oriented for the June solstice sunrise. The greatest eastward angle as viewed through the cave's entrance is 78°, therefore at least some sunlight is admitted to a

[25] Gullberg, 'The Astronomy of Peruvian Huacas'.

[26] Tom R. Zuidema, 'The Inca Calendar', in Anthony Aveni, ed., *Native American Astronomy* (Austin: University of Texas Press, 1977), pp. 219–59; Anthony Aveni, 'Horizon Astronomy in Incaic Cusco', in Ray A. Williamson, ed., *Archaeoastronomy in the Americas* (Los Altos: Ballena Press, 1981), pp. 305–18.

[27] Bernabe Cobo, *Inca Religion and Customs*. 1653. Translated by Roland Hamilton, (Austin: University of Texas Press, 1990), p. 65.

portion of the interior for several days before and after the solstice. The Sun centers on the cave opening at the time of the June solstice. During this period sunlight enters the portal, illuminating the altar and cave interior. When observed, the process began very quickly at 06:25 and persisted until the last vestiges of light disappeared from the altar's stone surface nearly two hours later at 08:24. The northeast cave is located at S 13° 30.34' W 071° 57.86' and 3650 metres above sea level.

Immediately to the east of the northeast cave is the north opening of the crevasse running across Lacco. It also is oriented approximately to the June solstice sunrise. Two ceremonial thrones are situated in front of and below two large steps leading to the northeast cave's opening. The thrones might have been occupied during the rising of the solstice Sun.

Lacco's southwest cave contains a small altar below a light-tube oriented to the ecliptic at times when the Sun's path is between 70° and 75° above the horizon. When properly positioned, either the Sun or a full moon can illuminate the altar within. A crescent moon was viewed through the light tube on 30 October 2006, near the date of the zenith Sun. The cave's door is oriented towards 235° of azimuth. The southwest cave is located at S 13° 30.35' W 071° 57.89' and 3662 metres above sea level.

A small altar was carved within the cave and is oriented so that it is illuminated by light passing through the tube. The elevation from the altar to the lower edge of the light tube is approximately 70° at an azimuth of 211°. The cave includes two recesses cut into its western wall.

Lacco's second cave with light-tube illumination is also known as Temple de la Luna, the Temple of the Moon. This chamber is the most elaborate found within the huaca and the remains of carvings of both a puma and a snake adorn its entrance, the serpent symbolizing passage into the realm of Ucu Pacha.[28] The shaft aligns vertically to admit the light of the zenith Sun at local noon. The light-tube is directed at a finely carved altar, which also can be illuminated by the Moon. The southeast cave is located at S 13° 30.36' W 071° 57.86' and 3655 metres above sea level.

4.3 Lanlakuyok (Amaromarcaguaci, An. 1:7)

Van de Guchte has suggested that Lanlakuyok is a candidate for Amaromarcaguaci (An 1:7).[29]

[28] Paternosto, *The Stone and the Thread: Andean Roots of Abstract Art.*

[29] Van de Guchte, 'Carving the World: Inca Monumental Sculpture and Landscape'.

> [An-1:7] The seventh *guaca* was called Amaromarcaguaci; this was a house of Amaro Tupa Inca, which was on the road of the Andes.[30]

Lanlakuyok is a large carved outcrop along the road to Pisac that has an extensive system of passageways within it illuminated by occasional tubes or openings to the sky. A primary cave opening faces sunrise at the time of an equinox on an azimuth of 91.5°.

4.4 Tambomachay (Cirocaya, Ch. 1:4)

The cave of Tambomachay is associated with an Inca platform and staircase and Bauer suggests it to be the best candidate for Cirocaya (Ch 1:4).[31]

> [Ch-1:4] The fourth *guaca* was called Cirocaya. It is a cave of stone from which they believed the hail issued. Hence, at the season when they were afraid of it, all went to sacrifice in the cave so that hail should not come out and destroy their crops.[32]

The cave opening looks out on a bearing of 135° while the 28°/208° oriented platform in front of it more directly faces the December solstice sunrise. The site is positioned with a clear view of the rest of Tambomachay, Puca Pucara, and parts of the Cusco valley. A stairway leads to the south end of the platform. A boulder rests centrally on the terrace of the platform and a wall was constructed on the side of the terrace closest to the outcrop. The cave is shallow and its interior is extensively eroded.

Bauer proposes that the highly structured fountain at Tambomachay may have been Quinoapuquiu (An 1:10).[33]

> [An-1:10] The tenth *guaca* was called Quinoapuquiu; it was a fountain near Tambo Machay which consists of two springs. Universal sacrifice was made to it, except children.[34]

The fountain is situated on the main level of the complex, well below the cave and platform.

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[30] Cobo, *Inca Religion and Customs*, p. 63.
[31] Bauer, *The Sacred Landscape of the Inca: The Cusco Ceque System.*
[32] Cobo, *Inca Religion and Customs*, p. 54.
[33] Bauer, *The Sacred Landscape of the Inca: The Cusco Ceque System.*
[34] Cobo, *Inca Religion and Customs*, p. 64.

4.5 Rumiwasi Bajo (Comovilca, An. 6:2)
To the east of Cusco above San Sebastián lies Rumiwasi Bajo. The rock of Rumiwasi Bajo contains a number of niches and a nine-meter-long cave passageway. One doorway to the passageway through the huaca looks out close to the June solstice sunset, but is 12° off. The other doorway opens to the December solstice sunrise. Niles proposes this as Comovilca, An. 6:2.[35]

5. Other Caves

5.1 Chinchero
Beyond the ceque system of Cusco is Chinchero. One of the first tasks before each new Inca was the establishment of his royal residence.[36] Topa Inca, the son of Pachacuti, claimed the Chinchero valley as the site for his estate and soon set about construction of its palace, courtyard, support buildings and agricultural terraces. Also at the site are several intricately carved rock huacas. The style of architecture and design suggests a view of nature similar to that of Pachacuti, in which natural rock and landscape features were included in structural forms.

There are two major carved rocks; the first to the south of the plaza, Titikaka, has two carved stairways, one of which leads upward to the top of the rock through a cave with an axis approximately north and south. On the top there are a series of cut rectangular trays similar to those of Kenko and Lacco. To the southwest is a second large carved stone, Chinkana, containing an elaborate stairway, enclosures, altars, and carved trays. At its lower end is a flowing stream beneath carved teeth. A triangular basin opens approximately toward sunset on the December solstice. Above and to the south are carved stones known as Mesakaka and Kondorkaka. In contrast to the solstitial orientations of the Cusco valley, our field research showed the majority of the features of Chinchero to emphasise cardinal directions. Still, solstitial orientations are not totally absent. The two primary carved rock huacas, Titikaka and Chinkana lie approximately on the axis of the June solstice sunrise and December solstice sunset. Both huacas are very large and were carved in-situ. The existence of this orientation was not lost upon the Incas while developing this site.

Chinkana lies low on the eastern end of Chinchero's central valley and has been extensively carved on all sides with such as seats, stairs, shelves

[35] Bauer, *The Sacred Landscape of the Inca: The Cusco Ceque System.*
[36] Susan Niles, *The Shape of Inca History: Narrative and Architecture in an Andean Empire* (Iowa City: University of Iowa Press, 1999).

and niches. Chinkana is located at S 13° 23.27' W 072° 02.58' and 3724 metres above sea level.

Approximately 360 meters west of Chinkana and north of the great plaza of Capallanpampa is Chinchero's largest carved outcrop, Titikaka.[37] Titikaka displays many carvings including two prominent stairways, one external, and the other within a break in the center of the rock leading to its top. This cave-like central stairway exhibits figurative carving. The upper surface of the stone is extensively carved and displays several examples of seats or trays and animals such as a condor and a snake. Titikaka is located at S 13° 23.35' W 072° 02.80' and 3753 metres above sea level. At the base of the rock, lower on the western side, are more carvings, a large crevasse and an opening to a shallow cave. The crevasse looks out on a 278.0° bearing and the cave opens to 254.5°. A large niche was carved near the mouth of the cave and looks out at 293.5°.

5.2 Choquequilla

Above the Rio Huarocondo, five kilometers southeast of Ollantaytambo and fourteen kilometers west of Urubamba, are the ruins of Choquequilla. Choquequilla is located at S 13° 17.53' W 79° 13.93' and 3627 metres above sea level. This remote huaca lies within the mouth of a cave opening to the approximate direction of the December solstice sunrise. The intricately carved shrine faces inward toward the cave, away from the horizon, and is flanked to the south by a wall constructed with two rows of four double-jambed niches, emphasizing the site's significance. The roof of the cave is formed by two relatively flat stone faces that form an inverted 'V'. Light from the December solstice Sun as it rises above the opposing horizon brightly illuminates the cave and huaca (see Fig. 2).

The cave is situated on the mountainside above agricultural terraces that have fallen into disuse. A central staircase ascends the terraces and at the top a trail proceeds north to the cave. A small masonry structure with a door and windows is situated immediately to the cave's north. The carved rock of black granite is said to be among the finest examples in existence and exhibits great symmetry and exquisite carving.[38] The sculpting closely resembles that of the Baño de la Ñusta at Ollantaytambo, but the Choquequilla rock has been damaged by looters.

[37] John Hemming and Edward Ranney, *Monuments of the Incas* (Albuquerque: University of New Mexico Press, 1982).
[38] Paternosto, *The Stone and the Thread: Andean Roots of Abstract Art.*

Fig. 2 Cave opening at Choquequilla.

Paternosto calls this 'the cave of *Choqequilla*, the Golden Moon', and Van de Guchte calls it the 'Moon Temple' of Choquequilla.[39] The cave opens to the December solstice sunrise and the carved stone is slightly offset at 130°. The horizon is inclinated +32.0°. The rise of the Sun illuminates the cave brightly. The light of a rising moon could create a dramatic effect.

6. The Caves of Machu Picchu

6.1 The Royal Mausoleum

The Torreon/Royal Mausoleum complex was one of the major huacas of Machu Picchu. The huaca consists of a very fine masonry wall that crowns the top of a large rock. The wall is beautifully fitted into the rock and contains two windows, one of which opens to June solstice sunrise and the rising of the Pleiades. A stone surrounded by the walled enclosure is illuminated through the window at sunrise during the time of the June solstice. A ledge cut into the top of the stone approximately bisects the early rays of the solstice Sun.[40]

[39] Paternosto, *The Stone and the Thread: Andean Roots of Abstract Art,* p. 89; Van de Guchte, 'Carving the World: Inca Monumental Sculpture and Landscape', p. 191.
[40] David S. P. Dearborn and Katharina J. Schreiber, 'Here Comes the Sun: The Cusco-Machu Picchu Connection', *Archaeoastronomy* 9 (1986): pp. 15–36.

Below the Torreon is the Royal Mausoleum, a cave, which contains a set of symbolic stairs, niches probably for mummies, and other stonework, and, which opens to June solstice sunrise. The cave gives the impression of a passageway to the underworld and the carved, stepped stone a shamanic stairway of ascent or descent. The major stone lined channel of Machu Picchu makes as sharp turn toward the rock, consistent with the role of water through the process of *camay* in the animation of huacas. Huacas and other forms of sacred architecture were animated by the circulation of running water and the pouring of libations. Most of the major astronomical sites of the Inca were associated with natural or offertory water.[41]

6.2 Intimachay

Also in Machu Picchu's Eastern Urban Sector lies a cave called the Intimachay. Dearborn, Schreiber and White argue that this cave was constructed to observe sunrise at the time of the December solstice and the festival of Capac Raymi.[42] A tunnel, like a horizontal light-tube, was oriented to admit sunlight to the cave for about ten days before and after the solstice. The window did not function to illuminate the cave, but instead was aligned precisely with the December solstice sunrise.[43] The view of the horizon was constrained by an interior stone that limited the field of view to ten arc-minutes. Reconstruction performed in 2006 narrowed the window and presently inhibits direct view of the horizon from the cave's interior.[44] Capac Raymi was a festival celebrated by the nobility that included ceremonies of passage to manhood for young Inca noblemen.[45] A site such as this could have played a role. In 2012 Ziolkowsi, Kosciuk, and Astete confirmed the December solstice orientation of the light tube using 3D laser scanning, although they found

[41] J. McKim Malville, 'Machu Picchu', in Ruggles, *Handbook of Archaeo-astronomy and Ethnoastronomy*, pp. 879–91.

[42] David S. P. Dearborn, Katharina J. Schreiber and Raymond E. White, 'Intimachay, A December Solstice Observatory', *American Antiquity* 52 (1987): pp. 346–52.

[43] David S. P. Dearborn and Raymond E. White, R., 'Inca Observatories: Their Relation to the Calendar and Ritual', in Anthony Aveni, ed., *World Archaeoastronomy* (Cambridge: Cambridge University Press, 1989), pp. 462–69.

[44] Malville, 'Machu Picchu'.

[45] Bernabe Cobo, *History of the Inca Empire: An Account of the Indians' Customs and Their Origin, Together with a Treatise on Inca Legends, History, and Social Institutions.* 1653. Translated by Roland Hamilton, (Austin: University of Texas Press, 1983).

that a view of December solstice sunrise could only be obtained at the end of the light tube.[46] They also suggest that a northern window of the light tube may have been intended to mark the major lunar standstill. An alternate interpretation is that the northern window may have been a place to insert and offering to the Sun at December solstice. Ziolkowski *et al.* suggest that the light tube reveals that Intimachay was an Inca 'observatory'. The alternate interpretation is that the cave and light tube primarily served ceremonial functions involving entry of the living Sun into the dark cave. The northern window may have been used to place objects to be illuminated by the dawn sun.

6.3 The Temple of the Condor

South of the Intimachay is the Temple of the Condor where designers carved a head in stone while incorporating in-situ rock as wings in the site's overall visual image of a condor, the creature that represented Hanan Pacha, their world above. The site's cosmological significance continued to the underworld through a system of three caves with an entrance below the boulder representing the left wing of the condor. Nonfunctional steps downward are found at the rear of this entrance area (see Fig. 3).[47] James Westerman and Alfredo Valencia explored the caves in 1995, finding such as fissures, stairs, and numerous bones of guinea pigs, animals which were frequently used as food in Inca ceremonies.[48]

Zuidema argues that the Inca were interested in the timing of the region's anti-zenith passages of the Sun, occurring on 26 April and 18 August, the two days that the Sun is at nadir for the latitude of Cusco.[49] The Temple of the Condor's cave is oriented to the anti-zenith sunrise with a true azimuth of 74°, and therefore could have played a role in associated

[46] Mariusz. Ziólkowski, Jacek Kościuk, and Fernando Astete, 'Inca Moon : Some Evidence of Lunar Observations in Tahuantinsuyu', in Ruggles, *Handbook of Archaoastronomy and Ethnoastronomy*, pp. 897–912.
[47] Malville, 'Machu Picchu'.
[48] Westerman, James S., 'Inti, the Condor and the Underworld: The Archaeoastronomical Implications of the Newly Discovered Caves at Machu Picchu, Peru', in John W. Fountain and Rolf M. Sinclair, eds., *Current Studies in Archaeoastronomy: Conversations Across Time and Space* (Durham: Carolina Academic Press, 2005), pp. 339–51.
[49] R. Tom Zuidema, 'Inca Observations of the Solar and Lunar Passages Through Zenith and Anti-Zenith at Cuzco', in Ray A. Williamson, ed., *Archaeoastronomy in the Americas* (Los Altos: Ballena Press, 1981), pp. 319–42.

ceremonies if such festivities took place.[50] Westerman relates that as the Sun rises on or near days of the anti-zenith its rays pass between two external structures, illuminate the condor stone, and extend beneath the boulder to the stairs at the cave's entrance. This orientation supports Zuidema's thoughts regarding anti-zenith observations.

Fig. 3 Temple of the Condor cave entrance.

6.4 Huayna Picchu

Framed in the major entrance to Machu Picchu is the peak of Huayna Picchu with two stairways up its southern and northern sides. The southern route, which starts in Machu Picchu, passes through a narrow cave near the summit (see Fig. 4). It would appear to be the paradigmatic exemplar of a liminal passageway between worlds, perhaps the best example we have in the Inca world. On the south-east stairway, one crosses a large observing platform and then enters this narrow, dark tunnel (difficult if one is wearing a backpack) and climb its stairs, moving, as it were, from the mundane world of Machu Picchu to the upper world of the heavens. The

[50] Westerman, 'Inti, the Condor and the Underworld'.

northern route starts at the Urubamba River and continues through the largest double-jamb doorway of Machu Picchu, near the cave of the Gran Caverna formerly known as the Temple of the Moon. Double-jamb doorways appear to be markers of liminality, doorways from one realm to another. This large cave contains beautifully formed double-jamb niches, perhaps places for mummies of important ancestors. It is possible that these mummies were carried on the backs of celebrants from the underworld of the cave to the sunrise on upper world of the summit of Huayna Picchu for special celebrations. This combination of stair, cave at the bottom, places for ceremony on the summits makes Huayna Picchu powerfully emblematic of passage between the lowest and the highest worlds. Huayna Picchu's summit is located at S 13° 09.40' W 072° 32.57' and 2698 metres above sea level.

Fig. 4 Cavern passage near the summit of Huayna Picchu.

6.5 Gran Caverna

Low on the northwest face of Huayna Picchu is a shrine referred to as both Gran Caverna and Temple of the Moon. This site includes an upper cave and a lower cave. The upper cave is the larger and within it are five finely constructed double-jambed niches. The double-jambs indicate this site was significant and might have been a place for the storage of mummies. The cave is oriented in the approximate direction of the June solstice sunset and can also be illuminated by the moon. The solstice sunset orientation is only approximate as it differs by approximately 7°. Two routes approach the site. One branches downward from the main trail between Machu Picchu and Huayna Picchu, while the other descends directly from Huayna Picchu's summit. A lower trail passed through a gateway on its way to the river and to the vicinity of the River Intihuatana. The upper cave is located at S 13° 9.09' W 072° 32.78' and 2277 metres above sea level.

Further northeast and lower on the slope is the lower cave which features a constructed doorway bracketed by two windows. As with the upper cave, the lower cave's door and flanking windows are approximately aligned with the June solstice sunset.

6.6 The River Intihuatana

During his exploration of the Vilcabamba, Hiram Bingham located two carved rocks that he identified as intihuatanas. One of these, the Intihuatana of Machu Picchu, is arguably the best-known carved rock of the Inca world. The second intihuatana, lying deep in the Urubamba canyon to the west of Machu Picchu, has been visited far less frequently. When examined this shrine was found to be rich with cosmological symbolism. The River Intihuatana is an important element of the extended ceremonial complex that combines Machu Picchu with sites on the Llactapata ridge. It is located on a hillside between PeruRail switchbacks near a hydroelectric complex.

The principle element of the shrine is a rock carved with steps and tiers. The adjacent upslope section of the sanctuary contains two water basins aligned east-west and has an elaborately engineered water fountain that is situated over a small cave. Eastward of these granite carvings are the remains of several support structures and a tower attached to a large boulder with a second cave beneath. The area exhibits agricultural terraces, but they are presently engulfed by trees.

The significance of the River Intihuatana has become clearer since the rediscovery of the Llactapata Sun Temple in 2003. The site can now be identified as a major shrine (a huaca sanctuary) connected to Machu

Picchu by two intersecting sightlines or ceques from the Llactapata ridge. The concentration of symbolic motifs suggests ceremonial significance at the site.

The site's primary feature is the Intihuatana, a somewhat worn, but finely carved stone situated at the sanctuary's western boundary. Its dimensions overall are 4.27 meters along the flat northern face by 3.20 meters wide. The tiers get increasingly smaller as they rise. The middle tier measures 2.17 meters by 2.14 meters and the top tier 1.50 meters by 1.70 meters. On the east side of the top tier is an intermediate level measuring 48 cm by 1.70 meters and both are adjoined by a set of descending steps too small to serve any necessary function as they are situated. There appears at present to be three symbolic steps, but the stone has been subject to enough erosion to make the original number uncertain.

One of the more intriguing areas found on the site is a complex incorporating several common huaca motifs: a fountain, two basins and a cave. The fountain structure is situated 3.84 meters upslope from the Intihuatana and spans 5.60 meters at its extremes. The face of the fountain points approximately north, is oriented approximately east-west, and was designed to receive water from the east into the channel. A ledge was carved 1.56 meters below the top of the fountain and worn examples of sculpted seats or shelves remain to the west. The channel was engineered to distribute water to each of the four outlets on the fountain's face. The outlets measure 16.5 cm by 9 cm and are spaced 61 cm apart. Within the channel a small baffle was constructed at each outlet to enhance an even diversion of water flow through that opening. The fountain is now dry, but would have once been fed by an upslope spring.

A small cave also exists within the fountain-basin complex. This orifice extends beneath the fountain with its opening situated between the fountain and the boulder with the basins. The cave has enough space for an attendant or priest to function and could possibly have been used for mummy storage. Above the cave entrance and carved into the boulder is a set of three symbolic stairs (see Fig. 5), in this case perhaps representing transition between the underworld and the world of the here and now. The Incas felt caves to express deep connections with the forces of nature.[51]

[51] Steven R. Gullberg and J. McKim Malville, 'The River Intihuatana: Huaca Sanctuary on the Urubamba', *Mediterranean Archaeology and Archaeometry* 14, no. 3 (2014): pp. 179–87.

Fig. 5 Cave entrance beneath the fountain at the River Intihuatana.

The property owner provided insight into a second cave that exists beneath the base of the boulder that forms part of the tower constructed on the sanctuary hillside. He stated that the cave was deep enough to have entrapped animals. A circular tower reaching to the sky while sitting atop a cave may have served to symbolise and facilitate strong connections between this world and those of both the heavens and of the underworld.[52]

7. Conclusion

Caves appear to have played a varied role in the ritual and culture of the Incas. We find no evidence that they were significant representations of the creation story of the Inca. As we have noted the Temple of Three Windows may be associated with that cultural history. They appear to have connected the living with their ancestors as evidenced by large niches used to store mummies at the Royal Mausoleum and the Grant Caverna of Machu Picchu. The Incas were a Sun-worshipping society and many of the caves selected and developed as huacas appear to have been chosen because sunlight entered. The portal of a cave as a metaphorical window

[52] Gullberg, 'The River Intihuatana: Huaca sanctuary on the Urubamba'.

for sunlight to penetrate the darkness is the most frequently encountered meaning, such as Kenko, Lacco, Intimachay, Choquequilla, The Royal Mausoleum, and the Temple of the Condor. Such a meeting of sunlight with darkness may be another example of binary opposition of Levi Strauss' theory of structuralism. Some of these caves exhibit intentional efforts to bring the solstice sun in their dark interiors. The cave within Kenko Grande showcases light climbing three symbolic stairs on the side of an altar at the time of the June solstice, while a second altar is illuminated with the December solstice sunrise. Two caves in Lacco incorporate light-tubes directed at altars and the opening of a third is positioned for the rising June solstice sun. Caves as transformative passageways are found at Titikaka of Chinchero and near the summit of Huayna Picchu. The precarious north and south stairways to the summit of Huayna Picchu, both involving caves, qualify as genuinely liminal experiences that carried celebrants from a lower to the upper world. Finally, the geopolitical significance of caves is perhaps evident at the two ends of the empire of Pachacuti. Both Kenko and Lacco were major cave complexes in the Cusco valley. At Machu Picchu there is a plethora of caves associated with both June and December solstices. Many of these caves were living beings, animated by water and sunlight with whom humans could interact and establish complex relationships we are gradually beginning to understand.

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