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# THE ARCHAEOASTRONOMY OF HIGH ALTITUDE INCA CEREMONIALISM

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## ABSTRACT

The Incas are renowned for their architecture, skillful masonry, complex political organization and their extensive system of roads. One of their most remarkable achievements was the ascent and the building of ceremonial structures on many of the highest peaks of the Andes, including Lulluillaco with an altitude of 22,110 feet, containing the world's highest archaeological site.

Offerings on the summits were made after state-supported pilgrimages, which often involved weeks or months of travel, covering distances of 1000 km or more. This paper discusses the sacrifices on the summit of Lulluillaco, their possible astronomical attributes and explores the meaning behind these challenging endeavors.

Lulluillaco can be climbed only during the southern summer, between November to March. The summit platform contained the bodies of three children, a 13-year-old girl and a boy and girl aged 4-5 years. Because the burials were in undisturbed conditions when excavated by Reinhard and his colleagues they also provided evidence for the role of astronomy in this ceremony. The platform has been rotated toward December solstice sunrise, which would have been an extraordinary endeavor, considering the difficulties of building and orienting stone structures at such an extreme altitude. Alignment of the young boy to sunrise on Capac Raymi may have been intended. The girl may have been oriented to June solstice sunrise. These ceremonies appear to have been a combination of imperial geopolitics and reciprocity between humans and mountain deities.

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**KEYWORDS:** shrines on Andean peaks, capacocha ceremony, child sacrifice, reciprocity

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## 1. INTRODUCTION

Evidence of the most remarkable example of solar ritual on a mountain summit is found on the summit of Llullaillaco with an altitude of 6739 meters (22,110 feet). It is the 7<sup>th</sup> highest peak of the Americas and contains on its summit the world's highest archaeological site. It was extensively and carefully excavated by Reinhard, Ceruti and assistants. They have published definitive description and analyses of the site (Reinhard and Ceruti, 2006, 2010). This paper addresses the possibility of astronomical alignments at the site. (Note: Reinhard comments that he suspected an astronomical alignment of the summit platform, but chose not to include that speculation in his publications).

The mountain is on the Chilean-Argentine border, east of Antofagasta, some 750 miles south of Cusco. It was climbed by the Inca sometime around 1500, close to December solstice, the start of the climbing season, and then not again until 1952 when two Chilean climbers, anticipating a first ascent, were disappointed to discover they were not the first. Ruins on this peak have been carefully excavated and mapped by Johan Reinhard and his colleagues (Reinhard and Ceruti, 2010). Other examples of similar sacrifices have been hard to find; most of these shrines, despite their high altitude, have been looted or excavated with little documentation.

Many of these mountain top shrines, of which there may be over 100, were the sites of *capacocha* (Quechua, *Qhapaq hucha*) ceremonies. (Beorchia, 2001; Reinhard, 2005; Reinhard and Ceruti, 2006, 2010). There are 16 shrines for which mummies have been documented and these almost entirely involved child sacrifice, boys of ages 4 to 10 and teen age girls chosen for their beauty and perfection, who were offered to the sun and mountain deities. Capacocha ceremonies were also performed, probably in Cusco, during critical events in the life of the Inca as well as to avert natural calamities such as volcanic eruptions. The most astronomically significant *capacocha* ceremonies were cyclical, some performed annually at the times of major solstice festivals of Inti Raymi (June) and Capac Raymi (December). The Inca empire was hierarchical and authoritative; little was done without permission of the authorities. Yet the struggle of climbing a 22,000 mountain was an intensely personal experience for which motivation had to be voluntary as well as imposed. Considering the extraordinary difficulty of climbing such a high mountain, the determination of the participants and victims to participate in this ritual is extraordinary, revealing something of the power of belief in Andean gods and associated ritual. According to Spanish chroniclers, offerings on the summits were made

after state-supported pilgrimages, which often involved weeks or months of travel. The elaborate, state-supported pilgrimages started in Cusco and may have covered distances of 1000 km or more. The party included priests, officials, assistants, local inhabitants, the child to be sacrificed, and sometimes proud parents. (It is not entirely clear that all parents would have been proudly happy. Many may have feared the dire consequences of refusing to offer their children to the state for such an event). We can only speculate what the children felt. They would have been treated briefly like royalty. When passing through the mountains the pilgrims would keep as silent as possible to avoid angering the mountain gods who were not to be honored at that time. These were important imperial events, and when they passed through villages, the residents were not allowed to view them directly and had to prostrate themselves. We are encountering an ontology here in which the mountains and sky deities were understood to be living beings who could be actively involved in people's lives. In addition, a distinction between the living and dead, between animate and the inanimate, was seriously blurred. (Alberti and Bray, 2009; Allen, 2015; Malville, 2016) Death did not mean a permanent departure from this world. The children could thereby function as mediators between powerful deities and the living.

These ceremonies were apparently a combination of reciprocity involving mountain deities and state ordained geopolitics. In the Andean world humans, quite wisely, sought to achieve reciprocal relationships with the powerful forces of the land and sky by making offerings, which they hoped would require a substantial positive response. Mountains, as living beings capable of being alternately very dangerous or benign, provided water for agriculture or were responsible for droughts, avalanches, earthquakes, and fierce weather. The establishing of close relationships was vitally important: offerings to the sun were hopefully reciprocated with bountiful harvests and relief from natural disasters. Climbing to the summit of the mountain also brought the offering closer to the solar deity. Only the most perfect of offerings (such as unblemished children) were considered worthy offerings to insure the desired reciprocal response. The chosen child also had to be able to survive in the unpredictable and dangerous realm between the living and dead

## 2. PILGRIMAGE AND LIMINALITY

Liminality relates to passages, often transformative ones, from one realm to another, coming from the Latin word *limen*, meaning a threshold (Turner, 2008). These passages may involve the ambiguity and disorientation that can occur when one crosses

into a new and unfamiliar space or time. The idea of liminality was extensively developed by Turner in his discussion of pilgrimage and the unsettling experience of traveling into unfamiliar landscapes. 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 include springs, caves, shores, rivers, crossroads, bridges, sacred spaces such as temples, and especially the cold and oxygen-deprived summits of high peaks in the Andes. In India, passages involving a “crossing-over” are known as *tirthas*, the most famous of all is on the banks of the Ganga in Varanasi. Tirtha has multiple meanings; it is a place for passing from one side of a river to the other, a place for meeting gods who have passed from their realm into ours, and a place to pass out of this life. The ascent of pyramids and high mountains in the Andes had a similar symbolism of moving across the three worlds into the upper realm where some of the gods resided.

### 3. TIMING OF THE CEREMONIES

There are two climbing seasons in Peru, Chile, and Argentina. In Peru, mountains are accessible during the dry cold winter months, while in the south, they can be climbed only during the southern summer between November to March. The most likely times for pilgrimage would be days around December solstice, the time of the Inca celebration of Capac Raymi, a major festival when young men from the aristocracy were initiated.

The timing of this celebration required incredible planning and precision. The pilgrims and priests

spent weeks on the road before reaching the base of the mountain. Everything on the mountain had to be ready for the participants. Weather would have added additional uncertainty, but because the sun does not move appreciably for several days around solstice, the date of the celebration was slightly flexible.

### 4. ASCENT

The route upward to the summit of Llullaillaco contains a number of resting places for pilgrims, priests, and sacrificial victims. The largest of these way stations is a tambo at 17,000 feet, where most of the pilgrims and, perhaps, the parents would have stayed, which could have housed as many as 100 people. Ascent to the summit by a smaller party, which included the children, would have taken at least three days. They would have had to spend a night on the summit before the sunrise ceremony. The two room building on the summit may have been used by the priests and children (Figures 1 and 2). Other members of the party must have huddled during the night behind the wind break.

Whether it was in the rooms or behind the wind-break, spending the night at such a high altitude would have been an excruciating test of endurance, as any climber who has bivouacked at high altitudes can attest. Clearly they did not have down sleeping bags or down jackets, but some of the discomfort may have been alleviated by chewing coca leaves. When the first gleam of the sun appeared, its location would have been burned in the memories of those waiting for the dawn. Few sunrises could have been greeted more enthusiastically than by those who spent a frigid night on the summit of Llullaillaco.



Figure 1. Room at the Top (Graham Zimmerman)





Figure 2. Summit of Llullaillaco. Note the rooms, wind break and trail to the platform (Graham Zimmerman)

## 5. THE SUMMIT PLATFORM

The platform (Figure 3), 30 feet long, 20 feet wide, contained the bodies of three children, a 13-year-old girl and a boy and girl aged 4-5 years. These may have been interred on three different years. The summit rooms, windbreak, and summit platform appear too extensive for them to have been used only once. It has been suggested that the two younger children may serve as attendants to the older girl. She had a higher status based upon her clothing and her elaborately braided hair. The trail to the summit platform, in particular, is too well marked in the soil for only one visit. Because the burials were in undisturbed conditions when carefully excavated, there were three perfectly preserved mummies as well as information on their approximate orientation. The platform has been rotated approximately 10 degrees away from the natural ridge line suggesting an intention to orient it toward December the date of solstice sunrise (Figure 4). Capac Raymi, which was an important festival among the Inca when boys of the aristocracy were initiated. The long side of the platform is oriented to  $30^\circ$  magnetic north (Reinhard and Ceruti, 2010, p. 66). The perpendicular to the long side would then have a true azimuth of  $118.4^\circ$ , and the boy is approximately facing that direction. There are no reported measurements of the angle of depression of the horizon, but it can be estimated by the panorama generator of [heywhatsthat.com](http://heywhatsthat.com). At an azimuth of  $118^\circ$  the horizon is depressed by approximately  $1.3^\circ$ . Measurements of refraction made from Cerro Tololo (2215m and 645 km to the south) (Schaefer and Liller, 1990), involving an average depression angle of  $-2.2^\circ$ , give an average refraction of  $.7^\circ$  with a standard deviation of  $.27^\circ$ . Using this re-

fraction angle, the azimuth of the upper limb of the sun would be  $117.3^\circ$ , which is within approximately a degree of the orientation of the platform. It thus appears possible that the young boy was intentionally placed facing the first gleam of the sun near the date of December solstice.



Figure 3. Summit Platform (Graham Zimmerman)

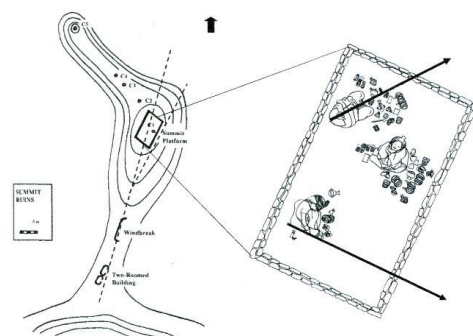


Figure 4. Summit Platform Showing Burials (after Reinhard and Ceruti, 2010)

The 13-year-old girl was facing northeast, approximately 53° north of the boy or to an azimuth 65.4°. (Note: personal communication from Reinhard expresses caution because of the difficulty of making such a measurement on the irregularly shaped mummy bundle *in situ*). That orientation is close to the direction of June solstice sunrise, the date of the Inca festival of Inti Raymi. The depressed horizon in that direction has an angle of -1.3°, giving an azimuth of the first gleam of sunrise of 66.1°, using a refraction angle of .7°. The orientation of the girl thus appears to have been within 0.7° of the first gleam of June sunrise. However, the mountain cannot be climbed during the winter month of June. There are two methods that could have been used to estimate the azimuth of June solstice sunrise. A ritual specialist could have noted the direction of the last gleam of the sun on December solstice. In that direction the depressed horizon had an angle of approximately -2.2°. Once that direction had been established, the priest could have turned himself 180° to establish the approximate direction of June solstice sunrise. That approach would have resulted in an orientation of the girl to an azimuth of 62.3° some 3° short of the direction toward which she was buried. Alternately, perhaps the more likely approach would have been to transfer the angular separation of June and December solstices measured somewhere else to the summit. That angle would have to be established at a site readily accessible in winter and close in latitude. The angular separation of the solstices could have been marked using a horizontal pole held at arm's length.

Where could such a measuring device have been calibrated? Because of the considerable importance of the solstices in the Inca ceremonial world, such a measurement may have had ritual importance and may not have been unusual. The modern town San Pedro de Atacama is 5 km south of the Inca center of Cartepe, which at an altitude of 8400 feet should have been occupied throughout the year. As observed from the town the two solstices occur 52° apart, within a degree of the angular separation of the northern and southern mummies. The orientation of two of the three children buried in the summit platform suggests an intention to mark the two major solar festivals of the Inca. The third child is approximately facing the major summit, perhaps

honoring the mountain deity. Analysis of the hair of the older girl indicates that 12 months before her death her diet became rich in animal protein and maize, marking the time she became an *Acllas* or chosen women and entered elite lifeways. Her hair was cut 6 months later and then trimmed just before her death. Ritual hair cutting is often associated with a change of status, perhaps a liminal rite. Hair cutting at six month intervals may indicate synchronization with the solstices as well as a countdown to sacrifice (Wilson et al., 2007, 2013).

## 6. FINAL THOUGHTS

Children were chosen for these *capacocha* ceremonies because they were deemed to be the most perfect offering that could be made. Sacrificial techniques employed in Inca *capacocha* ceremonies avoided any overt display of cruelty. The practice of burying children alive or sometimes of suffocating them prior to burial apparently was based on the belief that only "complete" offerings were acceptable to the sun or mountain deity. A victim who had shed blood would have been considered to be an "incomplete" offering in the eyes of the Incas. All of the children had ingested coca and alcohol (Wilson et al., 2007, 2013). The older girl had markedly higher levels of coca and alcohol, perhaps indicating a greater need to sedate her. The boy's knees were tightly bound against his chest by a rope. He may have suffered from pulmonary edema and died during the ascent. Next to him was an *aribalo*, containing the residues of *chicha*, which may have been intended as an offering to the sun whom he faced in death.

Climbing a 22,100 foot mountain is not an easy task; one has to contend with physical exhaustion, cold, and oxygen deprivation. It would not have been an ordinary journey, but rather a challenge that required a willingness on the part of the children to reach the summit. It's hard to believe that anyone could be coerced into climbing such a mountain. Spending the night on top may have been terribly frightening for the children. A brilliant sunrise in the luminous atmosphere of the summit of the mountain may have been exciting. Being in the presence of gods of the sun and mountain could have been an epiphany. We shall never know.

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