

Children of Heaven: A Bioarchaeological Review of the Inca *Capacocha* Mummies

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Abstract

Ruling over western South America for nearly 100 years, the Inca Empire was one of many global cultures that practiced human sacrifice, though few other rituals of human sacrifice are as captivating as the Inca child sacrifice of *capacocha*. *Capacocha* children were chosen to be representatives of the Inca people in the afterlife. As such, they were afforded an elevated position in society before their death. Following their selection, children would undergo a year-long pilgrimage terminating at a mountain top shrine where they would be killed. As a result of the low temperature and oxygen levels present at such a high elevation, the bodies of *capacocha* children were protected against decomposition, creating some of the best-preserved natural mummies in the world. These mummies have been the subject of numerous bioarchaeological analyses to determine their age, sex, geographic origin, pathological conditions, diet, and cause of death. Beyond these, however, the mummies present a unique opportunity to study how the *capacocha* ritual process — including the sudden ascension in status — manifested itself on the children's bodies. This paper aims to review the bioarchaeological data garnered from the mummies in order to reconstruct the experience of a child chosen for *capacocha*. Results suggest higher variability between children selected for *capacocha* than was originally outlined by Spanish chroniclers.

Keywords: bioarchaeology, mummies, Inca, human sacrifice, radiology, stable isotope analysis

Introduction

The Inca Empire was a successful civilization that expanded to encompass much of western South America, beginning in Cuzco (see Figure 1) in about 1438 and ending with Spanish contact in 1532 (Reinhard & Ceruti, 2010, p.3). Many Spanish chroniclers wrote about the practice of human sacrifice in the Inca Empire and although some accounts were likely sensationalized, they inspired a search for any archaeological

evidence to support this 500-year-old practice. No better evidence exists than the sacrificed children themselves, preserved as natural mummies atop the Andean peaks. The cold, high altitude environment prevents the decomposition of organic remains, resulting in some of the most well-preserved mummies known anywhere in the world. Multiple *capacocha* mummies have been recovered and studied extensively.

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Figure 1. Map showing the elevation of western South America with Cusco and the discussed *capacocha* sites marked. The dotted line represents the greatest extent of the Inca Empire. Own work. Background map retrieved from <https://mapswire.com/>, CC-BY 4.0.

The most well-preserved mummies identified so far were found in 1999 at the world's highest archaeological site on Llullaillaco volcano (see Figure 1) (Reinhard & Ceruti 2010, p.20). Buried near the summit were the mummies of three children; these, along with many other *capacocha* mummies, have been the subject of numerous bioarchaeological analyses. While valuable archaeological information has been gleaned from the burial sites and artifacts, this paper aims to provide a summary of the bioarchaeological research conducted on the *capacocha* mummies. Several conventional bioarchaeological markers, including age and sex, geographic origin, "health", diet, and cause of death will be discussed in a chronological framework that parallels the journey of a child chosen for the *capacocha* sacrifice. Suggestions for future research will also be addressed.

Children were selected for sacrifice due to their purity and were either offered by their parents or selected specifically by religious authorities (Cobo, 1990). After selection, children began a long pilgrimage to the mountain on which they would be sacrificed, accompanied by priests and other religious assistants (Reinhard & Ceruti, 2010, p.89). Upon reaching the mountaintop shrine, prayers and ceremonies were performed, which ultimately culminated in the killing of the child. Victims of the *capacocha* sacrifice were believed to act as representatives of the people in the afterlife, so as to protect their interests in the face of the gods (Reinhard & Ceruti, 2010, p.102). As such, the children selected for sacrifice — some as young as 6 years old — held a very important position in Inca religion and society.

Age, Sex, and Gender

Age and sex are the first pieces of information collected during bioarchaeological analysis. They are also primary ways in which individuals may be identified and given specific roles in society. Due to the excellent state of preservation of the *capacocha* mummies, age and sex can be determined with relative accuracy. Both male and female children were sacrificed, evidenced by preserved sex organs (e.g. Previgliano, Ceruti, Reinhard, Araoz, & Diez, 2003) as well as cultural markers of gender. Because all the sacrifice victims are young, tooth eruption and long bone measurements can be used to age the mummies. According to historical sources, boys and girls were selected at the age of 10 or younger, but girls may also have been maidens 15 or 16 years old (Cobo, 1990, p.112). This is consistent with the bioarchaeological data. The boy from El Plomo (see Figure 1) was examined radiologically and dentally and was assigned an age of 8 or 9 years (Horne & Kawasaki, 1984, p.926). Through the same methods, the boy from Llullaillaco was estimated to be 7 years of age (Previgliano et al., 2003). Similarly, the Aconcagua boy (see Figure 1) was aged at 7 years old (Fernández, Panarello, & Schobinger, 1999, p.32).

As for female mummies, some are in the same age range as boys while others are older. The Lightning Girl found on Llullaillaco was aged at 6 years old using radiographs of her bones and teeth (Previgliano et al. 2003). Two female mummies were recovered from Esmeralda (see Figure 1); the younger girl was aged at approximately 9 years old, while the other was a young adult (Checura, 1977, p.125).

The most well-known mummies that have been found thus far are predominantly girls between the ages of 14 and 16. The famous Ampato Ice Maiden (see Figure 1) "Juanita" was estimated to be 13 to 15 years old based on the crown development of her third molars, while another female mummy found at the same site was aged at 12 to 14 (Reinhard, 2005). CT scans of the mummy from Sara Sara (see Figure 1), "Sarita," revealed her to be about 15 years old at death (Reinhard, 2005). The Llullaillaco Maiden is also thought to be 15 years old, though her long bone measurements may suggest a slightly younger age (Previgliano et al., 2003). The age of the older female mummy found on Pichu Pichu (see Figure 1) was approximated at 16 to 18 years old (Reinhard, 2005). Based on historical accounts, these mummies likely represent *acllas*, maidens who were selected at a young age to remain chaste and devote themselves to the gods (Cobo, 1990, p.172). These "chosen women" lived in convents under the supervision of older *mamacunas*, who trained them in religious knowledge and domestic activities (Reinhard & Ceruti, 2010, p.102). When an *aclla* reached a certain age, she would either be offered as a wife to a nobleman, become a priestess, or be sacrificed as part of the *capacocha* ritual (Reinhard & Ceruti, 2010, p.102). This particular practice highlights the intersection between age, sex, and gender in Inca society. Young girls and women played a specific role in Inca religion, both in life and after death.

Geographical and Ethnic Origin

Determining the ethnic and geographical origins of the *capacocha* mummies is another logical avenue of bioarchaeological investigation. Spanish chroniclers have suggested *capacocha* children were often sacrificed in a different part of the Inca Empire than their place of origin (Cobo, 1990, p.111). Genetic analysis can aid in approximating the geographic origin of the sacrifice victims. For the three Llullaillaco mummies found in northeastern Chile, hair samples were taken for DNA analysis. The Llullaillaco boy belonged to haplogroup C and had genetic matches in Peru and Chile, while the younger Llullaillaco girl belonged to haplogroup D and matched to individuals in Bolivia and Peru (Reinhard & Ceruti, 2010, p.103). The Llullaillaco maiden also belonged to haplogroup D and demonstrated a genetic link to an individual living 1,000 miles away from where she was discovered. In contrast, the Ampato Ice maiden from

southern Peru belonged to haplogroup A and was matched with individuals in northern Peru and Argentina (Reinhard & Ceruti, 2010, p.103). Additionally, mitochondrial DNA analysis of the three Lulllaillaco children suggests they are not maternally related (Wilson et al., 2007). Isotopic analysis presents another tool for determining geographic origin of the mummies. The analysis of hydrogen isotopes suggests that all four mummies from Lulllaillaco and Sara Sara originated in the highlands, whereas the Aconcagua boy likely lived at a lower elevation (Wilson et al., 2007). Not only does the genetic and isotopic evidence indicate diversity among the *capacocha* victims, it also suggests that children were often sacrificed far from their place of origin. The archaeological evidence, based mainly on clothing and artifact styles, lends support to this argument as well (Wilson et al., 2007).

In terms of bioarchaeological evidence for ethnic origin, cranial modification may prove useful in assessing group affiliation; however, it has not been observed in many of the *capacocha* mummies. Reinhard noted conical cranial modification on the young female mummy from Pichu Pichu (Reinhard, 2005). This matches a description of cranial modification characteristic of the *Collas* population: "the Collas made their heads long and pointed" (Cobo, 1990, p.200). Cranial modification was also observed in both of the younger Lulllaillaco children; however, the boy's cranium exhibited occipital-parietal modification while the girl's demonstrated both frontal-parietal and occipital-parietal modification (Previgliano et al., 2003). In contrast, the older Lulllaillaco maiden did not exhibit any cranial modification. Once again this illustrates the diversity among *capacocha* victims, even those sacrificed in the same location.

"Health" and Pathology

Health is difficult to define when discussing ancient human remains. As such, this section will specifically review the information on any pathological conditions or abnormalities observed on the mummies. In terms of external abnormalities, the male mummy from El Plomo exhibited several. Upon examination, the boy had a scar on his elbow and two warts on his left hand, likely caused by human papilloma virus (Horne & Kawasaki, 1984). Eight ulcerated lesions on the El Plomo boy's lower extremities were identified as angiokeratoma - dilated capillaries on the skin's surface that form dark-coloured papules (Horne & Kawasaki, 1984). These abnormalities contradict historical accounts that children who were selected for *capacocha* could have no visible imperfections on their skin (Cobo, 1990, p.112). In addition, lice eggs were observed on his scalp (Horne & Kawasaki, 1984). This may suggest that the El Plomo boy originated from a lower social class. Internally, parasite eggs and *Entamoeba* cysts were observed in the boy's body,

indicating infection (Horne & Kawasaki, 1984). The Lulllaillaco children were also examined. The Maiden exhibited several symptoms of a mycobacterial lung infection, including a lesion on her calf and high levels of immune response proteins (Corthals et al., 2012). Both the El Plomo boy and the Maiden may have contracted these infections over the course of their year-long pilgrimage (Reinhard & Ceruti, 2010, p.106). In contrast, the younger Lulllaillaco children did not demonstrate any signs of infection. Radiographs of all three mummies from Lulllaillaco did not reveal any signs of bone disease (Previgliano et al., 2003). Accurately assessing the "health" of *capacocha* mummies is challenging since it is unclear when a particular infection began, whether it occurred before the sacrificial selection or after. More research will hopefully be conducted to reconstruct physiological stress as a result of this change in status. Regardless, dramatic changes to the children's lifestyles no doubt had an impact on their development and vulnerability to infection.

Diet and Nutrition

After the children were offered or selected for sacrifice, they often experienced a change in diet related to a transformation in their social status. Numerous ceremonies and feasts took place before and during the pilgrimage towards the children's final resting place (Reinhard & Ceruti, 2010, p.123). Though bone collagen is most commonly used to reconstruct diet, hair is particularly desirable because unlike bone it can provide evidence for short-term dietary shifts and does not remodel itself once grown (White, Nelson, Longstaffe, Grupe, & Jung, 2009). Due to the incredible preservation of the mummies from Lulllaillaco and Sara Sara, researchers were able to perform isotopic analysis on hair strands from all four children, equating 10 mm of hair growth to one month of life (Wilson et al., 2007). For specific investigations of diet, carbon isotopes can distinguish between C_3 and C_4 plants, nitrogen isotopes can determine the trophic level of consumed organisms, and sulfur isotopes can differentiate between a terrestrial and marine diet (Wilson et al., 2007). The $\delta^{15}N$ and $\delta^{13}C$ values from the Lulllaillaco Maiden's hair exhibit a dramatic change around 1 year before death, suggesting increased consumption of animal protein and C_4 plants such as maize (Wilson et al., 2007). The hair from the younger two Lulllaillaco children exhibits similar patterns of $\delta^{15}N$ and $\delta^{13}C$ change, while Sarita's hair suggests a decrease in C_4 plant consumption leading up to her death (Wilson et al., 2007). In another study, the $\delta^{13}C$ values from the Aconcagua boy's hair indicate a cyclical, likely seasonal importance of C_4 plants, while the $\delta^{34}S$ values reveal that he consumed a terrestrial diet beginning at

least 1.5 years before his death (Fernández, Panarello, & Schobinger, 1999). Preceding this period, the $\delta^{15}\text{N}$ concentration suggests the boy consumed a mixed terrestrial and marine diet (Fernández, Panarello, & Schobinger, 1999). The $\delta^{34}\text{S}$ data from the Llullaillaco mummies suggest a diet dominated by terrestrial foods starting around 6 months before death (Wilson et al., 2007).

Other bioarchaeological avenues for dietary and nutritional reconstruction have also been used in analyses of *capacocha* mummies. Tooth enamel, for example, does not remodel itself and is therefore a preserved record of diet in childhood (Wilson et al., 2007). The younger girl and boy from Llullaillaco exhibit dental abrasion on the occlusal surfaces of their teeth, which may indicate a diet reliant on corn flour (Previgliano et al., 2003). The same study revealed intriguing information on the nutritional health of the three Llullaillaco children. Radiographs of the mummies demonstrated “a thick layer of fat tissue, excellent bone mineralization, and muscular volume” — all of which suggest adequate nutrition during childhood (Previgliano et al., 2003). Additionally, no Harris lines were observed on any of the children (Previgliano et al., 2003). Assessments of the El Plomo boy and the girls from Esmeralda also concluded that they were in good nutritional health (Sanhueza et al., 2005; Ojeda, 2012). Nutritional status may be used as a proxy for social status; it is assumed that children from higher classes would have consumed a more varied diet. Although Previgliano and colleagues’ (2003) research concluded that the children of Llullaillaco were in good nutritional health, a study by Wilson and colleagues (2007) suggests a low status origin for all three individuals. This interpretation is based on values of hydrogen, oxygen, and sulfur isotopes that indicate a highland origin, which in Inca society can be equated with low status (Wilson et al., 2007). Additionally, this paper postulates that prior to her selection for sacrifice, the Llullaillaco Maiden consumed a meat-poor peasant diet (Wilson et al., 2007). This discord is concerning; however, it may simply be the result of diversity among the *capacocha* children in terms of socio-economic origin.

Immediately before the sacrifice, children were fed a large meal so they would not be hungry when they entered the afterlife (Cobo, 1990, p.112). This was likely the case for the Ampato Ice Maiden; a needle biopsy of her stomach revealed that she consumed a meal of vegetables 6 to 8 hours before she was killed (Reinhard, 2005). The presence of feces in the intestines of the Llullaillaco mummies, as demonstrated by CT scans, also supports a final meal before death (Previgliano et al., 2003). This last meal was often accompanied by *chicha* (maize beer) and sometimes coca leaves, implemented to sedate the children in the moments before their death (Reinhard, 2005). Again, the children of Llullaillaco are a

testament to this practice. Hair analysis from all three individuals indicated that each had consumed both alcohol and coca at least several days before death (Wilson et al., 2013). The Maiden presents an especially intriguing case, as her alcohol and coca consumption markedly increased one year before her sacrifice, and craniofacial radiographs revealed a chewed quid of coca leaves in her cheek (Wilson et al., 2013). This shift in consumption, coupled with evidence for a dietary shift, presents a strong argument that she underwent a significant change in status at approximately death minus 12 months. It is likely that regardless of socio-economic origin, all *capacocha* children experienced a change in status resulting in dietary alterations shortly after their selection for sacrifice.

Cause of Death

Upon finally reaching their destination — an elaborate mountain top shrine — the *capacocha* children would already have been in a weakened state due to exhaustion, altitude sickness, and low temperatures (Reinhard & Ceruti, 2010). The El Plomo boy’s feet were calloused and swollen from walking a considerable distance (Horne & Kawasaki 1984). His lips and clothing had traces of vomit and blood, indicating that he suffered from an altitude-induced pulmonary edema shortly before death (Quevedo & Durán, 1992, p.198). Blood found near the Llullaillaco boy’s mouth suggests he experienced a similar trauma (Corthals et al., 2012). In fact, based on the manner in which his legs were tightly bound to his body, the Llullaillaco boy may have died from altitude sickness even before reaching the mountain summit (Ceruti, 2003, p.101). This provides a sobering contrast to the eternally peaceful facial expressions of the mummies from El Plomo and Llullaillaco. On the other hand, the boy from Aconcagua exhibits a more pained expression. He is frozen in a fetal position with his legs tightly folded; his teeth and clothing are stained from vomit and diarrhea containing red achioté pigment (Schobinger, 1999, p.8). Regardless of whether his sickness was the result of high-altitude intolerance, the achioté beverage he consumed, or simply intense fear, the Aconcagua boy clearly suffered in the moments before his death. As a result of this weakened state, the children likely died quickly once the appropriate time came for them to be killed.

After all necessary ritual procedures had been completed, the children met their inevitable fate and were sacrificed to the gods. The manner in which they were killed, however, was not uniform. Spanish chroniclers recount several ways in which *capacocha* children may have been sacrificed, including strangulation and having their throats slit (Cobo, 1990, p.112). Bioarchaeological data does not provide explicit evidence for either of these possibilities;

however, suffocation after being buried alive presents a more plausible cause of death (Reinhard & Ceruti, 2010, p.125). This may have been the case for the Lullaillaco children, as radiographs revealed air trapped in their lungs (Previgliano et al., 2003). The El Plomo boy and the two girls from Esmeralda may also have suffocated following inhumation (Sanhueza et al., 2005; Ojeda, 2012). In this scenario, the children would likely have been sedated or unconscious when buried (Previgliano et al., 2003).

Cranial trauma on several of the mummies suggests they suffered a blow to the head, with the purpose of killing or incapacitating them (Reinhard & Ceruti, 2010, p.125). The boy from Aconcagua was likely killed in this way with a hard blow to his temple (Schobinger, 1999, p.8). A CT scan of the Ampato Ice Maiden's cranium revealed a fracture and hematoma near her right eye; the older female mummy from Pichu Pichu and the Sara Sara mummy "Sarita" also demonstrated similar cranial fractures and hematomas (Reinhard, 2005). Reinhard postulates that all three mummies may have been killed by a blow to the head with a club (Reinhard, 2005). In either scenario, the child's death would ideally have been relatively painless and quick. After completing their long, arduous journey up the mountain, their aforementioned state of weakness and possibly intoxication may have reduced prolonged suffering at the time of death. However, the experiences of the *capacocha* children are by no means universal, and it is challenging to say with any accuracy how the children felt in their last moments.

Discussion and Conclusion

The use of bioarchaeological data has been successful in reconstructing the journey of the *capacocha* children, beginning with their selection for sacrifice and terminating with their death on some of the highest mountains in South America. Beginning chronologically, selection was based on purity, both in external appearance and virginity, and both male and female children were selected for sacrifice (Reinhard & Ceruti, 2010). Teenage girls were also selected, but only if they had remained chaste as *acllas*. According to chroniclers, children were selected from throughout the Inca Empire and then brought to the capital city, Cuzco (Cobo, 1990, p.111). Genetic and isotopic analysis indicates that the children came from a variety of locations and were rarely, if ever, sacrificed in their own locality. Some evidence for cranial modification styles may also suggest diversity in ethnic origin, but this must be synthesized with other archaeological sources of data, such as clothing or pottery style, to come to a definite conclusion. Upon their selection for the *capacocha* ritual, the children experienced a dramatic ascension in status. This transition was accompanied by changes in diet, as well as possible susceptibility to infection. There is an apparent gap in the

literature when discussing the "health" of the *capacocha* children. Presently there is no research to suggest that any of the children experienced serious physical illness prior to their selection. Only the El Plomo boy and the Lullaillaco Maiden exhibited signs of infection, which were likely acquired over the course of the children's year-long pilgrimage. More research should be conducted in order to closely examine the possibly physiological effects of the selection process and subsequent pilgrimage on the children. In terms of dietary change, isotopic investigations demonstrated an overall increase in terrestrial protein and maize. The Lullaillaco Maiden also experienced a dramatic increase in her alcohol and coca consumption 12 months prior to her death. Generally, all mummies were in good nutritional health at the time of their death. Before being sacrificed, it was ensured that the children were well-fed and often sedated, so they would be satisfied and content upon meeting the gods. However, the final hours before the sacrifice were not necessarily without incident. The boys from El Plomo, Lullaillaco, and Aconcagua all exhibited evidence for illness and suffering preceding their deaths. When the time came for the sacrifice to be made, bioarchaeological data suggest that the children were killed in one of two ways: being buried alive or struck on the head. Weakened and sedated, the children passed away in their sleep or were instantaneously killed by a sharp blow to the head, thus completing their journey.

It is challenging to assess what position these children occupied in Inca society. Their journey can be conceptualized as having two transitions: their selection as a sacrifice and their death. These events represent changes in status and in the roles that the children enact in society. The first transition, that of selection, had obvious effects on the children's location, diet, and health — all of which are visible through bioarchaeological analyses. This event also marked an increase in the status of the children in that their role in the community became one of spiritual importance. Following their selection, the children were led in a procession from their place of origin to their final resting place, often lasting months. When the procession passed through villages, local inhabitants were to remain silent and avert their eyes, sometimes assisting in carrying offerings (Reinhard & Ceruti, 2010, p.90). The *capacocha* children were seen as messengers to the gods and were treated with reverence as a result (Reinhard & Ceruti, 2010). The second transition experienced by the children marked the shift from life to death, biologically-speaking. After their sacrifice, the children remained important figures and would have been honoured indefinitely, unlike commoners who were only given offerings for a period of two generations (Cobo, 1990, p.42-43). This represents the established difference in Inca culture between the biological and social death of the *capacocha* children (see Weiss-Krejci, 2011), the latter of which did not officially occur. Although they died young, they were essentially deified and

lived on indefinitely within a social and religious sphere (Reinhard & Ceruti, 2010).

Ultimately, every avenue of bioarchaeological analysis performed on the *capacocha* mummies emphasizes the diversity among them. The bioarchaeological data contradict historical accounts that only the children of the nobility were selected for sacrifice (Betanzos, 1996, p.78). More research is required to investigate whether *capacocha* selection was unique to children of a specific class, or if all children were susceptible to selection. Future research will also hopefully engage more with themes of changing identity and social roles, as well as the observable bioarchaeological markers that accompany them. It is also important to consider not only how the children were perceived within the Inca Empire, but also how their own identities were shaped and reshaped by their selection for this important spiritual duty. As more is understood about the mummies themselves, we can slowly begin to unravel the intricacies of the *capacocha* sacrifice — both tragic and captivating.

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